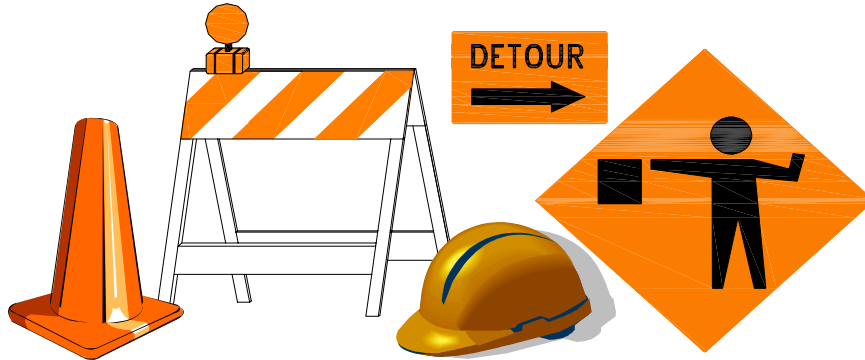


TRAFFIC CONTROL HANDBOOK



FOR
STREET MAINTENANCE
AND
CONSTRUCTION OPERATIONS



PUBLIC WORKS • TRAFFIC SERVICES • JANUARY 2005

Table of Contents

I.	INTRODUCTION	4
II.	PURPOSE OF HANDBOOK.....	4
III.	PURPOSE OF TRAFFIC CONTROL DEVICES	4
IV.	APPLICABILITY OF REGULATIONS.....	5
V.	PROCEDURE FOR OBTAINING PERMISSION TO WORK IN CITY STREETS	5
	A. Permit Work	5
	B. Non-Permit Work	5
VI.	GENERAL PROVISIONS APPLICABLE TO ALL STREET WORK	6
	A. General	6
	B. Certification Requirements	6
	C. Emergency Services	6
	D. Closures and Disruption to Traffic.....	6
	E. Specifications	7
	F. Protective Clothing	7
	G. Minimum Lane Width	7
VII.	WORK DURATION	7
	A. Long-term stationary is work that occupies a location more than 3 days.....	8
	B. Intermediate-term stationary is work that occupies a location for more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour	8
	C. Short-term stationary is daytime work that occupies a locaion for more than 1 hour within a single daylight period	8
	D. Short duration is work that occupies a location up to 1 hour	9
	E. Mobile is work that moves intermittently or continuously	9
VIII.	PROCEDURE FOR PERFORMING WORK IN A CITY STREET ON AN EMERGENCY BASIS	10

IX.	COMPONENTS OF TEMPORARY TRAFFIC CONTROL ZONES	10
	A. Advance Warning Area	10
	B. Transition Area.	12
	C. Activity Area.	14
	D. Termination Area.	15
X.	TRAFFIC CONTROL DEVICES AND THEIR USES.	15
	A. General Requirements.	15
	B. Signs	16
	C. Barricades and Channelizing Devices.	19
	D. Lighting Devices.	25
	E. Portable Changeable Message Signs	26
	F. Arrow Panels	28
	G. High Level Warning Devices (Flag Trees).	30
	H. Hand Signaling Devices.	30
	I. Pavement Markings.	32
	J. Sidewalks	33
XI.	SPECIAL OPERATIONS	33
	A. Moving Street Striping	33
	B. Moving Maintenance	33
	C. Crosswalk Pavement Markings	34
	D. Spot Maintenance	34

FIGURES

FIGURE 1	Component Parts of a Temporary Traffic Control Zone	11
FIGURE 2	Types of Tapers and Buffer Spaces.	13
FIGURE 3	Portable and Temporary Mountings for Signs	17
FIGURE 4	Typical Installation Height and Lateral Locations of Signs	18
FIGURE 5	Barricades and High Level Warning Devices	20
FIGURE 6	Channelizing Devices and High Level Warning Devices	21
FIGURE 7	Portable and Temporary Signs and Arrow Display.	29
FIGURE 8	Use of Hand Signaling Device by Flagger	31

Traffic Control Exhibits

Common Traffic Control Signs	35-38
Meaning of Symbols on Typical Application Diagrams	38
Typical Left Turn Lane Closure	39
Typical Right Turn Lane Closure	40
Typical Lane Closure Two-Lane Residential Street	41
Minor Encroachment on Roadway Two-Lane Arterial or Collector Street	42
Typical Lane Closure Two-Lane Arterial or Collector Street	43
Typical Lane Closure on Two-Lane Road Using Flaggers	44
Typical Right Lane Closure Four-Lane Divided Thoroughfare	45
Typical Right Turn Lane Closure Four-Lane Thoroughfare	46
Typical Left Lane Closure Four-Lane Thoroughfare	47
Typical Application Center Lane Closure	48
Median Cut Multi-Lane Divided Roadway Typical Application During Construction Periods	49
Median Cut Multi-Lane Divided Roadway Typical Application Non-Construction Periods	50
Typical Left Lane Closure Providing Access to Left Turn Lane	51
Typical Right Lane Closure Providing Access to Right Turn Lane	52
Four-Lane Undivided Thoroughfare One-Half Roadway Closure	53
Thoroughfare Double Lane Closure	54
Right Lane Closure on Far Side of Intersection	55
Left Lane Closure on Far Side of Intersection	56
Multiple Lane Closure at Intersection	57
Half Road Closure on Far Side of Intersection	58
Street Closure With Off-Site Detour	59
Closure at Side of Intersection for Residential or Collector Streets	60
Interior Lane Closure on Multi-Lane Thoroughfare	61
Work in Center of Residential or Collector with Low Traffic Volumes	62
Sidewalk Detour	63
Crosswalk Closures and Pedestrian Detours	64
Length and Device Spacing for Lane Closure and Channelization Tapers	65

CITY OF OVERLAND PARK TRAFFIC CONTROL HANDBOOK FOR STREET MAINTENANCE AND CONSTRUCTION OPERATIONS

I. INTRODUCTION

The primary function of streets and highways is to provide for the movement of traffic. A common secondary use of the street area, or its right of way, is for the placement of public and private utilities. While the movement of traffic is paramount, streets need to be constructed or reconstructed and utility facilities need to be repaired, modified or expanded. Consequently, traffic movements and street or utility repair work must be coordinated to provide optimum safety and convenience to the general public.

II. PURPOSE OF HANDBOOK

The purpose of this Handbook is to set forth basic principles, uniform procedures, and prescribed standards for all public and private organizations to follow in the design, application, installation and maintenance of all types of traffic control devices required for street maintenance and construction operations. These principles and standards are directed to provide for the reasonably safe and efficient movement of road users through or around temporary traffic control zones while reasonably protecting workers, responders to traffic incidents, and equipment where necessary construction or repair work is being undertaken.

Traffic control devices and procedures specified in this Handbook shall conform to the Manual on Uniform Traffic Control Devices, (MUTCD) latest edition, as published by the Federal Highway Administration and adopted by State law.

III. PURPOSE OF TRAFFIC CONTROL DEVICES

The purpose of the various traffic control devices used with construction and maintenance operations is to: (1) provide for the orderly flow of traffic, (2) reduce hazards for road users, pedestrians and workers; (3) reduce overall job costs to both the contractor and the general public; (4) eliminate the necessity for formal legislation which could be unduly restrictive to both the contractor as well as the general public; and (5) to improve public relations.

By using advance warning signs along with barricades and other types of traffic control devices, the best type of orderly traffic flow under existing conditions can be maintained. Orderly traffic flow makes it

safer for the worker, the pedestrian and the motorist. Adequate warning signs, delineation and channelization may, and generally does, initially increase the construction cost slightly, but the overall result will be less delay, and less cost to road users, as well as less delay and cost to the contractor.

Adequate signs explaining why or where the work is being performed and guiding the traffic with good channelizing devices and barricading are great assets to the public. If the public understands why it is being delayed, there is likely to be fewer objections to the delay. However, it should be remembered that the improper use and location of signs, channelizing devices and barricades can be worse than none at all.

IV. APPLICABILITY OF REGULATIONS

The provisions of this Handbook as set forth by the City of Overland Park shall apply to all municipal forces, contractors, utility companies, and any other person, firm, corporation, or agency performing construction or maintenance work or any other activity that would require the blockage or the partial blockage of a traffic lane within the right of way of any public street, public way, or alley in the City of Overland Park.

V. PROCEDURE FOR OBTAINING PERMISSION TO WORK IN CITY STREETS

A. Permit Work

No person shall make or cause to be made any cut, excavation, or grading in, on, under, or through any public right of way except after having first secured a permit therefore in accordance with Overland Park Municipal Code (OPMC) Chapter 13.12.

B. Non Permit Work

Approval for other type work not requiring a written permit, such as street or utility maintenance and repair which would not make or cause to be made any cut, excavation, or grading in, on, under or through any public right of way or for work in existing manholes shall be made to the City Engineer if such work requires the partial blocking of the street for an extended period of time. Temporary stops, generally 1 hour or less, will normally not require any written or oral permit. However, any applicable traffic control devices called for herein shall still be necessary.

Additional approval may also be necessary from the Kansas Department of Transportation for work on Federal and State Highways within the City.

VI. GENERAL PROVISIONS APPLICABLE TO ALL STREET WORK

Except where otherwise specified, all persons or agencies doing work in or on streets and highways shall be responsible for accomplishing the items listed below.

A. General

The Contractor shall be responsible for obtaining the required permits. Those securing permits will pay all fees and post any required bonds.

B. Certification Requirements

All personnel involved in the preparation of construction traffic control plans and the installation of all traffic control devices shall be certified by The American Traffic Safety Services Association (ATSSA) as a "Traffic Control Supervisor" or by the International Municipal Signal Association (ISMA) as a "Work Zone Safety Specialist" or other equivalent certification for the design and installation of construction traffic control devices. The certification must be current and readily available for verification at any time as requested by the City Engineer. Minimum requirements for the certification shall include, attending training sessions and successful completion of a written examination proctored by a nationally recognized and qualified agency.

C. Emergency Services

The local fire department of the area involved, Med Act Emergency Medical Service and the police department shall be notified of any excavation activity along fire lanes or thoroughfares. The Contractor or managing agency shall be responsible to make these contacts.

D. Closures and Disruption to Traffic

No work shall be performed on collector or arterial (thoroughfare) streets during the hours of 7:00 to 8:30 A.M. and 4:00 to 6:00 P.M. or on weekends or holidays unless prior approval is received through the City Engineer or there are emergency repairs necessary by a utility company or their representative.

E. Specifications

All construction shall be in accordance with the specifications, details, drawings, and City of Overland Park Manual of Infrastructure Standards approved by the City Engineer.

F. Protective Clothing

All workers exposed to the risks of moving roadway traffic or construction equipment should wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Safety Apparel" (see Section 1A.11), or equivalent revisions, and labeled as ANSI 107-1999 standard performance for Class 1, 2, or 3 risk exposure. A competent person designated by the employer to be responsible for the worker safety plan within the activity area of the job site should make the selection of the appropriate class of garment.

For daytime activity, flaggers shall wear safety apparel meeting the requirements of ISEA and labeled as meeting the ANSI 107-99 standard performance for Class 2 risk exposure. The apparel background (outer) material color shall be either fluorescent orange-red or fluorescent yellow-green as defined in the standard. The retroreflective material shall be either orange, yellow, white, silver, yellow-green or a fluorescent version of these colors, and shall be visible at a minimum distance of 1000 feet. The retroreflective clothing shall be designed to clearly identify the wearer as a person.

For nighttime activity, safety apparel meeting the requirements of ISEA ANSI 108-99 standard performance for Class 3 risk exposure should be used for flagger wear.

G. Minimum Lane Width

Minimum lane width shall be 11 feet unless otherwise approved by the City Engineer. If at any time construction encroaches upon the traveled lane which doesn't allow a minimum lane width of 11 feet, the lane shall be closed.

VII. Work Duration

Work duration is a major factor in determining the number and types of devices used in temporary traffic control zones. The duration of a temporary traffic control zone is defined relative to the length of time a work operation occupies a spot location.

The five categories of work duration and their time at a location shall be as follows:

A. Long-term stationary is work that occupies a location more than 3 days.

At long-term stationary temporary traffic control zones, there is ample time to install and realize benefits from the full range of temporary traffic control procedures and devices that are available for use. Generally, larger channelizing devices, temporary roadways, and traffic barriers are used.

Since long-term operations extend into nighttime, retroreflective and/or illuminated devices shall be used in long-term stationary temporary traffic control zones.

Inappropriate markings in long-term stationary temporary traffic control zones should be removed and replaced with temporary markings.

B. Intermediate-term stationary is work that occupies a location for more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.

In intermediate-term stationary temporary traffic control zones it may not be feasible or practical to use procedures or devices that would be desirable for long-term stationary temporary traffic control zones, such as altered pavement markings, temporary traffic barriers, and temporary roadways. The increased time to place and remove these devices in some cases could significantly lengthen the project, thus increasing exposure time.

However, since intermediate-term operations extend into nighttime, retro-reflective and/or illuminated devices shall be used in intermediate-term stationary temporary traffic control zones.

C. Short-term stationary is daytime work that occupies a location for more than 1 hour within a single daylight period.

Most maintenance and utility operations are short-term stationary work.

Because the potential exists for the operations to extend into nighttime, retroreflective and/or illuminated devices shall be used in short-term stationary temporary traffic control zones.

D. Short duration is work that occupies a location up to 1 hour.

Safety in short-duration operations should not be compromised by using fewer devices simply because the operation will frequently change its location.

Appropriately colored or marked vehicles with high-intensity rotating, flashing, oscillating or strobe lights, augmented with signs or arrow panels, may be used in place of signs and channelizing devices for short-duration operations.

E. Mobile is work that moves intermittently or continuously.

Mobile operations often involve frequent short stops for activities such as pothole patching, or utility operations, where work activities, workers and equipment move along the road without stopping, usually at slow speeds. The advance warning area moves with the work area.

Warning signs, high-intensity rotating, flashing, oscillating, or strobe lights on a vehicle, flags, and/or channelizing devices should be used and moved periodically to keep them near the mobile work area.

When mobile operations are being performed, a shadow vehicle equipped with an arrow panel or a sign should follow the work vehicle, especially when vehicular traffic speeds or volumes are high. Warning signs should be placed along the roadway and moved periodically as work progresses.

Under high-volume conditions, consideration should be given to scheduling mobile operations work during off-peak hours.

If there are mobile operations on a high-speed travel lane of a multilane divided roadway, arrow panels should be used, or appropriately colored and marked vehicles with signs, flags, high-intensity rotating, flashing, oscillating, or strobe lights, truck-mounted attenuators, and arrow panels or portable changeable message signs may follow a train of moving work vehicles.

VIII. PROCEDURE FOR PERFORMING WORK IN A CITY STREET ON AN EMERGENCY BASIS

Occasionally, an emergency situation may arise where immediate action to protect the safety of the general public requires work to be done in a City street which is not in full compliance with the provisions of this Handbook. Nothing in this Handbook shall be construed as requiring a person or agency to delay emergency repairs when to do so could endanger the public safety. However, if an emergency occurs during normal office hours (8:00 A.M. to 5:00 P.M. weekdays) the agency doing the work must first phone the Department of Public Works and obtain approval of said work. Following approval, the agency will be given a maximum of two hours to comply with all applicable traffic control requirements set forth in this handbook. The applicant then will obtain the written permit in person at the Department of Public Works on or before the next working day.

If the emergency occurs during other than normal work hours, the applicant is required to phone the Overland Park Police Department and give the location and nature of the emergency before starting the work. By this method all other emergency agencies such as the Fire Department and Med Act Emergency Medical Service can be notified. The applicant is required to appear in person on or before the next working day and obtain a written permit.

IX. COMPONENTS OF TEMPORARY TRAFFIC CONTROL ZONES

Most temporary traffic control zones are divided into four areas: the advance warning area, the transition area, the activity area, and the termination area. Figure 1, page 11 illustrates these four areas. These four areas are described as follows.

A. Advance Warning Area

The advance warning area is the section of roadway where road users are informed about the upcoming work zone or incident area. The length is dependent upon the number of advance warning signs in the series and the recommended spacing between the signs as outlined in Table 1 below.

TABLE 1				
Road Type	Speed Limit	Minimum Sign Spacing (feet)		
		A	B	C
Residential and Collector	30 mph and under	100	100	100
Urban Arterials	35 mph to 45 mph	350	350	350
Urban Arterials	50 mph and over	350	350	350
Rural Roads	40 mph and over	500	500	500

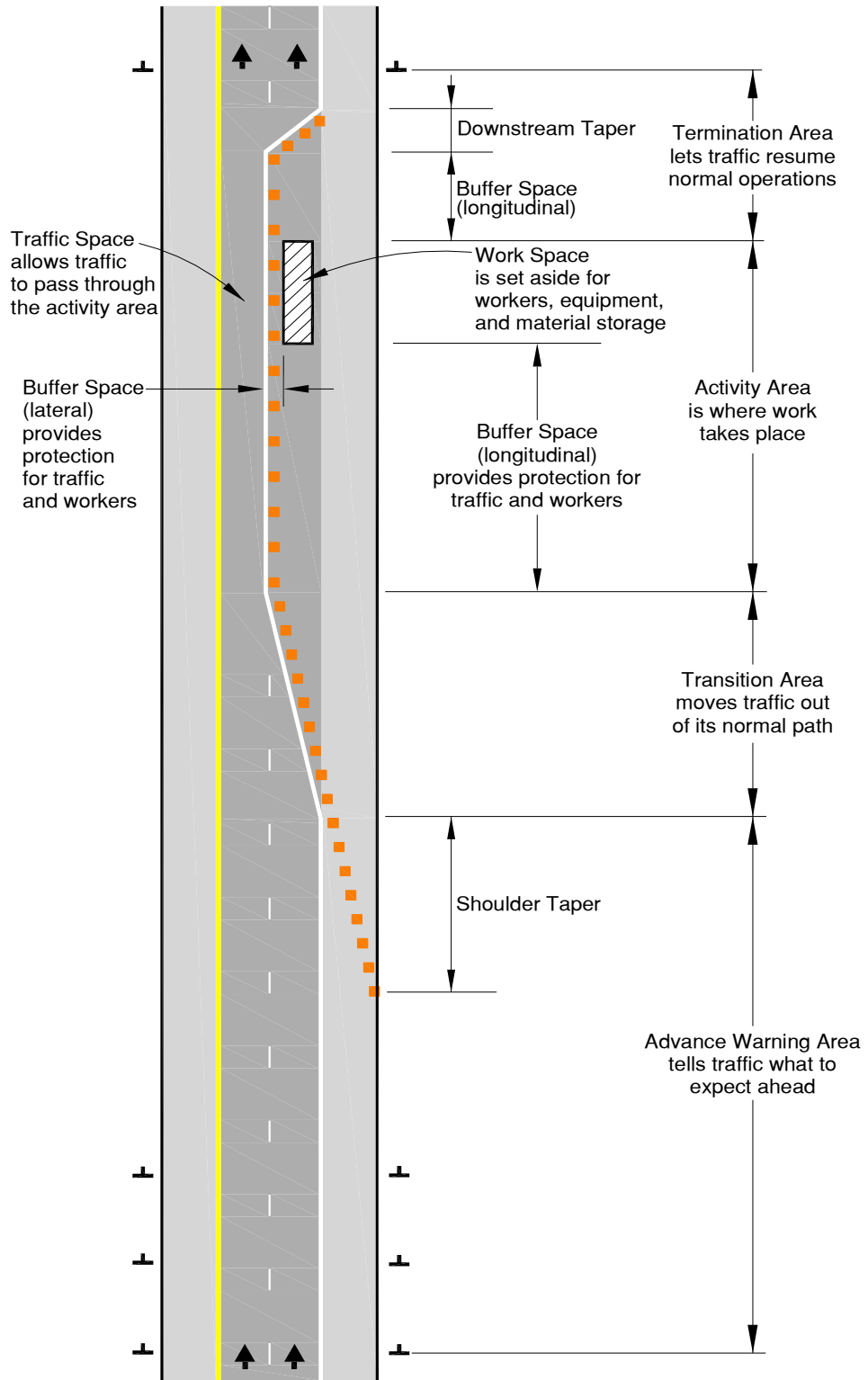


FIGURE 1

COMPONENT PARTS OF A
TEMPORARY TRAFFIC CONTROL ZONE

The effective placement of the first warning sign should be the sum of the following distances:

Buffer Space (see page 11)

Transition Area (see page 11)

Advance Warning Area (see page 11)

B. Transition Area

The transition area is that section of roadway where road users are redirected out of their normal path. In mobile operations, the transition area moves with the work space.

When redirection of the road users' normal path is required, they shall be channelized from the normal path to a new path using an appropriate taper.

Tapers are created by using a series of channelizing devices and/or pavement markings to move traffic out of or into the normal path.

Types of tapers are shown in Figure 2, page 13.

The criteria for determining the taper length (L) is shown below and should be the minimum used.

Formulas for L are as follows:

For speed limits of 40 mph or less -
$$L = \frac{WS^2}{60}$$

For speed limits of 45 mph or greater -
$$L = WS$$

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

The maximum distance in feet between devices in a taper should not exceed the speed limit in mph.

There are three types of tapers that occur in the Transition Area of a Traffic Control Zone: 1) Merging Taper, 2) Shifting Taper, and 3) Shoulder Taper.

Merging Taper - A merging taper requires the longest distance because drivers are required to merge into common road space. A merging taper should be long enough to enable merging drivers to have adequate advance warning and sufficient length to adjust their speeds and merge into a single lane before the end of the transition.

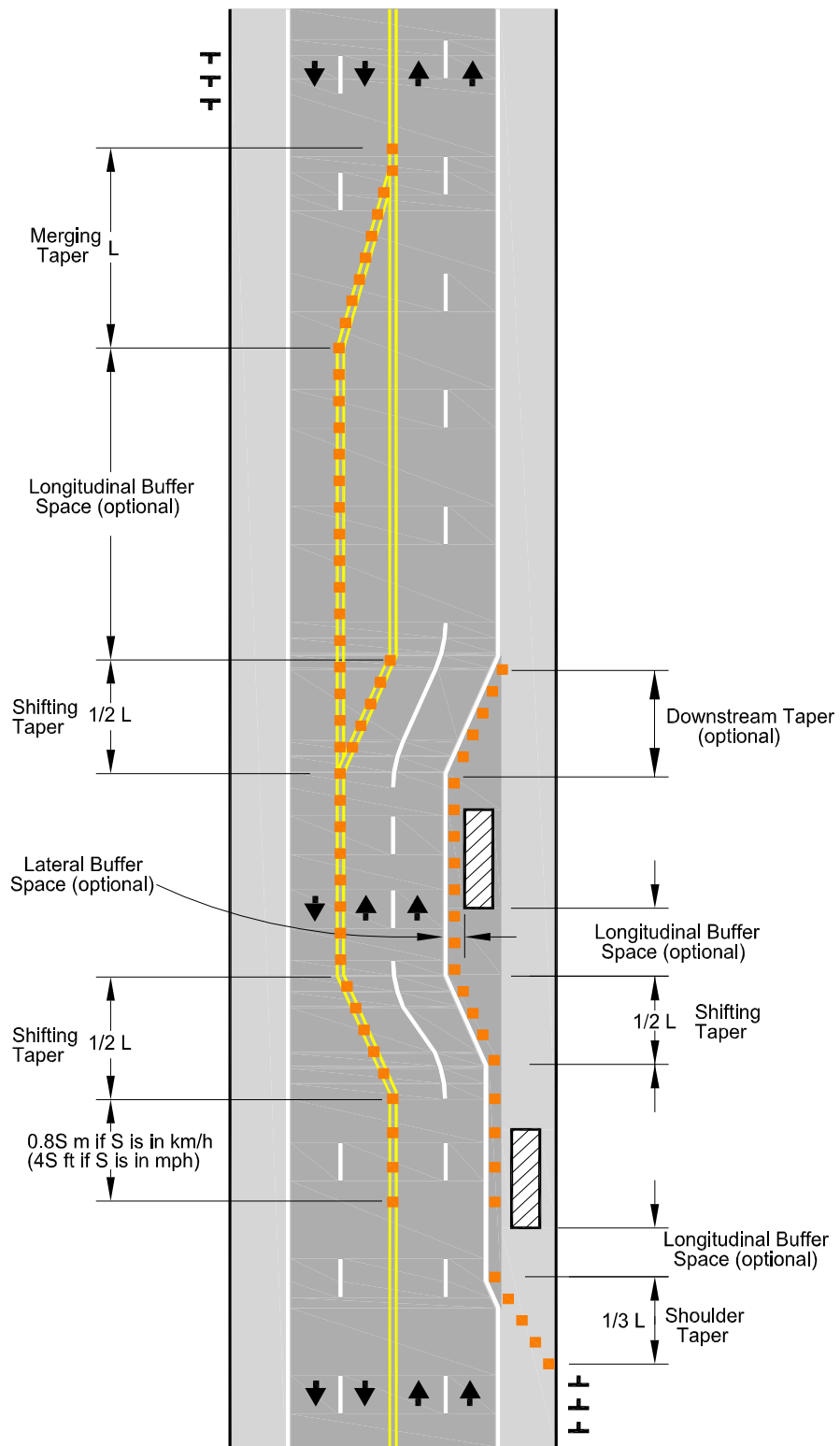


FIGURE 2
TYPES OF TAPERS AND BUFFER SPACES

- Shifting Taper - A shifting taper is used when a lateral shift is needed but when the number of lanes is not being reduced. When more space is available, a longer than minimum taper distance can be beneficial. Changes in alignment can also be accomplished by using horizontal curves designed for normal operating speeds. A shifting taper should have a length of approximately $1/2 L$.
- Shoulder Taper - A shoulder taper may be beneficial on a high-speed roadway where shoulders are part of the activity area and are closed, or when improved shoulders might be mistaken as a driving lane. In these instances the same type, but abbreviated, closure procedures used on a normal portion of the roadway can be used. If used, shoulder tapers should have a length of approximately $1/3 L$. If a shoulder is used as a travel lane, either through practice or during a temporary traffic control activity, a normal merging or shifting taper should be used.

C. Activity Area

The activity area is the section of the roadway where the work activity takes place. It is comprised of the work space, the traffic space and the buffer space.

- Work Space - The work space is that portion of the roadway closed to road users and set aside for workers, equipment, and material, and a shadow vehicle if one is used upstream. Work spaces are usually delineated for road users by channelizing devices or, to exclude vehicles and pedestrians, by temporary barriers. The work space may be stationary or may move as work progresses. Since there may be several work spaces within the project limits, each work space should be adequately signed to inform road users and reduce confusion.
- Traffic Space - The traffic space is the portion of the roadway in which road users are routed through the activity area.
- Buffer Space - The buffer space is a lateral and/or longitudinal area that separates road user flow from the work spaces or an unsafe area, and might provide some recovery space for an errant vehicle. Neither work activity nor storage of equipment, vehicles, or material should occur within a buffer space. Buffer spaces may be positioned either longitudinally or laterally with respect to the direction of road user flow. The activity area may contain one or more lateral or longitudinal buffer spaces.

A longitudinal buffer space may be placed in advance of a work space. The longitudinal buffer space may also be used to separate opposing road user flows that use portions of the same traffic lane, as shown in Figure 2, page 13.

Typically, the buffer space is formed as a traffic island and defined by channelizing devices. When a shadow vehicle, arrow panel or changeable message sign is placed in a closed lane in advance of a work space, only the area upstream of the vehicle, arrow panel, or changeable message sign constitutes the buffer space.

The lateral buffer space may be used to separate the traffic space from the work space, as shown in Figure 1, page 11 and Figure 2, page 13 or such areas as excavations or pavement-edge drop-offs. A lateral buffer space also may be used between two travel lanes, especially those carrying opposing flows.

D. Termination Area

The termination area shall be used to return road users to their normal path. The termination area shall extend from the downstream end of the work area to the last temporary traffic control device such as END ROAD WORK signs, if posted. A downstream taper should be used in termination areas to provide a visual cue to the driver that access is available back into the original lane or path that was closed. When used the downstream taper should have a minimum length of approximately 100 feet per lane with devices placed at a spacing of approximately 20 feet

X. TRAFFIC CONTROL DEVICES AND THEIR USES

A. General Requirements

All roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used shall meet the crashworthy performance criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features. The word "crashworthy" is a characteristic of a roadside appurtenance that has been successfully crash tested in accordance with a national standard such as the National Cooperative Highway Research Program Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Contractors shall be responsible for providing and maintaining all traffic control devices and flaggers as necessary to protect the work area and safeguard and direct traffic around their work. Existing traffic signs and control devices must necessarily remain in place until construction or maintenance activities are started. The Contractor will be responsible for any damage or loss resulting from failure to maintain or protect such devices. It shall be the responsibility of the Contractor to notify the City Engineer when existing signs need to be removed for construction or maintenance work.

Traffic control devices shall be set up prior to the start of construction or maintenance operations and shall be properly maintained during the time such conditions exist. They shall remain in place only as long as they are needed and shall be removed immediately thereafter. Where operations are performed in stages, there shall be in place only those devices that apply to the conditions present during the stage in progress. Signs that do not apply to existing conditions shall be removed, covered, folded, or turned so as not to be readable by oncoming traffic.

All barricades and sign supports shall be neatly constructed and they shall be repaired, cleaned, re-sheeted or repainted as needed to maintain their appearance.

Weeds, shrubbery, construction materials or equipment, spoil, etc., shall not be allowed to obscure any traffic control device.

B. Signs

The color, size, shape, lettering and retroreflectorization of any special sign must conform to the principles outlined in the Manual on Uniform Traffic Control Devices, latest edition. All orange construction signs shall be reflectorized with fluorescent orange micro-encapsulated prismatic retroreflective grade sheeting. All regulatory signs shall be reflectorized with micro-encapsulated prismatic retroreflective grade sheeting.

Signs shall be placed in positions where they will convey their messages most effectively and placement must, therefore, be accommodated to roadway design and alignment. Signs shall be so placed that the driver will have adequate time for response. The use of standard orange flags or yellow flashing warning lights in conjunction with signs is permitted, so long as they do not interfere with a clear view of the sign face.

As a general rule, signs shall be located on the right-hand side of the street or roadway. Where special emphasis is needed, such as a multi-lane divided arterial roadway, dual installations should be made which consist of duplicate signs opposite each other on the left and right sides of the roadway, respectively. However, within a construction or maintenance zone, it is often necessary and/or desirable to erect signs on portable supports placed within the roadway itself. It is also permissible to mount appropriate signs on or above barricades. Signs on fixed supports are usually mounted on a single post, although those wider than 36 inches or larger than 10 square feet in area should be mounted on two posts. Construction and maintenance signs shall not be mounted on existing traffic signs, posts or other utility structures within the public right of way without permission from the City Engineer.

Construction or maintenance projects that require 3 working days or less may mount signs on portable sign supports (See Figure 3, pg. 17); the bottom of the signs shall be a minimum of 1 foot above the adjacent pavement surface. Projects requiring more than 3 working days shall mount signs on posts as indicated in the rural and urban district detail as appropriate. (See Figure 4, pg. 18).

Warning signs for construction and maintenance projects are used to notify drivers of specific hazards which may be encountered when those operations are underway. Advance warning signs shall be used in conjunction with barricading and channelization. The information presented by such signs assists the motorist following the required traffic arrangements. As an alternate to specific distance on advance warning signs, the word AHEAD may be used.

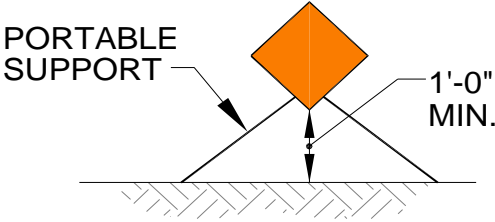


FIGURE 3
PORTABLE AND TEMPORARY
MOUNTINGS FOR SIGNS

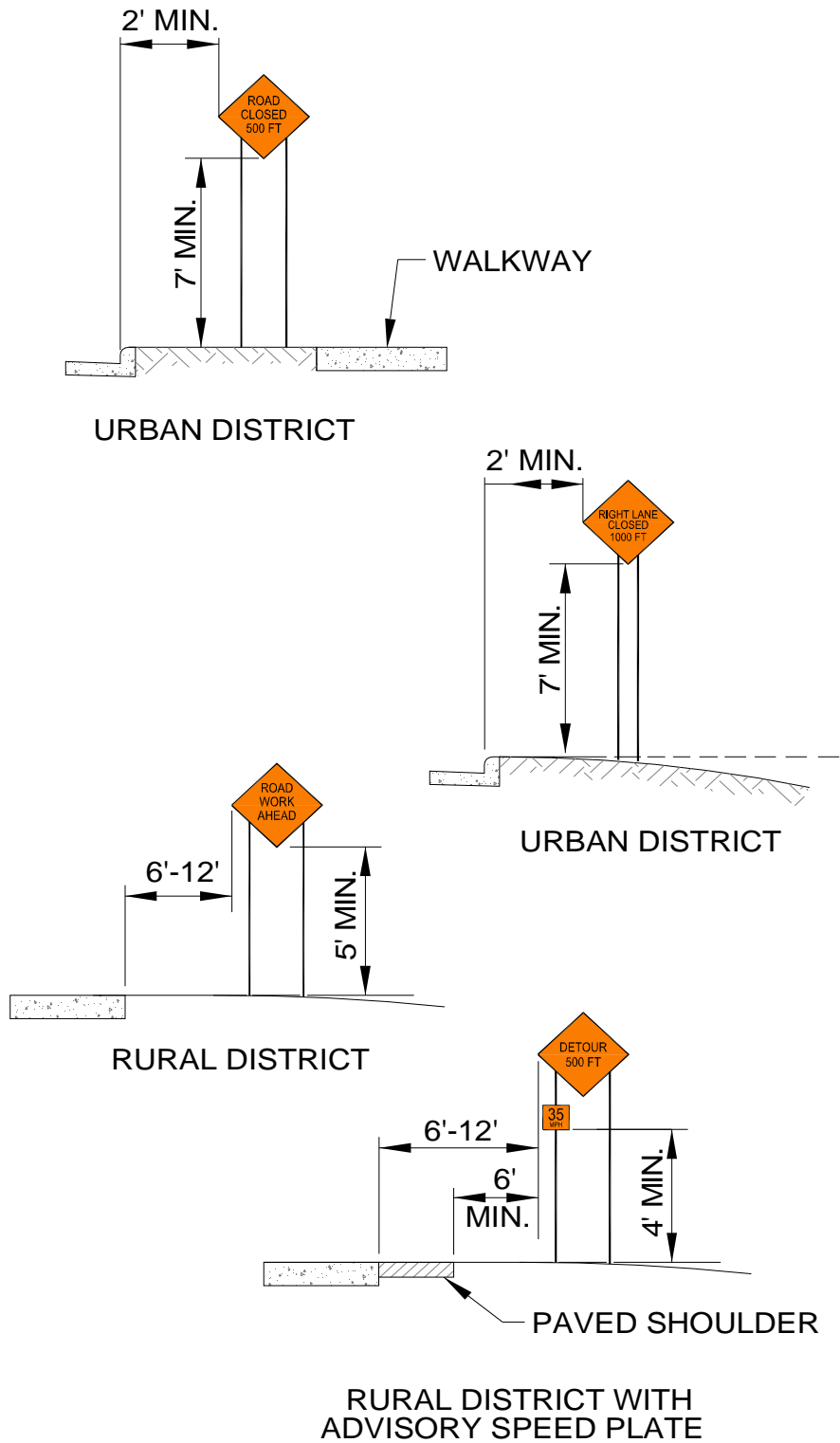


FIGURE 4
TYPICAL INSTALLATION HEIGHT AND
LATERAL LOCATIONS OF SIGNS

Recommended sign spacing for construction and maintenance projects shall be as shown on Table 1, page 10.

The sign spacing generally indicated on the typical traffic control plans in this handbook is the minimum spacing as indicated on Table 1. It should be noted that some urban conditions may require adjustment to the recommended spacing due to the proximity of driveways, intersections and physical barriers. In all cases sign spacing shall not be less than indicated in the above table

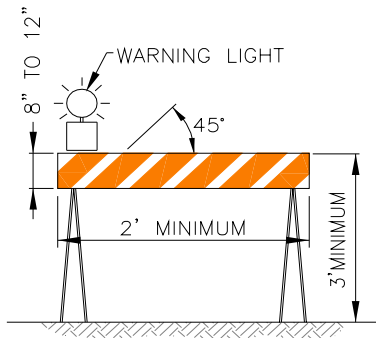
C. Barricades and Channelizing Devices

Barricades

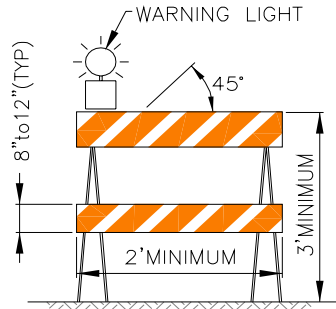
Barricades are especially valuable for outlining the excavation or construction area in the street or for road and entrance closures. Portable, crashworthy barricades shall be used where the project is of short duration or for which the passage of equipment or of local traffic must be provided.

Barricades shall be one of three types: Type I, Type II, or Type III. The characteristics of these types are shown in Figure 5, page 20. Markings for barricade rails shall be alternating orange and white stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. The stripes, except as otherwise noted below shall be 6 inches wide. When rail lengths are less than 36 inches, 4 inch wide stripes may be used. The entire area of orange and white shall be retroreflectorized with Kansas Department of Transportation approved high intensity grade retroreflective sheeting.

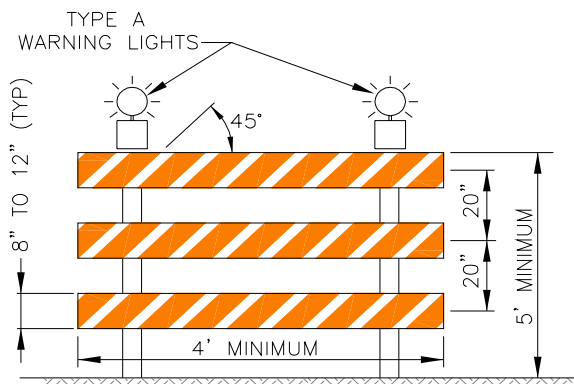
On construction projects, when a road section is closed to traffic, Type III barricades shall be erected at the points of closure. They may extend completely across a roadway and its shoulders or from curb to curb. Where provisions must be made for access of equipment and authorized vehicles, the Type III barricades should be provided with gates or movable sections that can be closed when work is not in progress, or with indirect openings that will discourage public entry. Where access is provided through the Type III barricades, responsibility should be assigned to a person to assure closure at the end of each working day.



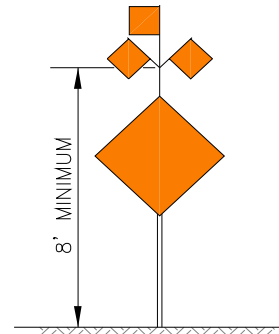
TYPE I BARRICADE



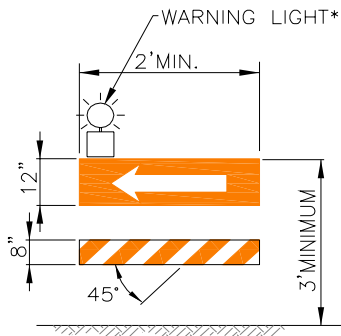
TYPE II BARRICADE



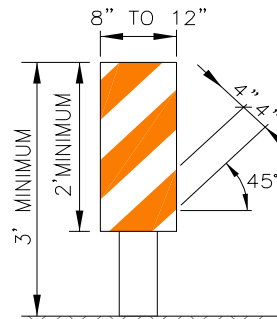
TYPE III BARRICADE



**HIGH LEVEL
WARNING DEVICE**

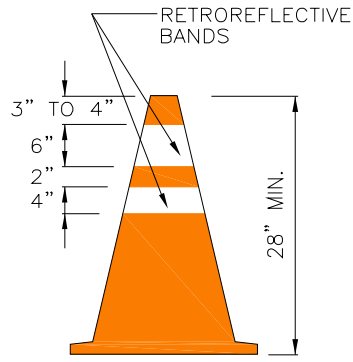
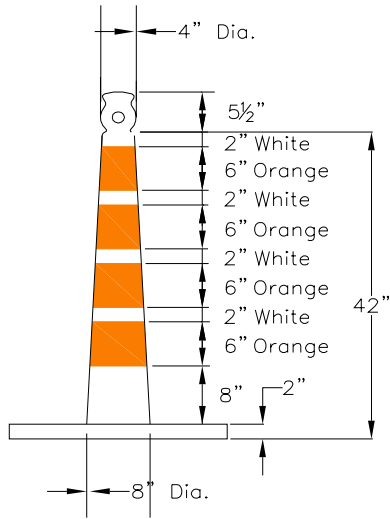


**DIRECTION INDICATOR
BARRICADE**



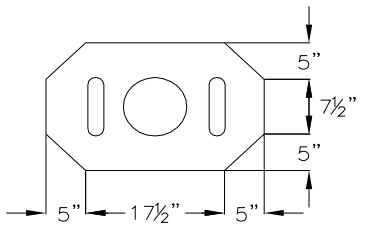
VERTICAL PANEL

FIGURE 5
BARRICADES AND
HIGH LEVEL WARNING DEVICES

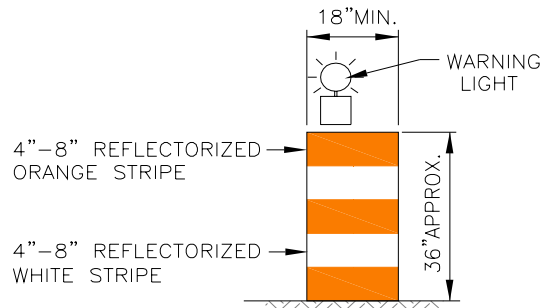


CONE*

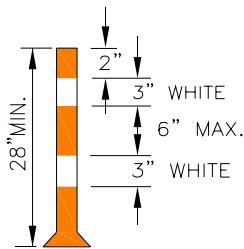
(NIGHT TIME USE AND HIGH SPEEDS)



CONICAL DELINEATOR

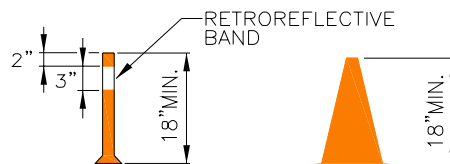


DRUM



BASE VARIES

(NIGHT TIME USE AND HIGH SPEEDS)



BASE VARIES

(DAYTIME USE AND LOW SPEED ROADWAY ONLY)

TUBULAR MARKER & CONES*

* NOT ALLOWED FOR LONG-TERM STATIONARY WORK

FIGURE 6

CHANNELIZING DEVICES AND HIGH LEVEL WARNING DEVICES

When a road or street is legally closed, but access must still be allowed for local traffic, the Type III barricades usually are not erected completely across a roadway. Instead, an arrangement should be devised that will permit local use but effectively discourage use by through traffic. A sign with the appropriate legend concerning permissible use by local traffic should be installed.

Where barricades extend entirely across a roadway, the stripes should slope downward in the direction toward which road users must turn. Where both right and left turns are provided, the barricade stripes should slope downward in both directions from the center of the barricade or barricades. Where no turns are intended, the stripes should be positioned to slope downward toward the center of the barricade or barricades.

Type I or Type II barricades shall be used to outline the work area when traffic is maintained through the area being constructed and/or reconstructed. They may be used singly or in groups to mark a specific hazard or they may be used in a series for channelizing traffic. Type I barricades would normally be used on conventional roads or urban streets and arterials. As Type II barricades have more reflective area, they are intended for use on expressways and freeways or other high speed roadways.

On high speed expressways or in other situations where barricades may be susceptible to overturning in the wind, sandbags should be used for ballasting. Sandbags may be placed on lower parts of the frame or stays to provide the required ballast but shall not be placed on top of any striped rail.

Where maintenance activities are being performed, a street condition is seldom of a character that will require a complete closing of the facility. When such a condition does occur, it is almost always an emergency situation, as would result from a broken water main, for example. Repair work is generally initiated on an emergency basis and the street or road closing generally is of a kind wherein Type I or Type II barricades are utilized.

A construction type sign shall be installed on or above the barricades such as "Large Arrow", "Road Closed", or "Detour" arrow signs.

All barricades when used at night shall be equipped with appropriate warning lights.

Direction Indicator Barricades may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary. If used, they should be used in series to direct the driver through the transition and into the intended travel lane. (See Figure 5, page 20)

Direction Indicator Barricades shall consist of a One-Direction Large Arrow (W1-6) sign mounted above a diagonal striped, horizontally aligned, retroreflective rail. The One-Direction Large Arrow (W1-6) sign shall be black on an orange background and be 24 inches x 12 inches. The stripes on the bottom rail shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. The stripes shall be 4 inches wide. The bottom rail shall have a length of 24 inches and a height of 8 inches.

Traffic Cones

Traffic cones shall be predominantly orange and shall be made of a material that will not damage vehicles if they are impacted. The standard 18 inch cone is acceptable for use during daylight hours and speeds less than or equal to 40 mph. For nighttime use, and speeds greater than 40 mph, 28 inch retroreflectorized cones shall be used. Retroreflectorization shall be provided by a 6 inch wide white band located 3 to 4 inches from the top of the cone, and an additional 4 inch wide white band located 2 inches below the 6 inch band made of KDOT approved high intensity retroreflective sheeting. Traffic cones shall be orange in color and should be kept clean and should be checked frequently for location. The 28 inch retroreflectorized cone shall not be used for long-term stationary work. (See figure 6, page 21).

Drums

Drums used for road user warning or channelization shall be constructed of lightweight, deformable materials. They shall be a minimum of 36 inches in height and have at least an 18 inch width regardless of orientation. The markings on drums shall be horizontal, circumferential, alternating orange and white retroreflectorized stripes 4 to 6 inches wide. The white stripes shall be made of KDOT approved high intensity retroreflectorized sheeting. Orange stripes shall be fluorescent micro-encapsulated prismatic grade retroreflective sheeting. (See Figure 6 page 21).

There shall be at least two orange and two white stripes on each drum with the top stripe being orange. Any non-retroreflectorized spaces between the horizontal orange and white stripes shall not exceed 3 inches in width. Drums should not be weighted with sand, water or any material to the extent that would make them hazardous to road users or workers when struck.

In addition, a flashing warning light should be added when drums are used singly, and steady warning lights when they are used in a series for channelization.

Vertical Panels

Vertical panels shall be 8 to 12 inches in width and 24 inches in height. They shall be mounted with the top a minimum of 36 inches above the roadway on a substantial support (See Figure 5, pg. 20). The vertical panel shall be retroreflectorized with alternate orange and white stripes of a minimum 4-inch width width at an angle of 45 degrees with the vertical (slanting downward toward the side to which traffic is to pass).

Vertical panels are used to divide opposing streams of traffic, divert a traffic lane, and outline the edge of a hazard along the road-way. When a vertical panel is used to divide opposing streams of traffic, back to back panels shall be used.

Conical Delineators

Conical delineators, also referred to as trimlines or grabber cones, are an acceptable alternative to drums. Therefore, they shall meet the MUTCD requirements for retroreflective sheeting. They shall be constructed of light weight deformable, two piece materials with breakaway design. They shall be a minimum of 42 inches in height, excluding the handle, with a minimum diameter at the base of 8 inches and a minimum diameter of 4 inches immediately below the grabber handle. It shall be supported by a rubberized slipover base approximately 18 inches by 28 inches by 2 inches. The markers on the trimline/grabber cone shall be horizontal circumferential alternating orange and white retroreflective stripes, 4 to 6 inches wide. The white stripes shall be made of KDOT approved high intensity retroreflective sheeting. The orange stripes shall be fluorescent micro-encapsulated prismatic retroreflective sheeting. Each device shall have a minimum of two orange and two white stripes, with the top stripe being orange. Any non-retroreflective spaces between the horizontal orange and white stripes shall not exceed three inches in width. (See Figure 6, page 21)

Delineators

Delineators are retroreflective devices mounted on the roadway surface or at the side of the roadway in a series to indicate the alignment of the roadway. They may be used in temporary traffic control zones to indicate the alignment of the roadway and to outline the required vehicle path through the temporary traffic control zone. When used delineators shall combine with or supplement other traffic control devices. They shall be mounted on crashworthy supports so that the reflecting unit is approximately 4 feet above the near roadway edge. The standard color for delineators used along both sides of the two-way streets and roadways and the right side of one-way roadways shall be white. Delineators used along the left side of one-way roadways shall be yellow.

Tubular Markers

Tubular markers have less visible area than other devices and should be used only where space restrictions do not allow for the use of more visible devices. They may be used effectively to divide opposing lanes of traffic, divide two lanes of traffic when two or more lanes are kept open in the same direction, and to delineate edge of pavement drop-off where space limitations do not allow the use of larger devices.

Tubular markers for daytime use and speeds less than or equal to 40 mph, shall be predominantly orange, not less than 18 inches high, and 2 inches wide when facing traffic with a single 3" white KDOT approved high intensity retroreflective band. They shall be made of a material that can be struck without causing damage to the impacting vehicle. Tubular markers for nighttime use and/or speeds greater than 40 mph shall be a minimum of 28 inches high and shall be retroreflectorized. Retroreflection of tubular markers shall be provided by two 3-inch wide bands placed a maximum of 2 inches from the top, with a maximum of 6 inches between the bands. (See figure 6, pg. 21) Tubular markers shall not be used for long-term stationary work.

D. Lighting Devices

Hazard Identification Beacons are flashing yellow signal lights (minimum diameter eight inches) used at points of special hazard as a means of calling drivers' attention to these locations. When used, the flashing beacons should operate 24 hours a day.

During normal daytime maintenance operations, the function of flashing warning beacons are adequately provided by rotating lights or strobe lights on maintenance vehicles. Although vehicle hazard warning lights are permitted to be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights, they shall not be used instead of high-intensity rotating, flashing, oscillating, or strobe lights.

Warning Lights

Warning Lights as used herein are portable, powered, yellow, lens directed, enclosed lights. The color of the light emitted shall be yellow. They may be used in either a steady burn or flashing mode. Warning lights shall be in accordance with the current ITE "Purchase Specification for Flashing and Steady-Burn Warning Lights" and shall be mounted on signs or channelizing devices in a manner that, if hit by an errant vehicle, they will not be likely to penetrate the windshield. Warning lights shall have a minimum mounting height of 30 inches to the bottom of the lens.

TYPE A low intensity flashing warning lights are used to warn road users during nighttime hours that they are approaching or proceeding in a potentially hazardous area. They shall be maintained so as to be capable of being visible on a clear night from a distance of 3,000 feet. Type A warning lights may be mounted on channelizing devices and barricades.

TYPE B high intensity warning lights are used to warn road users during both daylight and nighttime hours that they are approaching a potentially hazardous area and shall be maintained as to be capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1,000 feet. They are designed to operate 24 hours per day and may be mounted on advance warning signs or independent supports.

TYPE C steady burn lights shall be maintained so as to be capable of being visible on a clear night from a distance of 3,000 feet. They may be used during night time hours to delineate the edge of the traveled way.

Flashing warning lights shall not be used for roadway delineation because a series of flashers fail to identify the desired path.

E. Portable Changeable Message Signs.

The primary purpose of portable changeable message signs in temporary traffic control zones is to advise the road user of unexpected situations.

Portable changeable message signs shall be temporary traffic control devices with the flexibility to display a variety of messages. Each message shall consist of either one or two phases. A phase shall consist of up to three lines of eight characters per line. Each character module shall use at least a five wide and seven high pixel matrix.

The front face of the sign should be covered with a protective material. The color of the elements should be yellow or orange on a black background. Portable changeable message signs should be visible from 0.5 miles under both day and night conditions. The message should be legible from a minimum distance of 650 feet. The message panel should have adjustable display rates, so that the entire message can be read at least twice at the posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated operating speed.

Portable changeable message signs shall automatically adjust their brightness under varying light conditions, to maintain legibility.

The control system shall include a display screen upon which messages can be reviewed before being displayed on the message sign. The control system shall be capable of maintaining memory when power is unavailable. Portable changeable message signs shall be equipped with a power source and a battery back-up to provide continuous operation when failure of the primary power source occurs.

The mounting of Portable changeable message signs on a trailer, a large truck, or service patrol truck shall be such that the bottom of the message sign panel shall be a minimum of 7 feet above the roadway when it is in the operating mode.

The text of the messages shall not scroll or travel horizontally or vertically across the face of the sign.

Portable changeable message signs should be used as a supplement to and not as a substitute for conventional signs and pavement markings.

Portable changeable message sign trailers should be delineated on a permanent basis by affixing retroreflective material, known as conspicuity material, in a continuous line on the face of the trailer as seen by oncoming road users.

Messages should be designed taking into account the following factors:

- A. Each phase should convey a single thought.
- B. If the message can be displayed in one phase, the top line should present the problem, the center line should present the location or distance ahead, and the bottom line should present the recommended driver action.
- C. The message should be as brief as possible
- D. When a message is longer than two phases, additional Portable Changeable Message signs should be used.
- E. When abbreviations are used, they should be easily understood.

F. Arrow Panels

An arrow panel shall be a sign with a matrix of elements capable of either flashing or sequential displays. This sign shall provide additional warning and directional information to assist in merging and controlling road users through or around a temporary traffic control zone. Arrow panels shall meet the minimum size, legibility distance, number of elements, and other specifications shown on Figure 7, page 29.

Type A, B, and C arrow panels shall have solid rectangular appearances. A Type D arrow panel shall conform to the shape of the arrow. All arrow panels shall be finished in nonreflective black. The color presented by the elements shall be yellow. The arrow panel shall be mounted on a vehicle, a trailer, or other suitable support.

Arrow panel elements shall be capable of at least a 50 percent dimming from full brilliance. The dimmed mode shall be used for nighttime operation of arrow panels. Full brilliance should be used for daytime operation of arrow panels.

The minimum element on-time shall be 50 percent for the flashing mode, with equal intervals of 25 percent for each sequential phase. The flashing rate shall be not less than 25 nor more than 40 flashes per minute.

An arrow panel shall have the following three mode selections:

- A. A flashing arrow, sequential arrow, or sequential chevron mode; and
- B. A flashing double arrow mode; and
- C. A flashing caution mode.

An arrow panel in the arrow or chevron mode shall be used only for stationary or moving lane closures on multilane roadways.

For shoulder work, blocking the shoulder, for roadside work near the shoulder, or for temporarily closing one lane on a two-lane, two-way roadway an arrow panel shall be used only in the caution mode.

An arrow panel shall be used at all lane closures on multi-lane streets, or other locations specified by the City Engineer. An arrow panel should be used in combination with appropriate signs, channelizing devices, or other temporary traffic control devices. For a stationary lane closure, the arrow panel should be located on the shoulder at the beginning of the merging taper.

Where the shoulder is narrow, the arrow panel should be located in the closed lane. When arrow panels are used to close multiple lanes, a separate arrow panel shall be used for each closed lane.

For mobile operations where a lane is closed, the arrow panel should be located to provide adequate separation from the work operation to allow for appropriate reaction by approaching drivers.

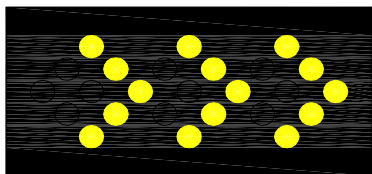
A vehicle displaying an arrow panel shall be equipped with rotating lights or strobe lights. When an arrow panel is not being used, it should be removed, shielded, or delineated with retroreflective temporary traffic control devices.

The minimum mounting height of an arrow panel should be 7 feet from the roadway to the bottom of the panel, except on vehicle-mounted panels, which should be as high as practical.

ADVANCE WARNING ARROW DISPLAY

<u>TYPE</u>	<u>MIN. SIZE</u>	<u>MIN. # LAMPS</u>
A	24"x48"	12
B	30"x60"	13
C	48"x96"	15

USAGE

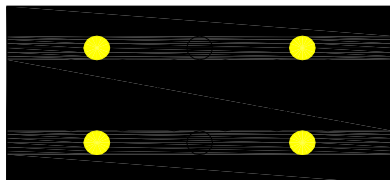


LOW SPEED STREETS 25-30 MPH
 INTERMEDIATE SPEED 35-45 MPH
 HIGH SPEED STREETS 50-55 MPH

ARROW DISPLAY SHALL BE SET IN THE (LEFT OR RIGHT) SEQUENTIAL CHEVRON MODE FOR LANE CLOSURES.

USE OF A TYPE "C" DISPLAY AT AN "A" OR "B" LOCATION OR USE OF A TYPE "B" DISPLAY AT AN "A" LOCATION IS ALLOWABLE. A TYPE "B" DISPLAY MAY BE USED FOR MOVING MAINTENANCE OPERATIONS.

USAGE



CAUTION MODE:
 FOR USE ON SHOULDER
 OR IN TURN BAYS

NOTE:

VEHICLE MOUNTED ARROW DISPLAYS ARE ACCEPTABLE

FIGURE 7

PORTABLE AND TEMPORARY SIGNS
AND ARROW DISPLAY

G. High Level Warning Devices (Flag Trees)

High-level warning devices are most commonly used in high-density road user situations to warn road users of short-term operations, and supplement other traffic control devices in temporary traffic control zones.

A high-level warning device shall consist of a minimum of two flags with or without a Type B high-intensity flashing warning light. The distance from the roadway to the bottom of the lens of the light and to the lowest point of the flag material shall be not less than 8 feet. The flag shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color. An appropriate warning sign may be mounted below the flags. (See Figure 5, page 20)

H. Hand Signaling Devices

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

The STOP/SLOW paddle shall have an octagonal shape on a rigid handle. STOP/SLOW paddles shall be at least 18 inches wide with letters at least 6 inches high and should be fabricated from light semirigid material. The background of the STOP face shall be red with white letters and border. The background of the SLOW face shall be orange with black letters and border. When used at night the STOP/SLOW paddle shall be retro-reflectorized.

Flaggers are provided at work sites to stop traffic intermittently as necessitated by work progress or to maintain continuous traffic past a work site at reduced speeds to help protect the work crew. The flagger stations shall be located such that approaching road users will have sufficient distance to stop at an intended stopping point.

The flagger should stand either on the shoulder adjacent to the road user being controlled or in the closed lane prior to stopping road users. At a spot constriction, the flagger may have to stand on the shoulder or curb opposite the closed section to operate effectively. Under no circumstances should they stand in the lane being used by moving traffic. They should be clearly visible to approaching traffic at all times. For this reason they should stand alone, never permitting a group of workers to congregate around them. They should be stationed sufficiently in advance of the work force to warn them of approaching danger, such as out of control vehicles.

Flagger stations should be adequately protected and preceded by proper advance warning signs. At night, flagger stations should be adequately illuminated. Flagging procedures have been illustrated in Figure 8, page 31.

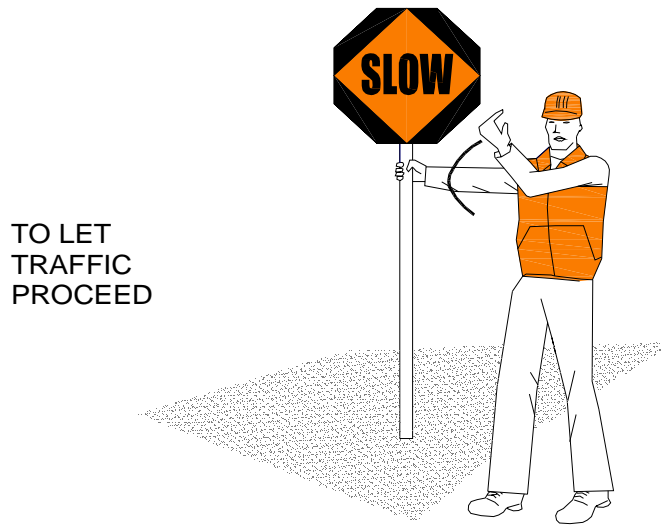
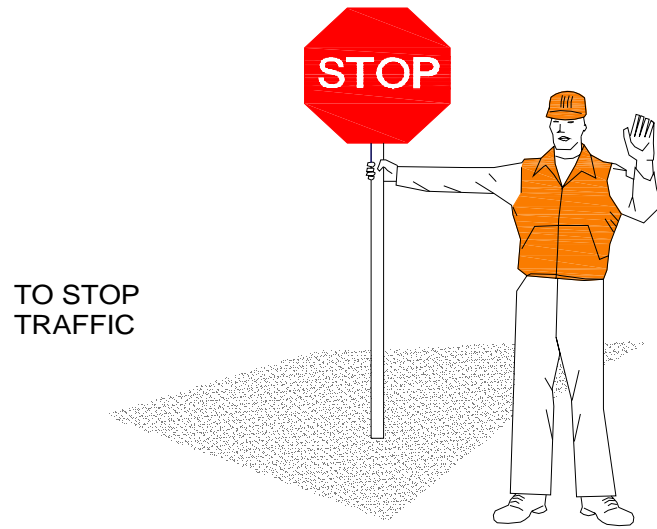


FIGURE 8
USE OF HAND SIGNALING
DEVICE BY FLAGGER

I. Pavement Markings

Interim Pavement Markings

Interim pavement markings are those that are allowed to remain in place until the earliest date when it is practical and possible to install pavement markings that meet the standards for pavement markings, according to Part 3 of the MUTCD. All interim pavement markings, including pavement markings for no-passing zones, shall conform to the requirements of Chapters 3A and 3B of the MUTCD.

Interim pavement markings should not be in place for more than 2 weeks unless justified by an engineering study. All temporary broken-line pavement markings shall use the same cycle length as permanent markings and be at least 2 feet long.

Half-cycle lengths with a minimum of 2 foot stripes may be used on roadways with severe curvature. This applies to centerlines in passing zones and lane lines.

For temporary situations of 3 calendar days or less, for a two- or three-lane road, no-passing zones may be identified by using DO NOT PASS (R4-1), PASS WITH CARE (R4-2), and NO PASSING ZONE (W14-3) signs rather than pavement markings.

Temporary Pavement Markings

These provisions for work zone pavement markings apply only for long-term stationary and intermediate term stationary traffic control zones as described in Section VII on pages 7 thru 9. They are not considered applicable for short term stationary, short duration, mobile, or incident management temporary traffic control zones.

Temporary pavement markings shall be maintained along streets and roadways in accordance with Chapters 3A and 3B in the MUTCD and shall match existing markings in place at each end of the temporary traffic control zone. Temporary pavement markings shall be placed along the entire length of any surfaced detour or temporary roadway prior to the detour or roadway being opened to road users. Appropriate warning signs, channelizing devices and delineation shall accompany the temporary pavement markings to provide a clear path for the roadway users where it is not possible to provide a clear path by pavement markings alone.

For long-term stationary operations, pavement markings in the temporary traveled way that are no longer applicable shall be removed or obliterated as soon as practical. Pavement marking obliteration shall leave a minimum of pavement scars and shall remove old marking material. Painting over existing pavement markings with black paint or spraying with asphalt shall not be accepted as a substitute for removal or obliteration.

J. Sidewalks

When a sidewalk or section of a sidewalk is removed, the contractor shall provide a temporary surface with the appropriate warning or close the sidewalk and install the proper traffic control devices as deemed necessary by the City. The Contractor shall conform to Chapter 6D in the MUTCD regarding pedestrian and worker safety including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (or most current revision).

XI. SPECIAL OPERATIONS

A. Moving Street Striping

Moving street striping operations shall be considered mobile-work and require only the use of vehicle mounted warning lights for traffic control. Cones and/or flaggers may be used to supplement the warning lights for traffic control.

B. Moving Maintenance

Moving maintenance operations with stops of a short duration (usually less than 1 hour) will be considered short duration work. On multi-lane roads that require the blockage or partial blockage of a traffic lane, they shall trail a flashing arrow panel and utilize vehicle mounted warning lights for traffic control. An advance warning sign such as "ROAD WORK AHEAD" should also be mounted on portable sign supports on the right hand side of the roadway and relocated as the maintenance operation progresses. Moving maintenance on collector streets should utilize a flagger and vehicle mounted warning lights for traffic control. Moving maintenance on residential or low volume streets should utilize vehicle mounted warning lights for traffic control unless limited sight distance or other conditions warrant the use of a flagger.

C. Crosswalk Pavement Markings

Crosswalk pavement marking installations should utilize the following traffic control:

- | | | |
|-----------------------------------|---|---|
| Residential | - | Vehicle mounted warning lights and channelizers |
| Collector and Two Lane Arterial | - | Vehicle mounted warning lights, channelizers, and "Road Work Ahead" signs |
| Multi Lane Collector and Arterial | - | Vehicle mounted warning lights, channelizers, "Road Work Ahead" signs, and advance warning arrow displays |

D. Spot Maintenance

Spot Maintenance will be considered mobile operations (usually less than 15 minutes) for traffic signal maintenance (e.g. light bulb change out, signal head adjustment, etc.); streetlight maintenance (e.g. random lamp replacement); and traffic sign installation or repair on thoroughfares and shall require the use of vehicle mounted warning lights and may require an advance warning arrow panel when deemed necessary by the City for traffic control. Spot maintenance on collector streets shall require the use of vehicle mounted warning lights for traffic control. Cones and/or flaggers should be used to supplement the warning lights for traffic control when deemed necessary by the City.

Vehicle mounted warning lights shall be defined as a rotating beacon, warning arrow, arrow display, strobe light, or light bar. Standard 4-way emergency flashers alone will not meet these requirements.

COMMON TRAFFIC CONTROL SIGNS



G20-2



M4-9



M4-8a



M4-10



R1-1



R1-2



R2-1



R3-1



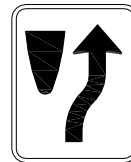
R3-2



R3-7



R4-7B



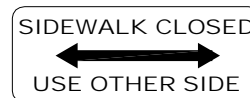
R4-8



R5-1

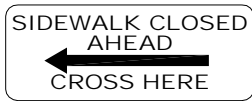


R9-9

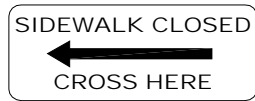


R9-10

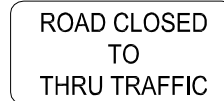
COMMON TRAFFIC CONTROL SIGNS



R9-11



R9-11a



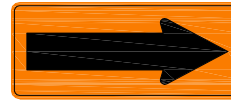
R11-4



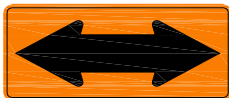
R11-2



W1-4



W1-6



W1-7



W3-4



W3-5



W4-2



W9-3



W5-1

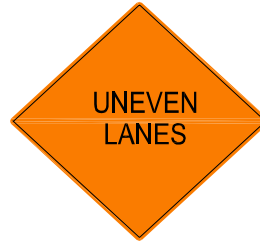
COMMON TRAFFIC CONTROL SIGNS



W6-3



W8-9A



W8-11



W9-2



W12-1



W13-1



W11-2



W20-1



W20-2



W16-7P



W20-3

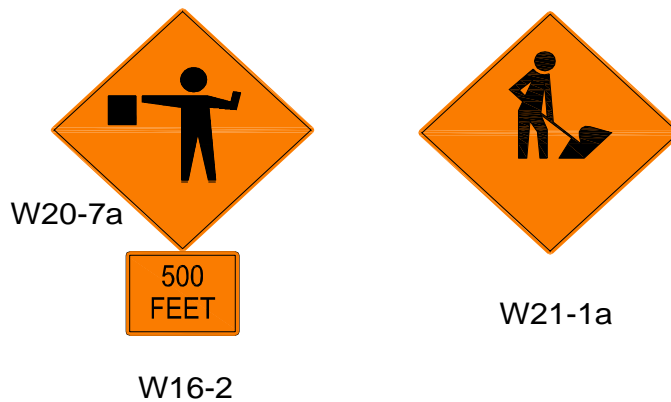


W20-4

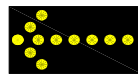


W20-5

COMMON TRAFFIC CONTROL SIGNS



MEANING OF SYMBOLS ON TYPICAL APPLICATION DIAGRAMS



ARROW PANEL



ARROW PANEL SUPPORT OR TRAILER
(SHOWN FACING DOWN)



CHANNELIZING DEVICE



DIRECTION OF TRAFFIC



FLAGGER



TRAFFIC OR PEDESTRIAN SIGNAL



SIGN (SHOWN FACING LEFT)



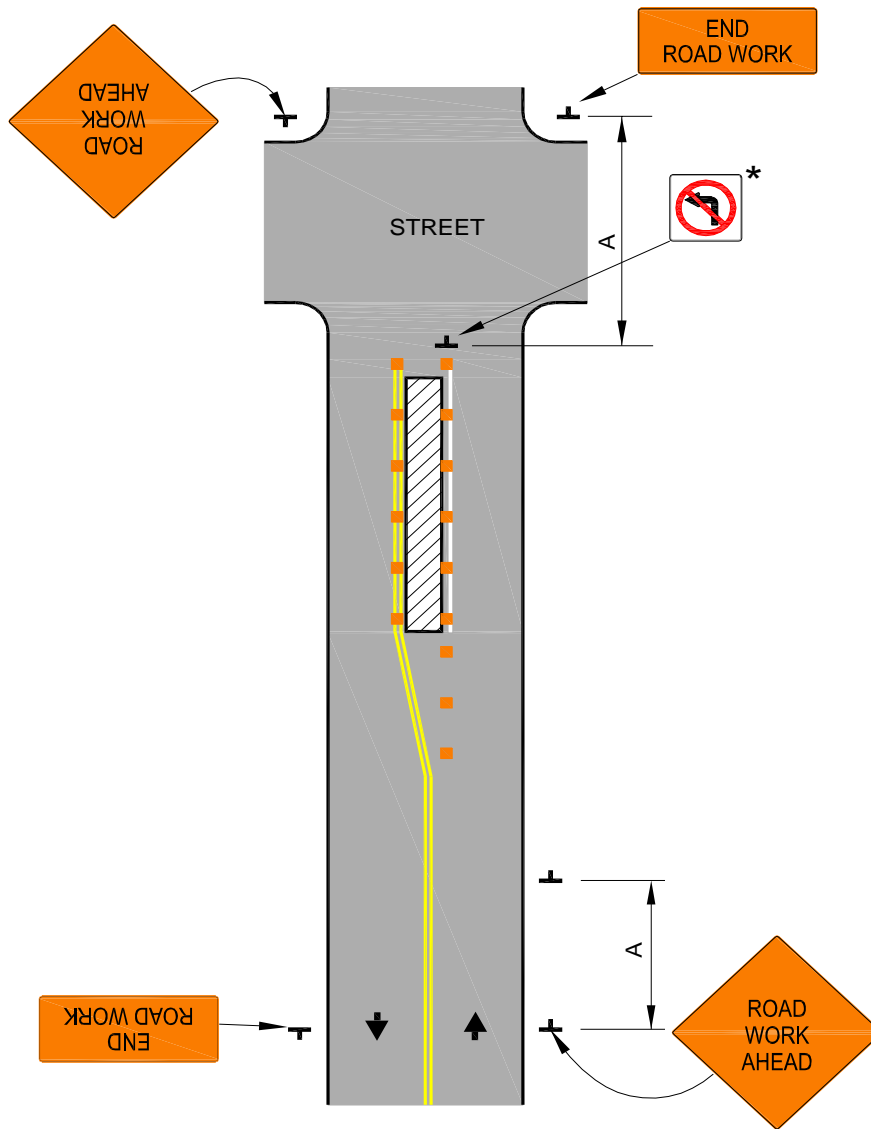
TYPE III BARRICADE



WORK SPACE



HIGH LEVEL WARNING DEVICE
(FLAG TREE)

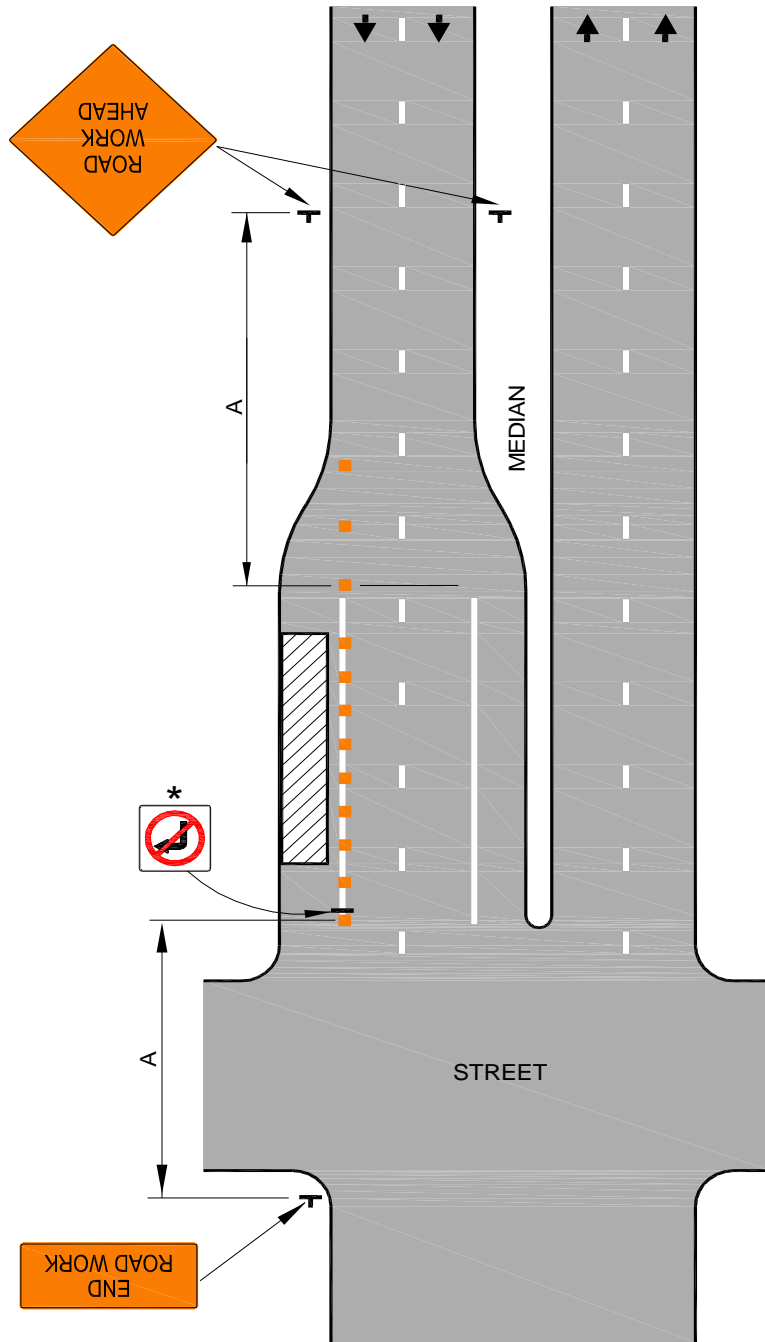


NOTES:

1. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
2. IF CONSTRUCTION OR MAINTENANCE REQUIRES A COMPLETE LEFT TURN LANE CLOSURE, CONTACT THE CITY TRAFFIC ENGINEER FOR VERIFICATION OF "NO LEFT TURN" SIGN REQUIREMENTS
3. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
4. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

TYPICAL LEFT TURN LANE CLOSURE

* AS APPROVED BY THE ENGINEER

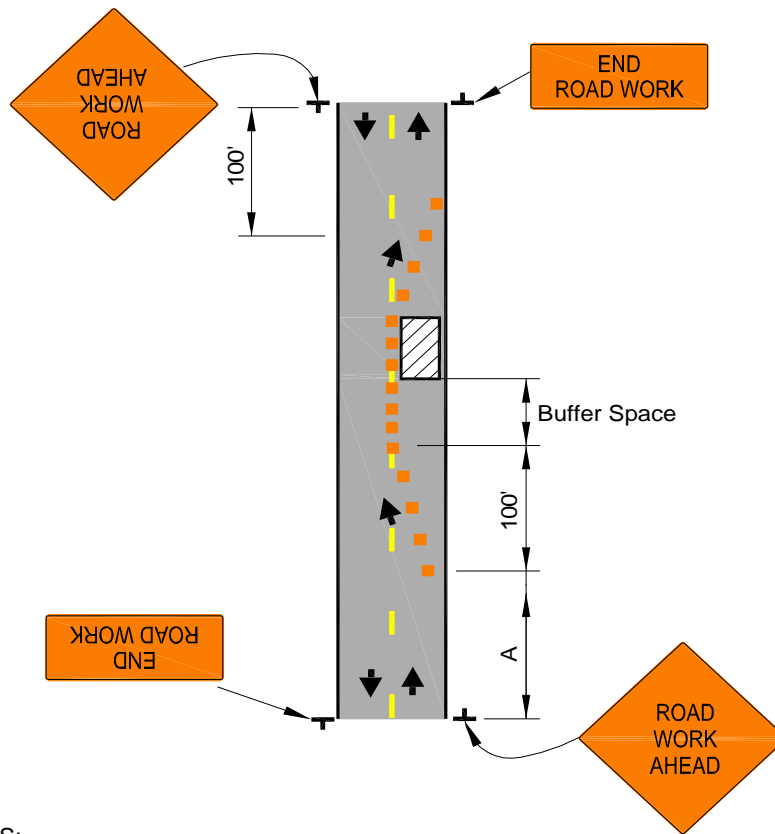


TYPICAL RIGHT TURN LANE CLOSURE

* AS APPROVED BY THE ENGINEER

NOTES:

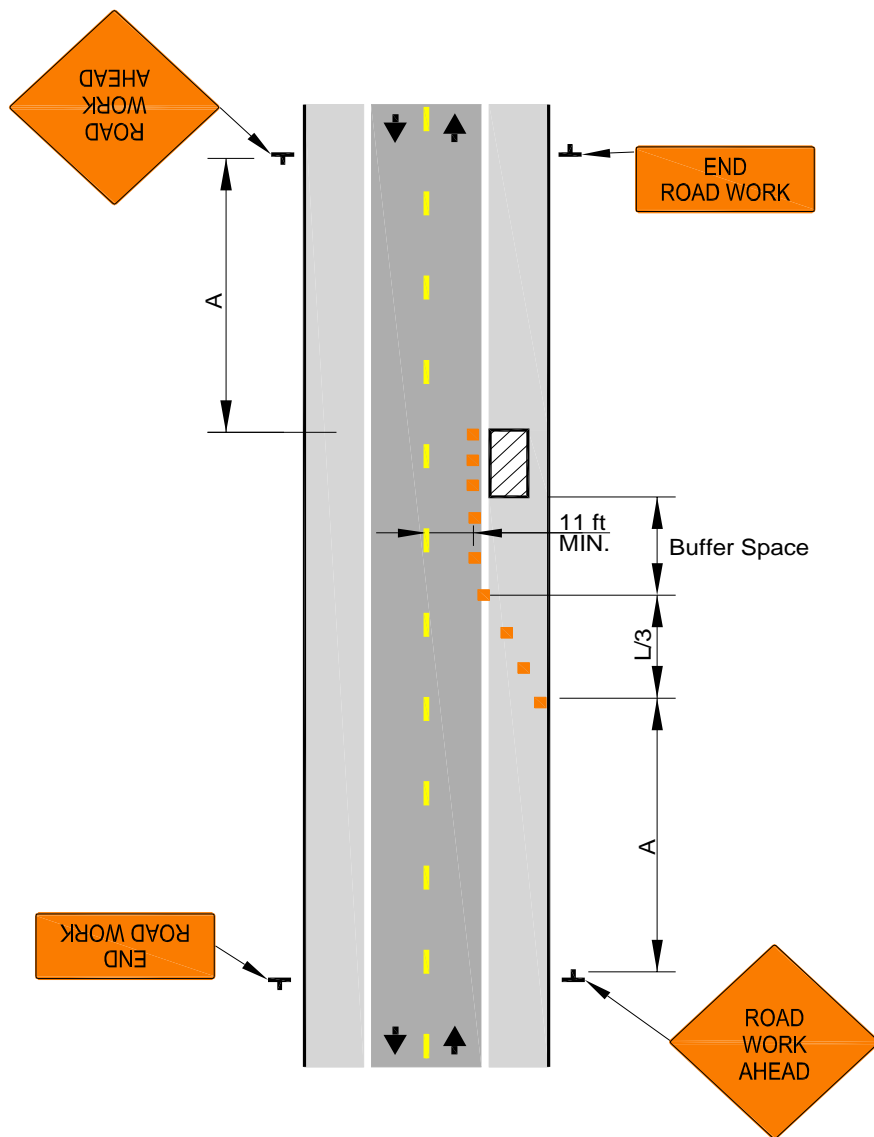
1. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
2. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
3. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.



NOTES:

1. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE 10'-20' APART.
2. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA BETWEEN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
3. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A DOWNSTREAM TAPER SHOULD BE APPROXIMATELY 20'.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.
6. CHANNELIZING DEVICES ARE TO BE EXTENDED TO A POINT WHERE THEY ARE VISIBLE TO APPROACHING TRAFFIC.
7. THIS TYPICAL APPLICATION APPLIES WHEN BI-DIRECTIONAL TRAFFIC CAN MOVE FREELY AT REDUCED SPEEDS THROUGH THE WORK AREA.

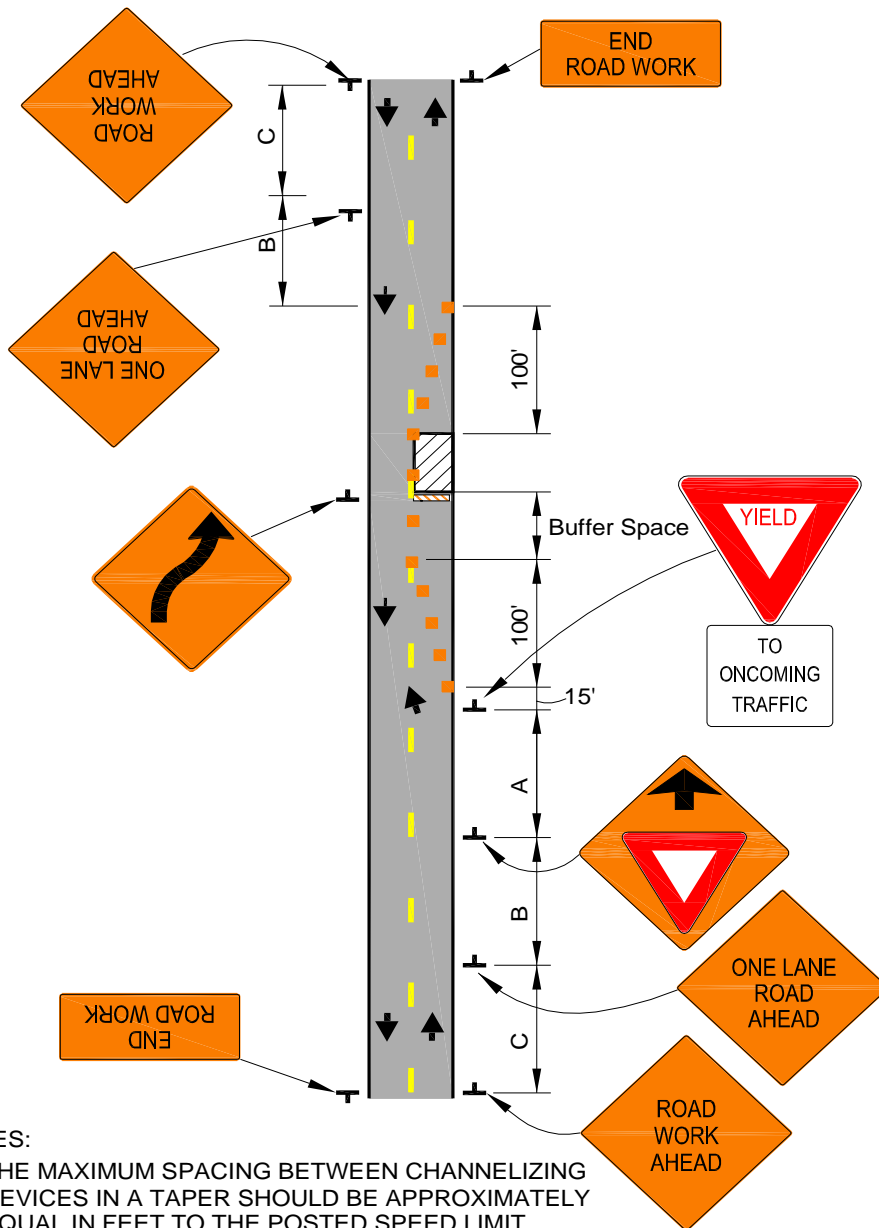
TYPICAL LANE CLOSURE
TWO-LANE RESIDENTIAL STREET
 (LOW TRAFFIC VOLUME)



NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.
6. THIS TYPICAL APPLICATION APPLIES WHEN BI-DIRECTIONAL TRAFFIC CAN MOVE FREELY AT REDUCED SPEEDS THROUGH THE WORK AREA.

MINOR ENCROACHMENT ON ROADWAY
TWO-LANE ARTERIAL OR COLLECTOR STREET



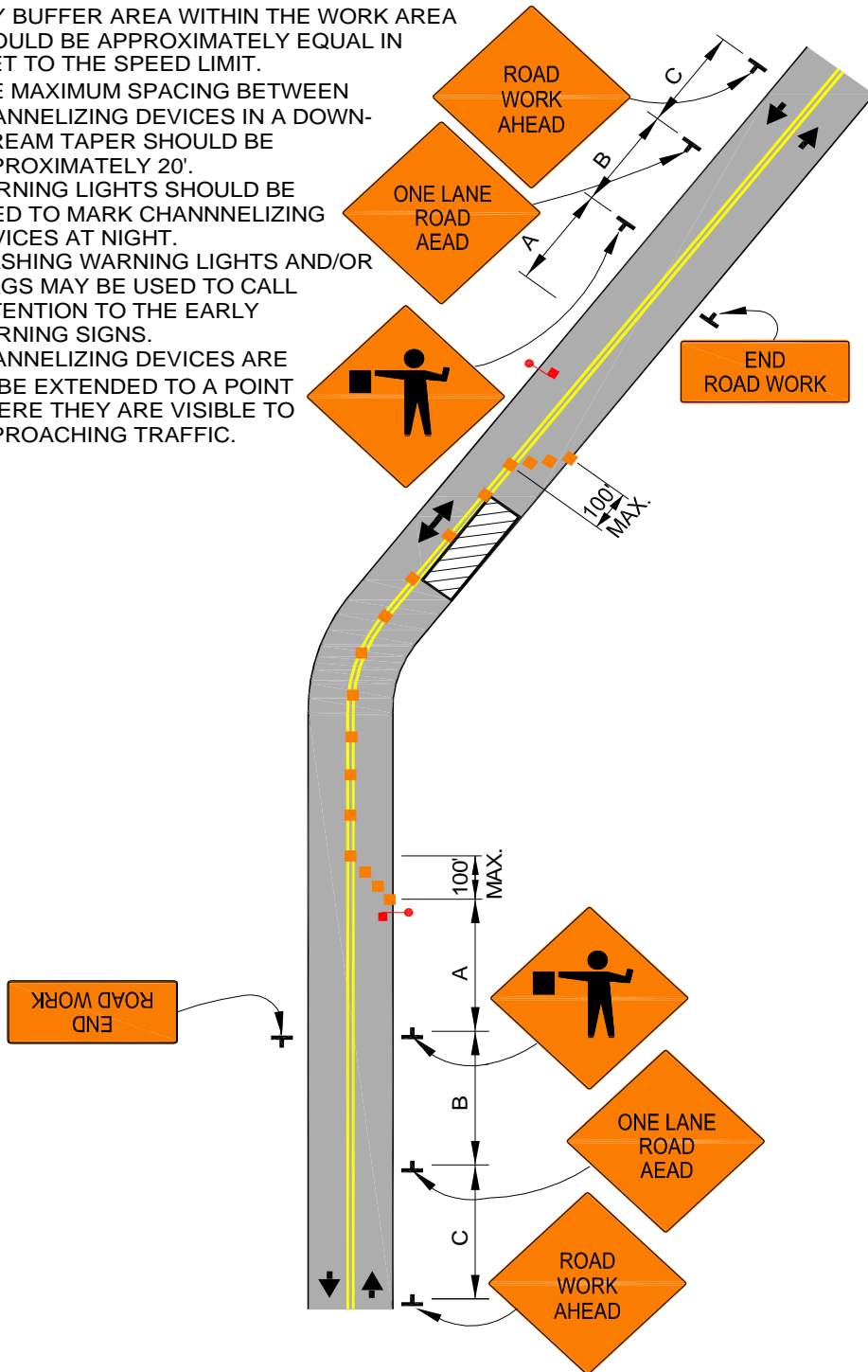
NOTES:

1. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
2. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A DOWNSTREAM TAPER SHOULD BE APPROXIMATELY 20'.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.
6. IF ENTIRE WORK AREA IS VISIBLE FROM ONE STATION, A SINGLE FLAGGER MAY BE USED. THIS TYPICAL APPLICATION APPLIES WHEN BI-DIRECTIONAL TRAFFIC CAN MOVE FREELY AT REDUCED SPEEDS THROUGH THE WORK AREA.
7. CHANNELIZING DEVICES ARE TO BE EXTENDED TO A POINT WHERE THEY ARE VISIBLE TO APPROACHING TRAFFIC.

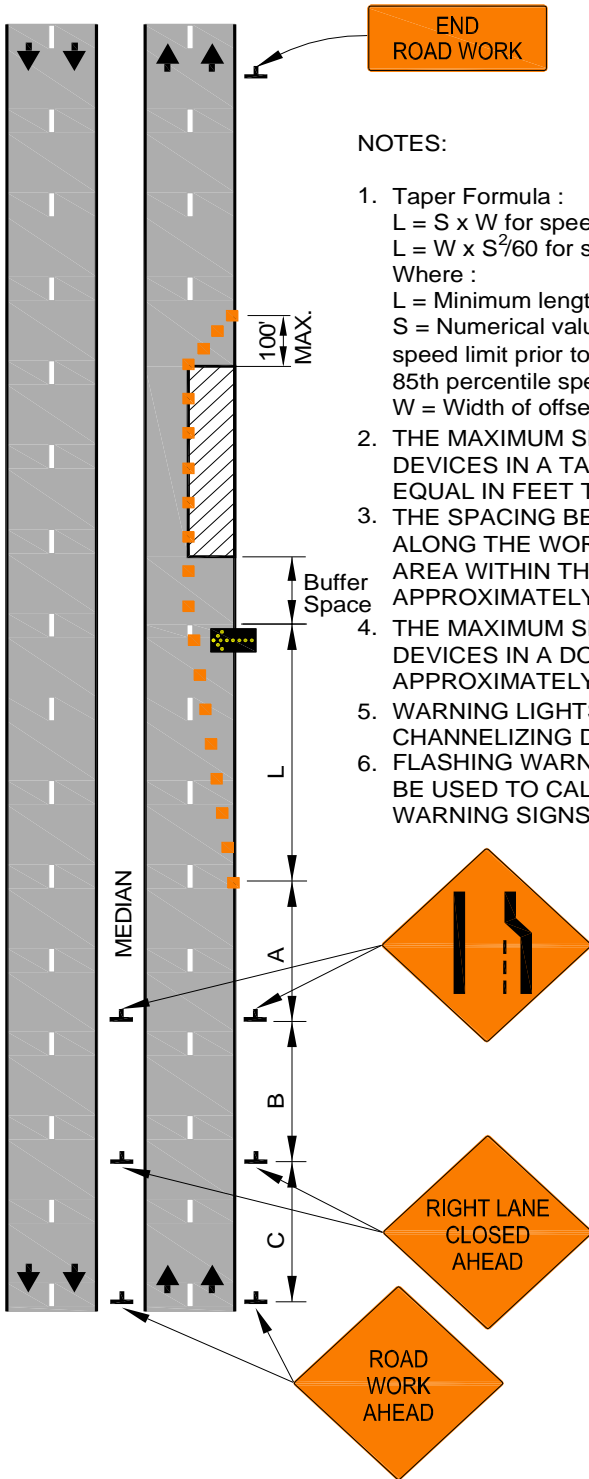
TYPICAL LANE CLOSURE
TWO-LANE ARTERIAL OR COLLECTOR STREET

NOTES:

1. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE 10'-20' APART.
2. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
3. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A DOWN-STREAM TAPER SHOULD BE APPROXIMATELY 20'.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.
6. CHANNELIZING DEVICES ARE TO BE EXTENDED TO A POINT WHERE THEY ARE VISIBLE TO APPROACHING TRAFFIC.



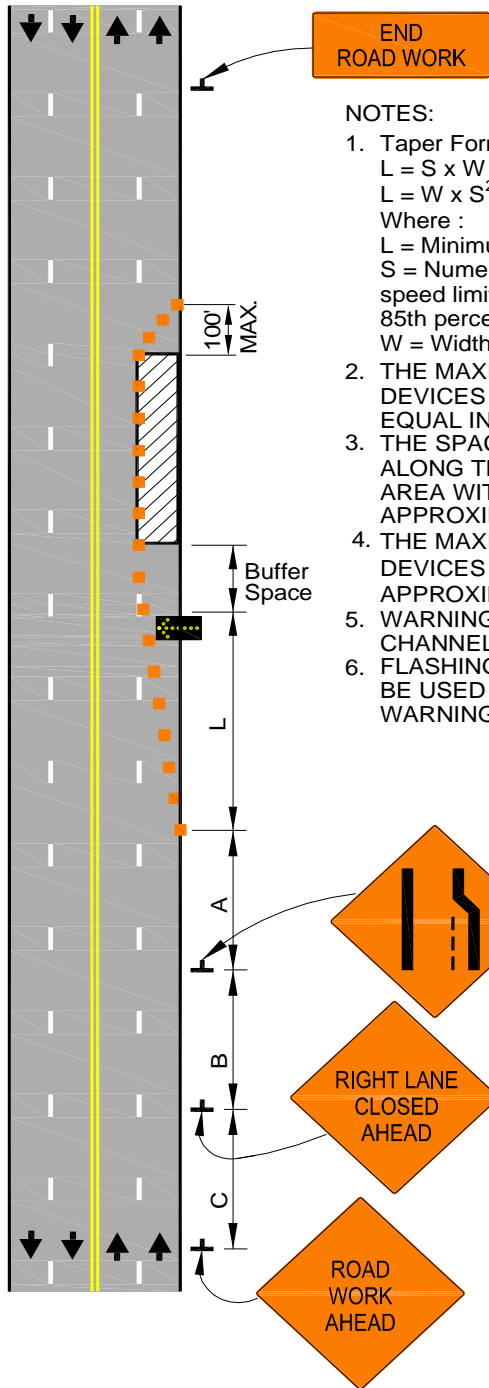
TYPICAL LANE CLOSURE ON
TWO-LANE ROAD USING FLAGGERS



NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A DOWNSTREAM TAPER SHOULD BE APPROXIMATELY 20'.
5. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
6. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

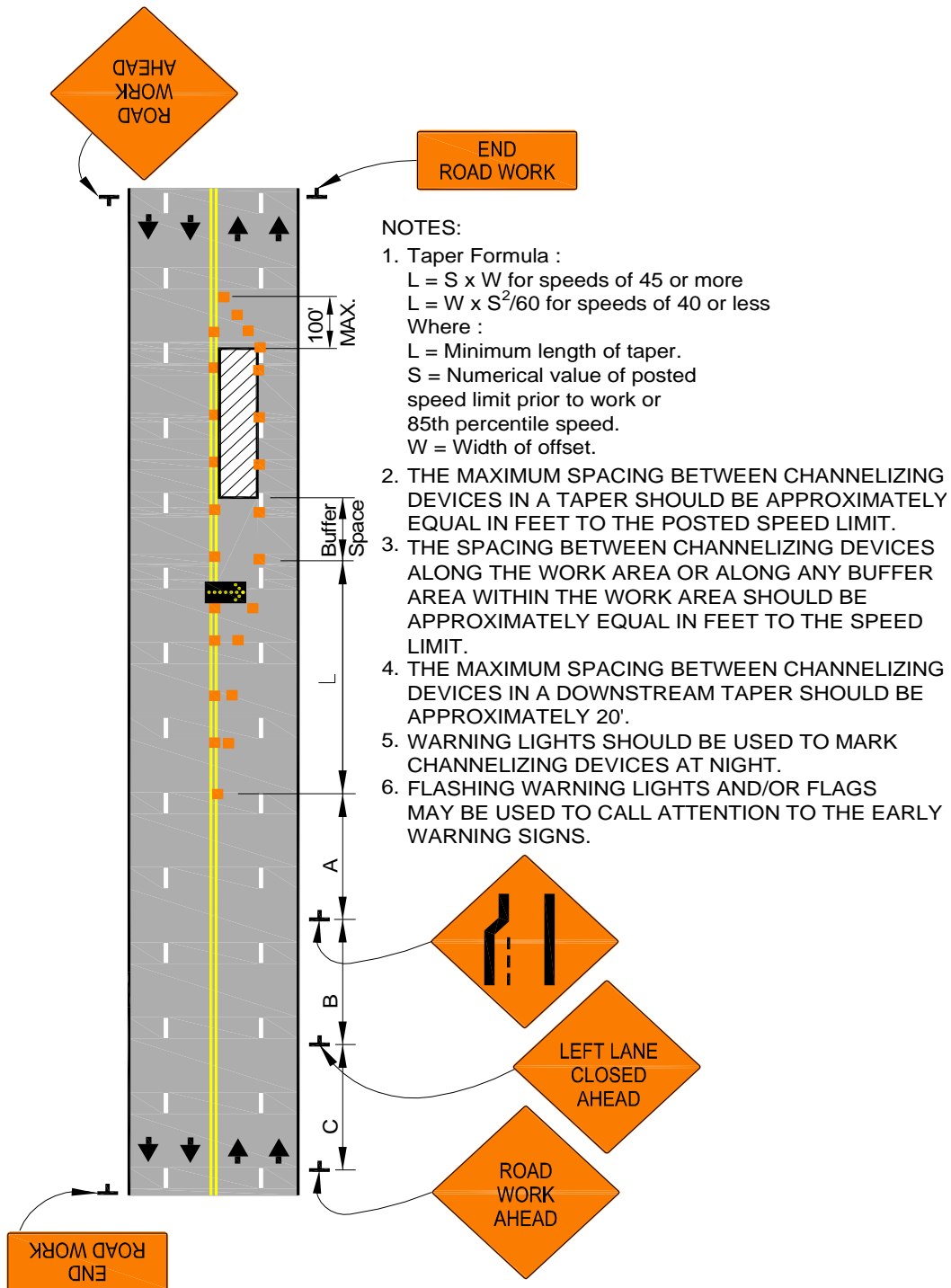
TYPICAL RIGHT LANE CLOSURE
FOUR-LANE DIVIDED THOROUGHFARE



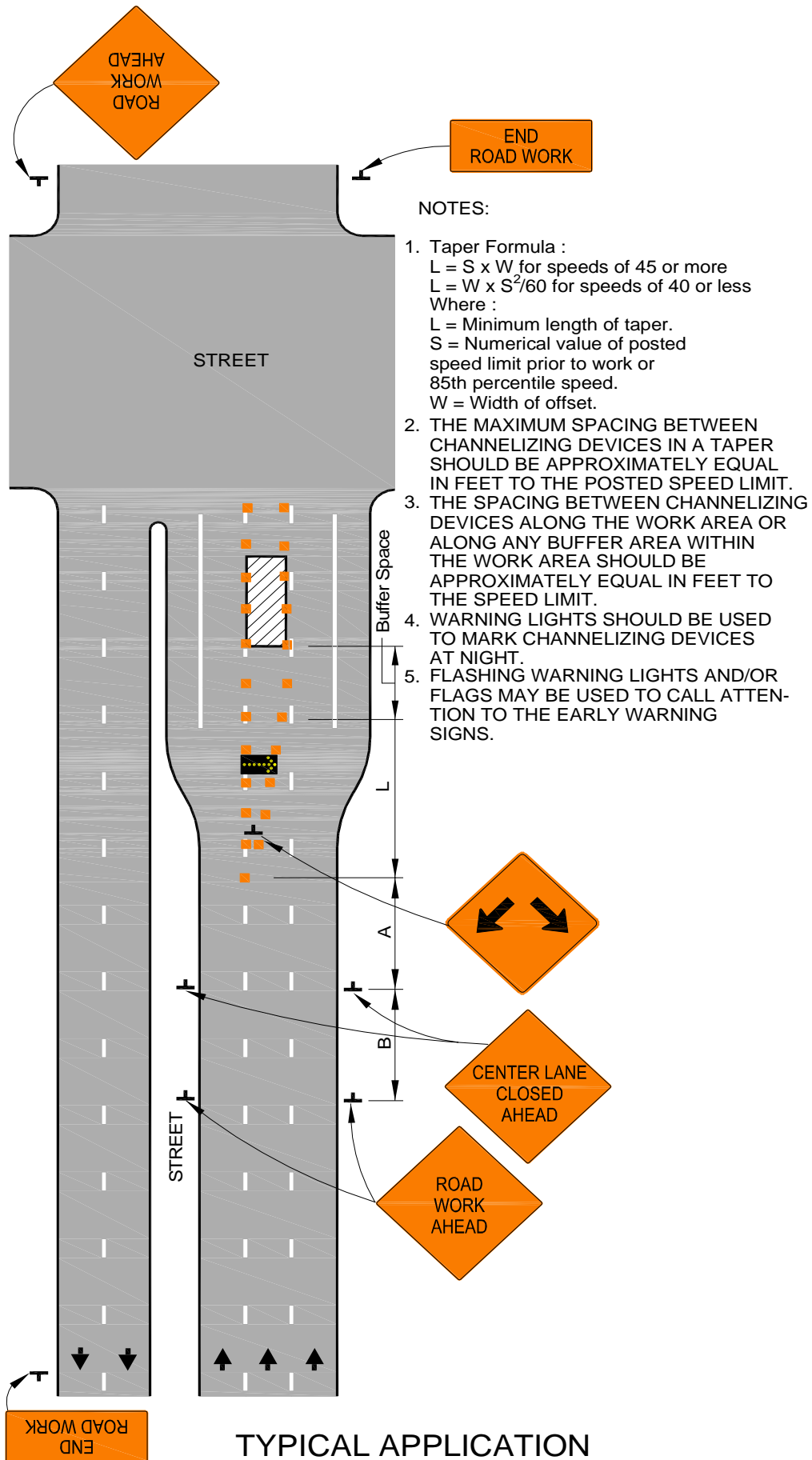
NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A DOWNSTREAM TAPER SHOULD BE APPROXIMATELY 20'.
5. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
6. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

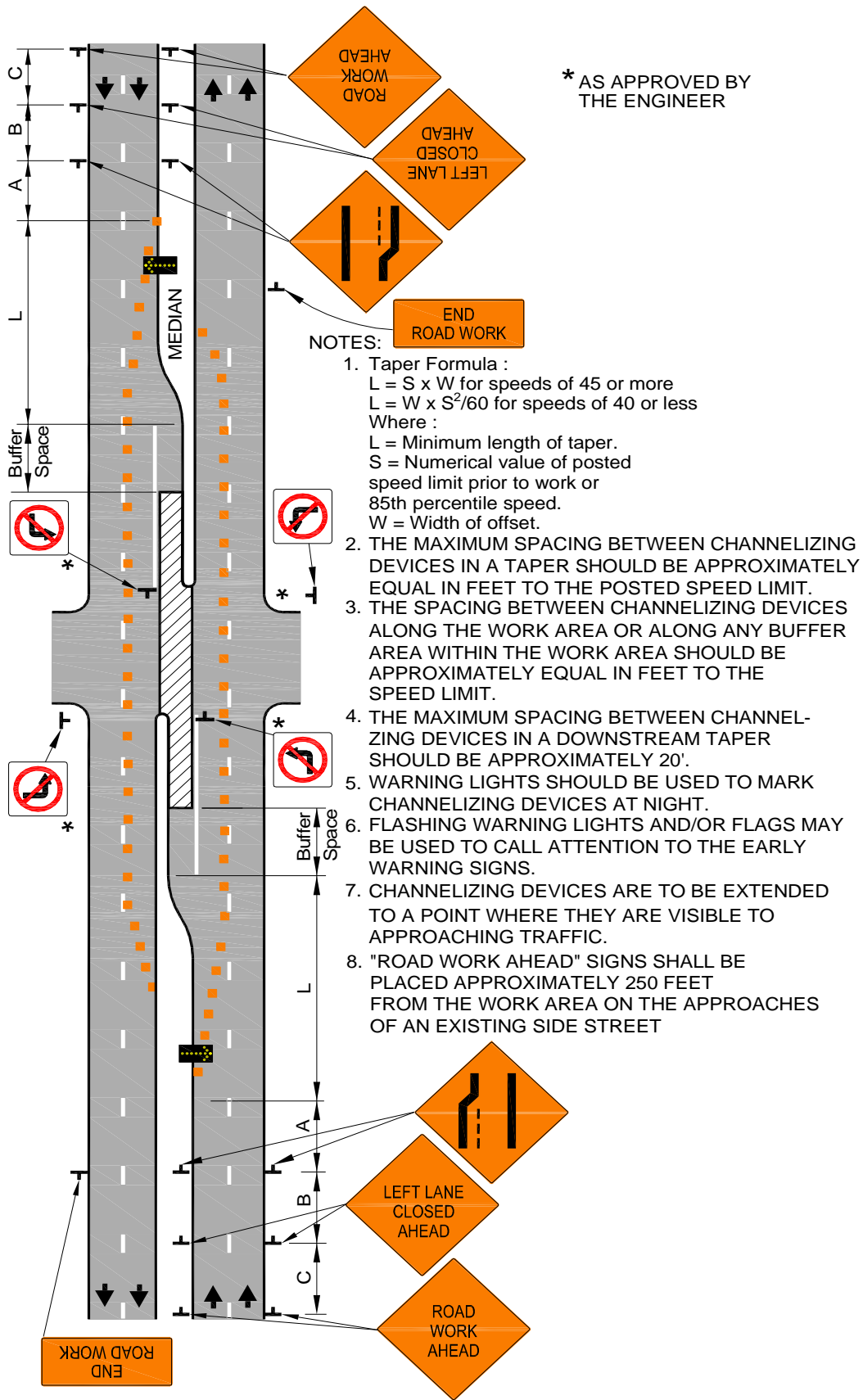
TYPICAL RIGHT LANE CLOSURE
FOUR-LANE THOROUGHFARE



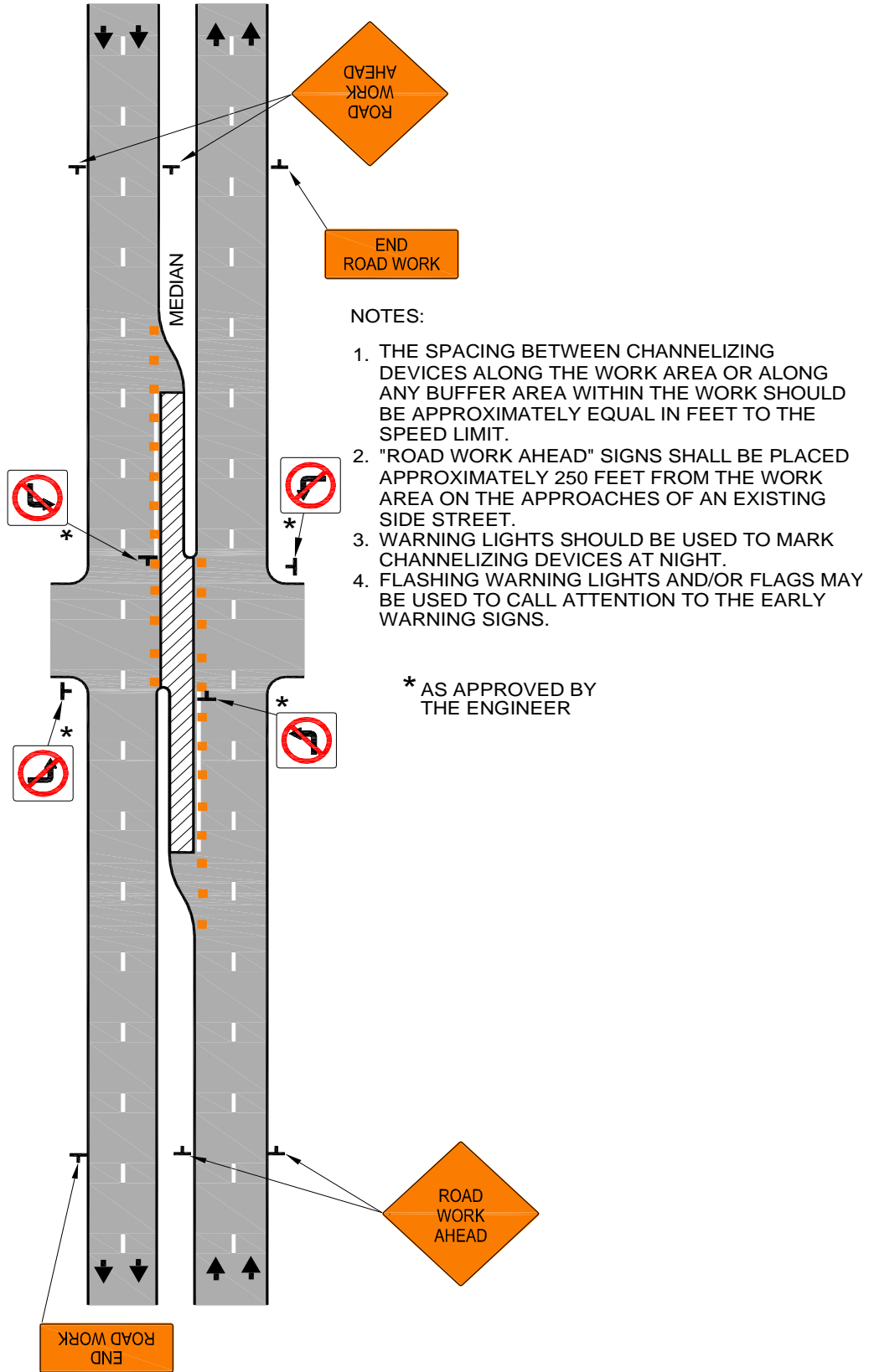
TYPICAL LEFT LANE CLOSURE
FOUR-LANE THOROUGHFARE



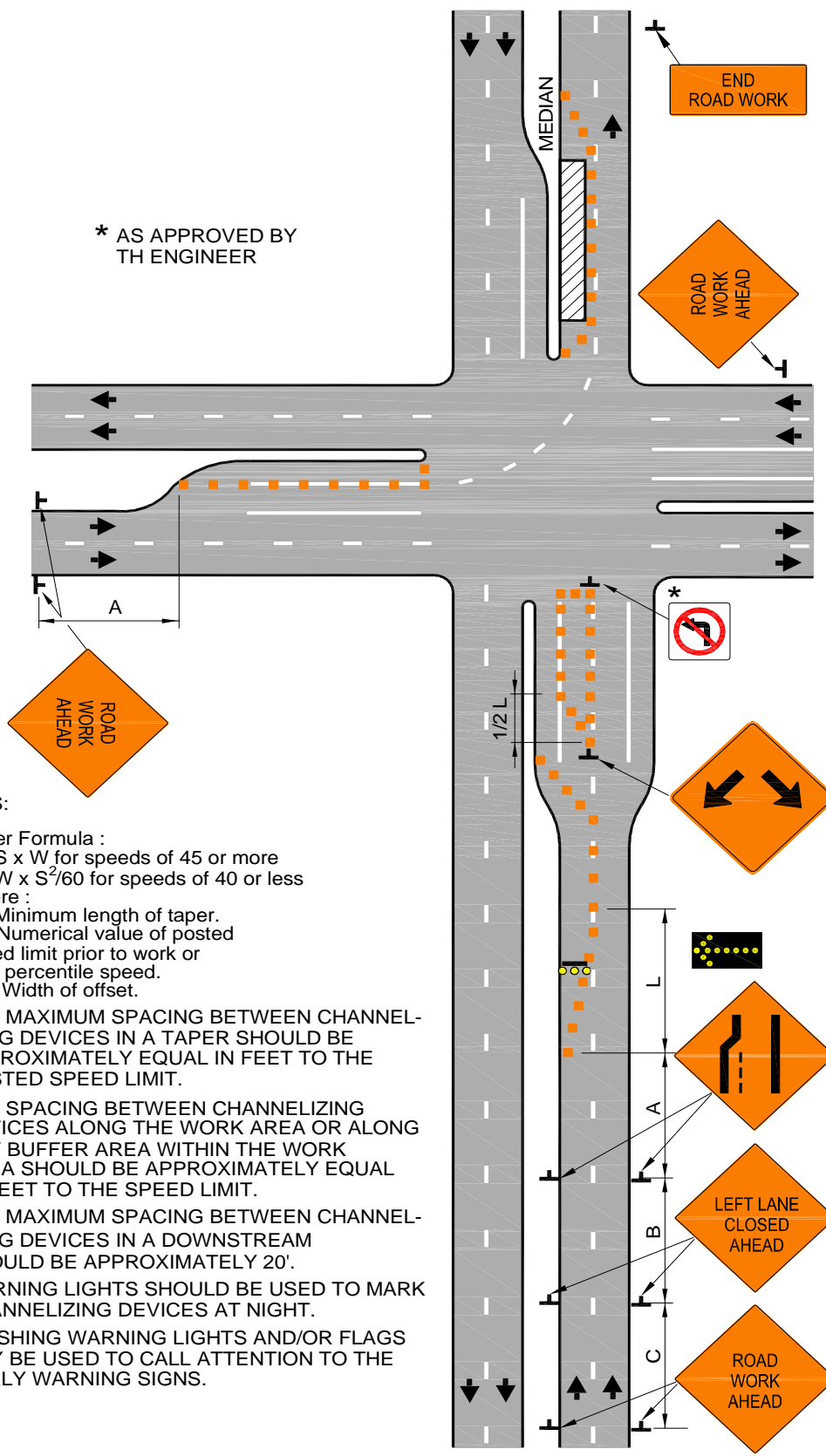
TYPICAL APPLICATION
CENTER LANE CLOSURE



**MEDIAN CUT MULTI-LANE DIVIDED ROADWAY
 TYPICAL APPLICATION
 DURING CONSTRUCTION PERIODS**



**MEDIAN CUT MULTI-LANE DIVIDED ROADWAY
TYPICAL APPLICATION
NON-CONSTRUCTION PERIODS**

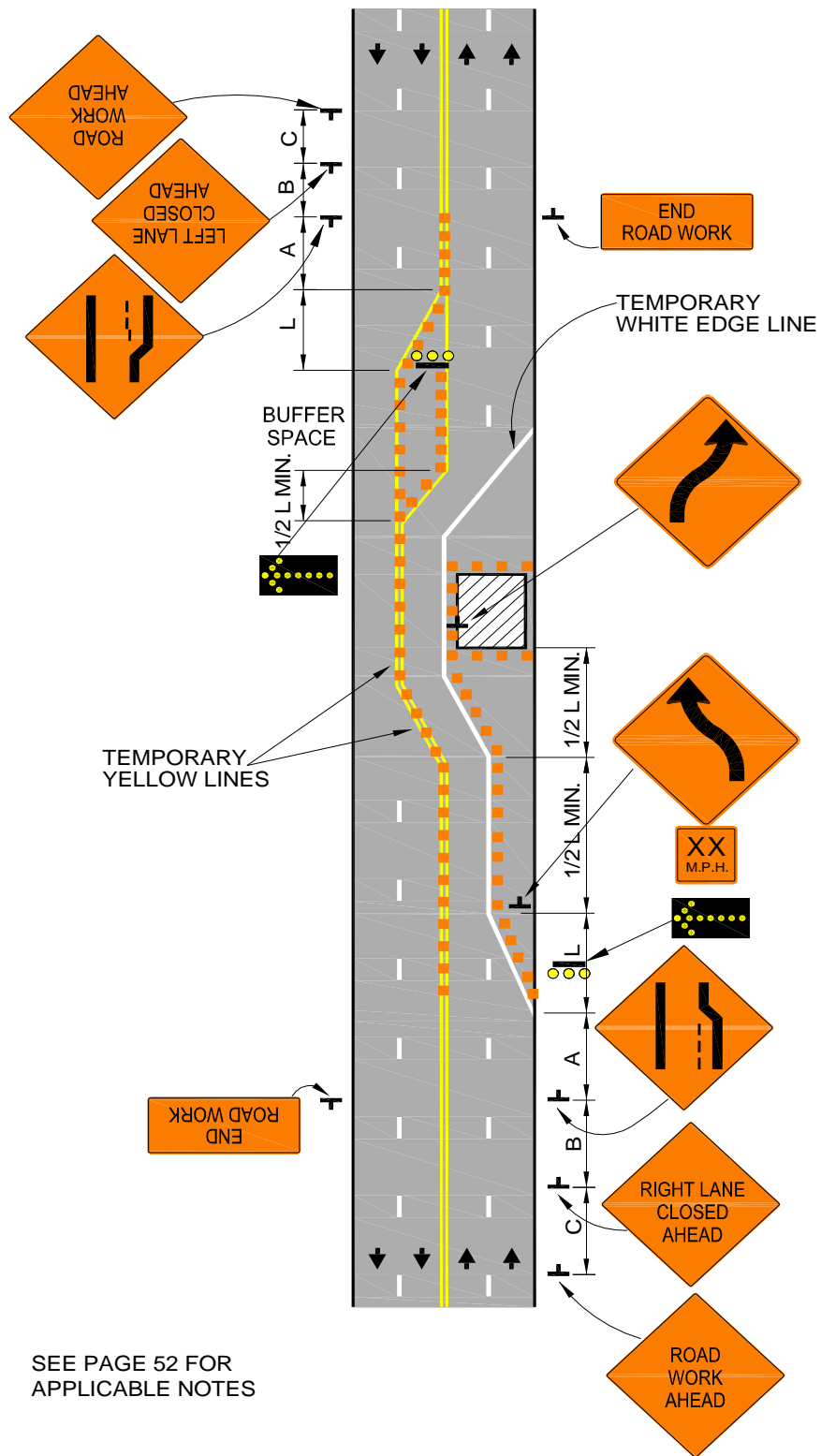


* AS APPROVED BY
TH ENGINEER

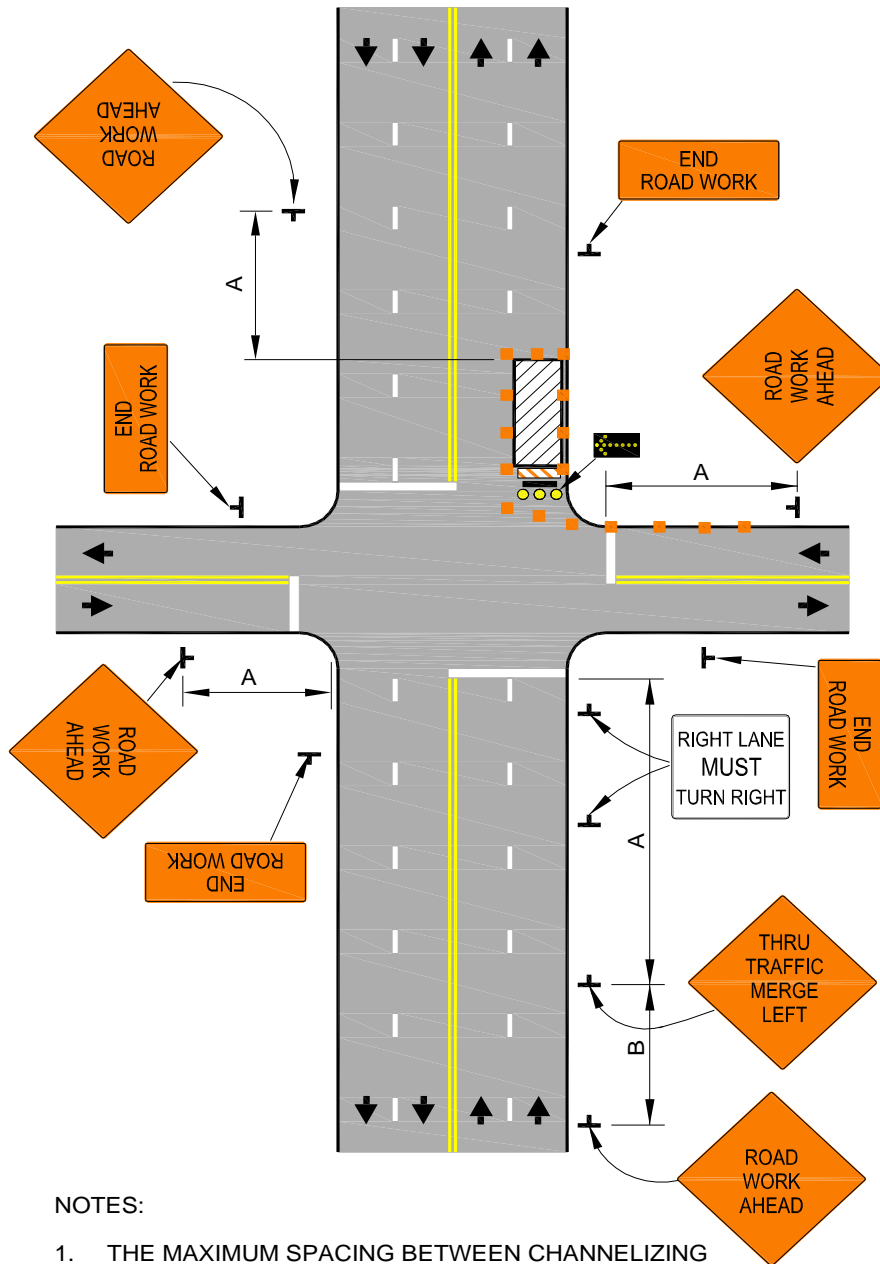
NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A DOWNSTREAM SHOULD BE APPROXIMATELY 20'.
5. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
6. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

TYPICAL LEFT LANE CLOSURE
PROVIDING ACCESS TO LEFT TURN LANE



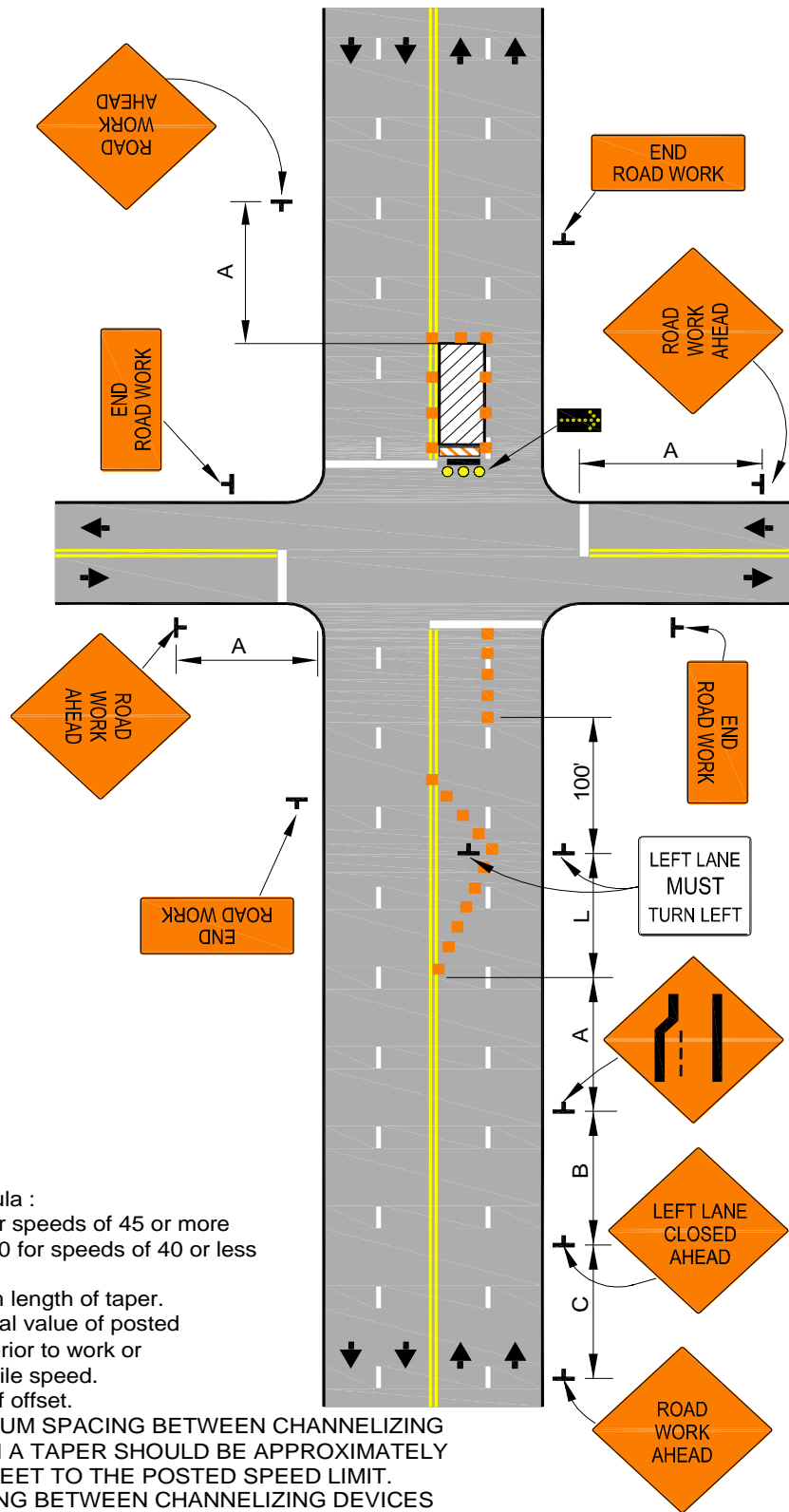
**FOUR-LANE UNDIVIDED THOROUGHFARE
ONE-HALF ROADWAY CLOSURE**



NOTES:

1. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
2. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
3. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

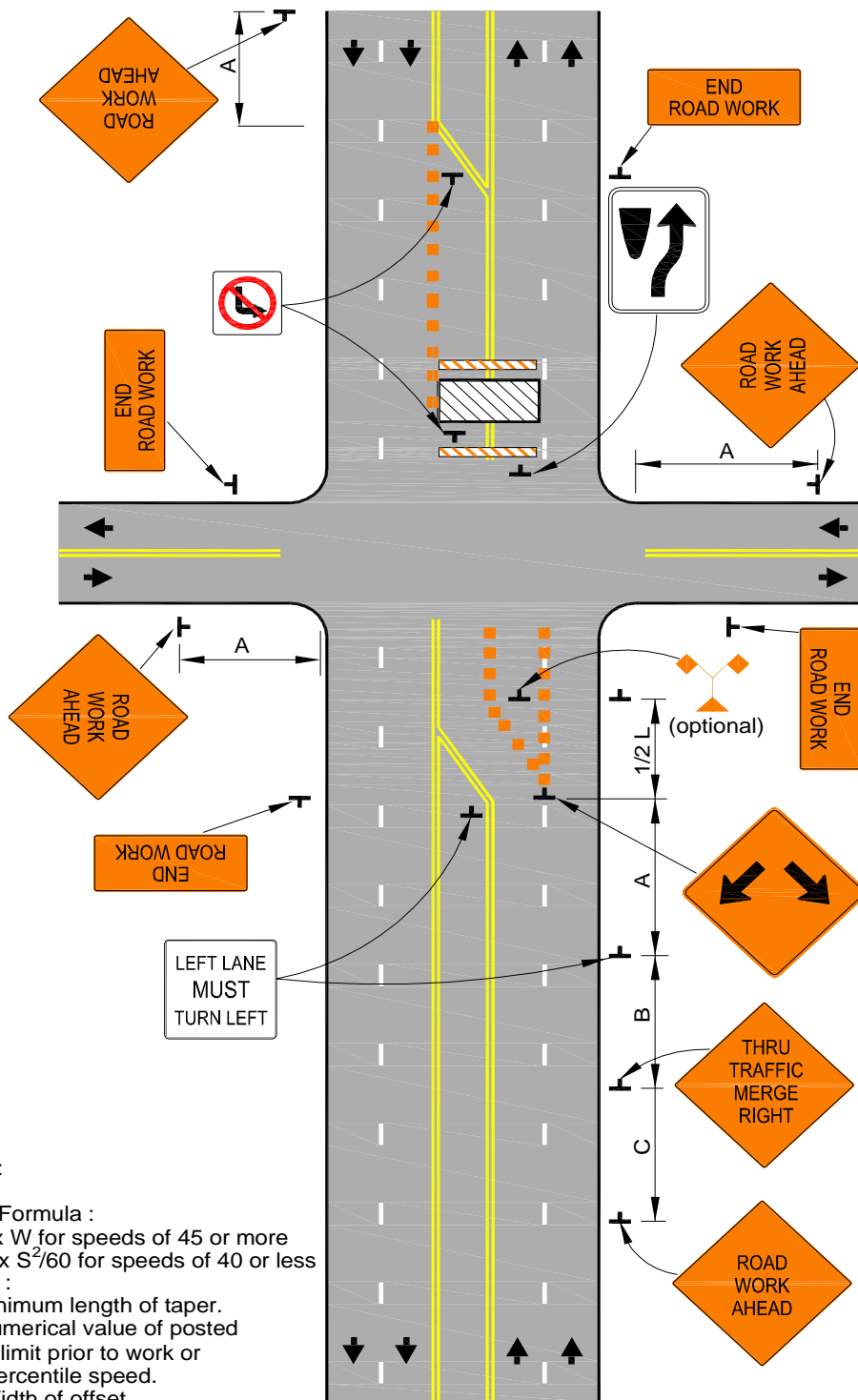
RIGHT LANE CLOSURE
ON FAR SIDE OF INTERSECTION



NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

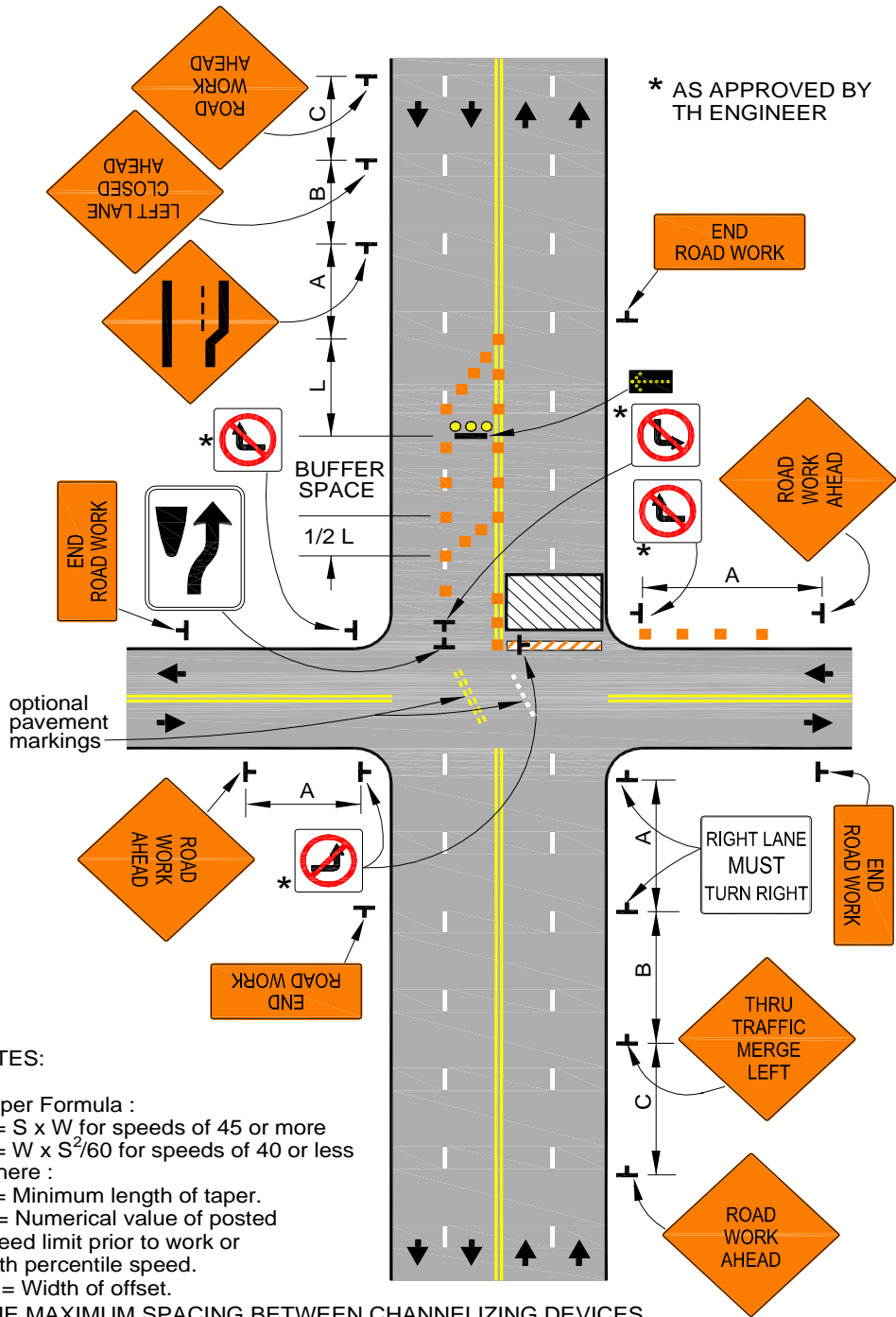
**LEFT LANE CLOSURE
ON FAR SIDE OF INTERSECTION**



NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNLEIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

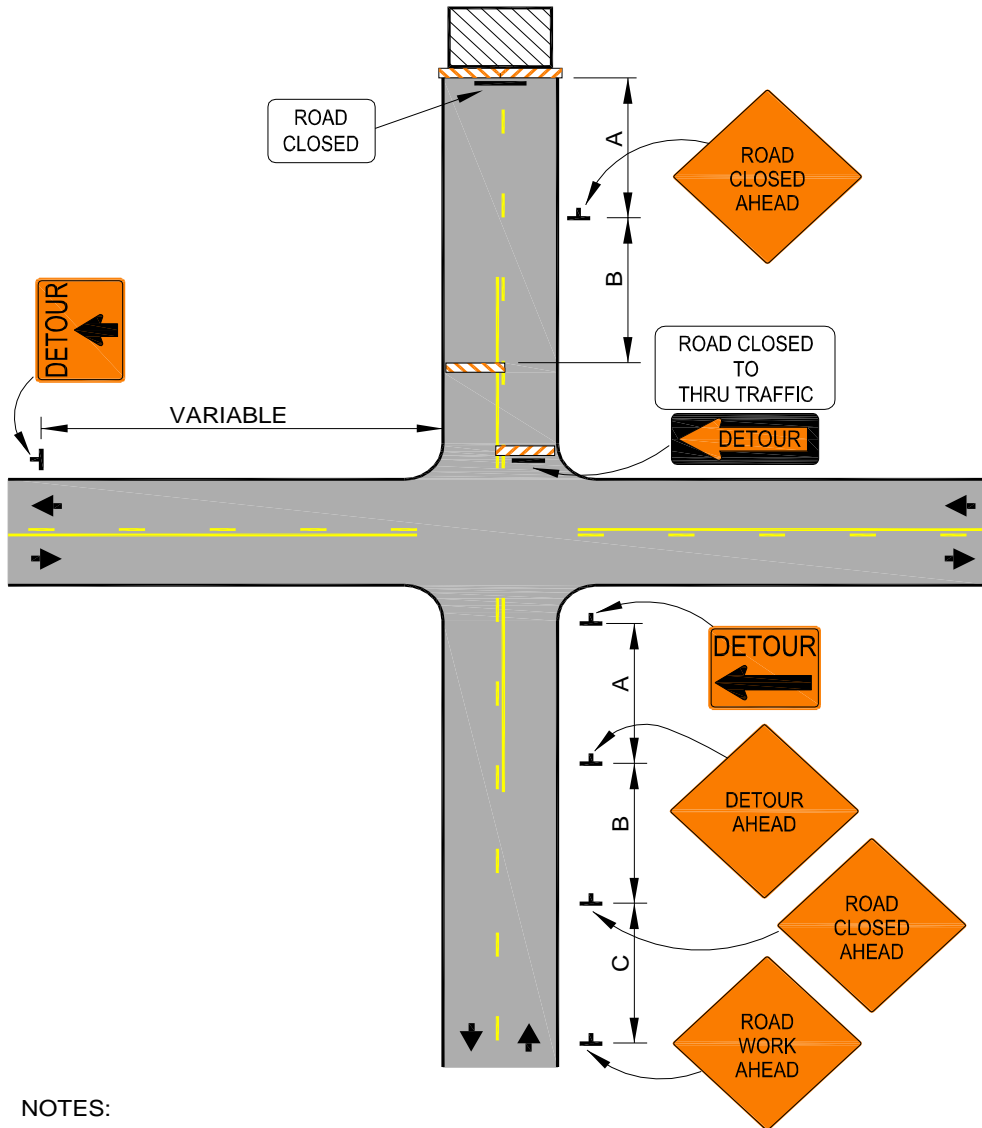
MULTIPLE LANE CLOSURE AT INTERSECTION



NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

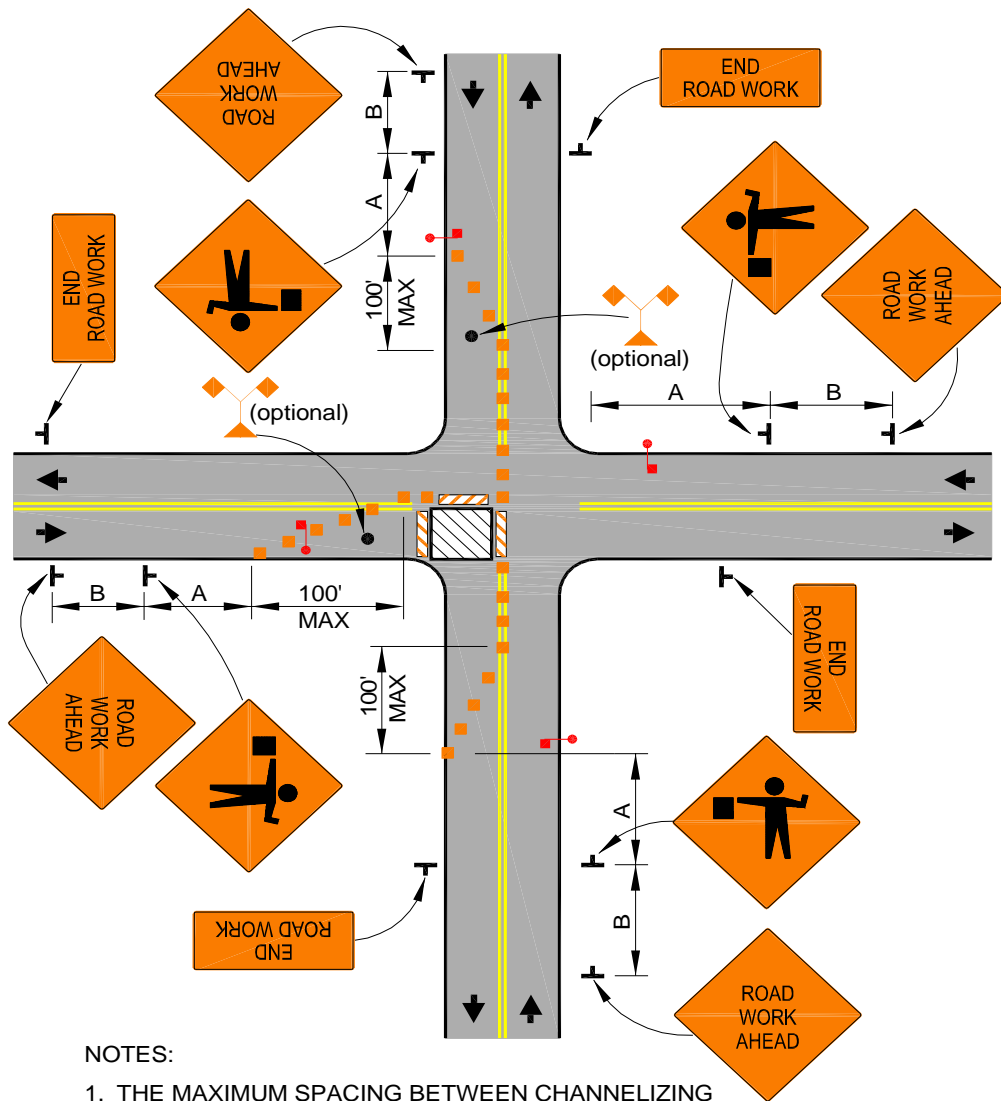
HALF ROAD CLOSURE ON FAR SIDE OF INTERSECTION



NOTES:

1. The Contractor shall be required to submit a full traffic detour signing plan to the City Engineer for approval.
2. The contractor shall be required to contact all emergency providers to notify them of the street closure.
3. Flashing warning lights and/or flags may be used to call attention to the early warning signs.
4. Advance lane closings or turn lane closures will be necessary for streets with multi-lane approaches. Consult other typical appropriate traffic control arrangements within this handbook.

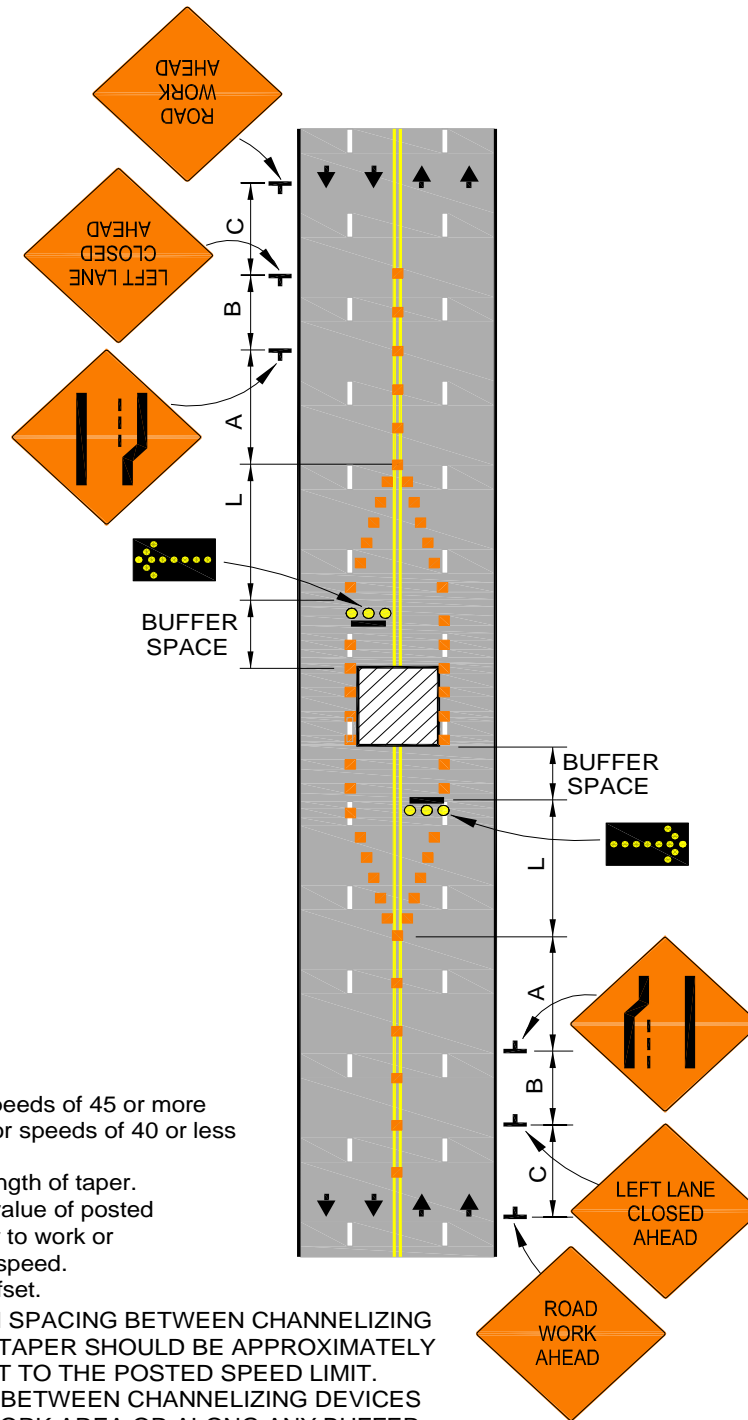
STREET CLOSURE WITH OFF-SITE DETOUR



NOTES:

1. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE 10'-20' APART.
2. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
3. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
4. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.
5. CHANNELIZING DEVICES ARE TO BE EXTENDED TO A POINT WHERE THEY ARE VISIBLE TO APPROACHING TRAFFIC.

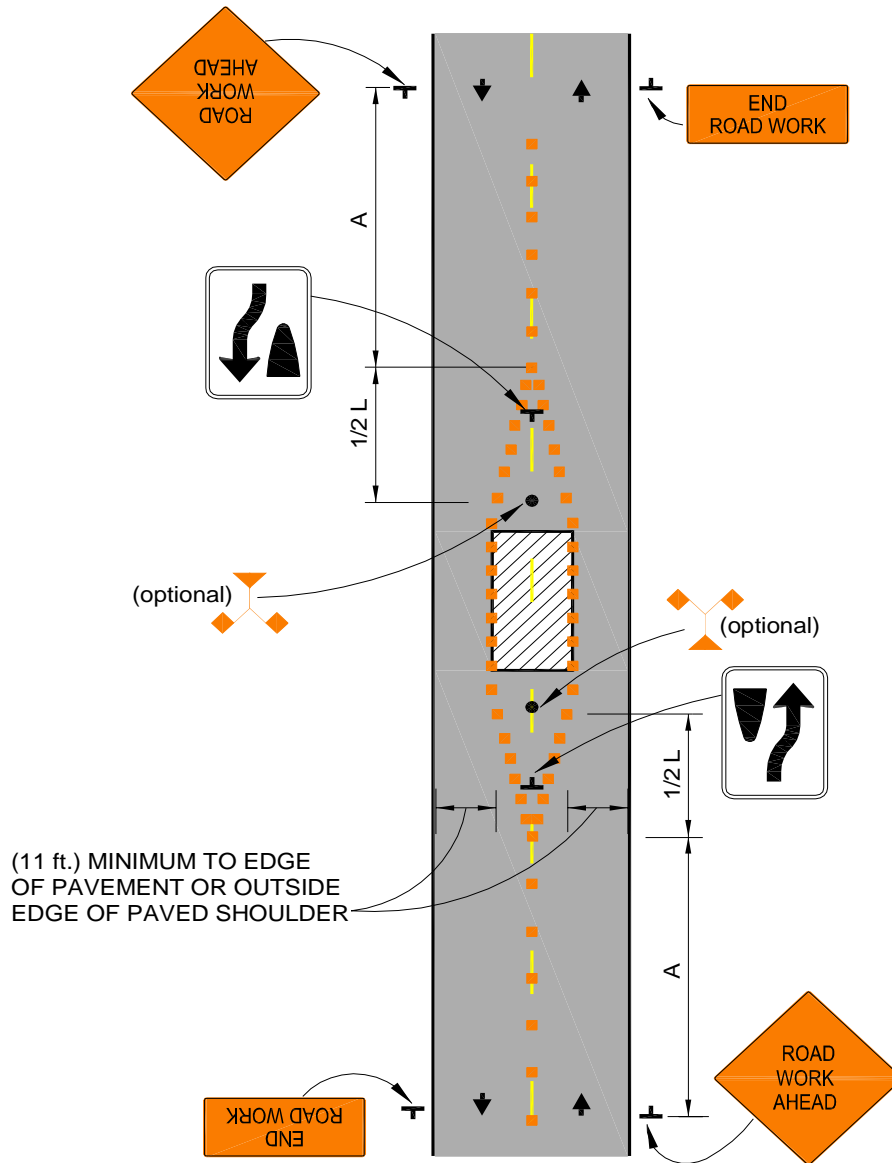
**CLOSURE AT SIDE OF INTERSECTION
FOR RESIDENTIAL OR COLLECTOR STREETS**



NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A DOWNSTREAM TAPER SHOULD BE APPROXIMATELY 20'.
5. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
6. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

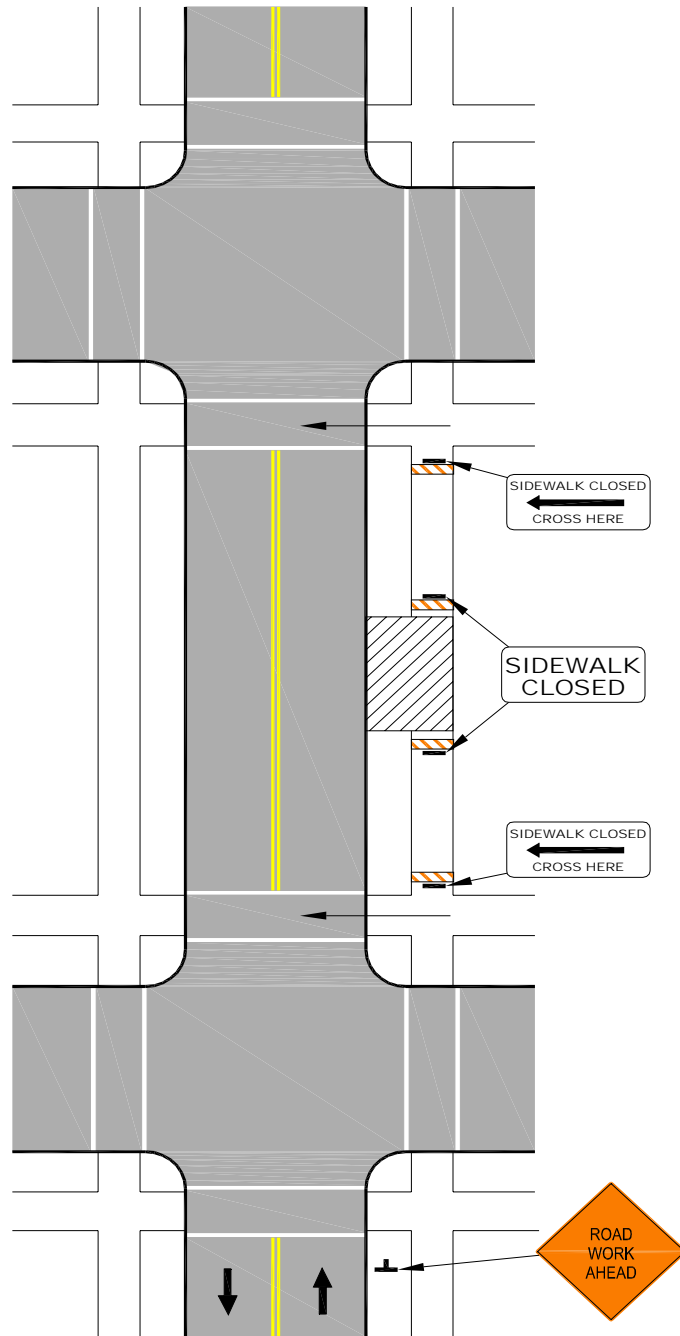
**INTERIOR LANE CLOSURE ON
MULTI-LANE THOROUGHFARE**



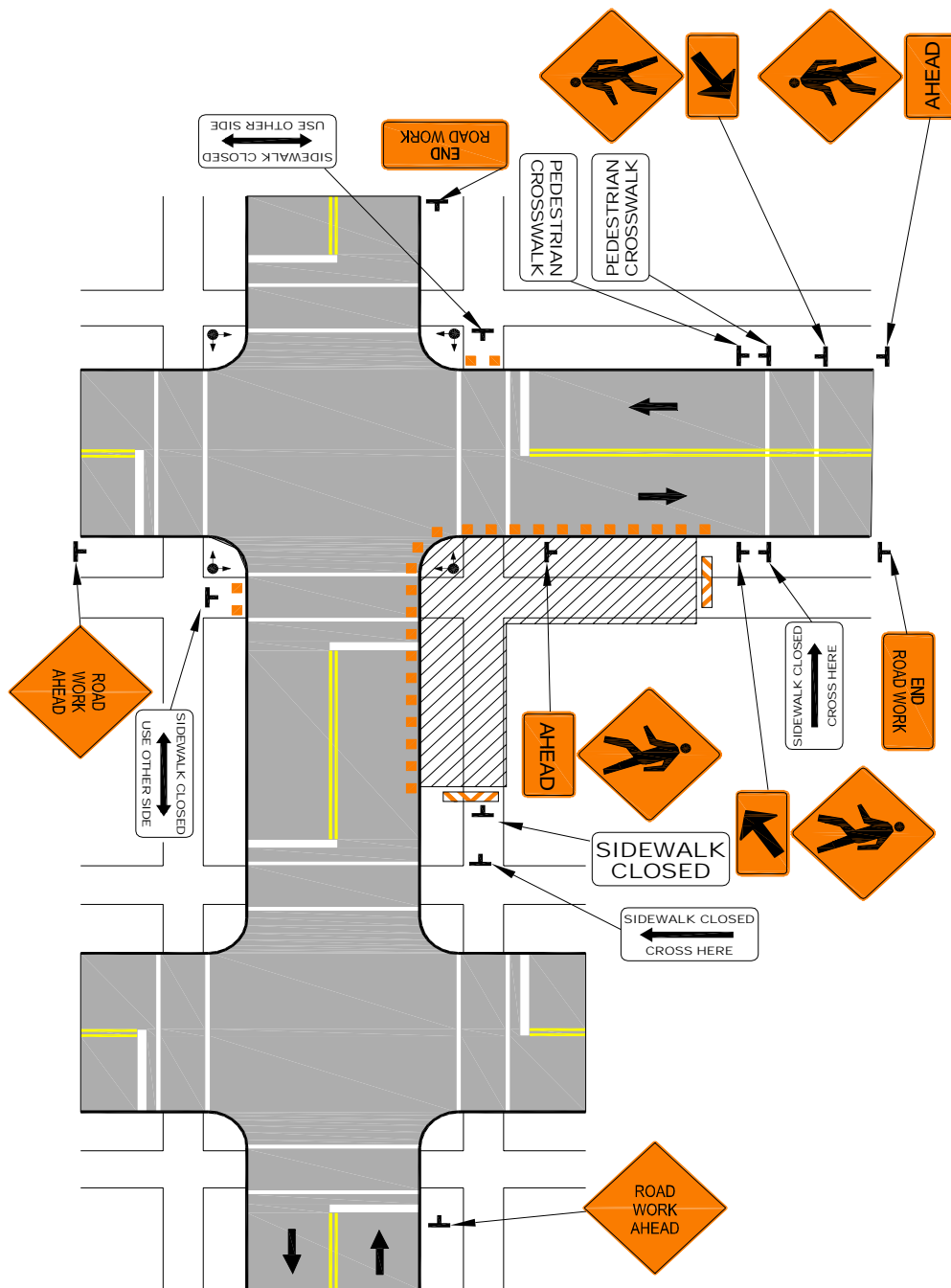
NOTES:

1. Taper Formula :
 $L = S \times W$ for speeds of 45 or more
 $L = W \times S^2/60$ for speeds of 40 or less
 Where :
 L = Minimum length of taper.
 S = Numerical value of posted speed limit prior to work or 85th percentile speed.
 W = Width of offset.
2. THE MAXIMUM SPACING BETWEEN CHANNELIZING DEVICES IN A TAPER SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE POSTED SPEED LIMIT.
3. THE SPACING BETWEEN CHANNELIZING DEVICES ALONG THE WORK AREA OR ALONG ANY BUFFER AREA WITHIN THE WORK AREA SHOULD BE APPROXIMATELY EQUAL IN FEET TO THE SPEED LIMIT.
4. WARNING LIGHTS SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
5. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE EARLY WARNING SIGNS.

WORK IN CENTER OF RESIDENTIAL OR COLLECTOR WITH LOW TRAFFIC VOLUMES



SIDEWALK DETOUR



Note:
 For Long-term stationary work,
 the double yellow centerline
 and/or lane lines should be
 removed between the crosswalk lines.

CROSSWALK CLOSURES AND PEDESTRIAN DETOURS

LENGTH AND DEVICE SPACING FOR LANE CLOSURE AND CHANNELIZATION TAPERS

SPEED LIMIT	MINIMUM TAPER LENGTH (L) **			MIN. NO. OF DEVICES FOR TAPER (12FT. LANE)	MAXIMUM DEVICE SPACING IN FEET
	LANE WIDTH IN FEET				
M.P.H.	10	11	12		
20	70	75	80	5	20
25	105	115	125	6	25
30	150	165	180	7	30
35	205	225	245	8	35
40	270	295	320	9	40
45	450	495	540	13	45
50	500	550	600	13	50
55	550	605	660	13	55
60	600	660	720	13	60
65	650	715	780	13	65
70	700	770	840	13	70

**NOTE: TAPER FORMULA - $L = WS$ $S > 45$ MPH
 $L = (WS^2)/60$ $S < 40$ MPH

WHERE
L = MINIMUM TAPER LENGTH
S = POSTED SPEED LIMIT
W = WIDTH OF OFFSET