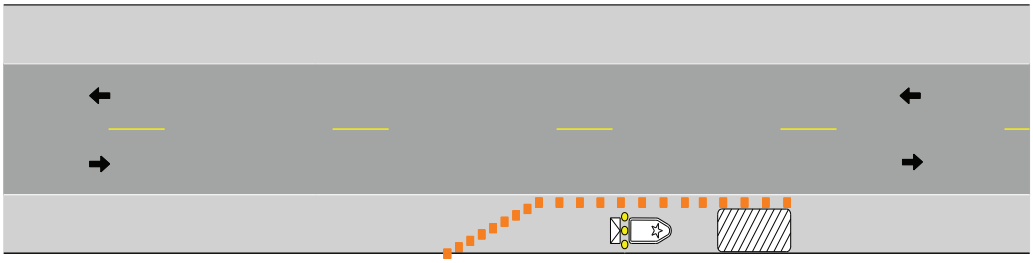
Delaware Department of Transportation

Manual on Uniform Traffic Control Devices (MUTCD)

for Streets and Highways

PART 6

TEMPORARY TRAFFIC CONTROL



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Delaware Department of Transportation

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PART 6. TEMPORARY TRAFFIC CONTROL

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CHAPTER 6A. GENERAL

Section 6A.01 Introduction

This Delaware Manual on Uniform Traffic Control Devices (MUTCD) Part 6, herein referred to as "Delaware MUTCD", is published by the State of Delaware Department of Transportation and is issued to prescribe uniform standards and specifications for all official traffic control devices, in accordance with Title 17 of the Delaware Code.

Delaware's Manual on Uniform Traffic Control Devices (2003 Edition) Part 6, is hereby adopted as the standard for all official traffic control devices, in accordance Title 17 of the Delaware Code. The Delaware MUTCD 2003 Edition Part 6 supersede and replace the 2000 Delaware Department of Transportation Traffic Controls for Streets & Highway Construction, Maintenance, Utility & Emergency Operations, as amended, and all previous editions thereof.

Nothing contained in the Delaware MUTCD 2003 Edition Part 6 shall prevent the Department of Transportation from modifying, changing, or adopting new specifications deemed necessary.

Judgment must be used to apply these guidelines and typical applications, or adjust them to fit individual field site conditions. The Delaware MUTCD is not intended to be a substitute for knowledge, experience or judgment.

Responsibility

Traffic control devices shall be maintained and shall not be removed or altered in any way without the authority of the Chief Traffic Engineer or designee. In accordance with Title 17 Chapter 5 Paragraph 505 of the Delaware Code. The provisions for public, pedestrian and worker protection established herein are for application by (1) the Department, County Utility and/or Municipal forces performing construction or maintenance operations on roads or streets, (2) Contractors employed in road or street construction or maintenance under contract to any governmental authority, and (3) all other, including employee and contractor working for public or private Utility companies, fire department and enforcement officer, performing any operation on highway or so closely adjacent as to create a hazard for the public or for themselves. **DelDOT Rev.**

Certified Traffic Control Supervisor

When specified in the contract documents, the Contractor shall be required to have an American Traffic Safety Services Association (ATSSA) certified traffic control supervisor on the project. The ATSSA certified traffic control supervisor's sole responsibility will be the maintenance of traffic on the project. This responsibility shall include, but is not limited to, the installation, operation, maintenance and service of traffic control devices. Also required is the daily maintenance of a log to record maintenance of traffic activities i.e. number and location of traffic control devices; and times of installation, changes, and repairs to traffic control devices. He/she shall also serve as the liaison with the Department concerning the Contractor's maintenance of traffic.

NCHRP Report 350 Compliance Requirements

All traffic control devices used on construction, maintenance, or utility work in both rural and urban areas shall conform to the applicable sections of this supplement and the National Cooperative Highway Research Program (NCHRP) Report 350 and the memorandum issued August 28, 1998 by the USDOT Federal Highway Administration.

For DelDOT administered projects, the certification shall be submitted to the Chief Traffic Engineer or designee prior to installation of use of traffic control devices. For Category I devices, the manufacturer or

owner may self-certify that the devices meet NCHRP Report 350 criteria. For Category II and Category III devices, the contractor shall supply the Federal Highway Administration's NCHRP Report 350 acceptance letter for each type of device.

NCHRP Report 350 certified traffic control devices are required for all other activities occurring on or within all highways open to public travel within the State. It is the responsibility of the device owner or user to insure that all traffic control devices meet the above requirements. Unless specified above, it is the traffic control device owner or user's responsibility to retain copies of certification documents. To validate device certification, these documents must be available for inspection by the Chief Traffic Engineer or designee.

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Section 6A.02 General

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

When the normal function of the roadway is suspended, TTC planning provides for continuity of the movement of motor vehicle, bicycle, and pedestrian traffic (including accessible passage); transit operations; and access (and accessibility) to property and utilities.

The primary function of TTC is to provide for the reasonably safe and efficient movement of road users through or around TTC zones while reasonably protecting workers, responders to traffic incidents, and equipment.

Of equal importance to the public traveling through the TTC zone is the safety of workers performing the many varied tasks within the work space. TTC zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers and incident management responders on or near the roadway (see Section 6D.03). At the same time, the TTC zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway.

Consideration for road user safety, worker and responder safety, and the efficiency of road user flow is an integral element of every TTC zone, from planning through completion. A concurrent objective of the TTC is the efficient construction and maintenance of the highway and the efficient resolution of traffic incidents.

No one set of TTC devices can satisfy all conditions for a given project or incident. At the same time, defining details that would be adequate to cover all applications is not practical. Instead, Part 6 displays typical applications that depict common applications of TTC devices. The TTC selected for each situation depends on type of highway, road user conditions, duration of operation, physical constraints, and the nearness of the work space or incident management activity to road users.

Improved road user performance might be realized through a well-prepared public relations effort that covers the nature of the work, the time and duration of its execution, the anticipated effects upon road users, and possible alternate routes and modes of travel. Such programs have been found to result in a significant reduction in the number of road users traveling through the TTC zone, which reduces the possible number of conflicts.

Definitions

The headings Standard, Guidance, Option, and Support are used to classify the nature of the text that follows.

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When used in this Manual, the text headings shall be defined as follows:

1. Standard – a statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device. All standards are labeled, and the text appears in bold type. The verb shall is typically used. Standards are sometimes modified by Options.
2. Guidance – a statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. All Guidance statements are labeled, and the text appears in unbold type. The verb should is typically used. Guidance statements are sometimes modified by Options.
3. Option – a statement of practice that is a permissive condition and carries no requirement or recommendation. Options may contain potentially allowable modifications to a Standard or Guidance. All Option statements are labeled, and the text appears in unbold type. The verb may is typically used. **Use of any Option contained in this manual shall require prior approval of the Chief Traffic Engineer or designee.** **DelDOT Rev.**
4. Support – an informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. Support statements are labeled, and the text appears in unbold type. The verbs shall, should, and may are not used in Support statements.

In the Delaware MUTCD, sections dealing with the design and application of traffic control devices, the words "shall," "should," and "may" are used to describe specific conditions concerning these devices. To clarify the meanings intended in this supplement by the use of these words, the following definitions apply:

1. SHALL – a *mandatory* condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory when an installation is made that these requirements be met.

2. SHOULD – an *advisory* condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.

3. MAY – a *permissive* condition. No requirement for design or application is intended.

CHAPTER 6B. FUNDAMENTAL PRINCIPLES

Section 6B.01 Fundamental Principles of Temporary Traffic Control

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

Construction, maintenance, utility, and incident zones can all benefit from TTC to compensate for the unexpected or unusual situations faced by road users. When planning for TTC in these zones, it can be assumed that it is appropriate for road users to exercise caution. Even though road users are assumed to be using caution, special care is still needed in applying TTC techniques.

Special plans preparation and coordination with transit, other highway agencies, law enforcement and other emergency units, utilities, schools, and railroad companies might be needed to reduce unexpected and unusual road user operation situations.

During TTC activities, commercial vehicles might need to follow a different route from passenger vehicles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous materials might need to follow a different route from other vehicles. The Hazardous Materials and National Network signs are included in Sections 2B.52 and 2B.53, respectively.

Experience has shown that following the fundamental principles of Part 6 will assist road users and help protect workers in the vicinity of TTC zones.

Guidance:

Road user and worker safety and accessibility in TTC zones should be an integral and high-priority element of every project from planning through design and construction. Similarly, maintenance and utility work should be planned and conducted with the safety and accessibility of all motorists, bicyclists, pedestrians (including those with disabilities), and workers being considered at all times. If the TTC zone includes a highway-rail grade crossing, early coordination with the railroad company should take place.

Support:

Formulating specific plans for TTC at traffic incidents is difficult because of the variety of situations that can arise.

Guidance:

General plans or guidelines should be developed to provide safety for motorists, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipment, with the following factors being considered:

A. The basic safety principles governing the design of permanent roadways and roadsides should also govern the design of TTC zones. The goal should be to route road users through such zones using roadway geometrics, roadside features, and TTC devices as nearly as possible comparable to those for normal highway situations.
B. A TTC plan, in detail appropriate to the complexity of the work project or incident, should be prepared and understood by all responsible parties before the site is occupied. Any changes in the TTC plan should be approved by an official knowledgeable (for example, trained and/or certified) in proper TTC practices.

Road user movement should be inhibited as little as practical, based on the following considerations:

A. TTC at work and incident sites should be designed on the assumption that drivers will only reduce their speeds if they clearly perceive a need to do so (see Section 6C.01).

B. Frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions that require rapid maneuvers, should be avoided.
C. Provisions should be made for the reasonably safe operation of work, particularly on high-speed, high-volume roadways.
D. Road users should be encouraged to use alternative routes that do not include TTC zones.
E. Bicyclists and pedestrians, including those with disabilities, should be provided with access and reasonably safe passage through the TTC zone.
F. Roadway occupancy should be scheduled during off-peak hours and, if necessary, night work should be considered.
G. Early coordination with officials having jurisdiction over the affected cross streets and providing emergency services should occur before roadway or ramp closings.

Motorists, bicyclists, and pedestrians should be guided in a clear and positive manner while approaching and traversing TTC zones and incident sites. The following principles should be applied:

A. Adequate warning, delineation, and channelization should be provided to assist in guiding road users in advance of and through the TTC zone or incident site by using proper pavement marking, signing, or other devices that are effective under varying conditions. Providing information that is in usable formats by pedestrians with visual disabilities should also be considered.
B. TTC devices inconsistent with intended travel paths through TTC zones should be removed or covered. However, in intermediate-term stationary, short-term, and mobile operations, where visible permanent devices are inconsistent with intended travel paths, devices that highlight or emphasize the appropriate path should be used. Providing traffic control devices that are accessible to and usable by pedestrians with disabilities should be considered.
C. Flagging procedures, when used, should provide positive guidance to road users traversing the TTC zone.

To provide acceptable levels of operations, routine day and night inspections of TTC elements should be performed as follows:

A. Individuals who are knowledgeable (for example, trained and/or certified) in the principles of proper TTC should be assigned responsibility for safety in TTC zones. The most important duty of these individuals should be to check that all TTC devices of the project are reasonably consistent with the TTC plan and are effective in providing reasonably safe conditions for motorists, bicyclists, pedestrians, and workers.
B. As the work progresses, temporary traffic controls and/or working conditions should be modified in order to provide reasonably safe and efficient road user movement and to provide worker safety. The individual responsible for TTC should have the authority to halt work until applicable or remedial safety measures are taken.
C. TTC zones should be carefully monitored under varying conditions of road user volumes, light, and weather to check that applicable TTC devices are effective, clearly visible, clean, and in compliance with the TTC plan.
D. When warranted, an engineering study should be made (in cooperation with law enforcement officials) of reported crashes occurring within the TTC zone. Crash records in TTC zones should be monitored to identify the need for changes in the TTC zone.

Attention should be given to the maintenance of roadside safety during the life of the TTC zone by applying the following principles:

A. To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical.
B. Channelization of road users should be accomplished by the use of pavement markings, signing, and crashworthy, detectable channelizing devices.
C. Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.

Each person whose actions affect TTC zone safety, from the upper-level management through the field workers, should receive training appropriate to the job decisions each individual is required to make. Only those individuals who are trained in proper TTC practices and have a basic understanding of the

principles (established by applicable standards and guidelines, including those of this Manual) should supervise the selection, placement, and maintenance of TTC devices used for TTC zones and for incident management.

Good public relations should be maintained by applying the following principles:

A. The needs of all road users should be assessed such that appropriate advance notice is given and clearly defined alternative paths are provided.
B. The cooperation of the various news media should be sought in publicizing the existence of and reasons for TTC zones because news releases can assist in keeping the road users well informed.
C. The needs of abutting property owners, residents, and businesses should be assessed and appropriate accommodations made.
D. The needs of emergency service providers (law enforcement, fire, and medical) should be assessed and appropriate coordination and accommodations made.
E. The needs of railroads and transit should be assessed and appropriate coordination and accommodations made.
F. The needs of operators of commercial vehicles such as buses and large trucks should be assessed and appropriate accommodations made.

Standard:

Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place.

All TTC devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods of time, TTC devices that are no longer appropriate shall be removed or covered.

CHAPTER 6C. TEMPORARY TRAFFIC CONTROL ELEMENTS

Section 6C.01 Temporary Traffic Control Plans

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

TTC zones, work zones, and incident areas shall be defined as specified in the Delaware Code, Title 21, Part III, Chapter 41, Subchapter I, § 4105, Subsection (f)(2), and as contained below:

"As used in this subsection, the phrase "within any highway construction or maintenance area indicated by traffic-control devices" shall mean that area between the first traffic-control device informing road users of their approach toward a work zone area until the last traffic-control device indicating all restrictions are removed and normal vehicle operations can resume. The phrase shall also include detour routes for highway construction or maintenance marked by traffic-control devices. "Traffic-control devices" and "work zone" shall have the same meaning as adopted pursuant to § 147 of Title 17, as amended. "Highway construction and maintenance area" shall also include construction and maintenance for utilities or railroads within or adjacent to the highway rights-of-way." DelDOT Rev.

The portion of the Delaware Code as stated above is current as of March 30, 2005.

Support:

A TTC plan describes TTC measures to be used for facilitating road users through a work zone or an incident area. TTC plans play a vital role in providing continuity of reasonably safe and efficient road user flow when a work zone, incident, or other event temporarily disrupts normal road user flow. Important auxiliary provisions that cannot conveniently be specified on project plans can easily be incorporated into Special Provisions within the TTC plan.

TTC plans range in scope from being very detailed to simply referencing typical drawings contained in this Manual, standard approved highway agency drawings and manuals, or specific drawings contained in the contract documents. The degree of detail in the TTC plan depends entirely on the nature and complexity of the situation.

Guidance:

TTC plans should be prepared by persons knowledgeable (for example, trained and/or certified) about the fundamental principles of TTC and work activities to be performed. The design, selection and placement of TTC devices for a TTC plan should be based on engineering judgment.

Coordination should be made between adjacent or overlapping projects to check that duplicate signing is not used and to check compatibility of traffic control between adjacent or overlapping projects.

Traffic control planning should be completed for all highway construction, utility work, maintenance operations, and incident management including minor maintenance and utility projects prior to occupying the TTC zone. Planning for all road users should be included in the process.

Provisions for effective continuity of accessible circulation paths for pedestrians should be incorporated into the TTC process. Where existing pedestrian routes are blocked or detoured, information should be provided about alternative routes that are usable by pedestrians with disabilities, particularly those who have visual disabilities. Access to temporary bus stops, reasonably safe travel across intersections with accessible pedestrian signals (see Section 4E.06), and other routing issues should be considered where temporary pedestrian routes are channelized. Barriers and channelizing devices that are detectable by people with visual disabilities should be provided.

Option:

Provisions may be incorporated into the project bid documents that enable contractors to develop an alternate TTC plan.

Modifications of TTC plans may be necessary because of changed conditions or a determination of better methods of safely and efficiently handling road users.

Guidance:

This alternate or modified plan should have the approval of the responsible highway agency prior to implementation.

Provisions for effective continuity of transit service should be incorporated into the TTC planning process because often public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). Where applicable, the TTC plan should provide for features such as accessible temporary bus stops, pull-outs, and satisfactory waiting areas for transit patrons, including persons with disabilities, if applicable (see Section 10A.05 for additional light rail transit issues to consider for TTC).

Provisions for effective continuity of railroad service and acceptable access to abutting property owners and businesses should also be incorporated into the TTC planning process.

Reduced speed limits should be used only in the specific portion of the TTC zone where conditions or restrictive features are present. However, frequent changes in the speed limit should be avoided. A TTC plan should be designed so that vehicles can reasonably safely travel through the TTC zone with a speed limit reduction of no more than 16 km/h (10 mph).

A reduction of more than 16 km/h (10 mph) in the speed limit should be used only when required by restrictive features in the TTC zone. Where restrictive features justify a speed reduction of more than 16 km/h (10 mph), additional driver notification should be provided. The speed limit should be stepped down in advance of the location requiring the lowest speed, and additional TTC warning devices should be used.

Reduced speed zoning (lowering the regulatory speed limit) should be avoided as much as practical because drivers will reduce their speeds only if they clearly perceive a need to do so.

Support:

Research has demonstrated that large reductions in the speed limit, such as a 50 km/h (30 mph) reduction, increase speed variance and the potential for crashes. Smaller reductions in the speed limit of up to 16 km/h (10 mph) cause smaller changes in speed variance and lessen the potential for increased crashes. A reduction in the regulatory speed limit of only up to 16 km/h (10 mph) from the normal speed limit has been shown to be more effective.

Section 6C.02 <u>Temporary Traffic Control Zones</u>

Support:

A TTC zone is an area of a highway where road user conditions are changed because of a work zone or an incident through the use of TTC devices, uniformed law enforcement officers, or other authorized personnel.

A work zone is an area of a highway with construction, maintenance, or utility work activities. A work zone is typically marked by signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or high-intensity rotating, flashing, oscillating, or strobe lights on a vehicle to the END ROAD WORK sign or the last TTC device.

An incident area is an area of a highway where temporary traffic controls are imposed by authorized officials in response to a traffic incident, natural disaster, or special event. It extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a point where road users return to the original lane alignment and are clear of the incident.

Section 6C.03 Components of Temporary Traffic Control Zones

Support:

Most TTC zones are divided into four areas: the advance warning area, the transition area, the activity area, and the termination area. Figure 6C-1 illustrates these four areas. These four areas are described in Sections 6C.04 through 6C.07.

Section 6C.04 Advance Warning Area

Support:

The advance warning area is the section of highway where road users are informed about the upcoming work zone or incident area.

Option:

The advance warning area may vary from a single sign or high-intensity rotating, flashing, oscillating, or strobe lights on a vehicle to a series of signs in advance of the TTC zone activity area.

Guidance:

Typical distances for placement of advance warning signs on freeways and expressways should be longer because drivers are conditioned to uninterrupted flow. Therefore, the advance warning sign placement should extend on these facilities as far as 800 m (0.5 mi) or more.

On urban streets, the effective placement of the first warning sign in meters (feet) should range from 0.75 to 1.5 times the speed limit in km/h (4 to 8 times the speed limit in mph), with the high end of the range being used when speeds are relatively high. When a single advance warning sign is used (in cases such as low-speed residential streets), the advance warning area can be as short as 30 m (100 ft). When two or more advance warning signs are used on higher-speed streets, such as major arterials, the advance warning area should extend a greater distance (see Table 6C-1).

Since rural highways are normally characterized by higher speeds, the effective placement of the first warning sign in meters (feet) should be substantially longer—from 1.5 to 2.25 times the speed limit in km/h (8 to 12 times the speed limit in mph). Since two or more advance warning signs are normally used for these conditions, the advance warning area should extend 450 m (1,500 ft) or more for open highway conditions (see Table 6C-1).

Option:

Advance warning may be eliminated when the activity area is sufficiently removed from the road users' path so that it does not interfere with the normal flow.

Section 6C.05 Transition Area

Support:

The transition area is that section of highway where road users are redirected out of their normal path. Transition areas usually involve strategic use of tapers, which because of their importance are discussed separately in detail.

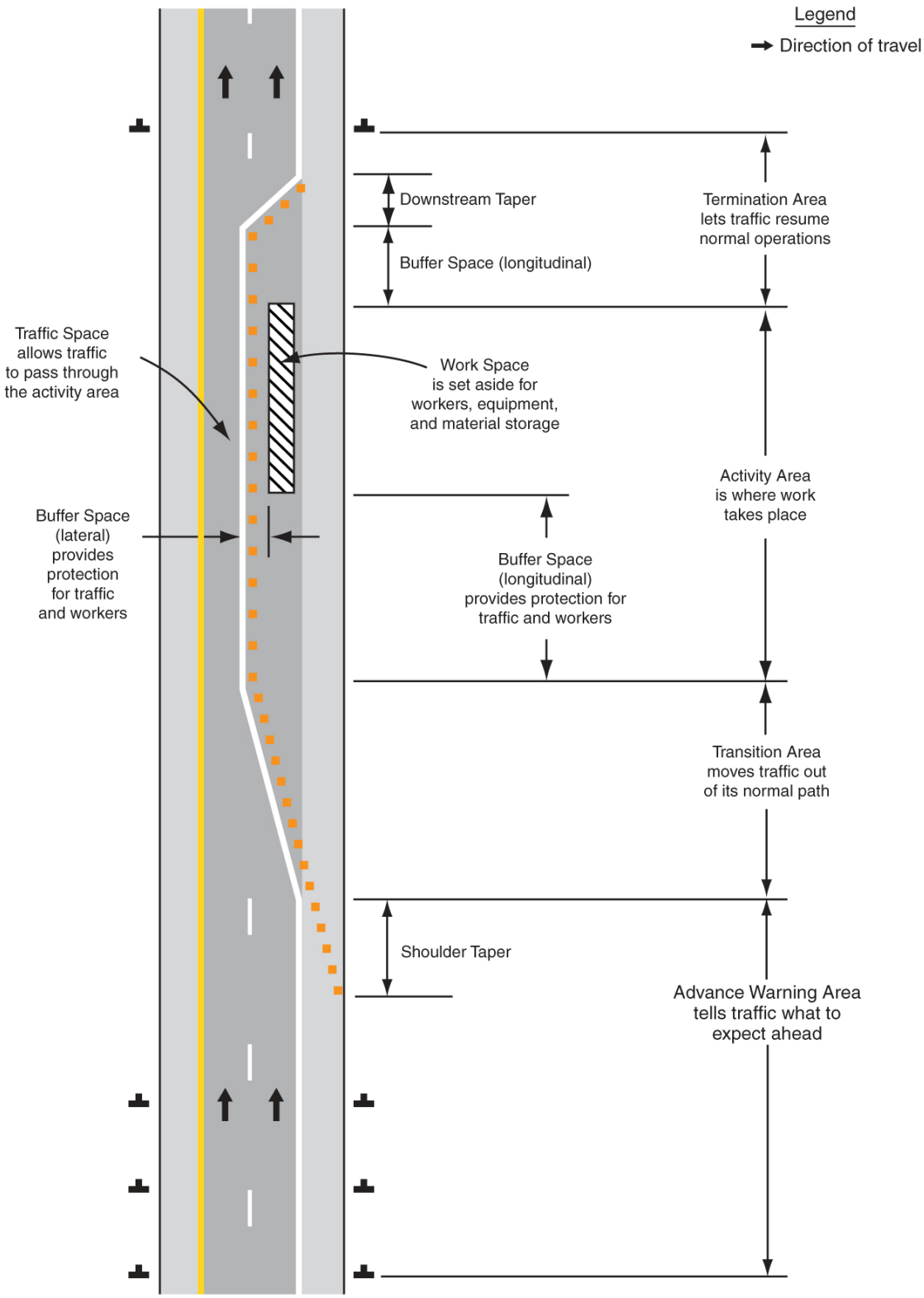
Standard:

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

Support:

In mobile operations, the transition area moves with the work space.

Figure 6C-1. Component Parts of a Temporary Traffic Control Zone



DelDOT Rev.

Table 6C-1. Suggested Advance Warning Sign Spacing

Road Type	Distance Between Signs (ft) *		
	A	B	C
Interstate / Expressway / Freeway	1000	1640 (0.3 mi)	2640 (0.5 mi)
All other roadways	500	500	500

* The column headings A, B, and C are the dimensions shown in the Case Diagrams (see Section 6H). 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 third sign is the first one in a three-sign series encountered by a driver approaching a TTC zone).

Section 6C.06 Activity Area

Support:

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

The work space is that portion of the highway 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.

Option:

The work space may be stationary or may move as work progresses.

Guidance:

Since there might be several work spaces (some even separated by several kilometers or miles) within the project limits, each work space should be adequately signed to inform road users and reduce confusion.

Support:

The traffic space is the portion of the highway in which road users are routed through the activity area.

The buffer space is a lateral and/or longitudinal area that separates road user flow from the work space or an unsafe area, and might provide some recovery space for an errant vehicle.

Guidance:

Neither work activity nor storage of equipment, vehicles, or material should occur within a buffer space.

Option:

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 6C-2.

If a longitudinal buffer space is used, the values shown in Table 6C-2 may be used to determine the length of the longitudinal buffer space.

Support:

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.

Option:

The lateral buffer space may be used to separate the traffic space from the work space, as shown in Figures 6C-1 and 6C-2, 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.

Guidance:

The width of a lateral buffer space should be determined by engineering judgment.

Option:

When work occurs on a high-volume, highly congested facility, a vehicle storage or staging space may be provided for incident response and emergency vehicles (for example, tow trucks and fire apparatus) so that these vehicles can respond quickly to road user incidents.

Guidance:

If used, an incident response and emergency-vehicle storage area should not extend into any portion of the buffer space.

Section 6C.07 Termination Area

Standard:

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 TTC device such as END ROAD WORK signs, if posted.

Option:

An END ROAD WORK sign, a Speed Limit sign, or other signs may be used to inform road users that they can resume normal operations.

A longitudinal buffer space may be used between the work space and the beginning of the downstream taper.

Section 6C.08 Tapers

Option:

Tapers may be used in both the transition and termination areas. Whenever tapers are to be used in close proximity to an interchange ramp, crossroads, curves, or other influencing factors, the length of the tapers may be adjusted.

Support:

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 6C-2.

Longer tapers are not necessarily better than shorter tapers (particularly in urban areas with characteristics such as short block lengths or driveways) because extended tapers tend to encourage sluggish operation and to encourage drivers to delay lane changes unnecessarily. The test concerning adequate lengths of tapers involves observation of driver performance after TTC plans are put into effect.

Figure 6C-2. Types of Tapers and Buffer Spaces

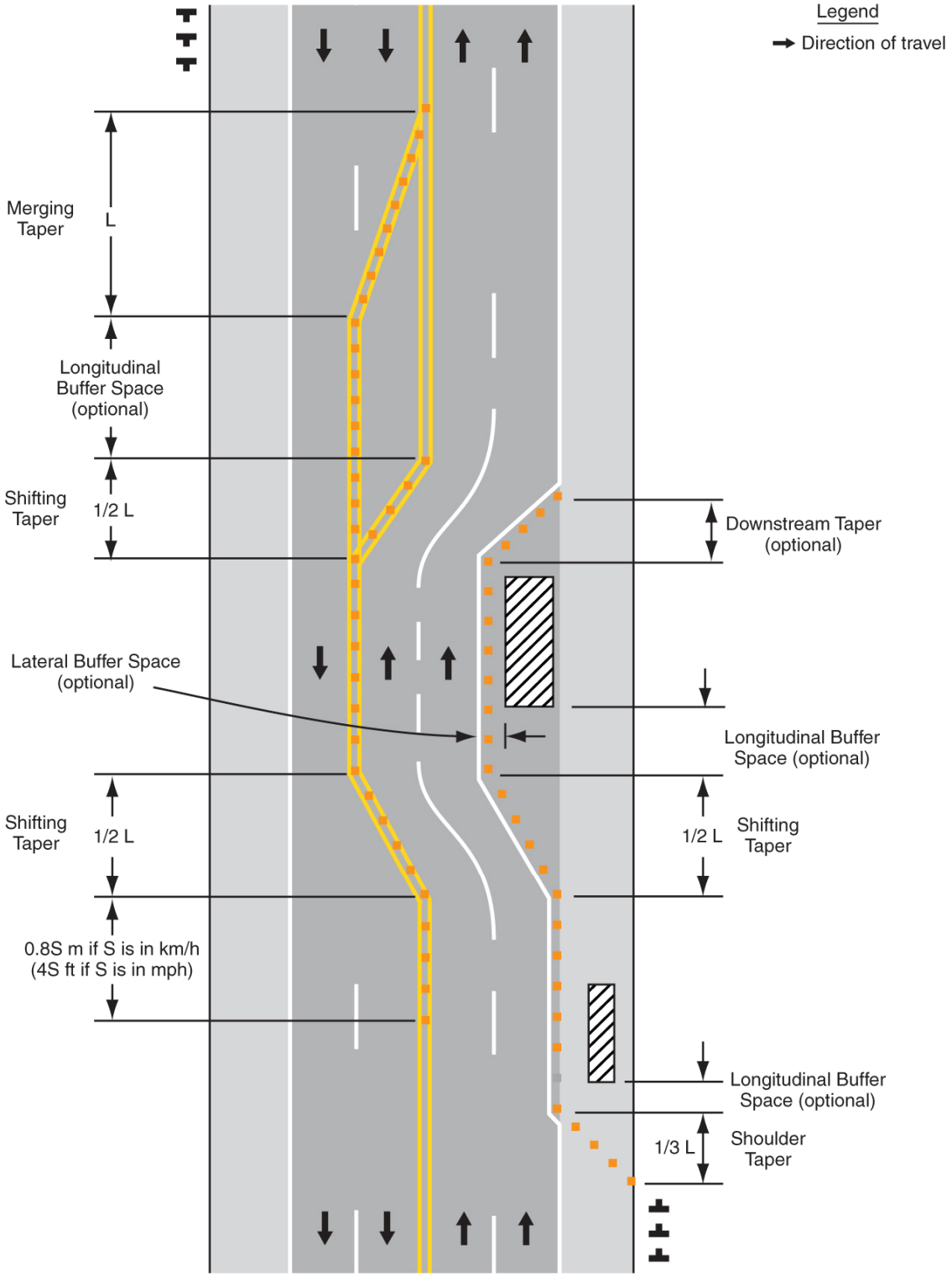


Table 6C-2. Stopping Sight Distance as a Function of Speed

Speed* (km/h)	Distance (m)
30	35
40	50
50	65
60	85
70	105
80	130
90	160
100	185
110	220
120	250

Speed* (mph)	Distance (ft)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820

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

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Guidance:

The appropriate taper length (L) should be determined using the criteria shown in Tables 6C-3 and 6C-4.

The maximum distance in meters (feet) between devices in a taper should not exceed 0.2 times the speed limit in km/h (1.0 times the speed limit in mph).

Support:

A merging taper requires the longest distance because drivers are required to merge into common road space.

Guidance:

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.

Support:

A shifting taper is used when a lateral shift is needed. 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 highway speeds.

Guidance:

A shifting taper should have a length of approximately 0.5 L (see Tables 6C-3 and 6C-4).

Support:

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.

Guidance:

If used, shoulder tapers should have a length of approximately 0.33 L (see Tables 6C-3 and 6C-4). If a shoulder is used as a travel lane, either through practice or during a TTC activity, a normal merging or shifting taper should be used.

Table 6C-3. Taper Length Criteria for Temporary Traffic Control Zones

Type of Taper	Taper Length (L)*
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	30 m (100 ft) maximum
Downstream Taper	30 m (100 ft) per lane

Table 6C-4. Formulas for Determining Taper Lengths

Speed Limit (S)	Taper Length (L) Meters
60 km/h or less	$L = \frac{WS^2}{155}$
70 km/h or more	$L = \frac{WS}{1.6}$

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

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

Option:

A downstream taper may be useful 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.

Guidance:

When used, a downstream taper should have a length of approximately 30 m (100 ft) per lane with devices placed at a spacing of approximately 6.1 m (20 ft).

Support:

The one-lane, two-way taper is used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction.

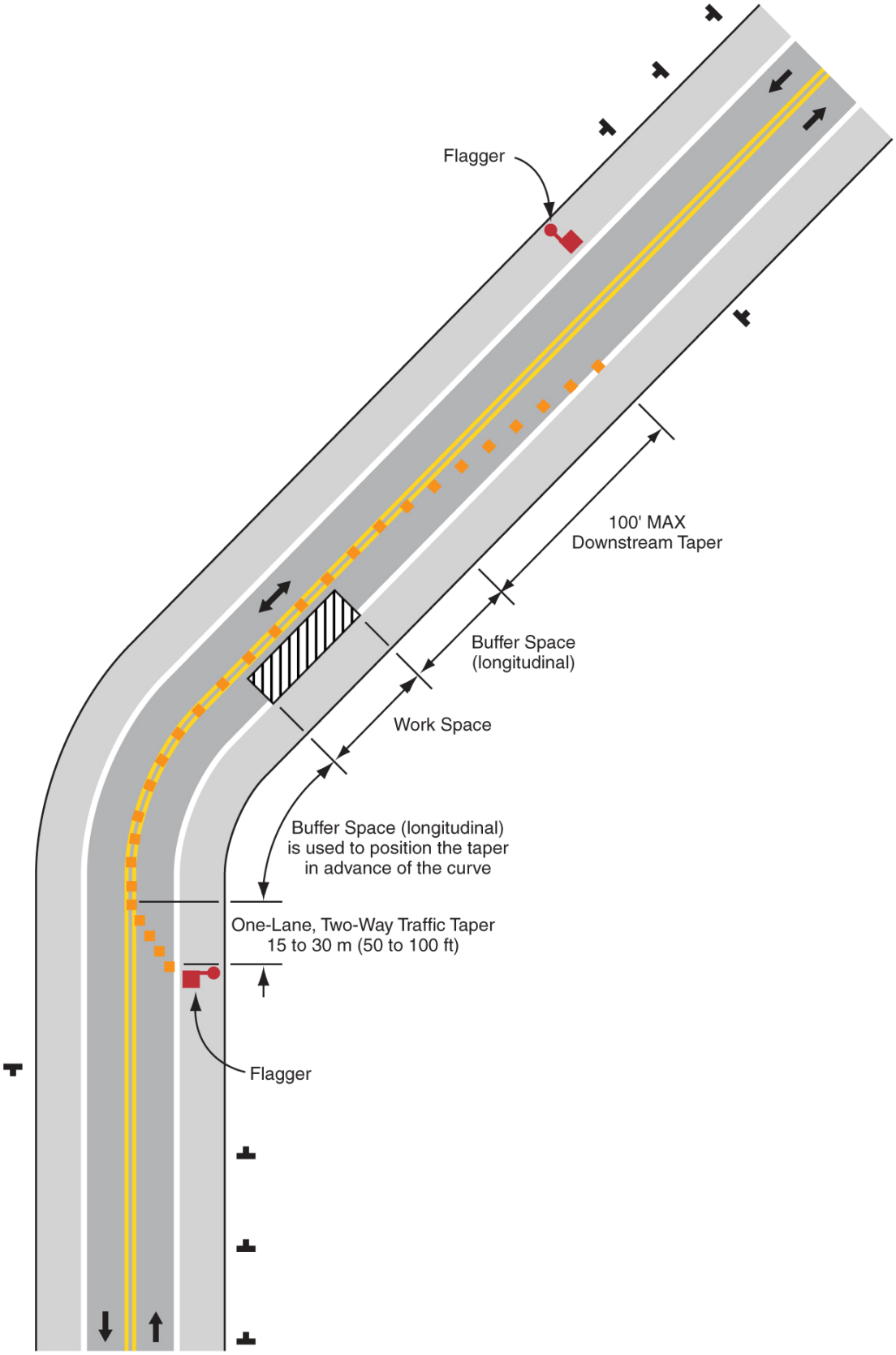
Guidance:

Traffic should be controlled by a flagger or temporary traffic control signal (if sight distance is limited), or a STOP or YIELD sign. A short taper having a maximum length of 30 m (100 ft) with channelizing devices at approximately 6.1 m (20 ft) spacings should be used to guide traffic into the one-way section.

Support:

An example of a one-lane, two-way traffic taper is shown in Figure 6C-3.

Figure 6C-3. Example of a One-Lane, Two-Way Traffic Taper



Section 6C.09 Detours and Diversions

Standard:

Detours and diversions areas shall be defined as specified in the Delaware Code, Title 21, Part III, Chapter 41, Subchapter I, Section 4105, Subsection (f)(2). (See Section 6C.02 above) DelDOT Rev.

Support:

A detour is a temporary rerouting of road users onto an existing highway in order to avoid a TTC zone.

Guidance:

Detours should be clearly signed over their entire length so that road users can easily use existing highways to return to the original highway.

Support:

A diversion is a temporary rerouting of road users onto a temporary highway or alignment placed around the work area.

Section 6C.10 One-Lane, Two-Way Traffic Control

Standard:

When traffic in both directions must use a single lane for a limited distance, movements from each end shall be coordinated.

Guidance:

Provisions should be made for alternate one-way movement through the constricted section via methods such as flagger control, a flag transfer, a pilot car, traffic control signals, or stop or yield control.

Control points at each end should be chosen to permit easy passing of opposing lanes of vehicles.

If traffic on the affected one-lane roadway is not visible from one end to the other, then flagging procedures, a pilot car with a flagger used as described in Section 6F.54, or a traffic control signal should be used to control opposing traffic flows.

Support:

At a spot constriction, such as an isolated pavement patch on highways with lower speeds and adequate sight distance, the movement of traffic through one-lane, two-way constrictions tends to be self-regulating.

Section 6C.11 Flagger Method of One-Lane, Two-Way Traffic Control

Option:

When a one-lane, two-way TTC zone is short enough to allow a flagger to see from one end of the zone to the other, traffic may be controlled by either a single flagger or by a flagger at each end of the section.

Guidance:

When a single flagger is used, the flagger should be stationed on the shoulder opposite the constriction or work space, or in a position where good visibility and traffic control can be maintained at all times. When good visibility and traffic control cannot be maintained by one flagger station, traffic should be controlled by a flagger at each end of the section. One of the flaggers should be designated as the coordinator. Flaggers should be able to communicate with each other orally, electronically, or with manual signals. These manual signals should not be mistaken for flagging signals.

Section 6C.12 Flag Transfer Method of One-Lane, Two-Way Traffic Control

Support:

The driver of the last vehicle proceeding into the one-lane section is given a red flag (or other token) and instructed to deliver it to the flagger at the other end. The opposite flagger, upon receipt of the flag, then knows that it is reasonably safe to allow traffic to move in the other direction. A variation of this method is to replace the use of a flag with an official pilot car that always follows the last road user vehicle proceeding through the section.

Guidance:

The flag transfer method should be employed only where the one-way traffic is confined to a relatively short length of a road, usually not more than 1.6 km (1 mi) in length.

Section 6C.13 Pilot Car Method of One-Lane, Two-Way Traffic Control

Option:

A pilot car may be used to guide a queue of vehicles through the TTC zone or detour.

Guidance:

The operation of the pilot vehicle should be coordinated with flagging operations or other controls at each end of the one-lane section. The pilot car should have the name of the contractor or contracting authority prominently displayed.

Standard:

The PILOT CAR FOLLOW ME (G20-4) sign (see Figure 6F-4, Sheet 4 of 4) shall be mounted at a conspicuous location on the rear of the vehicle.

Section 6C.14 Temporary Traffic Control Signal Method of One-Lane, Two-Way Traffic Control

Option:

Traffic control signals may be used to control vehicular traffic movements in one-lane, two-way TTC zones (see Chapter 4G).

Section 6C.15 Stop or Yield Control Method of One-Lane, Two-Way Traffic Control

Option:

STOP or YIELD signs may be used to control traffic on low-volume roads at a one-lane, two-way TTC zone when drivers are able to see the other end of the one-lane, two-way operation and have sufficient visibility of approaching vehicles.

Guidance:

If the STOP or YIELD sign is installed for only one direction, then the STOP or YIELD sign should face road users who are driving on the side of the roadway that is closed for the work activity area.

CHAPTER 6D. PEDESTRIAN AND WORKER SAFETY

Section 6D.01 Pedestrian Considerations

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Minimum length of run of temporary traffic barrier shall conform to manufacturer's recommendations. DelDOT Rev.

Support:

A wide range of pedestrians might be affected by TTC zones, including the young, elderly, and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path. Considerations for pedestrians with disabilities are addressed in Section 6D.02.

The most desirable way to provide information to pedestrians with visual disabilities that is equivalent to visual signage for notification of sidewalk closures is a speech message provided by an audible information device. Devices that provide speech messages in response to passive pedestrian actuation are the most desirable. Other devices that continuously emit a message, or that emit a message in response to use of a pushbutton, are also acceptable. Signage information can also be transmitted to personal receivers, but currently such receivers are not likely to be carried or used by pedestrians with visual disabilities in TTC zones. Audible information devices might not be needed if detectable channelizing devices make an alternate route of travel evident to pedestrians with visual disabilities.

Guidance:

If a pushbutton is used to provide equivalent TTC information to pedestrians with visual disabilities, the pushbutton should be equipped with a locator tone to notify pedestrians with visual disabilities that a special accommodation is available, and to help them locate the pushbutton.

Standard:

The various TTC provisions for pedestrian and worker safety set forth in Part 6 shall be applied by knowledgeable (for example, trained and/or certified) persons after appropriate evaluation and engineering judgment.

Advance notification of sidewalk closures shall be provided to the maintaining agency. Where pedestrians with visual disabilities normally use the closed sidewalk, a barrier that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.

Support:

It must be recognized that pedestrians are reluctant to retrace their steps to a prior intersection for a crossing or to add distance or out-of-the-way travel to a destination.

Guidance:

Adequate provisions should be made for persons with disabilities as determined by an engineering study or by engineering judgment. Because printed signs and surface delineation are not usable by pedestrians with visual disabilities, blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing audible information devices, accessible pedestrian signals, and barriers and channelizing devices that are detectable to pedestrians traveling with the aid of a long cane or who have low vision.

The following three items should be considered when planning for pedestrians in TTC zones:

A. Pedestrians should not be led into conflicts with work site vehicles, equipment, and operations.
B. Pedestrians should not be led into conflicts with vehicles moving through or around the work site.

C. Pedestrians should be provided with a reasonably safe, convenient, and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or footpath(s). Where pedestrians who have visual disabilities encounter work sites that require them to cross the roadway to find an accessible route, instructions should be provided using an audible information device. Accessible pedestrian signals (see Section 4E.06) with accessible pedestrian detectors (see Section 4E.09) might be needed to enable pedestrians with visual disabilities to cross wide or heavily traveled roadways.

A pedestrian route should not be severed and/or moved for nonconstruction activities such as parking for vehicles and equipment.

Consideration should be made to separate pedestrian movements from both work site activity and vehicular traffic. Unless a reasonably safe route that does not involve crossing the roadway can be provided, pedestrians should be appropriately directed with advance signing that encourages them to cross to the opposite side of the roadway. In urban and suburban areas with high vehicular traffic volumes, these signs should be placed at intersections (rather than midblock locations) so that pedestrians are not confronted with midblock work sites that will induce them to attempt skirting the work site or making a midblock crossing.

Guidance:

When pedestrian movement through or around a work site is necessary, a separate usable footpath should be provided. If the previous pedestrian facility was accessible to pedestrians with disabilities, the footpath provided during temporary traffic control should also be accessible. There should not be any abrupt changes in grade or terrain that could cause a tripping hazard or could be a barrier to wheelchair use. Barriers and channelizing devices should be detectable to pedestrians who have visual disabilities (see Section 6F.68).

Option:

Whenever it is feasible, closing off the work site from pedestrian intrusion may be preferable to channelizing pedestrian traffic along the site with TTC devices.

Support:

Maintaining a detectable, channelized pedestrian route is much more useful to pedestrians who have visual disabilities than closing a walkway and providing audible directions to an alternate route involving additional crossings and a return to the original route. Braille is not useful in conveying such information because it is difficult to find. Audible instructions might be provided, but the extra distance and additional street crossings might add complexity to a trip.

Guidance:

Fencing should not create sight distance restrictions for road users. Fences should not be constructed of materials that would be hazardous if impacted by vehicles.

Wooden railing, fencing, and similar systems placed immediately adjacent to motor vehicle traffic should not be used as substitutes for crashworthy temporary traffic barriers.

Standard:

TTC devices used to delineate a TTC zone pedestrian walkway shall be crashworthy and, when struck by vehicles, present a minimum threat to pedestrians, workers, and occupants of impacting vehicles.

Guidance:

Ballast for TTC devices should be kept to the minimum amount needed and should be mounted low to prevent penetration of the vehicle windshield.

Movement by work vehicles and equipment across designated pedestrian paths should be minimized and, when necessary, should be controlled by flaggers or TTC. Staging or stopping of work vehicles or equipment along the side of pedestrian paths should be avoided, since it encourages movement of workers, equipment, and materials across the pedestrian path.

Access to the work space by workers and equipment across pedestrian walkways should be minimized because the access often creates unacceptable changes in grade, and rough or muddy terrain,

and pedestrians will tend to avoid these areas by attempting nonintersection crossings where no curb ramps are available.

Option:

A canopied walkway may be used to protect pedestrians from falling debris, and to provide a covered passage for pedestrians.

Guidance:

Covered walkways should be sturdily constructed and adequately lighted for nighttime use.

When pedestrian and vehicle paths are rerouted to a closer proximity to each other, consideration should be given to separating them by a temporary traffic barrier.

If a temporary traffic barrier is used to shield pedestrians, it should be designed to accommodate site conditions.

Support:

Depending on the possible vehicular speed and angle of impact, temporary traffic barriers might deflect upon impact by an errant vehicle. Guidance for locating and designing temporary traffic barriers can be found in Chapter 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11).

Standard:

Short intermittent segments of temporary traffic barrier shall not be used because they nullify the containment and redirective capabilities of the temporary traffic barrier, increase the potential for serious injury both to vehicle occupants and pedestrians, and encourage the presence of blunt, leading ends. All upstream leading ends that are present shall be appropriately flared or protected with properly installed and maintained crashworthy cushions. Adjacent temporary traffic barrier segments shall be properly connected in order to provide the overall strength required for the temporary traffic barrier to perform properly.

Normal vertical curbing shall not be used as a substitute for temporary traffic barriers when temporary traffic barriers are clearly needed.

Option:

Temporary traffic barriers or longitudinal channelizing devices may be used to discourage pedestrians from unauthorized movements into the work space. They may also be used to inhibit conflicts with vehicular traffic by minimizing the possibility of midblock crossings.

Support:

A major concern for pedestrians is urban and suburban building construction encroaching onto the contiguous sidewalks, which forces pedestrians off the curb into direct conflict with moving vehicles.

Guidance:

If a significant potential exists for vehicle incursions into the pedestrian path, pedestrians should be rerouted or temporary traffic barriers should be installed.

Support:

TTC devices, jersey barriers, and wood or chainlink fencing with a continuous detectable edging can satisfactorily delineate a pedestrian path.

Guidance:

Tape, rope, or plastic chain strung between devices are not detectable, do not comply with the design standards in the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11), and should not be used as a control for pedestrian movements.

The extent of pedestrian needs should be determined through engineering judgment for each TTC zone situation. In general, pedestrian routes should be preserved in urban and commercial suburban areas. Alternative routing should be discouraged.

The highway agency in charge of the TTC zone should regularly inspect the activity area so that effective pedestrian TTC is maintained.

Section 6D.02 Accessibility Considerations

Support:

Additional information on the design and construction of accessible temporary facilities is found in publications listed in Section 1A.11 (see Documents 10 and 29 through 31).

Guidance:

The extent of pedestrian needs should be determined through engineering judgment or by the individual responsible for each TTC zone situation. This individual should be aware that the absence of a continuous pathway, including curb ramps and other accessible features, might preclude the use of the facility by pedestrians with disabilities.

Standard:

When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

Guidance:

To accommodate the needs of pedestrians, including those with disabilities, the following considerations should be addressed when temporary pedestrian pathways in TTC zones are designed or modified:

A. Provisions for continuity of accessible paths for pedestrians should be incorporated into the TTC process. Pedestrians should be provided with a reasonably safe, convenient, and accessible path that replicates as much as practical the desirable characteristics of the existing pedestrian facilities.
B. Access to temporary transit stops should be provided.
C. Blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing devices such as audible information devices, accessible pedestrian signals, or barriers and channelizing devices that are detectable to the pedestrians traveling with the aid of a long cane or who have low vision. Where pedestrian traffic is detoured to a TTC signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals should be considered for crossings along an alternate route.
D. When channelization is used to delineate a pedestrian pathway, a continuous detectable edging should be provided throughout the length of the facility such that pedestrians using a long cane can follow it. These detectable edgings should adhere to the provisions of Section 6F.68.
E. A smooth, continuous hard surface should be provided throughout the entire length of the temporary pedestrian facility. There should be no curbs or abrupt changes in grade or terrain that could cause tripping or be a barrier to wheelchair use. The geometry and alignment of the facility should meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11).
F. The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 1500 mm (60 in) throughout the entire length of the pedestrian pathway, a 1500 x 1500 mm (60 x 60 in) passing space should be provided at least every 60 m (200 ft), to allow individuals in wheelchairs to pass.
G. Signs and other devices mounted lower than 2.1 m (7 ft) above the temporary pedestrian pathway should not project more than 100 mm (4 in) into accessible pedestrian facilities.

Section 6D.03 Worker Safety Considerations

Support:

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.

Maintaining TTC zones with road user flow inhibited as little as possible, and using TTC devices that get the road user's attention and provide positive direction are of particular importance. Likewise, equipment and vehicles moving within the activity area create a risk to workers on foot. When possible, the separation of moving equipment and construction vehicles from workers on foot provides the operator of these vehicles with a greater separation clearance and improved sight lines to minimize exposure to the hazards of moving vehicles and equipment.

Guidance:

The following are the key elements of worker safety and TTC management that should be considered to improve worker safety:

A. Training—all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific TTC responsibilities should be trained in TTC techniques, device usage, and placement.
B. Worker Safety Apparel—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 107-2004 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.
C. Temporary Traffic Barriers—temporary traffic barriers should be placed along the work space depending on factors such as lateral clearance of workers from adjacent traffic, speed of traffic, duration and type of operations, time of day, and volume of traffic.
D. Speed Reduction—reducing the speed of vehicular traffic, mainly through regulatory speed zoning, funneling, lane reduction, or the use of uniformed law enforcement officers or flaggers, should be considered.
E. Activity Area—planning the internal work activity area to minimize backing-up maneuvers of construction vehicles should be considered to minimize the exposure to risk.
F. Worker Safety Planning—a competent person designated by the employer should conduct a basic hazard assessment for the work site and job classifications required in the activity area. This safety professional should determine whether engineering, administrative, or personal protection measures should be implemented. This plan should be in accordance with the Occupational Safety and Health Act of 1970, as amended, "General Duty Clause" Section 5(a)(1) - Public Law 91-596, 84 Stat. 1590, December 29, 1970, as amended, and with the requirement to assess worker risk exposures for each job site and job classification, as per 29 CFR 1926.20 (b)(2) of "Occupational Safety and Health Administration Regulations, General Safety and Health Provisions " (see Section 1A.11).

Option:

The following are additional elements of TTC management that may be considered to improve worker safety:

A. Shadow Vehicle—in the case of mobile and constantly moving operations, such as pothole patching and striping operations, a shadow vehicle, equipped with appropriate lights and warning signs, may be used to protect the workers from impacts by errant vehicles. The shadow vehicle may be equipped with a rear-mounted impact attenuator.
B. Road Closure—if alternate routes are available to handle road users, the road may be closed temporarily. This may also facilitate project completion and thus further reduce worker vulnerability.
C. Law Enforcement Use—in highly vulnerable work situations, particularly those of relatively short duration, law enforcement units may be stationed to heighten the awareness of passing vehicular traffic and to improve safety through the TTC zone.
D. Lighting—for nighttime work, the TTC zone and approaches may be lighted.

E. Special Devices—these include rumble strips, changeable message signs, hazard identification beacons, flags, and warning lights. Intrusion warning devices may be used to alert workers to the approach of errant vehicles.

Support:

Judicious use of the special devices described in Item E above might be helpful for certain difficult TTC situations, but misuse or overuse of special devices or techniques might lessen their effectiveness.

CHAPTER 6E. FLAGGER CONTROL

Section 6E.01 Qualifications for Flaggers

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

A flagger shall be a person who provides TTC. All flaggers, except for emergency personnel and law enforcement officers, shall be certified by a DelDOT-recognized flagger certification program. All flaggers, except for emergency personnel and law enforcement officers, shall be required to carry a flagger certification card and photo identification on their person at all times. DelDOT Rev.

Guidance:

Because flaggers are responsible for public safety and make the greatest number of contacts with the public of all highway workers, they should be trained in safe traffic control practices and public contact techniques. 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.

Section 6E.02 High-Visibility Safety Apparel

Standard:

All High-Visibility Safety Apparel shall meet the ANSI 107-2004 standard requirements.

All flaggers, except for emergency response personnel and law enforcement officers, shall wear safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel" (see Section 1A.11) and labeled as meeting the ANSI 107-2004 standard performance for Class 3 risk exposure, unless otherwise directed by the Chief Traffic Engineer or designee.

All other personnel, except for emergency response personnel and law enforcement officers, shall wear safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel" (see Section 1A.11) and labeled as meeting the ANSI 107-2004 standard performance for Class 2 risk exposure, unless otherwise directed by the Chief Traffic Engineer or designee.

The apparel background (outer) material color shall be fluorescent yellow-green, fluorescent orange, or combination 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 300 m (1,000 ft). The retroreflective safety apparel shall be designed to clearly identify the wearer as a person. DelDOT Rev.

Flaggers shall be properly and modestly attired for a work site. As a minimum, each flagger shall wear a shirt with short sleeves and long pants down to the ankles at all times. Additionally, flaggers shall wear closed toe shoes or footwear that appropriate for a construction site. The absence of attire or the wearing of abbreviated or suggestive attire, including shorts and halter tops or attire which is subject so as to create a danger or inadvertent snagging by vehicles and/or equipment shall be prohibited.

Flaggers shall wear the appropriate orange colored head gear at all times.

Guidance:

For nighttime activity and work on roadways with posted speeds of 50 MPH or greater, safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel" (see Section 1A.11) and labeled as meeting the ANSI 107-2004 standard performance for Class 3 risk exposure should be considered for all non-flagging personnel (instead of the Class 2 safety apparel in the Standard above).

When uniformed law enforcement officers are used, high-visibility safety apparel as described in this Section should be worn by the law enforcement officer.

Section 6E.03 Hand-Signaling Devices

Support:

Hand-signaling devices, such as STOP/SLOW paddles, lights, and red flags, are used to control road users through TTC zones.

Guidance:

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.

Standard:

The STOP/SLOW paddle shall have an octagonal shape on a rigid handle. The rigid handle shall be provided such that the bottom of the sign paddle will be 1.8 m (6 ft) above ground. STOP/SLOW paddles shall be at least 600 mm (24 in) wide, with 100 mm (8 in) series C letters used for the STOP side and 100 mm (8 in) series B letters used for the SLOW side. When used at night, the STOP/SLOW paddle shall be retroreflectorized. **DelDOT Rev.**

Option:

The STOP/SLOW paddle may be modified to improve conspicuity by incorporating either white or red flashing lights on the STOP face, and either white or yellow flashing lights on the SLOW face. The flashing lights may be arranged in any of the following patterns:

A. Two white or red lights, one centered vertically above and one centered vertically below the STOP legend; and/or two white or yellow lights, one centered vertically above and one centered vertically below the SLOW legend; or
B. Two white or red lights, one centered horizontally on each side of the STOP legend; and/or two white or yellow lights, one centered horizontally on each side of the SLOW legend; or
C. One white or red light centered below the STOP legend; and/or one white or yellow light centered below the SLOW legend; or
D. A series of eight or more small white or red lights no larger than 6 mm (0.25 in) in diameter along the outer edge of the paddle, arranged in an octagonal pattern at the eight corners of the border of the STOP face; and/or a series of eight or more small white or yellow lights no larger than 6 mm (0.25 in) in diameter along the outer edge of the paddle, arranged in a diamond pattern along the border of the SLOW face.
E. A series of white lights forming the shapes of the letters in the legend.

Standard:

If flashing lights are used on the STOP face of the paddle, their colors shall be all white or all red. If flashing lights are used on the SLOW face of the paddle, their colors shall be all white or all yellow.

If more than eight flashing lights are used, the lights shall be arranged such that they clearly convey the octagonal shape of the STOP face of the paddle and/or the diamond shape of the SLOW face of the paddle.

If flashing lights are used on the STOP/SLOW paddle, the flash rate shall be at least 50, but not more than 60, flashes per minute.

Flags, when used, shall be a minimum of 600 mm (24 in) square, made of a good grade of red material, and securely fastened to a staff that is approximately 900 mm (36 in) in length.

Guidance:

The free edge of a flag should be weighted so the flag will hang vertically, even in heavy winds.

Standard:

When used at nighttime, flags shall be retroreflectorized red.

Section 6E.04 <u>Flagger Procedures</u>

Support:

The use of paddles and flags by flaggers is illustrated in Figure 6E-1.

Standard:

The following methods of signaling with paddles shall be used:

A. To stop road users, the flagger shall face road users and aim the STOP paddle face toward road users in a stationary position with the arm extended horizontally away from the body. The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic.

B. To direct stopped road users to proceed, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body. The flagger shall motion with the free hand for road users to proceed.

C. To alert or slow traffic, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body.

Option:

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.

Standard:

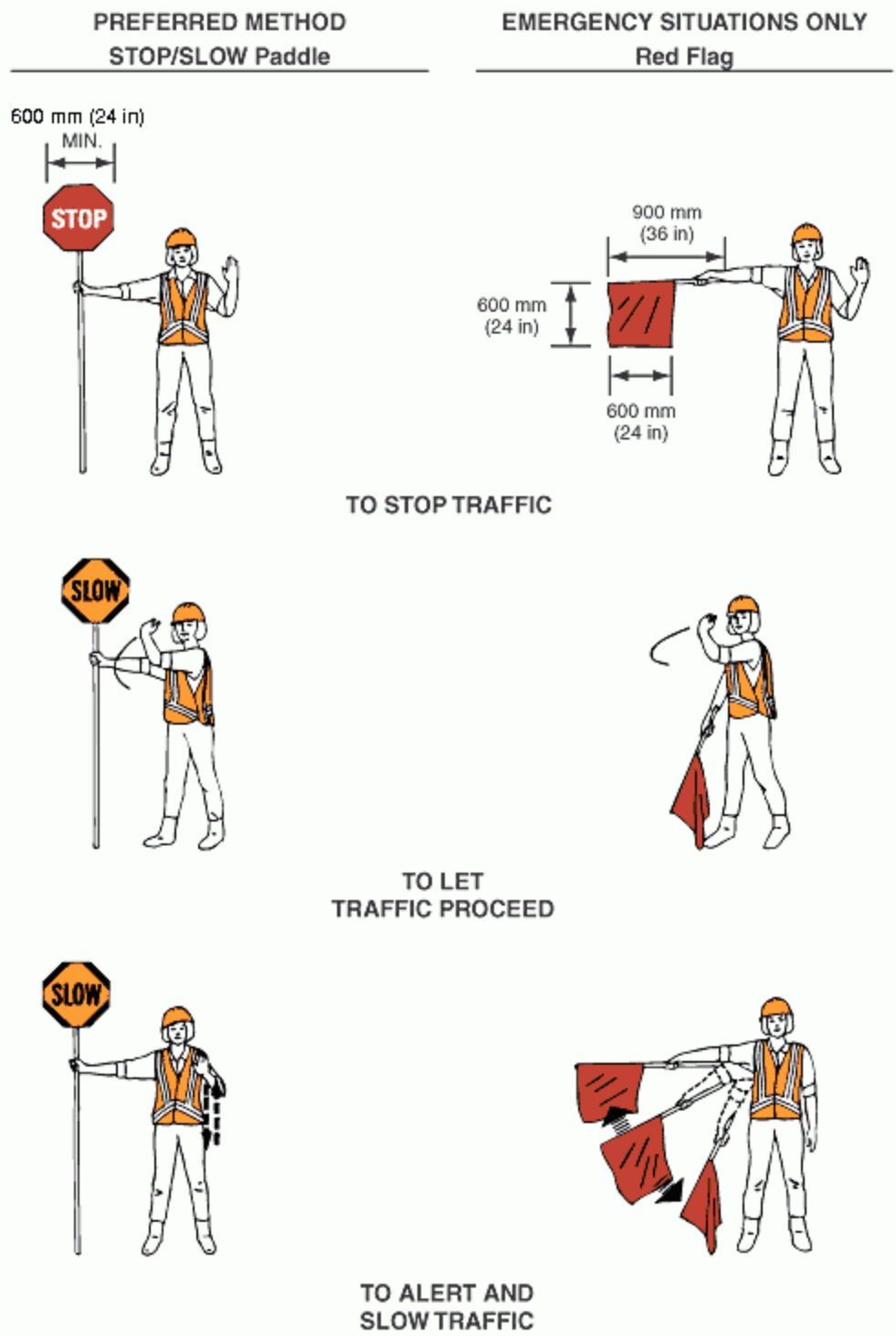
The following methods of signaling with a flag shall be used:

A. To stop road users, the flagger shall face road users 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 free arm shall be held with the palm of the hand above the shoulder level toward approaching traffic.

B. To direct stopped road users to proceed, the flagger shall stand parallel to the road user movement and with 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.

C. To alert or slow traffic, the flagger 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.

Figure 6E-1. Use of Hand-Signaling Devices by Flaggers



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Section 6E.05 Flagger Stations

Standard:

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

When the queuing of vehicles across rail tracks cannot be avoided, a uniformed law enforcement officer or flagger shall be provided at the highway-rail grade crossing to prevent vehicles from stopping within the highway-rail grade crossing, considered to be 15 m (50 ft) on either side of the closest and farthest rail, even if automatic warning devices are in place. **DelDOT Rev.**

Option:

The distances shown in Table 6E-1, which provides information regarding the stopping sight distance as a function of speed, may be used for the location of a flagger station. These distances may be increased for downgrades and other conditions that affect stopping distance.

Guidance:

Flagger stations should be located such that an errant vehicle has additional space to stop without entering the work space.

When highway-rail grade crossings exist either within or in the vicinity of roadway work activities, extra care should be taken to minimize the probability of conditions being created by flagging operations, where vehicles might be stopped within the highway-rail grade crossing, considered as being 15 m (50 ft) on either side of the closest and farthest rail.

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Standard:

Except in emergency situations, flagger stations shall be preceded by an advance warning sign or signs. Except in emergency situations, flagger stations shall be illuminated at night with a minimum average horizontal luminance of 50 lux (5 foot candles).

Guidance:

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. A flagger should only stand in the lane being used by moving road users after road users have stopped. The flagger should be clearly visible to the first approaching road user at all times. The flagger also should be visible to other road users. The flagger should be stationed sufficiently in advance of the workers to warn them (for example, with audible warning devices such as horns or whistles) of approaching danger by out-of-control vehicles. The flagger should stand alone, never permitting a group of workers to congregate around the flagger station.

Option:

At a spot constriction, the flagger may have to take a position on the shoulder opposite the closed section in order to operate effectively.

At spot lane closures where adequate sight distance is available for the reasonably safe handling of traffic, the use of one flagger may be sufficient.

Support:

For flagging operations at night, a horizontal luminance of 50 lux (5 foot candles) can typically be achieved by a light plant featuring four (4) 1000 Watt metal halide light fixtures, positioned within 4.6 m (15 ft) of the flagging station at a minimum mounting height of 4.6 m (15 ft). At a minimum, one (1) light plant is to be dedicated to the flagger operation. Light fixtures are to be positioned so as not to cause glare problems for vehicles approaching from any direction. **DelDOT Rev.**

Table 6E-1. Stopping Sight Distance as a Function of Speed

Speed* (km/h)	Distance (m)
30	35
40	50
50	65
60	85
70	105
80	130
90	160
100	185
110	220
120	250

Speed* (mph)	Distance (ft)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820

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

CHAPTER 6F. TEMPORARY TRAFFIC CONTROL ZONE DEVICES

Section 6F.01 Types of Devices

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Guidance:

The design and application of TTC devices used in TTC zones should consider the needs of all road users (motorists, bicyclists, and pedestrians), including those with disabilities.

Support:

FHWA policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used on the National Highway System 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 FHWA website at "http://safety.fhwa.dot.gov/programs/roadside_hardware.htm" identifies all such hardware and includes copies of FHWA acceptance letters for each of them. In the case of proprietary items, links are provided to manufacturers' websites as a source of detailed information on specific devices. The website also contains an "Ask the Experts" section where questions on roadside design issues can be addressed. State Departments of Transportation and local agencies might also have expanded the NCHRP Report 350 crashworthy criteria to apply to other highways in addition to the National Highway System.

Crashworthiness and crash testing information on devices described in Part 6 are found in AASHTO's "Roadside Design Guide" (see Section 1A.11).

As stated in Definition 17 in Section 1A.13, "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."

Standard:

Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, pedestrian facility, or bikeway by authority of a public body or official having jurisdiction.

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

Section 6F.02 General Characteristics of Signs

Support:

TTC zone signs convey both general and specific messages by means of words or symbols and have the same three categories as all road user signs: regulatory, warning, and guide.

Standard:

The colors for regulatory signs shall follow the Standards for regulatory signs in Table 2A-4 and Chapter 2B. Warning signs in TTC zones shall have a black legend and border on a fluorescent orange background, except for the Highway-Rail Grade Crossing Advance Warning (W10-1) sign which shall have a black legend and border on a yellow background, and except for signs that are permitted in Parts 2 or 7 to have fluorescent yellow-green backgrounds. Colors for guide signs shall follow the Standards in Table 2A-4 and Chapter 2D, except for guide signs as noted in Section 6F.50.

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Option:

Where the color orange is required, fluorescent red-orange or fluorescent yellow-orange colors may also be used.

Support:

The fluorescent versions of orange provide higher conspicuity than standard orange, especially during twilight.

Guidance:

Warning and guide signs used for TCC incident management situations (see Chapter 6I) should have a black legend and border on a fluorescent pink background. **DelDOT Rev.**

Option:

Existing warning signs that are still applicable may remain in place.

In order to maintain the systematic use of yellow or fluorescent yellow-green backgrounds for pedestrian, bicycle, and school warning signs in a jurisdiction, the yellow or fluorescent yellow-green background for pedestrian, bicycle, and school warning signs may be used in TTC zones.

Standard orange flags or flashing warning lights may be used in conjunction with signs.

Standard:

When standard orange flags or flashing warning lights are used in conjunction with signs, they shall not block the sign face.

The sizes for TTC signs shall be as shown in Table 6F-1.

Option:

The dimensions of signs shown in Table 6F-1 may be increased wherever necessary for greater legibility or emphasis, such as on freeways and expressways.

Standard:

Deviations from standard sizes as prescribed herein shall be in 150 mm (6 in) increments.

Support:

Sign design details are contained in the "Standard Highway Signs" book (see Section 1A.11).

Standard:

All TTC signs, including those made of flexible material (i.e. roll-up signs), shall be made of prismatic retroreflective sheeting. **DelDOT Rev.**

Flexible signs made of mesh material shall not be used for TTC operations within the State of Delaware.

Option:

Signs may be made of rigid or flexible material.

Guidance:

Sign design details for DelDOT specific TTC signs not included in the "Standard Highway Signs" book, denoted by "-DE" in the sign code as listed in Table 6F-1, are contained in the Appendix. **DelDOT Rev.**

Section 6F.03 <u>Sign Placement</u>

Guidance:

Signs should be located on the right side of the roadway unless otherwise specified in this Manual.

Option:

Where special emphasis is needed, signs may be placed on both the left and right sides of the roadway. Signs mounted on portable supports may be placed within the roadway itself. Signs may also be mounted on or above barricades.

Support:

The Provisions of this section regarding mounting height apply unless specifically stated otherwise for a particular sign elsewhere in this Manual.

Guidelines for height and lateral clearance of temporary ground-mounted signs are shown in Figure 6F-1.

Standard:

Ground-mounted signs installed at the side of the road shall be mounted at a height of at least 2.1 m (7 ft), measured from the bottom of the sign to the near edge of the pavement. Signs mounted on portable sign supports shall be mounted at a height of at least 1.5 m (5 ft), measured from the bottom of the sign to the near edge of pavement. **DelDOT Rev.**

Signs mounted on barricades and barricade/sign combinations shall be crashworthy.

Where it has been determined that the accommodation of pedestrians with disabilities is necessary, signs shall be mounted and placed in accordance with Section 4.4 of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11).

Signs mounted on fixed supports shall be mounted on a minimum of two (2) posts, unless otherwise directed by the Chief Traffic Engineer or designee. The number of posts used to support an individual sign shall not exceed four (4). **DelDOT Rev.**

The posts used shall meet Federal breakaway standards unless located behind barrier or guardrail.

Guidance:

Neither portable nor permanent sign supports should be located on sidewalks, bicycle facilities, or areas designated for pedestrian or bicycle traffic. Signs mounted lower than 2.1 m (7 ft) should not project more than 100 mm (4 in) into pedestrian facilities.

If a sign to be mounted on fixed supports requires more than three (3) posts, a more permanent support structure should be considered. **DelDOT Rev.**

Option:

A 2.1 m (7 ft) mounting height may be used in rural areas for increased visibility.

The height to the bottom of a secondary sign mounted below another sign may be 0.3 m (1 ft) less than the appropriate height specified above.

Guidance:

Except as noted in the Option, signs mounted on portable supports should not be used for a duration of more than 3 days.

Option:

The R9-9 through R9-11a series, R11 series, W1-6 through W1-8 series, M4-10, E5-1, or other similar type signs (see Figures 6F-3, 6F-4, and 6F-5) may be used on portable supports for longer than 3 days.

Guidance:

Signs mounted on Type III barricades should not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails.

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Table 6F-1. Sizes of Temporary Control Signs (Sheet 1 of 3)

Sign	MUTCD Code	Standard Size	Minimum
Stop	R1-1	48 x 48	---
Yield	R1-2	48 x 48 x 48	36 x 36 x 36
Do Not Pass	R4-1	36 x 48	24 x 30
Keep Right	R4-7a	36 x 48	24 x 30
Do Not Stop On Tracks	R8-8	36 x 48	24 x 30
Sidewalk Closed	R9-9	24 x 12	
Sidewalk Closed, Cross Here	R9-11a	24 x 12	
Road Closed	R11-2	48 x 30	
Road Closed – Local Traffic Only	R11-3a,3b,4	60 x 30	
Weight Limit	R12-1, 2	36 x 48	24 x 30
Weight Limit	R12-3-DE	24 x 36	
Weight Limit (with symbols)	R12-5-DE	30 x Var.	
Railroad Crossbuck	R15-1	48 x 9	
Turn and Curve Sign	W1-1,2,3,4	48 x 48	30 x 30
One-Direction Large Arrow	W1-6	48 x 24	60 x 30
Two-Direction Large Arrow	W1-7	48 x 24	60 x 30
Yield Ahead (symbol)	W3-2	48 x 48	36 x 36
Road Narrows	W5-1	48 x 48	36 x 36
Two-Way Traffic	W6-3	48 x 48	
Two-Way Traffic (plaque)	W6-4	18 x 24	
Bump	W8-1	48 x 48	30 x 30
Dip	W8-2	48 x 48	30 x 30
Soft Shoulder	W8-4	48 x 48	30 x 30
Truck Crossing	W8-6	48 x 48	30 x 30
Low Shoulder	W8-9	48 x 48	30 x 30
Uneven Lanes	W8-11	48 x 48	30 x 30

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Table 6F-1. Sizes of Temporary Control Signs (Sheet 2 of 3)

Sign	MUTCD Code	Standard Size	Minimum
Advisory Speed (plaque)	W13-1	24 x 24	18 x 18
XX Feet (plaque)	W16-2	24 x 18	
Road Work (with distance)	W20-1	48 x 48	
Detour (with distance)	W20-2	48 x 48	
Road (Street) Closed (with distance)	W20-3	48 x 48	
One Lane Road (with distance)	W20-4	48 x 48	
Lane(s) Closed (with distance)	W20-5,5a	48 x 48	
Flagger (symbol)	W20-7a	48 x 48	
Workers	W21-1	48 x 48	
Fresh Oil	W21-2	48 x 48	30 x 30
Road Machinery Ahead	W21-3	48 x 48	36 x 36
Shoulder Closed	W21-5a	48 x 48	
Shoulder Closed (with distance)	W21-5b	48 x 48	
Survey Crew	W21-6	48 x 48	30 x 30
Utility Work Ahead	W21-7	48 x 48	
Blasting Zone Ahead	W22-1	48 x 48	
Turn Off 2-Way Radio and Cell Phone	W22-2	42 x 36	
End Blasting Zone	W22-3	42 x 36	
Road Work Next XX Miles	G20-1	72 x 48	60 x 24
End Road Work	G20-2	48 x 24	
Exit Gore	E5-1	48 x 36	
Exit Open	E5-2	48 x 36	

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Table 6F-1. Sizes of Temporary Control Signs (Sheet 3 of 3)

Sign	MUTCD Code	Standard Size	Minimum
End Detour	M4-8a	24 x 18	
Detour (with arrow)	M4-9	30 x 24	
Detour (inside arrow)	M4-10	48 x 18	
Fines Doubled in Work Zone	R2-6-DE	60 x 30	
Do Not Pass	R4-1-DE1	48 x 12	
Keep Right	R4-7-DE	48 x 12	
Keep Left	R4-8-DE	48 x 12	
Bridge Work Ahead (1 MILE)	W5-3-DE	48 x 48	
Two Way Traffic Ahead	W6-3-DE	36 x 48	
Two Way Traffic	W6-3p-DE	24 x 18	
_____ Lane Closed (Center, Left, Right)	W9-3-DE	48 x 48	
Lane Closed Ahead	W9-3-DE1	48 x 48	
Lane Closed	W9-3-DE2	48 x 48	
Merge _____ (Left, Right)	W20-6-DE	48 x 48	
Flagger _____ (with distance)	W20-7-DE	48 x 48	
Shoulder Closed Ahead	W21-5-DE	48 x 48	
Survey Crew Ahead	W21-6-DE	48 x 48	
Mowing Ahead	W21-8-DE	48 x 48	
End Mowing	W21-8-DE1	48 x 24	
Wet Road Paint	W25-1-DE	48 x 48	
Wet Road Paint	W25-1-DE1	54 x 12	
Detour (Through)	M4-9-DE	30 x 24	

Notes:

1. Larger signs may be used wherever necessary for greater legibility or emphasis.
2. Dimensions are shown in millimeters followed by inches in parentheses and are shown as width x height.
3. For freeways and expressways, the size of diamond shaped TTC warning signs shall be a minimum of 1200 x 1200 mm (48 x 48 in).

Figure 6F–1. Height and Lateral Location of Signs—Typical Installations

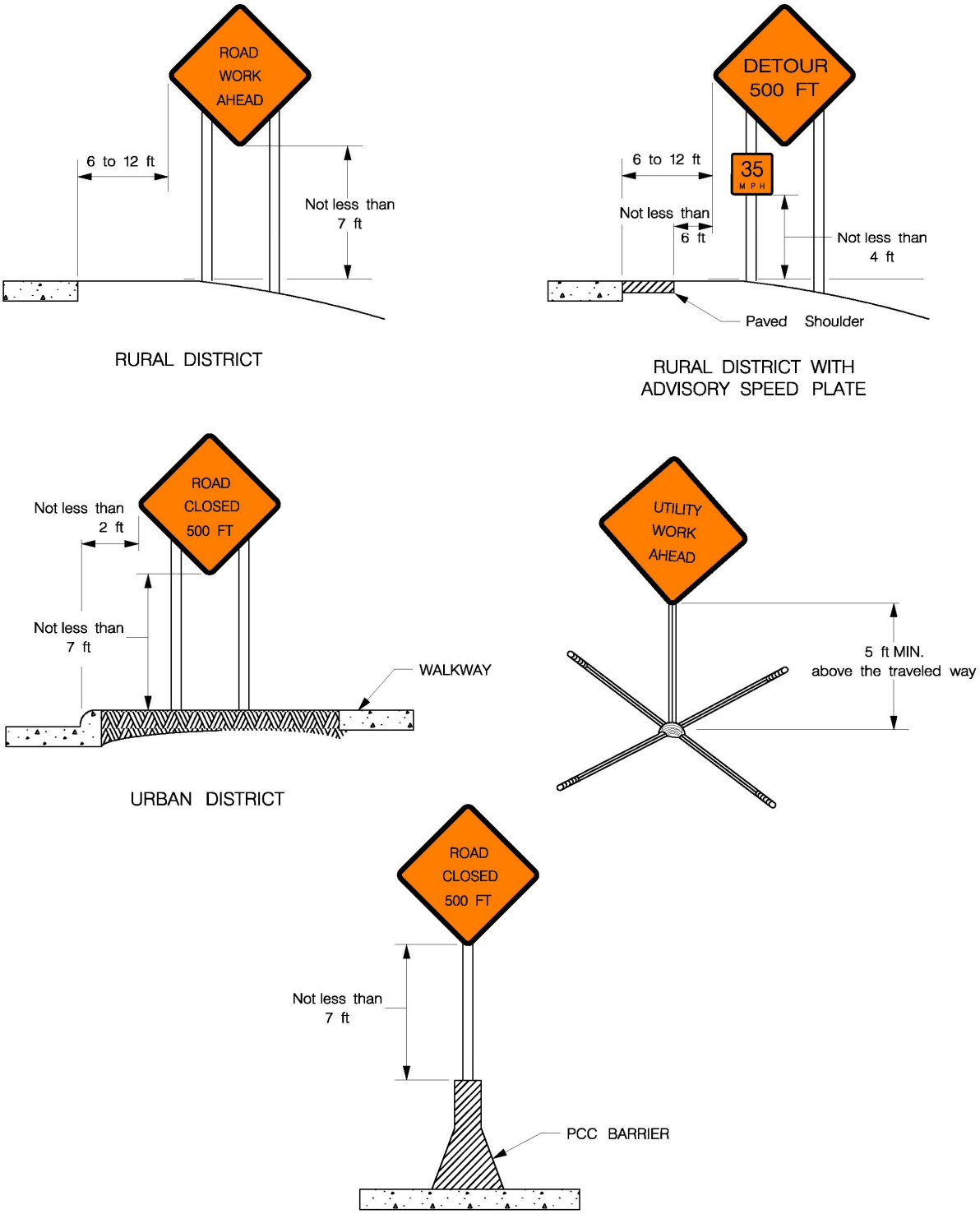

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Figure 6F-3. Regulatory Signs in Temporary Traffic Control Zones
(Sheet 1 of 2)

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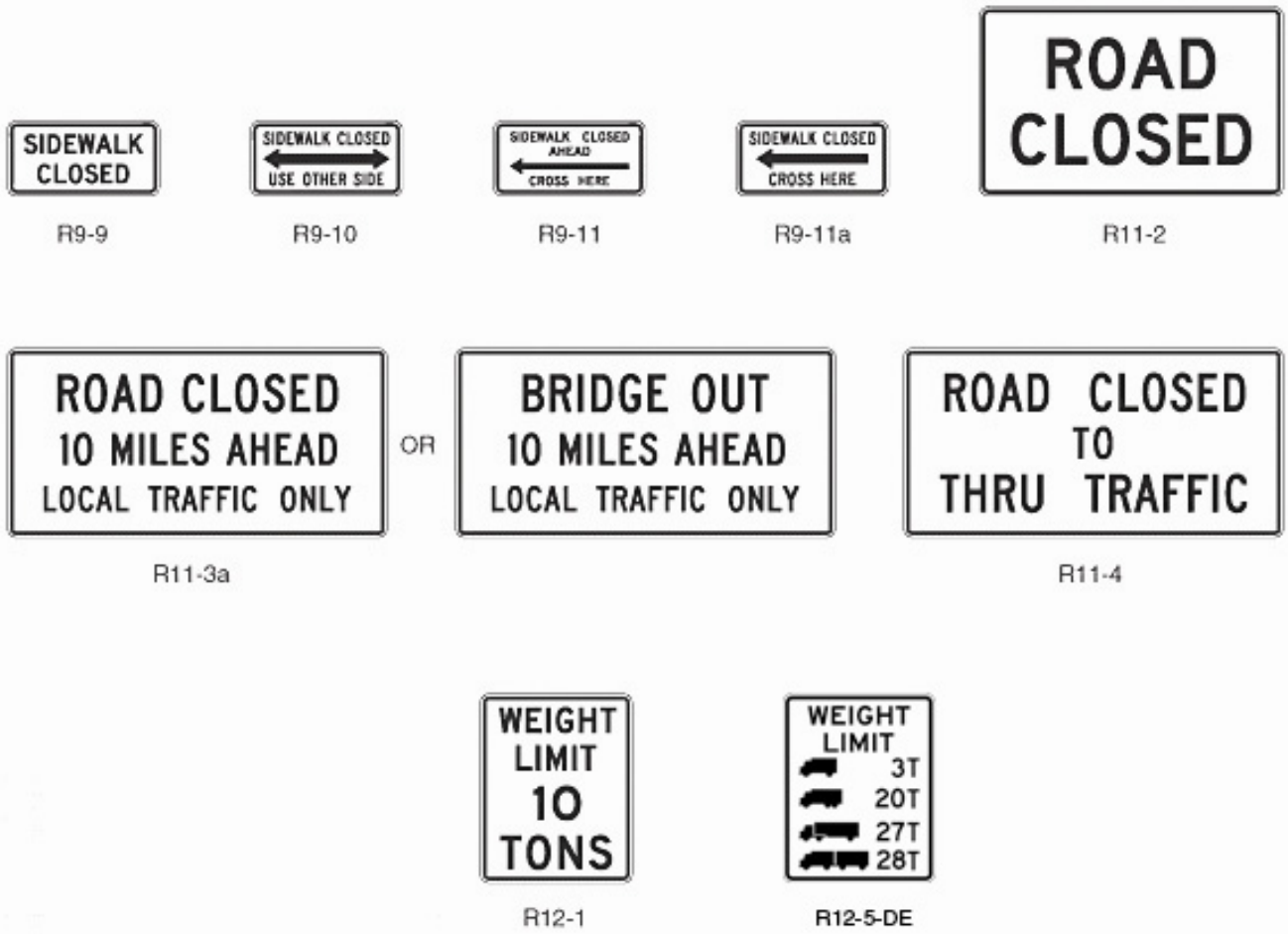
Figure 6F-3. Regulatory Signs in Temporary Traffic Control Zones
(Sheet 2 of 2)



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Standard:

Sign supports shall be crashworthy. Large signs having an area exceeding 5 m² (50 ft²) that are installed on multiple breakaway posts shall be mounted a minimum of 2.1 m (7 ft) above the ground.

Signs mounted on barricades, or other portable supports, shall be no less than 0.3 m (1 ft) above the traveled way.

Portable sign supports shall comply with FHWA NCHRP Report 350 standards. Skids and collapsible metal sign supports are typical portable supports. All such installations shall be constructed so as to yield upon impact to minimize hazard to motorists. In addition the following criteria apply:

A. Use NCHRP Report 350 compliant skids and collapsible metal sign supports only for temporary signs unless otherwise approved by the Chief Traffic Engineer or designee.

B. Use NCHRP Report 350 compliant skids and collapsible metal sign supports only in the crash tested and NCHRP Report 350 approved positions.

C. Immediately remove the skids and collapsible metal sign supports from the project site under the following circumstances:

a. After the completion of each operation, or

b. At the end of each daily work period, or

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c. Anytime when the contractor will leave the site, or
d. As directed by the Chief Traffic Engineer or designee.

Signs mounted on portable sign supports shall not be placed on sidewalks unless otherwise directed by the Chief Traffic Engineer or designee.

Signs mounted on portable supports shall not be used for operations exceeding 24 hours in duration, unless approved by the Chief Traffic Engineer or designee. **DelDOT Rev.**

Option:

For mobile operations, a sign may be mounted on a work vehicle, a shadow vehicle, or a trailer stationed in advance of the TTC zone or moving along with it. The work vehicle, the shadow vehicle, or the trailer may or may not have an impact attenuator.

If utility conflicts or concrete sidewalks/medians prevent the installation of permanent signs in the appropriate location, portable sign supports may be used. **DelDOT Rev.**

Guidance:

Unshielded sign posts placed in the clear zone should yield or breakaway upon impact to minimize obstructions to road users.

Support:

If alterations are made to specific traffic control device supports that have been successfully crash tested in accordance with NCHRP Report 350, the altered supports might not be considered to be crashworthy.

For maximum mobility on certain types of maintenance operations, a larger sign may be effectively mounted on a vehicle stationed in advance of the work or moving along with it. This may be the working vehicle itself, as in the case of pavement marking equipment, or a vehicle provided expressly for this purpose. **DelDOT Rev.**

Section 6F.04 Sign Maintenance

Standard:

Signs shall be properly maintained for cleanliness, visibility, and correct positioning.

Signs that have lost significant legibility shall be promptly replaced.

Section 6F.05 Regulatory Sign Authority

Support:

Regulatory signs such as those shown in Figure 6F-3 inform road users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent.

Standard:

Regulatory signs shall be authorized by the public agency or official having jurisdiction and shall conform with Chapter 2B.

Section 6F.06 Regulatory Sign Design

Standard:

TTC regulatory signs shall conform to the Standards for regulatory signs presented in Part 2 and in the FHWA's "Standard Highway Signs" book (see Section 1A.11).

Support:

Regulatory signs are generally rectangular with a black legend and border on a white background. Exceptions include the STOP, YIELD, DO NOT ENTER, WRONG WAY, and ONE WAY signs.

Option:

The ONE WAY sign may be either a horizontal or vertical rectangular sign.

Section 6F.07 Regulatory Sign Applications

Standard:

If a TTC zone requires regulatory measures different from those existing, the existing permanent regulatory devices shall be removed or covered and superseded by the appropriate

temporary regulatory signs. This change shall be made in conformance with applicable ordinances or statutes of the jurisdiction.

Section 6F.08 ROAD (STREET) CLOSED Sign (R11-2)

Guidance:

The ROAD (STREET) CLOSED (R11-2) sign (see Figure 6F-3, Sheet 2 of 2) should be used when the roadway is closed to all road users except contractors' equipment or officially authorized vehicles. The R11-2 sign should be accompanied by appropriate warning and detour signing.

Option:

The words BRIDGE OUT (or BRIDGE CLOSED) may be substituted for ROAD (STREET) CLOSED where applicable.

Guidance:

The ROAD (STREET) CLOSED sign should be installed at or near the center of the roadway on or above a Type III barricade that closes the roadway (see Section 6F.63).

Standard:

The ROAD (STREET) CLOSED sign shall not be used where road user flow is maintained or where the actual closure is some distance beyond the sign.

Section 6F.09 Local Traffic Only Signs (R11-3a, R11-4)

Guidance:

The Local Traffic Only signs (see Figure 6F-3, Sheet 2 of 2) should be used where road user flow detours to avoid a closure some distance beyond the sign, but where local road users can use the roadway to the point of closure. These signs should be accompanied by appropriate warning and detour signing.

In rural applications, the Local Traffic Only sign should have the legend ROAD CLOSED XX km (MILES) AHEAD, LOCAL TRAFFIC ONLY (R11-3a).

Option:

In urban areas, the legend ROAD (STREET) CLOSED TO THRU TRAFFIC (R11-4) or ROAD CLOSED, LOCAL TRAFFIC ONLY may be used.

The words BRIDGE OUT (or BRIDGE CLOSED) may be substituted for the words ROAD (STREET) CLOSED on the R11-3a or R11-4 sign where applicable.

Section 6F.10 Weight Limit Signs (R12-1, R12-5-DE) DelDOT Rev.

Standard:

A Weight Limit sign (see Figure 6F-3, Sheet 2 of 2), which shows the gross weight or axle weight that is permitted on the roadway or bridge, shall be consistent with State or local regulations and shall not be installed without the approval of the authority having jurisdiction over the highway.

When weight restrictions are imposed because of the activity in a TTC zone, a marked detour shall be provided for vehicles weighing more than the posted limit.

Section 6F.11 STAY IN LANE Sign (R4-9)

Option:

A STAY IN LANE (R4-9) sign (see Figure 6F-3, Sheet 1 of 2) may be used where a multi-lane shift has been incorporated as part of the TTC on a highway to direct road users around road work that occupies part of the roadway on a multi-lane highway.

Section 6F.12 This section not used. DelDOT Rev.

Section 6F.13 SIDEWALK CLOSED Signs (R9-9, R9-10, R9-11, R9-11a)

Guidance:

SIDEWALK CLOSED signs (see Figure 6F-3, Sheet 2 of 2) should be used where pedestrian flow is restricted. Bicycle/Pedestrian Detour (M4-9a) signs or Pedestrian Detour (M4-9b) signs should be used where pedestrian flow is rerouted (see Section 6F.53).

The SIDEWALK CLOSED (R9-9) sign should be installed at the beginning of the closed sidewalk, at the intersections preceding the closed sidewalk, and elsewhere along the closed sidewalk as needed.

The SIDEWALK CLOSED, (ARROW) USE OTHER SIDE (R9-10) sign should be installed at the beginning of the restricted sidewalk when a parallel sidewalk exists on the other side of the roadway.

The SIDEWALK CLOSED AHEAD, (ARROW) CROSS HERE (R9-11) sign should be used to indicate to pedestrians that sidewalks beyond the sign are closed and to direct them to open crosswalks, sidewalks, or other travel paths.

The SIDEWALK CLOSED, (ARROW) CROSS HERE (R9-11a) sign should be installed just beyond the point to which pedestrians are being redirected.

Support:

These signs are typically mounted on a detectable barricade to encourage compliance and to communicate with pedestrians that the sidewalk is closed. Printed signs are not useful to many pedestrians with visual disabilities. A barrier or barricade detectable by a person with a visual disability is sufficient to indicate that a sidewalk is closed. If the barrier is continuous with detectable channelizing devices for an alternate route, accessible signage might not be necessary. An audible information device is needed when the detectable barricade or barrier for an alternate channelized route is not continuous.

Section 6F.14 Special Regulatory Signs

Standard:

Temporary and/or relocated existing STOP signs mounted on a barricade or placed to stop traffic for construction, maintenance, or utility activity (except manually operated signs) shall have one (1) Red, Type "B" Warning Light mounted above the sign on the side nearest the approaching lane. STOP signs shall be made of prismatic retroreflective sheeting. Temporary STOP signs shall be 1200 x 1200 mm (48 x 48 in) unless otherwise directed by the Chief Traffic Engineer or designee. The Type "B" Warning Light shall be no larger or heavier than conventional Type A or C lights and shall be approved for mounting on signs under the provisions of the NCHRP Report 350. The bottom of the Type "B" Warning Light shall be not less than 300 mm (12 in) nor more than 600 mm (24 in) above the top of the STOP sign. DelDOT Rev.

Option:

Special regulatory signs may be used based on engineering judgment consistent with regulatory requirements.

Guidance:

Special regulatory signs should conform to the general requirements of color, shape, and alphabet size and series. The sign message should be brief, legible, and clear.

Support:

Section 2B.17 contains information regarding the use of FINES DOUBLED IN WORK ZONE signs (see Appendix for sign detail). DelDOT Rev.

Section 6F.15 Warning Sign Function, Design, and Application

Support:

TTC zone warning signs (see Figure 6F-4) notify road users of specific situations or conditions on or adjacent to a roadway that might not otherwise be apparent.

Standard:

TTC warning signs shall conform to the Standards for warning signs presented in Part 2 and in FHWA's "Standard Highway Signs" book (see Section 1A.11). Except as noted in the Option, TTC warning signs shall be diamond-shaped with a black legend and border on a fluorescent orange background, except for the W10-1 sign which shall have a black legend and border on a yellow background, and except for signs that are permitted in Parts 2 or 7 to have fluorescent yellow-green backgrounds. DelDOT Rev.

DelDOT Rev.

Option:

Warning signs used for TCC incident management situations may have a black legend and border on a fluorescent pink background.

Mounting or space considerations may justify a change from the standard diamond shape.

In emergencies, available warning signs having yellow backgrounds may be used if signs with orange or fluorescent pink backgrounds are not at hand.

Guidance:

Where roadway or road user conditions require greater emphasis, larger than standard size warning signs should be used, with the symbol or legend enlarged approximately in proportion to the outside dimensions.

Where any part of the roadway is obstructed or closed by work activities or incidents, advance warning signs should be installed to alert road users well in advance of these obstructions or restrictions.

Where road users include pedestrians, the provision of supplemental audible information or detectable barriers or barricades should be considered for people with visual disabilities.

Support:

Detectable barriers or barricades communicate very clearly to pedestrians who have visual disabilities that they can no longer proceed in the direction that they are traveling.

Option:

Advance warning signs may be used singly or in combination.

Standard:

All diamond shaped TTC warning signs shall be a minimum of 1200 x 1200 mm (48 x 48 in) unless otherwise approved by the Chief Traffic Engineer or designee. DelDOT Rev.

Option:

Where speeds and volumes are moderately low, a minimum size of 900 x 900 mm (36 x 36 in) may be used for advance warning signs.

On secondary roads or City streets where speeds are very low, signs smaller than the standard size, but not less than 600 x 600 mm (24 x 24 in), may be used for warning signs having short word messages or clear symbols.

Advance warning signs larger than the minimum standards may be used for additional emphasis of the TTC zone (see Part 2).

Where distances are not shown on warning signs as part of the message, a supplemental plaque with the distance legend may be mounted immediately below the sign on the same support.

Section 6F.16 <u>Position of Advance Warning Signs</u>

Guidance:

Where highway conditions permit, warning signs should be placed in advance of the TTC zone at varying distances depending on roadway type, condition, and posted speed. Table 6C-1 contains information regarding the spacing of advance warning signs. Where a series of two or more advance warning signs is used, the closest sign to the TTC zone should be placed approximately 30 m (100 ft) for low-speed urban streets to 300 m (1,000 ft) or more for freeways and expressways.

Support:

Various conditions, such as limited sight distance or obstructions that might require a driver to reduce speed or stop, might require additional advance warning signs.

Signs erected for individual operations within the TTC zone limits of a construction project should be coordinated with advance warning signs that are to remain for the entire duration of the project. DelDOT Rev.

Option:

As an alternative to a specific distance on advance warning signs, the word AHEAD may be used.

Support:

At TTC zones on lightly-traveled roads, all of the advance warning signs prescribed for major construction might not be needed.

Option:

Utility work, maintenance, or minor construction can occur within the TTC zone limits of a major construction project, and additional warning signs may be needed.

Guidance:

Utility, maintenance, and minor construction signing and TTC should be coordinated with appropriate authorities so that road users are not confused or misled by the additional TTC devices.

Section 6F.17 ROAD (STREET) WORK Sign (W20-1)

Guidance:

The ROAD (STREET) WORK (W20-1) sign (see Figure 6F-4, Sheet 3 of 4), which serves as a general warning of obstructions or restrictions, should be located in advance of the work space or any detour, on the road where the work is taking place.

Where traffic can enter a TTC zone from a crossroad or a major (high-volume) driveway, an advance warning sign should be used on the crossroad or major driveway.

Standard:

The ROAD (STREET) WORK (W20-1) sign shall have the legend ROAD (STREET) WORK, XX m (FT), XX km (MILES), or AHEAD.

Section 6F.18 DETOUR Sign (W20-2)

Guidance:

The DETOUR (W20-2) sign (see Figure 6F-4, Sheet 3 of 4) should be used in advance of a road user detour over a different roadway or route.

Standard:

The DETOUR sign shall have the legend DETOUR, XX m (FT), XX km (MILES), or AHEAD.

Section 6F.19 ROAD (STREET) CLOSED Sign (W20-3)

Guidance:

The ROAD (STREET) CLOSED (W20-3) sign (see Figure 6F-4, Sheet 3 of 4) should be used in advance of the point where a highway is closed to all road users, or to all but local road users.

Standard:

The ROAD (STREET) CLOSED sign shall have the legend ROAD (STREET) CLOSED, XX m (FT), XX km (MILES), or AHEAD.

Section 6F.20 ONE LANE ROAD Sign (W20-4)

Standard:

The ONE LANE ROAD (W20-4) sign (see Figure 6F-4, Sheet 3 of 4) shall be used only in advance of that point where motor vehicle traffic in both directions must use a common single lane (see Section 6C.10). It shall have the legend ONE LANE ROAD, XX m (FT), XX km (MILES), or AHEAD.

Section 6F.21 Lane(s) Closed Signs (W20-5, W20-5a)

Standard:

The Lane(s) Closed sign (see Figure 6F-4, Sheet 3 of 4) shall be used in advance of that point where one or more through lanes of a multi-lane roadway are closed.

For a single lane closure, the Lane Closed (W20-5) sign (see Figure 6F-4, Sheet 3 of 4) shall have the legend RIGHT (LEFT) LANE CLOSED, XX m (FT), XX km (MILES), or AHEAD. Where two adjacent lanes are closed, the W20-5a sign (see Figure 6F-4, Sheet 3 of 4) shall have the legend RIGHT (LEFT) TWO LANES CLOSED, XX m (FT), XX km (MILES), or AHEAD.

Section 6F.22 CENTER LANE CLOSED AHEAD Signs (W9-3, W9-3a)

Guidance:

The CENTER LANE CLOSED AHEAD (W9-3) sign (see Figure 6F-4, Sheet 2 of 4) should be used in advance of that point where work occupies the center lane(s) and approaching motor vehicle traffic is directed to the right or left of the work zone in the center lane.

Option:

The Center Lane Closed Ahead (W9-3a) symbol sign (see Figure 6F-4, Sheet 2 of 4) may be substituted for the CENTER LANE CLOSED AHEAD (W9-3) word message sign.

Section 6F.23 THRU TRAFFIC MERGE LEFT (RIGHT) Sign (W4-7)

Guidance:

The THRU TRAFFIC MERGE LEFT (RIGHT) (W4-7) sign (see Figure 6F-4, Sheet 1 of 4) should be used in advance of an intersection where one or more lane closures on the far side of a multi-lane intersection require through vehicular traffic on the approach to the intersection to use the left (right) lane to proceed through the intersection.

Section 6F.24 Lane Ends Sign (W4-2)

Option:

The Lane Ends (W4-2) symbol sign (see Figure 6F-4, Sheet 1 of 4) may be used to warn drivers of the reduction in the number of lanes for moving motor vehicle traffic in the direction of travel on a multi-lane roadway.

Section 6F.25 ON RAMP Plaque (W13-4)

Guidance:

When work is being done on a ramp, but the ramp remains open, the ON RAMP (W13-4) plaque (see Figure 6F-4, Sheet 3 of 4) should be used to supplement the advance ROAD WORK sign.

Figure 6F-4. Warning Signs in Temporary Traffic Control Zones
(Sheet 1 of 4)

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Figure 6F-4. Warning Signs in Temporary Traffic Control Zones
(Sheet 2 of 4)

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Figure 6F-4. Warning Signs in Temporary Traffic Control Zones
(Sheet 3 of 4)

* An optional STREET CLOSED word message sign is shown in the "Standard Highway Signs" book.

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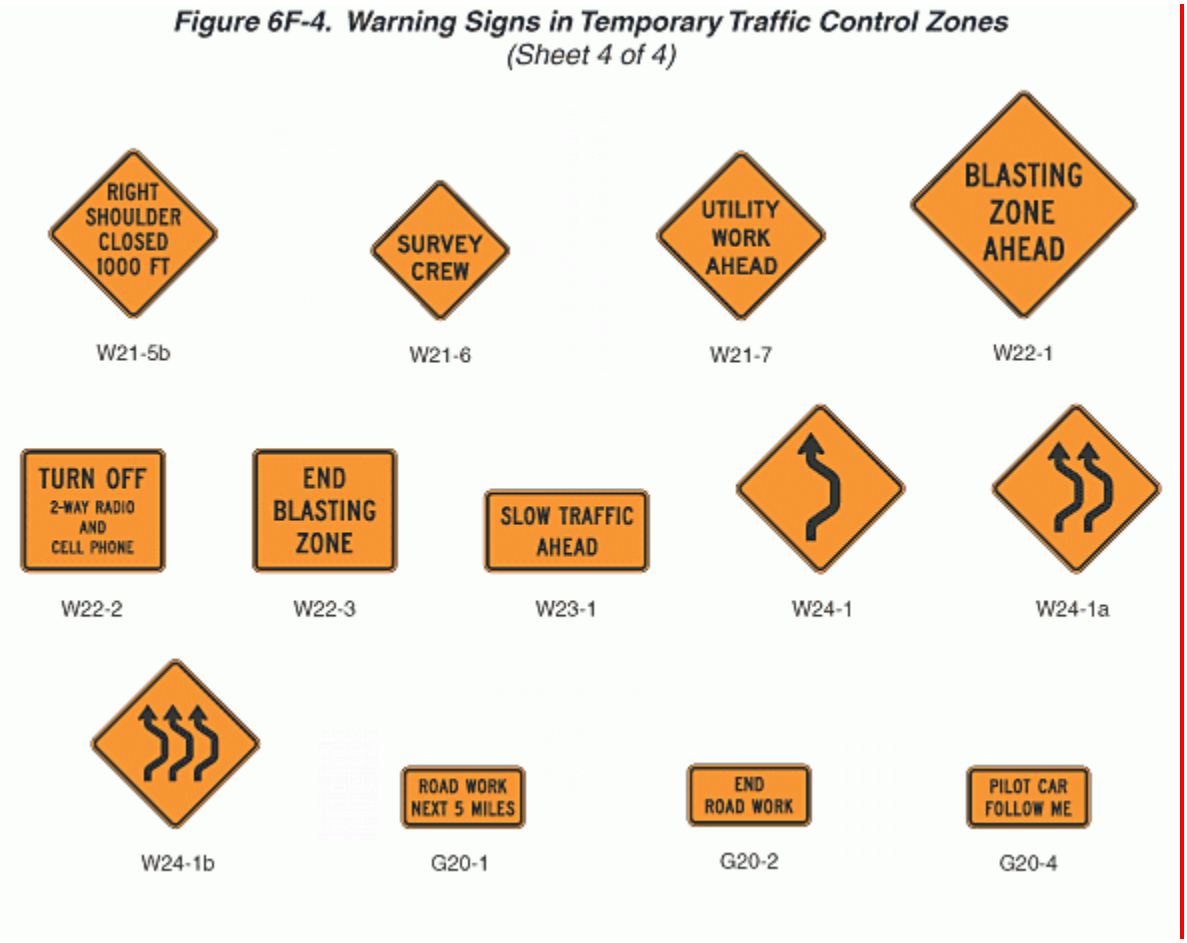


Figure 6F-4. Warning Signs in Temporary Traffic Control Zones (Sheet 4 of 4)

DelDOT Rev.

Section 6F.26 RAMP NARROWS Sign (W5-4)

Guidance:

The RAMP NARROWS (W5-4) sign (see Figure 6F-4, Sheet 1 of 4) should be used in advance of the point where work on a ramp reduces the normal width of the ramp along a part or all of the ramp.

Section 6F.27 SLOW TRAFFIC AHEAD Sign (W23-1)

Option:

The SLOW TRAFFIC AHEAD (W23-1) sign (see Figure 6F-4, Sheet 4 of 4) may be used on a shadow vehicle, usually mounted on the rear of the most upstream shadow vehicle, along with other appropriate signs for mobile operations to warn of slow moving work vehicles. A ROAD WORK (W20-1) sign may also be used with the SLOW TRAFFIC AHEAD sign.

Section 6F.28 EXIT OPEN, EXIT CLOSED, EXIT ONLY Signs (E5-2, E5-2a, E5-3)

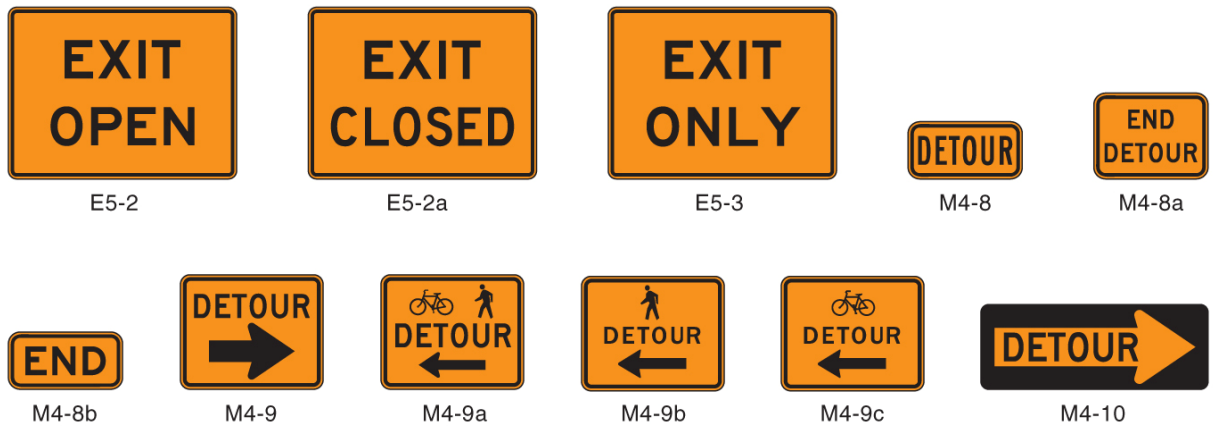
Option:

An EXIT OPEN (E5-2), EXIT CLOSED (E5-2a), or EXIT ONLY (E5-3) sign (see Figure 6F-5) may be used to supplement other warning signs where work is being conducted in the vicinity of an exit ramp and where the exit maneuver for motor vehicle traffic using the ramp is different from the normal condition.

Guidance:

When an exit ramp is closed, an EXIT CLOSED panel with a black legend and border on an orange background should be placed diagonally across the interchange/intersection guide signs.

Figure 6F-5. Exit Open and Closed and Detour Signs



Section 6F.29 Flagger Sign (W20-7a, W20-7-DE)

Guidance:

The Flagger (W20-7a) symbol sign (see Figure 6F-4, Sheet 3 of 4) or Flagger XXX m (FT) or AHEAD (W20-7-DE) sign (see Appendix) should be used in advance of any point where a flagger is stationed to control road users. **DelDOT Rev.**

Option:

A distance legend may be displayed on a supplemental plaque below the Flagger (W20-7a) symbol sign. The sign may be used with appropriate legends or in conjunction with other warning signs, such as the BE PREPARED TO STOP (W3-4) sign (see Figure 6F-4, Sheet 1 of 4).

Standard:

The Flagger sign shall be removed, covered, or turned away from road users when the flagging operations are not occurring.

Section 6F.30 Two-Way Traffic Sign (W6-3)

Guidance:

When one roadway of a normally divided highway is closed, with two-way vehicular traffic maintained on the other roadway, the Two-Way Traffic (W6-3) sign (see Figure 6F-4, Sheet 2 of 4) should be used at the beginning of the two-way vehicular traffic section and at intervals to remind road users of opposing vehicular traffic.

Section 6F.31 Workers Sign (W21-1, W21-1a)

Option:

A Workers (W21-1a) symbol sign (see Figure 6F-4, Sheet 3 of 4) may be used to alert road users of workers in or near the roadway.

Guidance:

In the absence of other warning devices, a Workers symbol sign should be used when workers are in the roadway.

Option:

The WORKERS (W21-1) word message sign may be used as an alternate to the Workers (W21-1a) symbol sign.

Section 6F.32 FRESH OIL (TAR) Sign (W21-2)

Guidance:

The FRESH OIL (TAR) (W21-2) sign (see Figure 6F-4, Sheet 3 of 4) should be used to warn road users of the surface treatment.

Section 6F.33 ROAD MACHINERY AHEAD Sign (W21-3)

Option:

The ROAD MACHINERY AHEAD (W21-3) sign (see Figure 6F-4, Sheet 3 of 4) may be used to warn of machinery operating in or adjacent to the roadway.

Section 6F.34 Motorized Traffic Signs (W8-6, W11-10)

Option:

Motorized Traffic (W8-6, W11-10) signs may be used to alert road users to locations where unexpected travel on the roadway or entries into or departures from the roadway by construction vehicles might occur. The TRUCK CROSSING (W8-6) word message sign may be used as an alternate to the Truck Crossing symbol (W11-10) sign (see Figure 6F-4, Sheet 2 of 4) where there is an established construction vehicle crossing of the roadway.

Support:

These locations might be relatively confined or might occur randomly over a segment of roadway.

Section 6F.35 Shoulder Work Signs (W21-5, W21-5a, W21-5b)

Support:

Shoulder Work signs (see Figure 6F-4, Sheets 3 and 4 of 4) warn of maintenance, reconstruction, or utility operations on the highway shoulder where the roadway is unobstructed.

Standard:

The Shoulder Work sign shall have the legend SHOULDER WORK (W21-5), RIGHT (LEFT) SHOULDER CLOSED (W21-5a), or RIGHT (LEFT) SHOULDER CLOSED XXX m (FT) or AHEAD (W21-5b).

Option:

The Shoulder Work sign may be used in advance of the point on a nonlimited access highway where there is shoulder work. It may be used singly or in combination with a ROAD WORK NEXT X km (MILES) or ROAD WORK AHEAD sign.

Guidance:

On freeways and expressways, the RIGHT (LEFT) SHOULDER CLOSED XXX m (FT) or AHEAD (W21-5b) sign followed by RIGHT (LEFT) SHOULDER CLOSED (W21-5a) sign should be used in advance of the point where the shoulder work occurs and should be preceded by a ROAD WORK AHEAD sign.

Section 6F.36 SURVEY CREW Sign (W21-6)

Guidance:

The SURVEY CREW (W21-6) sign (see Figure 6F-4, Sheet 4 of 4) should be used to warn of surveying crews working in or adjacent to the roadway.

Section 6F.37 UTILITY WORK Sign (W21-7)

Option:

The UTILITY WORK (W21-7) sign (see Figure 6F-4, Sheet 4 of 4) may be used as an alternate to the ROAD (STREET) WORK (W20-1) sign for utility operations on or adjacent to a highway.

Standard:

The UTILITY WORK sign shall carry the legend UTILITY WORK, XX m (FT), XX km (MILES), or AHEAD.

Section 6F.38 Signs for Blasting Areas

Support:

Radio-Frequency (RF) energy can cause the premature firing of electric detonators (blasting caps) used in TTC zones.

Standard:

Road users shall be warned to turn off mobile radio transmitters and cellular telephones where blasting operations occur. A sequence of signs shall be prominently displayed to direct operators of mobile radio equipment, including cellular telephones, to turn off transmitters in a blasting area. These signs shall be covered or removed when there are no explosives in the area or the area is otherwise secured.

Section 6F.39 BLASTING ZONE AHEAD Sign (W22-1)

Standard:

The BLASTING ZONE AHEAD (W22-1) sign (see Figure 6F-4, Sheet 4 of 4) shall be used in advance of any TTC zone where explosives are being used. The TURN OFF 2-WAY RADIO AND CELL PHONE and END BLASTING ZONE signs shall be used in sequence with this sign.

Section 6F.40 TURN OFF 2-WAY RADIO AND CELL PHONE Sign (W22-2)

Standard:

The TURN OFF 2-WAY RADIO AND CELL PHONE (W22-2) sign (see Figure 6F-4, Sheet 4 of 4) shall follow the BLASTING ZONE AHEAD sign and shall be placed at least 300 m (1,000 ft) before the beginning of the blasting zone.

Section 6F.41 END BLASTING ZONE Sign (W22-3)

Standard:

The END BLASTING ZONE (W22-3) sign (see Figure 6F-4, Sheet 4 of 4) shall be placed a minimum of 300 m (1,000 ft) past the blasting zone.

Option:

The END BLASTING ZONE sign may be placed either with or preceding the END ROAD WORK sign.

Section 6F.42 Shoulder Signs (W8-4, W8-9, W8-9a)

Standard:

See Section 6G.21 regarding use of these signs. **DelDOT Rev.**

Section 6F.43 UNEVEN LANES Sign (W8-11)

Standard:

See Section 6G.21 regarding use of this sign. **DelDOT Rev.**

Section 6F.44 NO CENTER STRIPE Sign (W8-12)

Guidance:

The NO CENTER STRIPE (W8-12) sign (see Figure 6F-4, Sheet 2 of 4) should be used when the work obliterates the centerline pavement markings. This sign should be placed at the beginning of the TTC zone and repeated at 3.2 km (2 mi) intervals in long TTC zones.

Section 6F.45 Double Reverse Curve Signs (W24 Series)

Option:

The Double Reverse Curve (W24-1, W24-1a, or W24-1b) sign (see Figure 6F-4, Sheet 4 of 4) may be used when the tangent distance between two reverse curves is less than 180 m (600 ft), thus making it difficult for a second Reverse Curve (W1-4 Series) sign to be placed between the curves.

Standard:

If a Double Reverse Curve sign is used, the number of lanes illustrated on the sign shall be the same as the number of through lanes available to road users, and the direction of the double reverse curve shall be appropriately illustrated.

Section 6F.46 Other Warning Signs

Option:

Advance warning signs may be used by themselves or with other advance warning signs.

Besides the warning signs specifically related to TTC zones, several other warning signs in Part 2 may apply in TTC zones.

Standard:

Except as noted in Section 6F.02, other warning signs that are used in TTC zones shall have black legends and borders on an orange background.

Section 6F.47 Special Warning Signs

Option:

Special warning signs may be used based on engineering judgment.

Guidance:

Special warning signs should conform to the general requirements of color, shape, and alphabet size and series. The sign message should be brief, legible, and clear.

Section 6F.48 Advisory Speed Plaque (W13-1)

Option:

In combination with a warning sign, an Advisory Speed (W13-1) plaque (see Figure 6F-4, Sheet 2 of 4) may be used to indicate a recommended safe speed through the TTC zone.

Standard:

The Advisory Speed plaque shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone. When used with orange TTC zone signs, this plaque shall have a black legend and border on an orange background. The plaque shall be at least 600 x 600 mm (24 x 24 in) in size when used with a sign that is 900 x 900 mm (36 x 36 in) or larger. Except in emergencies, an Advisory Speed plaque shall not be mounted until the recommended speed is determined by the highway agency.

Section 6F.49 Supplementary Distance Plaque (W7-3a)

Option:

In combination with a warning sign, a Supplementary Distance (W7-3a) plaque with the legend NEXT XX km (MILES) may be used to indicate the length of highway over which a work activity is being conducted, or over which a condition exists in the TTC zone.

In long TTC zones, Supplementary Distance plaques with the legend NEXT XX km (MILES) may be placed in combination with warning signs at regular intervals within the zone to indicate the remaining length of highway over which the TTC work activity or condition exists.

Standard:

The Supplementary Distance plaque with the legend NEXT XX km (MILES) shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone. When used with orange TTC zone signs, this plaque shall have a black legend and border on an orange background. The plaque shall be at least 750 x 600 mm (30 x 24 in) in size when used with a sign that is 900 x 900 mm (36 x 36 in) or larger.

Guidance:

When used in TTC zones, the Supplementary Distance plaque with the legend NEXT XX km (MILES) should be placed below the initial warning sign designating that, within the approaching zone, a temporary work activity or condition exists.

Section 6F.50 Guide Signs

Support:

Guide signs along highways provide road users with information to help them along their way through the TTC zone. The design of guide signs is presented in Part 2.

Guidance:

The following guide signs should be used in TTC zones as needed:

A. Standard route markings, where temporary route changes are necessary;
B. Directional signs and street name signs; and
C. Special guide signs relating to the condition or work being done.

Standard:

If additional temporary guide signs are used in TTC zones, they shall have a black legend and border on an orange background.

Option:

Guide signs used in TTC incident management situations may have a black legend and border on a fluorescent pink background.

When directional signs and street name signs are used in conjunction with detour routing, these signs may have a black legend and border on an orange background.

When permanent directional signs or permanent street name signs are used in conjunction with detour signing, they may have a white legend on a green background.

Section 6F.51 ROAD WORK NEXT XX km (MILES) Sign (G20-1)

Guidance:

The ROAD WORK NEXT XX km (MILES) (G20-1) sign (see Figure 6F-4, Sheet 4 of 4) should be installed in advance of TTC zones that are more than 3.2 km (2 mi) in length.

Option:

The ROAD WORK NEXT XX km (MILES) sign may be mounted on a Type III barricade. The sign may also be used for TTC zones of shorter length.

Standard:

The distance shown on the ROAD WORK NEXT XX km (MILES) sign shall be stated to the nearest whole kilometer (or mile).

Section 6F.52 END ROAD WORK Sign (G20-2)

Guidance:

When used, the END ROAD WORK (G20-2) sign (see Figure 6F-4, Sheet 4 of 4) should be placed near the end of the termination area, as determined by engineering judgment.

Option:

The END ROAD WORK sign may be installed on the back of a warning sign facing the opposite direction of road users or on the back of a Type III barricade.

Section 6F.53 Detour Signs (M4-8, M4-8a, M4-8b, M4-9, M4-9a, M4-9b, M4-9c, and M4-10)

Standard:

Each detour shall be adequately marked with standard temporary route signs and destination signs.

Option:

Detour signs in TTC incident management situations may have a black legend and border on a fluorescent pink background.

The Detour Arrow (M4-10) sign (see Figure 6F-5) may be used where a detour route has been established.

The DETOUR (M4-8) sign (see Figure 6F-5) may be mounted at the top of a route sign assembly to mark a temporary route that detours from a highway, bypasses a section closed by a TTC zone, and rejoins the highway beyond the TTC zone.

Guidance:

The Detour Arrow (M4-10) sign should normally be mounted just below the ROAD CLOSED (R11-2, R11-3a, or R11-4) sign. The Detour Arrow sign should include a horizontal arrow pointed to the right or left as required.

The DETOUR (M4-9) sign (see Figure 6F-5) should be used for unnumbered highways, for emergency situations, for periods of short durations, or where, over relatively short distances, road users are guided along the detour and back to the desired highway without route signs.

A Street Name sign should be placed above, or the street name should be incorporated into, a DETOUR (M4-9) sign to indicate the name of the street being detoured.

Option:

The END DETOUR (M4-8a) or END (M4-8b) sign (see Figure 6F-5) may be used to indicate that the detour has ended.

Guidance:

When the END DETOUR sign is used on a numbered highway, the sign should be mounted above a sign after the end of the detour.

The Pedestrian/Bicycle Detour (M4-9a) sign (see Figure 6F-5) should be used where a pedestrian/bicycle detour route has been established because of the closing of a pedestrian/bicycle facility to through traffic.

Standard:

If used, the Pedestrian/Bicycle Detour sign shall have an arrow pointing in the appropriate direction.

Option:

The arrow on a Pedestrian/Bicycle Detour sign may be on the sign face or on a supplemental plaque.

The Pedestrian Detour (M4-9b) sign or Bicycle Detour (M4-9c) sign (see Figure 6F-5) may be used where a pedestrian or bicycle detour route (not both) has been established because of the closing of the pedestrian or bicycle facility to through traffic.

Section 6F.54 <u>PILOT CAR FOLLOW ME Sign (G20-4)</u>

Standard:

The PILOT CAR FOLLOW ME (G20-4) sign (see Figure 6F-4, Sheet 4 of 4) shall be mounted in a conspicuous position on the rear of a vehicle used for guiding one-way vehicular traffic through or around a TTC zone. A flagger shall be stationed on the approach to the activity area to stop vehicular traffic until the pilot vehicle is available.

Section 6F.55 <u>Portable Changeable Message Signs</u>

Standard:

Portable Changeable Message signs shall be TTC 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.

Portable Changeable Message signs shall be used as a supplement to and not as a substitute for conventional signs and pavement markings.

All Portable Changeable Message signs to be placed within State Right of Way and the messages they display shall be approved by the Chief Traffic Engineer or designee prior to installation, except for those used for EMERGENCY OPERATIONS. DelDOT Rev.

Six (6) channelizing devices (drums or cones) shall be provided to close the shoulder in advance of each Portable Changeable Message sign located within the shoulder during the daytime. When a

Portable Changeable Message sign will be on site at night, drums shall be utilized, and one (1) amber Type B light shall be provided on each of the first two drums. If all drums meet the new sheeting requirements, lights shall not be utilized. (See Section 6F.62 for drum sheeting requirements)

All Portable Changeable Message signs no longer in use shall be removed from the work area within 48 hours, unless otherwise directed by the Chief Traffic Engineer or designee.

DelDOT Rev.

Support:

Portable Changeable Message signs are used most frequently on high-density urban freeways, but have applications on all types of highways where highway alignment, road user routing problems, or other pertinent conditions require advance warning and information.

Portable Changeable Message signs have a wide variety of applications in TTC zones including: roadway, lane, or ramp closures, crash or emergency incident management, width restriction information, speed control or reductions, advisories on work scheduling, road user management and diversion, warning of adverse conditions or special events, and other operational control.

The primary purpose of Portable Changeable Message signs in TTC zones is to advise the road user of unexpected situations. Some typical applications include the following:

A. Where the speed of vehicular traffic is expected to drop substantially;
B. Where significant queuing and delays are expected;
C. Where adverse environmental conditions are present;
D. Where there are changes in alignment or surface conditions;
E. Where advance notice of ramp, lane, or roadway closures is needed;
F. Where crash or incident management is needed; and/or
G. Where changes in the road user pattern occur.

Guidance:

The components of a Portable Changeable Message sign should include: a message sign panel, control systems, a power source, and mounting and transporting equipment.

Portable Changeable Message signs should subscribe to the principles established in Section 2A.07 and other sections of this Manual and, to the extent practical, with the design (that is, color, letter size and shape, and borders) and applications prescribed in this Manual, except that the reverse colors for the letters and the background are considered acceptable.

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 800 m (0.5 mi) under both day and night conditions. For a trailer or large truck mounted sign, the letter height should be a minimum of 450 mm (18 in). For Changeable Message signs mounted on service patrol trucks, the letter height should be a minimum of 250 mm (10 in).

The message panel should have adjustable display rates (minimum of 3 seconds per phase), 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.

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 (see Section 1A.14).

Option:

The message sign panel may vary in size.

Smaller letter sizes may be used on a Portable Changeable Message sign mounted on a trailer or large truck provided that the message is legible from at least 200 m (650 ft), or mounted on a service patrol truck provided that the message is legible from at least 100 m (330 ft).

Two Portable Changeable Message signs may be used for the purpose of allowing the entire message to be read twice at the posted speed.

Standard:

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. DelDOT Rev.

The mounting of Portable Changeable Message signs on a trailer, a large truck, or a service patrol truck shall be such that the bottom of the message sign panel shall be a minimum of 2.1 m (7 ft) 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. The text of the messages shall not flash unless approved by the Chief Traffic Engineer or designee.

Guidance:

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

When Portable Changeable Message signs are used for route diversion, they should be placed far enough in advance of the diversion to allow road users ample opportunity to perform necessary lane changes, to adjust their speed, or to exit the affected highway.

The Portable Changeable Message signs should be sited and aligned to provide maximum legibility. Multiple Portable Changeable Message signs should be placed on the same side of the roadway, separated from each other at distances based on Table 6C-1.

Portable Changeable Message signs should be placed on the shoulder of the roadway or, if practical, further from the traveled lane. They should be delineated with retroreflective TTC devices. When Portable Changeable Message signs are not being used, they should be removed; if not removed, they should be shielded; or if the previous two options are not feasible, they should be delineated with retroreflective TTC devices.

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.

Section 6F.56 <u>Arrow Panels</u>

Standard:

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 TTC zone.

Guidance:

An arrow panel in the arrow or chevron mode should be used to advise approaching traffic of a lane closure along major multi-lane roadways in situations involving heavy traffic volumes, high speeds, and/or limited sight distances, or at other locations and under other conditions where road users are less likely to expect such lane closures.

If used, an arrow panel should be used in combination with appropriate signs, channelizing devices, or other TTC devices.

An arrow panel should be placed on the shoulder of the roadway or, if practical, further from the traveled lane. It should be delineated with retroreflective TTC devices. When an arrow panel is not being

used, it should be removed; if not removed, it should be shielded; or if the previous two options are not feasible, it should be delineated with retroreflective TTC devices.

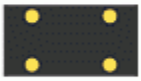
Standard:

Arrow panels shall meet the minimum size, legibility distance, number of elements, and other specifications shown on Figure 6F-6.

Support:

Type A arrow panels are appropriate for use on low-speed urban streets. Type B arrow panels are appropriate for intermediate-speed facilities and for maintenance or mobile operations on high-speed roadways. Type C arrow panels are intended to be used on high-speed, high-volume motor vehicle traffic control projects. Type D arrow panels are intended for use on authorized vehicles.

Figure 6F-6. Advance Warning Arrow Display Specifications

Operating Mode	Panel Display (Type C panel illustrated)
I. At least one of the three following modes shall be provided:	(Right arrow shown; left is similar)
Flashing Arrow	Move/Merge Right
Sequential Arrow	Move/Merge Right
Sequential Chevron	Move/Merge Right
II. The following mode shall be provided: Flashing Double Arrow	Move/Merge Right or Left
III. The following mode shall be provided: Flashing Caution	 Caution

Panel Type	Minimum Size	Minimum Legibility Distance	Minimum Number of Elements
A	1200 x 600 mm (48 x 24 in)	0.8 km (1/2 mi)	12
B	1500 x 750 mm (60 x 30 in)	1.2 km (3/4 mi)	13
C	2400 x 1200 mm (96 x 48 in)	1.6 km (1 mi)	15
D	None*	0.8 km (1/2 mi)	12

*Length of arrow equals 1200 mm (48 in), width of arrowhead equals 600 mm (24 in)

DelDOT Rev.

Standard:

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 arrow panel shall be mounted on a vehicle, a trailer, or other suitable support. Sign W1-6 shall be centered below and attached to the bottom of all trailer-mounted arrow panels.

Six (6) channelizing devices (drums or cones) shall be provided to close the shoulder in advance of each unattended arrow panel located within the shoulder during the daytime. When an unattended arrow panel will be on site at night, drums shall be utilized, and one (1) amber Type B light shall be provided on each of the first two drums. If all drums meet the new sheeting requirements, lights shall not be utilized. (See Section 6F.62 for drum sheeting requirements) DelDOT Rev.

Guidance:

The minimum mounting height of an arrow panel should be 2.1 m (7 ft) from the roadway to the bottom of the panel, except on vehicle-mounted panels, which should be as high as practical.

A vehicle-mounted arrow panel should be provided with remote controls.

Drums with old or new sheeting should not be mixed. DelDOT Rev.

Standard:

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.

Guidance:

Full brilliance should be used for daytime operation of arrow panels.

Standard:

The arrow panel shall have suitable elements capable of the various operating modes. The color presented by the elements shall be yellow.

Guidance:

If an arrow panel consisting of a bulb matrix is used, the elements should be recess-mounted or equipped with an upper hood of not less than 180 degrees.

Standard:

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 multi-lane 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.

Guidance:

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.

Standard:

When arrow panels are used to close multiple lanes, a separate arrow panel shall be used for each closed lane.

Guidance:

When arrow panels are used to close multiple lanes, if the first arrow panel is placed on the shoulder, the second arrow panel should be placed in the first closed lane at the beginning of the second merging taper. When the first arrow panel is placed in the first closed lane, the second arrow panel should be placed in the second closed lane at the downstream end of the second merging taper.

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.

Standard:

A vehicle displaying an arrow panel shall be equipped with high-intensity rotating, flashing, oscillating, or strobe lights.

Arrow panel(s) shall not be used to laterally shift traffic.

Option:

A portable changeable message sign may be used to simulate an arrow panel display.

Section 6F.57 <u>High-Level Warning Devices (Flag Trees)</u>

Standard:

High-level warning devices shall not be used for TTC operations within the State of Delaware, unless approved by the Chief Traffic Engineer or designee. **DelDOT Rev.**

Option:

A high-level warning device (flag tree) may supplement other TTC devices in TTC zones.

Support:

A high-level warning device is designed to be seen over the top of typical passenger cars.

Standard:

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 2.4 m (8 ft). The flag shall be 400 mm (16 in) square or larger and shall be orange or fluorescent red-orange in color.

Option:

An appropriate warning sign may be mounted below the flags.

Support:

High-level warning devices are most commonly used in high-density road user situations to warn road users of short-term operations.

Section 6F.58 <u>Channelizing Devices</u>

Standard:

Designs of various channelizing devices shall be as shown in Figure 6F–7.

Support:

The function of channelizing devices is to warn road users of conditions created by work activities in or near the roadway and to guide road users. Channelizing devices include cones, tubular markers, vertical panels, drums, barricades, and temporary raised islands.

Channelizing devices provide for smooth and gradual vehicular traffic flow from one lane to another, onto a bypass or detour, or into a narrower traveled way. They are also used to separate vehicular traffic from the work space, pavement drop-offs, pedestrian or shared-use paths, or opposing directions of vehicular traffic.

Standard:

Devices used to channelize pedestrians shall be detectable to users of long canes and visible to persons having low vision.

Where barricades are used to channelize pedestrians, there shall be continuous detectable bottom and top rails with no gaps between individual barricades to be detectable to users of long

canes. The bottom of the bottom rail shall be no higher than 150 mm (6 in) above the ground surface. The top of the top rail shall be no lower than 900 mm (36 in) above the ground surface.

Option:

A gap not exceeding 150 mm (6 in) between the bottom rail and the ground surface may be used to facilitate drainage.

Standard:

If drums, cones, or tubular markers are used to channelize pedestrians, they shall be located such that there are no gaps between the bases of the devices, in order to create a continuous bottom, and the height of each individual drum, cone, or tubular marker shall be no less than 900 mm (36 in) to be detectable to users of long canes.

Guidance:

Channelizing devices should be constructed and ballasted to perform in a predictable manner when inadvertently struck by a vehicle. Channelizing devices should be crashworthy. Fragments or other debris from the device or the ballast should not pose a significant hazard to road users or workers.

The spacing of channelizing devices should not exceed a distance in meters (feet) equal to 0.2 times the speed limit in km/h (1.0 times the speed limit in mph) when used for taper channelization, and a distance in meters (feet) equal to 0.4 times the speed limit in km/h (2.0 times the speed limit in mph) when used for tangent channelization.

When channelizing devices have the potential of leading vehicular traffic out of the intended vehicular traffic space, the channelizing devices should be extended a distance in meters (feet) of 0.4 times the speed limit in km/h (2.0 times the speed limit in mph) beyond the end of the transition area.

Option:

Warning lights may be added to channelizing devices in areas with frequent fog, snow, or severe roadway curvature, or where visual distractions are present.

Standard:

Warning lights shall flash when placed on channelizing devices used alone, in a cluster to warn of a condition, or in a series to channelize road users. Steady-burn warning lights shall not be utilized.

Effective January 5, 2009, channelizing devices shall have prismatic retroreflective sheeting. The prismatic retroreflective material used on channelizing devices shall have a smooth, sealed outer surface that will display a similar color day or night.

DelDOT Rev.

Option:

The name and telephone number of the highway agency, contractor, or supplier may be shown on the nonretroreflective surface of all types of channelizing devices.

Standard:

The letters and numbers of the name and telephone number shall be nonretroreflective and not over 50 mm (2 in) in height.

Guidance:

Particular attention should be given to maintaining the channelizing devices to keep them clean, visible, and properly positioned at all times.

Standard:

Devices that are damaged or have lost a significant amount of their retroreflectivity and effectiveness shall be replaced.

Standard:

The spacing of channelizing devices used for tangent channelization shall be equal to 1.0 times the speed limit in mph and shall not exceed 15 m (50 ft).

The spacing of the first four channelizing devices in a series used for taper channelization shall not exceed 7.6 m (25 ft). The spacing of all other channelizing devices used for taper channelization shall be equal to 1.0 times the speed limit in mph but shall not exceed 15 m (50 ft).

DelDOT Rev.

Section 6F.59 <u>Cones</u>

Standard:

Cones (see Figure 6F-7, Sheet 1 of 2) shall be predominantly orange and shall be made of a material that can be struck without causing damage to the impacting vehicle. Cones shall be a minimum of 28 in. in height for all operations.

Cones shall not be used for nighttime operations. However, reflectorized cones may be used in lieu of drums for a single nighttime EMERGENCY OPERATION. For nighttime use, cones shall be retroreflectorized for maximum visibility. Retroreflectorization of cones that are 700 to 900 mm (28 to 36 in) in height shall be provided by a 150 mm (6 in) wide white band located 75 mm to 100 mm (3 to 4 in) from the top of the cone and an additional 100 mm (4 in) wide white band located approximately 50 mm (2 in) below the 150 mm (6 in) band. DelDOT Rev.

Retroreflectorization of cones that are more than 900 mm (36 in) in height shall be provided by horizontal, circumferential, alternating orange and white retroreflective stripes that are 100 to 150 mm (4 to 6 in) wide. Each cone shall have a minimum of two orange and two white stripes with the top stripe being orange. Any retroreflective spaces between the orange and white stripes shall not exceed 75 mm (3 in) in width.

For spacing of cones, refer to Section 6F.58.

If used, sand ballasts shall consist of sodium chloride amounting to five (5) percent by volume mixed with dry clean sand.

Option:

Traffic cones may be used to channelize road users, divide opposing vehicular traffic lanes, divide lanes when two or more lanes are kept open in the same direction, and delineate short duration maintenance and utility work.

Guidance:

Steps should be taken to minimize the possibility of cones being blown over or displaced by wind or moving vehicular traffic.

Cones should not be used for pedestrian channelization or as pedestrian barriers in TTC zones on or along sidewalks unless they are continuous between individual devices and detectable to users of long canes.

Option:

Cones may be doubled up to increase their weight.

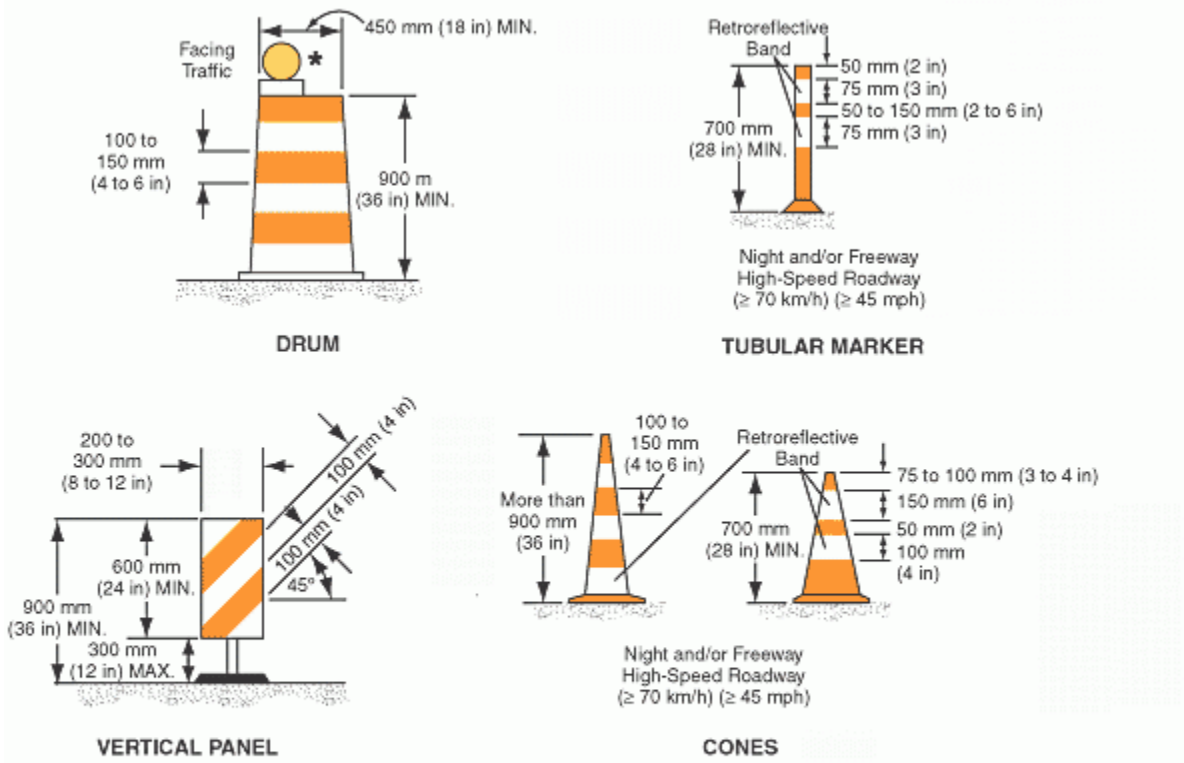
Support:

Some cones are constructed with bases that can be filled with ballast. Others have specially weighted bases, or weight such as sandbag rings that can be dropped over the cones and onto the base to provide added stability.

Guidance:

Ballast should be kept to the minimum amount needed.

Figure 6F-7. Channelizing Devices *(Sheet 1 of 2)*



* Warning lights shall not be utilized without approval of the Chief Traffic Engineer or designee

Note: If drums, cones, or tubular markers are used to channelize pedestrians, they shall be located such that there are no gaps between the bases of the devices, in order to create a continuous bottom, and the height of each individual drum, cone, or tubular marker shall be no less than 900 mm (36 in) to be detectable to users of long canes.

DelDOT Rev.

Section 6F.60 Tubular Markers

Standard:

Tubular markers (see Figure 6F-7, Sheet 1 of 2) shall be predominantly orange and shall be not less than 700 mm (28 in) high and 50 mm (2 in) wide facing road users. They shall be made of a material that can be struck without causing damage to the impacting vehicle.

For nighttime use, tubular markers shall be retroreflectorized. Retroreflectorization of 700 mm (28 in) or larger tubular markers shall be provided by two 75 mm (3 in) wide white bands placed a maximum of 50 mm (2 in) from the top with a maximum of 150 mm (6 in) between the bands.

If used, sand ballasts shall consist of sodium chloride amounting to five (5) percent by volume mixed with dry clean sand.

DelDOT Rev.

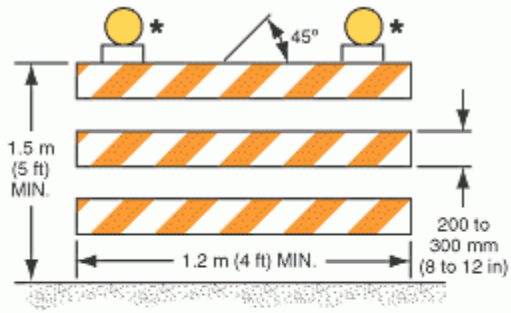
Guidance:

Tubular markers should not be used for pedestrian channelization or as pedestrian barriers in TTC zones on or along sidewalks unless they are continuous between individual devices and detectable to users of long canes.

Tubular markers have less visible area than other devices and should be used only where space restrictions do not allow for the use of other more visible devices.

Tubular markers should be stabilized by affixing them to the pavement, by using weighted bases, or weights such as sandbag rings that can be dropped over the tubular markers and onto the base to provide added stability. Ballast should be kept to the minimum amount needed.

Figure 6F-7. Channelizing Devices (Sheet 2 of 2)



TYPE III BARRICADE **

* Warning lights (optional)
** Rail stripe widths shall be 150 mm (6 in), except that 100 mm (4 in) wide stripes may be used if rail lengths are less than 900 mm (36 in). The sides of barricades facing traffic shall have retroreflective rail faces.

Notes: If barricades are used to channelize pedestrians, there shall be continuous detectable bottom and top rails with no gaps between individual barricades to be detectable to users of long canes. The bottom of the bottom rail shall be no higher than 150 mm (6 in) above the ground surface. The top of the top rail shall be no lower than 900 mm (36 in) above the ground surface.

Warning lights shall be mounted on vertical uprights. Warning lights shall not be mounted on rails.

DelDOT Rev.

Option:

Tubular markers may be used effectively to divide opposing lanes of road users, divide vehicular traffic lanes when two or more lanes of moving motor vehicle traffic are kept open in the same direction, and to delineate the edge of a pavement drop off where space limitations do not allow the use of larger devices.

Standard:

When a noncylindrical tubular marker is used, it shall be attached to the pavement in a manner such that the width facing road users meets the minimum requirements.

A tubular marker shall be attached to the pavement to display the minimum 50 mm (2 in) width to the approaching road users.

Section 6F.61 <u>Vertical Panels</u>

Standard:

Effective January 5, 2009, the vertical panel stripes shall utilize fluorescent orange and white prismatic retro reflective sheeting. DelDOT Rev.

Vertical panels (see Figure 6F-7, Sheet 1 of 2) shall be 200 to 300 mm (8 to 12 in) in width and at least 600 mm (24 in) in height. They shall have orange and white diagonal stripes and be retroreflectorized.

Vertical panels shall be mounted with the top a minimum of 900 mm (36 in) above the roadway.

Where the height of the vertical panel itself is 900 mm (36 in) or greater, a panel stripe width of 150 mm (6 in) shall be used.

Option:

Where the height of the vertical panel itself is less than 900 mm (36 in), a panel stripe width of 100 mm (4 in) may be used.

Standard:

Markings for vertical panels shall be alternating orange and white retroreflective stripes, sloping downward at an angle of 45 degrees in the direction vehicular traffic is to pass. Vertical panels used on freeways, expressways, and other high-speed roadways shall have a minimum of 169,000 mm² (270 in²) retroreflective area facing vehicular traffic.

Option:

Where space is limited, vertical panels may be used to channelize vehicular traffic, divide opposing lanes, or replace barricades.

Section 6F.62 <u>Drums</u>

Standard:

Effective January 5, 2009, the horizontal, circumferential markings on drums shall be made of fluorescent orange and white prismatic retro reflective sheeting.

Drums (see Figure 6F-7, Sheet 1 of 2) used for road user warning or channelization shall be constructed of lightweight, deformable materials. They shall be a minimum of 900 mm (36 in) in height and have at least a 450 mm (18 in) minimum width regardless of orientation. Metal drums shall not be used. The markings on drums shall be horizontal, circumferential, alternating fluorescent orange and white stripes 100 to 150 mm (4 to 6 in) wide. Each drum shall have a minimum of two fluorescent orange and two white stripes with the top stripe being fluorescent orange. Any nonretroreflectorized spaces between the horizontal fluorescent orange and white stripes shall not exceed 75 mm (3 in) wide. Drums shall have closed tops that will not allow collection of construction debris or other debris. DelDOT Rev.

One (1) amber Type B flashing light shall be installed on each of the first two (2) drums in a series used for channelization. One (1) amber Type B flashing light shall be installed on the drum at the end of the work space. If all drums meet the new sheeting requirements, lights are not required.

Drums shall not be weighted with sand, water, or any material to the extent that would make them hazardous to road users or workers when struck. Drums shall not be weighted with sand bags.

For spacing of drums, refer to Section 6F.58.

Support:

Drums are highly visible, have good target value, give the appearance of being formidable obstacles and, therefore, command the respect of road users. They are portable enough to be shifted from place to place within a TTC zone in order to accommodate changing conditions, but are generally used in situations where they will remain in place for a prolonged period of time.

Option:

Although drums are most commonly used to channelize or delineate road user flow, they may also be used alone or in groups to mark specific locations.

Guidance:

Drums should not be used for pedestrian channelization or as pedestrian barriers in TTC zones on or along sidewalks unless they are continuous between individual devices and detectable to users of long canes.

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. Drums used in regions susceptible to freezing should have drain holes in the bottom so that water will not accumulate and freeze causing a hazard if struck by a road user.

Standard:

Ballast shall not be placed on the top of a drum.

Section 6F.63 <u>Type I, II, or III Barricades</u>

Standard:

Type I and Type II Barricades shall not be used for Temporary Traffic Control operations within the State of Delaware. DelDOT Rev.

Type III Barricades (see Figure 6F-7, Sheet 2 of 2) used at a road closure shall be placed completely across a roadway or from curb to curb. DelDOT Rev.

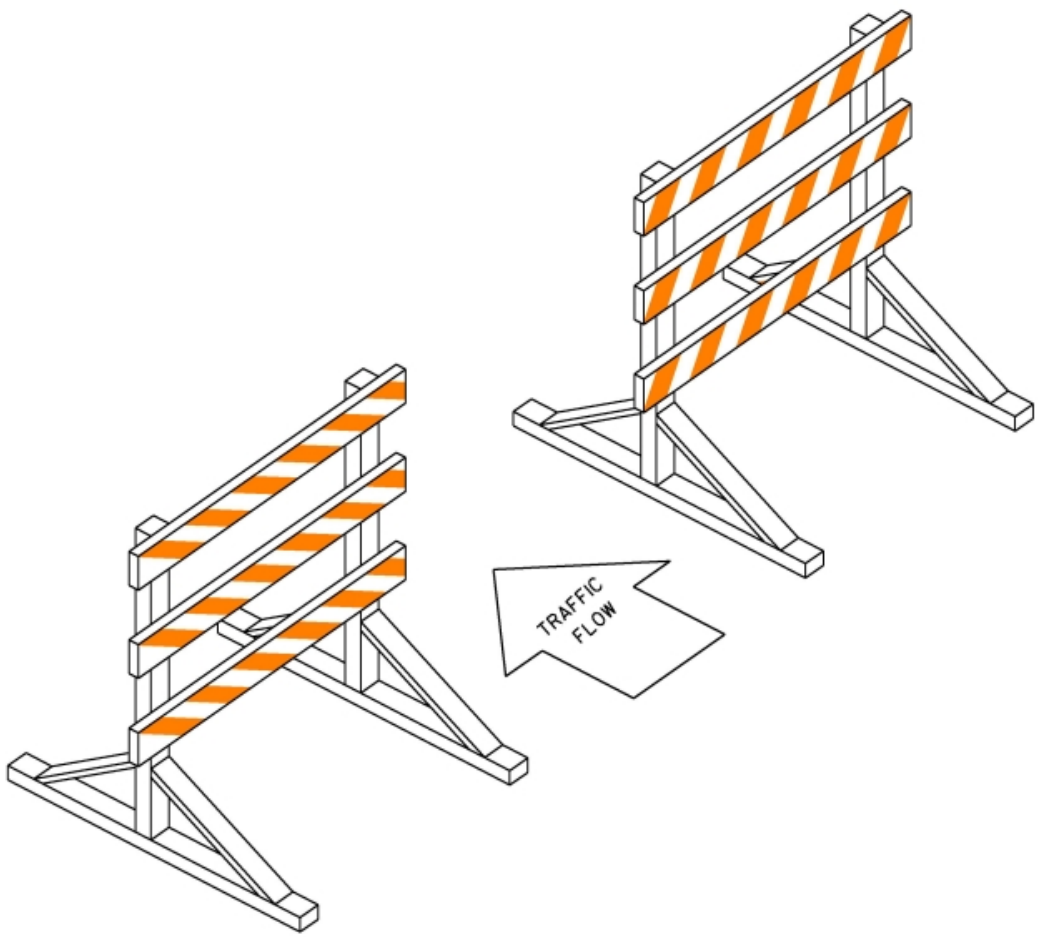
Support:

A barricade is a portable or fixed device having from one to three rails with appropriate markings and is used to control road users by closing, restricting, or delineating all or a portion of the right-of-way.

Standard:

Stripes on barricade rails shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass (See Figure 6F-8). The stripes shall be 150 mm (6 in) wide.

Figure 6F-8. Barricade Striping and Placement
(DelDOT MUTCD Only)



Standard:

The minimum length for Type III Barricades shall be 1,200 mm (48 in). Each barricade rail shall be 200 to 300 mm (8 to 12 in) wide. Barricades used on freeways, expressways, and other high-speed roadways shall have a minimum of 169,000 mm² (270 in²) of retroreflective area facing road users.

Guidance:

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.

Barricade rails should be supported in a manner that will allow them to be seen by the road user, and in a manner that provides a stable support that is not easily blown over or displaced.

The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 1500 mm (60 in) throughout the entire length of the pedestrian pathway, a 1500 x 1500 mm (60 x 60 in) passing space should be provided at least every 60 m (200 ft) to allow individuals in wheelchairs to pass.

Barricade rail supports should not project into pedestrian circulation routes more than 100 mm (4 in) from the support between 675 mm (27 in) and 2000 mm (80 in) from the surface as described in Section 4.4.1 of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11).

Guidance:

Barricades should be crashworthy as they are located adjacent to vehicular traffic flow and are subject to impact by errant vehicles.

On high-speed expressways or in other situations where barricades may be susceptible to overturning in the wind, ballasting should be used.

Option:

Sandbags may be placed on the lower parts of the frame or the stays of barricades to provide the required ballast.

Standard:

Ballast shall not be placed on top of any striped rail. Barricades shall not be ballasted by nondeformable objects such as rocks or chunks of concrete. Ballast shall not extend into the accessible passage width of 1,500 mm (60 in).

If used, sand ballasts shall consist of sodium chloride amounting to five (5) percent by volume mixed with dry clean sand.

Option:

Barricades may be used alone or in groups to mark a specific condition or they may be used in a series for channelizing road users.

Guidance:

Type III Barricades should be used on freeways and expressways or other high-speed roadways. Type III Barricades should be used to close or partially close a road.

Guidance:

Where provision is made for access of authorized equipment and vehicles, the responsibility for Type III Barricades should be assigned to a person who will provide proper closure at the end of each work day.

Support:

When a highway is legally closed but access must still be allowed for local road users, barricades usually are not extended completely across the roadway.

Standard:

A sign (see Section 6F.09) shall be installed with the appropriate legend concerning permissible use by local road users. Adequate visibility of the barricades from both directions shall be provided.

Option:

Signs may be installed on barricades (see Section 6F.03).

Section 6F.64 This section not used

DelDOT Rev.

Section 6F.65 <u>Temporary Traffic Barriers as Channelizing Devices</u>

Support:

Temporary traffic barriers are not TTC devices in themselves; however, when placed in a position identical to a line of channelizing devices and marked and/or equipped with appropriate channelization features to provide guidance and warning both day and night, they serve as TTC devices.

Standard:

Temporary traffic barriers serving as TTC devices shall conform to requirements for such devices as set forth throughout Part 6.

Temporary traffic barriers shall not be used solely to channelize road users, but also to protect the work space (see Section 6F.81). If used to channelize vehicular traffic, the temporary traffic barrier shall be supplemented with delineation, pavement markings, or channelizing devices for improved daytime and nighttime visibility.

Guidance:

Temporary traffic barriers should not be used for a merging taper except in low-speed urban areas. Temporary traffic barriers should not be used for a constricted/restricted TTC zone.

When it is necessary to use a temporary traffic barrier for a merging taper in low-speed urban areas or for a constricted/restricted TTC zone, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.

When used for channelization, temporary traffic barriers should be of a light color for increased visibility.

Section 6F.66 <u>Longitudinal Channelizing Barricades</u>

Support:

Longitudinal channelizing barricades are lightweight, deformable channelizing devices that can be used singly as Type I, II, or III barricades, or connected so they are highly visible and have good target value.

Guidance:

When used as a barricade, longitudinal channelizing barricades should conform to the general size, color, stripe pattern, retroreflectivity, and placement characteristics established for the devices described in Chapter 6F.

Option:

Longitudinal channelizing barricades may be used instead of a line of cones, drums, or barricades.

Longitudinal channelizing barricades may be hollow and filled with water as a ballast.

Guidance:

If used, longitudinal channelizing barricades should be interlocked to delineate or channelize flow including pedestrian traffic control. The interlocking barricade wall should not have gaps that allow pedestrians or vehicles to stray from the channelizing path.

Support:

Longitudinal channelizing barricades are often located adjacent to traffic and therefore are subject to impact by errant vehicles.

Guidance:

Because of their vulnerable position, longitudinal channelizing barricades should be constructed of lightweight materials and be crashworthy.

Although longitudinal channelizing barricades might give the appearance of being formidable obstacles, they have not met the crashworthy requirements for temporary traffic barriers and, therefore, should not be used to shield pedestrians, including workers, from vehicle impacts or obstacles.

Option:

Longitudinal channelizing barricades may be used to channelize pedestrians.

Section 6F.67 Other Channelizing Devices

Option:

Channelizing devices other than those described in this Chapter may be used in special situations based on an engineering study.

Guidance:

Other channelizing devices should conform to the general size, color, stripe pattern, retroreflection, and placement characteristics established for the devices described in this Chapter.

Section 6F.68 Detectable Edging for Pedestrians

Support:

Individual channelizing devices, tape or rope used to connect individual devices, other discontinuous barriers and devices, and pavement markings are not detectable by persons with visual disabilities and are incapable of providing detectable path guidance on temporary or realigned sidewalks or other pedestrian facilities.

Guidance:

When it is determined that a facility should be accessible to and detectable by pedestrians with visual disabilities, a continuously detectable edging should be provided throughout the length of the facility such that it can be followed by pedestrians using long canes for guidance. This edging should protrude at least 150 mm (6 in) above the surface of the sidewalk or pathway, with the bottom of the edging a maximum of 62 mm (2.5 in) above the surface. This edging should be continuous throughout the length of the facility except for gaps at locations where pedestrians or vehicles will be turning or crossing. This edging should consist of a prefabricated or formed-in-place curbing or other continuous device that is placed along the edge of the sidewalk or walkway. This edging should be firmly attached to the ground or to other devices. Adjacent sections of this edging should be interconnected such that the edging is not displaced by pedestrian or vehicular traffic or work operations, and such that it does not constitute a hazard to pedestrians, workers, or other road users.

Support:

Examples of detectable edging for pedestrians include:

A. Prefabricated lightweight sections of plastic, metal, or other suitable materials that are interconnected and fixed in place to form a continuous edge.
B. Prefabricated lightweight sections of plastic, metal, or other suitable materials that are interconnected, fixed in place, and placed at ground level to provide a continuous connection between channelizing devices located at intervals along the edge of the sidewalk or walkway.
C. Sections of lumber interconnected and fixed in place to form a continuous edge.
D. Formed-in-place asphalt or concrete curb.
E. Prefabricated concrete curb sections that are interconnected and fixed in place to form a continuous edge.
F. Continuous temporary traffic barrier or longitudinal channelizing barricades placed along the edge of the sidewalk or walkway that provides a pedestrian edging at ground level.
G. Chain link or other fencing equipped with a continuous bottom rail.

Guidance:

Detectable pedestrian edging should be orange, white, or yellow and should match the color of the adjacent channelizing devices or traffic control devices, if any are present.

Section 6F.69 Temporary Raised Islands

Standard:

Temporary raised islands shall be used only in combination with pavement striping and other suitable channelizing devices.

Option:

A temporary raised island may be used to separate vehicular traffic flows in two-lane, two-way operations on roadways having a vehicular traffic volume range of 4,000 to 15,000 average daily traffic (ADT) and on freeways having a vehicular traffic volume range of 22,000 ADT to 60,000 ADT.

Temporary raised islands also may be used in other than two-lane, two-way operations where physical separation of vehicular traffic from the TTC zone is not required.

Guidance:

Temporary raised islands should have the basic dimensions of 100 mm (4 in) high by at least 450 mm (18 in) wide and have rounded or chamfered corners.

The temporary raised islands should not be designed in such a manner that they would cause a motorist to lose control of the vehicle if the vehicle inadvertently strikes the temporary raised island. If struck, pieces of the island should not be dislodged to the extent that they could penetrate the occupant compartment or involve other vehicles.

Standard:

At pedestrian crossing locations, temporary raised islands shall have an opening or be shortened to provide at least a 1,500 mm (60 in) wide pathway for the crossing pedestrian.

Section 6F.70 Opposing Traffic Lane Divider

Support:

Opposing traffic lane dividers are delineation devices used as center lane dividers to separate opposing vehicular traffic on a two-lane, two-way operation.

Standard:

Opposing traffic lane dividers shall not be placed across pedestrian crossings.

The Opposing Traffic Lane Divider (W6-4) sign (see Figure 6F-4, Sheet 2 of 4) is an upright, retroreflective orange-colored sign placed on a flexible support and sized at least 300 mm (12 in) wide by 450 mm (18 in) high.

Section 6F.71 Pavement Markings

Standard:

The provisions of this Section shall not be considered applicable for short-term, mobile, or incident management TTC zones.

Pavement markings shall be maintained along paved streets and highways in all long- and intermediate-term stationary (see Section 6G.02) TTC zones. All pavement markings shall be in accordance with Chapters 3A and 3B, except as indicated in Section 6F.72. Pavement markings shall match the markings in place at both ends of the TTC zone. 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.

Warning signs, channelizing devices, and delineation shall be used to indicate required road user paths in TTC zones where it is not possible to provide a clear path by pavement markings. All pavement markings and devices used to delineate road user paths shall be carefully reviewed during daytime and nighttime periods.

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.

Guidance:

Road users should be provided pavement markings within a TTC zone comparable to the pavement markings normally maintained along such roadways, particularly at either end of the TTC zone.

The intended vehicle path should be defined in day, night, and twilight periods under both wet and dry pavement conditions.

The work should be planned and staged to provide for the placement and removal of the pavement markings.

Markings should be provided in intermediate-term stationary work zones.

Option:

Removable, nonreflective, preformed tape may be used where markings need to be covered temporarily.

Section 6F.72 Temporary Pavement Markings

Support:

Temporary 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 Part 3 standards for pavement markings.

Guidance:

Temporary pavement markings should not be in place for more than 2 weeks unless justified by an engineering study.

Standard:

All temporary pavement markings, including pavement markings for no-passing zones, shall conform to the requirements of Chapters 3A and 3B. All temporary broken-line pavement markings shall use the same cycle length as permanent markings and be at least 0.6 m (2 ft) long.

Option:

Half-cycle lengths with a minimum of 0.6 m (2 ft) stripes may be used on roadways with severe curvature (see Section 3A.05) for centerlines in passing zones and for 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) sign (see Sections 2B.29, 2B.30, and 2C.35) rather than pavement markings. Also, the DO NOT PASS sign may be used instead of pavement markings on roads with low volumes for longer periods in accordance with the State's or highway agency's policy. **DelDOT Rev.**

Guidance:

If used, the DO NOT PASS sign should be placed in accordance with Sections 2B.29, 2B.30, and 2C.35.

The temporary use of edge lines, channelizing lines, lane reduction transitions, gore markings, and other longitudinal markings, and the various nonlongitudinal markings (such as stop lines, railroad crossings, crosswalks, words or symbols) should be in accordance with the State's or highway agency's policy.

Section 6F.73 Raised Pavement Markers

Standard:

If raised pavement markers are used to substitute for broken line segments, at least two retroreflective markers shall be placed, one at each end of a segment of 0.6 to 1.5 m (2 to 5 ft) in length. For segments longer than 1.5 m (5 ft), a group of at least three retroreflective markers shall be equally spaced at no greater than N/8 (see Section 3B.11). The value of N for a broken or dotted line shall equal the length of one line segment plus one gap. The value of N referenced for solid

lines shall equal the N for the broken or dotted lines that might be adjacent to or might extend the solid lines (see Sections 3B.13 and 3B.14).

Guidance:

Raised pavement markers should be considered for use along surfaced detours or temporary roadways, and other changed or new travel-lane alignments.

Option:

Retroreflective or internally illuminated raised pavement markers, or nonretroreflective raised pavement markers supplemented by retroreflective or internally illuminated markers, may replace or supplement markings prescribed in Chapters 3A and 3B.

Section 6F.74 Delineators

Standard:

When used, delineators shall combine with or supplement other TTC devices. They shall be mounted on crashworthy supports so that the reflecting unit is approximately 1.2 m (4 ft) above the near roadway edge. The standard color for delineators used along both sides of two-way streets and highways and the right side of one-way roadways shall be white. Delineators used along the left side of one-way roadways shall be yellow.

Guidance:

Spacing along roadway curves should be as set forth in Section 3D.04 and should be such that several delineators are always visible to the driver.

Option:

Delineators may be used in TTC zones to indicate the alignment of the roadway and to outline the required vehicle path through the TTC zone.

Section 6F.75 Lighting Devices

Guidance:

Lighting devices should be provided in TTC zones based on engineering judgment.

When used to supplement channelization, the maximum spacing for warning lights should be identical to the channelizing device spacing requirements.

On expressways and other high volume, high speed roadways (above 45 mph), any and all vehicles within the clear zone should be equipped with and display flashing lights, such as a light bar. **DelDOT Rev.**

Support:

Four types of lighting devices are commonly used in TTC zones. They are floodlights, flashing warning beacons, warning lights, and steady-burn electric lamps.

Option:

Lighting devices may be used to supplement retroreflectorized signs, barriers, and channelizing devices.

During normal daytime maintenance operations, the functions of flashing warning beacons may be provided by high-intensity rotating, flashing, oscillating, or strobe lights on a maintenance vehicle.

Standard:

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.

Flashing lights shall be either a separate large rotating amber beacon or a strobe light. Flashing lights shall be mounted on the vehicle in such a manner as to be clearly visible for 360 degrees around the vehicle. The flashing lights shall be visible from a distance of not less than 914 m (3,000 ft) under normal atmospheric conditions at night. **DelDOT Rev.**

Section 6F.76 Floodlights

Support:

Utility, maintenance, or construction activities on highways are frequently conducted during nighttime periods when vehicular traffic volumes are lower. Large construction projects are sometimes operated on a double-shift basis requiring night work (see Section 6G.20).

Guidance:

When nighttime work is being performed, floodlights should be used to illuminate the work area, equipment crossings, and other areas.

Standard:

Except in emergency situations, flagger stations shall be illuminated at night.

Floodlighting shall not produce a disabling glare condition for approaching road users, flaggers, or workers.

Guidance:

The adequacy of the floodlight placement and elimination of potential glare should be determined by driving through and observing the floodlighted area from each direction on all approaching roadways after the initial floodlight setup, at night, and periodically.

Support:

Desired illumination levels vary depending upon the nature of the task involved. An average horizontal luminance of 50 lux (5 foot candles) can be adequate for general activities. Tasks requiring high levels of precision and extreme care can require an average horizontal luminance of 216 lux (20 foot candles).

Section 6F.77 Flashing Warning Beacons

Support:

Flashing warning beacons are often used to supplement a TTC device.

Standard:

Flashing warning beacons shall comply with the provisions of Chapter 4K. A flashing warning beacon shall be a flashing yellow light with a minimum nominal diameter of 200 mm (8 in).

Guidance:

Flashing warning beacons should be operated 24 hours per day.

Support:

The temporary terminus of a freeway is an example of a location where flashing warning beacons alert drivers to the changing roadway conditions and the need to reduce speed in transitioning from the freeway to another roadway type.

Section 6F.78 Warning Lights

Support:

Type B warning lights are portable, powered, yellow, lens-directed, enclosed lights.

Standard:

Warning lights shall be in accordance with the current ITE "Purchase Specification for Flashing and Steady-Burn Warning Lights" (see Section 1A.11). DelDOT Rev.

When warning lights are used, they 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.

Guidance:

The maximum spacing for warning lights should be identical to the channelizing device spacing requirements.

Support:

The light weight and portability of warning lights are advantages that make these devices useful as supplements to the retroreflectorization on signs and channelizing devices. The flashing lights are effective in attracting road users' attention.

Option:

Warning lights may be used in either a steady-burn or flashing mode.

Standard:

Flashing warning lights shall not be used for delineation, as a series of flashers fails to identify the desired vehicle path.

Type B High-Intensity Flashing warning lights shall be maintained so as to be capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 300 m (1,000 ft). DelDOT Rev.

Warning lights shall have a minimum mounting height of 750 mm (30 in) to the bottom of the lens.

Support:

Type B High-Intensity Flashing warning lights are used to warn road users during both daylight and nighttime hours that they are approaching a potentially hazardous area.

Option:

Type B warning lights are designed to operate 24 hours per day and may be mounted on advance warning signs or on independent supports. DelDOT Rev.

Section 6F.79 This section not used

Section 6F.80 <u>Temporary Traffic Control Signals</u>

Standard:

Temporary traffic control signals (see Section 4D.20) used to control road user movements through TTC zones and in other TTC situations shall meet the applicable provisions of Part 4.

Support:

Temporary traffic control signals are typically used in TTC zones such as temporary haul road crossings; temporary one-way operations along a one-lane, two-way highway; temporary one-way operations on bridges, reversible lanes, and intersections.

Standard:

One-lane, two-way vehicular traffic flow (see Chapter 4G) requires an all-red interval of sufficient duration for road users to clear the portion of the TTC zone controlled by the traffic control signals. Safeguards shall be incorporated to avoid the possibility of conflicting signal indications at each end of the TTC zone.

Guidance:

Where pedestrian traffic is detoured to a temporary traffic control signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals (see Section 4E.06) are needed for crossing along an alternate route.

When temporary traffic control signals are used, conflict monitors typical of traditional traffic control signal operations should be used.

Option:

Temporary traffic control signals may be portable or temporarily mounted on fixed supports.

Standard:

The supports for temporary traffic control signals shall not encroach into the minimum required width of a "pedestrian access route" of 1200 mm (48 in) or an "alternate circulation path" of 900 mm (36 in).

Guidance:

Temporary traffic control signals should only be used in situations where temporary traffic control signals are preferable to other means of traffic control, such as changing the work staging or work zone size to eliminate one-way vehicular traffic movements, using flaggers to control one-way or crossing movements, using STOP or YIELD signs, and using warning devices alone.

Support:

Factors related to the design and application of temporary traffic control signals include the following:

A. Safety and road user needs;
B. Work staging and operations;
C. The feasibility of using other TTC strategies (for example, flaggers, providing space for two lanes, or detouring road users, including bicyclists and pedestrians);
D. Sight distance restrictions;
E. Human factors considerations (for example, lack of driver familiarity with temporary traffic control signals);
F. Road-user volumes including roadway and intersection capacity;
G. Affected side streets and driveways;
H. Vehicle speeds;
I. The placement of other TTC devices;
J. Parking;
K. Turning restrictions;
L. Pedestrians;
M. The nature of adjacent land uses (such as residential or commercial);
N. Legal authority;
O. Signal phasing and timing requirements;
P. Full-time or part-time operation;
Q. Actuated, fixed-time, or manual operation;
R. Power failures or other emergencies;
S. Inspection and maintenance needs;
T. Need for detailed placement, timing, and operation records; and
U. Operation by contractors or by others.

Although temporary traffic control signals can be mounted on trailers or lightweight portable supports, fixed supports offer superior resistance to displacement or damage by severe weather, vehicle impact, and vandalism.

Guidance:

Other TTC devices should be used to supplement temporary traffic control signals, including warning and regulatory signs, pavement markings, and channelizing devices.

The design and placement of temporary traffic control signals should include interconnection to other traffic control signals along the subject roadway.

Temporary traffic control signals not in use should be covered or removed.

Section 6F.81 <u>Temporary Traffic Barriers</u>

Standard:

Before installation, temporary portland cement concrete traffic barrier shall be painted white on side adjacent to traffic unless otherwise directed by the Chief Traffic Engineer or designee. The barrier shall be painted white every March, July, and November unless otherwise directed by the Chief Traffic Engineer or designee. The white painted surface(s) of the barrier shall be cleaned once a month while construction is active unless otherwise directed by the Chief Traffic Engineer or designee. Cleaning of the barrier in winter months shall be completed in a manner that does not create ice on the roadway.

Temporary plastic traffic barrier shall be cleaned once a month while construction is active unless otherwise directed by the Chief Traffic Engineer or designee.

DelDOT Rev.

Temporary traffic barrier shall be offset a minimum of 0.3 m (1 ft) from the travelway.

Lengths of run of temporary traffic barriers shall be in accordance with manufacturer's recommendations.

For roadways with a posted speed greater than 30 mph, end protection shall be provided on barrier if the end of barrier is less than 9.1 m (30 ft) from the travelway. In such conditions, an impact attenuator or crash cushion shall be installed.

For roadways with a posted speed of 30 mph or less, a tapered end shall be installed if the end of barrier is less than 9.1 m (30 ft) from the roadway, unless otherwise directed by the Chief Traffic Engineer or designee. DelDOT Rev.

Storage of temporary traffic barrier shall be in accordance with Section 6G.22.

If the lead end of barrier is protected by an attenuating device, there shall be two (2) amber Type B flashing lights mounted horizontally at least 0.6 m (2 ft) apart on the lead end of the actual barrier. Batteries for the Type B lights shall be mounted on top of the barrier or shall be located on the work zone side of the barrier.

Non-directional reflective panels shall be used in lieu of Type C lights on temporary traffic barrier at 15 m (50 ft) intervals.

Support:

Temporary traffic barriers are devices designed to help prevent penetration by vehicles while minimizing injuries to vehicle occupants, and are designed to protect workers, bicyclists, and pedestrians.

The four primary functions of temporary traffic barriers are:

A. To keep vehicular traffic from entering work areas, such as excavations or material storage sites;
B. To separate workers, bicyclists, and pedestrians from motor vehicle traffic;
C. To separate opposing directions of vehicular traffic; and
D. To separate vehicular traffic, bicyclists, and pedestrians from the work area such as false work for bridges and other exposed objects.

Option:

Temporary traffic barriers, including shifting portable or movable barrier installations to accommodate varying directional vehicular traffic demands, may be used to separate two-way vehicular traffic.

Guidance:

Because the protective requirements of a TTC situation have priority in determining the need for temporary traffic barriers, their use should be based on an engineering study. When serving the additional function of channelizing vehicular traffic (see Section 6F.65), temporary traffic barriers should be a light color for increased visibility.

Standard:

Temporary traffic barriers shall be supplemented with standard delineation, pavement markings, or channelizing devices for improved daytime and nighttime visibility if they are used to channelize vehicular traffic. The delineation color shall match the applicable pavement marking color.

In order to mitigate the effect of striking the end of a temporary traffic barrier, the end shall be installed in accordance with AASHTO's "Roadside Design Guide" (see Section 1A.11) by flaring until the end is outside the acceptable clear zone or by providing crashworthy end treatments.

Option:

Warning lights or steady-burn electric lamps may be mounted on temporary traffic barrier installations.

Support:

A movable barrier is a linear system of connected barrier segments that can rapidly be shifted laterally by using a specially designed transfer vehicle. The transfer is accomplished in a manner that does not interfere with vehicular traffic in adjacent lanes. Applications of movable barriers include the following:

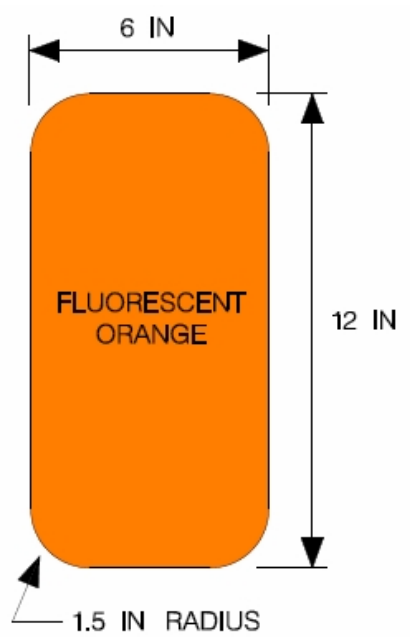
A. Closing an additional lane during work periods while maintaining the advantage of having the travel way separated from the work space by a barrier;
B. Closing an additional lane during off-peak periods to provide extra space for work activities without adversely impacting vehicular traffic flow; and
C. Creating a temporary reversible lane, thus providing unbalanced capacity favoring the major direction of vehicular traffic flow.

More specific information on the use of temporary traffic barriers is contained in Chapters 8 and 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11).

Standard:

Each Non-directional Reflective Panel shall be 150 mm (6 in) wide and 300 mm (12 in) high with rounded corners. The Non-directional Reflective Panel shall have fluorescent orange, prismatic retroreflective sheeting on both sides (See Figure 6F-9). DelDOT Rev.

Figure 6F-9. Retroreflective Panel
(DelDOT MUTCD Only)



When used, at least six (6) reflective panels shall be used in every case. The first reflective panel shall be mounted within 3 m (10 ft) of the Type B lights.

If all reflective panels meet the new sheeting requirements, Type B warning lights shall not be utilized, and additional panels shall be installed in place of Type B warning lights.

Under conditions where attenuating devices are not required to protect the lead end, the first non-directional reflective panel shall be mounted on the first element of the barrier. On a taper when the taper reaches a point which is less than 4.6 m (15 ft) from the travelway, reflective panels shall be used on temporary traffic barrier at 15 m (50 ft). At least six (6) reflective panels shall be used in every case. DelDOT Rev.

The panels shall be attached to the temporary traffic barrier in such a manner as to prevent accidental removal. Bolts or epoxy based adhesives shall be used. All other methods shall be approved by the Chief Traffic Engineer or designee.

Section 6F.82 Crash Cushions

Support:

Crash cushions are systems that mitigate the effects of errant vehicles that strike obstacles, either by smoothly decelerating the vehicle to a stop when hit head-on, or by redirecting the errant vehicle. The two types of crash cushions that are used in TTC zones are stationary crash cushions and truck-mounted attenuators. Crash cushions in TTC zones help protect the drivers from the exposed ends of barriers, fixed objects, shadow vehicles, and other obstacles. Specific information on the use of crash cushions can be found in AASHTO's "Roadside Design Guide" (see Section 1A.11).

Standard:

Crash cushions shall be crashworthy. They shall also be designed for each application to stop or redirect errant vehicles under prescribed conditions. Crash cushions shall be periodically inspected to verify that they have not been hit or damaged. Damaged crash cushions shall be promptly repaired or replaced to maintain their crashworthiness.

Crash cushions shall not be used to split traffic, unless otherwise directed by the Chief Traffic Engineer or designee.

Crash cushions shall be installed prior to the work crew leaving the barrier installation operation work area. A barrier installation operation work area shall be defined as one continuous length of barrier. Therefore, if multiple barriers requiring crash cushions are being installed during a single work period or during a continuous operation, the crash cushion for each barrier shall be installed before installing subsequent barriers. Construction work forces shall not leave the operation work area at the end of the work period until the crash cushion is properly installed.

Option:

Truck-mounted attenuators may be used in place of crash cushions only during a barrier installation operation. **DelDOT Rev.**

Truck-mounted Attenuators

Standard:

Truck-mounted attenuators shall be required on all limited access highways and on all highways which have four or more lanes with posted speeds of 45 MPH or greater, for the following operations: pavement marking, roadside spraying, patching, rotomilling, sweeping, temporary traffic barrier placement, or any other situation where the Chief Traffic Engineer or designee feels such protection is warranted.

All vehicles equipped with a Truck-mounted attenuator shall also be equipped with an arrow panel (See Section 6F.56).

Support:

Stationary crash cushions are used in the same manner as permanent highway installations to protect drivers from the exposed ends of barriers, fixed objects, and other obstacles.

Option:

Truck-mounted attenuators may be employed whenever construction, utility, or maintenance activities within 3 m (10 ft) of the travelway, not protected by safety barriers, present a hazard to motorists or the workers as determined by the Chief Traffic Engineer or designee. **DelDOT Rev.**

Standard:

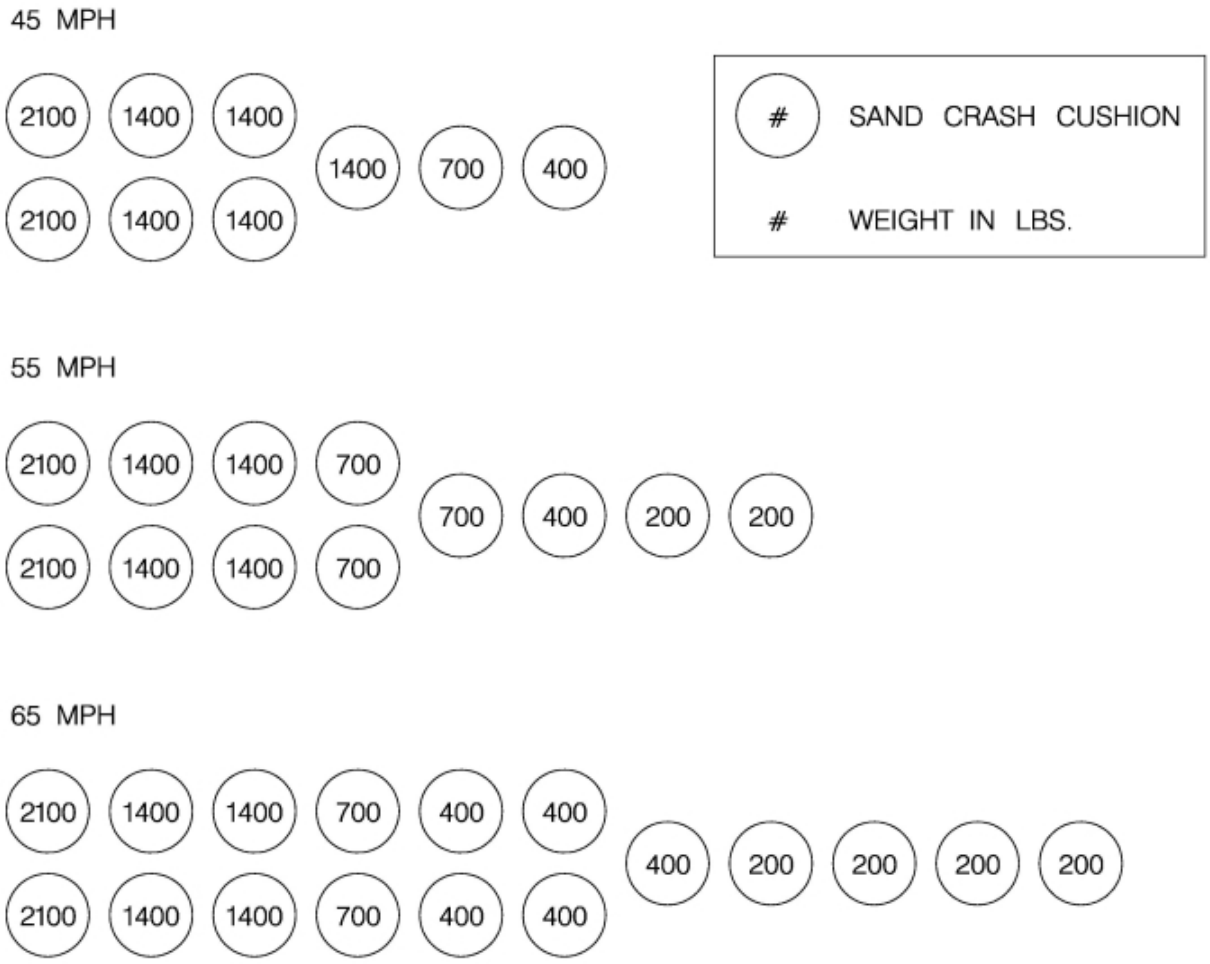
Sand crash cushions shall be designed for the specific application intended. **DelDOT Rev.**

Truck-mounted attenuators shall be energy-absorbing devices attached to the rear of shadow trailers or trucks. If used, the shadow vehicle with the attenuator shall be located in advance of the work area, workers, or equipment to reduce the severity of rear-end crashes from errant vehicles.

Sand crash cushions shall be designed according to manufacturer's recommendations. **DelDOT Rev.**

Sand in crash cushions shall consist of sodium chloride amounting to five (5) percent by volume mixed with dry clean sand.

Figure 6F-10. Typical Sand Crash Cushion Arrays
(DelDOT MUTCD Only)



Configurations shown are only typical arrays. Actual designs shall be based on manufacturer's recommendations.

Support:

Trucks or trailers are often used as shadow vehicles to protect workers or work equipment from errant vehicles. These shadow vehicles are normally equipped with flashing arrows, changeable message signs, and/or high-intensity rotating, flashing, oscillating, or strobe lights located properly in advance of the workers and/or equipment that they are protecting. However, these shadow vehicles might themselves cause injuries to occupants of the errant vehicles if they are not equipped with truck-mounted attenuators.

Guidance:

The shadow truck should be positioned a sufficient distance in advance of the workers or equipment being protected so that there will be sufficient distance, but not so much so that errant vehicles will travel around the shadow truck and strike the protected workers and/or equipment.

Support:

Chapter 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11) contains additional information regarding the use of shadow vehicles.

Guidance:

If used, the truck-mounted attenuator should be used in accordance with the manufacturer's specifications.

Section 6F.83 Vehicle-Arresting Systems

Support:

Vehicle-arresting systems are designed to prevent penetration into activity areas while providing for smooth, reasonably safe deceleration for the errant vehicles. They can consist of portable netting, cables, and energy-absorbing anchors.

Guidance:

When used, a vehicle-arresting system should be used in accordance with the manufacturer's specifications, and should be located so that vehicles are not likely to penetrate the location that the system is designed to protect.

Section 6F.84 Rumble Strips

Support:

Transverse rumble strips consist of intermittent narrow, transverse areas of rough-textured or slightly raised or depressed road surface that extend across the travel lanes to alert drivers to unusual vehicular traffic conditions. Through noise and vibration they attract the driver's attention to such features as unexpected changes in alignment and to conditions requiring a stop.

Longitudinal rumble strips consist of a series of rough-textured or slightly raised or depressed road surfaces located along the shoulder to alert road users that they are leaving the travel lanes.

Standard:

If it is desirable to use a color other than the color of the pavement for a longitudinal rumble strip, the color of the rumble strip shall be the same color as the longitudinal line the rumble strip supplements.

If the color of a transverse rumble strip used within a travel lane is not the color of the pavement, the color of the rumble strip shall be white.

Option:

Intervals between transverse rumble strips may be reduced as the distance to the approached conditions is diminished in order to convey an impression that a closure speed is too fast and/or that an action is imminent. A sign warning drivers of the onset of rumble strips may be placed in advance of any transverse rumble strip installation.

Guidance:

Transverse rumble strips should be placed transverse to vehicular traffic movement. They should not adversely affect overall pavement skid resistance under wet or dry conditions.

In urban areas, even though a closer spacing might be warranted, transverse rumble strips should be designed in a manner that does not promote unnecessary braking or erratic steering maneuvers by road users.

Transverse rumble strips should not be placed on sharp horizontal or vertical curves.

Rumble strips should not be placed through pedestrian crossings or on bicycle routes.

Transverse rumble strips should not be placed on roadways used by bicyclists unless a minimum clear path of 1.2 m (4 ft) is provided at each edge of the roadway or on each paved shoulder as described in AASHTO's "Guide to the Development of Bicycle Facilities" (see Section 1A.11).

Longitudinal rumble strips should not be placed on the shoulder of a roadway that is used by bicyclists unless a minimum clear path of 1.2 m (4 ft) is also provided on the shoulder.

Sections 6F.85 Screens

Support:

Screens are used to block the road users' view of activities that can be distracting. Screens might improve safety and motor vehicle traffic flow where volumes approach the roadway capacity because they discourage gawking and reduce headlight glare from oncoming motor vehicle traffic.

Guidance:

Screens should not be mounted where they could adversely restrict road user visibility and sight distance and adversely affect the reasonably safe operation of vehicles.

Option:

Screens may be mounted on the top of temporary traffic barriers that separate two-way motor vehicle traffic.

Guidance:

Design of screens should be in accordance with Chapter 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11).

Section 6F.86 Future and Experimental Devices

Support:

The States, FHWA, AASHTO, the Transportation Research Board, and other organizations conduct research and experimentation on new traffic control and safety devices. Users of this Manual are encouraged to stay abreast of these current efforts and to use such devices with care so as to avoid presenting road users with unusual or confusing situations that might be abnormal or unexpected.

Standard:

New traffic control devices shall conform to the provisions for design, use, and application set forth in this Manual. New traffic control devices that do not conform with the provisions in this Manual shall be subject to experimentation, documentation, and adoption following the provisions of Section 1A.10.

CHAPTER 6G. TYPE OF TEMPORARY TRAFFIC CONTROL ZONE ACTIVITIES

Section 6G.01 Cases

DelDOT Rev.

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

Each TTC zone is different. Many variables, such as location of work, highway type, geometrics, vertical and horizontal alignment, intersections, interchanges, road user volumes, road vehicle mix (buses, trucks, and cars), and road user speeds affect the needs of each zone. The goal of TTC in work zones is safety with minimum disruption to road users. The key factor in promoting TTC zone safety is proper judgment.

Cases of TTC zones are organized according to duration, location, type of work, and highway type. Table 6H-1 is an index of these Cases. These Cases include the use of various TTC methods, but do not include a layout for every conceivable work situation.

Guidance:

Cases should be altered, when necessary, to fit the conditions of a particular TTC zone.

Option:

Other devices may be added to supplement the devices shown in the Cases, while others may be deleted. The sign spacings and taper lengths may be increased to provide additional time or space for driver response.

Support:

Decisions regarding the selection of the most appropriate typical application to use as a guide for a specific TTC zone require an understanding of each situation. Although there are many ways of categorizing TTC zone applications, the four factors mentioned earlier (work duration, work location, work type, and highway type) are used to characterize the Cases illustrated in Chapter 6H.

Section 6G.02 Work Duration

Support:

Chapter 6D and Sections 6F.68 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

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

Standard:

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

A. Long-term stationary is work that occupies a location more than 3 days.
B. Intermediate-term stationary is work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.
C. Short-term stationary is daytime work that occupies a location for more than 1 hour within a single daylight period.
D. Short duration is work that occupies a location up to 1 hour.
E. Mobile is work that moves intermittently or continuously.

Support:

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

Standard:

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

Guidance:

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

Support:

In intermediate-term stationary TTC zones, it might 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. In other instances, there might be insufficient pay-back time to economically justify more elaborate TTC measures.

Standard:

Since intermediate-term operations extend into nighttime, retroreflective and/or illuminated devices shall be used in intermediate-term stationary TTC zones.

Support:

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

As compared to stationary operations, mobile and short-duration operations are activities that might involve different treatments. Devices having greater mobility might be necessary such as signs mounted on trucks. Devices that are larger, more imposing, or more visible can be used effectively and economically. The mobility of the TTC zone is important.

Maintaining reasonably safe work and road user conditions is a paramount goal in carrying out mobile operations.

Guidance:

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

Option:

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

Support:

During short-duration work, it often takes longer to set up and remove the TTC zone than to perform the work. Workers face hazards in setting up and taking down the TTC zone. Also, since the work time is short, delays affecting road users are significantly increased when additional devices are installed and removed.

Option:

Considering these factors, simplified control procedures may be warranted for short-duration work. A reduction in the number of devices may be offset by the use of other more dominant devices such as high-intensity rotating, flashing, oscillating, or strobe lights on work vehicles.

Support:

Mobile operations often involve frequent short stops for activities such as litter cleanup, pothole patching, or utility operations, and are similar to short-duration operations.

Guidance:

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.

Option:

Flaggers may be used for mobile operations that often involve frequent short stops.

Support:

Mobile operations also include work activities where workers and equipment move along the road without stopping, usually at slow speeds. The advance warning area moves with the work area.

Guidance:

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. Where feasible, 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 multi-lane divided highway, arrow panels should be used.

Option:

For mobile operations that move at speeds less than 5 km/h (3 mph), mobile signs or stationary signing that is periodically retrieved and repositioned in the advance warning area may be used.

At higher speeds, vehicles may be used as components of the TTC zones for mobile operations. 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.

For some continuously moving operations, such as street sweeping and snow removal, a single work vehicle with appropriate warning devices on the vehicle may be used to provide warning to approaching road users.

Standard:

Mobile operations that move at speeds greater than 30 km/h (20 mph), such as pavement marking operations, shall have appropriate devices on the equipment (that is, high-intensity rotating, flashing, oscillating, or strobe lights, signs, or special lighting), or shall use a separate vehicle with appropriate warning devices.

Section 6G.03 <u>Location of Work</u>

Support:

Chapter 6D and Sections 6F.68 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

The choice of TTC needed for a TTC zone depends upon where the work is located. As a general rule, the closer the work is to road users (including bicyclists and pedestrians), the greater the number of TTC devices that are needed. Procedures are described later in this Chapter for establishing TTC zones in the following locations:

A. Outside the shoulder;
B. On the shoulder with no encroachment;
C. On the shoulder with minor encroachment;
D. Within the median; and
E. Within the traveled way.

Standard:

When the work space is within the traveled way, except for short-duration and mobile operations, advance warning shall provide a general message that work is taking place and shall

supply information about highway conditions. TTC devices shall indicate how vehicular traffic can move through the TTC zone.

Section 6G.04 Modifications To Fulfill Special Needs

Support:

Chapter 6D and Sections 6F.68 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

The Cases in Chapter 6H illustrate commonly encountered situations in which TTC devices are employed.

Option:

Other devices may be added to supplement the devices indicated in the Cases, and device spacing may be adjusted to provide additional reaction time as directed by the Chief Traffic Engineer or designee. When conditions are less complex than those depicted in the Cases, fewer devices may be needed with approval of the Chief Traffic Engineer or designee. **DelDOT Rev.**

Guidance:

When conditions are more complex, Cases should be modified by giving particular attention to the provisions set forth in Chapter 6B and by incorporating appropriate devices and practices from the following list and with approval of the Chief Traffic Engineer or designee: **DelDOT Rev.**

A. Additional devices:
   1. Signs
   2. Arrow panels
   3. More channelizing devices at closer spacing (see Section 6F.68 for information regarding detectable edging for pedestrians)
   4. Temporary raised pavement markers
   5. High-level warning devices
   6. Portable changeable message signs
   7. Temporary traffic control signals (including pedestrian signals and accessible pedestrian signals).
   8. Temporary traffic barriers
   9. Crash cushions
   10. Screens
   11. Rumble strips
   12. More delineation
B. Upgrading of devices:
   1. A full complement of standard pavement markings
   2. Brighter and/or wider pavement markings
   3. Larger and/or brighter signs
   4. Channelizing devices with greater conspicuity
   5. Temporary traffic barriers in place of channelizing devices
C. Improved geometrics at detours or crossovers
D. Increased distances:
   1. Longer advance warning area
   2. Longer tapers
E. Lighting:
   1. Temporary roadway lighting
   2. Flashing lights for isolated hazards
   3. Illuminated signs
   4. Floodlights

Where pedestrian or bicycle usage is high, Cases should also be modified by giving particular attention to the provisions set forth in Chapter 6D, Section 6F.68, and other Sections of Part 6 related to accessibility and detectability provisions in TTC zones.

Section 6G.05 Work Affecting Pedestrian and Bicycle Facilities

Support:

It is not uncommon, particularly in urban areas, that road work and the associated TTC will affect existing pedestrian or bicycle facilities. It is essential that the needs of all road users, including pedestrians with disabilities, are considered in TTC zones.

In addition to specific provisions identified in Sections 6G.11, 6G.12, and 6G.13, there are a number of provisions that might be applicable for all of the types of activities identified in this Chapter.

Guidance:

Where pedestrian or bicycle usage is high, the Cases should be modified by giving particular attention to the provisions set forth in Chapters 6D and 6G, Section 6F.68, and in other Sections of Part 6 related to accessibility and detectability provisions in TTC zones.

Pedestrians should be separated from the worksite by appropriate devices that maintain the accessibility and detectability for pedestrians with disabilities.

Bicyclists and pedestrians should not be exposed to unprotected excavations, open utility access, overhanging equipment, or other such conditions.

Except for short duration and mobile operations, when a highway shoulder is occupied, a SHOULDER WORK sign should be placed in advance of the activity area. When work is performed on a paved shoulder 2.4 m (8 ft) or more in width, channelizing devices should be placed on a taper having a length that conforms to the requirements of a shoulder taper. Signs should be placed such that they do not narrow any existing pedestrian passages to less than 1200 mm (48 in).

Pedestrian detours should be avoided since pedestrians rarely observe them and the cost of providing accessibility and detectability might outweigh the cost of maintaining a continuous route. Whenever possible, work should be done in a manner that does not create a need to detour pedestrians from existing routes or crossings.

Standard:

Where pedestrian routes are closed, alternate pedestrian routes shall be provided.

When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

Section 6G.06 This section not used

Section 6G.07 This section not used

Section 6G.08 This section not used

Section 6G.09 This section not used

Section 6G.10 This section not used

DelDOT Rev.

Section 6G.11 Work Within the Traveled Way of Urban Streets

Support:

In urban TTC zones, decisions are needed on how to control vehicular traffic, such as how many lanes are required, whether any turns need to be prohibited at intersections, and how to maintain access to business, industrial, and residential areas.

Pedestrian traffic needs separate attention. Chapter 6D contains information regarding pedestrian movements near TTC zones.

DelDOT Rev.

Standard:

If the TTC zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.

If the TTC zone affects the movement of bicyclists, adequate access to the roadway or shared-use paths shall be provided (see Part 9).

Where transit stops are affected or relocated because of work activity, access to temporary transit stops shall be provided.

Guidance:

If a designated bicycle route is closed because of the work being done, a signed alternate route should be provided. Bicyclists should not be directed onto the path used by pedestrians.

Work sites within the intersection should be protected against inadvertent pedestrian incursion by providing detectable channelizing devices.

Support:

Utility work takes place both within and outside the roadway to construct and maintain services such as power, gas, light, water, or telecommunications. Operations often involve intersections, since that is where many of the network junctions occur. The work force is usually small, only a few vehicles are involved, and the number and types of TTC devices placed in the TTC zone is usually minimal.

Standard:

All TTC devices shall be retroreflective or illuminated if utility work is performed during nighttime hours.

Guidance:

As discussed under short-duration projects, however, the reduced number of devices in utility work zones should be offset by the use of high-visibility devices, such as high-intensity rotating, flashing, oscillating, or strobe lights on work vehicles or high-level warning devices.

Section 6G.12 <u>Work Within the Traveled Way of Multi-lane, Nonaccess Controlled Highways</u>

Support:

Highways described as nonaccess controlled indicates that access connections, which may be at-grade or grade-separated, are provided with selected public roads, and private driveways.

Highways described as access controlled indicates that preference is given to through traffic by providing access connections by means of ramps with only selected public roads and by prohibiting crossings at grade and direct private driveway connections.

DelDOT Rev.

Standard:

When a lane is closed on a multi-lane road for other than a mobile operation, a transition area containing a merging taper shall be used.

Guidance:

When justified by an engineering study, temporary traffic barriers should be used to prevent incursions of errant vehicles into hazardous areas or work space.

Standard:

When temporary traffic barriers are placed immediately adjacent to the traveled way, they shall be equipped with appropriate channelizing devices, delineation, and/or other TTC devices. For lane closures, the merging taper shall use channelizing devices and the temporary traffic barrier shall be placed beyond the transition area.

Support:

Temporary traffic barriers are not considered to be TTC devices in themselves.

DelDOT Rev.

Standard:

When only the left lane is closed on undivided roads, channelizing devices shall be placed along the centerline as well as along the adjacent lane.

Guidance:

When an interior lane is closed, an adjacent lane should also be considered for closure to provide additional space for vehicles and materials and to facilitate the movement of equipment within the work space.

When multiple lanes in one direction are closed, a capacity analysis should be made to determine the number of lanes needed to accommodate motor vehicle traffic needs. Vehicular traffic should be moved

over one lane at a time. As shown in Case 9, the tapers should be separated by a distance of 2L, with L being determined by the formulas in Table 6C-3.

Standard:

When a directional roadway is closed, inapplicable WRONG WAY signs and markings, and other existing traffic control devices at intersections within the temporary two-lane, two-way operations section shall be covered, removed, or obliterated.

Section 6G.13 Work Within the Traveled Way at an Intersection

Guidance:

The effect of the work upon signal operation should be considered, such as signal phasing for ensuring adequate capacity, maintaining or adjusting signal detectors, and ensuring the appropriate visibility of signal heads.

Standard:

When work will occur near an intersection where operational, capacity, or pedestrian accessibility problems are anticipated, the Chief Traffic Engineer or designee shall be contacted. **DelDOT Rev.**

Guidance:

For work at an intersection, advance warning signs, devices, and markings should be used on all cross streets, as appropriate. Where the posted speed limit, the off-peak 85th-percentile speed prior to the work starting, or the anticipated speed exceeds 60 km/h (40 mph), additional warning signs should be used in the advance warning area.

Pedestrian crossings near TTC sites should be separated from the worksite by appropriate barriers that maintain the accessibility and detectability for pedestrians with disabilities.

Support:

Near-side work spaces are simply handled as a midblock lane closure. A problem that might occur with near-side lane closure is a reduction in capacity, which during certain hours of operation could result in congestion and backups.

Option:

When near-side work spaces are used, an exclusive turn lane may be used for through vehicular traffic.

Where space is restricted in advance of near-side work spaces, as with short block spacings, two warning signs may be used in the advance warning area, and a third action-type warning or a regulatory sign (such as Keep Left) may be placed within the transition area.

Support:

Far-side work spaces involve additional treatment because road users typically enter the activity area by straight-through and left- or right-turning movements.

Guidance:

When a lane through an intersection must be closed on the far side, it should also be closed on the near-side approach to preclude merging movements within the intersection.

Option:

If there are a significant number of vehicles turning from a near-side lane that is closed on the far side, the near-side lane may be converted to an exclusive turn lane.

Option:

If the work is within the intersection, any of the following strategies may be used:

A. A small work space so that road users can move around it
B. Flaggers or uniformed law enforcement officers to direct road users
C. Work in stages so the work space is kept to a minimum; and
D. Road closures or upstream diversions to reduce road user volumes.

Guidance:

Depending on road user conditions, a flagger(s) and/or a uniformed law enforcement officer(s) should be used to control road users.

Section 6G.14 This section not used

DelDOT Rev.

Section 6G.15 Two-Lane, Two-Way Traffic on One Roadway of a Normally Divided Highway

Support:

Two-lane, two-way operation on one roadway of a normally divided highway is a typical procedure that requires special consideration in the planning, design, and work phases, because unique operational problems (for example, increasing the risk of head-on crashes) can arise with the two-lane, two-way operation.

Standard:

When two-lane, two-way traffic control must be maintained on one roadway of a normally divided highway, opposing vehicular traffic shall be separated with either temporary traffic barriers (concrete safety-shape or approved alternate) or with channelizing devices throughout the length of the two-way operation. The use of markings and complementary signing, by themselves, shall not be used.

Section 6G.16 Crossovers

Guidance:

The following are considered good guiding principles for the design of crossovers:

A. Tapers for lane drops should be separated from the crossovers, as shown in Case 12.
B. Crossovers should be designed for speeds no lower than 16 km/h (10 mph) below the posted speed, the off-peak 85th-percentile speed prior to the work starting, or the anticipated operating speed of the roadway, unless unusual site conditions require that a lower design speed be used.
C. A good array of channelizing devices, delineators, and full-length, properly placed pavement markings should be used to provide drivers with a clearly defined travel path.
D. The design of the crossover should accommodate all vehicular traffic, including trucks and buses.

Support:

Temporary traffic barriers and the excessive use of TTC devices cannot compensate for poor geometric and roadway cross-section design of crossovers.

Section 6G.17 Interchanges

Guidance:

Access to interchange ramps on limited-access highways should be maintained even if the work space is in the lane adjacent to the ramps. Access to exit ramps should be clearly marked and delineated with channelizing devices. For long-term projects, conflicting pavement markings should be removed and new ones placed. Early coordination with officials having jurisdiction over the affected cross streets and providing emergency services should occur before ramp closings.

Option:

If access is not possible, ramps may be closed by using signs and Type III barricades. A TTC zone in the exit ramp may be handled as shown in Case 14.

When a work space interferes with an entrance ramp, a lane may need to be closed on the freeway (see Case 13). A TTC zone in the entrance ramp may require shifting ramp vehicular traffic.

Section 6G.18 This section not used

Section 6G.19 Work in the Vicinity of Highway-Rail Grade Crossings

Standard:

When highway-rail grade crossings exist either within or in the vicinity of a TTC zone, lane restrictions, flagging, or other operations shall not create conditions where vehicles can be queued across the railroad tracks. If the queuing of vehicles across the tracks cannot be avoided, a

uniformed law enforcement officer or flagger shall be provided at the crossing to prevent vehicles from stopping on the tracks, even if automatic warning devices are in place.

Support:

Cases 17-A and 17-B show work in the vicinity of a highway-rail grade crossing.

DelDOT Rev.

Guidance:

Early coordination with the railroad company should occur before work starts.

Section 6G.20 Temporary Traffic Control During Nighttime Hours

Support:

Chapter 6D and Sections 6F.68 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

Conducting highway construction and maintenance activities during night hours could provide an advantage when traditional daytime traffic control strategies cannot achieve an acceptable balance between worker and public safety, traffic and community impact, and constructability. The two basic advantages of working at night are reduced traffic congestion and less involvement with business activities. However, the two basic conditions that must normally be met for night work to offer any advantage are reduced traffic volumes and easy set up and removal of the traffic control patterns on a nightly basis.

Shifting work activities to night hours, when traffic volumes are lower and normal business is less active, might offer an advantage in some cases, as long as the necessary work can be completed and the work site restored to essentially normal operating conditions to carry the higher traffic volume during non-construction hours.

Although working at night might offer advantages, it also includes safety issues. Reduced visibility inherent in night work impacts the performance of both drivers and workers. Because traffic volumes are lower and congestion is minimized, speeds are often higher at night necessitating greater visibility at a time when visibility is reduced. Finally, the incidence of impaired (alcohol or drugs), fatigued, or drowsy drivers might be higher at night.

Working at night also involves other factors, including construction productivity and quality, social impacts, economics, and environmental issues. A decision to perform construction or maintenance activities at night normally involves some consideration of the advantages to be gained compared to the safety and other issues that might be impacted.

Guidance:

Considering the safety issues inherent to night work, consideration should be given to enhancing traffic controls (see Section 6G.04) to provide added visibility and driver guidance, and increased protection for workers.

In addition to the enhancements listed in Section 6G.04, consideration should be given to providing additional lights and retroreflective markings to workers, work vehicles, and equipment.

Option:

Where reduced traffic volumes at night make it feasible, the entire roadway may be closed by detouring traffic to alternate facilities, thus removing the traffic risk from the activity area.

Guidance:

Because typical street and highway lighting is rarely adequate to provide sufficient levels of illumination for work tasks, temporary lighting should be provided where workers are active to supply sufficient illumination to reasonably safely perform the work tasks.

Temporary lighting for night work should be designed such that glare does not interfere with driver visibility, or create visibility problems for truck drivers, equipment operators, flaggers, or other workers.

Consideration should also be given to stationing uniformed law enforcement officers and lighted patrol cars at night work locations where there is a concern that high speeds or impaired drivers might result in undue risks for workers or other drivers.

Standard:

Except in emergencies, temporary lighting shall be provided at all flagger stations.

Support:

Desired illumination levels vary depending upon the nature of the task involved. An average horizontal luminance of 50 lux (5 foot candles) can be adequate for general activities. An average horizontal luminance of 108 lux (10 foot candles) can be adequate for activities around equipment. Tasks requiring high levels of precision and extreme care can require an average horizontal luminance of 216 lux (20 foot candles).

Section 6G.21 Vertical Difference

Support:

A vertical difference is created whenever a difference in grade of more than 25 mm (1 in) exists:

A. Between the travelway and an adjacent area,
B. Across a travelway, or
C. Along or between a travelway(s).

Possible causes of vertical differences include, but are not limited to, milling or excavation for paving, repaving lifts, and utility operations.

DelDOT Rev.

Guidance:

Operations should be sequenced so vertical differences of greater than 50 mm (2 in) do not exist across a travelway open to traffic or between adjacent travelways open to traffic.

Standard:

Vertical difference treatments shall meet the requirements indicated in Table 6G-1.

Table 6G-1. Vertical Difference
(DelDOT MUTCD Only)

Type of Vertical Difference	Type of Direction	Height of Vertical Difference			
		≤ 25 mm (1 in)	> 25 mm (1 in) to < 50 mm (2 in)	≥ 50 mm (2 in) to ≤ 150 mm (6 in)	> 150 mm (6 in)
Longitudinal, < 3.7 m (12 ft) from edge of Travelway	Standard	• No channelizing devices required	• For differences along or between travelways, the UNEVEN LANES (W8-11) sign shall be used • For differences between the travelway and a shoulder, or at the edge of pavement less than 3 m (10 ft) from the travelway, the LOW SHOULDER (W8-9) sign shall be used	• At the end of the work day, a fillet of material, a wedge of gravel, or other suitable material as directed by the Chief Traffic Engineer or designee shall be placed in a manner that will provide stability for errant vehicles. This material shall be placed no steeper than a 4 to 1 slope. • Temporary traffic barrier shall be used if fillet cannot be placed • Drums shall be used throughout vertical difference condition, until fillet is placed [1] • Warning signs shall be used	• Temporary traffic barrier shall be used • Work area shall be limited to distances of not more than 305 m (1,000 ft) [1]
	Guidance		• Wedge not required, however, vertical difference should be eliminated no later than the following day • Drums should be used throughout vertical difference condition • Work area should be limited to distances of not more than 305 m (1,000 ft) [1]	• Work area should be limited to distances of not more than 305 m (1,000 ft) [1] • Cases should be used to determine additional devices required for specific operations	• Cases should be used to determine additional devices required for specific operations
Longitudinal, ≥ 3.7 m (12 ft) to ≤ 9.1 m (30 ft) from edge of Travelway [2],[3]	Standard	• No channelizing devices required	• No channelizing devices required	• Drums shall be used throughout vertical difference condition [2]	• Drums shall be used throughout vertical difference condition [2]
Transverse	Standard	• No channelizing devices required	• BUMP (W8-1) or DIP (W8-2) sign shall be used	• Ramp with Bituminous Temporary Roadway Material at a slope of 20 to 1 or flatter	• Ramp with Bituminous Temporary Roadway Material at a slope of 20 to 1 or flatter

[1] Unless otherwise directed by the Chief Traffic Engineer or designee
[2] No channelizing devices are required if the vertical difference is:
- outside right-of-way
- behind guiderail, barrier, or curb

[3] No channelizing devices are required if the vertical difference is further than 9.1 m (30 ft) from the edge of the roadway

The edge of the travelway shall be defined as the white stripe. If there is no white line, the curb or the edge of pavement shall be the edge of the travelway.

Where: < = "Less than" ≤ = "Less than or equal to" ≥ = "Greater than or equal to" > = "Greater than"

Section 6G.22 Storage of Equipment

DelDOT Rev.

Standard:

Each storage area shall be treated as a road side obstacle.

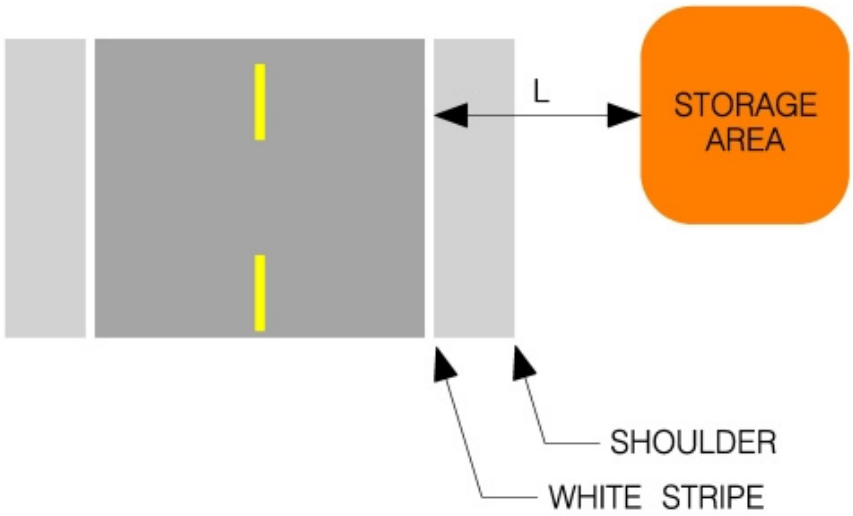
Table 6G-2. Storage of Equipment
(DelDOT MUTCD Only)

Road Type	Distance from Travelway*, L (feet)	Speed, V (mph)	Required Channelizing Devices
Flammable Materials (fuel, propane, etc.)			
All roadways			
	L ≤ 30	All	Temporary Traffic Barrier
	L > 30	All	Drums (Expressway) None (Other Roadways)
Equipment and All Other Materials			
Expressway / Freeway			
	L ≤ 30	All	Temporary Traffic Barrier
	L > 30	All	Drums
All other roadways			
	0 ≤ L ≤ 12	V ≤ 25	Drums
		V > 25	Temporary Traffic Barrier
	12 < L ≤ 30	V ≤ 25	None
		V > 25	Drums
	L>30	All	None

< "Less than"
≤ "Less than or equal to"
> "Greater than"

* The edge of the travelway shall be defined as the white stripe (see diagram below). If there is no white line, the curb or the edge of pavement shall be the edge of the travelway.

Figure 6G-1. Storage of Equipment
(DelDOT MUTCD Only)



Vehicles and equipment shall enter and leave the work area in the direction of traffic flow. The contractor's vehicle(s) and equipment shall enter on and exit from the roadway, at interchanges or legally allowed public use crossovers. U-turns across any medians or crossovers, signed for use of authorized and emergency vehicles only, made by the contractor's vehicle(s) or equipment are prohibited unless written approval is granted by the Chief Traffic Engineer or designee.

Section 6G.23 <u>Detours</u> **DelDOT Rev.**

Standard:

All traffic detour plans and pedestrian detour plans shall be approved by the Chief Traffic Engineer or designee.

Support:

Section 6C.09 contains additional information regarding detours and diversions.

CHAPTER 6H. CASES

DelDOT Rev.

Section 6H.01 Cases

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

Chapter 6H presents Cases for a variety of situations commonly encountered. While not every situation is addressed, the information illustrated can generally be adapted to a broad range of conditions. In many instances, an appropriate TTC plan is achieved by combining features from various Cases. For convenience in using the Case diagrams, Tables 6C-1 and 6C-4 are reproduced in this Chapter as Tables 6H-3 and 6H-4, respectively.

Procedures for establishing TTC zones vary with such conditions as road configuration, location of the work, work activity, duration of work, road user volumes, road vehicle mix (buses, trucks, cars, motorcycles, and bicycles), and road user speeds. Examples are presented in this Chapter showing how to apply principles and standards. Applying these guidelines to actual situations and adjusting to field conditions requires judgment. In general, the procedures illustrated represent minimum solutions for the situations depicted.

Option:

Other devices may be added to supplement the devices and device spacing may be adjusted to provide additional reaction time or delineation. Fewer devices may be used based on field conditions.

Support:

Figures and tables found throughout Part 6 provide information for the development of TTC plans. Also, Table 6H-3 is used for the determination of sign spacing and other dimensions for various area and roadway types.

Table 6H-1 is an index of the 29 Cases. In many of the typical applications, sign spacings and other dimensions are indicated by letters using the criteria provided in Table 6H-3. The formulas for determining taper lengths are provided in Table 6H-4.

Most of the typical applications show TTC devices for only one direction.

DelDOT Rev.

Table 6H-1. Index to Cases

Case Description	Case No.
Work Outside of Shoulder	
Work Beyond the Shoulder	1
Work on the Shoulder	
Two Lane, Two-Way Traffic, Shoulder Closure – Within 10 Feet of Travelway	2
Multilane, Divided, Nonaccess Controlled Highways – Shoulder Closure	3
Multilane Access Controlled Highways and Interstates, Shoulder Work – Off Shoulder	4
Multilane Access Controlled Highways and Interstates, Shoulder Work – On Shoulder	5
Work Within the Traveled Way	
Two-Lane, Two-Way Traffic, Lane Closure	6
Multilane, Divided Highways – Lane Closure	7
Multilane, Divided Highways – Interior Lane Closure	8
Multilane, Divided Highways – Double Lane Closure	9
Two-Lane, Two-Way Traffic – 25 MPH or Less, Daylight Operations, Lane Diversion	10
Two-Lane, Two-Way Traffic – 25 MPH or Less, Daylight Operations, Work in Center of Road	11
Multilane, Divided Highways – Half Road Closure	12
Multilane Interstates and Highways, Work in Vicinity of Entrance Ramp	13
Multilane Interstates and Highways, Work in Vicinity of Exit Ramp	14
Detours	
Two-Lane, Two-Way Traffic – Detour	15
Sidewalk Detour	16
Work in the Vicinity of Highway-Rail Grade Crossings	
Two-Lane, Two-Way Traffic – Work in Vicinity of Highway-Rail Grade Crossing	17-A
Multilane, Divided Highway – Work in Vicinity of Highway-Rail Grade Crossing	17-B
Work in the Vicinity of Blasting Zones	
Blasting Zone	18
Moving Operations	
Two-Lane, Two-Way Traffic, Moving Daytime Operations – Lane Closure	19
Two-Lane, Two-Way, Traffic and Multilane Highways Moving Daytime Operations or Short Duration (1 Hour or Less) Stationary – On Shoulder	20-A
Two-Lane, Two-Way, Traffic and Multilane Highways Moving Daytime Operations or Short Duration (1 Hour or Less) Stationary – Lane Closure	20-B
Multilane Interstates and Highways, Single Lane, Stop & Go or Slow Moving Operations	21
Multilane Interstates and Highways, Multilane, Stop & Go or Slow Moving Operations	22
Two-Lane, Two-Way Traffic – Moving Striping Operations	23-A
Multilane, One-Way Traffic – Moving Striping Operations	23-B
Multilane, Fully Access-Controlled Highways, Moving Striping Operations	23-C
Two-Lane, Two-Way Traffic – Mowing Operations	24
Multilane, Divided Highways – Mowing Operations	25

DelDOT Rev.

Table 6H-3. Meaning of Letter Codes on Typical Application Diagrams

Road Type	Distance Between Signs (ft) *		
	A	B	C
Interstate / Expressway / Freeway	1000	1640 (0.3 mi)	2640 (0.5 mi)
All other roadways	500	500	500

* The column headings A, B, and C are the dimensions shown in the Case Diagrams (see Section 6H). 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 third sign is the first one in a three-sign series encountered by a driver approaching a TTC zone).

Table 6H-4. Formulas for Determining Taper Lengths

Speed Limit (S)	Taper Length (L) Meters
60 km/h or less	$L = \frac{WS^2}{155}$
70 km/h or more	$L = \frac{WS}{1.6}$

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

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

CHAPTER 6I. CONTROL OF TRAFFIC THROUGH TRAFFIC INCIDENT MANAGEMENT AREAS

Section 6I.01 General

Support:

Whenever the acronym "TTC" is used in this Chapter, it refers to "temporary traffic control".

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

A traffic incident is an emergency road user occurrence, a natural disaster, or other unplanned event that affects or impedes the normal flow of traffic.

A traffic incident management area is an area of a highway where temporary traffic controls are imposed by authorized officials in response to a road user incident, natural disaster, hazardous material spill, or other unplanned incident. It is a type of TTC zone and extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a point where vehicles return to the original lane alignment and are clear of the incident.

Traffic incidents can be divided into three general classes of duration, each of which has unique traffic control characteristics and needs. These classes are:

A. Major—expected duration of more than 2 hours;
B. Intermediate—expected duration of 30 minutes to 2 hours; and
C. Minor—expected duration under 30 minutes.

The primary functions of TTC at a traffic incident management area are to move road users reasonably safely and expeditiously past or around the traffic incident, to reduce the likelihood of secondary traffic crashes, and to preclude unnecessary use of the surrounding local road system. Examples include a stalled vehicle blocking a lane, a traffic crash blocking the traveled way, a hazardous material spill along a highway, and natural disasters such as floods and severe storm damage.

Guidance:

In order to reduce response time for traffic incidents, highway agencies, appropriate public safety agencies (law enforcement, fire and rescue, emergency communications, emergency medical, and other emergency management), and private sector responders (towing and recovery and hazardous materials contractors) should mutually plan for occurrences of traffic incidents along the major and heavily traveled highway and street system.

On-scene responders should be trained in safe practices for accomplishing their tasks in and near traffic. Responders should always be aware of their visibility to oncoming traffic and take measures to move the traffic incident as far off the traveled roadway as possible or to provide for appropriate warning.

Responders arriving at a traffic incident should, within 15 minutes of arrival on-scene, estimate the magnitude of the traffic incident, the expected time duration of the traffic incident, and the expected vehicle queue length, and then should set up the appropriate temporary traffic controls for these estimates.

Support:

While some traffic incidents might be anticipated and planned for, emergencies and disasters might pose more severe and unpredictable problems. The ability to quickly install proper temporary traffic controls might greatly reduce the effects of an incident, such as secondary crashes or excessive traffic delays. An essential part of fire, rescue, spill clean-up, highway agency, and enforcement activities is the proper control of road users through the traffic incident management area in order to protect responders, victims, and other personnel at the site while providing reasonably safe traffic flow. These operations might need corroborating legislative authority for the implementation and enforcement of appropriate

road user regulations, parking controls, and speed zoning. It is desirable for these statutes to provide sufficient flexibility in the authority for, and implementation of, TTC to respond to the needs of changing conditions found in traffic incident management areas.

Option:

For traffic incidents, particularly those of an emergency nature, TTC devices on hand may be used for the initial response as long as they do not themselves create unnecessary additional hazards.

Section 6I.02 Major Traffic Incidents

Support:

Major traffic incidents are typically traffic incidents involving hazardous materials, fatal traffic crashes involving numerous vehicles, and other natural or man-made disasters. These traffic incidents typically involve closing all or part of a roadway facility for a period exceeding 2 hours.

Guidance:

If the traffic incident is anticipated to last more than 24 hours, applicable procedures and devices set forth in other Chapters of Part 6 should be used.

Support:

A road closure can be caused by a traffic incident such as a road user crash that blocks the traveled way. Road users are usually diverted through lane shifts or detoured around the traffic incident and back to the original roadway. A combination of traffic engineering and enforcement preparations is needed to determine the detour route, and to install, maintain or operate, and then to remove the necessary traffic control devices when the detour is terminated. Large trucks are a significant concern in such a detour, especially when detouring them from a controlled-access roadway onto local or arterial streets.

During traffic incidents, large trucks might need to follow a route separate from that of automobiles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous material might need to follow a different route from other vehicles.

Some traffic incidents such as hazardous material spills might require closure of an entire highway. Through road users must have adequate guidance around the traffic incident. Maintaining good public relations is desirable. The cooperation of the news media in publicizing the existence of, and reasons for, traffic incident management areas and their TTC can be of great assistance in keeping road users and the general public well informed.

The establishment, maintenance, and prompt removal of lane diversions can be effectively managed by inter-agency planning that includes representatives of highway and public safety agencies.

Guidance:

All traffic control devices needed to set up the TTC at a traffic incident should be available so that they can be readily deployed for all major traffic incidents. The TTC should include the proper traffic diversions, tapered lane closures, and upstream warning devices to alert approaching traffic of the end of a queue.

Attention should be paid to the end of the traffic queue such that warning is given to road users approaching the end of the queue.

If manual traffic control is needed, it should be provided by qualified flaggers or uniformed law enforcement officers.

Option:

If flaggers are used to provide traffic control for an incident management situation, the flaggers may use appropriate traffic control devices that are readily available or that can be brought to the traffic incident scene on short notice.

Guidance:

When flares are used to initiate TTC at traffic incidents, more permanent traffic control devices should replace them as soon as practical. Both the flare and its supporting device should then be removed from the roadway.

On-scene responders should be trained in safe practices for accomplishing their tasks in and near traffic. Responders should always be aware of their visibility to oncoming traffic and take measures to move the traffic incident as far off the traveled roadway as possible or to provide for appropriate warning.

Section 6I.03 Intermediate Traffic Incidents

Support:

Intermediate traffic incidents typically affect travel lanes for a time period of 30 minutes to 2 hours, and usually require traffic control on the scene to divert road users past the blockage. Full roadway closures might be needed for short periods during traffic incident clearance to allow traffic incident responders to accomplish their tasks.

The establishment, maintenance, and prompt removal of lane diversions can be effectively managed by inter-agency planning that includes representatives of highway and public safety agencies.

Guidance:

All traffic control devices needed to set up the TTC at a traffic incident should be available so that they can be readily deployed for intermediate traffic incidents. The TTC should include the proper traffic diversions, tapered lane closures, and upstream warning devices to alert approaching traffic of the end of a queue.

Attention should be paid to the end of the traffic queue such that warning is given to road users approaching the end of the queue.

If manual traffic control is needed, it should be provided by qualified flaggers or uniformed law enforcement officers.

Option:

If flaggers are used to provide traffic control for an incident management situation, the flaggers may use appropriate traffic control devices that are readily available or that can be brought to the traffic incident scene on short notice.

Guidance:

When flares are used to initiate TTC at traffic incidents, more permanent traffic devices should replace them as soon as practical. Both the flare and its supporting device should then be removed from the roadway.

On-scene responders should be trained in safe practices for accomplishing their tasks in and near traffic. Responders should always be aware of their visibility to oncoming traffic and take measures to move the traffic incident as far off the traveled roadway as possible or to provide for appropriate warning.

Section 6I.04 Minor Traffic Incidents

Support:

Minor traffic incidents are typically disabled vehicles and minor crashes that result in lane closures of less than 30 minutes. On-scene responders are typically law enforcement and towing companies, and occasionally highway agency service patrol vehicles.

Diversion of traffic into other lanes is often not needed or is needed only briefly. It is not generally possible or practical to set up a lane closure with traffic control devices for a minor traffic incident. Traffic control is the responsibility of on-scene responders.

Guidance:

When a minor traffic incident blocks a travel lane, it should be removed from that lane to the shoulder as quickly as possible.

Section 6I.05 Use of Emergency-Vehicle Lighting

Support:

The use of emergency-vehicle lighting (such as high-intensity rotating, flashing, oscillating, or strobe lights) is essential, especially in the initial stages of a traffic incident, for the safety of emergency responders and persons involved in the traffic incident, as well as road users approaching the traffic

incident. Emergency-vehicle lighting, however, provides warning only and provides no effective traffic control. It is often confusing to road users, especially at night. Road users approaching the traffic incident from the opposite direction on a divided facility are often distracted by emergency-vehicle lighting and slow their vehicles to look at the traffic incident posing a hazard to themselves and others traveling in their direction.

The use of emergency-vehicle lighting can be reduced if good traffic control has been established at a traffic incident scene. This is especially true for major traffic incidents that might involve a number of emergency vehicles. If good traffic control is established through placement of advanced warning signs and traffic control devices to divert or detour traffic, then public safety agencies can perform their tasks on scene with minimal emergency-vehicle lighting.

Guidance:

Public safety agencies should examine their policies on the use of emergency-vehicle lighting, especially after a traffic incident scene is secured, with the intent of reducing the use of this lighting as much as possible while not endangering those at the scene. Special consideration should be given to reducing or extinguishing forward facing emergency-vehicle lighting, especially on divided roadways, to reduce distractions to on-coming road users.

Vehicle headlights not needed for illumination, or to provide notice to other road users of the incident response vehicle being in an unexpected location, should be turned off at night.

CASE 1

TWO-LANE, TWO-WAY TRAFFIC
OVER 10 FEET FROM EDGE OF TRAVELWAY

NOTES

1. The ROAD WORK AHEAD sign may be omitted when the work space is behind a barrier or 15 feet or more from the edge of roadway.

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

3. For short-duration operations (operations lasting less than one hour), all signs and channelizing devices may be eliminated.

4. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

5. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

6. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

7. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

8. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 6) in the work area should be delineated by drums.

9. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

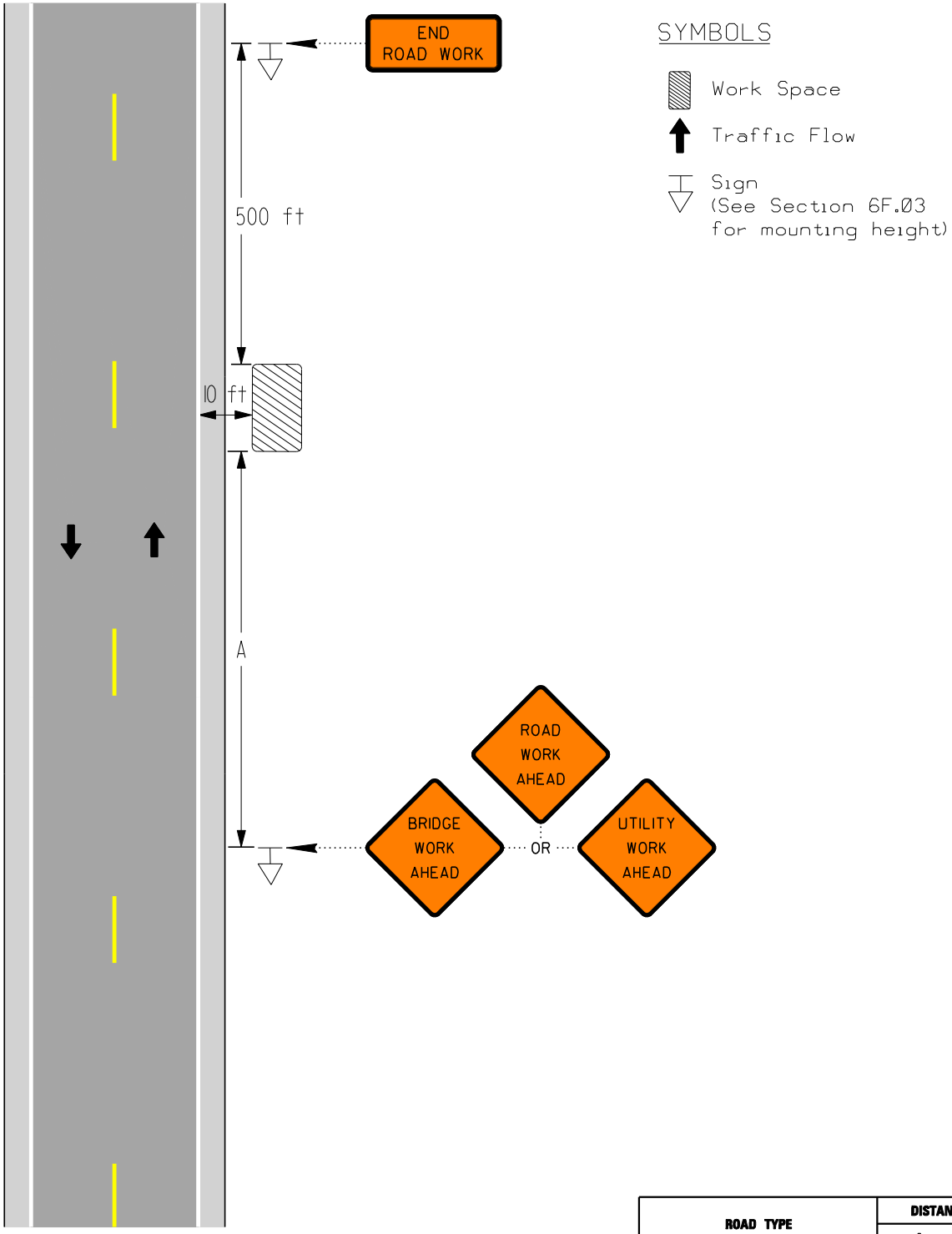
10. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

11. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

12. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE I
TWO-LANE, TWO-WAY TRAFFIC
OVER 10 FEET FROM EDGE OF TRAVELWAY



ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 2

TWO-LANE, TWO-WAY TRAFFIC
SHOULDER CLOSURE – WITHIN 10 FEET OF TRAVELWAY

When, at any time, all vehicles, equipment, workers and their activities are within 10 feet of the edge of, but not encroaching on the travelway.

NOTES

1. If the work operation requires that four (4) or more vehicles enter the through traffic lane in a one (1) hour period, a flagger should be provided with required signing for flagger operations.

2. A minimum of three (3) channelizing devices shall be placed along the side of the work area adjacent and perpendicular to the lane open to traffic.

3. One (1) AMBER TYPE B flashing light shall be installed on each of the first two (2) drums. One (1) AMBER TYPE B flashing light shall be installed on the drum at the end of the work space. If all drums meet the new sheeting requirements, lights are not required.

4. For moving shoulder operations, channelizing devices may be omitted as directed by the Chief Traffic Engineer or designee.

5. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

6. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

7. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

8. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

9. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 7) in the work area should be delineated by drums.

10. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

11. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

12. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

13. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

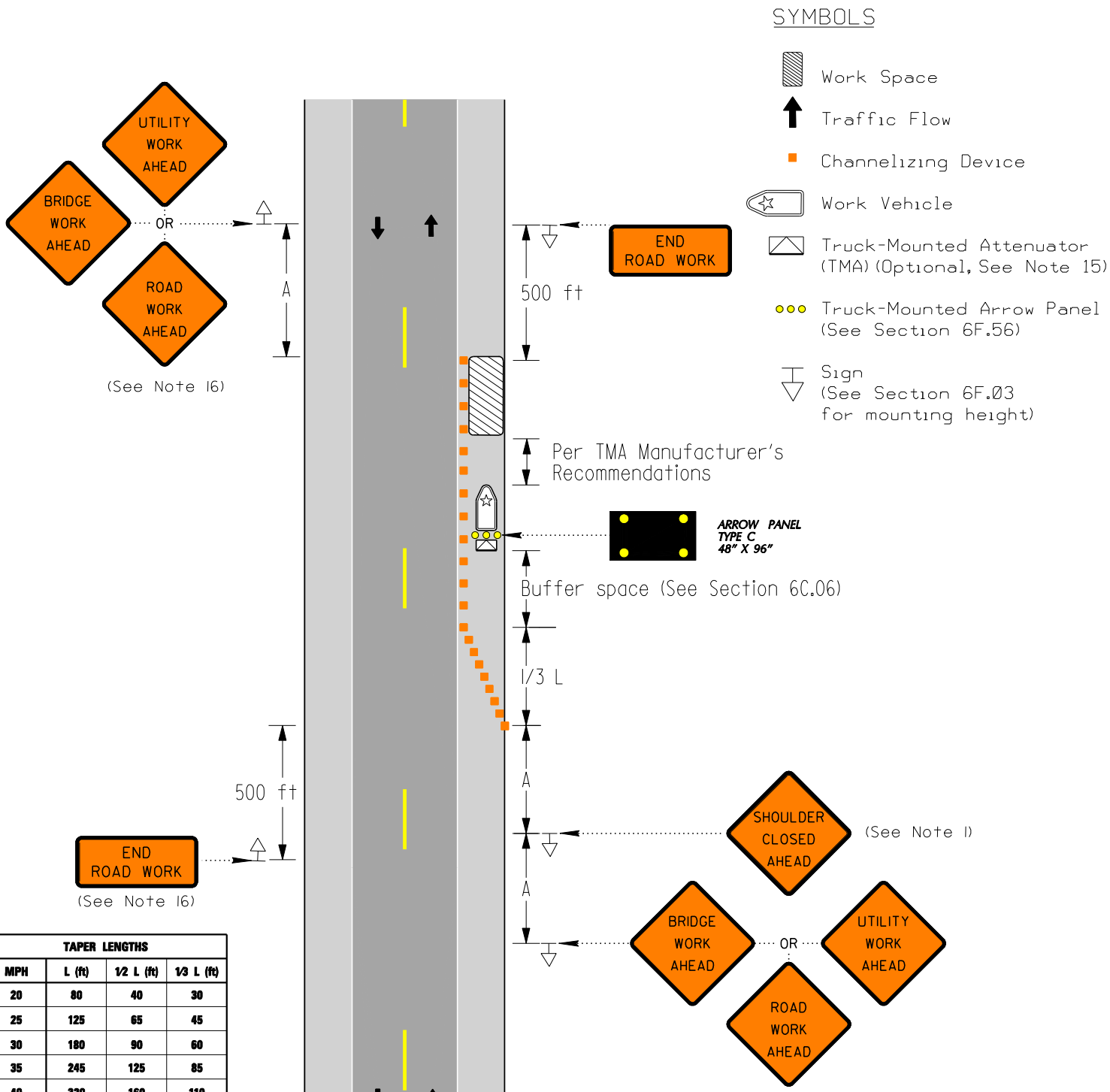
14. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

15. Use of Truck Mounted Attenuators shall be optional, unless otherwise directed by the Chief Traffic Engineer or designee.

16. Signs for opposing traffic shall be erected as directed by Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 2
TWO-LANE, TWO-WAY TRAFFIC
SHOULDER CLOSURE -
WITHIN 10 FEET OF TRAVELWAY



TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 3

MULTILANE, DIVIDED, NONACCESS CONTROLLED HIGHWAYS - SHOULDER CLOSURE

NOTES

1. If the work operation requires that four (4) or more vehicles enter the through traffic lane in a one (1) hour period, a flagger should be provided with required signing for flagger operations.

2. This case also applies to work being performed in the median area. Under these conditions, the signs shall be provided for both travel directions.

3. This case also applies when work is being performed on a multilane undivided highway. Under these conditions, the signs normally mounted in the median shall be omitted.

4. For operations greater than 10 feet but not further than 30 feet beyond the edge of the roadway or pavement, channelizing devices may be omitted.

5. For operations greater than 30 feet from the edge of the roadway or pavement, channelizing devices and signs may be omitted.

6. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

7. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

8. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

9. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

10. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 8) in the work area should be delineated by drums.

11. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

12. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

13. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

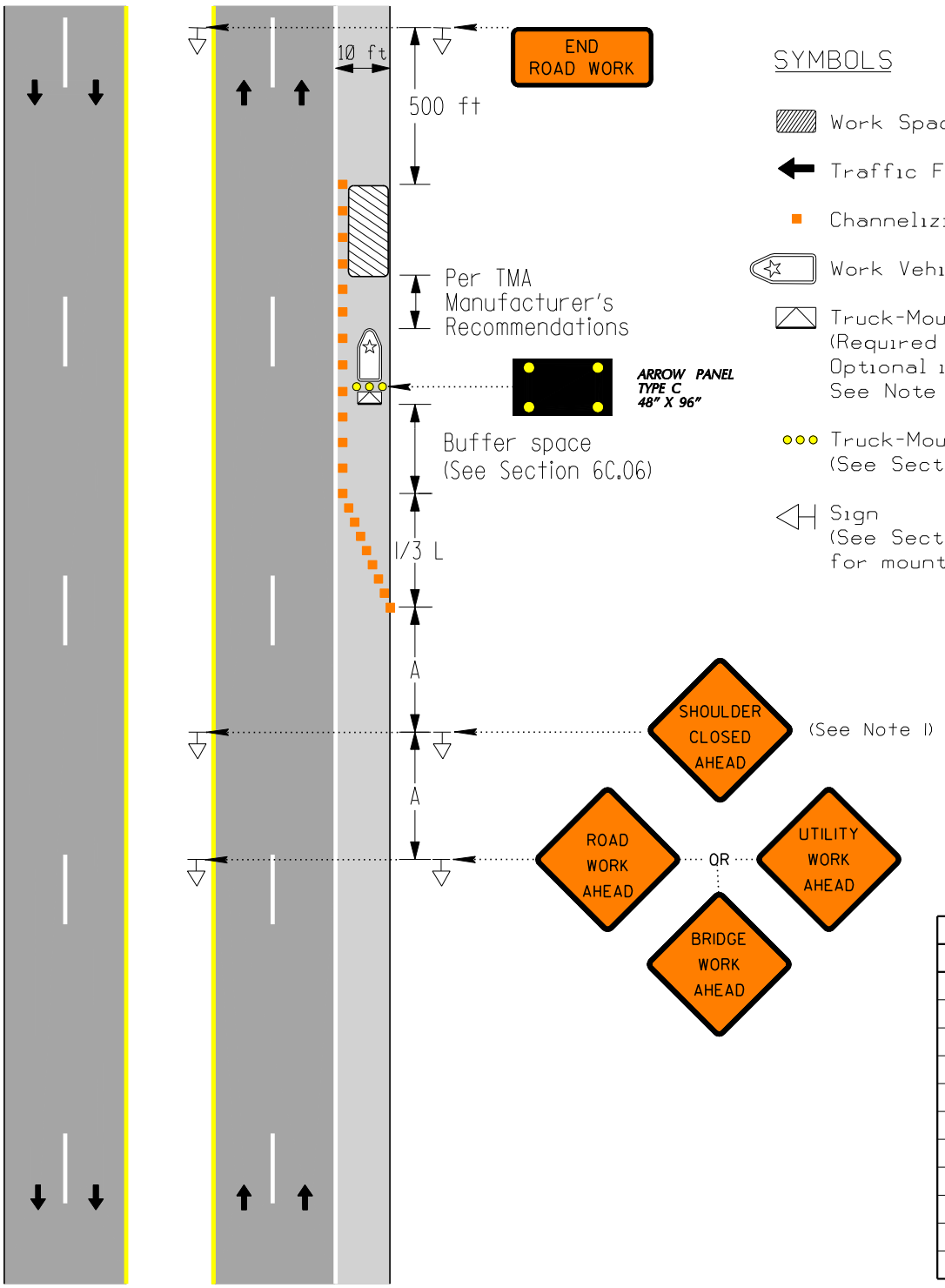
14. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

15. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

16. Use of Truck-Mounted Attenuators (TMAs) shall be required if the posted speed is greater than or equal to 45 MPH. Use of TMAs is optional if the posted speed is less than 45 MPH, unless otherwise directed by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 3
MULTILANE, DIVIDED, NONACCESS CONTROLLED HIGHWAYS - SHOULDER CLOSURE



SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Work Vehicle
- Truck-Mounted Attenuator (Required for 45 MPH roadway, Optional if less than 45 MPH, See Note 16)
- Truck-Mounted Arrow Panel (See Section 6F.56)
- Sign (See Section 6F.03 for mounting height)

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 4

MULTILANE, ACCESS CONTROLLED HIGHWAYS AND INTERSTATES
SHOULDER WORK – OFF SHOULDER

This case shall be required for shoulder work in areas where the shoulder is a minimum of 10 feet, and where the work area does not encroach upon the adjacent travel lane.

NOTES

1. Warning signs on the opposite side of the road from the work zone may be omitted if the work zone is only for daylight hours with no shoulder restrictions during remaining hours.

2. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

3. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

4. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

5. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

6. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 4) in the work area should be delineated by drums.

7. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

8. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

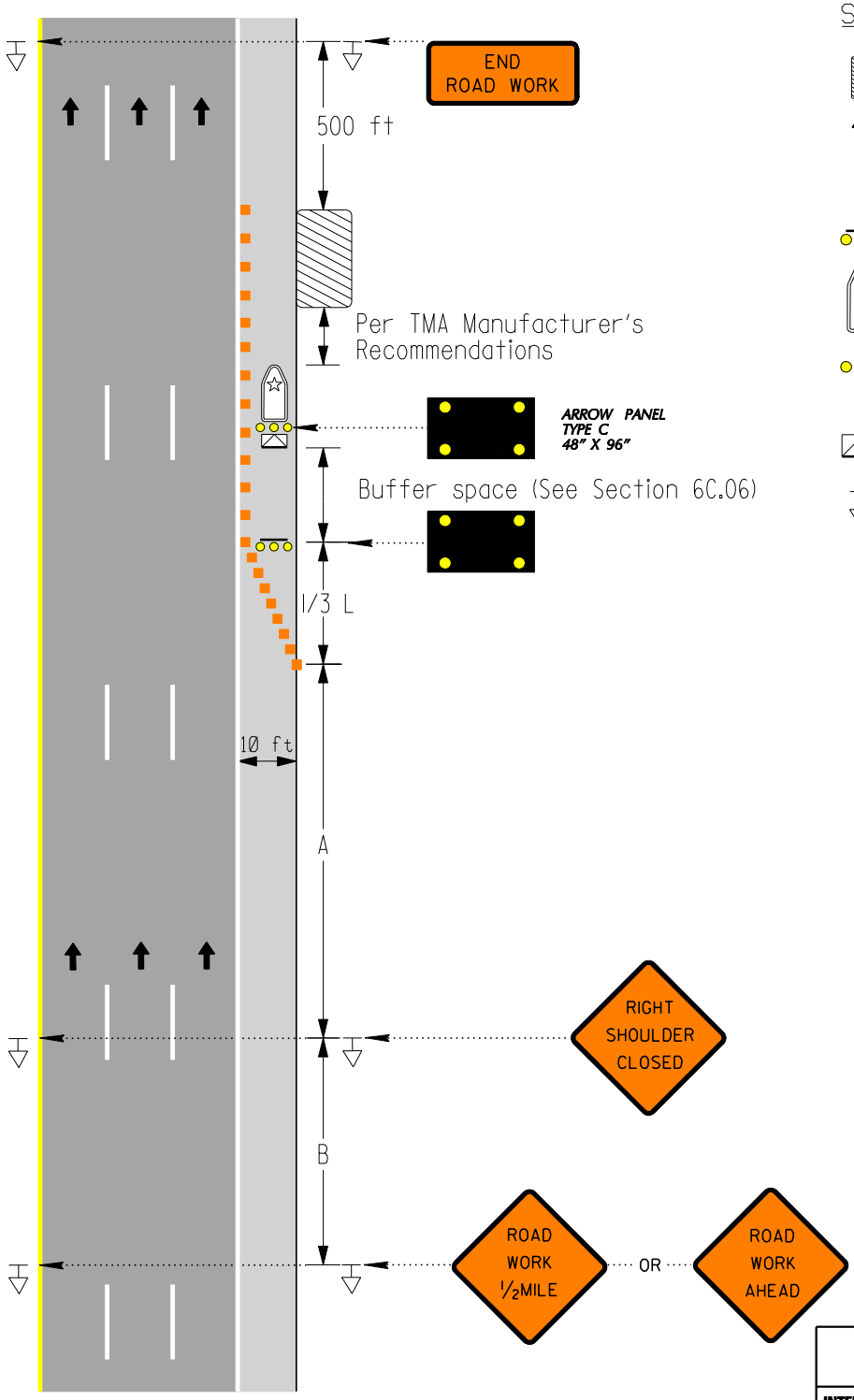
9. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

10. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

11. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 4
MULTILANE, ACCESS CONTROLLED HIGHWAYS AND INTERSTATES
SHOULDER WORK - OFF SHOULDER



SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Arrow Panel
- Work Vehicle
- Truck-Mounted Arrow Panel (See Section 6F.56)
- Truck-Mounted Attenuator (TMA)
- Sign (See Section 6F.03 for mounting height)

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 5

MULTILANE, ACCESS CONTROLLED HIGHWAYS AND INTERSTATES
SHOULDER WORK – ON SHOULDER

This case applies to shoulder work in areas where the work is being performed less than 10 feet from the edge of traveled way, and/or where the work encroaches upon the adjacent travel lane. This case also applies to work performed in the median less than 10 feet from either pavement.

NOTES

1. One (1) AMBER TYPE B flashing light shall be installed on each of the first two (2) drums. One (1) AMBER TYPE B flashing light shall be installed on the drum at the end of the work space. If all drums meet the new sheeting requirements, lights are not required.

2. Warning signs on the opposite side of the road from the work zone may be omitted if the work zone is only for daylight hours with no shoulder restrictions during remaining hours.

3. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

4. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

5. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

6. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

7. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 5) in the work area should be delineated by drums.

8. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

9. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

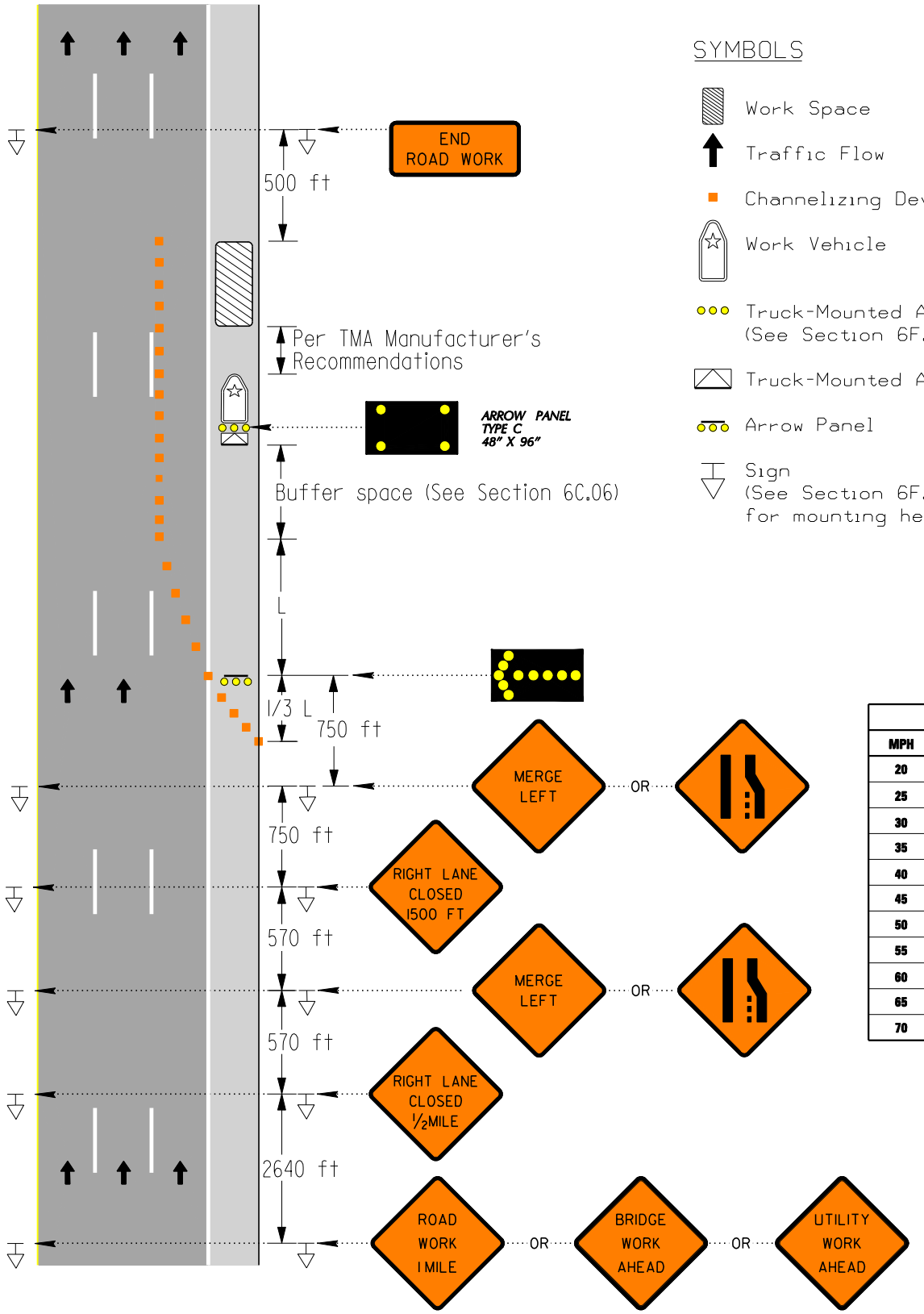
10. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

11. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

12. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 5
MULTILANE, ACCESS CONTROLLED HIGHWAYS AND INTERSTATES
SHOULDER WORK - ON SHOULDER



SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Work Vehicle
- Truck-Mounted Arrow Panel (See Section 6F.56)
- Truck-Mounted Attenuator (TMA)
- Arrow Panel
- Sign (See Section 6F.03 for mounting height)

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

CASE 6

TWO-LANE, TWO-WAY TRAFFIC
LANE CLOSURE

When, at any time, any vehicle, equipment, workers and their activities will encroach in the area between the centerline and the outside edge of the travelway.

NOTES

1. Flaggers shall be in sight of each other or in communication with each other at all times.

2. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

3. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

4. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

5. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

6. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 4) in the work area should be delineated by drums.

7. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

8. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

9. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

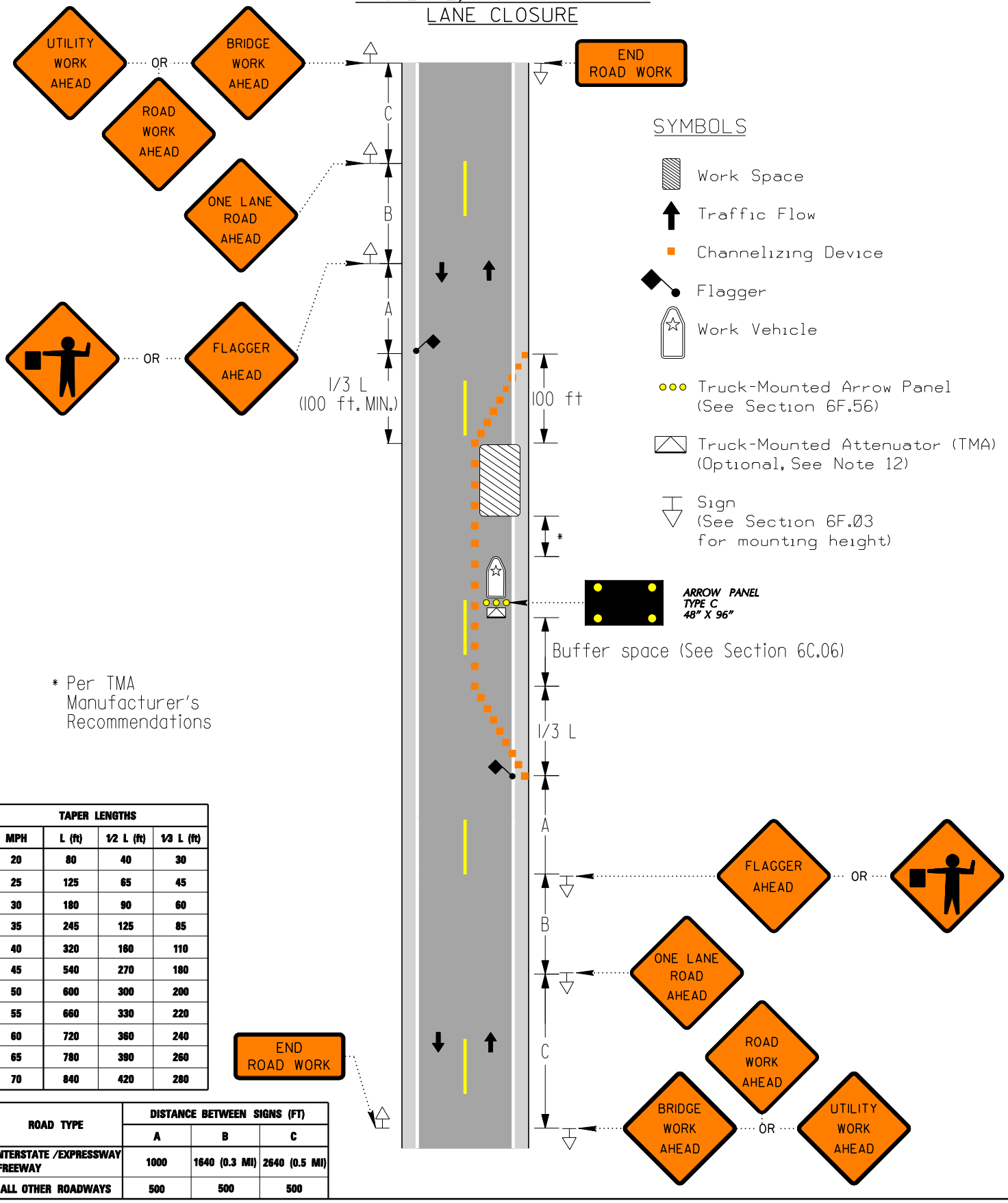
10. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

11. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

12. Use of Truck Mounted Attenuators shall be optional, unless otherwise directed by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 6
TWO-LANE, TWO-WAY TRAFFIC
LANE CLOSURE



* Per TMA Manufacturer's Recommendations

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 7

MULTILANE, DIVIDED HIGHWAYS AND INTERSTATES - LANE CLOSURE

When, at any time, any vehicle, equipment, worker or their activities will encroach in the area between the centerline and the outside of the roadway or pavement.

NOTES

1. If the work operation requires that four (4) or more vehicles enter the through traffic lane in a one (1) hour period, a flagger should be provided with required signing for flagger operations. When traffic volumes permit or there is no work being performed, the FLAGGER signs and the flagger may not be required, as directed by the Chief Traffic Engineer or designee.

2. This case also applies when work is being performed in the LEFT hand most lane of a Multilane Highway. Under these conditions, LEFT LANE CLOSED signs shall be substituted for RIGHT LANE CLOSED signs and MERGE RIGHT signs shall be substituted for MERGE LEFT signs. Also, RIGHT Arrow Panel shall be substituted for LEFT Arrow Panel.

3. For multilane undivided roadways or roadways where there are reduced shoulder widths, the signs in the median shall not be required. The ROAD WORK 1 MILE sign, the BRIDGE WORK AHEAD sign, or the UTILITY WORK AHEAD sign shall be added in the opposite direction. Signs specific to the conditions of the operation may be provided as directed by the Chief Traffic Engineer or designee.

4. One (1) AMBER TYPE B flashing light shall be installed on each of the first two (2) drums. One (1) AMBER TYPE B flashing light shall be installed on the drum at the end of the work space. If all drums meet the new sheeting requirements, lights are not required.

5. Arrow Panels shall be provided 1) in the shoulder where the taper crosses from the shoulder to the travel lane, and 2) on the Truck-Mounted Attenuator located at the beginning of the buffer space.

6. A minimum of three (3) channelizing devices shall be placed along the side of the work area adjacent and perpendicular to the lane open to traffic.

7. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

8. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

9. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

10. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

11. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 9) in the work area should be delineated by drums.

12. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

13. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

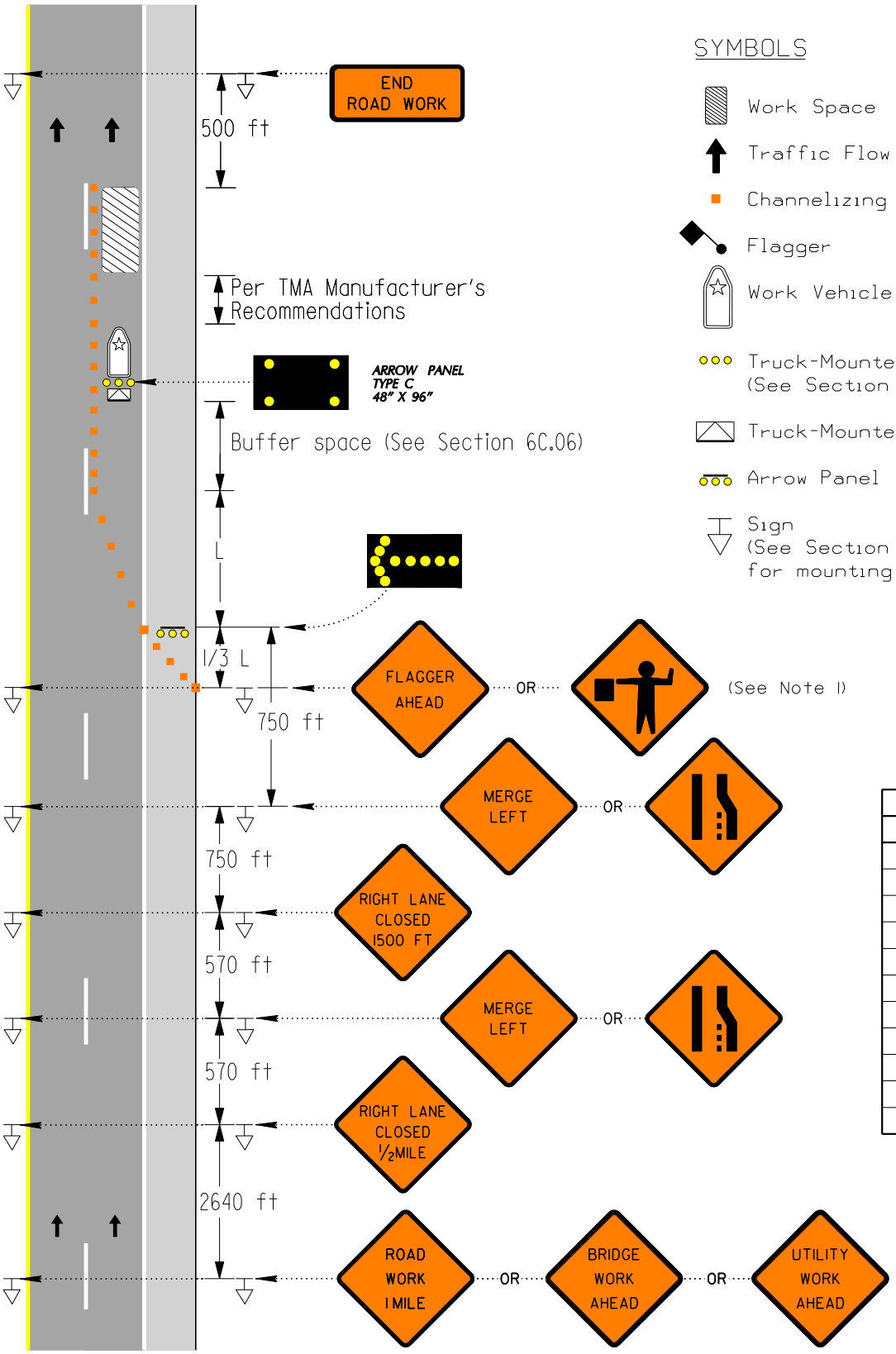
14. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

15. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

16. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 7
MULTILANE, DIVIDED HIGHWAYS AND INTERSTATES - LANE CLOSURE



SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Flagger
- Work Vehicle
- Truck-Mounted Arrow Panel (See Section 6F.56)
- Truck-Mounted Attenuator (TMA)
- Arrow Panel
- Sign (See Section 6F.03 for mounting height)

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

CASE 8

MULTILANE, DIVIDED HIGHWAYS AND INTERSTATES -
INTERIOR LANE CLOSURE

NOTES

1. Arrow Panels shall be provided 1) in the shoulder where the taper crosses from the shoulder to the travel lane, and 2) on the Truck-Mounted Attenuator located at the beginning of the buffer space.

2. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

3. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

4. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

5. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

6. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 4) in the work area should be delineated by drums.

7. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

8. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

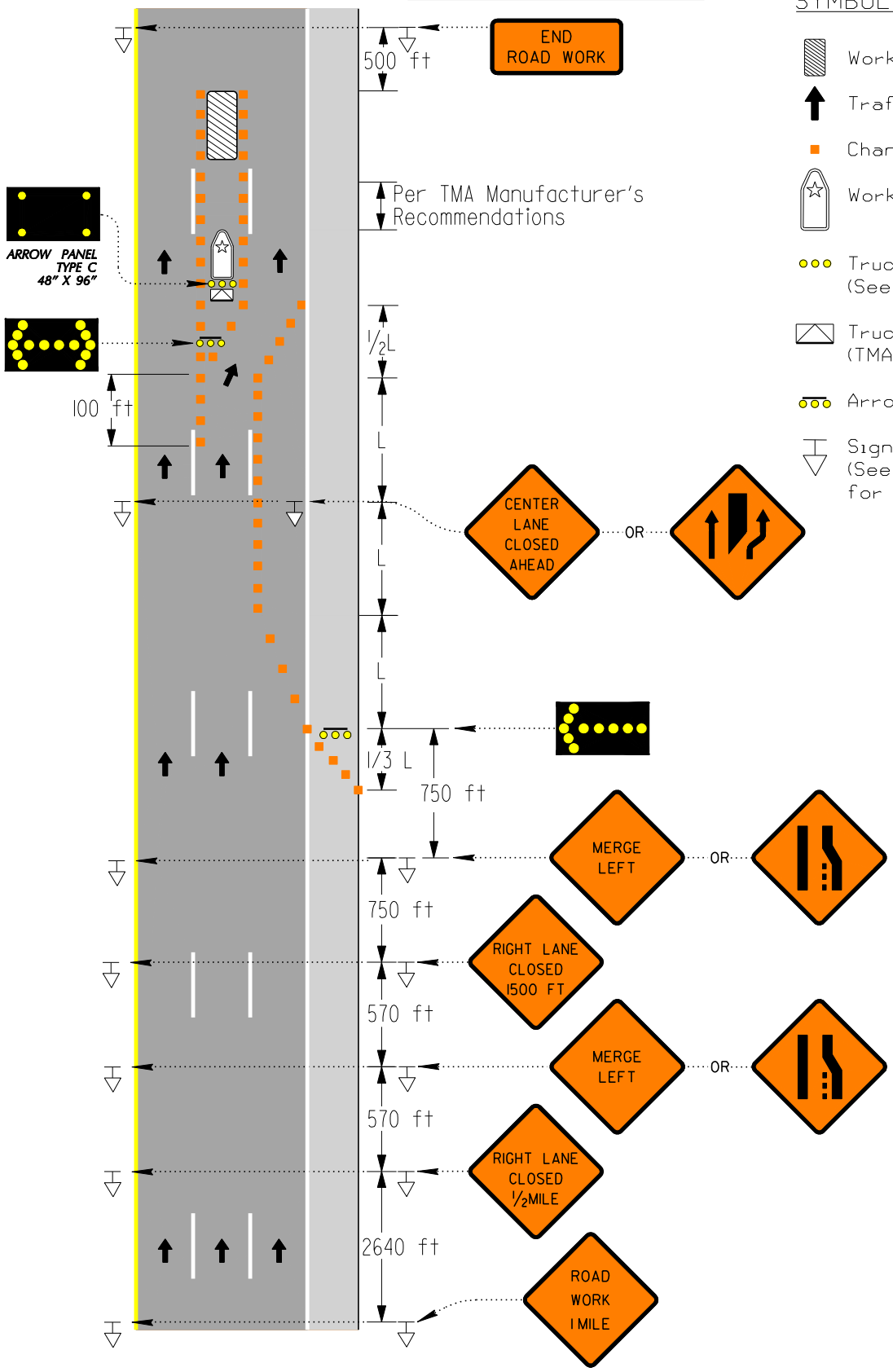
9. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

10. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

11. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 8
MULTILANE, DIVIDED HIGHWAYS AND INTERSTATES - INTERIOR LANE CLOSURE



SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Work Vehicle
- Truck-Mounted Arrow Panel (See Section 6F.56)
- Truck-Mounted Attenuator (TMA)
- Arrow Panel
- Sign (See Section 6F.03 for mounting height)

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

CASE 9

MULTILANE, DIVIDED HIGHWAYS - DOUBLE LANE CLOSURE

NOTES

1. If the work operation requires that four (4) or more vehicles enter the through traffic lane in a one (1) hour period, a flagger should be provided with required signing for flagger operations. When traffic volumes permit or there is no work being performed, the FLAGGER signs and the flagger may not be required, as directed by the Chief Traffic Engineer or designee.

2. This case also applies when work is being performed in the TWO LEFT hand most lanes of a Multilane Highway. Under these conditions, TWO LEFT LANES CLOSED signs shall be substituted for TWO RIGHT LANES CLOSED signs and MERGE RIGHT signs shall be substituted for MERGE LEFT signs. Also, RIGHT Arrow Panels shall be substituted for LEFT Arrow Panels.

3. For multilane undivided roadways or roadways where there are reduced shoulder widths, the signs in the median shall not be required. The ROAD WORK 1 MILE sign, the BRIDGE WORK AHEAD sign, or the UTILITY WORK AHEAD sign shall be added in the opposite direction. Signs specific to the conditions of the operation may be provided as directed by the Chief Traffic Engineer or designee.

4. One (1) AMBER TYPE B flashing light shall be installed on each of the first two (2) drums. One (1) AMBER TYPE B flashing light shall be installed on the drum at the end of the work space. If all drums meet the new sheeting requirements, lights are not required.

5. Arrow Panels shall be provided 1) in the shoulder where the taper crosses from the shoulder to the travel lane, 2) in the nearest to the shoulder travel lane where the taper crosses from this lane to the nest travel lane, and 3) on the Truck-Mounted Attenuators located at the beginning of the buffer space.

6. A minimum of three (3) channelizing devices shall be placed along the side of the work area adjacent and perpendicular to the lane open to traffic.

7. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

8. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

9. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

10. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

11. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 9) in the work area should be delineated by drums.

12. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

13. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

14. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

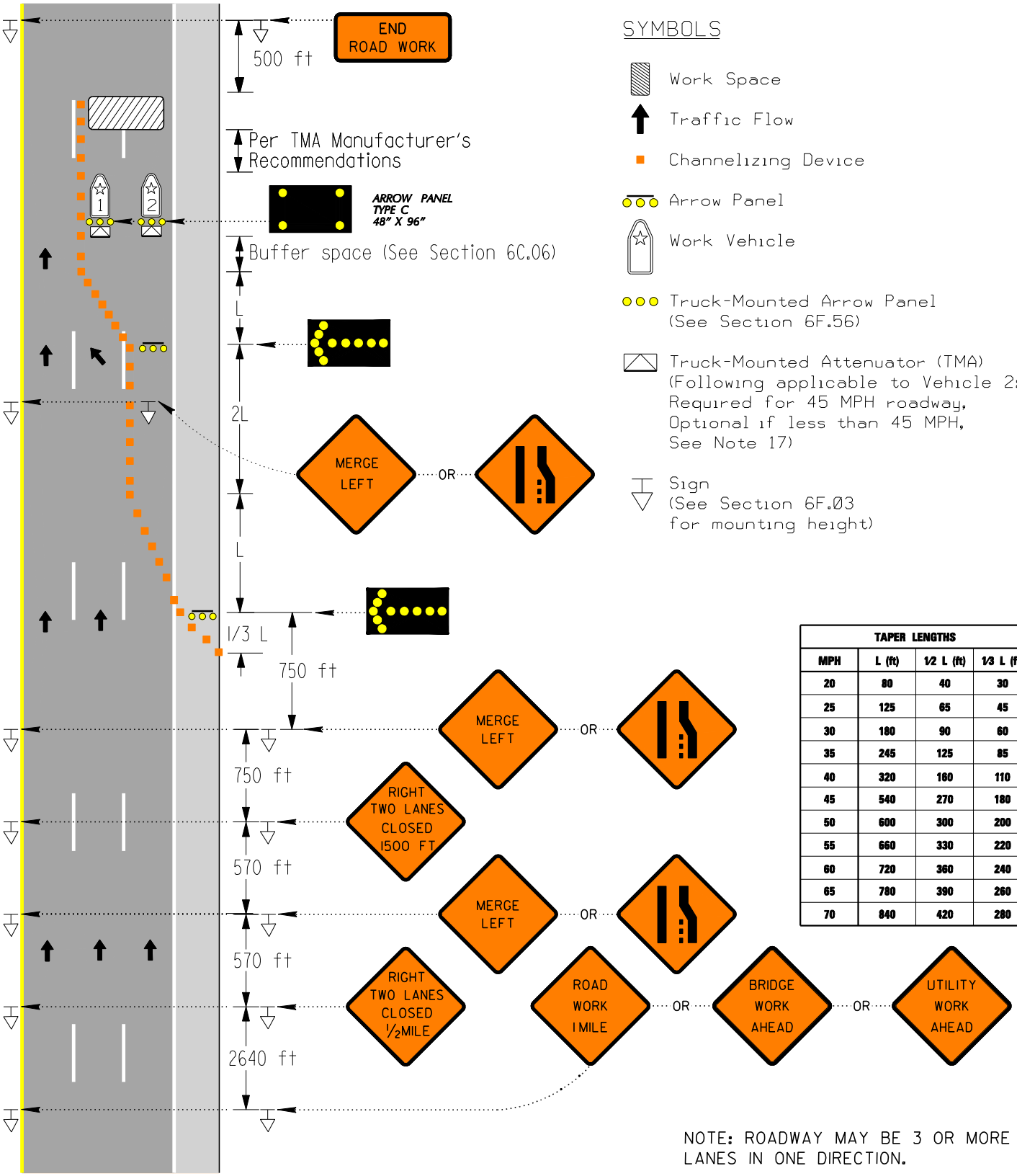
15. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

16. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

17. Use of a Truck-Mounted Attenuator (TMA) on Vehicle 2 shall be required if the posted speed is greater than or equal to 45 MPH. Use of TMA on Vehicle 2 is optional if the posted speed is less than 45 MPH, unless otherwise directed by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 9
MULTILANE, DIVIDED HIGHWAYS - DOUBLE LANE CLOSURE



TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

NOTE: ROADWAY MAY BE 3 OR MORE LANES IN ONE DIRECTION.

CASE 10

TWO-LANE, TWO-WAY TRAFFIC – 25 MPH OR LESS
DAYLIGHT OPERATIONS
LANE DIVERSION

NOTES

1. This case shall be used for roadways with posted speeds of 25 MPH or less, unless otherwise approved by the Chief Traffic Engineer or designee.

2. One or more workers shall be dedicated to maintaining all traffic control devices to the satisfaction of the Chief Traffic Engineer or designee.

3. The diverted travel lanes shall have a minimum width of 10 feet.

4. Traffic may be diverted onto paved shoulders if the shoulders are capable of bearing traffic.

5. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

6. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

7. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

8. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

9. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 7) in the work area should be delineated by drums.

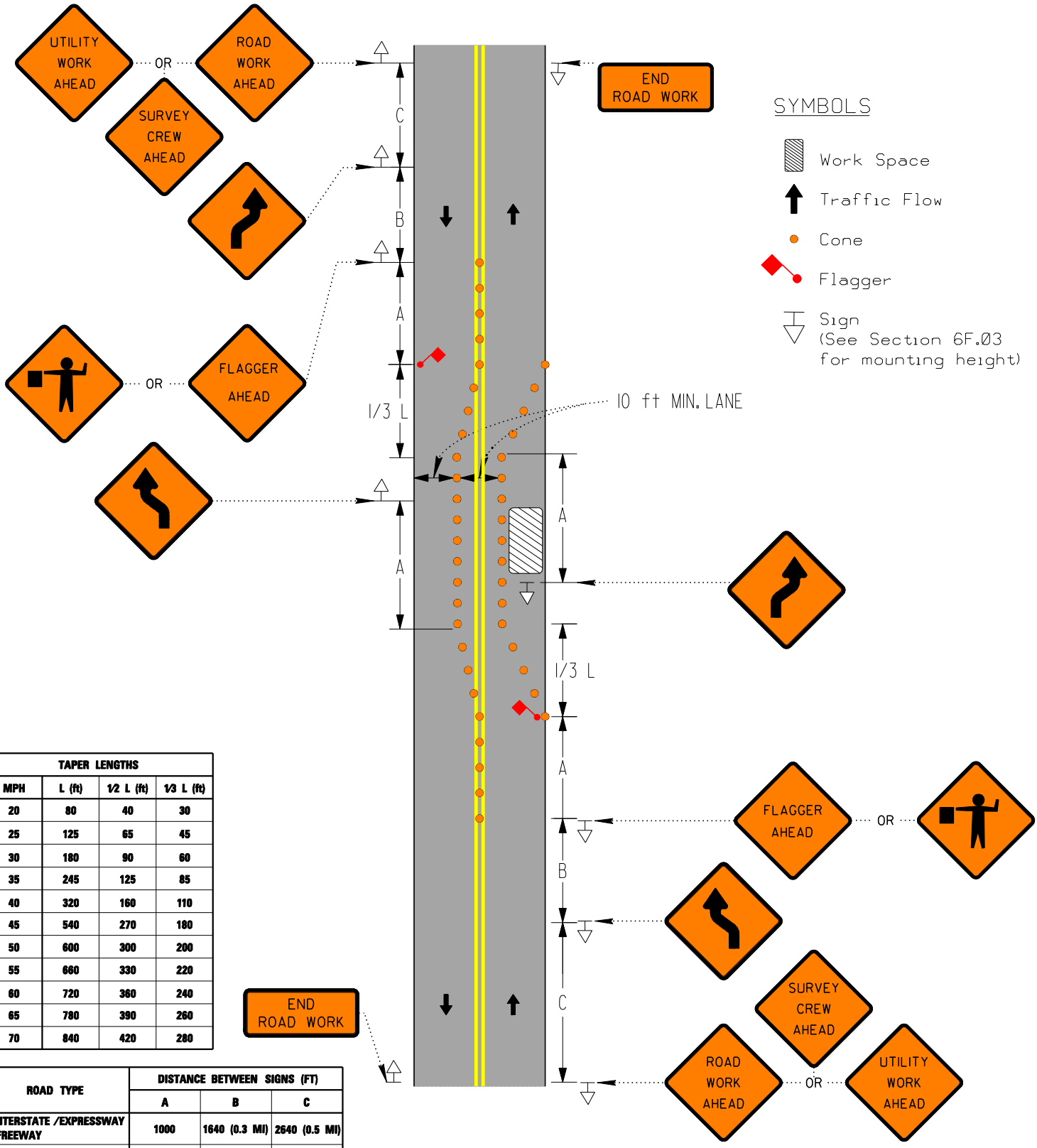
10. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

11. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

12. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 10
TWO-LANE, TWO-WAY TRAFFIC - 25 MPH OR LESS
DAYLIGHT OPERATIONS
LANE DIVERSION



TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 11

TWO-LANE, TWO-WAY TRAFFIC – 25 MPH OR LESS
DAYLIGHT OPERATIONS
WORK IN CENTER OF ROAD

NOTES

1. This case shall be used for roadways with posted speeds of 25 MPH or less, unless otherwise approved by the Chief Traffic Engineer or designee.

2. The lanes on either side of the center work space should have a minimum width of 10 feet as measured from the near edge of the channelizing devices to the edge of pavement or the outside edge of paved shoulder.

3. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or his/her designee may require additional traffic control devices including flaggers as deemed necessary.

4. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

5. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

6. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

7. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 5) in the work area should be delineated by drums.

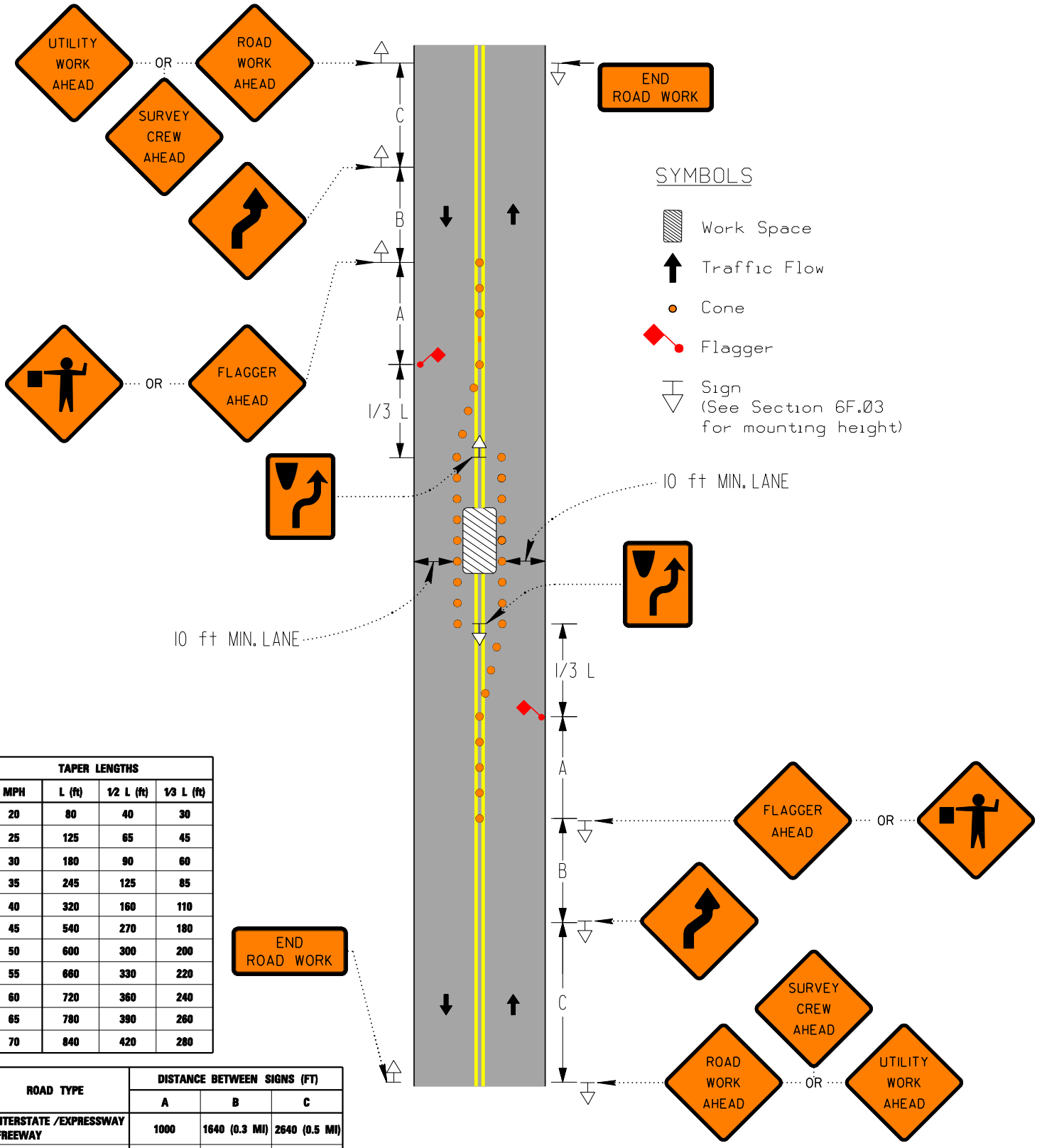
8. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

9. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

10. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE II
TWO-LANE, TWO-WAY TRAFFIC - 25 MPH OR LESS
DAYLIGHT OPERATIONS
WORK IN CENTER OF ROAD



TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 12

MULTILANE, DIVIDED HIGHWAYS -
HALF ROAD CLOSURE

NOTES

1. One (1) AMBER TYPE B flashing light shall be installed on each of the first two (2) drums. One (1) AMBER TYPE B flashing light shall be installed on the drum at the end of the work space. If all drums meet the new sheeting requirements, lights are not required.

2. Channelizing devices shall be as shown unless otherwise approved by the Chief Traffic Engineer or designee.

3. Conflicting pavement markings shall be removed.

4. Possible concerns regarding passage of oversized vehicles or loads through the operation should be investigated.

5. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

6. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

7. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

8. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

9. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 7) in the work area should be delineated by drums.

10. Cones may be used in lieu of drums and barrier during daylight operations. Reflectorized cones may be used in lieu of drums and barrier for a single nighttime emergency operation.

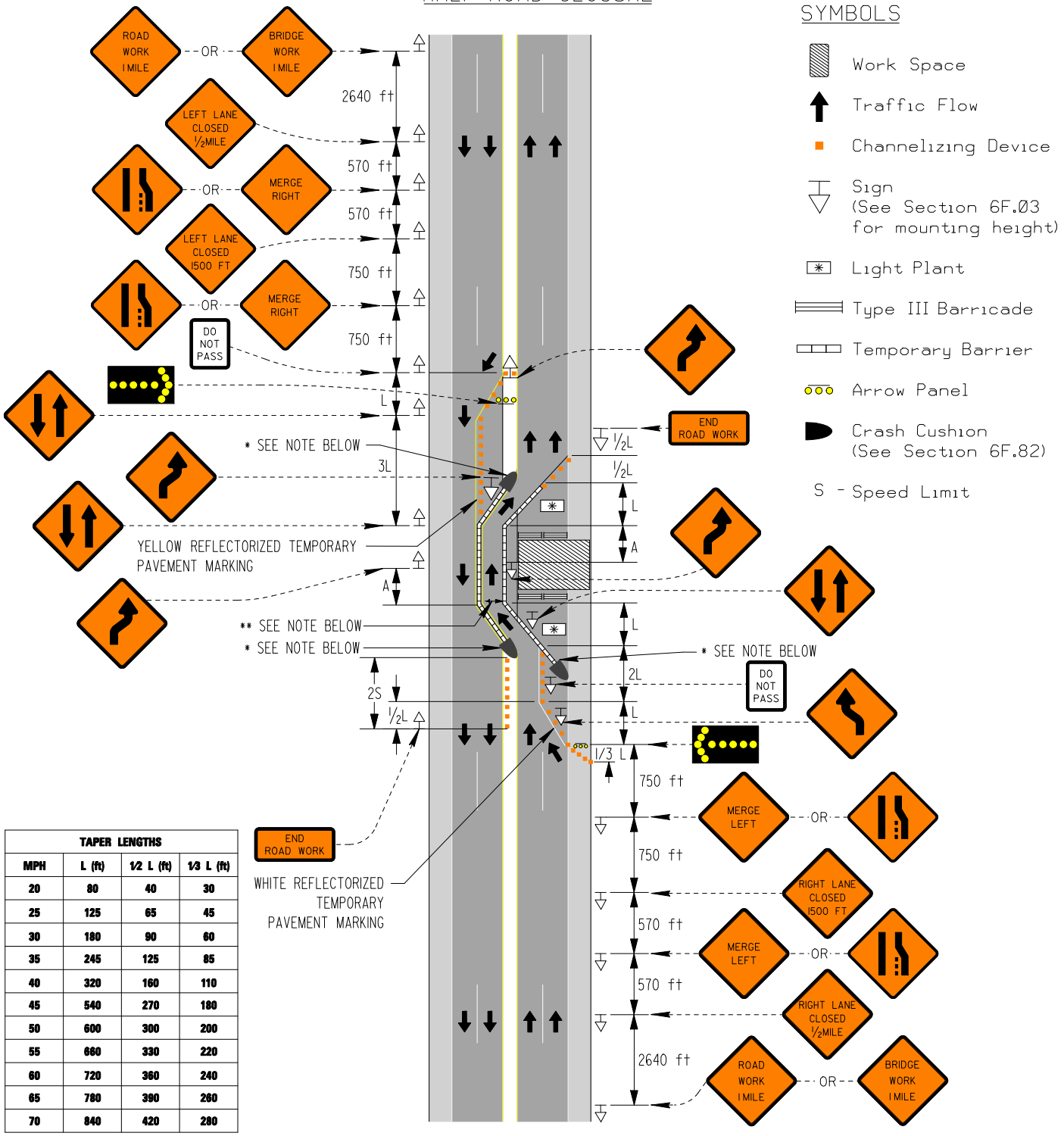
11. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

12. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

13. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 12
MULTILANE, DIVIDED HIGHWAYS - HALF ROAD CLOSURE



SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Sign (See Section 6F.03 for mounting height)
- Light Plant
- Type III Barricade
- Temporary Barrier
- Arrow Panel
- Crash Cushion (See Section 6F.82)
- S - Speed Limit

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

* TIE TEMPORARY BARRIER INTO EXISTING MEDIAN BARRIER WHERE POSSIBLE. END PROTECTION WITHIN CLEAR ZONE FOR OPPOSING TRAFFIC MUST BE COMPLIENT WITH NCHRP-350.

** MINIMUM LANE WIDTH SHALL BE 12 FT, AND MINIMUM DISTANCE BETWEEN TEMPORARY TRAFFIC BARRIER SHALL BE 14 FT, UNLESS DIRECTED OTHERWISE BY TRAFFIC ENGINEER.

CASE 13

MULTILANE INTERSTATES AND HIGHWAYS
WORK IN VICINITY OF ENTRANCE RAMP

NOTES

1. All operations in the vicinity of an entrance ramp shall be coordinated with and approved by the Chief Traffic Engineer or designee.

2. Where inadequate acceleration distance exists for the temporary entrance, the YIELD sign shall be replaced with the STOP sign and one (1) RED TYPE B flashing warning light, as directed by the Chief Traffic Engineer or designee.

3. At a minimum, ramp travel lanes shall be 12 feet wide. Whenever possible, wider lanes shall be provided.

4. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

5. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

6. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

7. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the roadway, unless otherwise authorized by the Chief Traffic Engineer or designee.

8. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 6) in the work area should be delineated by drums.

9. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

10. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

11. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

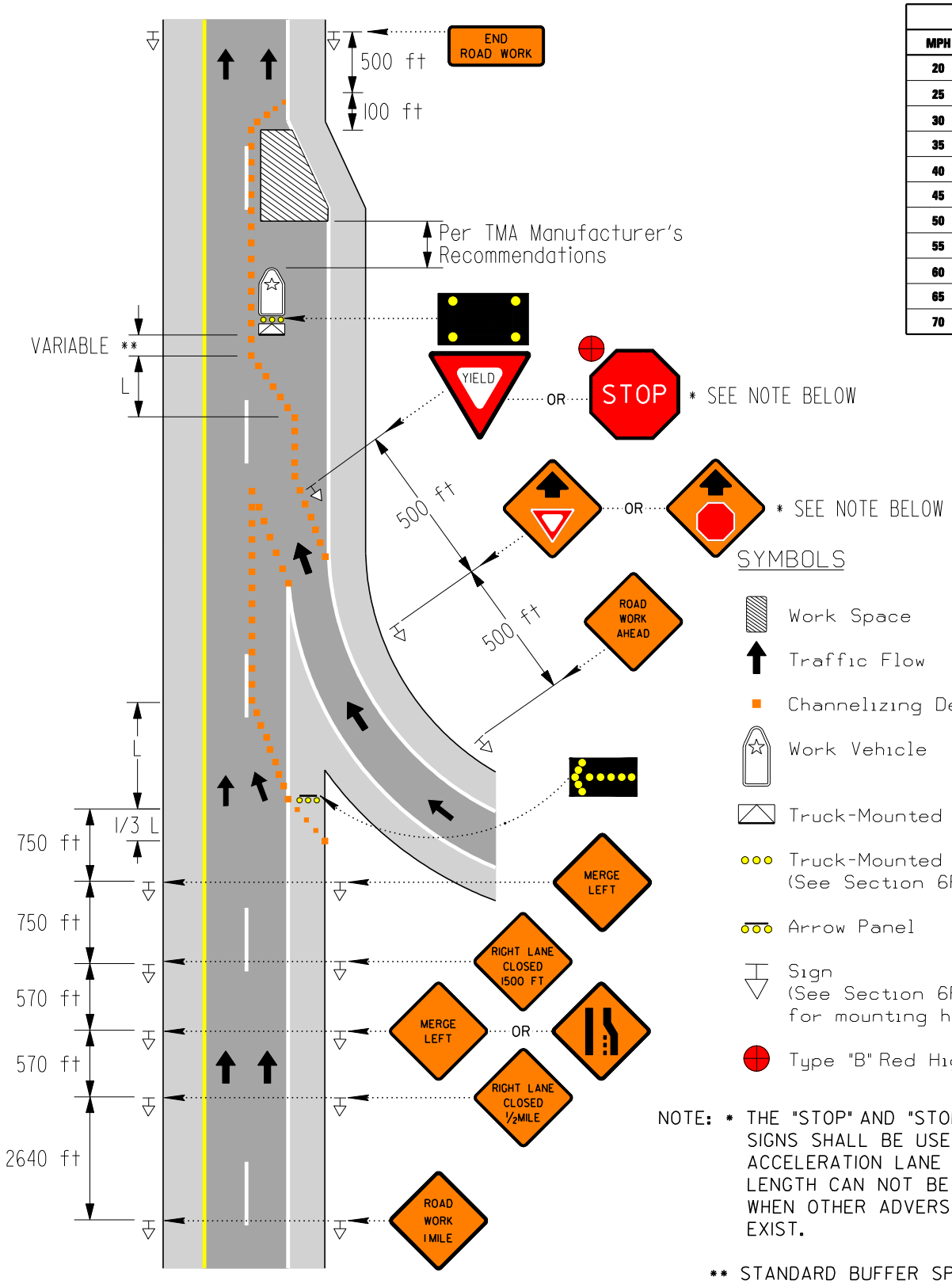
12. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

13. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 13
MULTILANE INTERSTATE AND HIGHWAYS
WORK IN VICINITY OF ENTRANCE RAMP

TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280



SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Work Vehicle
- Truck-Mounted Attenuator (TMA)
- Truck-Mounted Arrow Panel (See Section 6F.56)
- Arrow Panel
- Sign (See Section 6F.03 for mounting height)
- Type "B" Red High-intensity Light

NOTE: * THE "STOP" AND "STOP AHEAD" SIGNS SHALL BE USED WHEN AN ACCELERATION LANE OF SUFFICIENT LENGTH CAN NOT BE PROVIDED, OR WHEN OTHER ADVERSE CONDITIONS EXIST.

** STANDARD BUFFER SPACE SHALL BE PROVIDED WHERE POSSIBLE.

CASE 14

MULTILANE INTERSTATES AND HIGHWAYS
WORK IN VICINITY OF EXIT RAMP

NOTES

1. All operations in the vicinity of an exit ramp shall be coordinated with and approved by the Chief Traffic Engineer or designee.

2. At a minimum, ramp travel lanes shall be 12 feet wide. Whenever possible, wider lanes shall be provided.

3. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

4. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

5. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

6. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the roadway, unless otherwise authorized by the Chief Traffic Engineer or designee.

7. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 5) in the work area should be delineated by drums.

8. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

9. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

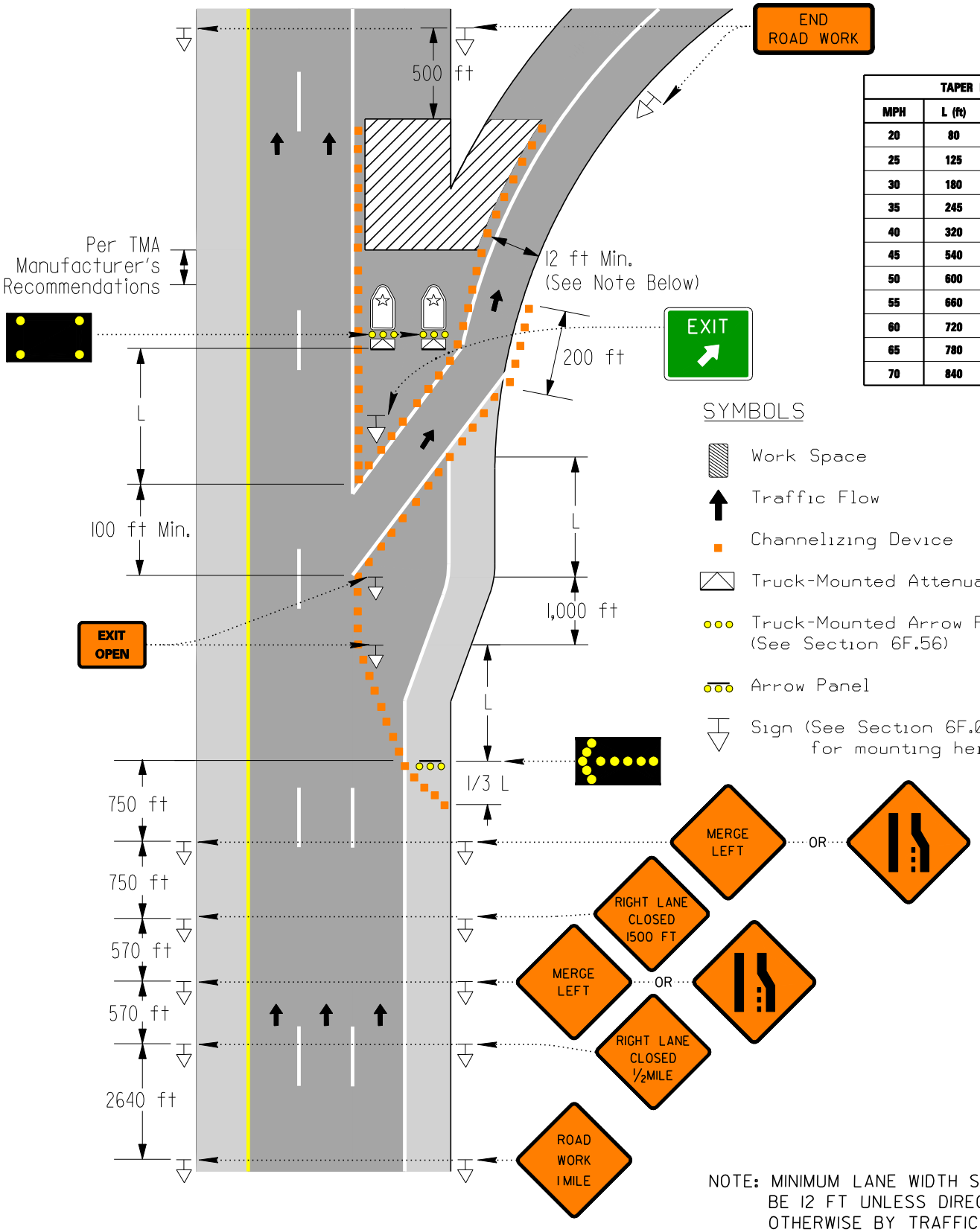
10. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

11. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

12. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 14
MULTILANE INTERSTATES AND HIGHWAYS - WORK IN VICINITY OF EXIT RAMP



TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

SYMBOLS

- Work Space
- Traffic Flow
- Channelizing Device
- Truck-Mounted Attenuator (TMA)
- Truck-Mounted Arrow Panel (See Section 6F.56)
- Arrow Panel
- Sign (See Section 6F.03 for mounting height)

NOTE: MINIMUM LANE WIDTH SHALL BE 12 FT UNLESS DIRECTED OTHERWISE BY TRAFFIC ENGINEER

CASE 15

TWO-LANE, TWO-WAY TRAFFIC – DETOUR

When, at any time, any vehicle, equipment, worker or their activities, including parades, block parties, or any other activities that require the closure of a street, and a detour is in effect.

NOTES

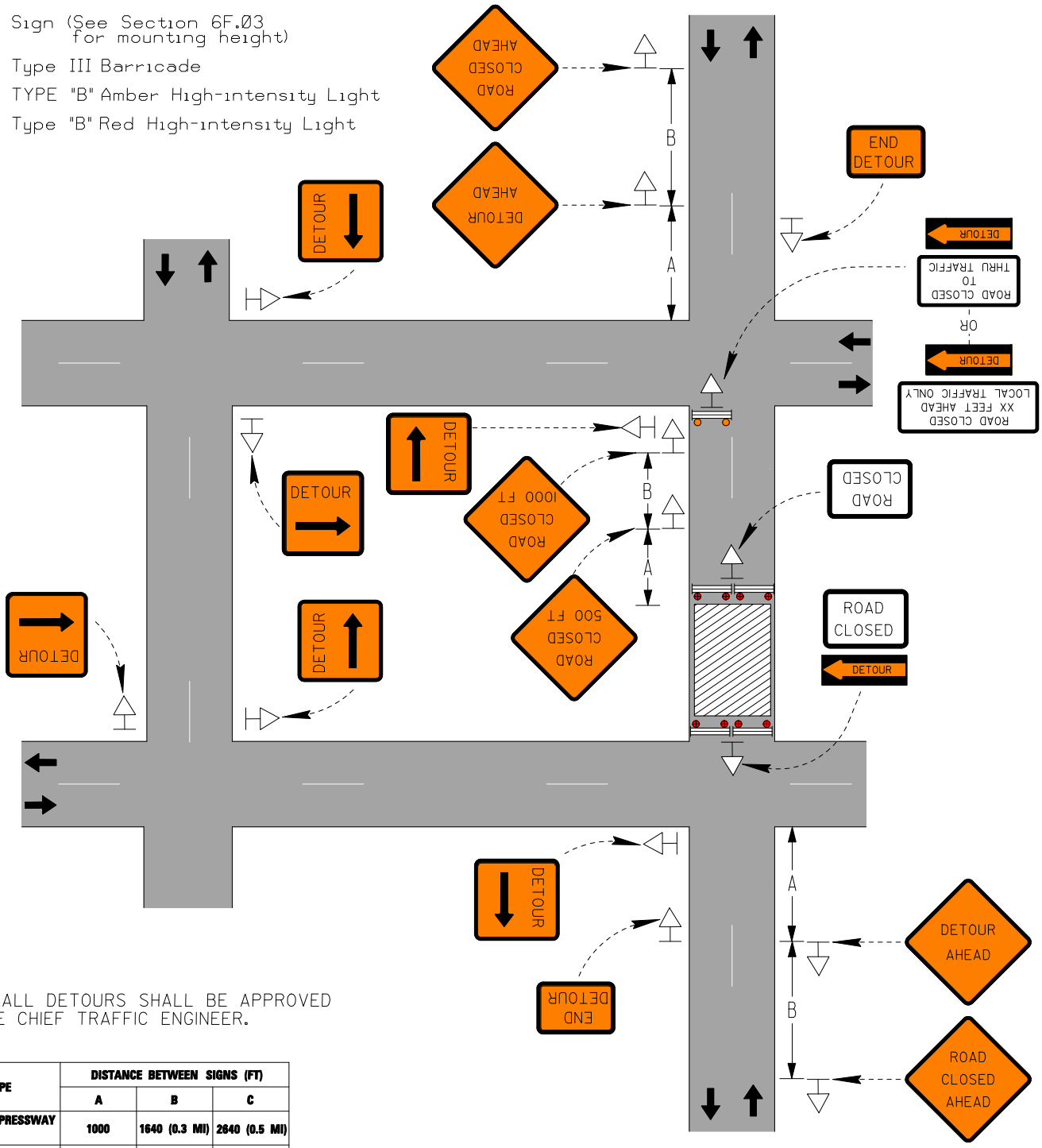
1. Per Delaware Code, all detour plans shall be approved by the Chief Traffic Engineer or designee.
2. The detour shall be established with approved signs before the roadway is closed to traffic.
3. Regulatory traffic control devices should be modified as needed for the duration of the detour.
4. Type III Barricades used at the point of roadway closure shall extend entirely across the roadway.
5. Two (2) RED TYPE B flashing warning lights shall be installed on top of the Type III Barricade that closes the street to all traffic.
6. Two (2) AMBER TYPE B flashing warning lights shall be installed on top of the Type III Barricade at the point of detour where local traffic is permitted access to nearer points than the actual closure.
7. On multi-lane streets, Detour signs with an Advance Turn Arrow should be used in advance of a turn.
8. Detour signs may be located on the far side of intersections. A Detour sign with an advance arrow may be used in advance of a turn.
9. A Street Name sign shall be mounted with the Detour sign for complex detour operations. A Street Name sign may be mounted with the Detour sign for any Detour operation. The Street Name sign may be either white on green or black on orange.
10. When used, the Street Name sign shall be placed above the Detour sign.
11. See Section 6F.03 regarding the mounting of signs on the Type III Barricades.
12. Supplemental detour sign assemblies shall be erected at each cross road intersecting the established detour, as approved by the Chief Traffic Engineer or designee.
13. Under emergency conditions, personnel shall be provided to ensure safe roadway closure until proper devices are in place. Proper devices shall be in place within 24 hours of the start of the emergency operation, or as approved by the Chief Traffic Engineer or designee.
14. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.
15. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.
16. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)
17. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.
18. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 16) in the work area should be delineated by drums.
19. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)
20. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.
21. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE I5
TWO-LANE, TWO-WAY TRAFFIC - DETOUR

SYMBOLS

- Work Space
- Traffic Flow
- Sign (See Section 6F.03 for mounting height)
- Type III Barricade
- TYPE "B" Amber High-intensity Light
- Type "B" Red High-intensity Light



NOTE: ALL DETOURS SHALL BE APPROVED BY THE CHIEF TRAFFIC ENGINEER.

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 16

SIDEWALK DETOUR

NOTES

1. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility. Detour route shall be accessible.

2. Where high speeds (speeds greater than 25 mph) are anticipated, a temporary traffic barrier and, if necessary, a crash cushion should be used to separate the temporary sidewalks from vehicular traffic.

3. Audible information devices should be considered where midblock closings and changed crosswalk areas cause inadequate communication to be provided to pedestrians.

4. Street lighting may be considered.

5. Only the temporary traffic control (TTC) devices related to pedestrians are shown. Other devices, such as lane closure signing or ROAD NARROWS signs, may be used to control vehicular traffic.

6. For nighttime closures, two (2) RED TYPE B flashing warning lights shall be used on barricades that support signs and close sidewalks.

7. Additional devices may be required, as directed by the Chief Traffic Engineer or designee.

8. Any sidewalk detours that deviate from this case shall require project-specific detour or diversion plans submitted to and approved by the Chief Traffic Engineer or designee.

9. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

10. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

11. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

12. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

13. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 11) in the work area should be delineated by drums.

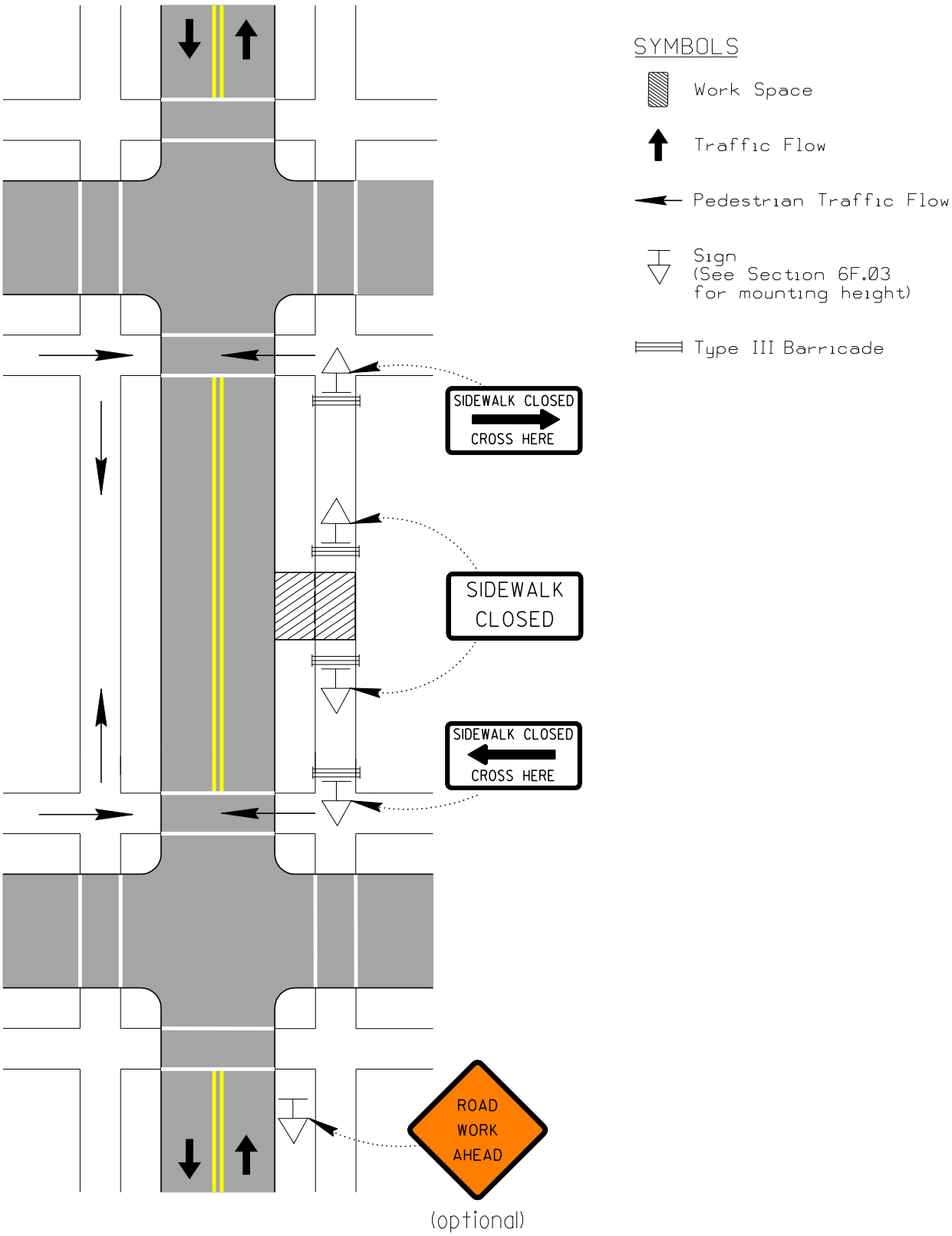
14. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

15. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

16. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 16
SIDEWALK DETOUR



CASE 17-A

TWO-LANE, TWO-WAY TRAFFIC - WORK IN VICINITY OF HIGHWAY-RAIL GRADE CROSSING

NOTES

1. When highway-rail grade crossings exist either within or in the vicinity of roadway work activities, extra care should be taken to minimize the probability of conditions being created, either by lane restrictions, flagging or other operations, where vehicles might be stopped within the highway-rail grade crossing, considered as being 50 feet on either side of the closest and farthest rail.

2. If the queuing of vehicles across rail tracks cannot be avoided, a uniformed law enforcement officer or flagger shall be provided at the highway-rail grade crossing to prevent vehicles from stopping within the highway-rail grade crossing (as described in Note 1), even if automatic warning devices are in place.

3. Early coordination with the railroad company should occur before work starts.

4. All roadway work activities in the vicinity of the highway-rail grade crossing should meet conditions specified by rail owner(s).

5. In the example depicted, the buffer space of the activity area should be extended upstream of the highway-rail grade crossing (as shown) so that a queue created by the flagging operation will not extend across the highway-rail grade crossing.

6. The DO NOT STOP ON TRACKS sign should be used on all approaches to a highway-rail grade crossing within the limits of a temporary traffic control (TTC) zone.

7. If the work space is in close proximity to the rail tracks such that the Truck-Mounted Attenuator will be located in advance of the highway-rail crossing, the roll-ahead distance provided shall not extend across the rail tracks.

8. Flaggers shall be positioned to direct traffic in either direction such that vehicles will not stop on tracks or otherwise block or encroach track area.

9. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

10. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

11. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

12. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

13. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 11) in the work area should be delineated by drums.

14. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

15. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

16. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

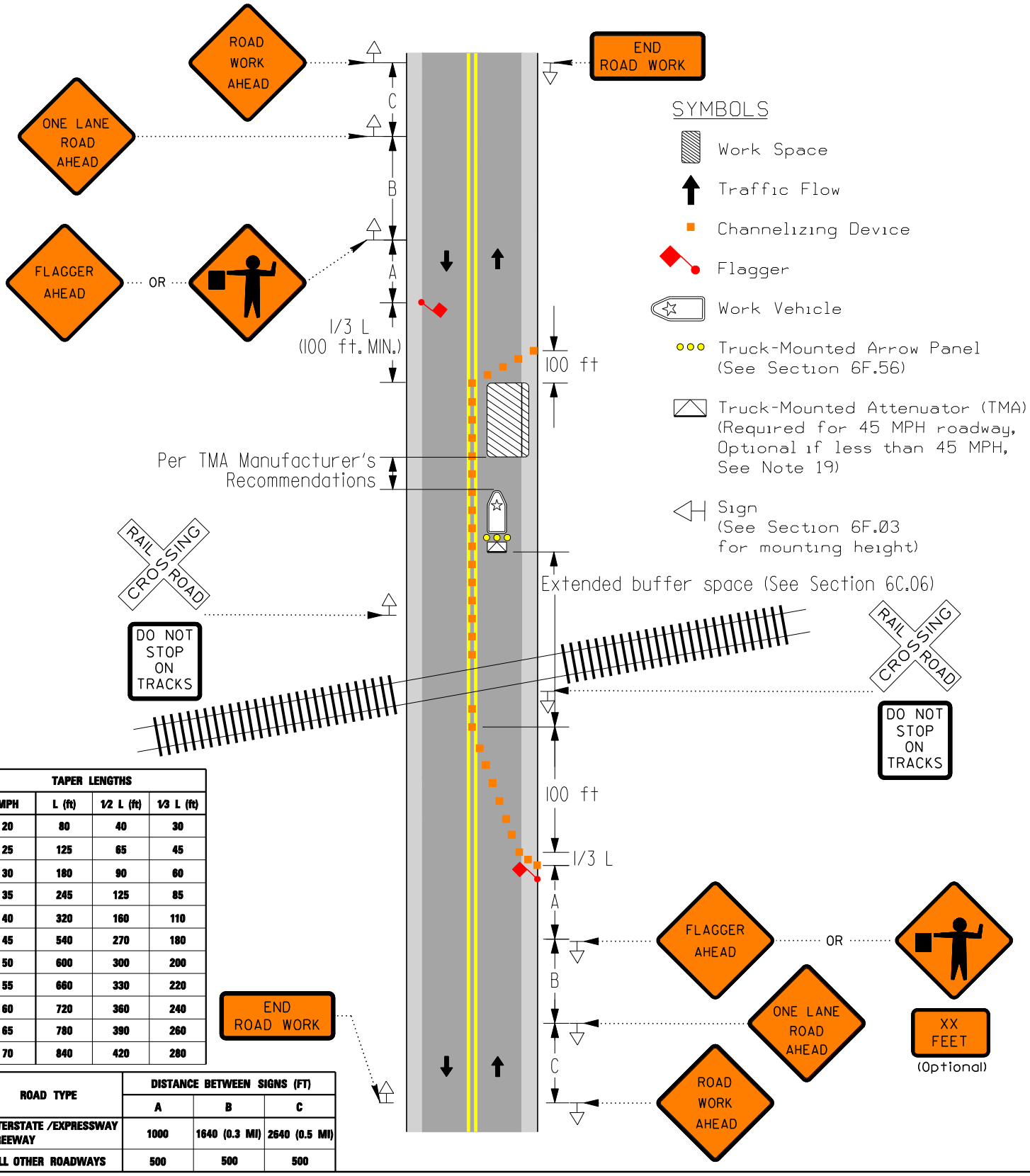
17. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

18. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

19. Use of Truck-Mounted Attenuators (TMAs) shall be required if the posted speed is greater than or equal to 45 MPH. Use of TMAs is optional if the posted speed is less than 45 MPH, unless otherwise directed by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 17-A
TWO-LANE, TWO-WAY TRAFFIC - WORK IN VICINITY OF HIGHWAY-RAIL GRADE CROSSING



TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 17-B

MULTILANE, DIVIDED HIGHWAY - WORK IN VICINITY OF HIGHWAY-RAIL GRADE CROSSING

NOTES

1. When highway-rail grade crossings exist either within or in the vicinity of roadway work activities, extra care should be taken to minimize the probability of conditions being created, either by lane restrictions, flagging or other operations, where vehicles might be stopped within the highway-rail grade crossing, considered as being 50 feet on either side of the closest and farthest rail.

2. If the queuing of vehicles across rail tracks cannot be avoided, a uniformed law enforcement officer or flagger shall be provided at the highway-rail grade crossing to prevent vehicles from stopping within the highway-rail grade crossing (as described in Note 1), even if automatic warning devices are in place.

3. Early coordination with the railroad company should occur before work starts.

4. All roadway work activities in the vicinity of the highway-rail grade crossing should meet conditions specified by rail owner(s).

5. In the example depicted, the buffer space of the activity area should be extended upstream of the highway-rail grade crossing (as shown) so that a queue created by the flagging operation will not extend across the highway-rail grade crossing.

6. The DO NOT STOP ON TRACKS sign should be used on all approaches to a highway-rail grade crossing within the limits of a TTC zone.

7. If the work space is in close proximity to the rail tracks such that the Truck-Mounted Attenuator will be located in advance of the highway-rail crossing, the roll-ahead distance provided shall not extend across the rail tracks.

8. Flaggers shall be positioned to direct traffic in such that vehicles will not stop on tracks or otherwise block or encroach track area.

9. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

10. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

11. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

12. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

13. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 11) in the work area should be delineated by drums.

14. Cones may be used in lieu of drums during daylight operations. Reflectorized cones may be used in lieu of drums for a single nighttime emergency operation.

15. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

16. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

17. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

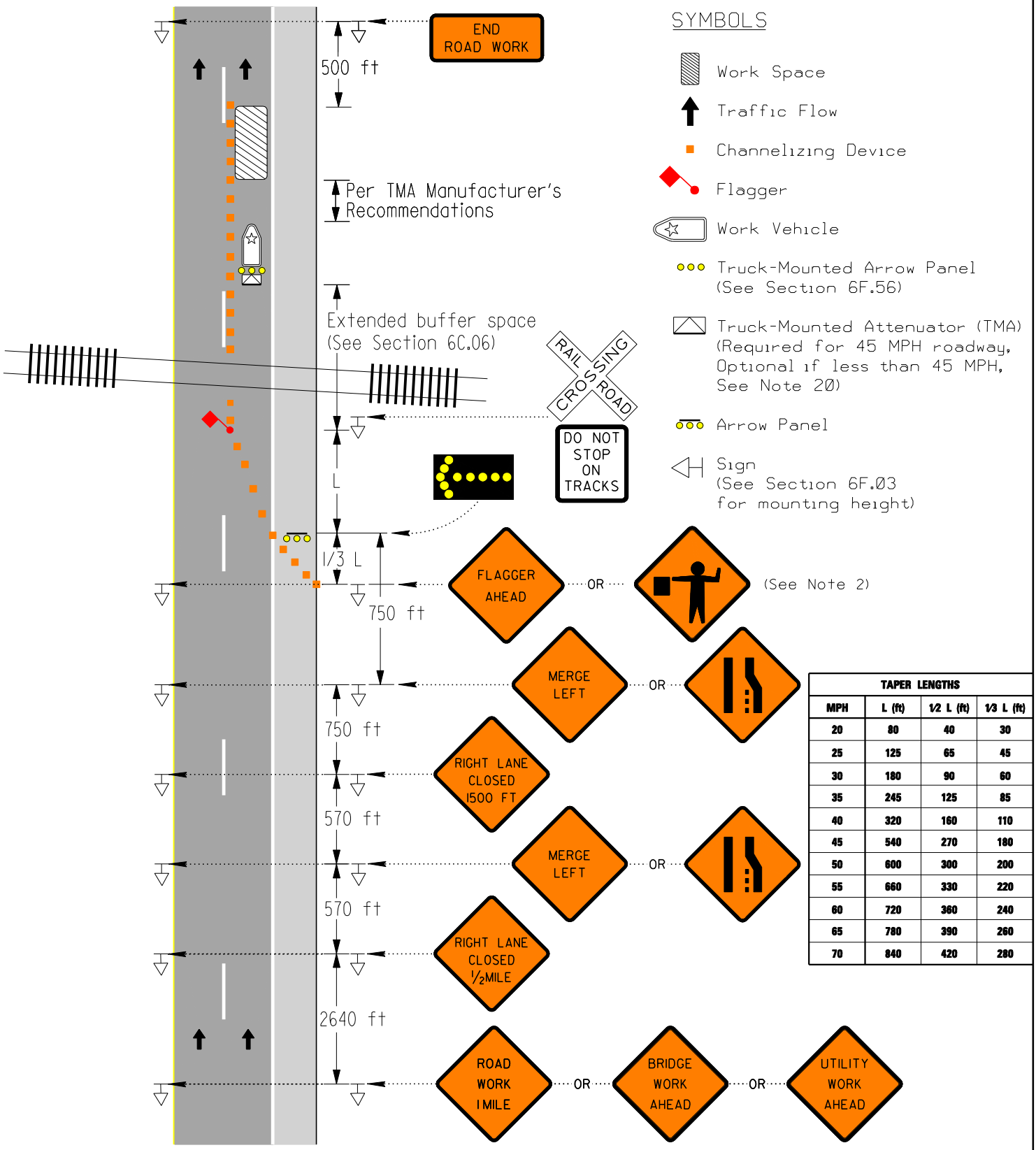
18. An Arrow Panel shall be provided in the shoulder where the taper crosses from the shoulder to the travel lane. An additional Arrow Panel may be provided on the Truck-Mounted Attenuator located at the beginning of the buffer space but shall not replace or be substituted for the required Arrow Panel.

19. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

20. Use of Truck-Mounted Attenuators (TMAs) shall be required if the posted speed is greater than or equal to 45 MPH. Use of TMAs is optional if the posted speed is less than 45 MPH, unless otherwise directed by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 17-B
MULTILANE, DIVIDED HIGHWAYS -
WORK IN VICINITY OF HIGHWAY-RAIL GRADE CROSSING



TAPER LENGTHS			
MPH	L (ft)	1/2 L (ft)	1/3 L (ft)
20	80	40	30
25	125	65	45
30	180	90	60
35	245	125	85
40	320	160	110
45	540	270	180
50	600	300	200
55	660	330	220
60	720	360	240
65	780	390	260
70	840	420	280

CASE 18

BLASTING ZONE

NOTES

1. Whenever blasting caps are used within 1,000 feet of a roadway, the signing shown shall be used.

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

3. Whenever a side road intersects the roadway between the BLASTING ZONE AHEAD sign and the END BLASTING ZONE sign, or a side road is within 1,000 feet of any blasting cap, similar signing, as on the mainline, shall be installed on the side road.

4. Prior to blasting, the blaster in charge shall determine whether road users in the blasting zone will be endangered by the blasting operation. If there is danger, road users shall not be permitted to pass through the blasting zone during blasting operations.

5. On a divided highway, the signs should be mounted on both sides of the directional roadways.

6. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

7. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

8. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

9. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

10. At a minimum, (except vehicles that meet the requirements of Note 8) any unattended obstacle in the work area should be delineated by drums.

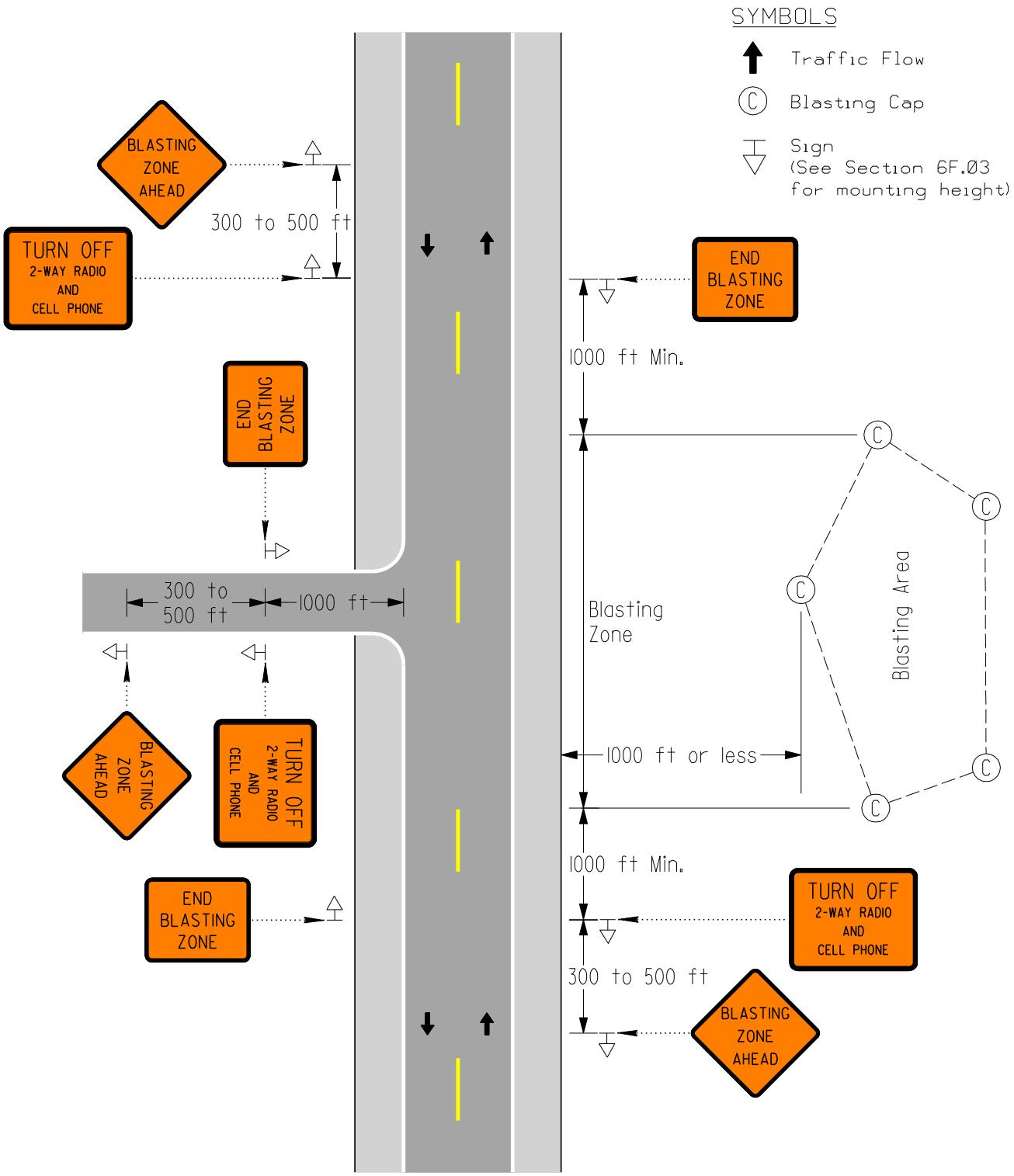
11. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

12. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

13. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 18
BLASTING ZONE



CASE 19

TWO-LANE, TWO-WAY TRAFFIC
MOVING DAYTIME OPERATIONS – LANE CLOSURE

When, at any time, any vehicle, equipment, workers or their activities require an intermittent or continuous moving operation on the roadway or pavement where the average speed is less than four (4) miles per hour.

NOTES

1. Maximum distance shall be determined by the Chief Traffic Engineer or designee, but in no case to exceed the length of one-half (½) day's operation or one (1) mile, whichever is less.

2. Flaggers shall be in sight of each other or in communication with each other at all times.

3. When a side road or major access point, such as a commercial, industrial or residential development driveway, intersects the roadway on which work is being performed, additional flagger(s) should be utilized in the vicinity of the intersection(s).

4. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

5. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

6. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

7. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

8. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 6) in the work area should be delineated by drums.

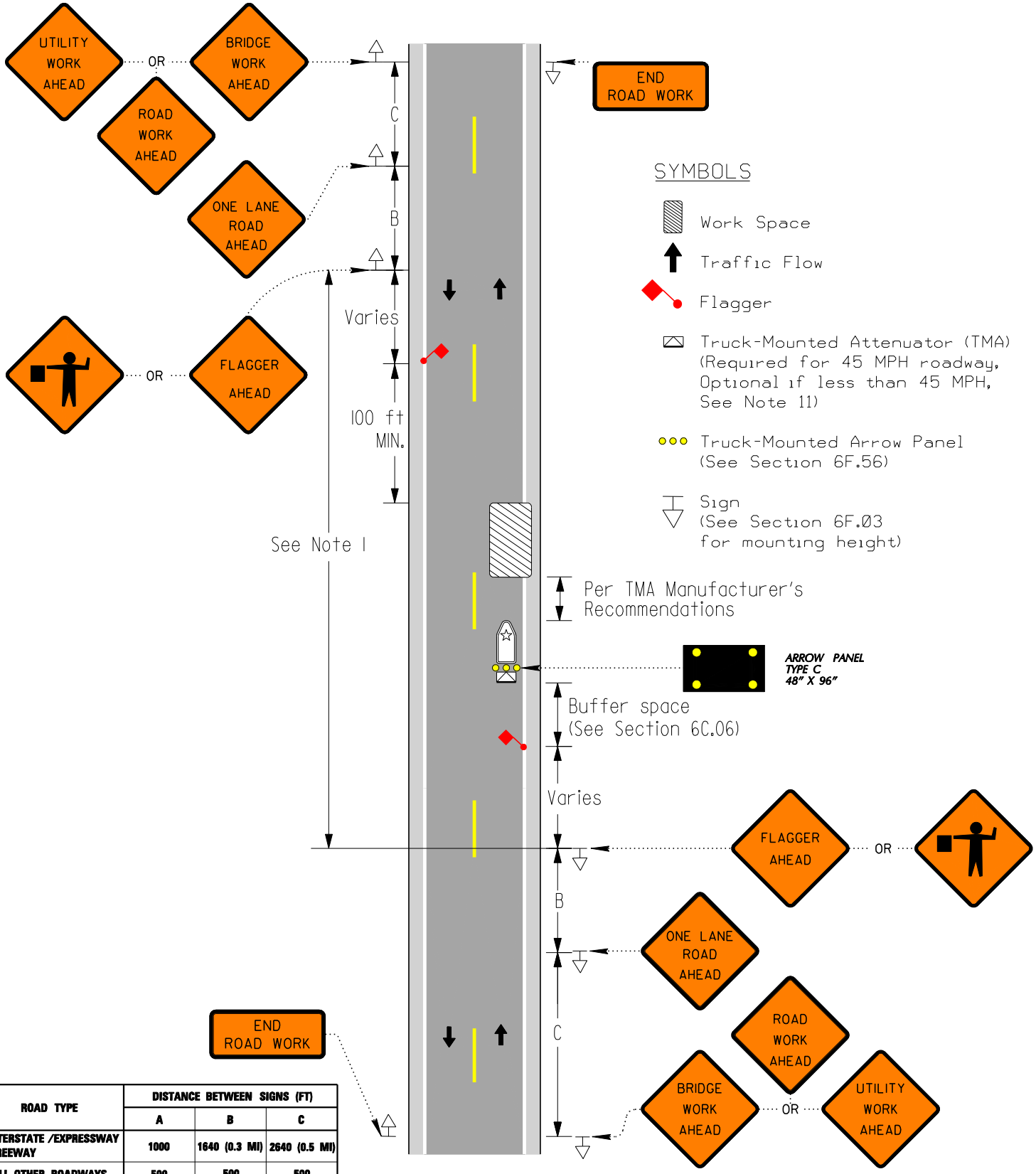
9. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

10. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

11. Use of Truck-Mounted Attenuators (TMAs) shall be required if the posted speed is greater than or equal to 45 MPH. Use of TMAs is optional if the posted speed is less than 45 MPH, unless otherwise directed by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 19
TWO-LANE, TWO-WAY TRAFFIC - MOVING DAYTIME OPERATIONS - LANE CLOSURE



ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
INTERSTATE /EXPRESSWAY /FREEWAY	1000	1640 (0.3 MI)	2640 (0.5 MI)
ALL OTHER ROADWAYS	500	500	500

CASE 20-A

TWO-LANE, TWO-WAY, TRAFFIC AND MULTILANE HIGHWAYS MOVING DAYTIME OPERATIONS OR SHORT DURATION (1 HOUR OR LESS) STATIONARY – ON SHOULDER

When, at any time, any vehicle, equipment, workers or their activities require a moving operation where the average speed of movement is greater than four (4) miles per hour.

NOTES

1. Vehicle-mounted signs shall be mounted in a manner such that they are not obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned from view when work is not in progress.

2. The arrow panel shall be used in the caution mode.

3. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.

4. The distance between the work and shadow vehicles may vary according to terrain, Truck-Mounted Attenuator manufacturer's recommendations, and other factors.

5. Additional shadow vehicles to warn and reduce the speed of oncoming or opposing vehicular traffic may be used. Law enforcement vehicles may be used for this purpose.

6. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

7. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

8. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

9. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

10. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 8) in the work area should be delineated by drums.

11. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

12. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

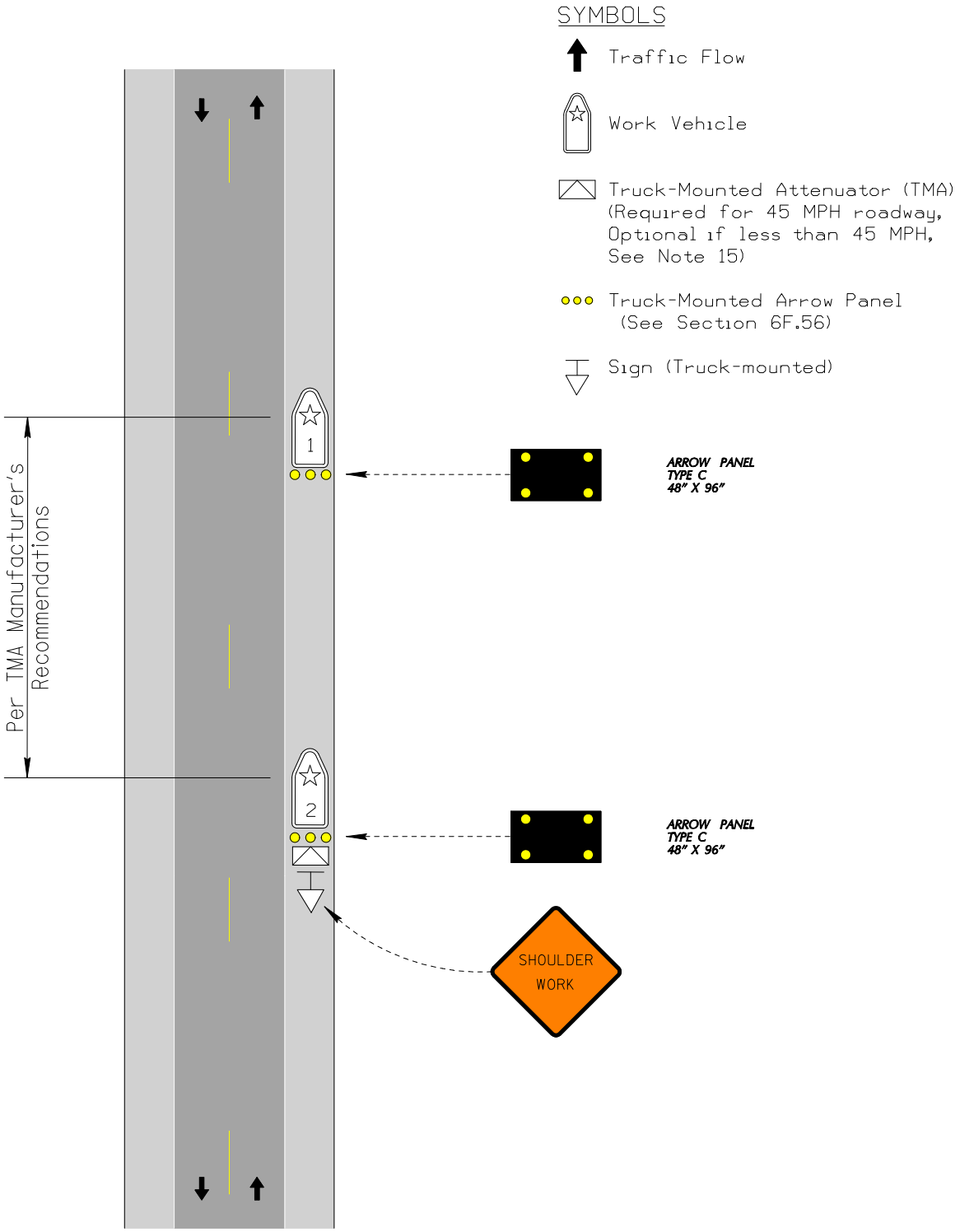
13. A specialized work vehicle, such as a sweeper truck, vacuum truck or pothole patching truck, shall not be required to be equipped with a Truck-Mounted Attenuator (TMA). Any other specialized work vehicle, other than those listed, shall be equipped with a TMA, unless otherwise approved by the Chief Traffic Engineer or designee.

14. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

15. Use of Truck-Mounted Attenuators (TMAs) shall be required if the posted speed is greater than or equal to 45 MPH. Use of TMAs is optional if the posted speed is less than 45 MPH, unless otherwise directed by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 20-A
TWO-LANE, TWO-WAY, TRAFFIC AND MULTILANE HIGHWAYS
MOVING DAYTIME OPERATIONS OR SHORT DURATION (1 HOUR OR LESS)
STATIONARY - ON SHOULDER



CASE 20-B

TWO-LANE, TWO-WAY, TRAFFIC AND MULTILANE HIGHWAYS MOVING DAYTIME OPERATIONS OR SHORT DURATION (1 HOUR OR LESS) STATIONARY – LANE CLOSURE

When, at any time, any vehicle, equipment, workers or their activities require a moving operation where the average speed of movement is greater than four (4) miles per hour.

NOTES

1. Vehicle-mounted signs shall be mounted in a manner such that they are not obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned from view when work is not in progress.

2. The arrow panel shall be used in the caution mode.

3. Where practical and when needed, the work and shadow vehicles should pull over periodically to allow vehicular traffic to pass.

4. If the work and shadow vehicles cannot pull over to allow vehicular traffic to pass frequently, a DO NOT PASS sign may be placed on the rear of the shadow vehicle.

5. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.

6. The distance between the work and shadow vehicles may vary according to terrain, Truck-Mounted Attenuator manufacturer's recommendations, and other factors.

7. Additional vehicles to warn and reduce the speed of oncoming or opposing vehicular traffic may be used. Law enforcement vehicles may be used for this purpose.

8. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

9. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

10. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

11. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

12. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 10) in the work area should be delineated by drums.

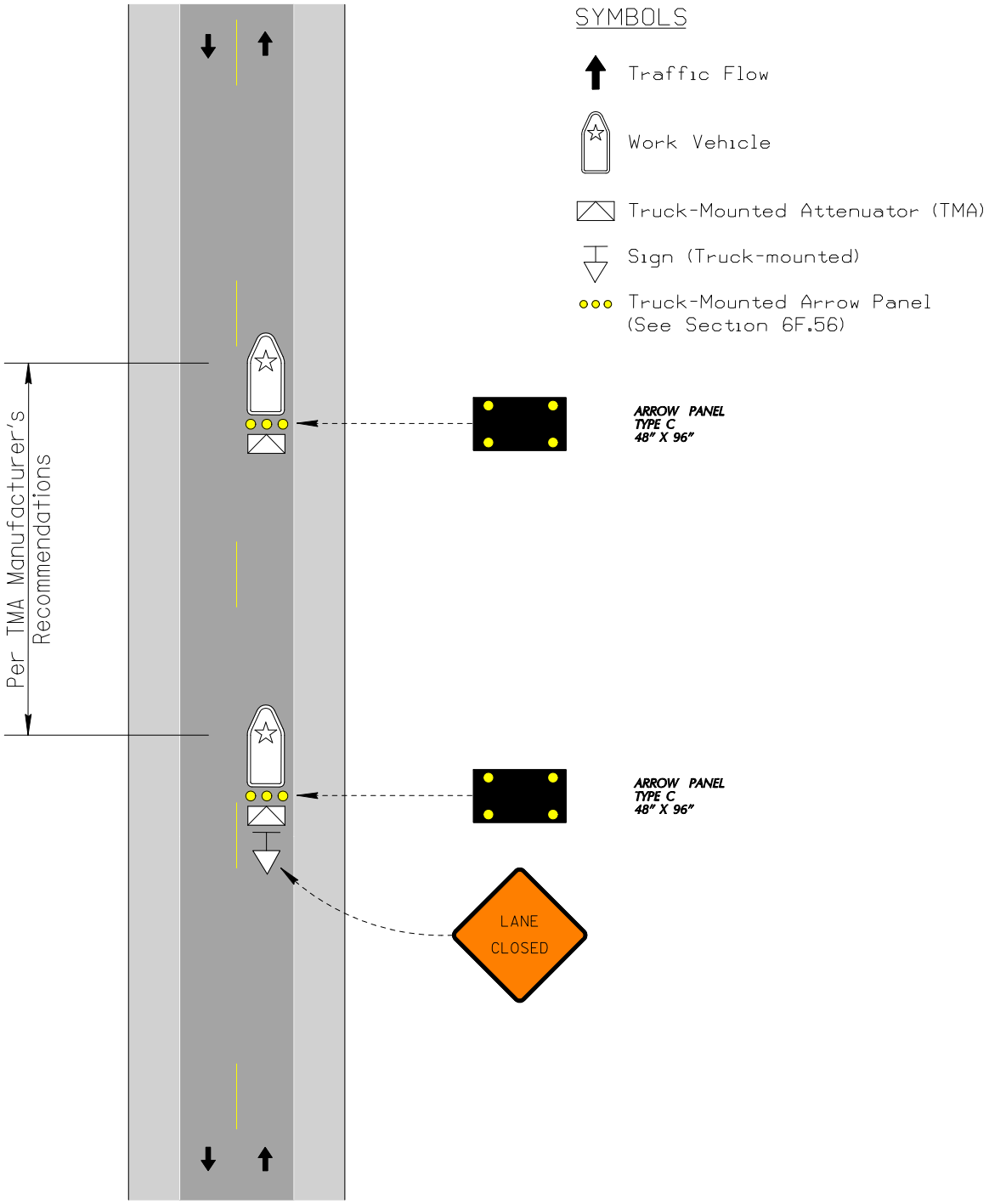
13. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

14. Use of Truck-Mounted Attenuators (TMAs) shall be in accordance with Section 6F.82. A specialized work vehicle, such as a sweeper truck, vacuum truck or pothole patching truck, shall not be required to be equipped with a TMA. Any other specialized work vehicle, other than those listed, shall be equipped with a TMA, unless otherwise approved by the Chief Traffic Engineer or designee.

15. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 20-B
TWO-LANE, TWO-WAY TRAFFIC AND MULTILANE HIGHWAYS
MOVING DAYTIME OPERATIONS OR SHORT DURATION (1 HOUR OR LESS)
STATIONARY - LANE CLOSURE



CASE 21

MULTILANE INTERSTATES AND HIGHWAYS
SINGLE LANE, STOP & GO OR SLOW MOVING OPERATIONS

NOTES

1. A minimum of six (6) vehicles are required at all times.

2. Operations may utilize additional work vehicles, as directed by the Chief Traffic Engineer or designee.

3. Use of a Truck-Mounted Attenuator (TMA) on Vehicle 1 is optional, unless otherwise directed by the Chief Traffic Engineer or designee. Vehicles 2, 3 and 4 shall be equipped with a TMA. Each of these vehicles shall be driven at a distance behind the preceding vehicle that is in accordance with the TMA manufacturer's recommendations.

   Vehicle 5 shall be driven approximately 500 feet behind the preceding vehicle. The interval distance may be varied depending on conditions.

   Vehicle 6 shall be driven approximately 2500 feet behind the preceding vehicle.

4. A specialized work vehicle, such as a sweeper truck, vacuum truck or pothole patching truck, shall not be required to be equipped with a Truck-Mounted Attenuator (TMA). Any other specialized work vehicle, other than those listed, shall be equipped with a TMA, unless otherwise approved by the Chief Traffic Engineer or designee.

5. Specialized work vehicles shall be equipped with a Type A arrow panel as a minimum.

6. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

7. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

8. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

9. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

10. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 8) in the work area should be delineated by drums.

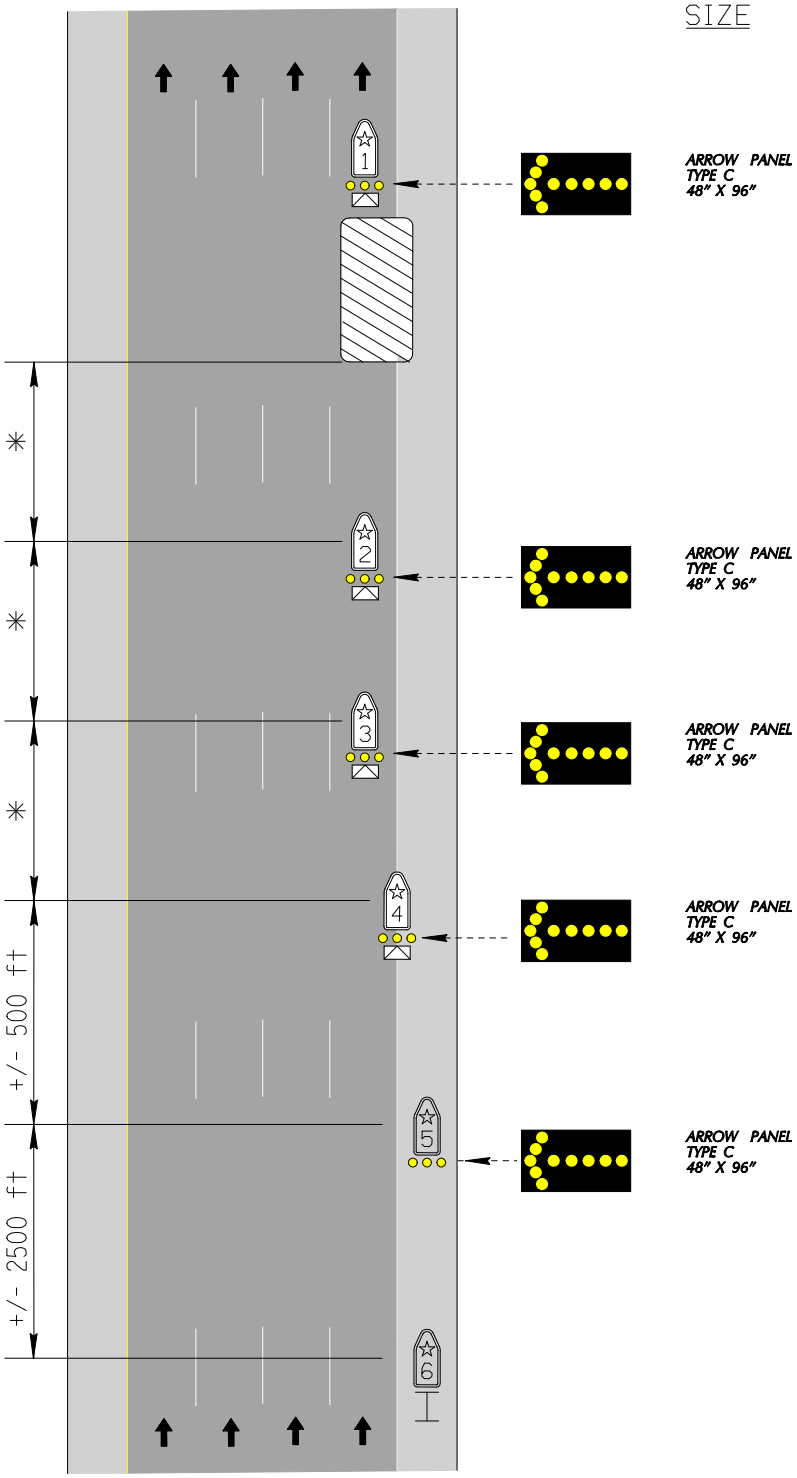
11. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

12. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

13. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 21
MULTILANE INTERSTATES AND HIGHWAYS
SINGLE LANE, STOP & GO OR SLOW MOVING OPERATIONS



SIZE

SYMBOLS

Traffic Flow

Work Space

Work Vehicle

Truck-Mounted Attenuator (TMA)
(Optional for Vehicle 1,
See Note 3)

Changeable Message Sign

Truck-Mounted Arrow Panel
(See Section 6F.56)

* – Per TMA Manufacturer's
Recommendations

CASE 22

MULTILANE INTERSTATES AND HIGHWAYS
MULTILANE, STOP & GO OR SLOW MOVING OPERATIONS

NOTES

1. A minimum of nine (9) vehicles are required at all times for multilane operations. When more than two (2) lanes are occupied by operations, additional vehicles equipped with Truck-Mounted Attenuators may be required as directed by the Chief Traffic Engineer or designee.

2. Operations may utilize additional work vehicles, as directed by the Chief Traffic Engineer or designee.

3. Use of Truck-Mounted Attenuators (TMAs) on Vehicles 1 and 3 are optional, unless otherwise directed by the Chief Traffic Engineer or designee. Vehicles 2, 4, 5, 6 and 7 shall be equipped with a Truck-Mounted Attenuator (TMA). Each of these vehicles shall be driven at a distance behind the preceding vehicle that is in accordance with the TMA manufacturer's recommendations.

   Vehicle 8 shall be driven approximately 500 feet behind the preceding vehicle. The interval distance may be varied depending on conditions.

   Vehicle 9 shall be driven approximately 2500 feet behind the preceding vehicle.

4. A specialized work vehicle, such as a sweeper truck, vacuum truck or pothole patching truck, shall not be required to be equipped with a Truck-Mounted Attenuator (TMA). Any other specialized work vehicle, other than those listed, shall be equipped with a TMA, unless otherwise approved by the Chief Traffic Engineer or designee.

5. Specialized work vehicles shall be equipped with a Type A arrow panel as a minimum.

6. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

7. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

8. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

9. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

10. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 8) in the work area should be delineated by drums.

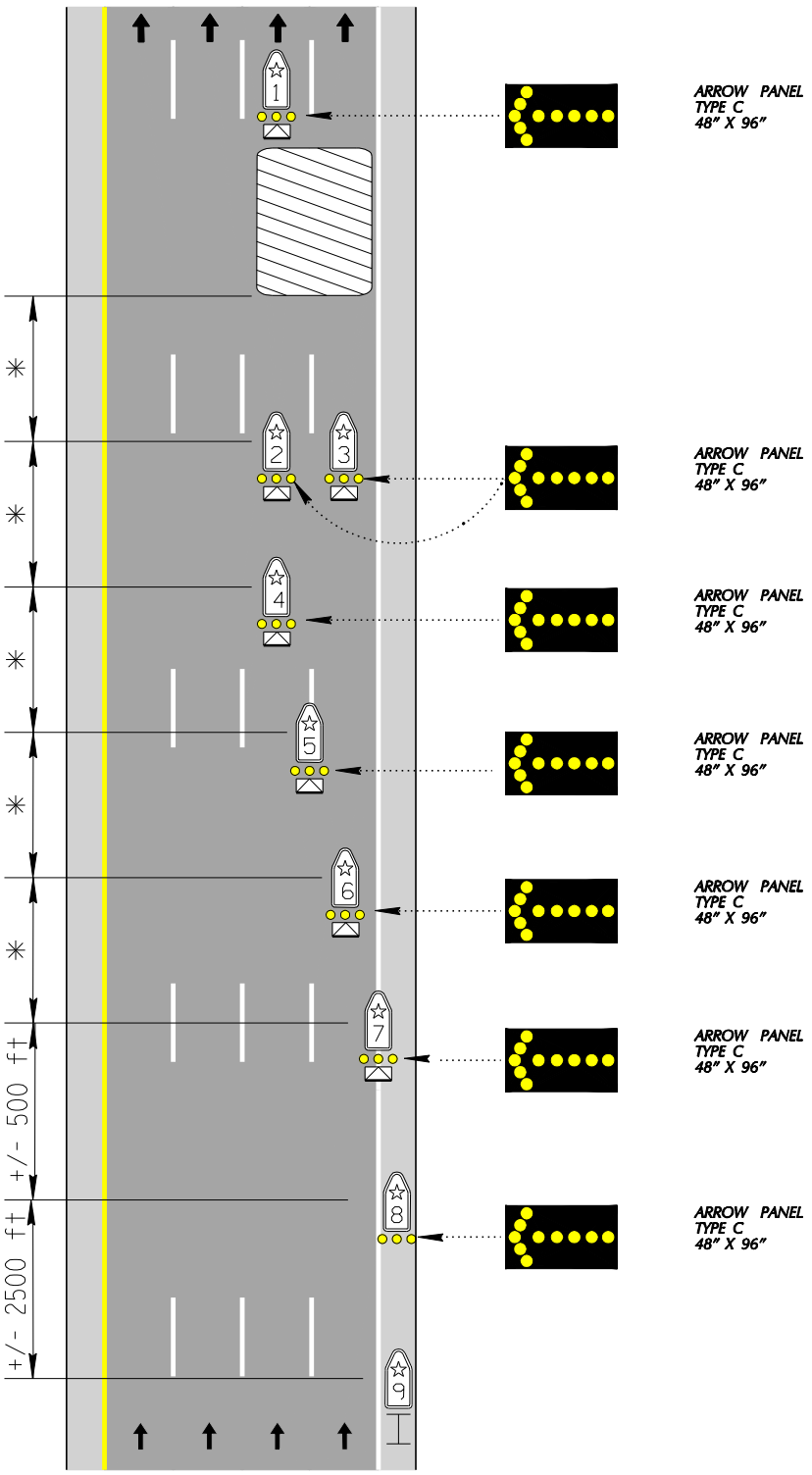
11. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

12. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

13. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 22
MULTILANE INTERSTATES AND HIGHWAYS
MULTILANE, STOP & GO OR SLOW MOVING OPERATIONS



SIZE

SYMBOLS

- Traffic Flow
- Work Space
- Work Vehicle
- Truck-Mounted Attenuator (TMA) (Optional for Vehicles 1 and 3, See Note 3)
- Changeable Message Sign
- Truck-Mounted Arrow Panel (See Section 6F.56)

* — Per TMA Manufacturer's Recommendations

CASE 23-A

TWO-LANE, TWO-WAY TRAFFIC - MOVING STRIPING OPERATIONS

NOTES

1. A minimum of five (5) vehicles are required at all times during moving applications of pavement markings.

2. The first shadow vehicle shall be equipped with a Truck-Mounted Attenuator (TMA). This vehicle shall be driven at a distance behind the application vehicle that is in accordance with the TMA manufacturer's recommendations.

   The second and third shadow vehicles shall be driven approximately 750 feet behind the preceding vehicle. These interval distances may be varied depending on conditions.

   The last shadow vehicle shall be equipped with a TMA. This vehicle shall be driven at a distance behind the preceding vehicle that is in accordance with the TMA manufacturer's recommendations.

3. Flags and flashing lights shall be mounted on the gun carriages whenever the carriage is extended 1 foot or more beyond the width of the application vehicle.

4. All signs shall be fabricated of an approved fluorescent, retroreflective background with black text and borders.

5. Vehicle-mounted signs shall be mounted in a manner such that they are not obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned from view when work is not in progress.

6. Arrow panels shall be used in the caution mode.

7. Inspection vehicle(s) may also follow within the line of the required shadow vehicles. The inspection vehicle(s) should be equipped with a Type B arrow panel.

8. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

9. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

10. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

11. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

12. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 10) in the work area should be delineated by drums.

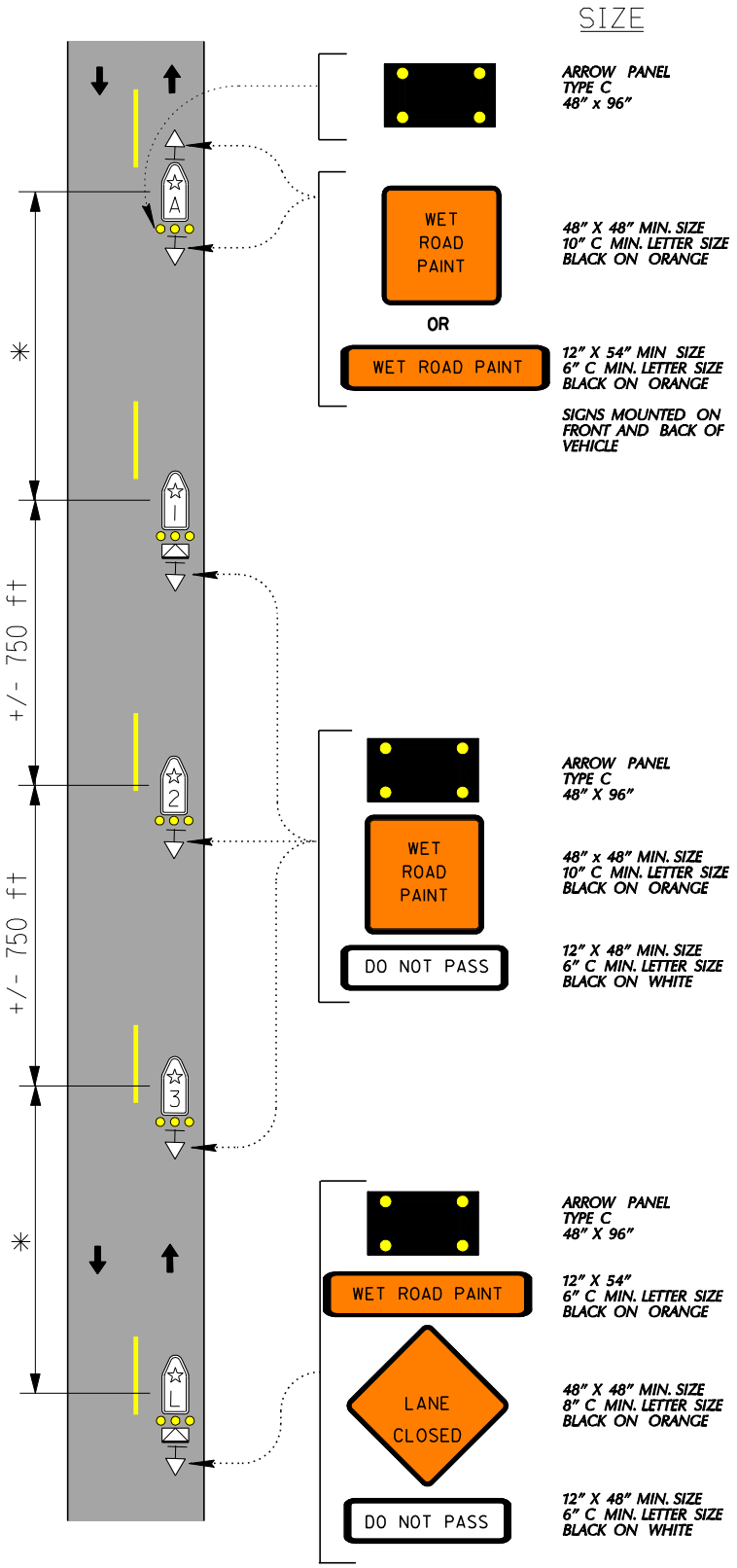
13. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

14. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

15. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 23-A
TWO-LANE, TWO-WAY TRAFFIC - MOVING STRIPING OPERATIONS



SYMBOLS

- Traffic Flow
- Work Vehicle
- Truck-Mounted Attenuator (TMA)
- Sign (Truck-mounted)
- Truck-Mounted Arrow Panel (See Section 6F.56)

* – Per TMA Manufacturer's Recommendations

CASE 23-B

MULTI-LANE, ONE-WAY TRAFFIC - MOVING STRIPING OPERATIONS

NOTES

1. A minimum of five (5) vehicles are required at all times during moving applications of pavement markings.

2. The first shadow vehicle shall be equipped with a Truck-Mounted Attenuator (TMA). This vehicle shall be driven at a distance behind the application vehicle that is in accordance with the TMA manufacturer's recommendations.

   The second shadow vehicle shall be driven approximately 750 feet behind the preceding vehicle. This interval distance may be varied depending on conditions.

   The third shadow vehicle (see case LANE CLOSURE WITH SHOULDER) shall be equipped with a TMA. This vehicle shall be driven at a distance behind the preceding vehicle that is in accordance with the TMA manufacturer's recommendations.

   The third shadow vehicle (see case LANE CLOSURE WITHOUT SHOULDER) shall be driven approximately 750 feet behind the preceding vehicle. This interval distance may be varied depending on conditions.

   The last shadow vehicle (see case LANE CLOSURE WITH SHOULDER) shall be driven approximately 750 feet behind the preceding vehicle. This interval distance may be varied depending on conditions.

   The last shadow vehicle (see case LANE CLOSURE WITHOUT SHOULDER) shall be equipped with a TMA. This vehicle shall be driven at a distance behind the preceding vehicle that is in accordance with the TMA manufacturer's recommendations.

3. Center lane only closures are prohibited. To close a center lane, the adjacent outside lane(s) shall be closed. Additional shadow vehicles and traffic control devices may be required, as directed by the Chief Traffic Engineer or his/her designee. Traffic shall not be split around a lane closure unless otherwise directed by the Chief Traffic Engineer or designee.

4. Flags and flashing lights shall be mounted on the gun carriages whenever the carriage is extended 1 foot or more beyond the width of the Paint Machine.

5. All signs shall be fabricated of an approved fluorescent, retroreflective background with black text and borders.

6. Vehicle-mounted signs shall be mounted in a manner such that they are not obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned from view when work is not in progress.

7. Inspection vehicle(s) may also follow within the line of required shadow vehicles. The inspection vehicle(s) should be equipped with a Type B arrow panel.

8. Use Case 23-C for all striping operations on fully access-controlled highways.

9. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

10. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

11. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

12. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

13. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 11) in the work area should be delineated by drums.

14. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

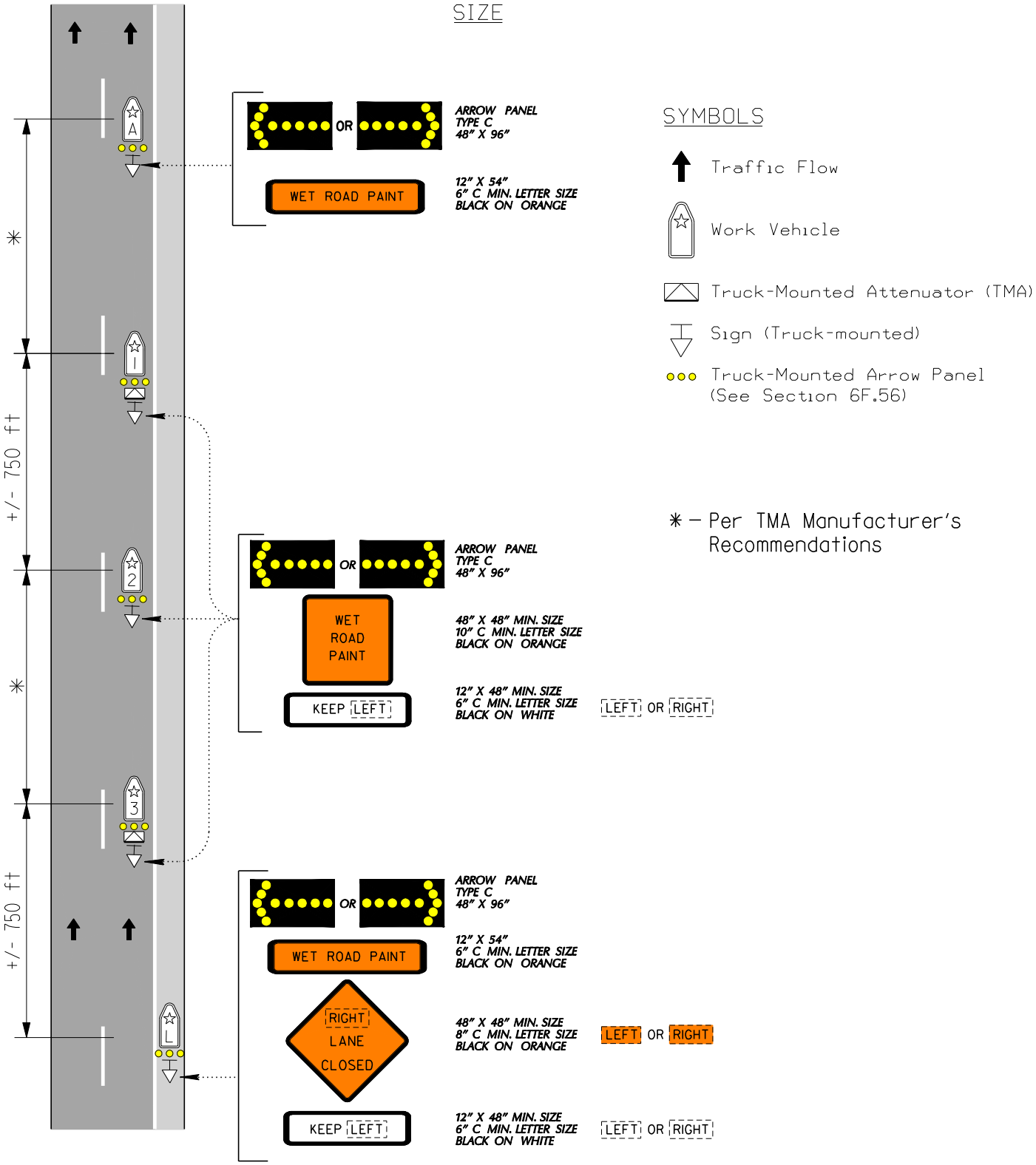
15. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

16. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 23-B
MOVING STRIPING OPERATIONS

MULTILANE, ONE-WAY TRAFFIC - LANE CLOSURE WITH SHOULDER

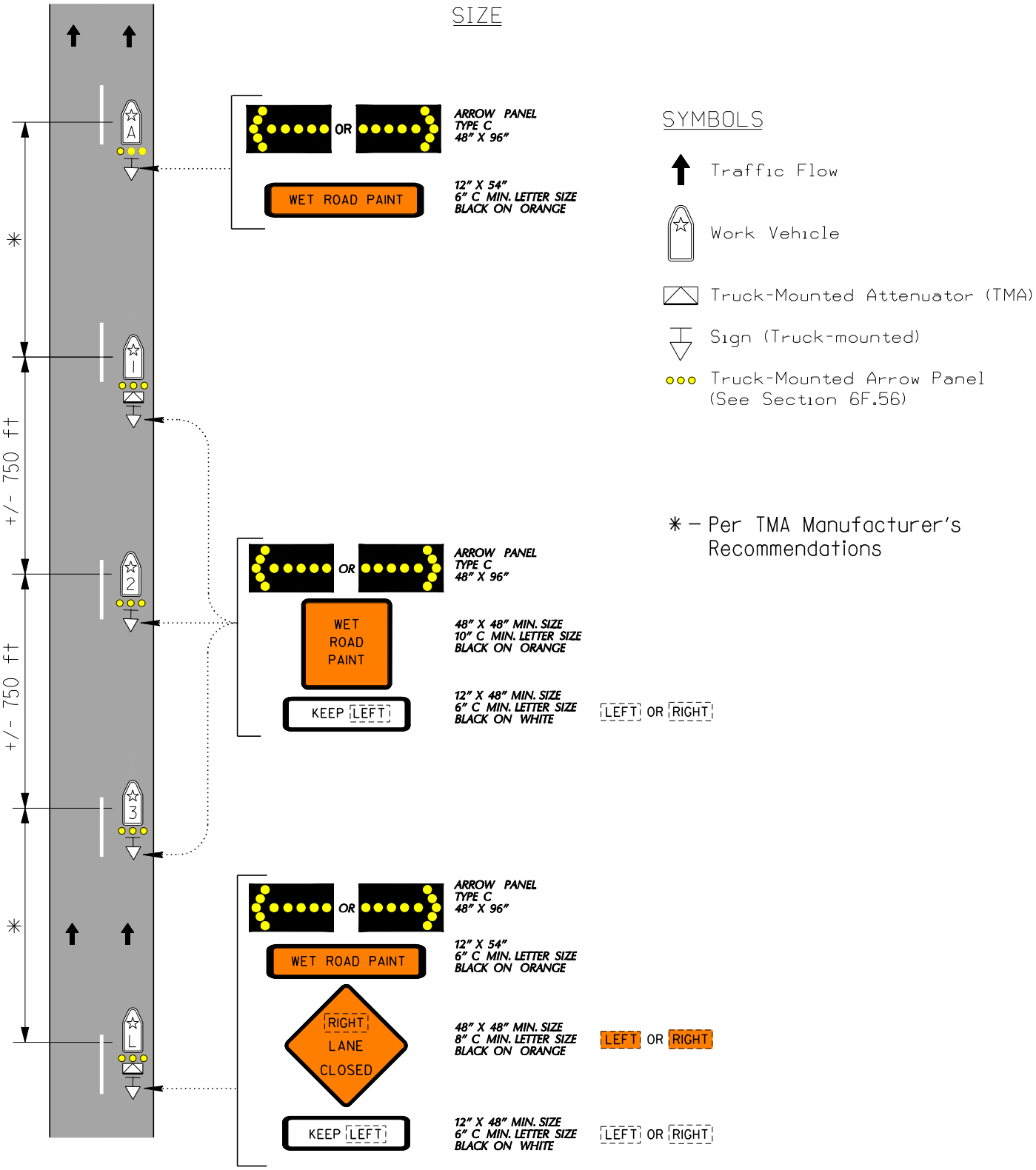


NOTE: ROADWAY MAY BE 2 OR MORE LANES IN ONE DIRECTION.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 23-B
MOVING STRIPING OPERATIONS

MULTILANE, ONE-WAY TRAFFIC - LANE CLOSURE WITHOUT SHOULDER



NOTE: ROADWAY MAY BE 2 OR MORE LANES IN ONE DIRECTION.

CASE 23-C

MULTI-LANE, FULLY ACCESS-CONTROLLED HIGHWAYS
MOVING STRIPING OPERATIONS

NOTES

1. A minimum of eight (8) vehicles are required at all times during moving applications of pavement markings on fully access-controlled highways.

2. Vehicles 1, 2, 3, 4, and 5 shall be equipped with a Truck-Mounted Attenuator (TMA). These vehicles shall be driven at a distance behind the application vehicle that is in accordance with TMA manufacturer's recommendations.

   Vehicle 6 shall be driven approximately 250 feet behind the preceding vehicle. This interval distance may be varied depending on conditions.

   The last shadow vehicle shall be driven approximately 2500 feet behind the preceding vehicle. These interval distances may be varied depending on conditions.

3. Flags and flashing lights shall be mounted on the gun carriages whenever the carriage is extended 1 foot or more beyond the width of the application vehicle.

4. Center lane only closures are prohibited. To close a center lane, the adjacent outside lane(s) shall be closed. Traffic shall not be split around a lane closure unless otherwise directed by the Chief Traffic Engineer or designee.

5. A State Police officer is required for striping operations on the following roadways:
   I-95, I-295, I-495, S.R. 1 – North of the Canal, S.R. 141 – From I-95 to S.R. 2.

6. A State Police officer shall be on shoulder or protected by other vehicles during striping operations.

7. All vehicles, police officers, inspectors and other participants must be equipped with radios that operate on the same radio frequency.

8. Changeable Message Signs are required on the last follow vehicle for the following roadways:
   I-95, I-295, I-495, S.R. 1 – From Dover Air Force Base and North, S.R. 141 – From I-95 to S.R. 2.

9. All signs shall be fabricated of an approved fluorescent, retroreflective background with black text and borders.

10. Vehicle-mounted signs shall be mounted in a manner such that they are not obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned from view when work is not in progress.

11. Inspection vehicle(s) may also follow within the line of required shadow vehicles. The inspection vehicle(s) should be equipped with a Type B arrow panel.

12. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

13. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

14. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

15. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

16. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 14) in the work area should be delineated by drums.

17. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

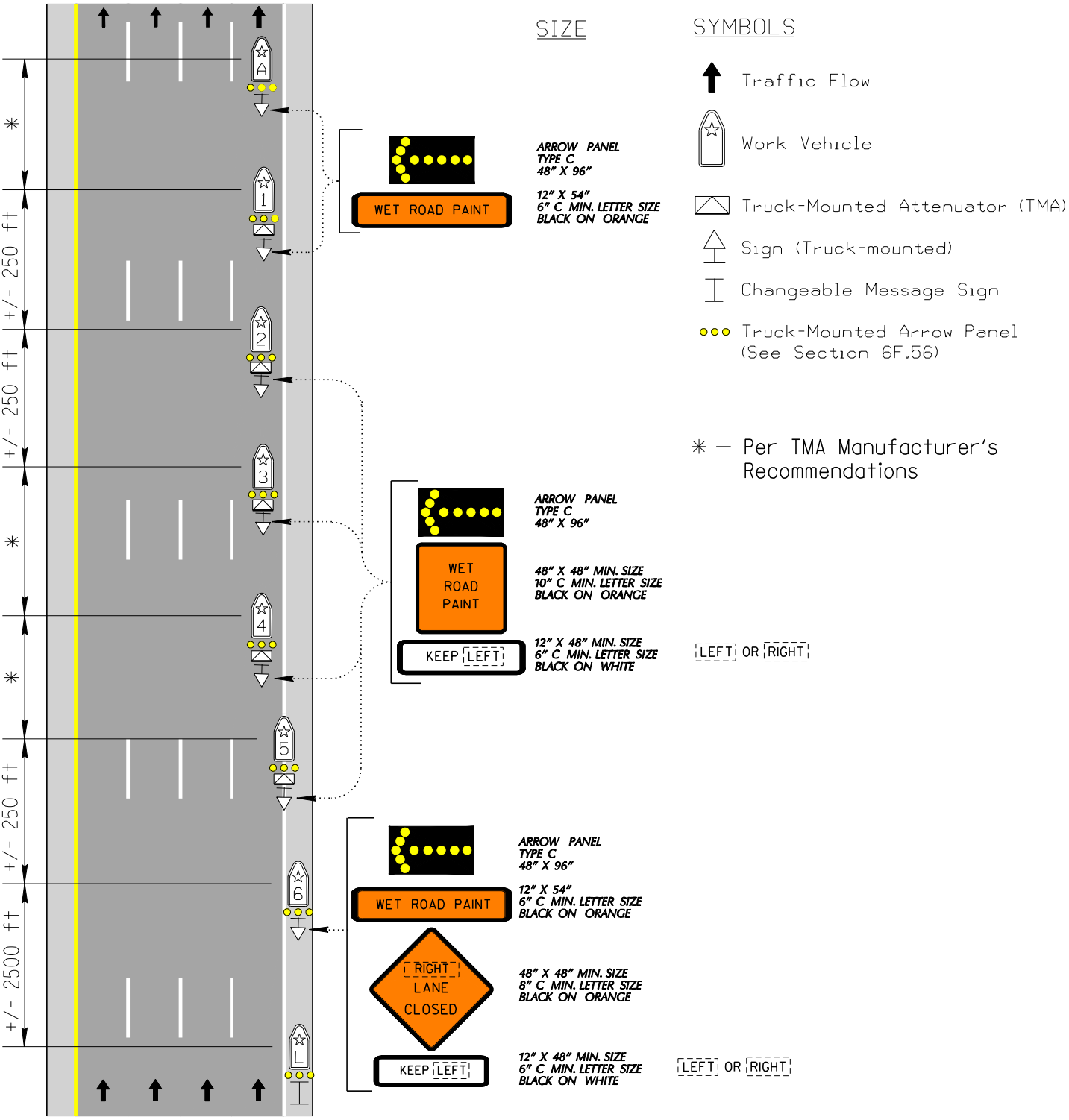
18. Use of Truck-Mounted Attenuators shall be in accordance with Section 6F.82.

19. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 23-C
MULTILANE, FULLY ACCESS-CONTROLLED HIGHWAYS
MOVING STRIPING OPERATIONS

SINGLE LANE CLOSURE



NOTE: ROADWAY MAY BE 2 OR MORE LANES IN ONE DIRECTION.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 23-C
MULTILANE, FULLY ACCESS-CONTROLLED HIGHWAYS
MOVING STRIPING OPERATIONS

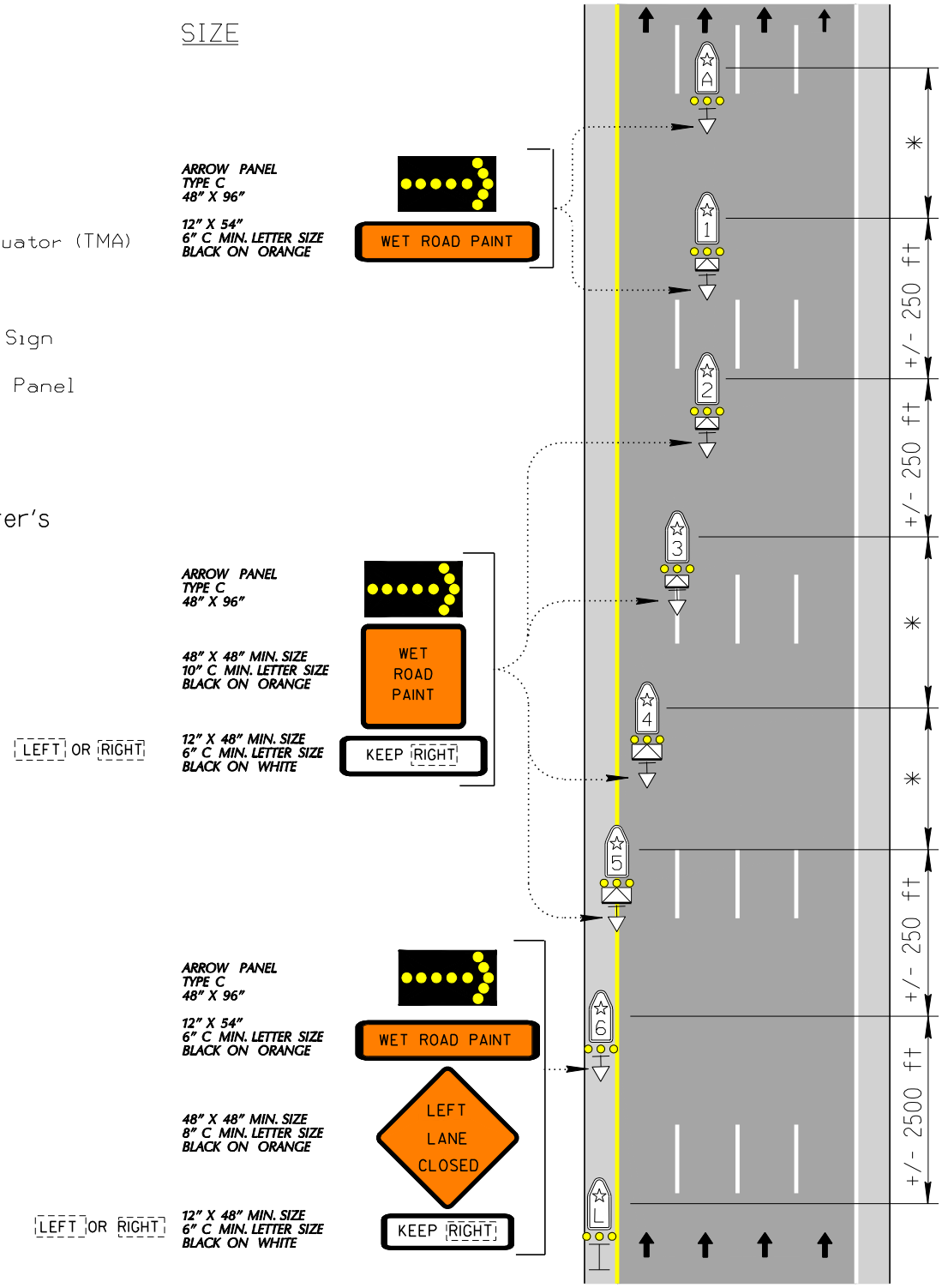
MULTILANE CLOSURE

SYMBOLS

- Traffic Flow
- Work Vehicle
- Truck-Mounted Attenuator (TMA)
- Sign (Truck-mounted)
- Changeable Message Sign
- Truck-Mounted Arrow Panel (See Section 6F.56)

✳ — Per TMA Manufacturer's Recommendations

SIZE



NOTE: ROADWAY MAY BE 3 OR MORE LANES IN ONE DIRECTION.

CASE 24

TWO-LANE, TWO-WAY TRAFFIC - MOWING OPERATIONS

When, at any time, any vehicle, equipment, workers or their activities require an intermittent, or continuous mowing operation.

NOTES

1. All mowing operations are restricted to daylight hours.

2. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

3. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

4. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

5. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

6. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 4) in the work area should be delineated by drums.

7. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

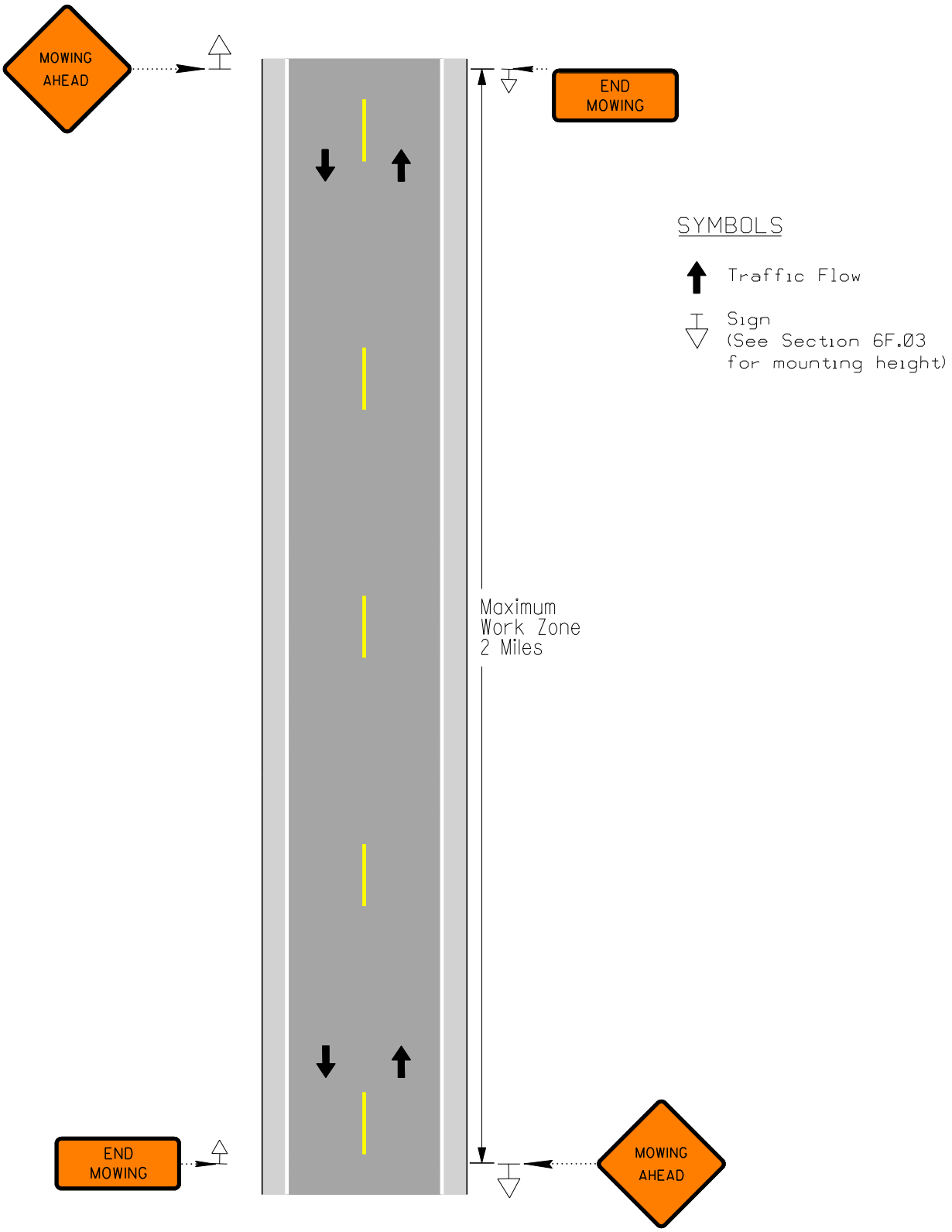
8. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

9. All equipment shall be stored in accordance with section 6G.22.

10. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 24
TWO-LANE, TWO-WAY TRAFFIC - MOWING OPERATIONS



CASE 25

MULTILANE, DIVIDED HIGHWAYS - MOWING OPERATIONS

When, at any time, any vehicle, equipment, workers or their activities require an intermittent or continuous mowing operation.

NOTES

1. All mowing operations are restricted to daylight hours.

2. For a divided highway, the required advance warning signs shall be posted on both the right and left sides of the roadway. When mowing operations are in the median, advanced warning signs are required for traffic approaching in both directions. When mowing operations are along the outside of the roadway, no signs are required for traffic approaching from the opposite direction.

3. For undivided highway, sign shall be posted for traffic approaching from the opposite direction.

4. This case is a minimum requirement for the conditions set forth. The Chief Traffic Engineer or designee may require additional traffic control devices including flaggers as deemed necessary.

5. Dimensions may be adjusted slightly to fit field conditions as approved by the Chief Traffic Engineer or designee.

6. All vehicles in a work area shall display high intensity rotating, flashing, oscillating or strobe lights installed for the purpose of warning approaching drivers of a vehicular traffic hazard requiring unusual care in approaching, overtaking, or passing. (See Section 6F.75)

7. All vehicles, equipment, workers (except flaggers) and their activities are restricted at all times to one side of the pavement, unless otherwise authorized by the Chief Traffic Engineer or designee.

8. At a minimum, any unattended obstacle (except vehicles that meet the requirements of Note 6) in the work area should be delineated by drums.

9. Skids or collapsible metal supports and attached signs shall be removed after the completion of each operation or at the end of each daily work period. (See Section 6F.03)

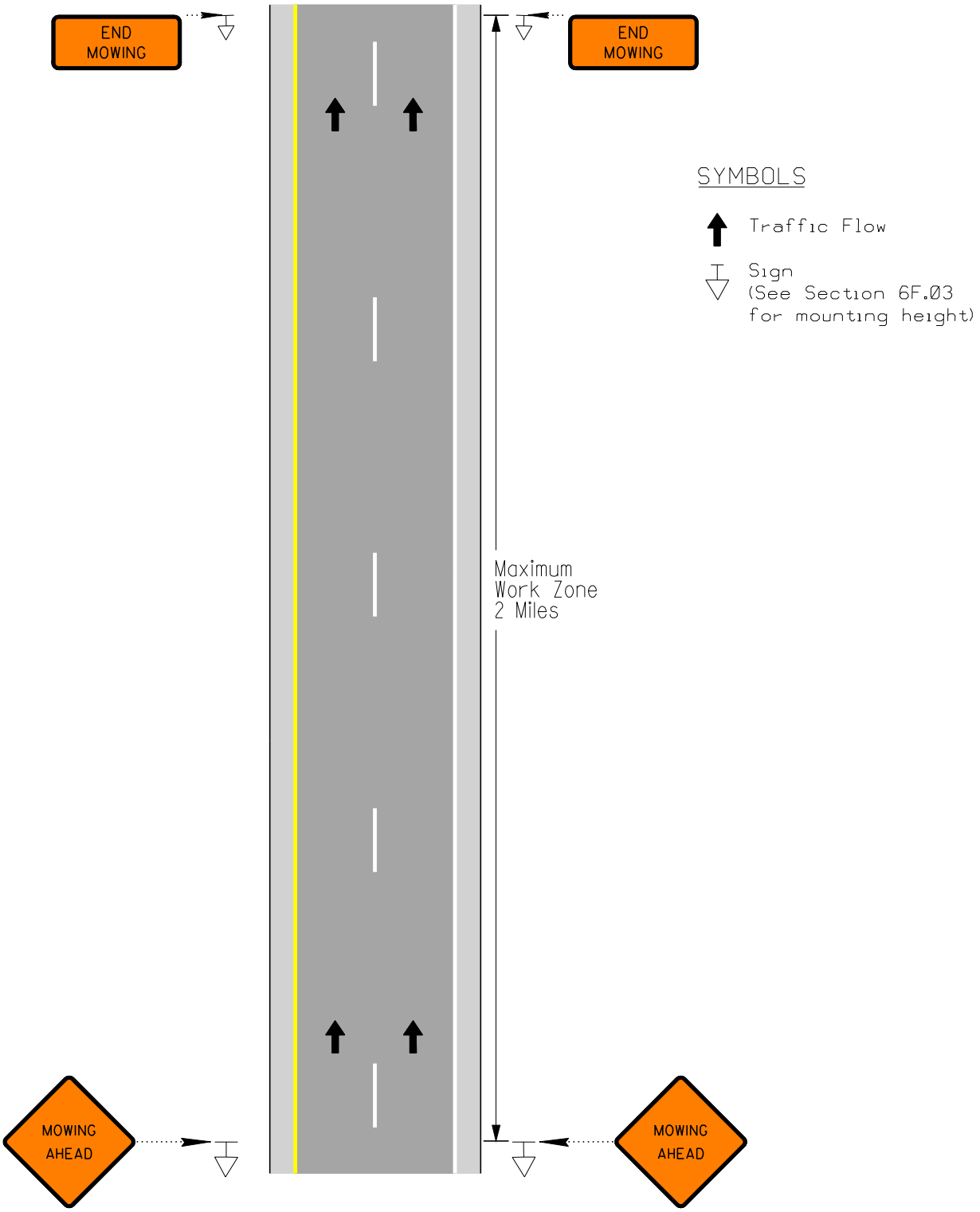
10. When any road intersects the roadway on which work is being performed, additional traffic control devices shall be erected as directed by the Chief Traffic Engineer or designee.

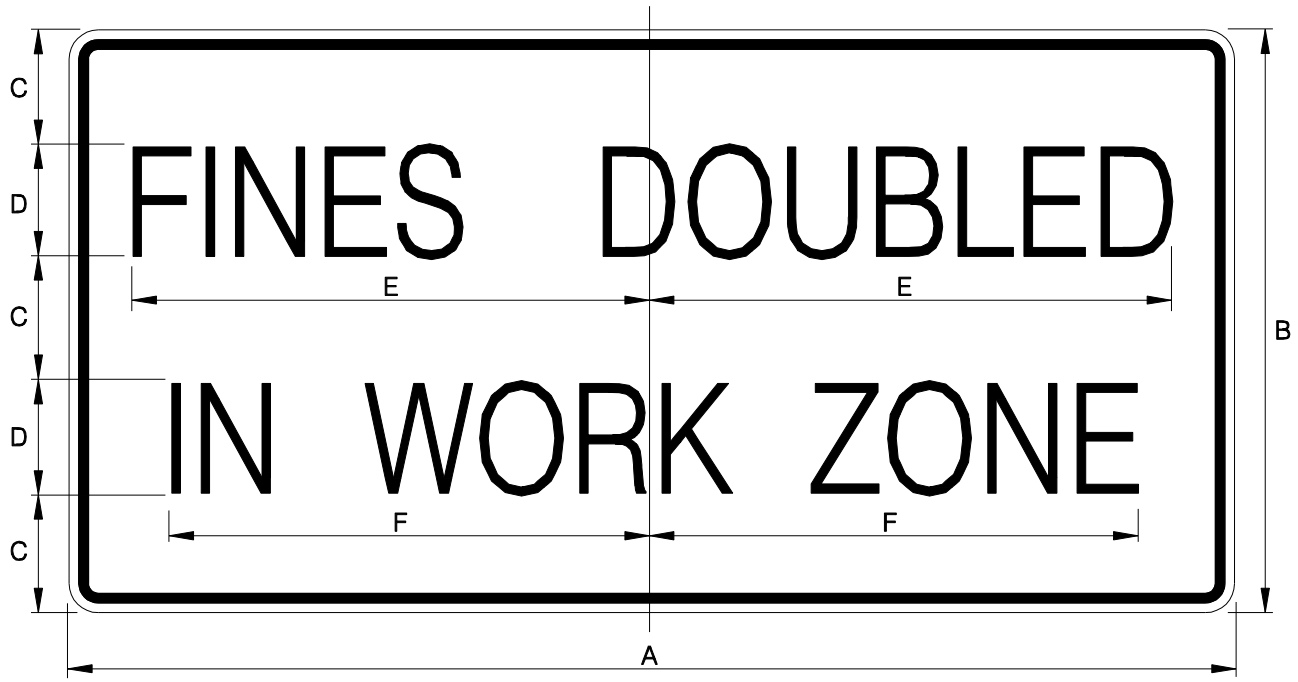
11. All equipment shall be stored in accordance with section 6G.22.

12. When bicycle and/or pedestrian facilities are affected by the work area, additional steps shall be taken to maintain accessibility in accordance with Section 6G.05 and as described by the Chief Traffic Engineer or designee.

STANDARD DESIGN
TYPICAL APPLICATION OF CONTROL DEVICES FOR
HIGHWAY CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS

CASE 25
MULTILANE, DIVIDED HIGHWAYS -
MOWING OPERATIONS





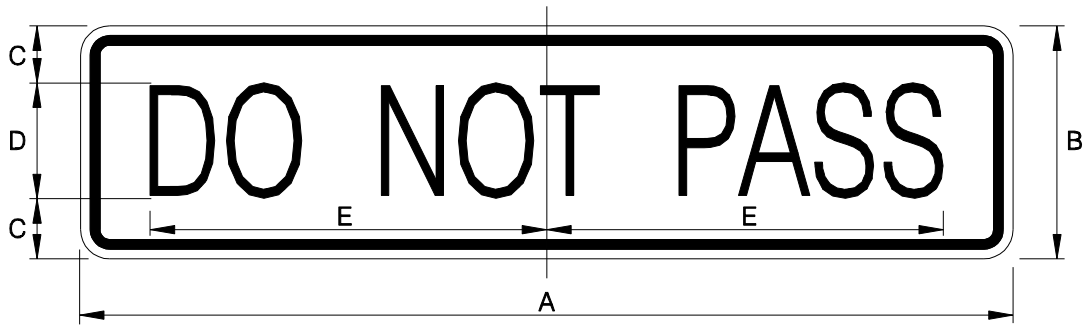
A	B	C	D	E	F	MARGIN	BORDER	CORNER RADIUS	SERIES
60	30	6	6	26.85	25.31	0.5	0.5	1.5	C

NOTES:
Horizontal spacing between words reduced to 66.7% of standard spacing

COLORS:
Legend – Black
Background – White (Prismatic Retroreflective)

Delaware Department of Transportation

R2–6–DE



A	B	C	D	E	MARGIN	BORDER	CORNER RADIUS	SERIES
48	12	3	6	20.42	0.5	0.5	1.5	C

NOTES:

Horizontal spacing between letters reduced to 50% of standard spacing

Horizontal spacing between words reduced to 50% of standard spacing

Horizontal spacing between words and border reduced to 66.7% of standard spacing

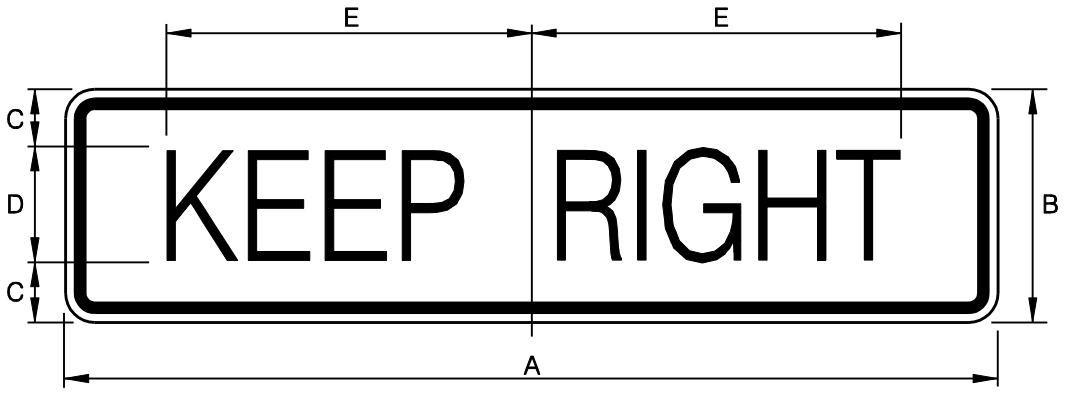
COLORS:

Legend – Black

Background – White (Prismatic Retroreflective)

Delaware Department of Transportation

R4–1–DE1



A	B	C	D	E	MARGIN	BORDER	CORNER RADIUS	SERIES
48	12	3	6	18.93	0.5	0.5	1.5	C

NOTES:

Horizontal spacing between letters reduced to 75% of recommended

Horizontal spacing between words reduced to 66.7% of recommended

Horizontal spacing between words and borders reduced to 66.7% of recommended

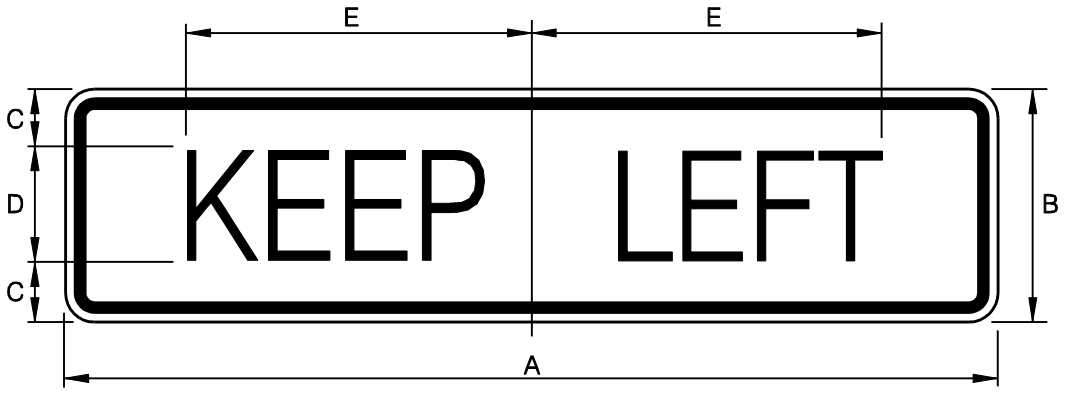
COLORS:

Legend – Black

Background – White (Prismatic Retroreflective)

Delaware Department of Transportation

R4–7–DE



A	B	C	D	E	MARGIN	BORDER	CORNER RADIUS	SERIES
48	12	3	6	17.80	0.5	0.5	1.5	C

NOTES:

Horizontal spacing between letters reduced to 75% of recommended

Horizontal spacing between words and borders reduced to 83.3% of recommended

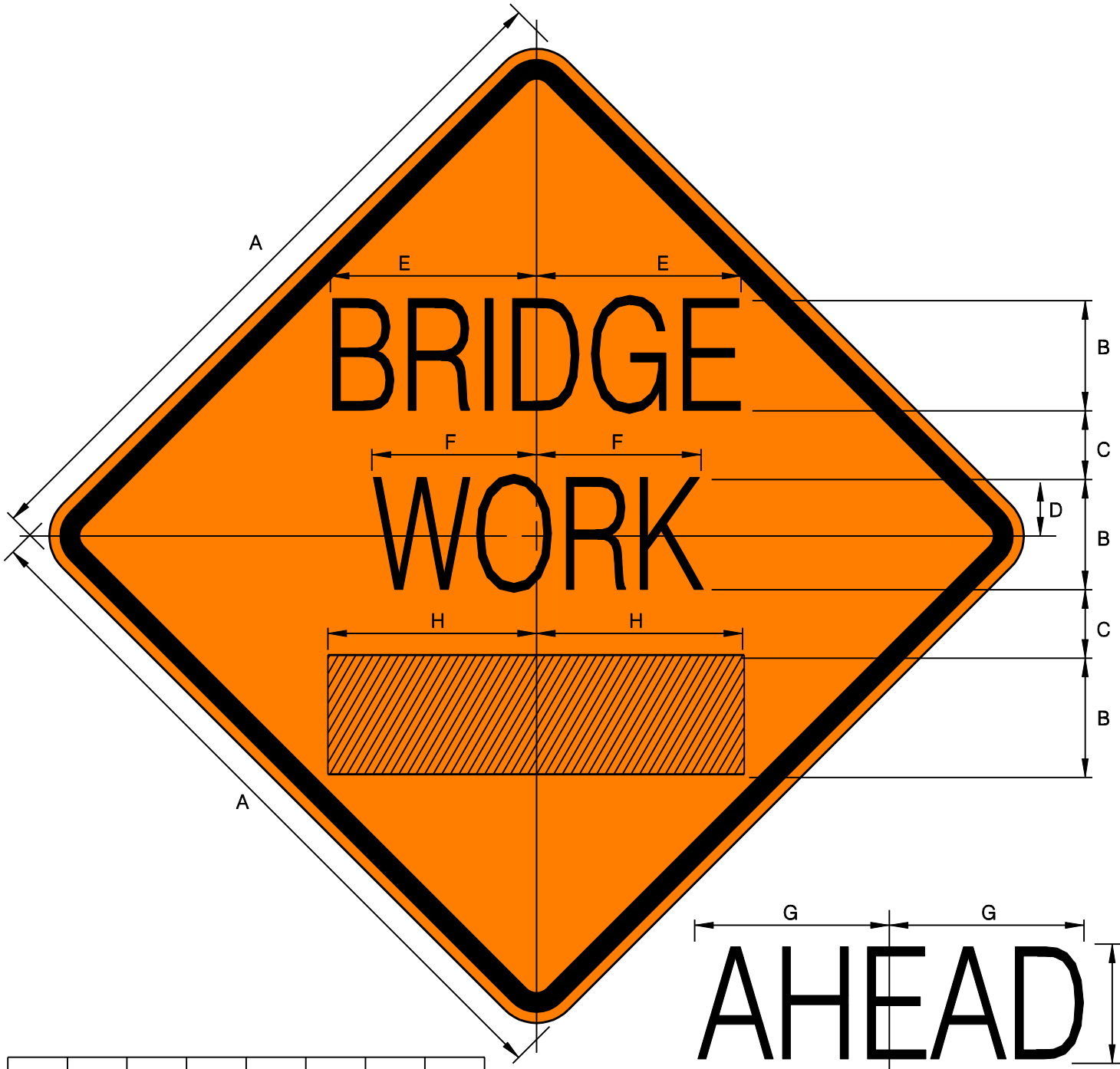
COLORS:

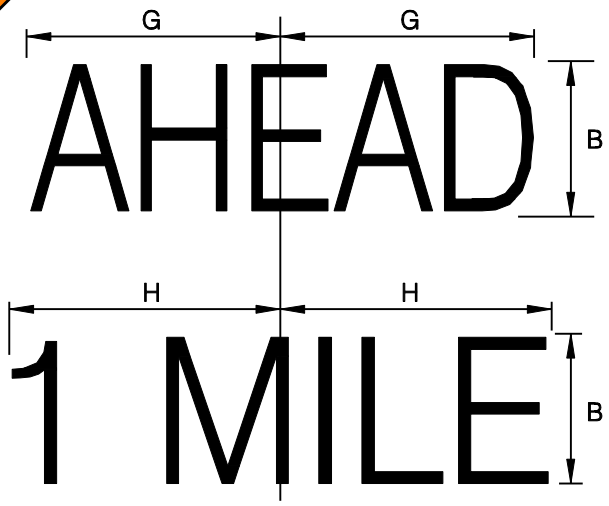
Legend – Black

Background – White (Prismatic Retroreflective)

Delaware Department of Transportation

R4–8–DE





A	B	C	D	E	F	G	H
48	8	4	3.79	13.79	11.05	13.07	13.97

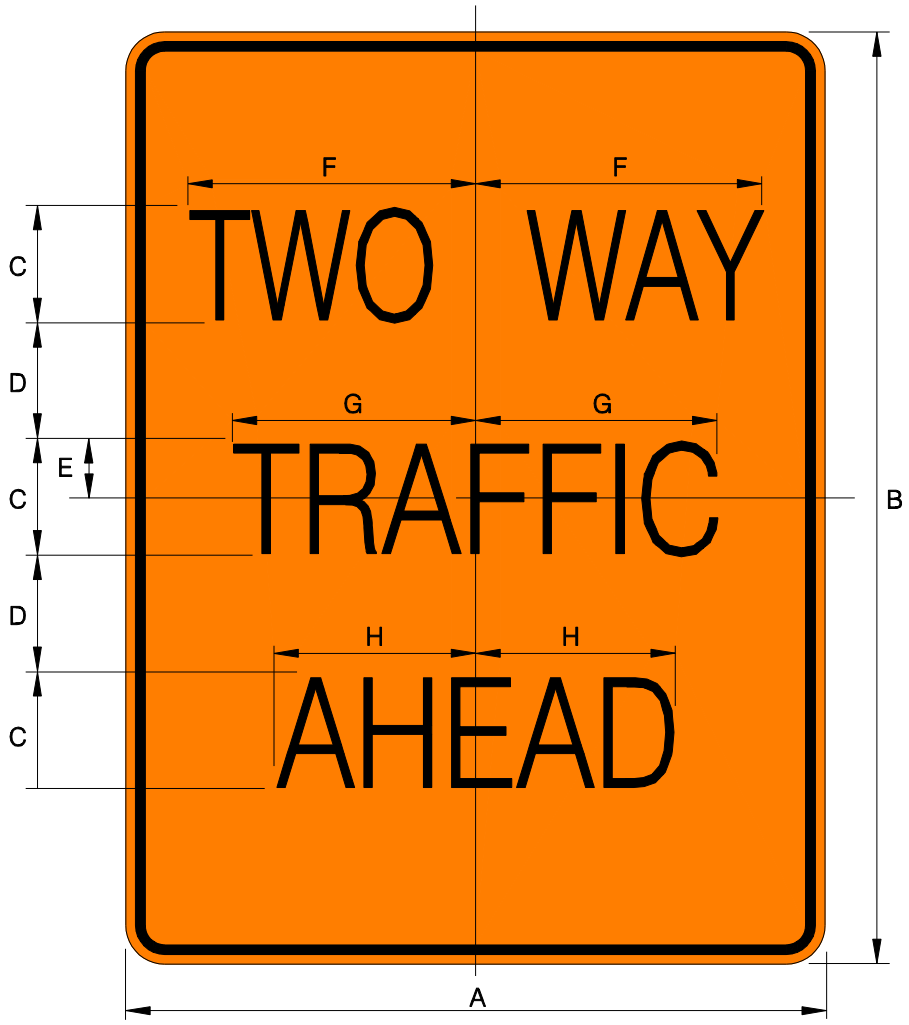
MARGIN	BORDER	CORNER RADIUS	SERIES
0.75	1.25	3	C

NOTE:
Horizontal spacing between letters and between words reduced to 50% of standard spacing

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W5–3–DE



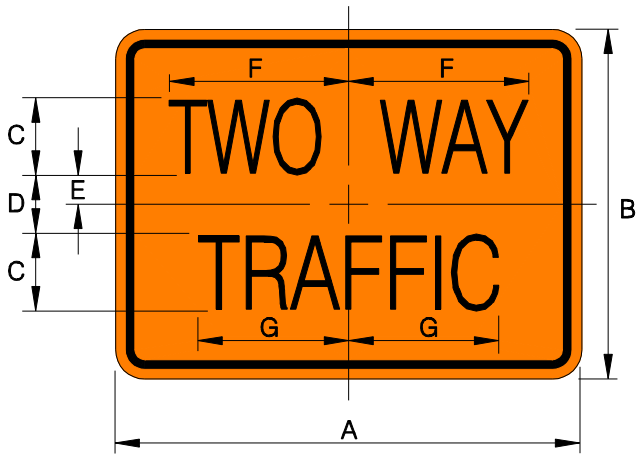
A	B	C	D	E	F	G	H	MARGIN	BORDER	CORNER RADIUS	SERIES
24	30	4	4	2	10.76	8.81	7.24	0.5	0.5	1.5	C
36	48	6	6	3	14.78*	12.49*	10.34*	0.5	0.5	2	C

* Horizontal spacing between letters reduced to 75% of standard spacing. Horizontal spacing between words reduced to 66.7% of standard spacing. Horizontal spacing between words and border reduced to 33.3% of standard spacing

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W6–3–DE



A	B	C	D	E	F	G	MARGIN	BORDER	CORNER RADIUS	SERIES
24	18	4	3	1.50	9.28	7.84	0.5	0.5	1.5	C

NOTES:

Horizontal spacing between letters reduced to 50% of standard spacing

Horizontal spacing between words reduced to 50% of standard spacing

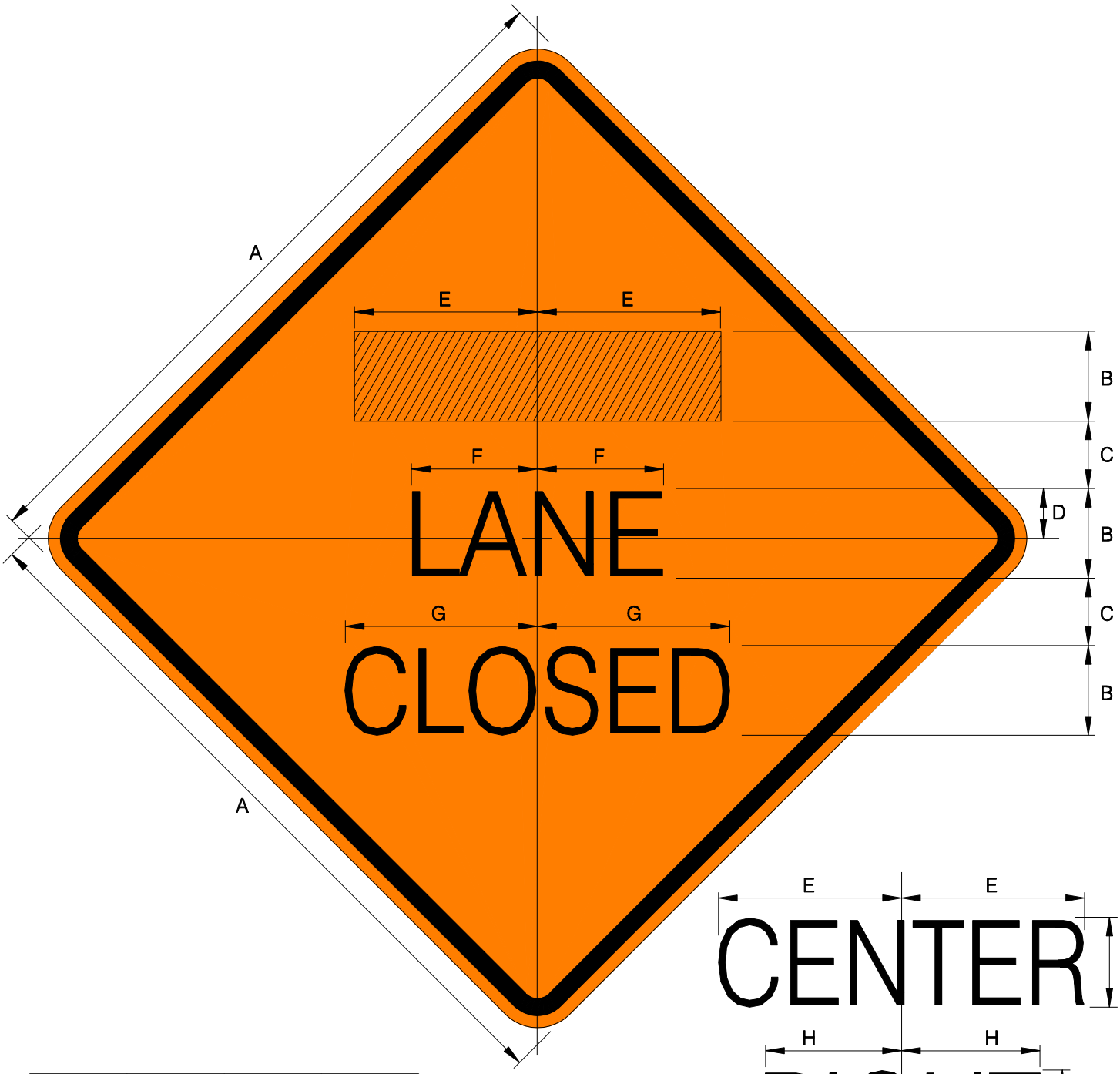
COLORS:

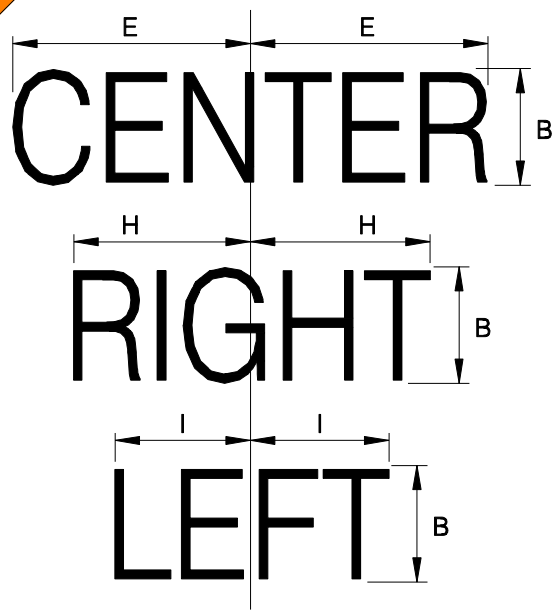
Legend – Black

Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W6–3p–DE





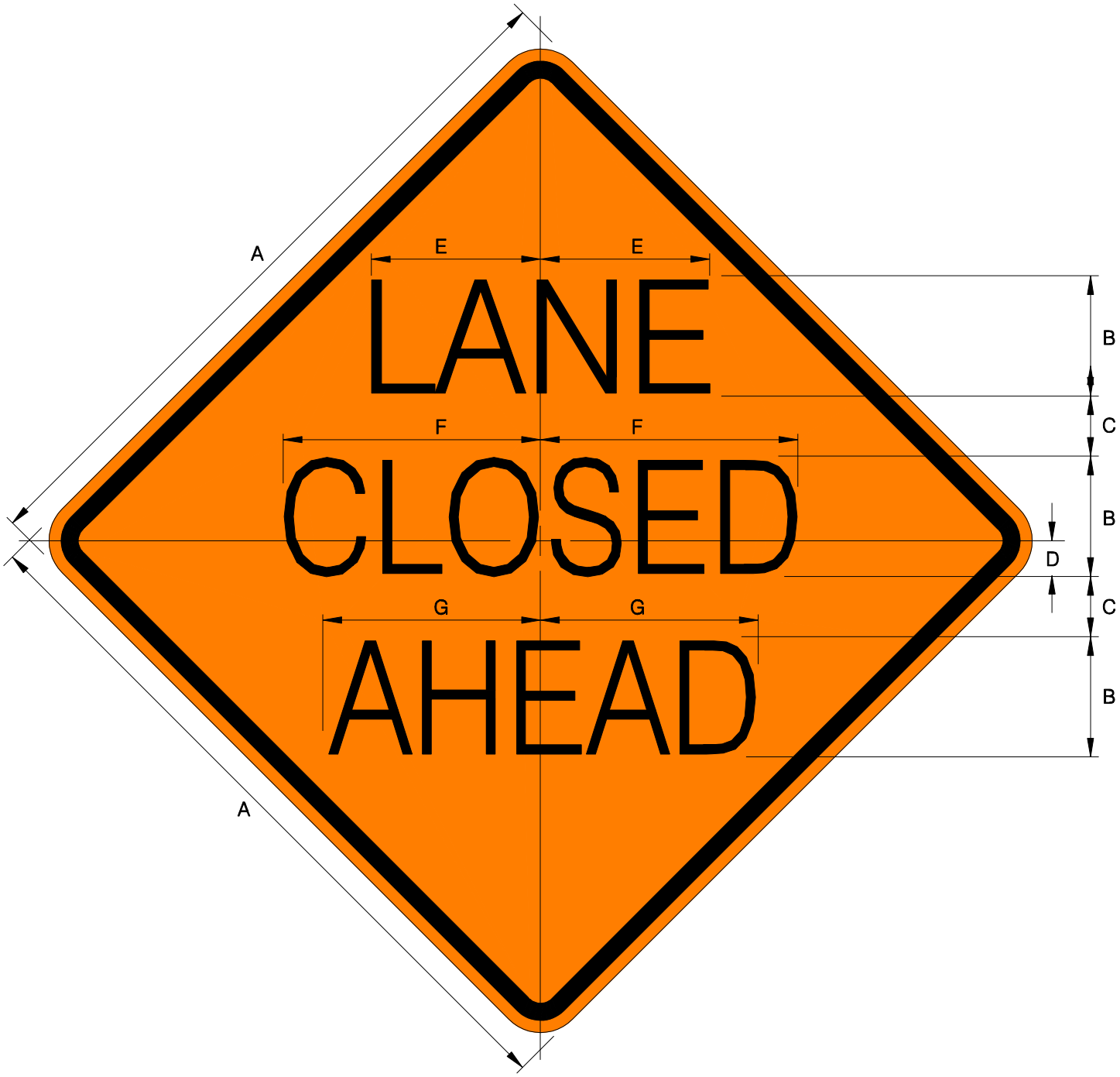
MARGIN	BORDER	CORNER RADIUS	SERIES
0.75	1.25	3	C

A	B	C	D	E	F	G	H	I
48	6	4.5	3.34	12.25	8.44	12.85	9.55	7.65

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W9–3–DE

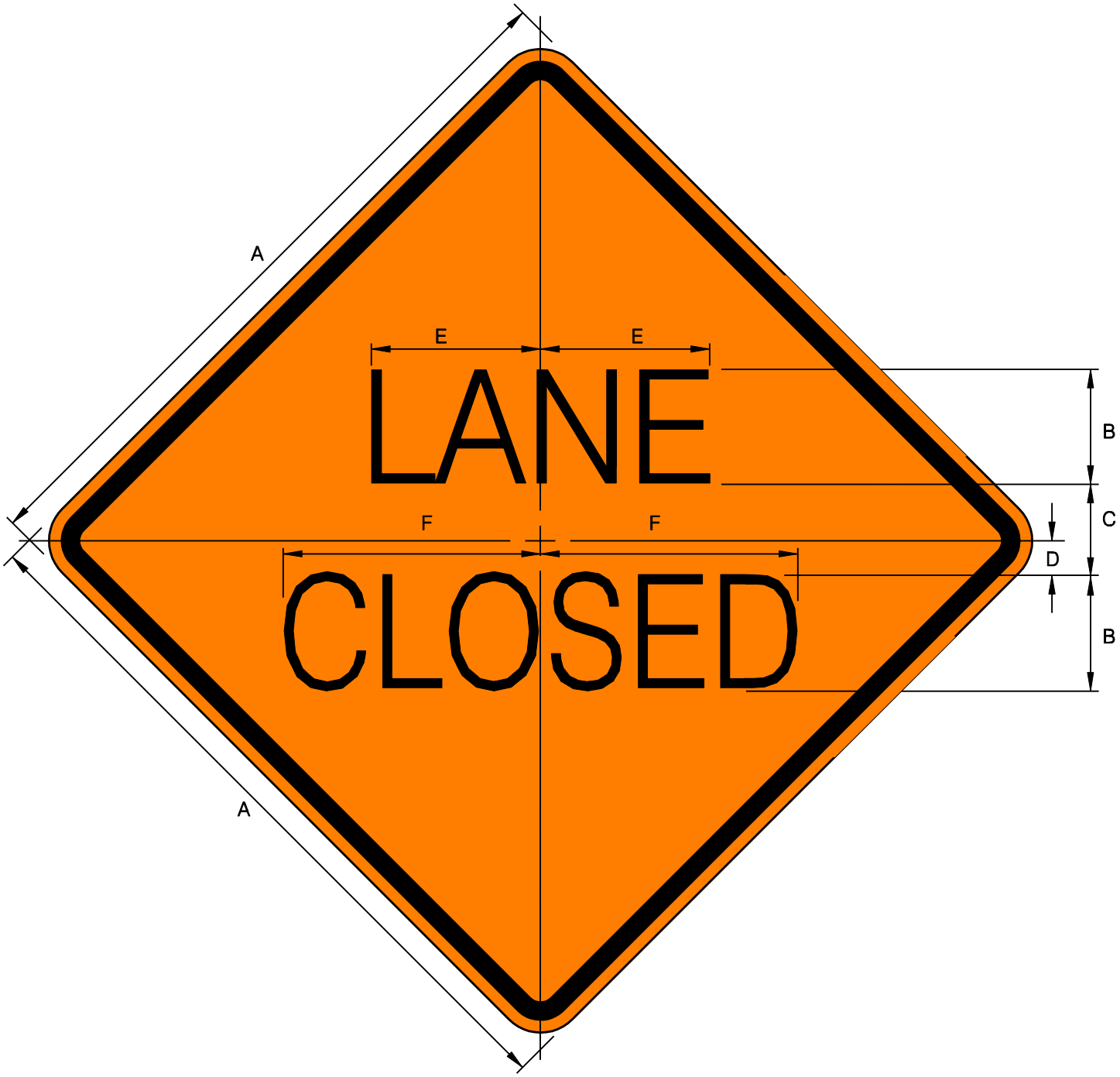


A	B	C	D	E	F	G	MARGIN	BORDER	CORNER RADIUS	SERIES
48	8	4	2.38	11.25	17.13	14.49	0.75	1.25	3	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W9–3–DE1

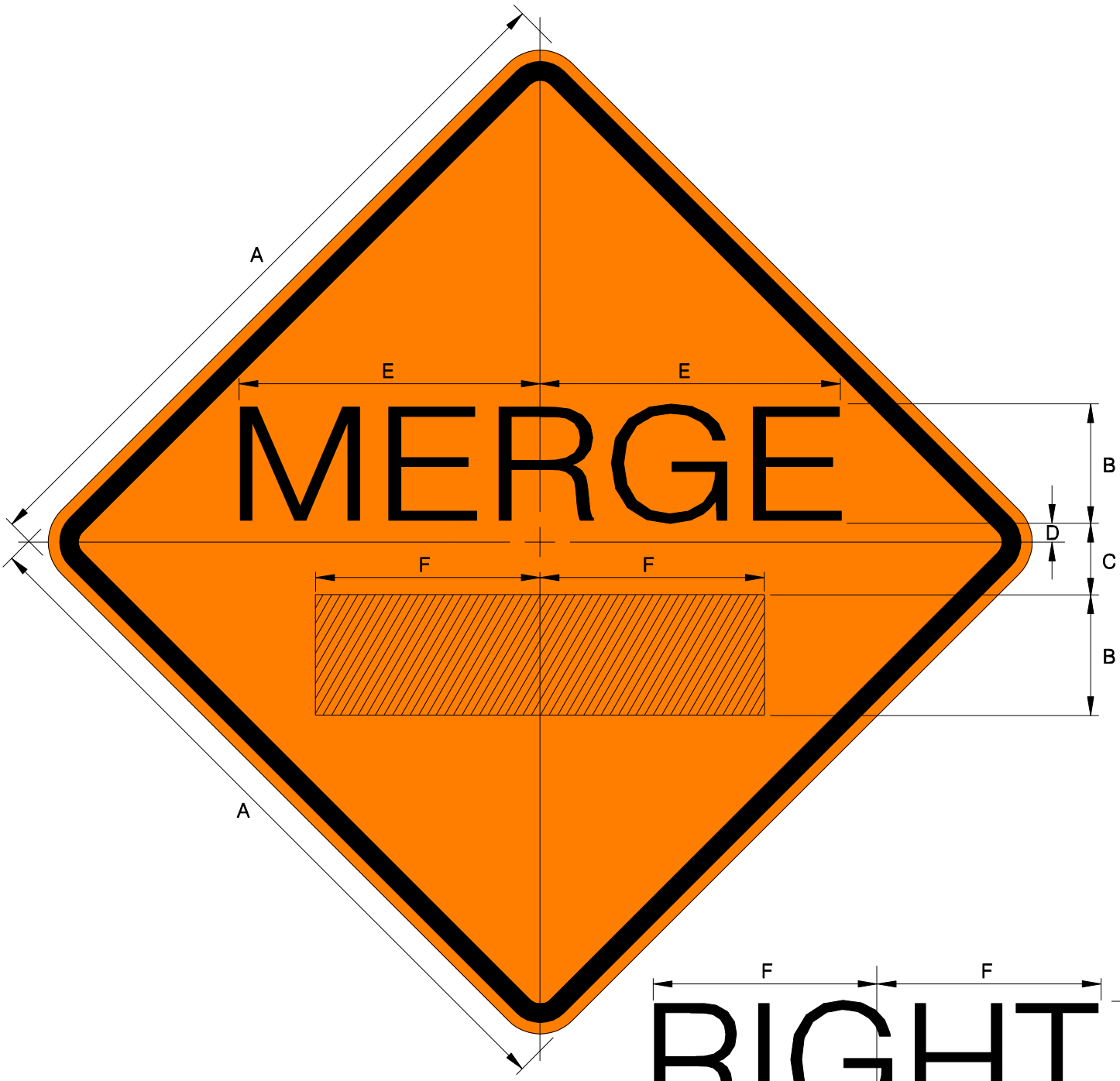


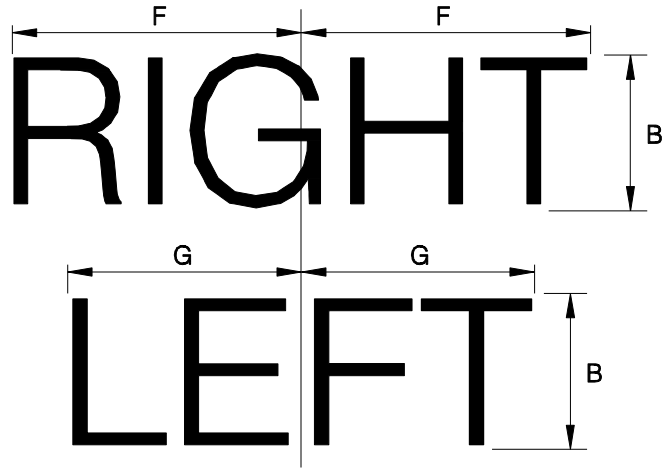
A	B	C	D	E	F	MARGIN	BORDER	CORNER RADIUS	SERIES
48	8	6	2.30	11.25	17.13	0.75	1.25	3	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W9–3–DE2





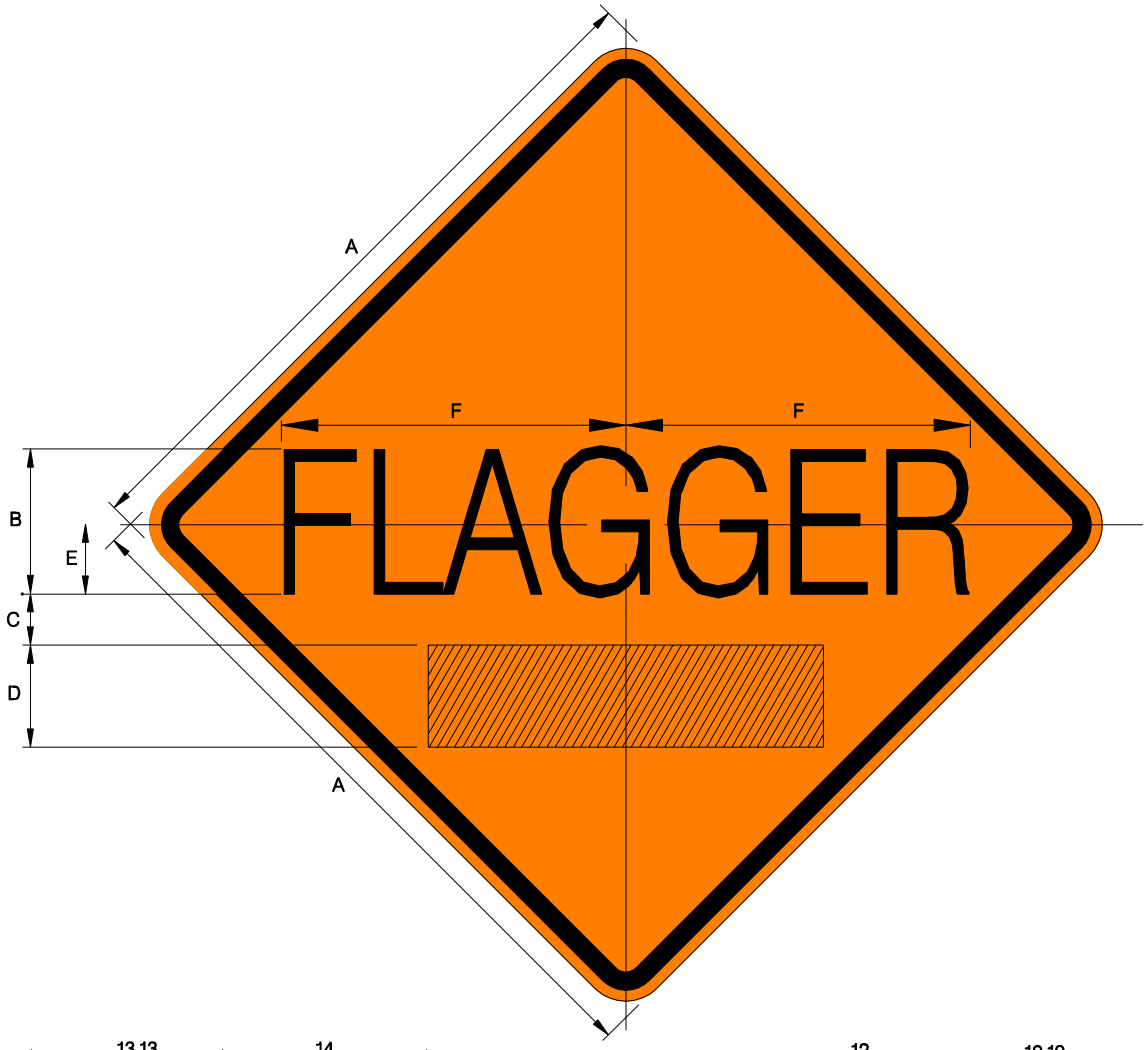
MARGIN	BORDER	CORNER RADIUS	SERIES
0.75	1.25	3	D

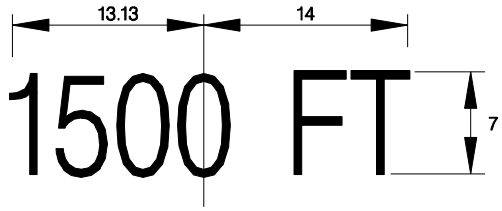
A	B	C	D	E	F	G
48	8	4.75	1.25	20	14.93	12.05

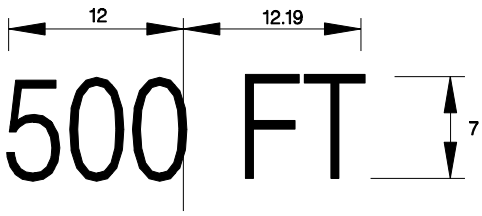
COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

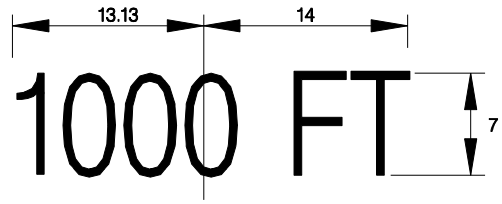
Delaware Department of Transportation

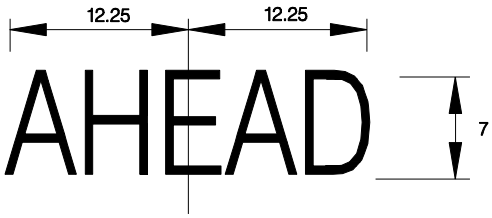
W20–6–DE









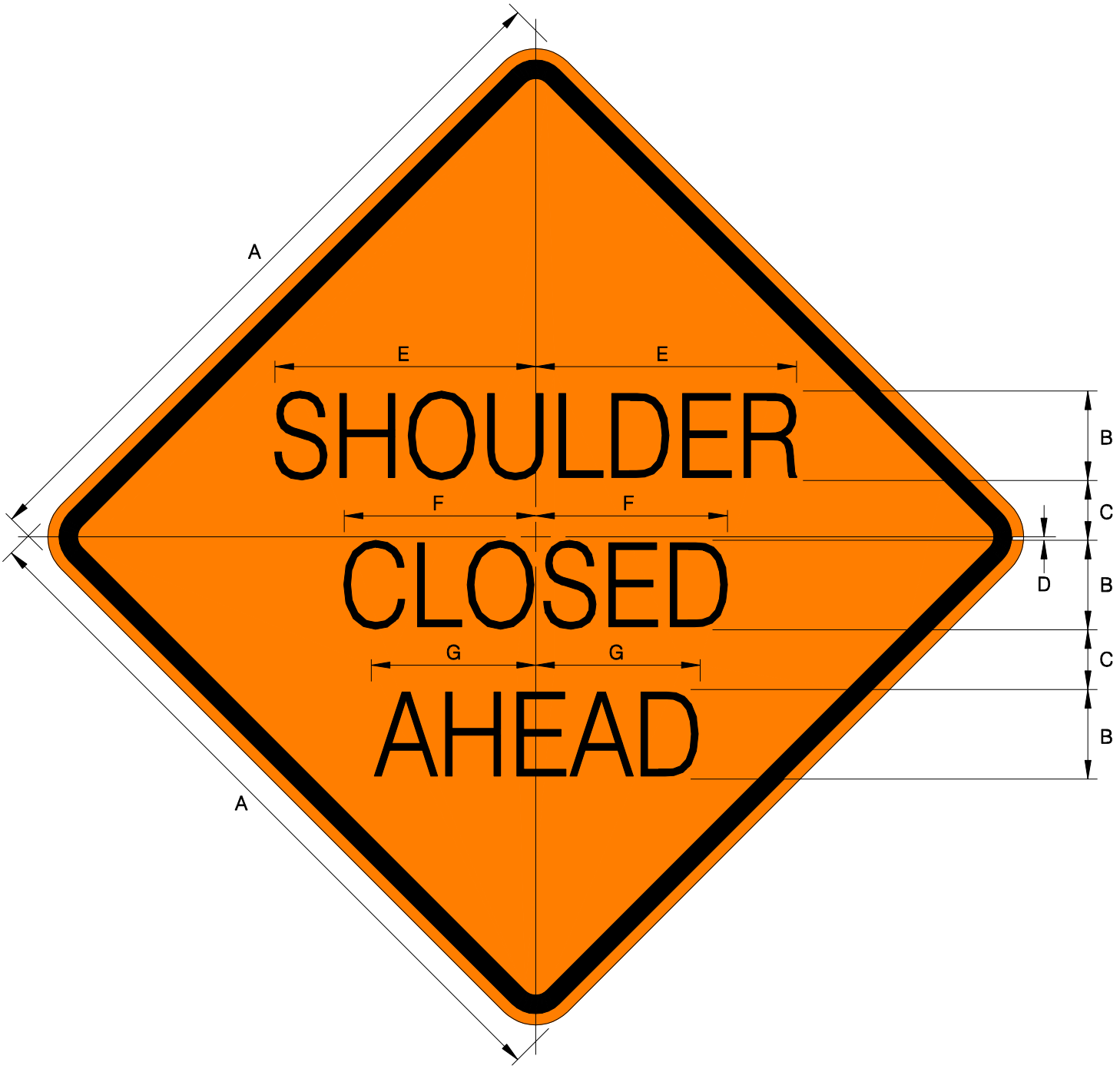


A	B	C	D	E	F	MARGIN	BORDER	CORNER RADIUS	SERIES
48	10	3.5	7	4.75	23.63	0.75	1.25	3	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W20–7–DE

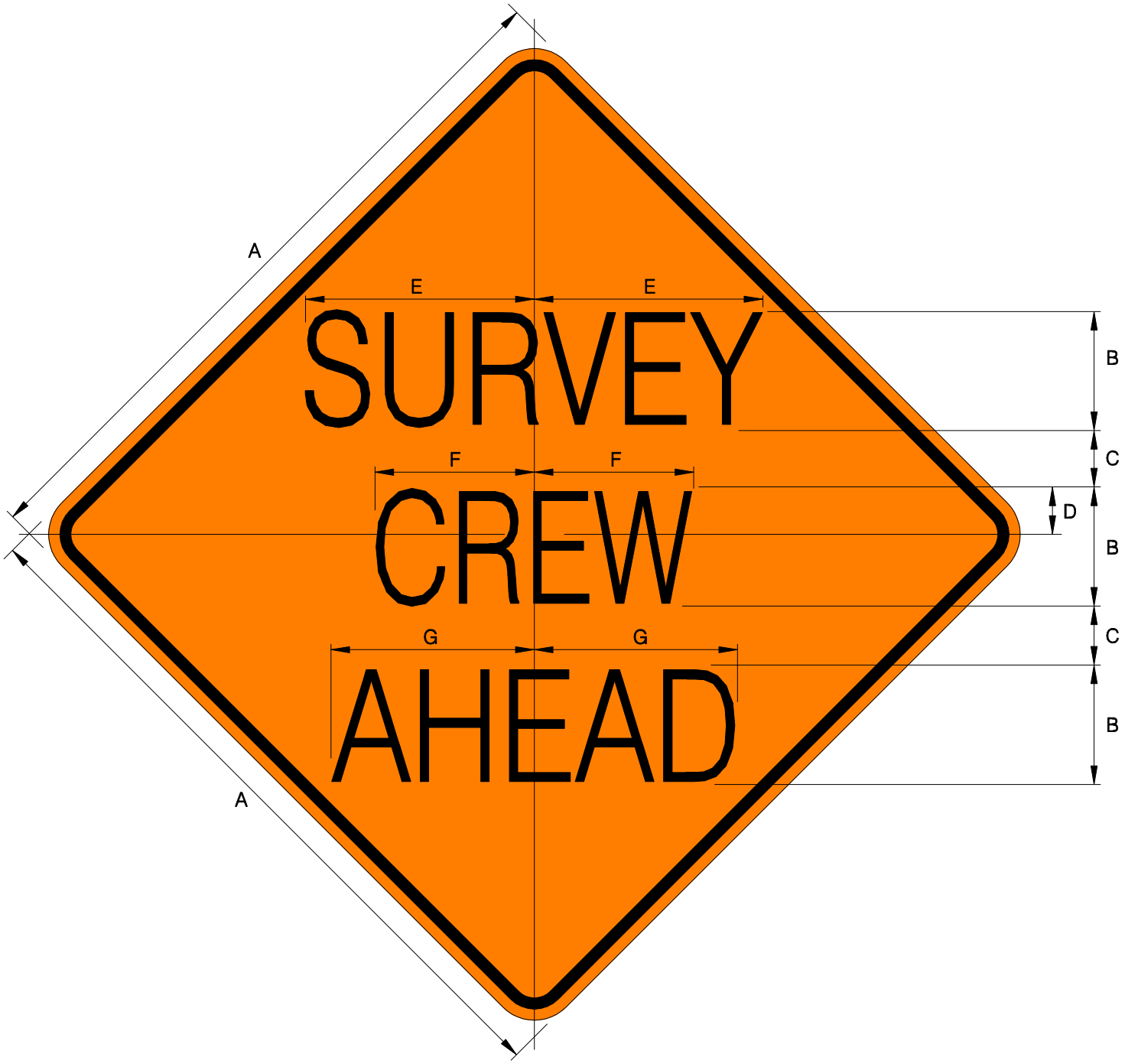


A	B	C	D	E	F	G	MARGIN	BORDER	CORNER RADIUS	SERIES
48	6	4	0.23	17.5	12.85	11.05	0.75	1.25	3	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W21–5–DE

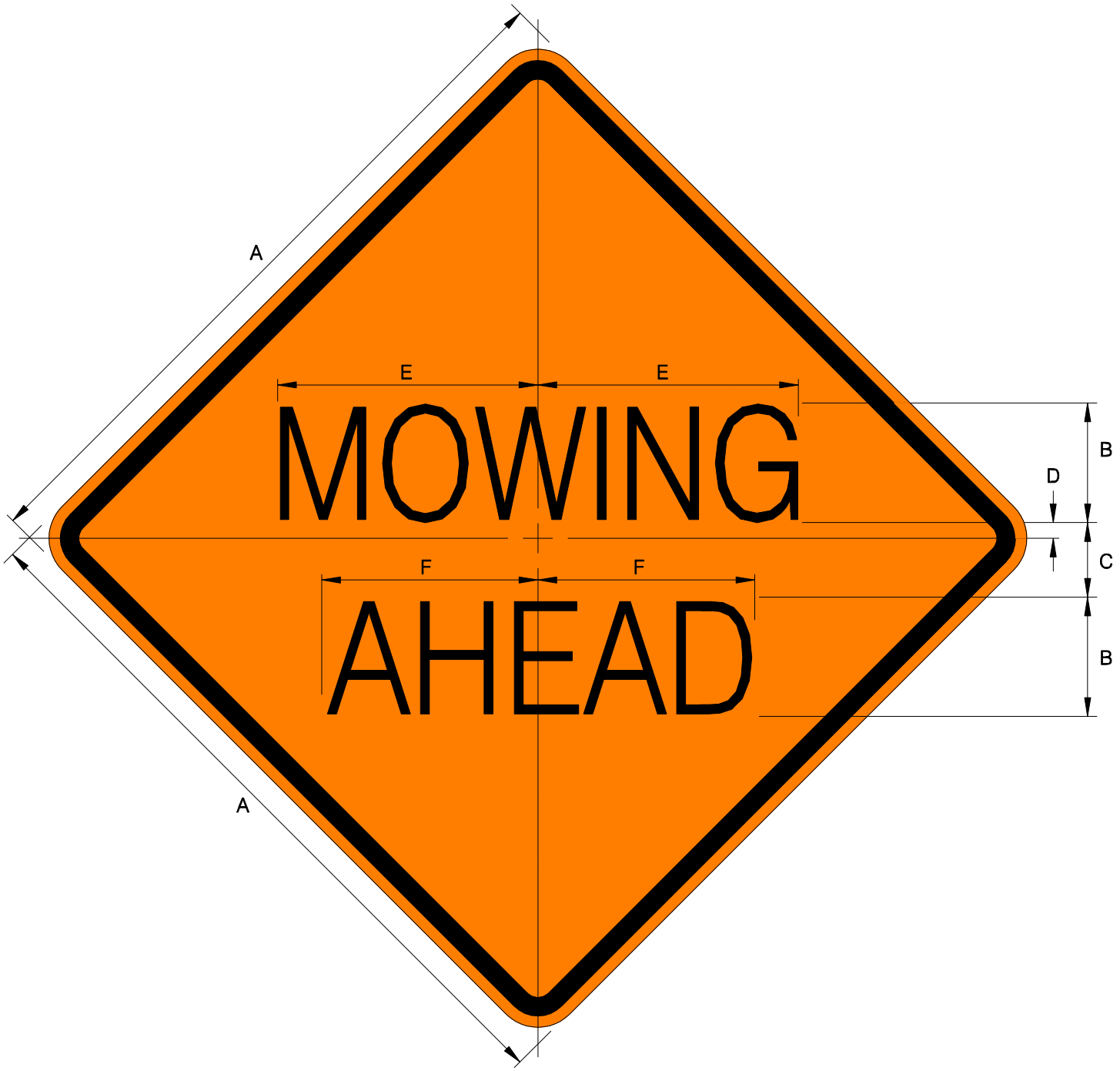


A	B	C	D	E	F	G	MARGIN	BORDER	CORNER RADIUS	SERIES
48	8	4	3.20	15.41	10.73	13.07	0.75	0.75	3	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W21–6–DE

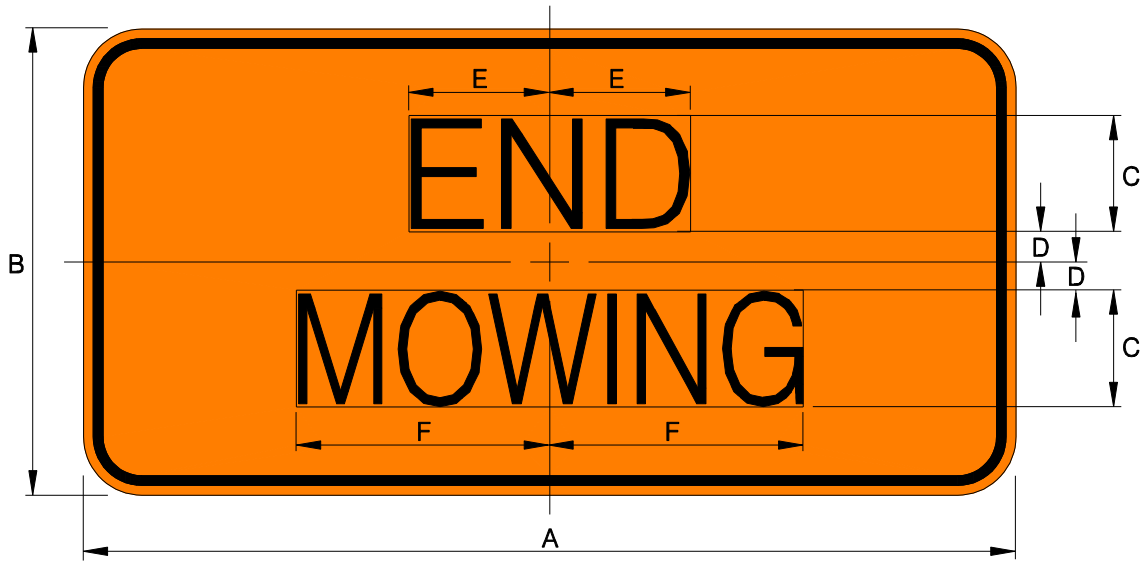


A	B	C	D	E	F	MARGIN	BORDER	CORNER RADIUS	SERIES
48	8	5	1.05	17.41	14.49	0.75	1.25	3	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W21–8–DE



A	B	C	D	E	F	MARGIN	BORDER	CORNER RADIUS	SERIES
48	24	6	1.5	7.25	13.06	0.5	0.5	3	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

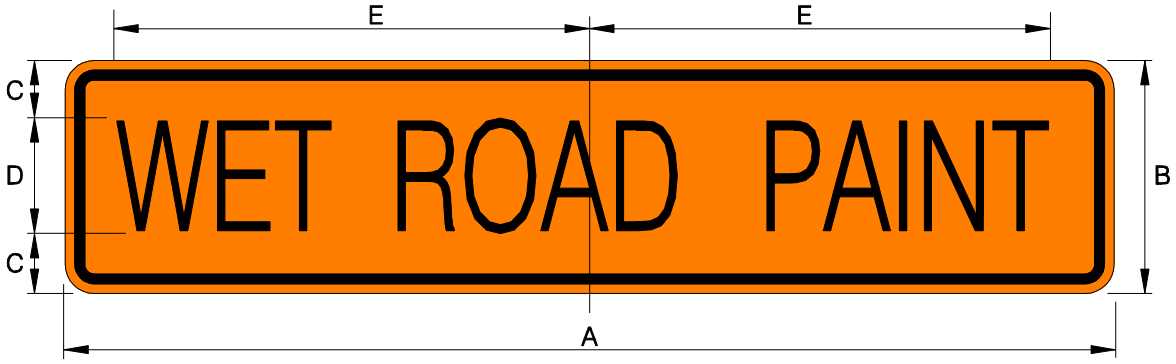
W21–8–DE1

A	B	C	D	E	F	G	H	MARGIN	BORDER	CORNER RADIUS	SERIES
48	48	10	4	4.92	10.36	14.81	15.59	0.5	0.5	1.5	C

COLORS:
Legend – Black
Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W25–1–DE



A	B	C	D	E	MARGIN	BORDER	CORNER RADIUS	SERIES
54	12	3	6	24.13	0.5	0.5	1.5	C

NOTES:

Horizontal spacing between letters reduced to 50% of standard spacing

Horizontal spacing between words reduced to 33.3% of standard spacing

Horizontal spacing between words and borders reduced to 33.3% of standard spacing

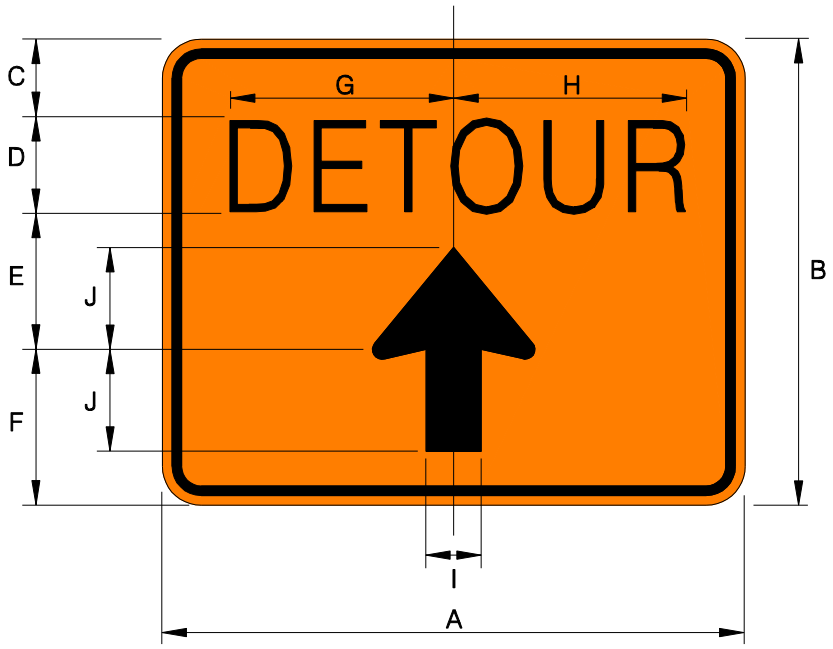
COLORS:

Legend – Black

Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

W25–1–DE1



A	B	C	D	E	F	G	H	I	J	MARGIN	BORDER	CORNER RADIUS	SERIES
30	24	4	5	7	8	11.5	12	2.625	5.25	0.5	0.5	1.5	D

NOTES:

Horizontal spacing between letters reduced to 60% of standard spacing

COLORS:

Legend – Black

Background – Orange (Prismatic Retroreflective)

Delaware Department of Transportation

M4–9–DE