



Prepared by:
City of Naperville
Transportation, Engineering and Development Business Group

WORK ZONE GUIDE

*for Construction and
Maintenance Projects*

A Guide for
Temporary Traffic Control
Zone Applications

Issued January 1, 2014
Revisions included through January 1, 2014

A NOTE TO USERS

This booklet is a guide for individuals charged with the duties of placing traffic control devices to protect a work area. Proper placement of traffic control devices is essential for the safety of workers and the motoring public.

This guide is not intended to provide instructions for every situation that may require traffic control, but should include direction and examples for common maintenance operations that occur within the City of Naperville. All illustrations were derived from or are in accordance with the Federal Highway Administrations, Manual on Uniform Traffic Control Devices, Part 6, latest edition.

For operations requiring several lane shifts, closures or extensive traffic detouring, please first notify your immediate supervisor.

For further assistance contact the City of Naperville's Transportation, Engineering and Development Business Group for instructions at:

(630) 420-6100, Option 4 (weekdays, 8:00 a.m. to 4:00 p.m.).

For assistance required outside normal work hours, contact City Dispatch at:

(630) 420 - 6187.

They will alert staff of the circumstances.

Notes:

Reproduction of this Work Zone Guide or the information contained therein is strictly prohibited.

Permission to reproduce must be obtained from the City of Naperville Transportation, Engineering and Development (T. E. D.) Business Group.

TABLE OF CONTENTS

I.	Traffic Control Devices	
1.	Warning Signs	1
2.	Cones & Barricades	2
3.	Arrow Displays	3
II.	Components of a Traffic Control Zone	4
1.	Advance Warning Areas	5
2.	Transition Areas	5
3.	Activity Areas	6
4.	Termination Areas	6
III.	Flagging Procedures	7
IV.	General Provisions	9
V.	Typical Applications	
A.	Two Lane Roadways - Local Roads	
1.	N-1 Lane closure on residential street (low volume)	10
2.	TA-18 Lane closure on a minor street (higher volume)	11
3.	TA-15 Work in center of low volume road	12
4.	TA-26 Closure in center of intersection	13
B.	Two lane Roadways - Collectors and Arterials	
1.	TA-6 Shoulder work with minor encroachment	14
2.	TA-10 Lane closure for one lane - two way traffic control	15
C.	Multi-lane Roadways - Arterials	
1.	TA-21 Lane closure near side of intersection	16
2.	TA-22 Right lane closure far side of intersection	17
3.	TA-23 Left lane closure far side of intersection	18
4.	TA-30 Interior lane closure on multi-lane road	19
5.	N-4 Right lane closure on multi-lane road	20
6.	TA-33 Lane closure on divided highway	21
D.	Mobile operations	
1.	TA-17 Mobile operations on a two-lane road	22
2.	TA-4 Mobile operations on shoulder	23
E.	Sidewalk Closures and bypass walkway	
1.	N-28A Pedestrian Detour	24
2.	N-28-B Bypass Walkway	25
F.	Surveying	
1.	Surveying along minor street (higher volume)	26

I. TRAFFIC CONTROL DEVICES

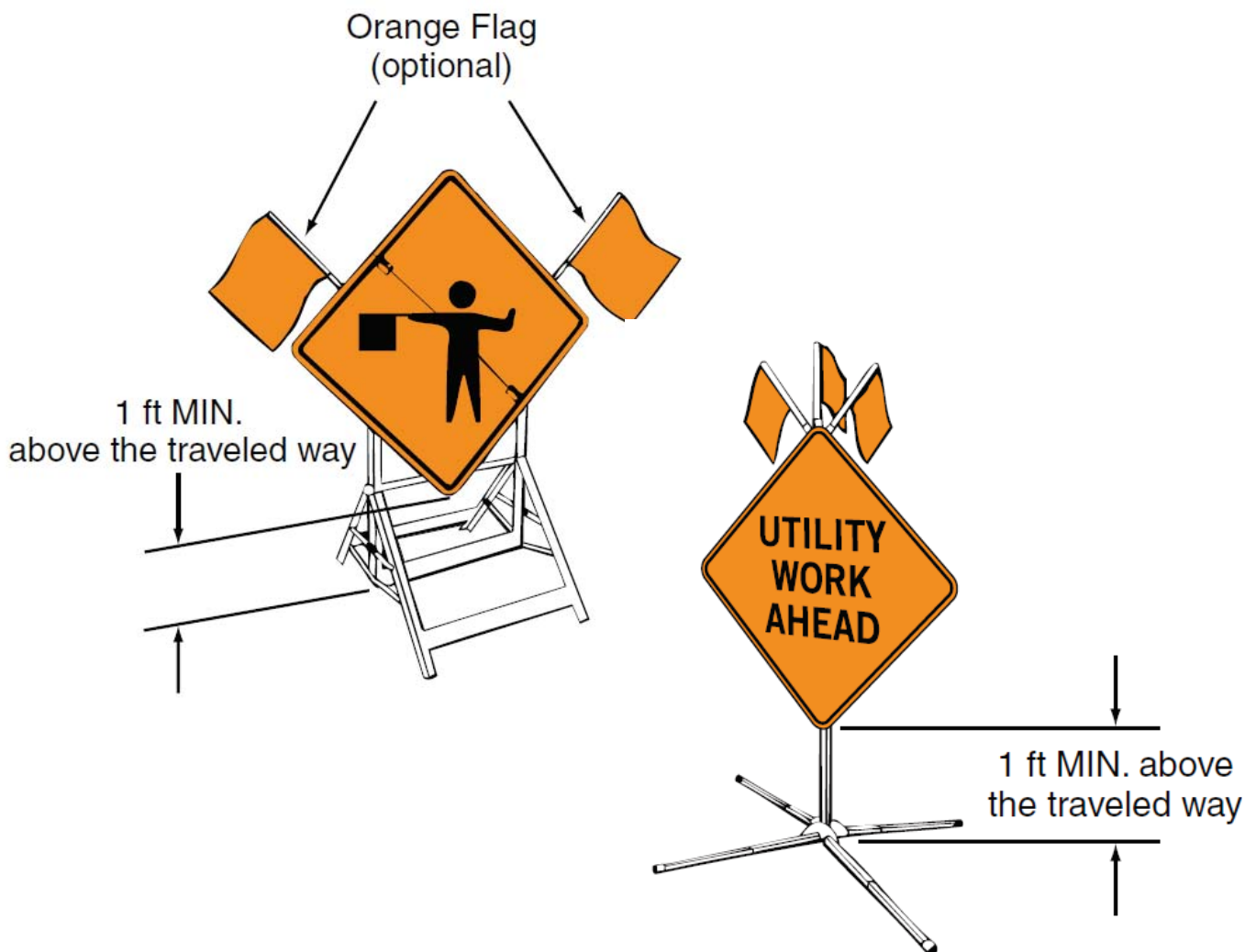
1. WARNING SIGNS

Warning signs for work zone protection shall consist of black legend or symbol on an orange background and convey a simple, but specific message.

All signs used for the purpose of work zone protection shall be made of retroreflective material.

Warning signs used in advance of a work site will generally be diamond shaped. For two-lane roadways, advance warning signs shall have a minimum dimension of 36 inches by 36 inches. Multi-lane roadways require the use of 48 inch by 48 inch advance warning signs.

Care should be taken to maintain visibility, legibility and overall effectiveness of traffic signs in order to provide sufficient warning to the motoring public. In general, signs should be located on the right-hand side of the road while maintaining a minimum lateral clearance of 12 inches from the pavement surface to the left-hand side of the sign. For short term work zones, signs supported by stands should have a minimum vertical clearance of 12 inches from sign bottom to grade. Refer to page 5 for details on warning sign spacing. Placement of signs should be adjusted to meet unique field conditions.



2. CONES & BARRICADES

Both traffic cones and barricades are channelizing devices which guide the flow of traffic. In order for them to be effective, proper placement and physical conditions must be maintained. Broken, scuffed, dirty, misplaced channelizing devices do not command respect of the motorist.

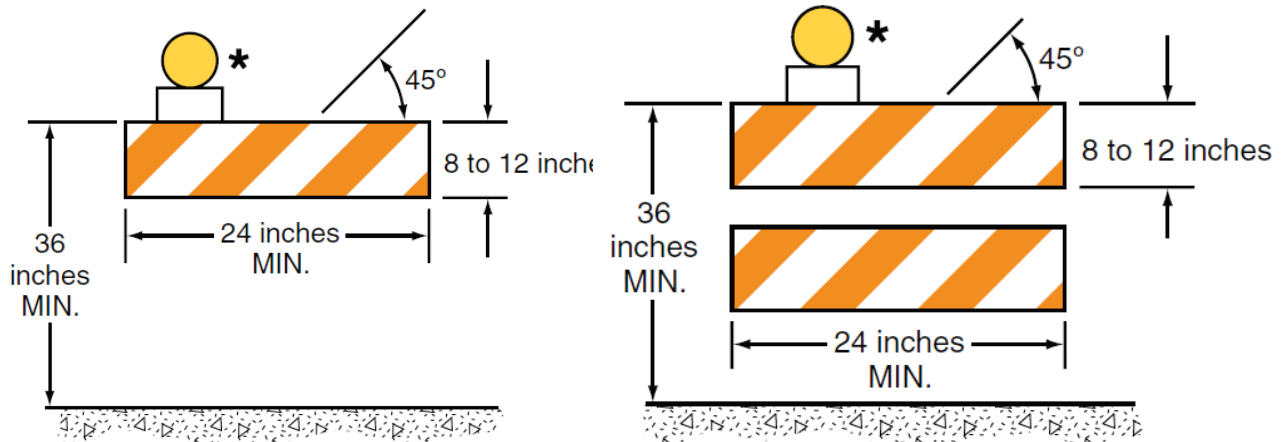
Traffic cones used as channelizing devices shall be bright fluorescent orange. On low-speed roadways, a minimum traffic cone height of 18 inches shall be used and only during daylight hours. High-speed and multi-lane roadways require the use of 28 inch traffic cones as channelizing devices.

All night operations require the use of 28 inch traffic cones with two retroreflective collars or lighted barricades.

Barricades may also be used as channelizing devices and tend to be more stable, especially when anchored with a sandbag. Stripes on a barricade shall slant down toward the intended travelway. If a warning light is attached, it should be fastened to the side nearest the traveled lane. Sandbags shall not be placed on top of the barricade and are permitted only on the bottom rail(s).

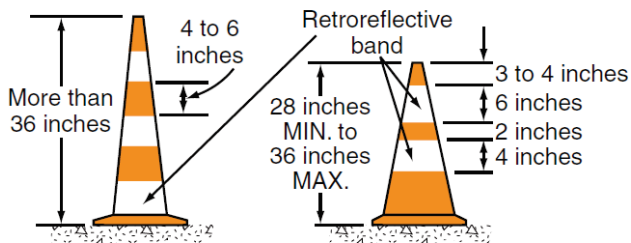
Warning lights attached to barricades shall be steady-burn when used for delineating the travel path. Flashing lights are intended for use when a barricade is marking a particular hazard.

Proper placement of channelizing devices is described on pages 5 and 6.

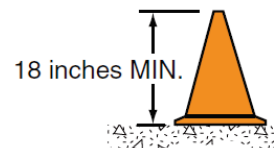


Type I Barricade

Type II Barricade



Night and/or freeway
High-speed roadway
(≥ 45 mph)



Day and low-speed
roadway (≤ 40 mph)

Cone Types

3. ARROW DISPLAYS

Arrow displays, or arrow boards, are supplementary devices to be use *in combination with* appropriate signs, barricades or other traffic control devices. They may not be used alone.

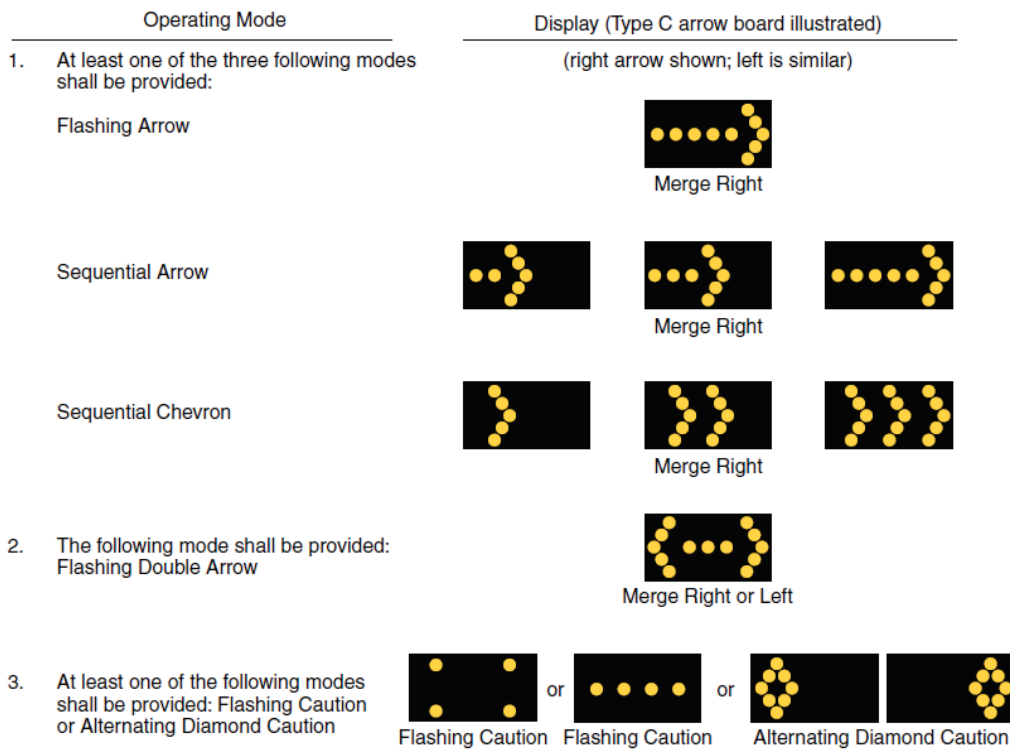
Before putting an arrow display into service, an inspection should be performed to ensure all systems are functional and all lights are working.

Never use an arrow display showing the arrow or chevron mode on a two-lane, two-way roadway for temporary one lane operation.

Proper planning is required for placement of an arrow display when horizontal or vertical curves are a factor in the work site. Avoid positioning the arrow display on or around a curve. Never allow an arrow display to be positioned in a manner that may cause a motorist to make abrupt and unnecessary lane changes.

High intensity light is needed during daytime operations; low intensity is needed at night to avoid glare. Be sure the arrow display you are using has this operational feature and is set accordingly.

Advance Warning Arrow Board Display Specification



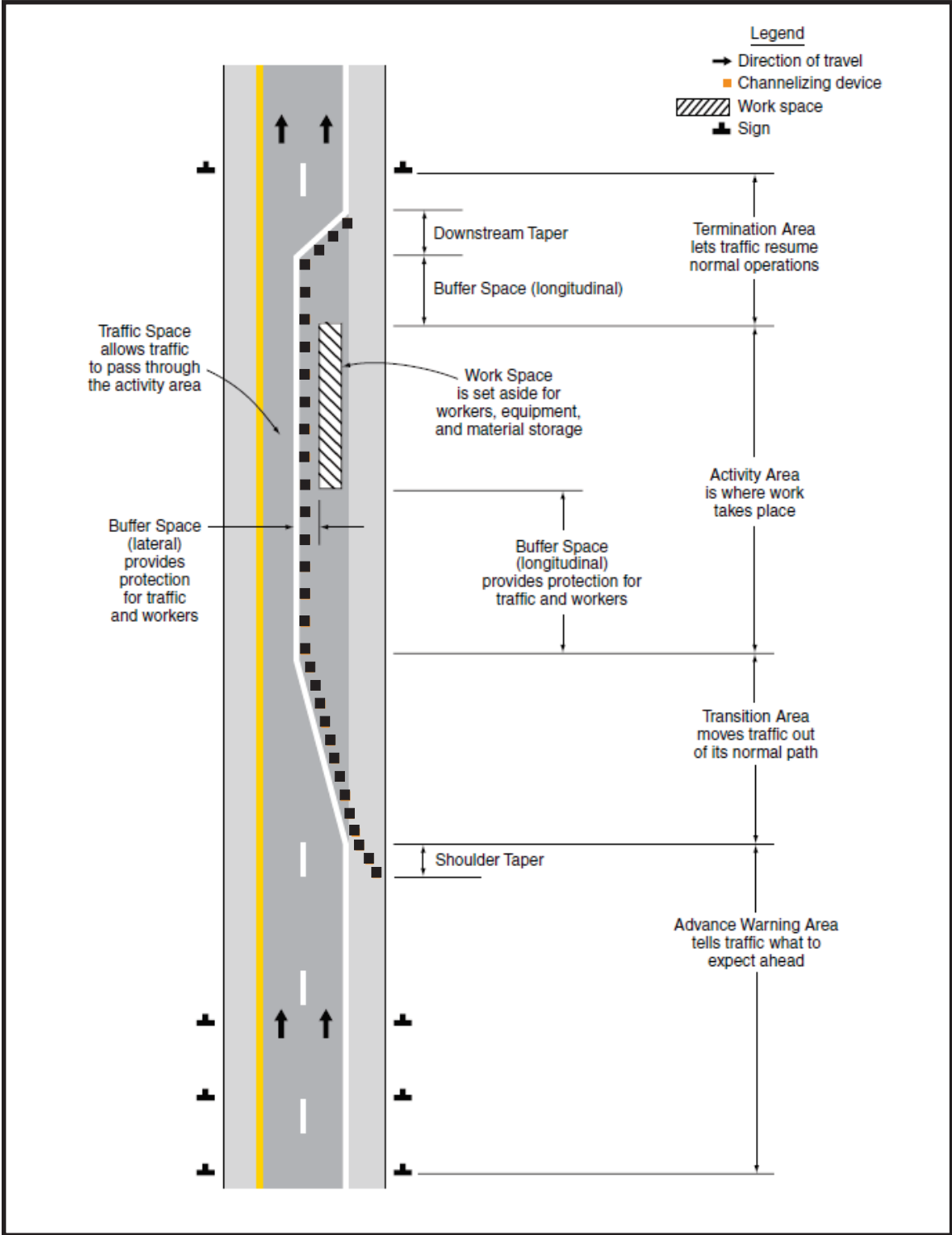
Arrow Board Type	Minimum Size	Minimum Legibility Distance	Minimum Number of Elements
A	48 x 24 inches	1/2 mile	12
B	60 x 30 inches	3/4 mile	13
C	96 x 48 inches	1 mile	15
D	None*	1/2 mile	12

*Length of arrow equals 48 inches, width of arrowhead equals 24 inches

II. Components of a Traffic Control Zone

Most traffic control zones can be divided into four parts as listed and shown.

- Advance Warning Area
- Transition Area
- Activity Area
- Termination Area



1. Advance Warning Areas are required for all temporary traffic control zones (TTC). This involves a system of advance warning signs, mainly diamond shaped signs with a black legend or symbol on an orange background. Placement and spacing of warning signs should follow the examples in Typical Applications on pages 10 - 26 and the table below. Note: The distances in the table below are approximate, are intended for guidance purposes only, and should be applied with engineering judgment. These distances should be adjusted for field conditions, if necessary, by increasing or decreasing the recommended distances.

Road Type	Distance Between Signs**		
	A	B	C
Urban (low speed)*	100 feet	100 feet	100 feet
Urban (high speed)*	350 feet	350 feet	350 feet
Rural	500 feet	500 feet	500 feet
Expressway / Freeway	1,000 feet	1,500 feet	2,640 feet

* Speed category to be determined by the highway agency.

** The column headings A, B and C are the dimensions shown in the Figures on pages 10-26. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The "first sign" is the sign in the three-sign series that is closest to the TTC zone. The "third sign" is the sign that is the furthest upstream from the TTC zone.)

2. Transition Areas are required when redirection of the driver's normal path is required; traffic must be channelized from the normal path to a new path. Transition areas usually involve the strategic use of tapers. Tapers are created by the proper deployment of channelizing devices such as cones and barricades. See the following table for proper channelizing device spacing and taper lengths under specific conditions.

Taper Length and Distance between Devices (Merging Taper Length)

Speed Limit (MPH)	Taper Length (L) (feet)**			Maximum Distance Between Devices (feet)	Minimum Number of Devices Needed
	10' Lane	11' lane	12' lane		
25	104	115	125	25*	6
30	150	165	185	30	7
35	204	225	245	35	8
40	267	293	320	40	9
45	450	495	540	45	13
50	500	550	600	50	13
55	550	605	660	55	13

* Distance between Traffic Cones used for tapers should not exceed 25 feet regardless of speed.

** Advance Warning Signs shall be placed a distance L in advance of channelization taper.

The appropriate taper length (L) should be determined using the criteria shown in the following two tables:

Taper Length Criteria for Temporary Traffic Control Zones (TTC)

Type of Taper	Taper Length
Merging Taper	at least L
Shifting Taper	at least 0.5 L
Shoulder Taper	at least 0.33 L
One-Lane, Two-Way Traffic Taper	50 feet minimum, 100 feet maximum
Downstream Taper	50 feet minimum, 100 feet maximum

Formulas for Determining Taper Length

Speed (S)	Taper Length (L) in feet
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or more	$L = WS$

Where: L = taper length in feet
W = width of offset in feet
S = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in mph

3. Activity Areas include a buffer space, work space and traffic space. The buffer space is an optional, but recommended feature in the activity area that separates traffic flow from the work space. Longitudinal and lateral buffer spaces can be used as shown in the example illustrated on page 4. The table below provides recommended lengths of buffer spaces.

Buffer Space Table

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

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

The work space is that portion of the roadway closed to traffic and set aside for workers, equipment and materials.

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

4. Termination Areas indicate the end of the temporary traffic control zone. It implies that drivers may resume normal driving practices. An **END ROAD WORK** sign could be employed to assist in providing this message.



III. Worker Safety Consideration

Equally as important as the safety of road users traveling through the TTC zone is the safety of workers. TTC zones present temporary and constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for workers on or near the roadway.

1. Safety Apparel

Standard: All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purposes of travel) or to work vehicles and construction equipment within the temporary traffic control (TTC) zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Safety Apparel and Headwear” (see [MUTCD Section 1A.11](#)), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure, except as provided in Paragraph 5. A person designated by the employer to be responsible for worker safety shall make the selection of the appropriate class of garment.

When uniformed law enforcement personnel are used to direct traffic, to investigate crashes, or to handle lane closures, obstructed roadways, and disasters, high-visibility safety apparel as described in this section shall be worn by the law enforcement personnel.

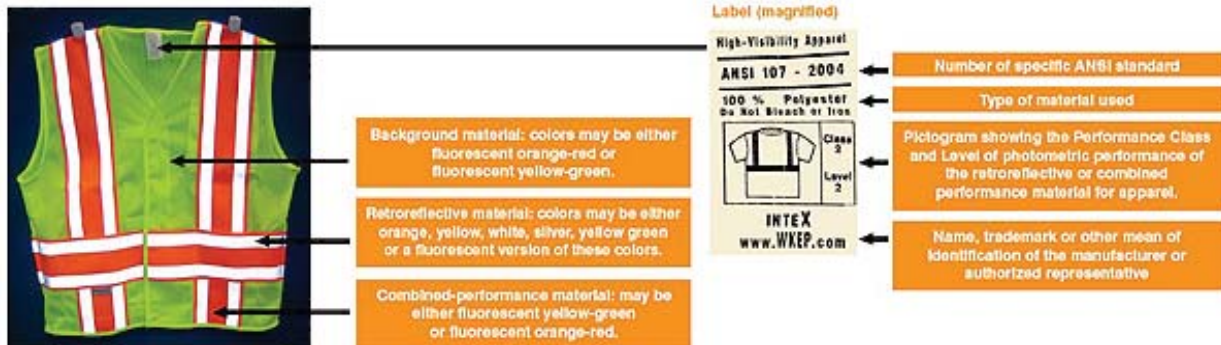


2. High-Visibility Safety Apparel

Standard: For daytime and nighttime activity, flaggers shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Apparel and Headwear” (see [MUTCD Section 1A.11](#)) and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. The apparel background (outer) material color shall be fluorescent orange-red, fluorescent yellow-green, or a combination of the two as defined in the ANSI standard. The retroreflective material shall be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of 1,000 feet. The retroreflective safety apparel shall be designed to clearly identify the wearer as a person.

Guidance: For nighttime activity, high-visibility safety apparel that meets the Performance Class 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Apparel and Headwear” (see [MUTCD Section 1A.11](#)) and labeled as meeting the ANSI 107-2004 standard performance for

Standard: When uniformed law enforcement officers are used to direct traffic within a TTC zone, they shall wear high-visibility safety apparel as described in this Section.



IV. FLAGGING PROCEDURES

The primary function of a flagger is to move vehicles and pedestrians safely and expeditiously through or around temporary traffic control zones while protecting on-site workers and equipment.

The flaggers responsibilities are critical to maintain a safe work site. When selecting flagger(s) for specific operations, certain qualifications should be considered. Flaggers should be able to satisfactorily demonstrate the following abilities:

- A. Ability to receive and communicate specific instructions clearly, firmly, and courteously;
- B. Ability to move and maneuver quickly in order to avoid danger from errant vehicles;
- C. Ability to control signaling devices (such as paddles and flags) in order to provide clear and positive guidance to drivers approaching a TTC zone in frequently changing situations;
- D. Ability to understand and apply safe traffic control practices, sometimes in stressful or emergency situations; and
- E. Ability to recognize dangerous traffic situations and warn workers in sufficient time to avoid injury.

For daytime and nighttime activity, flaggers shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Apparel and Headwear” (see Section 1A.11) and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. The apparel background (outer) material color shall be fluorescent orange-red, fluorescent yellow-green, or a combination of the two as defined in the ANSI standard. The retroreflective material shall be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of 1,000 feet. The retroreflective safety apparel shall be designed to clearly identify the wearer as a person.

For nighttime activity, high-visibility safety apparel that meets the Performance Class 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Apparel and Headwear” (see Section 1A.11) and labeled as meeting the ANSI 107-2004 standard performance for Class 3 risk exposure should be considered for flagger wear.

Hand Signaling Devices

The STOP/SLOW paddle should be the primary and preferred hand-signaling device because the STOP/SLOW paddle gives road users more positive guidance than red flags. Use of flags should be limited to emergency situations.

The STOP/SLOW paddle shall have an octagonal shape on a rigid handle. The STOP/SLOW paddles shall be at least 18 inches wide with letters at least 6 inches high. The STOP (R1-1) face shall have white letters and a white border on a red background. The SLOW (W20-8) face shall have black letters and a black border on an orange background. When used at night, the STOP/SLOW paddle shall be retroreflectorized

Flags, when used, shall be red or fluorescent orange/red in color, shall be a minimum of 24 inches square, and shall be securely fastened to a staff that is approximately 36 inches in length. The free edge of a flag should be weighted so the flag will hang vertically, even in heavy winds. When used at nighttime, flags shall be retroreflectorized red. The use of paddles and flags by flaggers is illustrated in the figure below.

The following methods of signaling with paddles shall be used:

To Stop Traffic:

The flagger should stand in a conspicuous position on the right edge of the traveled lane, facing traffic and extending the paddle in a vertical position so the full STOP face is visible. The flagger should look directly at the approaching driver and raise and expose the palm of the free hand to indicate the vehicle is required to stop. After the first vehicle has stopped, the flagger then moves to a position near the centerline so the STOP face can be seen by approaching drivers.

Directing Stopped Traffic to Proceed:

The flagger moves to a safe position toward the right edge of the traveled lane, facing traffic and rotates the paddle so the full SLOW message is displayed. Traffic is waved onward by moving the free arm across the body as shown.

To Alert or Slow Traffic:

The flagger, positioned in a safe location, faces traffic with the SLOW message held in a stationary position with the free arm extended horizontally away from the body. To further alert or slow traffic, the flagger holding the SLOW paddle face toward road users may motion up and down with the free hand, palm down.

The following methods of signaling with a flag shall be used:

To Stop Traffic:

The flagger should stand in a conspicuous position on the right edge of the traveled lane, facing traffic and extend the flag staff horizontally across the road users' lane in a stationary position so that the full area of the flag is visibly hanging below the staff. The flagger should look directly at the approaching driver and raise and expose the palm of the free hand to indicate the vehicle is required to stop. After the first vehicle has stopped, the flagger then moves to a position near the centerline so the flag can be seen by approaching drivers.

Directing Stopped Traffic to Proceed:

The flagger moves to a safe position toward the right edge of the traveled lane, the flagger shall face road users with the flag and arm lowered from the view of the road users, and shall motion with the free hand for road users to proceed. Flags shall not be used to signal road users to proceed.

To Alert or Slow Traffic:

The flagger, positioned in a safe location, shall face road users and slowly wave the flag in a sweeping motion of the extended arm from shoulder level to straight down without

raising the arm above a horizontal position. The flagger shall keep the free hand down.

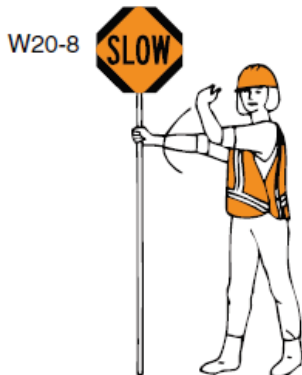
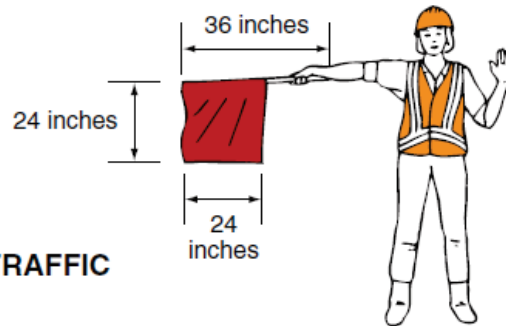
Flagger stations shall be located such that approaching road users will have sufficient distance to stop at an intended stopping point.

Use of Hand-Signaling Devices by Flagger.

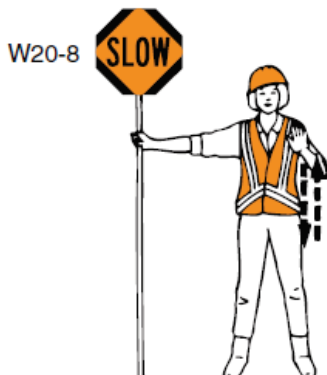
PREFERRED METHOD STOP/SLOW Paddle



EMERGENCY SITUATIONS ONLY Red Flag



TO LET
TRAFFIC PROCEED



TO ALERT AND
SLOW TRAFFIC



IV. GENERAL PROVISIONS

All quality traffic control zones begin with a traffic control plan (TCP). Unless emergency situations dictate otherwise, sufficient time should be provided to prepare a TCP. The proper order of device placement is: 1) advance warning signs, 2) channelizing devices and other adjacent signs and, 3) end work zone signs and devices. Pick up should be performed in the reverse order. For situations when diverting traffic into opposing traffic lane(s), the opposing traffic must be shifted out of the intended “traffic space” first. Any Men Working or Flagman Ahead signs placed for a temporary traffic control zone should be removed or covered when the work is completed and the activity area is cleared.

For work sites within the City of Naperville limits and on multi-lane arterials, arrow displays are required for any lane closures.

Work zones shall not delay traffic during the peak traffic periods. Lanes shall not be closed during these time except by express approval of the Transportation, Engineering and Development Business Group. For major arterials within the City of Naperville, it is only acceptable to close traffic lanes between the hours of 8:30 a.m. to 3:30 p.m. on weekdays unless an emergency exists.

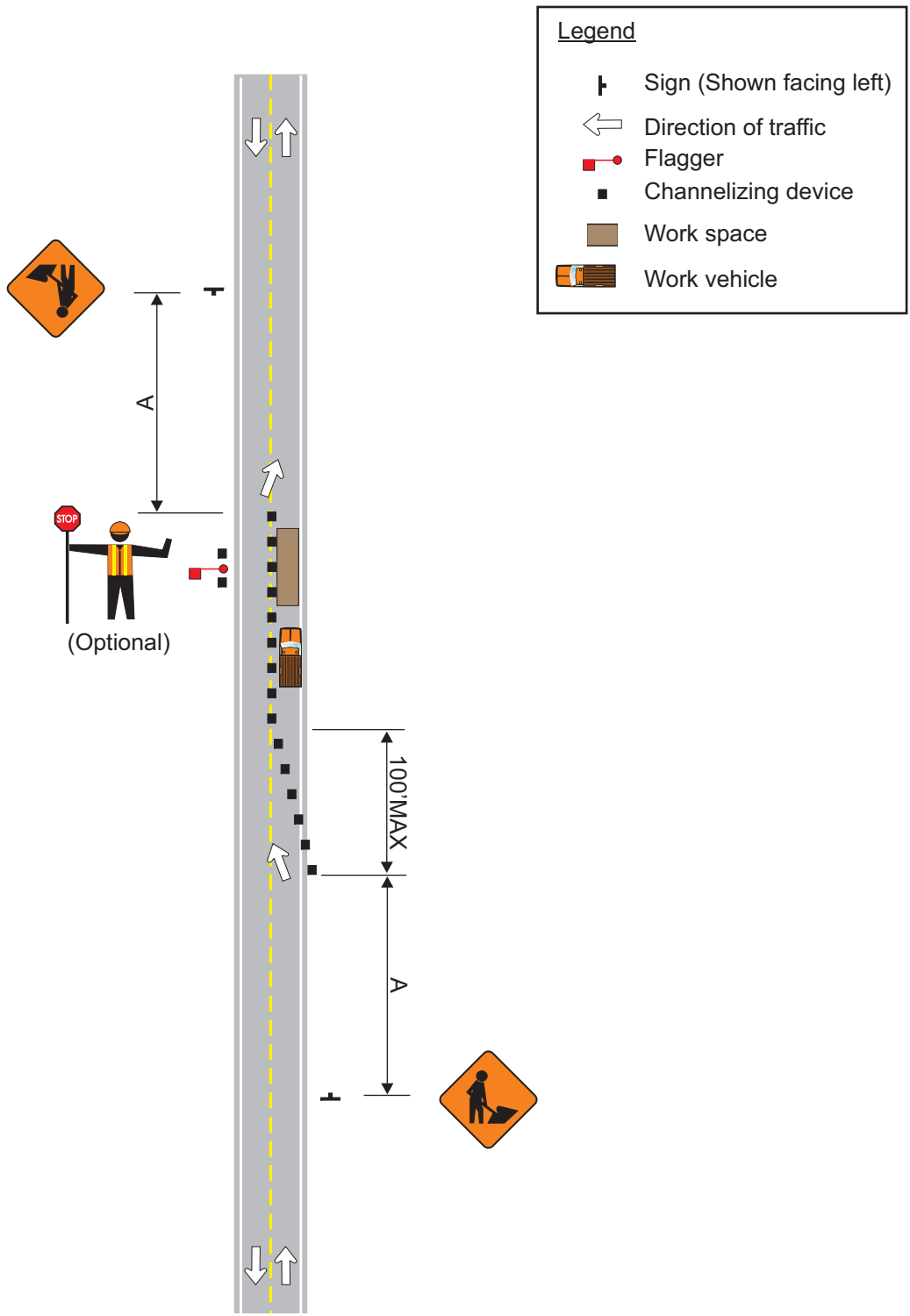
To reduce the disruption of vehicle flow, travel lane occupancy time can be significantly reduced by better work scheduling. Corrective steps include:

- Proper instruction of crews before they arrive at the work site.
- Make certain all tools, supplies and equipment needed are taken to the site and are in good working order.
- Schedule arrival of materials and special equipment so that productive time is not lost
- Control breaks and lunch periods keeping completion of the project in mind. When possible, schedule breaks while waiting for equipment or during curing times.
- Consider night operations, if practical.

All traffic control devices deployed must be in conformance with the provisions of the Manual on Uniform Traffic Control Devices.

V. Typical Applications

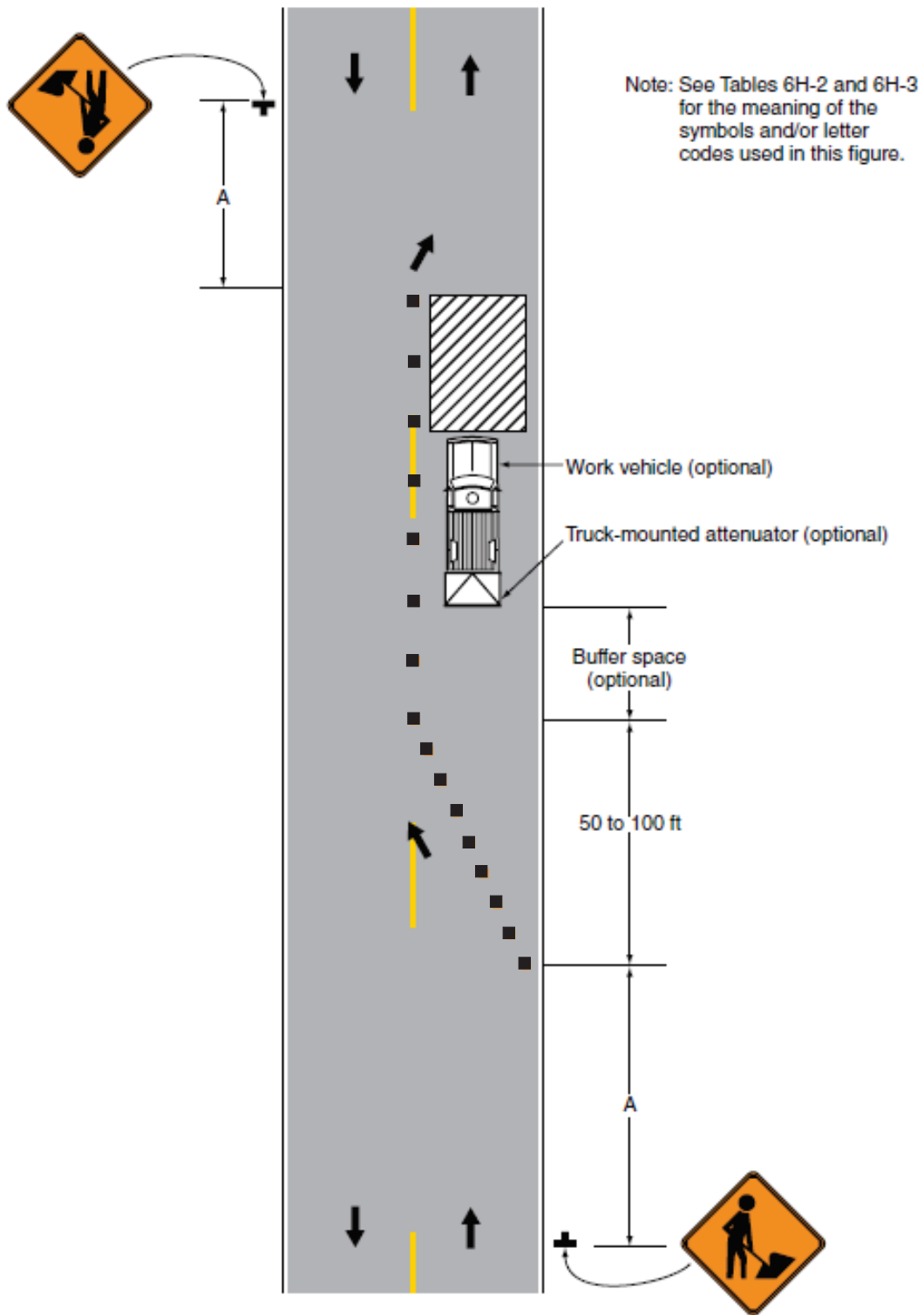
A) Two Lane Roadways - Local Roads



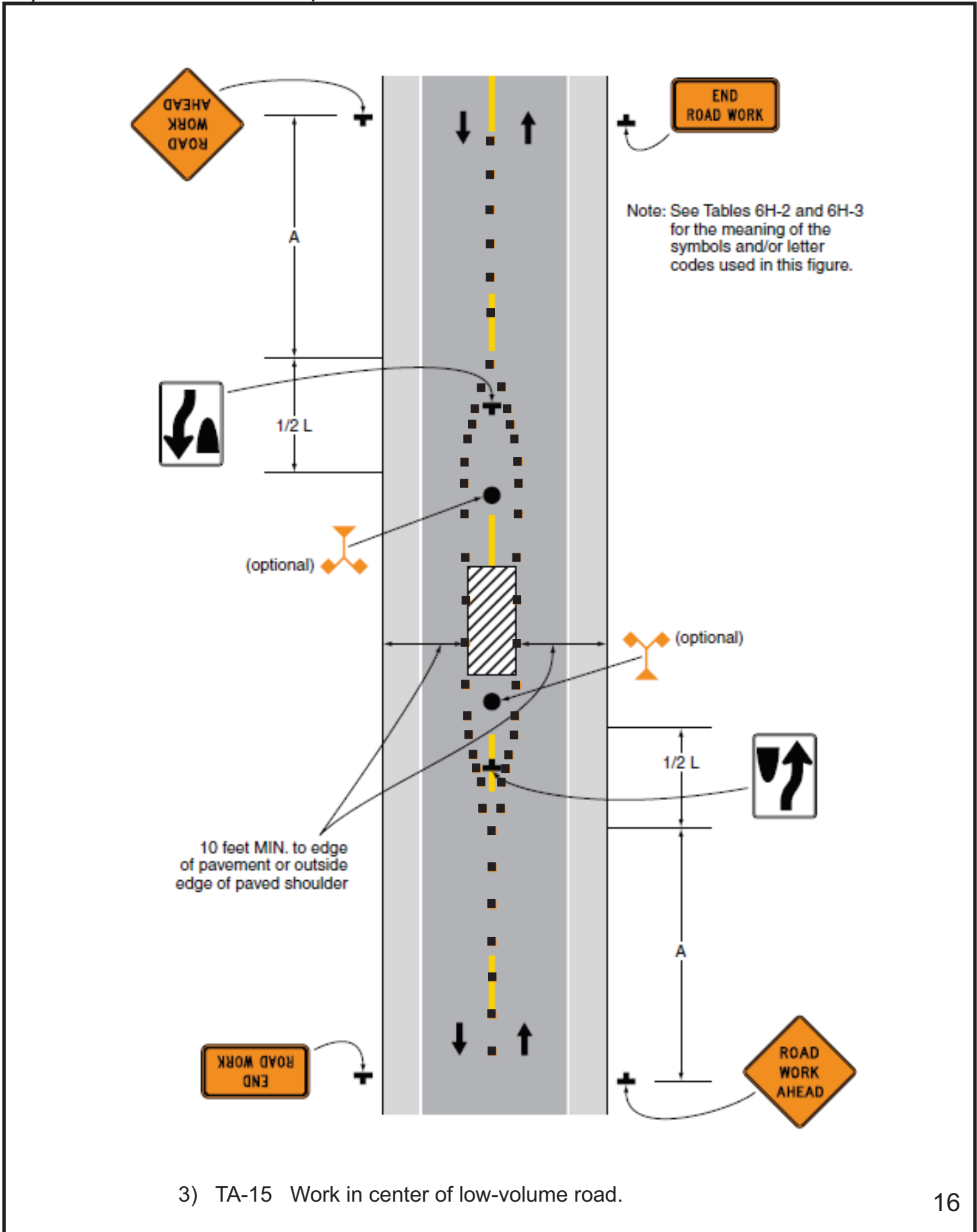
If in doubt, use flagger in conjunction with the Flagger Warning signs (See next page for sign placement).

1) N-1 Lane closure on residential street (low volume)

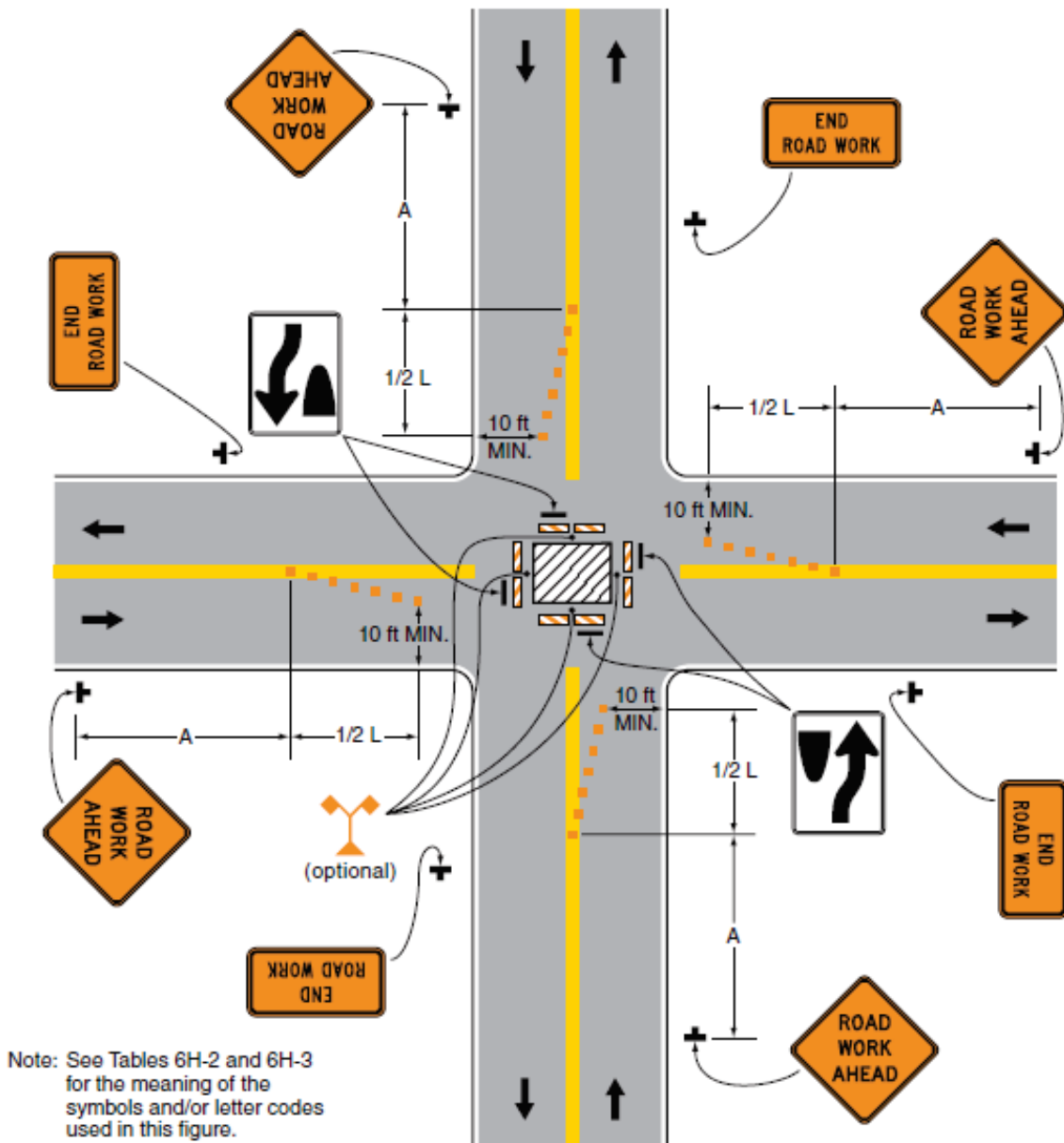
A) Two Lane Roadways - Local Roads



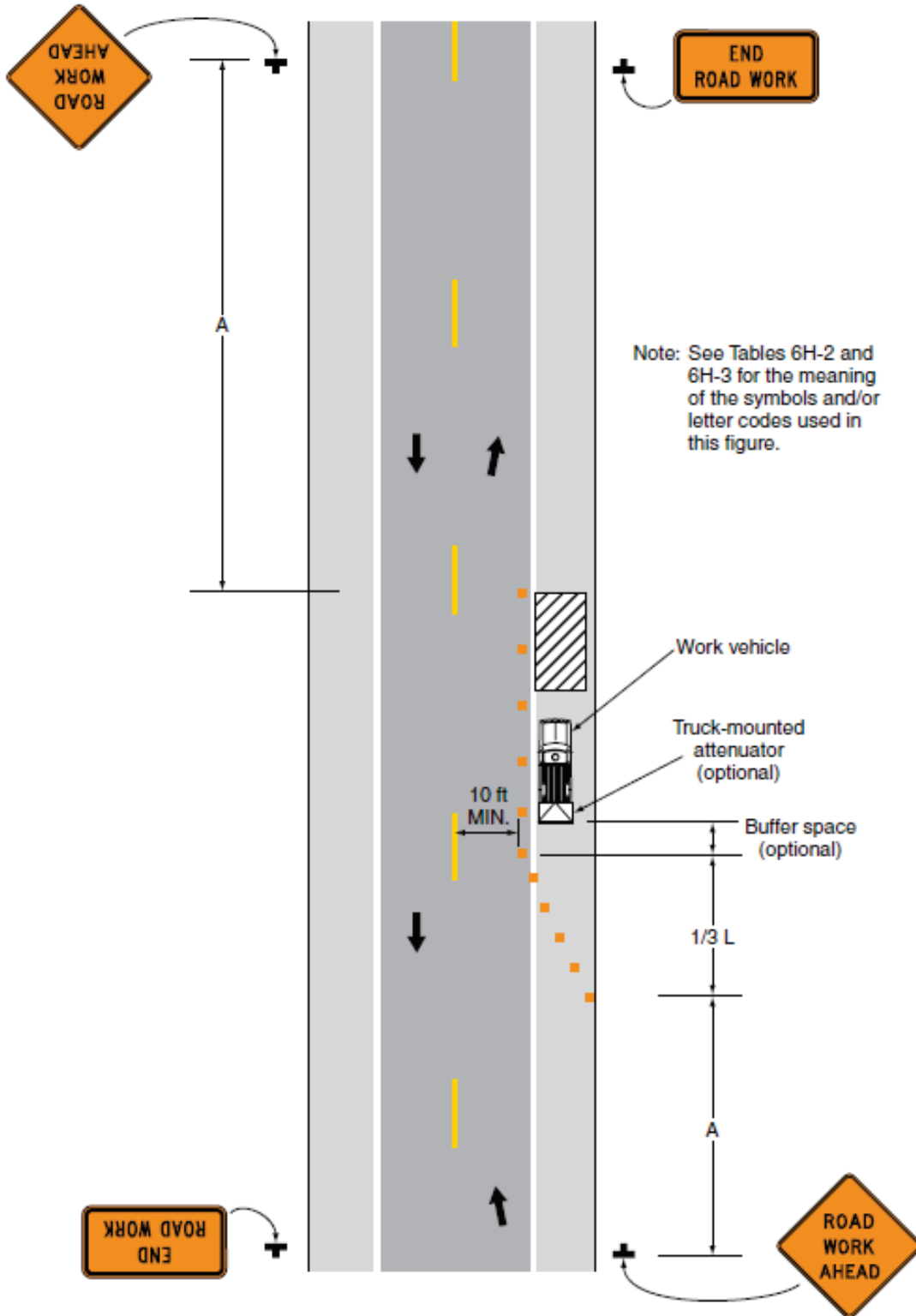
A) Two Lane Roadways - Local Roads



A) Two Lane Roadways - Local Roads



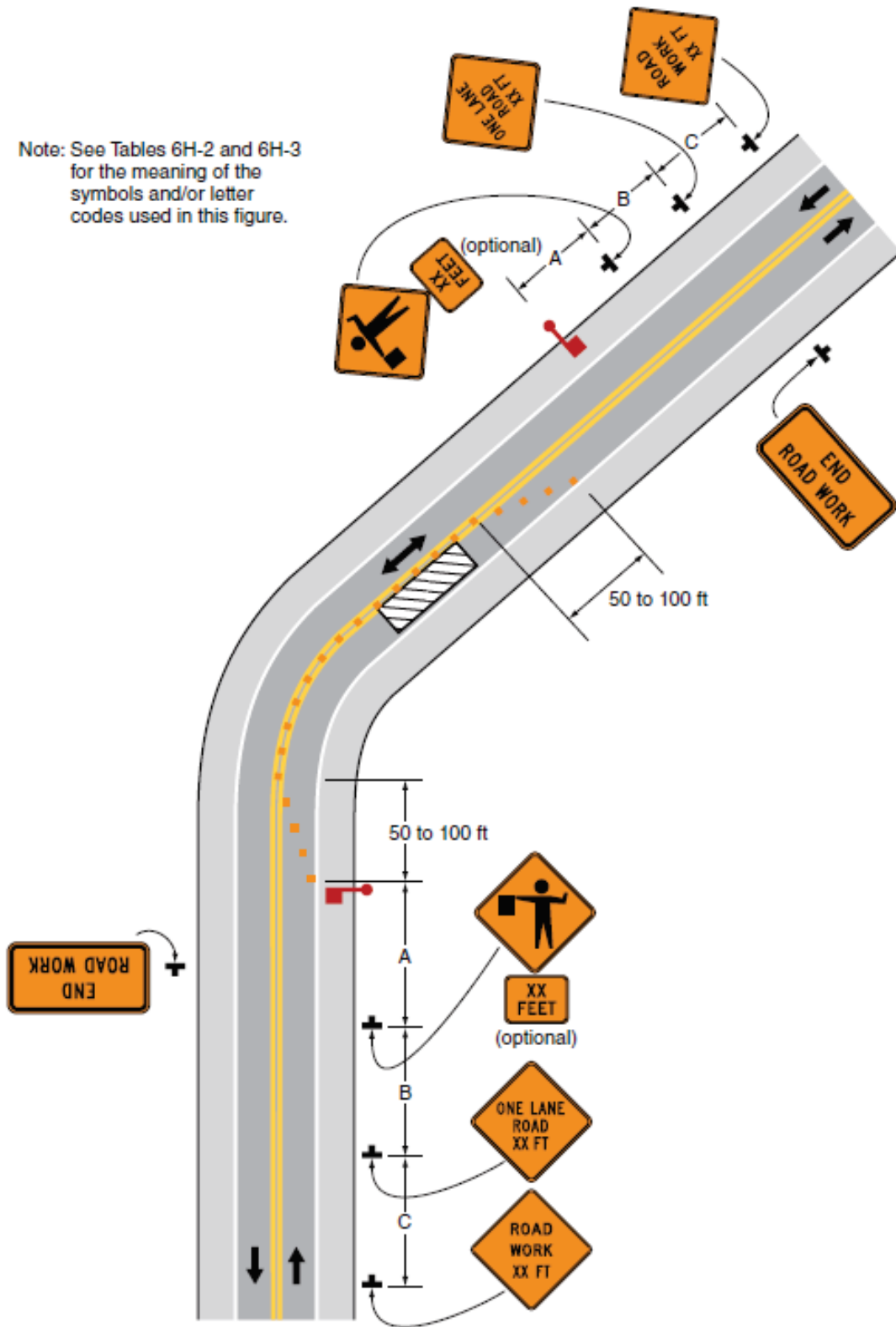
B) Two Lane Roadways - Collectors and Arterials



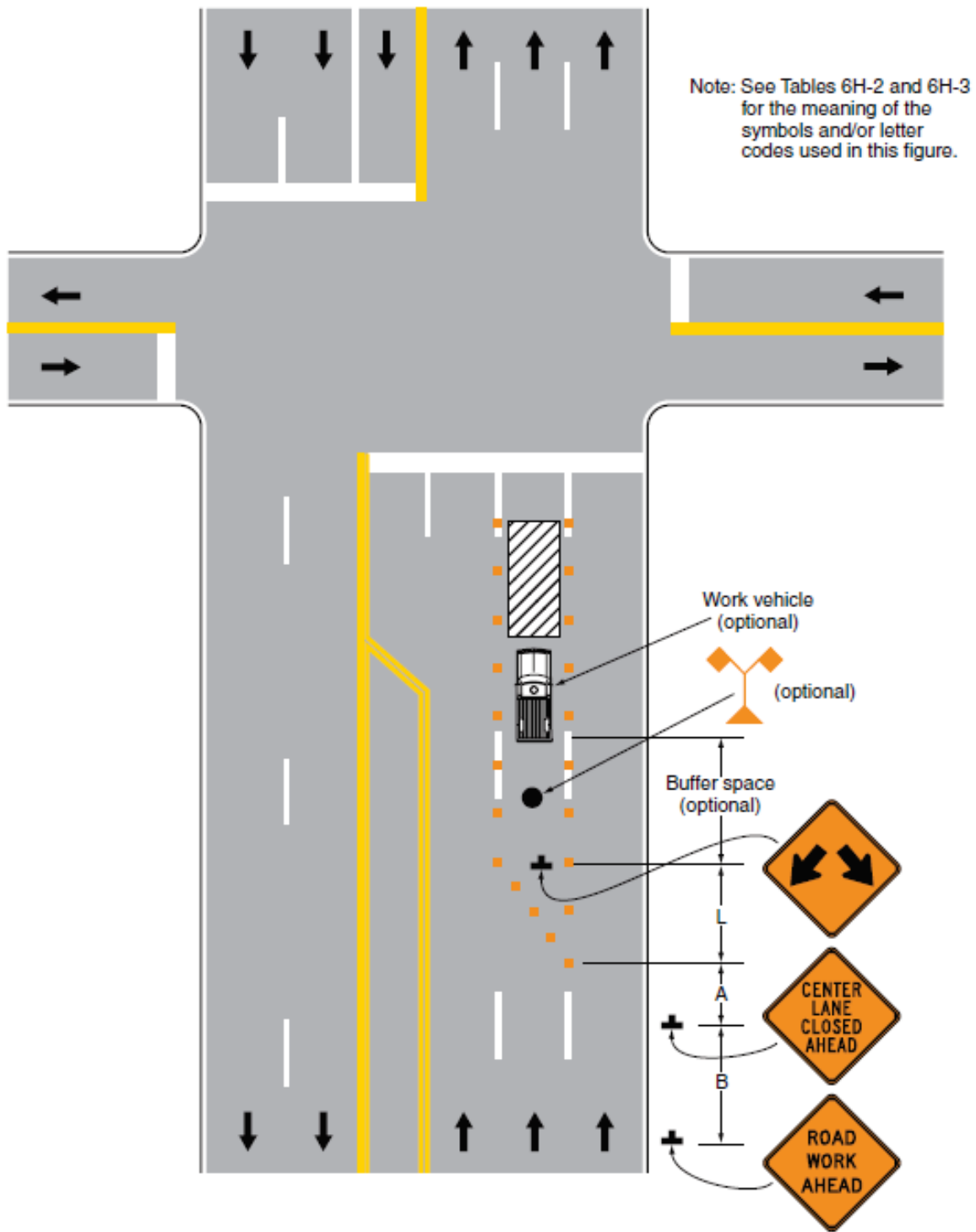
1) TA-6 Shoulder work with minor encroachment.

B) Two Lane Roadways - Collectors and Arterials

Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.

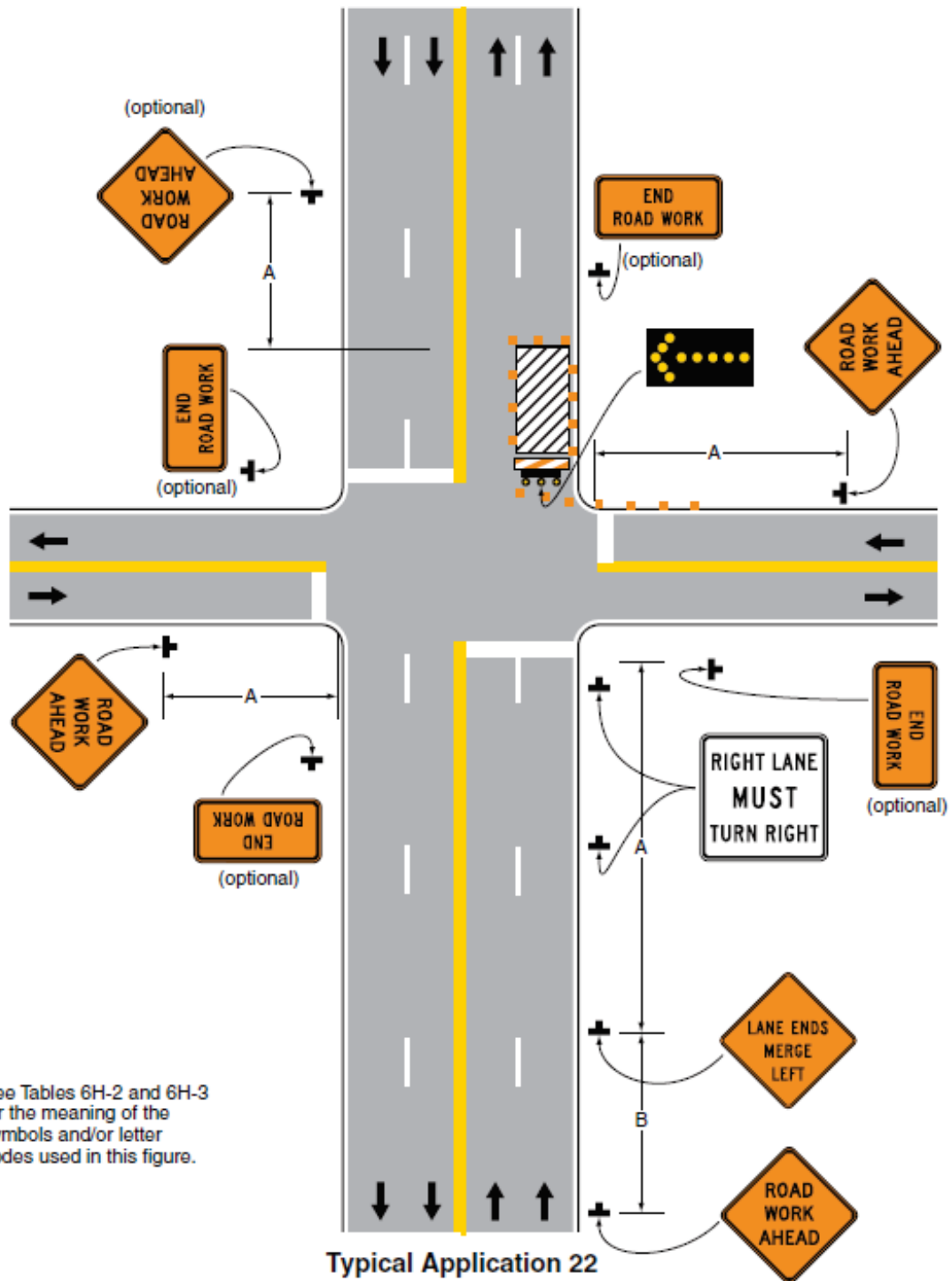


C) Multi-Lane Roadways - Arterials

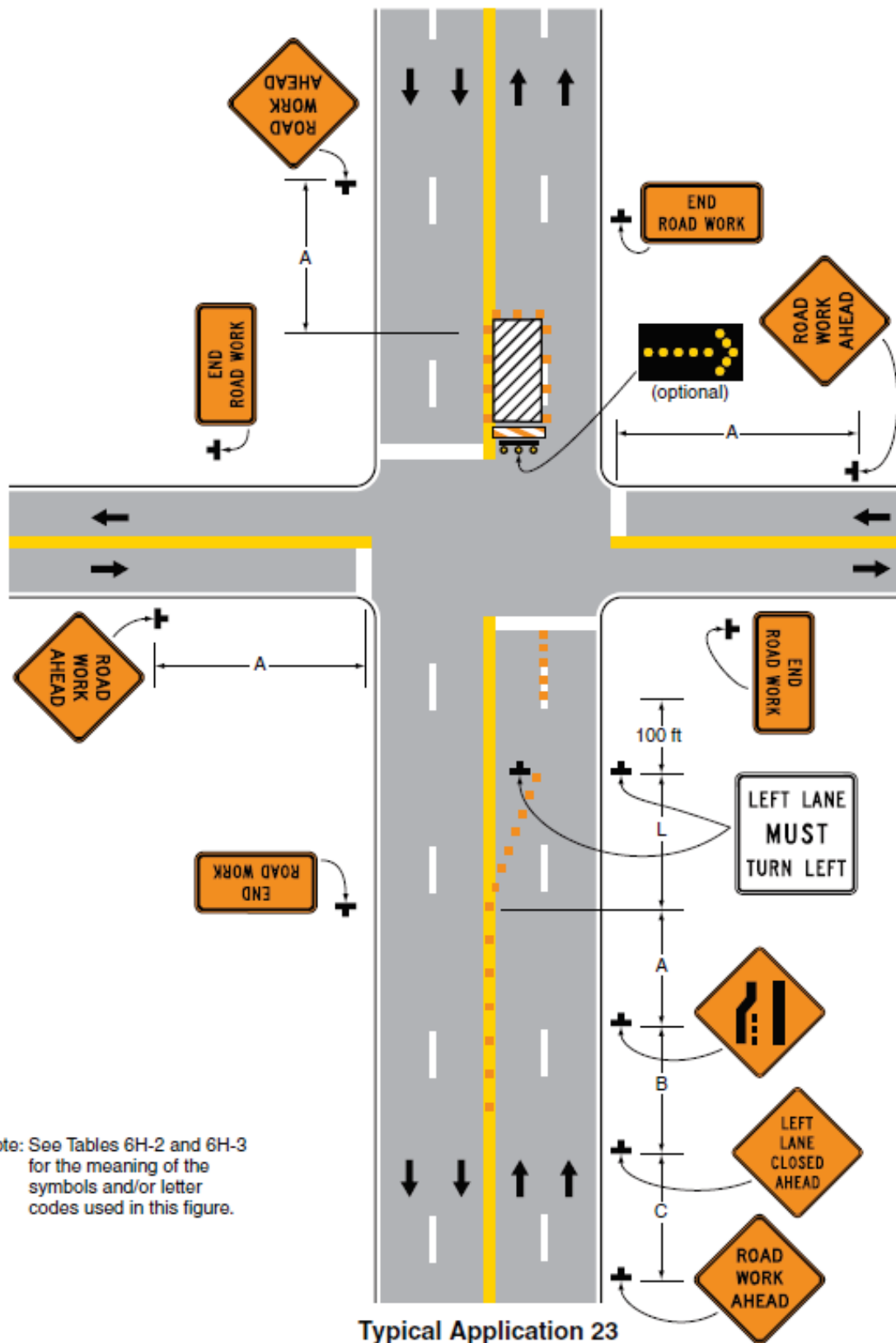


1) TA-21 Lane closure near side of intersection.

C) Multi-Lane Roadways - Arterials

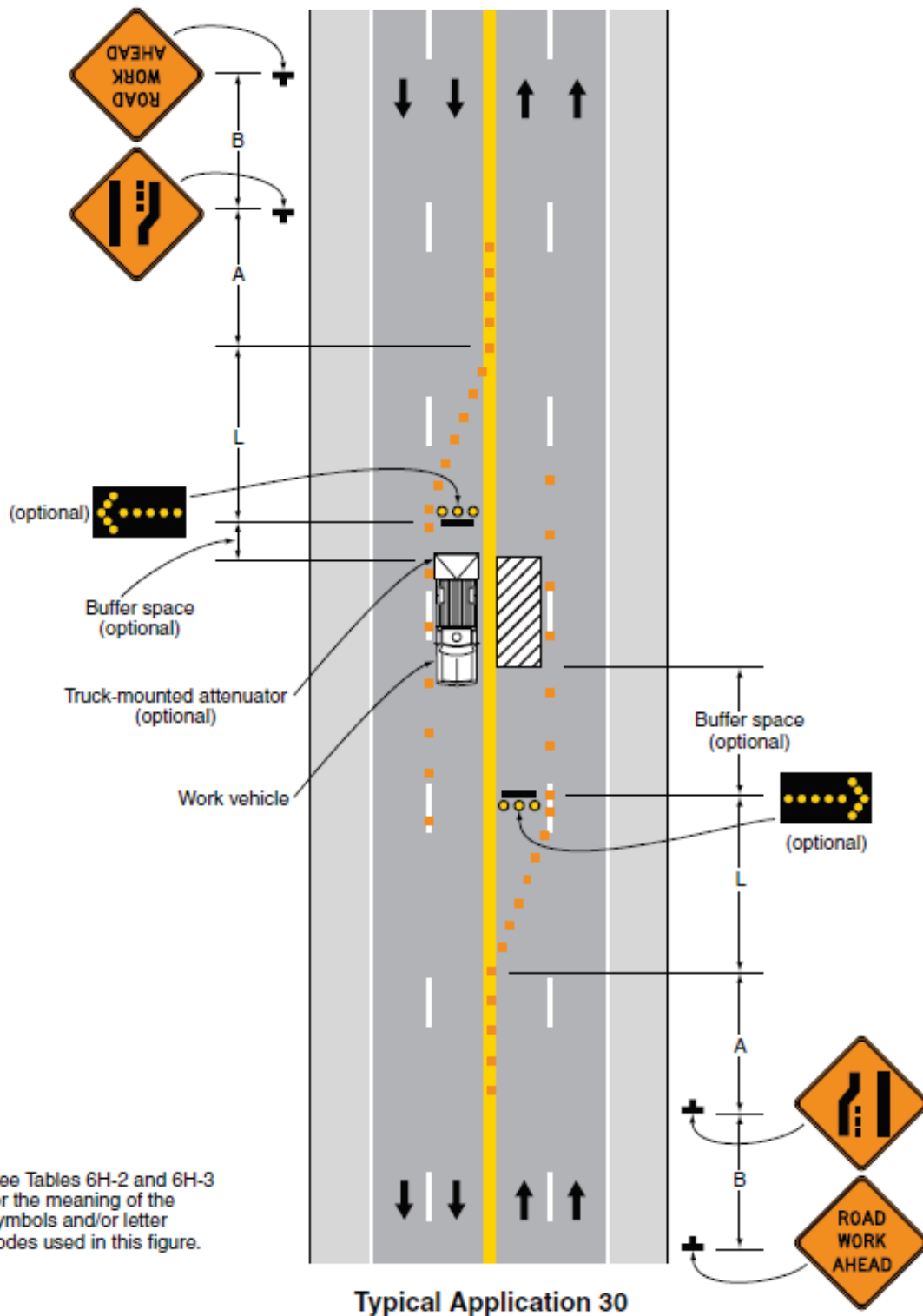


C) Multi-Lane Roadways - Arterials

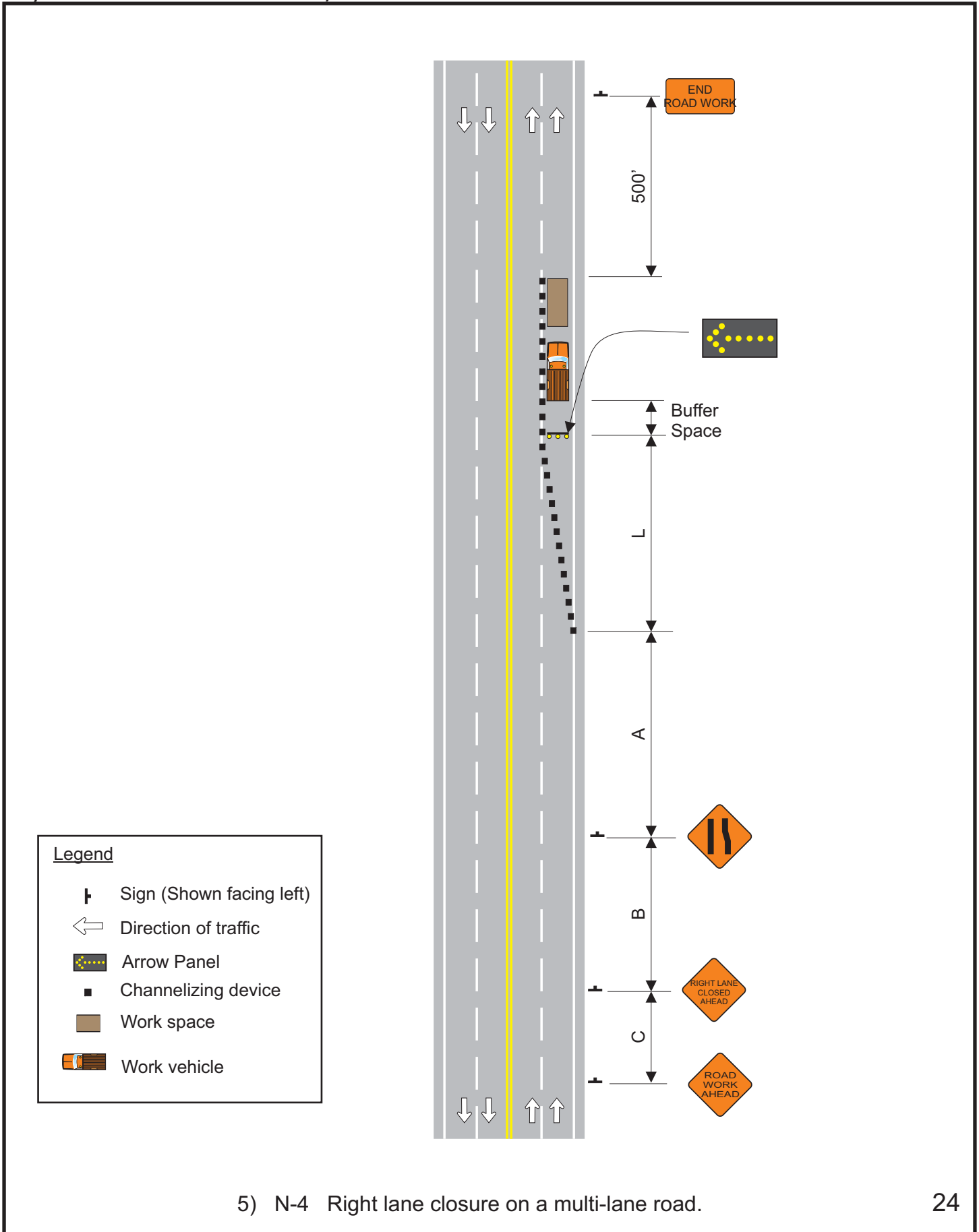


3) TA-23 Left lane closure far side of intersection.

C) Multi-Lane Roadways - Arterials

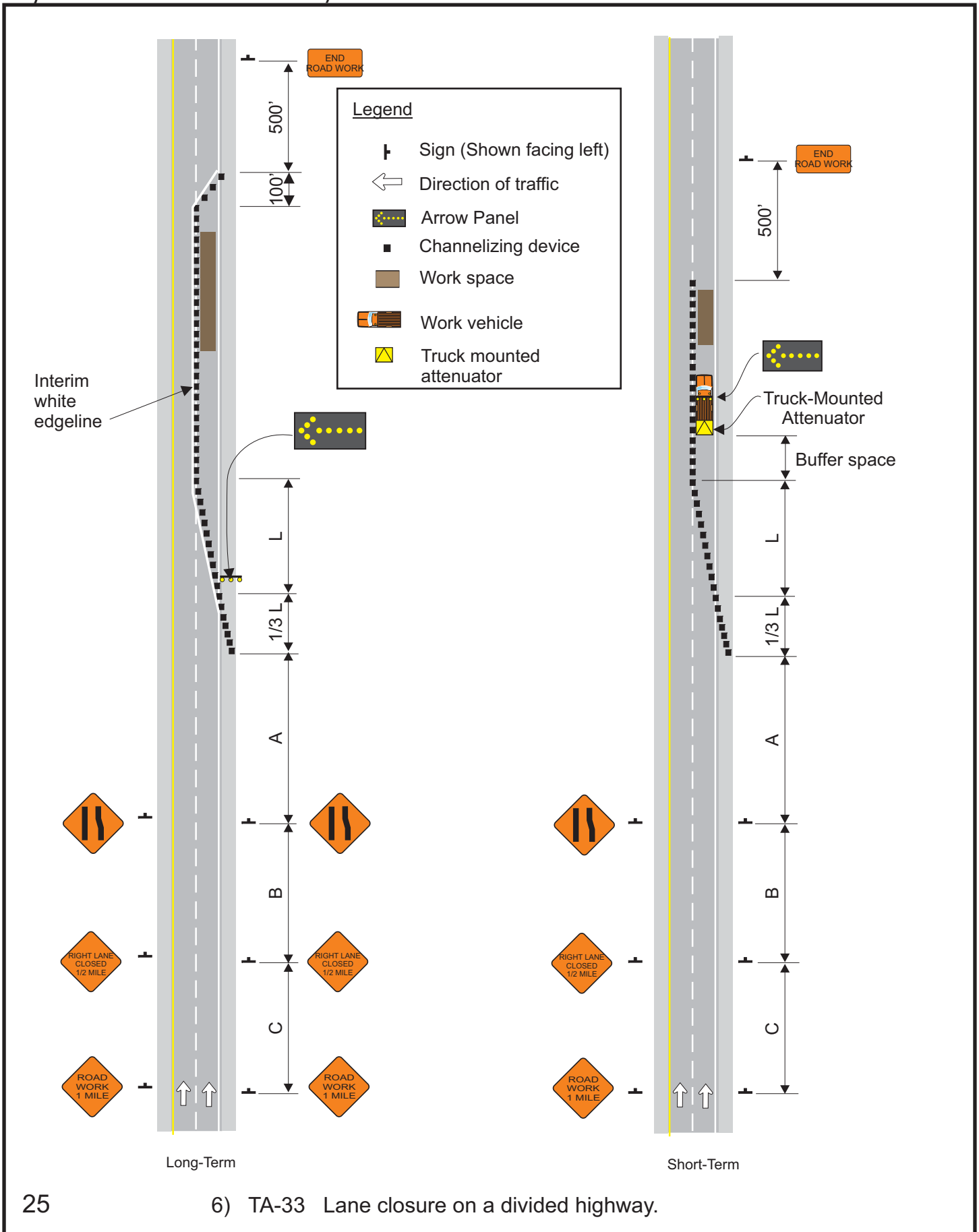


C) Multi-Lane Roadways - Arterials

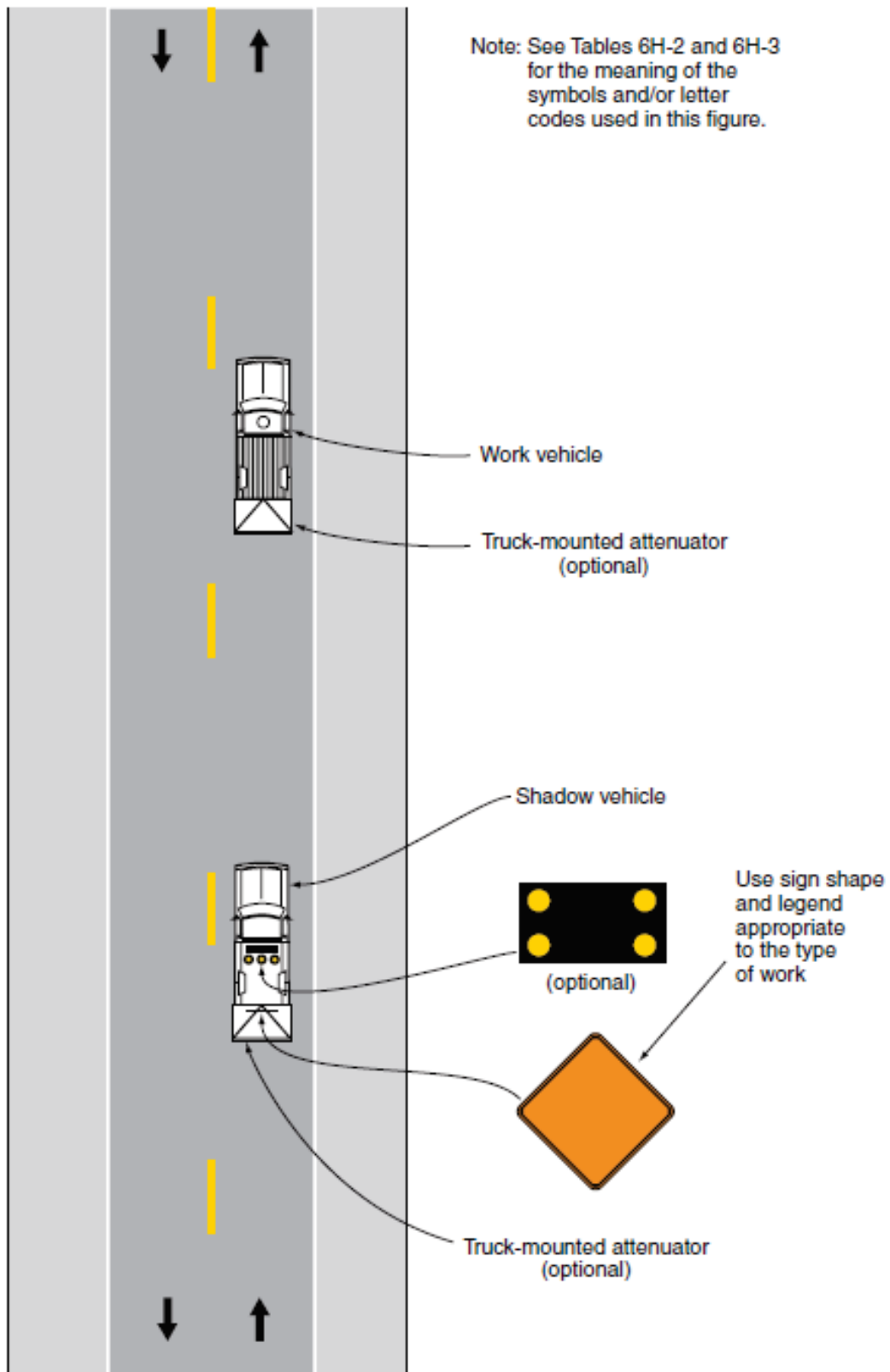


5) N-4 Right lane closure on a multi-lane road.

C) Multi-Lane Roadways - Arterials

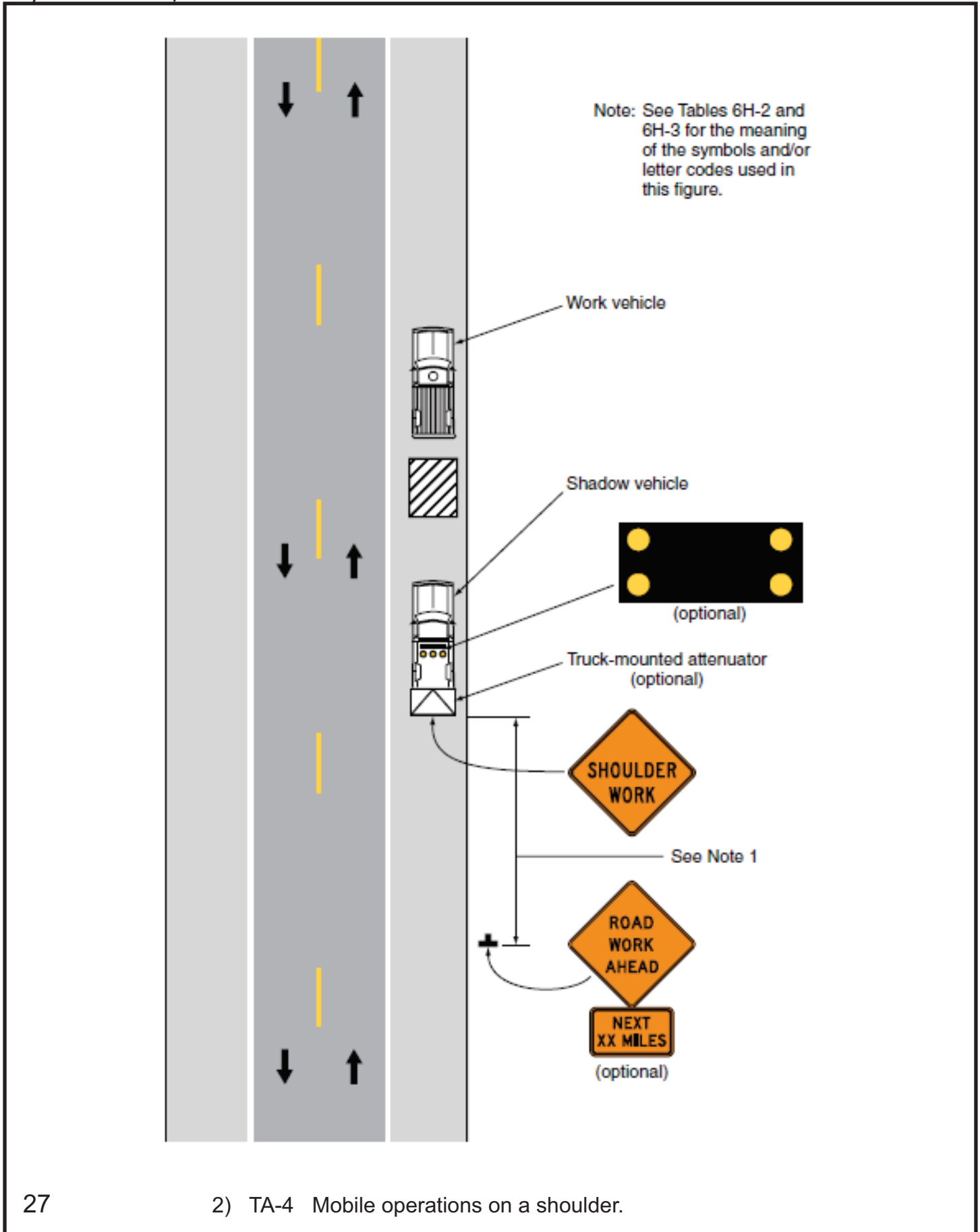


D) Mobile operations

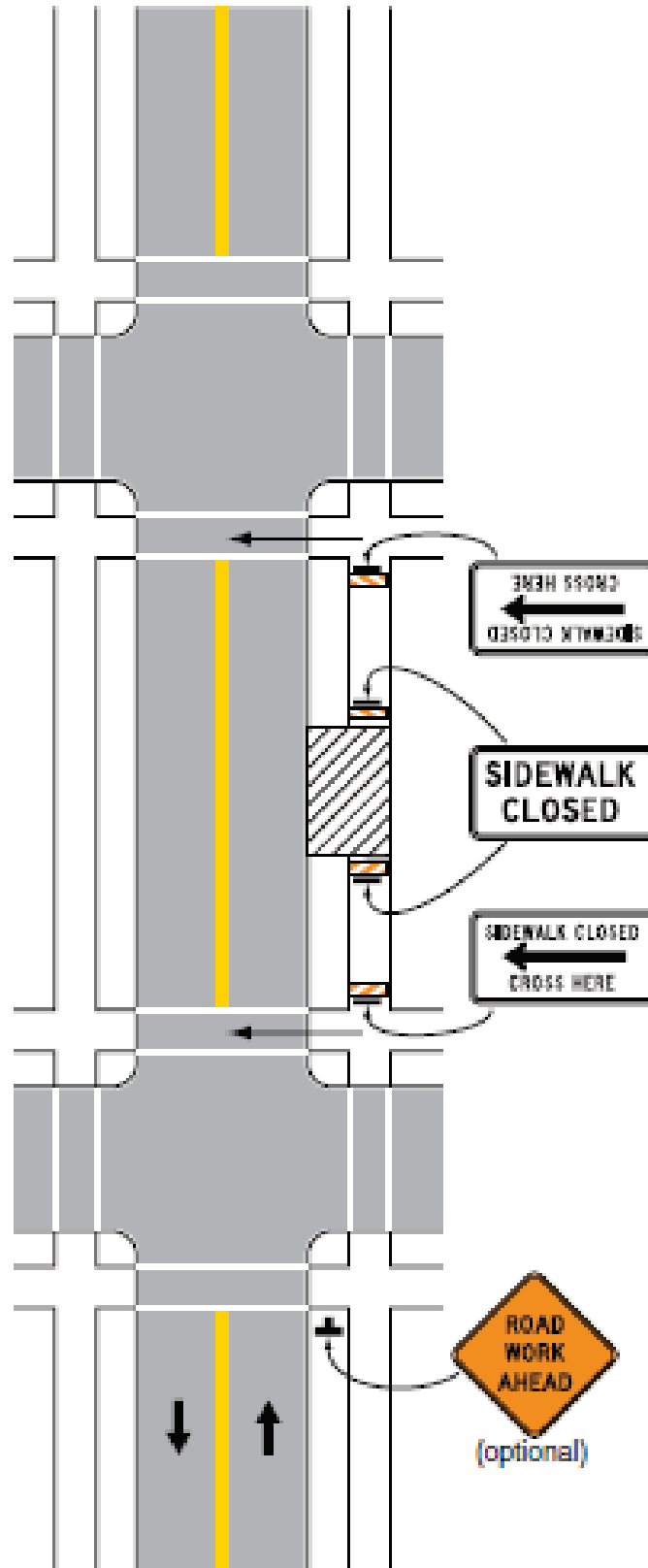


1) TA-17 Mobile operations on a two-lane road.

D) Mobile operations

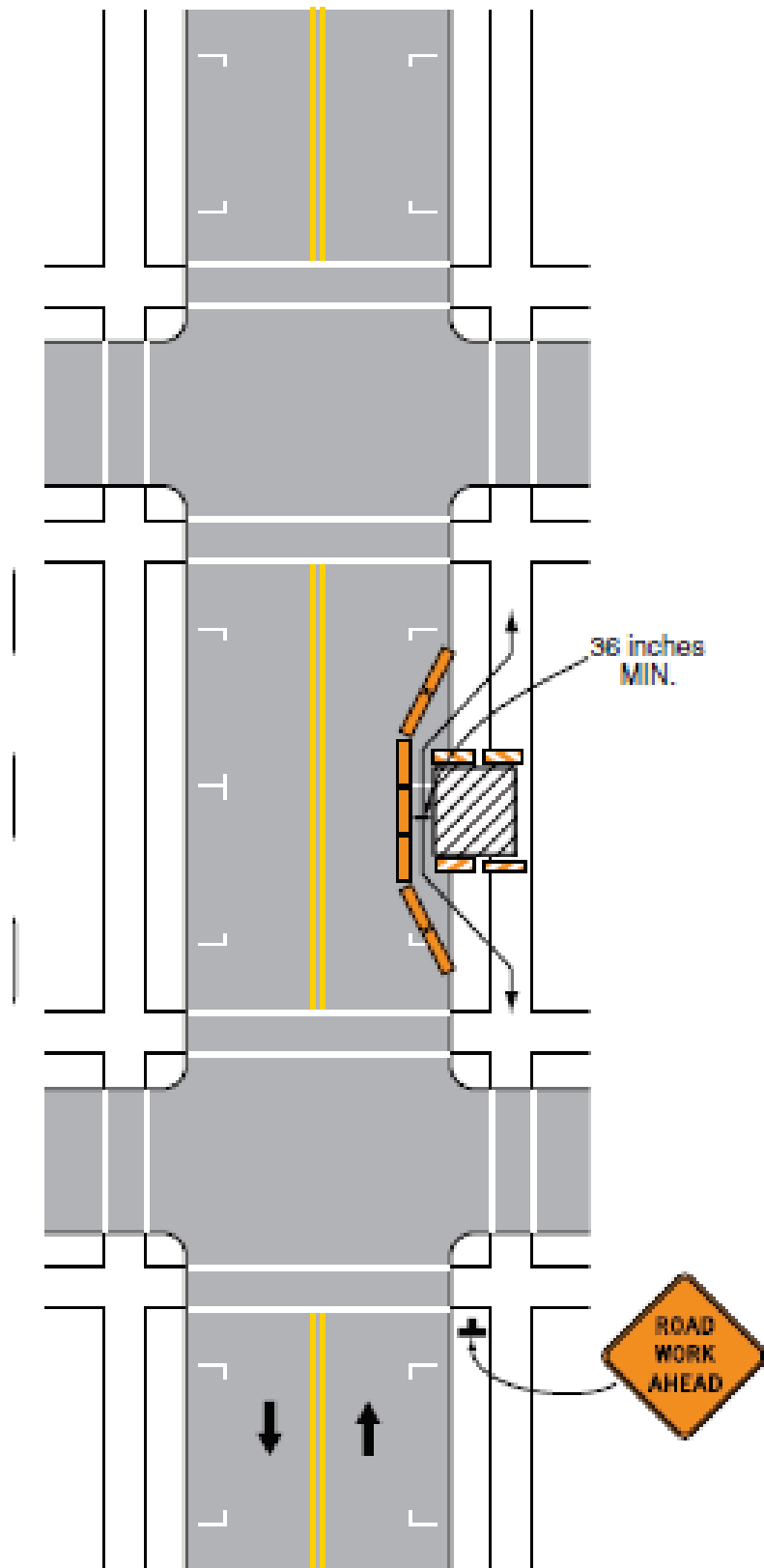


E) Sidewalk Closures

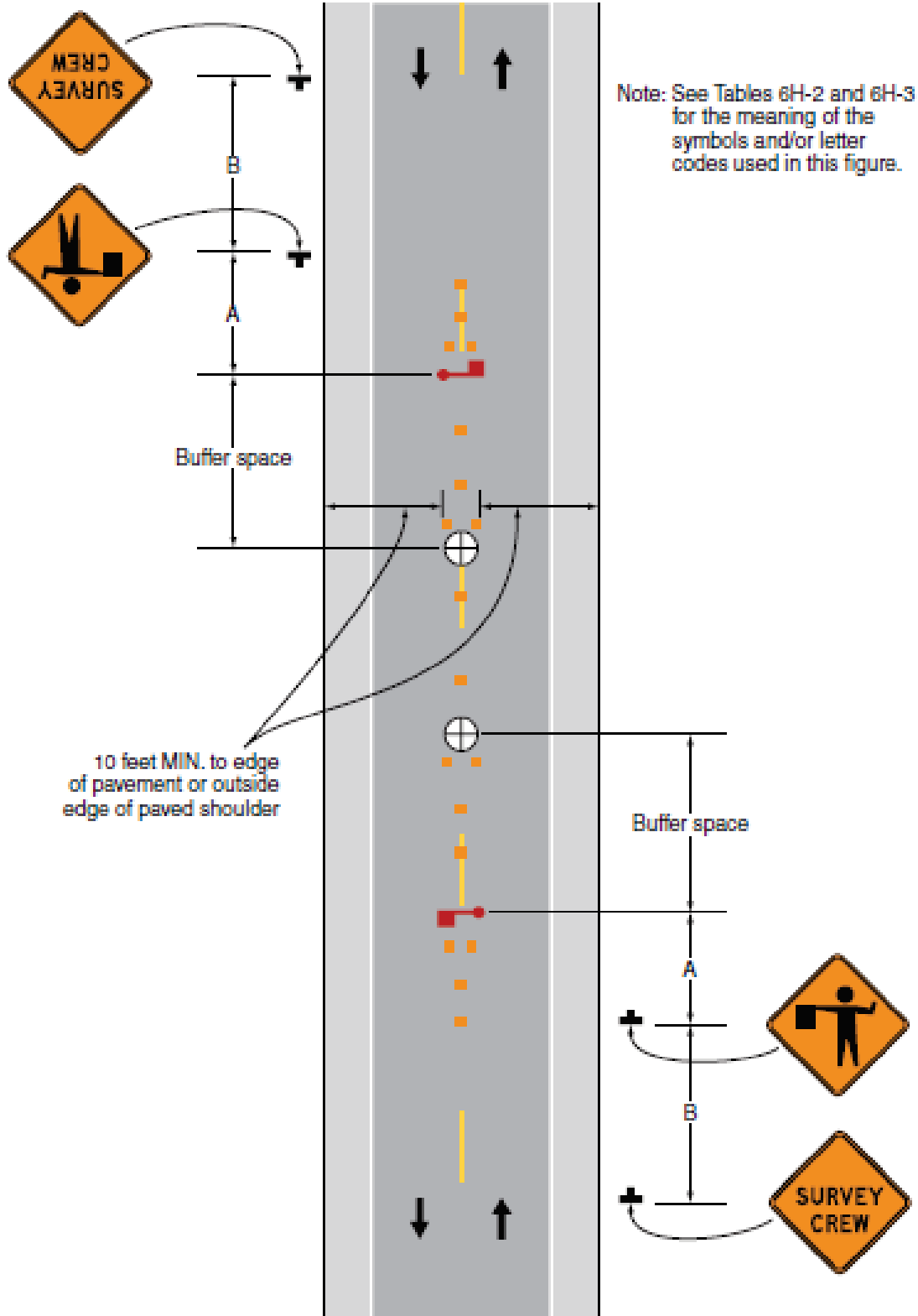


1) N-28A Pedestrian detour.

E) Sidewalk Closures



F) Surveying



1) TA-16 Surveying along minor street (higher volume)

Acknowledgments

Information and illustrations within this guide have been contributed by:

U.S. Department of Transportation, Federal Highway authority (FHWA),
2009 Manual on Uniform Traffic Control Devices (MUTCD)

City of Naperville, TED Business Group