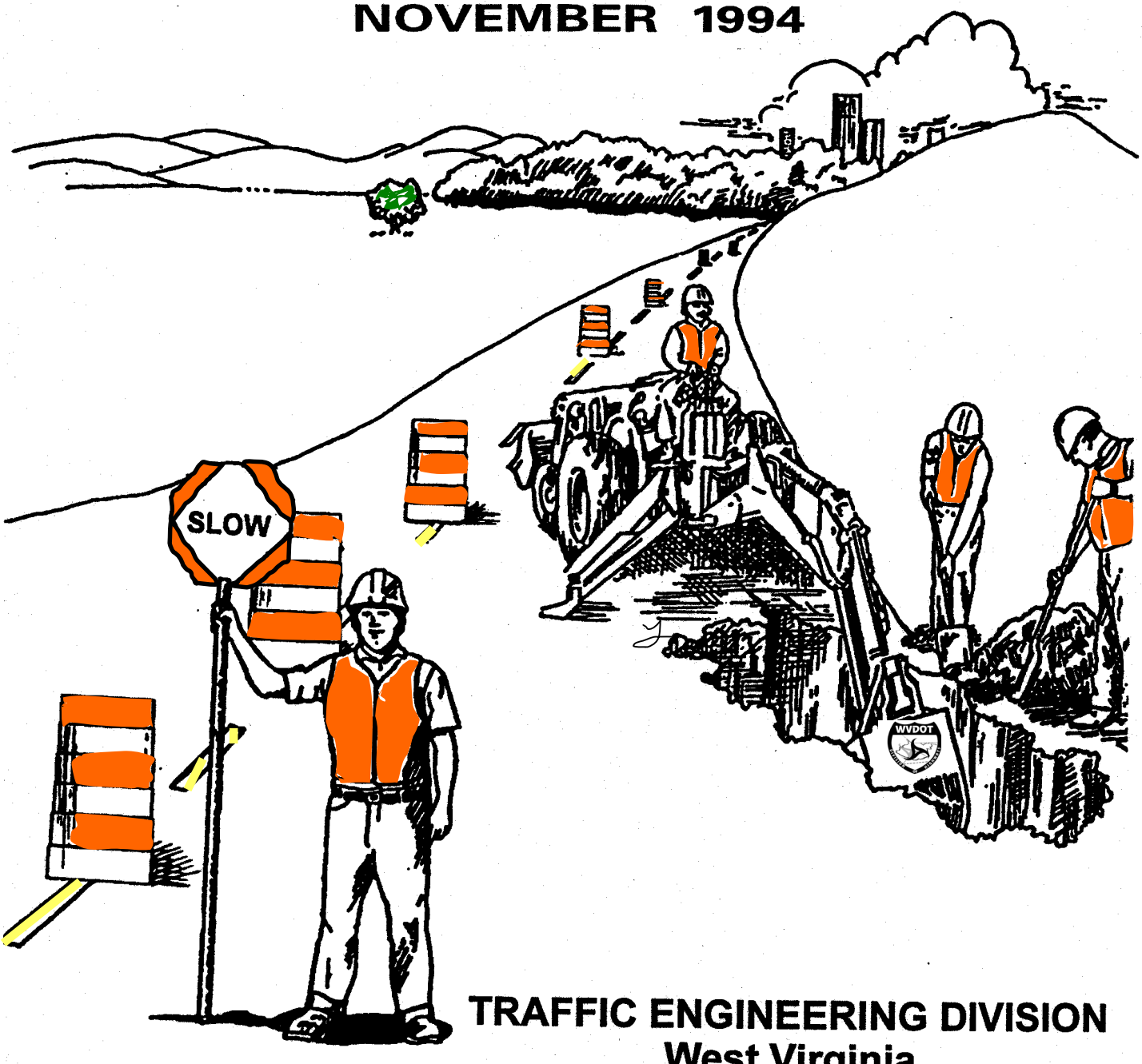
TRAFFIC CONTROL FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS

NOVEMBER 1994



TRAFFIC ENGINEERING DIVISION
West Virginia
Division of Highways

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
CHARLESTON, WEST VIRGINIA

ABSTRACT
FROM
THE RECORDS OF THE COMMISSIONER'S ORDERS
DATED
November 1, 1994

Distribution.

The Commissioner, upon recommendation of the Director, Traffic Engineering Division, and concurrence of the Chief Engineer Development, hereby ORDERS the adoption of standards for TRAFFIC CONTROLS FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS, NOVEMBER 1994, as the official standards of the West Virginia Department of Transportation, Division of Highways, as is required under provisions of Chapter 17C, Article 3, Section 1, of the Official Code of West Virginia, 1931, as amended.

The standards, TRAFFIC CONTROLS FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS, supersedes "Part VI, Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations" dated September 3, 1993, which is Revision 3 of the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREET AND HIGHWAYS, 1988 EDITION, which was adopted as the Official Manual of the Department of Highways by Commissioner's Order dated November 12, 1989. This order amends the November 12, 1989, Commissioner's Order only in regard to the adoption of Part VI. In addition, this order supersedes and replaces the Commissioner's Order on the adoption of standards for TRAFFIC CONTROL FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS dated July 1, 1985.

The standards are in compliance with the Official Code of West Virginia, 1931, as amended, Chapter 17, Article 2A, Section 8, Paragraph 37, to establish road policies and administration practices of control of traffic and promotion of safety on the public highways, and Chapter 17C, Article 3, Section 4a which pertains to traffic control at the site of street and highway construction or maintenance.

WHEREAS, Chapter 29A, of the Official Code of West Virginia, 1931, as amended, commonly known as the Administrative Procedures Act, requires and provides that administrative rules and regulations of the West Virginia Department of Transportation, Division of Highways, be filed for record with the Secretary of State's office; and,

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
CHARLESTON, WEST VIRGINIA

ABSTRACT
FROM
THE RECORDS OF THE COMMISSIONER'S ORDERS
DATED November 1, 1994

Distribution.

WHEREAS, the West Virginia Department of Transportation, Division of Highways, acting by and through its Commissioner, has promulgated rules and regulations for control of traffic for street and highway construction and maintenance operations on state highways right of way under the authority of Chapter 17, Article 2A, does at this time desire the adoption of said standards.

NOW, THEREFORE, IT IS ORDERED, that these standards for TRAFFIC CONTROL FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS, NOVEMBER 1994, be adopted.

DISTRIBUTION

CC, CA, HD, HO, RC, DT, DV, DR, DS, OM, OC
DISTRICT ENGINEERS
FEDERAL HIGHWAY ADMINISTRATION
SECRETARY OF STATE

Entered this 1st day of November, 1994

Fred VanKirk, Commissioner
West Virginia Division of Highways

STATE OF WEST VIRGINIA
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS, to wit:

I, Donald R. Adams, Business Manager of the Division of Highways, do hereby certify that the foregoing is a true abstract from the Orders of the West Virginia Commissioner of Highways entered of record on the 1st **day of** November **19** 94.

Given under my hand and seal of the Division of Highways this 1st **day of** November **19**94.

Business Manager
Division of Highways

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TRAFFIC CONTROLS FOR STREET AND HIGHWAY CONSTRUCTION, MAINTENANCE, UTILITY, AND INCIDENT MANAGEMENT OPERATIONS

6A. INTRODUCTION

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

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

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

The plans and devices should follow the principles set forth in this manual but may deviate from the typical drawings to allow for conditions and requirements of a particular site or jurisdiction.

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

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

6B. FUNDAMENTAL PRINCIPLES

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

Special plan preparation and coordination with transit and other highway agencies, police and other emergency units, utilities, schools, railroads, etc., may be needed to reduce unexpected and unusual traffic operation situations.

During temporary traffic control activities, commercial vehicles may need to follow a different route from automobiles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous materials may need to follow a different route from other vehicles. Truck Route National Network and hazardous cargo signs are included in section 2B-43 of the MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).

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

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

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

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

2. Traffic movement should be inhibited as little as practicable.

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

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

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

d. Roadway occupancy and work completion time should be minimized to reduce exposure to potential hazards.

e. Pedestrians should be provided with access and safe passage through the temporary traffic control zone at all times.

f. Roadway occupancy should be provided during off-peak hours and if feasible night work should be conducted.

3. Drivers and pedestrians should be guided in a clear and positive manner while approaching and traversing the temporary traffic control zone.

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

b. Signs, pavement markings, channelizing devices, delineators, and other traffic control devices that are inconsistent with intended travel paths through long-term workspaces should be removed. In short-duration and mobile workspaces where retained permanent devices are inconsistent with intended travel paths, attention should be given to devices that highlight or emphasize the appropriate path.

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

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

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

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

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

d. When warranted, an engineering analysis should be made (in cooperation with law enforcement officials) of all accidents occurring in temporary traffic control zones. Temporary traffic control zones and accident records should be monitored to identify and analyze traffic accidents or conflicts. For example, skid marks or damaged traffic control devices may indicate the need for changes in the traffic control. The project supervisor shall report all traffic accidents on the standard forms.

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

f. Periodic nighttime inspections should be made to review the condition of devices during darkness.

5. The maintenance of roadside safety requires attention during the life of the temporary traffic control zone because of the potential increase in hazards.

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

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

c. Whenever practical, equipment, workers' private vehicles, materials, and debris should be stored in such a manner as not to be vulnerable to run-off-the-road vehicle impact.

d. Pedestrian paths through the temporary traffic control zone should be protected to minimize pedestrian exposure to errant vehicles.

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

7. The control of traffic through work areas is an essential part of street and roadway construction, utility and maintenance operations. For these operations there must be adequate legislative authority for the implementation and enforcement of needed traffic regulations, parking controls, speed zoning, and incident management. Such statutes must provide sufficient flexibility in the application of traffic control to meet the needs of changing conditions in work areas.

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

6C.TEMPORARY TRAFFIC CONTROL ELEMENTS

6CB1. TRAFFIC CONTROL PLANS

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

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

Traffic control planning requires forethought. Provisions may be incorporated into the project bid documents that enable contractors to develop alternate traffic control plans, which

may be used only if the Traffic Engineering Division finds they are as good as those provided in the plans/specifications. For maintenance and minor utility projects that do not require bidding, forethought must be given to selecting the best traffic control before occupying the work zone. Also, coordination must be made between projects to ensure that duplicate signing is not used and to ensure compatibility of traffic control between adjacent projects.

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

6C-2. DEFINITION OF TEMPORARY TRAFFIC CONTROL ZONE COMPONENTS

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

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

a. Advance Warning Area

In the advance warning area, drivers are informed of what to expect. The advance warning may vary from a single sign or flashing lights on a vehicle to a series of signs in advance of the temporary traffic control zone transition area. On freeways and expressways, where driver speed is generally in the higher range (45 mph or more), signs may be placed from 500 feet to 1/2 mile or more before the temporary traffic control zone. The true test of adequacy of sign spacing is to evaluate how much time the driver has to perceive and react to the condition ahead. In this regard, the use of speed, roadway conditions, and related driver expectancy must be considered in order to derive a practical sign spacing distance. As a guide, Table II-1 in section 2C-3 of the MUTCD should be used in conjunction with consideration of actual or anticipated field conditions.

Table II-1 of MUTCD

A Guide for Advance Warning Sign Placement Distance

A high Posted or 85 percentile speed MPH	Condition Judgment needed [3] (10 secs. PIEV)	General warning signs [3] Condition B—Stop Condition 0	Condition C—Deceleration condition To listed advisory speed—MPH (or Desired speed at condition) 10	20	30	40	50
20.	[3] 175	([4])	([4])				
25.	250	([4])	[2] 100				
30.	325	[3] 100	150	[5] 100			
35.	400	150	200	175			
40.	475	225	275	250	[5] 175		
45.	550	300	350	300	250		
50.	625	375	425	400	325	225	
55.	700	450	500	475	400	300	
60.	775	550	575	550	500	400	[5] 300
65.	850	650	650	625	575	500	[5] 375

Typical Signs for the Listed Conditions in Table II-1: Condition A--Merge, Right Lane Ends, etc.; Condition B--Cross Road, Stop Ahead, Ped-Xing, etc.; Condition C--Turn, Curve, Divided Road, Hill, Dip, etc.

[1] Distances shown are for level roadways. Corrections should be made for grades. If 48-inch signs are used, the legibility distance may be increased to 200 feet. This would allow reducing the above distance by 75 feet.

[2] In urban areas, a supplementary plate underneath the warning sign should be used specifying the distance to the condition if there is an in-between intersection which might confuse the motorist.

[3] Distance provides for 3-second PIEV, 125 feet Sign Legibility Distance, Braking Distance for Condition B and Comfortable Braking Distance for Condition C as indicated in A Policy on Geometric Design of Highways and Streets, 1984, AASHTO, Figure II-13.

[4] No suggested minimum distance provided. At these speeds, sign location depends on physical conditions at site.

[5] Feet.

Effective placement of warning signs for urban and rural locales is as follows:

(1) Urban

Warning sign spacings in advance of the transition area normally range from four to eight times the speed (mph) in feet, with the high end of the range being used when speeds are relatively high. When single advance warning signs are used (as in the case of low-speed residential streets), the advance warning area can be as short as 200 feet. When two or more advance signs are used on higher-speed streets such as major arterials, the advance warning area should extend a greater distance. (See Table 3.)

(2) Rural

Rural roadways are characterized by higher speeds. Spacing for the placement of warning signs is substantially longer--from 8 to 12 times the speed (mph) in feet. Two or more advance warning signs are normally used in these conditions, the advance warning area should extend 1,500 feet or more in open highway conditions. (See Table 3.)

Advance warning is normally not needed when the activity area is sufficiently removed from the driver's path that it does not interfere with traffic.

b. Transition Area

When redirection of the driver's normal path is required, traffic must be channelized from the normal path to a new path. This redirection is intended to occur at the beginning of the transition area. In mobile operations, this transition area moves with the work space. Transition areas usually involve strategic use of tapers, which (because of their importance) are discussed in more detail in section 6C-3 of the MUTCD.

c. Activity Area

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

(1) Work Space

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

(2) Traffic Space

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

(3) Buffer Space

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

(a) Longitudinal Buffer Space

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

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

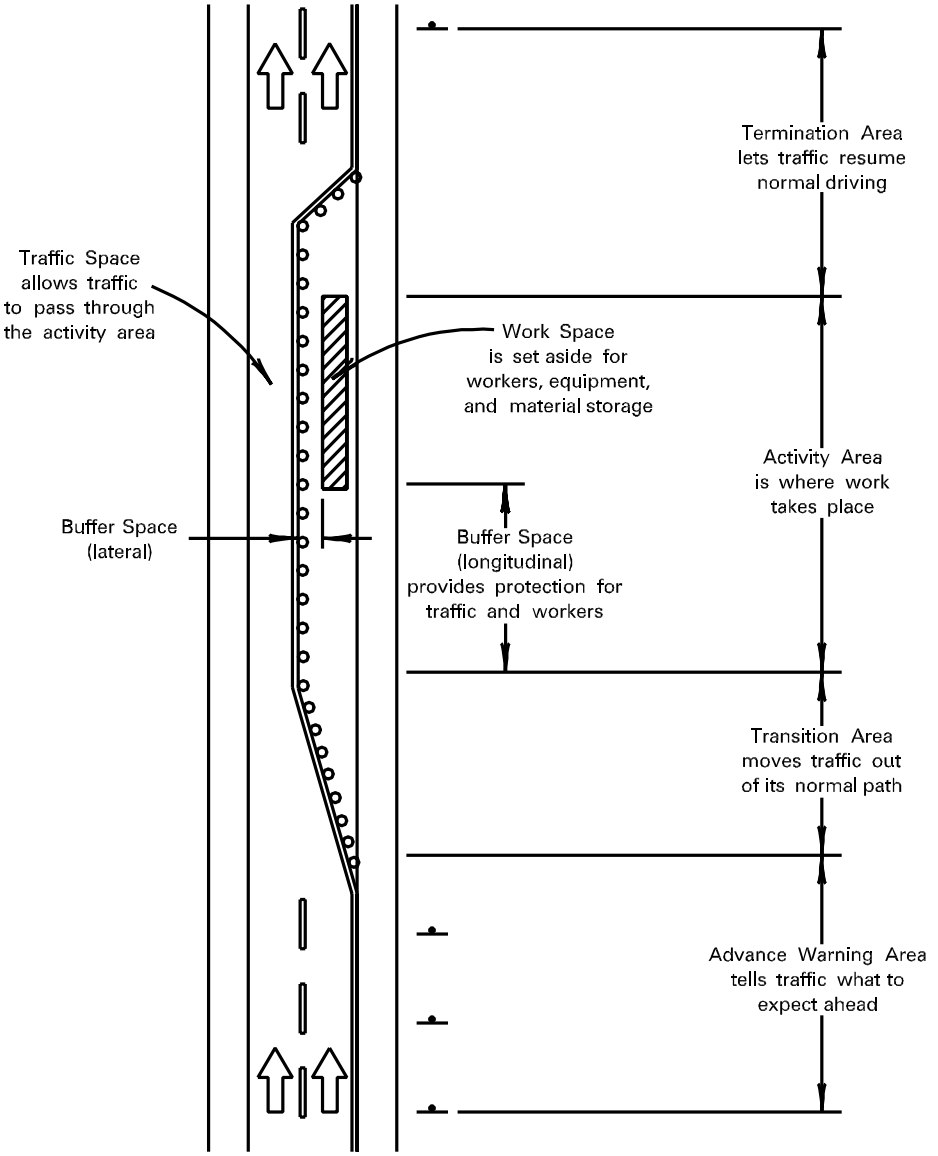
A guide for the length of longitudinal buffer space is shown in Table 1. The length may be adjusted to satisfy individual agency needs.

(b) Lateral Buffer Space

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

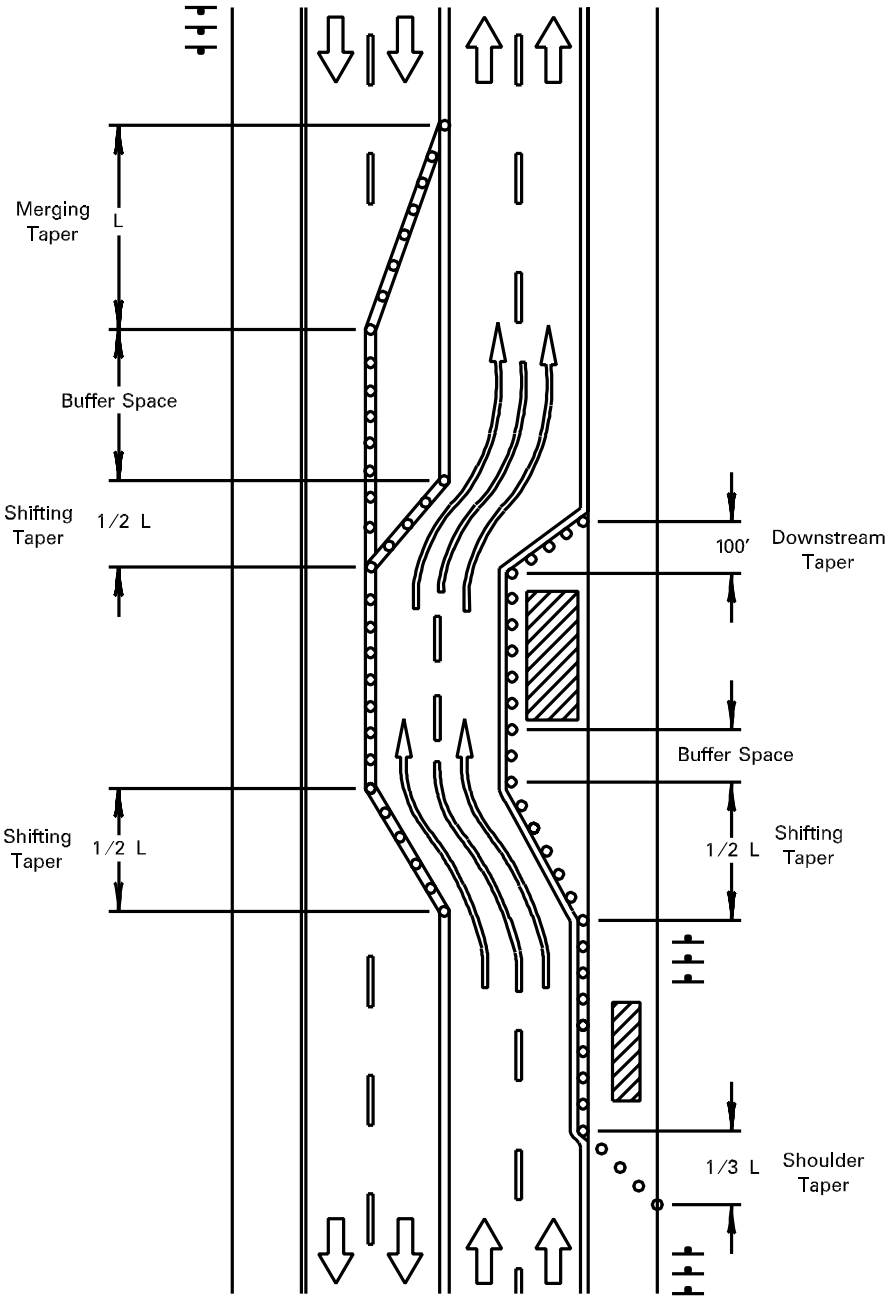
(4) Incident Management Vehicle Storage Space

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



COMPONENT PARTS OF A TEMPORARY TRAFFIC CONTROL ZONE.

FIGURE 1



TAPERS AND BUFFER SPACE.

FIGURE 2

Table 1. Guidelines for length of longitudinal buffer space[1]

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

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

[1] Based upon American Association of State Highway and Transportation Officials (AASHTO) braking distance portion of stopping sight distance for wet and level pavements (A Policy on Geometric Design of Highways and Streets, AASHTO, 1990, p. 120). This AASHTO document also recommends adjustments for the effect of grade on stopping and variation for trucks.

d. Termination Area

The termination area is used to return traffic to the normal traffic path. The termination area extends from the downstream end of the work area to the END ROAD WORK signs, if posted. Conditions may be such that posting of END ROAD WORK signs is not helpful. For example, the END ROAD WORK signs should normally not be used if other temporary traffic control zones begin within a mile of the end of the work space in rural areas, or about a quarter-mile within urban areas. For normal daytime maintenance operations, the END ROAD WORK SIGN is optional.

6C-3. TAPERS

A common important element of a temporary traffic control zone is a roadway taper. Tapers may be used in both the transition and termination areas. Tapers are created using a series of channelizing devices or pavement markings placed to move traffic out of or into its normal path. Whenever tapers are to be used near interchange ramps, crossroads, curves, or other influencing factors, it may be desirable to adjust the length of tapers. Longer tapers are not necessarily better than shorter tapers (particularly in urban areas characterized by short block lengths, driveways, etc.), because extended tapers tend to encourage sluggish operation and to encourage drivers to delay lane changes unnecessarily. The real test of taper length involves observation of driver performance after traffic control plans are put into effect. Types of taper lengths are presented in Table 2. The maximum space between devices in a taper normally approximates the distance in feet of the speed in miles per hour (i.e.: a 55-mph speed road should normally have devices spaced about 50-55 feet apart).

Types of tapers are shown in Figure 2 and the two-way traffic taper is shown in Figure 3.

a. Merging Taper

A merging taper requires the longest distances because drivers are required to merge with an adjacent lane of traffic at the prevailing speed. The taper should be long enough to enable merging drivers to adjust their speeds and merge into a single lane before the end of the transition. For freeways, expressways, and other roadways having a speed of 45 mph or greater, the minimum length for merging tapers should be computed by a formula $L = W \times S$. For residential, urban, and other streets with speeds less than 45 mph, the formula $L = (W \times S^2)/60$ should be used. Under either formula, L is the taper length in feet, W is the lateral shift of traffic due to the partially or fully closed lane (in feet), and S is the posted speed, the off-peak 85th percentile speed prior to work starting or the anticipated operating speed. The formula $L = (W \times S^2)/60$ is used for speeds less than 45 mph because slower traffic can merge safely in a shorter distance.

Table 2. Taper length criteria for work zones

Type of taper	Taper length
Upstream tapers	
Merging taper	L minimum
Shifting taper	1/2 L minimum
Shoulder taper	1/3 L minimum
Two-way traffic taper	100 feet maximum
Downstream tapers (use is optional)	100 feet minimum

Formulas for L*

Speed	Formula
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or greater	L = W x S

*L = Taper length in feet.
W = Width of offset in feet.
S = Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.

b. Shifting Taper

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

c. Shoulder Taper

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

d. Downstream Taper

The downstream taper may be useful in termination areas to provide a visual cue to the driver that access is available to the original lane/path that was closed. When a downstream taper is used, it should have a minimum length of about 100 feet per lane, with devices spaced about 25 feet apart. An example of a downstream taper is shown in Figure 2.

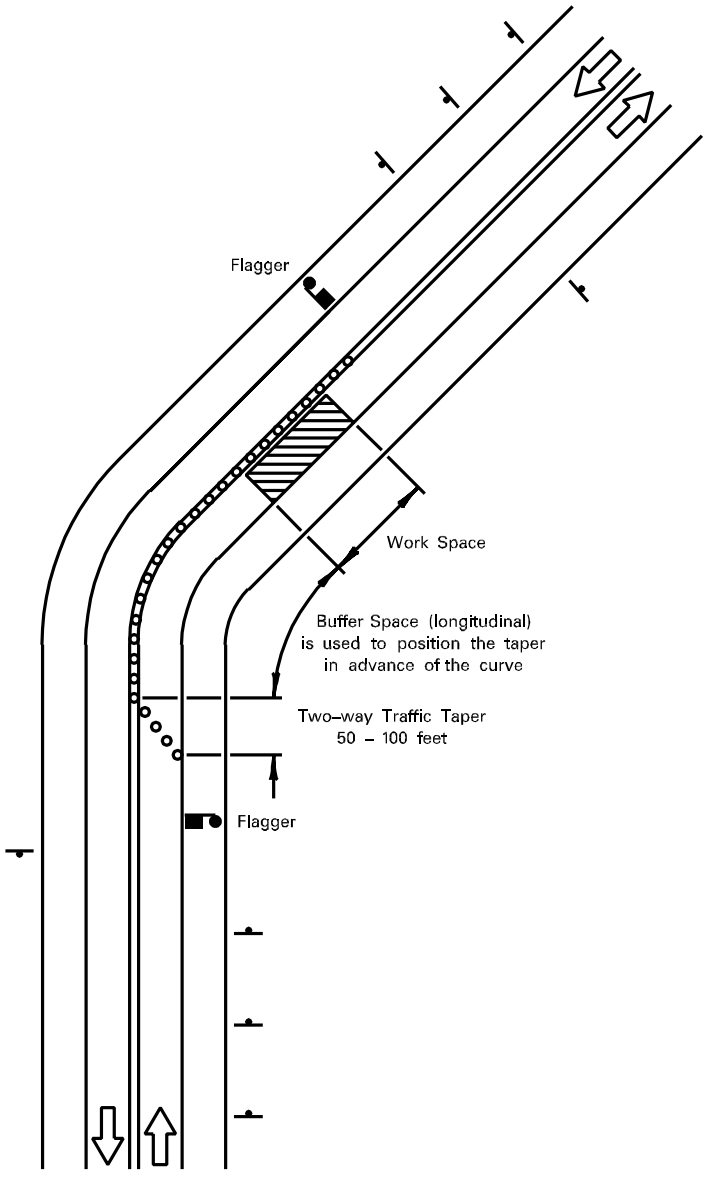
e. One-Lane, Two-Way Taper

The one-lane, two-way traffic taper is used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction. Typically, traffic is controlled by a temporary traffic signal or a flagger. A short taper having a maximum length of 100 feet with channelizing devices at approximately 25-foot spacings should be used to guide traffic into the one-way section. An example of a one-lane, two-way traffic taper is presented in Figure 3.

6C-4. DETOURS AND DIVERSIONS

At detours, traffic is directed onto another roadway to bypass the temporary traffic control zone. Detours should be signed clearly over their entire length so that motorists can easily determine how to return to the original roadway.

At diversions, traffic is directed onto a temporary roadway or alignment placed in or next to the right-of-way, e.g., median crossovers or lane shifts.



EXAMPLE OF A TWO–WAY TRAFFIC TAPER.

FIGURE 3

6C-5. ONE-LANE, TWO-WAY TRAFFIC CONTROL

Where traffic in both directions must, for a limited distance, use a single lane, provision should be made for alternate one-way movement through the constricted section. Some means of coordinating movements at each end shall be used to avoid head-on conflicts and to minimize delays. Control points at each end should be chosen to permit easy passing of opposing lines of vehicles. At a "spot" obstruction, however, such as an isolated pavement patch on roadways with lower speeds and adequate sight distance, the movement may be self-regulating.

Alternate one-way traffic control may be accomplished as appropriate by flagger control, a flag-carrying or official car, a pilot car, traffic signals, or by using stop or yield control. This section discusses each of these traffic control techniques. (See section 6E-2 for flagger qualifications.)

a. Flagger Method

Where a one-lane two-way temporary traffic control zone is short enough to allow visibility from one end to the other, traffic may be controlled by either a single flagger or by a flagger at each end of the section. When a single flagger is used, the flagger should be stationed on the shoulder opposite the obstruction 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 may 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 orally or with signals. These signals should not be mistaken for flagging signals. The use of radios may also be desirable even though visual contact is possible.

b. Flag Transfer Method

Flag carrying is effective when the route is well defined. It should be employed only when the one-way traffic is confined to a relatively short length of road, usually not more than 1 mile in length.

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 safe to allow traffic to move in the other direction. The flag being carried should always be clean and dry. A variation of this method is the use of an "official" car that always follows the last vehicle proceeding through the section. The use of an official car eliminates the possibility of loss of the flag.

c. Pilot Car Method

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

The pilot car should have the name of the contractor or contracting authority prominently displayed. The PILOT CAR sign (G20-4) shall be mounted at a conspicuous location on the rear of the vehicle.

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

d. Temporary Traffic Signal Method

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

e. Stop or Yield Control Method

A yield or stop sign may be installed on low-volume, two-lane roads where one side of the roadway is closed and the other side must serve both directions. The side that is closed should yield to or stop for oncoming traffic on the side that is open. The approach to the side that is not closed must be visible (for a distance equal to the safe-passing sight distance for that approach) to the driver who must yield or stop. See section 3B-5 of the MUTCD, Warrants for No-Passing Zones at Curves.

6C-6. TRANSIT CONSIDERATIONS

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

6D. PEDESTRIAN AND WORKER SAFETY

6D-1. PEDESTRIAN CONSIDERATIONS

There are three threshold considerations in planning for pedestrian safety in temporary traffic control zones on highways and streets:

- Pedestrians should not be led into direct conflicts with work site vehicles, equipment, or operations.
- Pedestrians should not be led into direct conflicts with mainline traffic moving through or around the work site.
- Pedestrians should be provided with a safe, convenient travel path that replicates as nearly as possible the most desirable characteristics of sidewalks or footpaths.

In accommodating the needs of pedestrians at work sites, it should always be remembered that the range of pedestrians that can be expected is very wide, including the blind, the hearing impaired, and those with walking handicaps. All pedestrians need protection from potential injury and a smooth, clearly delineated travel path.

Therefore, every effort should be made to separate pedestrian movement from both work site activity and adjacent traffic. Whenever possible, signing should be used to direct pedestrians to safe street crossings in advance of an encounter with a temporary traffic control zone. Signs should be placed at intersections so that pedestrians, particularly in high-traffic-volume urban and suburban areas, are not confronted with mid-block work sites that will induce them to skirt the work zone or make a mid-block crossing. It must be recognized that pedestrians will only infrequently retrace their steps to make a safe crossing. Consequently, ample advance notification of sidewalk closures is critically important. Refer to Cases B1 and B2 for typical traffic control device usage and techniques for pedestrian movement through work areas.

When pedestrian movement through or around a work site is necessary, the aim of the engineer should be to provide a separate, safe footpath without abrupt changes in grade or terrain. Judicious use of special warning and control devices may be helpful for certain difficult work area situations. These include rumble strips, changeable message signs, hazard identification beacons, flags, and warning lights. Flagger

activated audible warning devices may be used to alert pedestrians of the approach of erratic vehicles. Also, whenever it is feasible, closing off the work site from pedestrian intrusions is preferable to channelizing pedestrian traffic along the site solely with temporary traffic control devices such as cones, tubular markers, barricades, or drums. If the possibility of vehicle impact is very low, chain link or other suitable fencing, placed well away from traffic, is acceptable. Solid fencing with plywood, however, can create sight distance restrictions at intersections and at work site access cuts. Care must be taken not to create fenced areas that are vulnerable to splintering or fragmentation by vehicle impacts. Similarly, temporary traffic control devices used to delineate a work zone pedestrian walkway must be lightweight and, when struck, present a minimum threat to pedestrians, workers, and impacting vehicles. Only minimally necessary ballasting with safe, lightweight materials should be used with these devices.

Movement by work vehicles and equipment across designated pedestrian paths should be minimized and, when necessary, should be controlled by flaggers or temporary traffic control. Cuts into work areas across pedestrian walkways should be kept to a minimum, because they often create unacceptable changes in grade and rough or muddy terrain. Pedestrians cannot be expected to traverse these areas willingly. They will tend to avoid the cuts by attempting non-intersection crossings.

At work sites of significant duration, especially in urban areas with high pedestrian volumes, where falling debris is a concern (such as work on overhead structures), a canopied walkway is frequently provided to protect pedestrians from falling debris. These covered walkways should be sturdily constructed and adequately lit for nighttime use.

In places where pedestrians are judged especially vulnerable to impact by errant vehicles, all foot traffic should be separated and protected by longitudinal barrier systems. Where a barrier is clearly needed, it should have sufficient strength and low deflection characteristics, to keep vehicles from intruding into the pedestrian space. Further, short, noncontinuous segments of longitudinal systems, such as concrete barriers, must be avoided because they nullify the containment and redirective capabilities of the design, increase the potential for serious injury to both 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 impact attenuators. With regard to concrete barriers in particular, it is very important to ensure that adjacent segments are properly joined to effect the overall strength required for the system to perform properly.

It has been determined through study and experience that vertical curbs cannot prevent vehicle intrusions onto sidewalks. As a consequence, normal vertical curbing is not a satisfactory substitute for positive barriers when these are clearly needed. Similarly, contractor-constructed wooden railings, chain-link fencing with horizontal pipe runs, and similar systems placed directly adjacent to vehicle traffic are not acceptable substitutes for crashworthy positive barriers; when struck, they are dangerous to vehicle occupants, workers, and pedestrians. In many instances, temporary positive barriers may be necessary to prevent pedestrians from unauthorized movements into the active work area and to prevent conflicts with traffic by eliminating the possibility of mid-block crossings.

If a high potential exists for vehicle incursions into the pedestrian space, judgment must be exercised as to whether to reroute pedestrians or use barriers. Normally, standard traffic control devices can satisfactorily delineate a work zone pedestrian path, but fail-safe channelization can never be guaranteed with these devices because of the gaps between them. Tape, rope, or plastic chain strung between devices can help discourage pedestrian movements off the designated pathway.

Good engineering judgment in each work zone situation should readily determine the extent of pedestrian needs. The engineer in charge of work zone traffic control should provide both a sense of security and safety for pedestrians walking past work sites and consistent, unambiguous channelization to maintain foot traffic along the desired travel paths.

6D-2. WORKER SAFETY CONSIDERATIONS

Of equal importance to the safety of the public traveling through the work zone is the safety of the worker performing the many varied tasks within the work site. Work areas present temporary and constantly changing conditions that are unexpected by the traveler. Further, these work area conditions almost always present situations that are more confusing for the driver. This creates an even higher degree of vulnerability for the personnel on or near the roadway.

Following the Fundamental Principles noted above in Section 6B will usually provide the degree of control and traffic operation that will bring about safe conditions for the worker. Of particular importance is maintaining work areas with traffic flow inhibited as little as possible, providing standard, conspicuous and clear traffic control devices that get the driver's attention and provide positive direction.

Below are key elements of traffic control management that should be considered in any procedure for assuring worker safety:

- Training-All workers should be trained in how to work next to traffic in a way that minimizes their vulnerability. In addition, workers with specific traffic control responsibilities should be trained in traffic control techniques, device usage, and placement.

- Worker Clothing-Workers exposed to traffic should be attired in bright, highly visible clothing similar to that of flaggers.

- Barriers-Barriers should be placed along the work space depending on such factors as lateral clearance of workers from adjacent traffic, speed of traffic, duration of operations, time of day, and volume of traffic.

- Speed Reduction-In highly vulnerable situations, consideration should be given to reducing the speed of traffic through regulatory speed zoning, funneling, use of police, lane reduction, or flaggers.

- Use of Police-In highly vulnerable work situations, particularly those of relatively short duration, stationing police units heightens the awareness of passing traffic and will likely cause a reduction in travel speed.

- Lighting-For nighttime work, lighting the work area and approaches may allow the driver better comprehension of the requirements being imposed. Care should be taken to ensure that the lighting does not cause blinding.

- Special Devices-Judicious use of special warning and control devices may be helpful for certain difficult work area situations. These include rumble strips, changeable message signs, hazard identification beacons, flags, and warning lights. Flagger activated audible warning devices may be used to alert workers to the approach of erratic vehicles. Misuse and overuse of special devices/techniques can greatly lessen their effectiveness.

- Public Information-Improved driver performance may be realized through a well-prepared and complete public relations effort that covers the nature of the work, the time and duration of its execution, and its anticipated effects upon traffic and possible alternate routes and modes of travel. Such programs have been found to result in a significant drop in

traffic; that reduces the possible number of conflicts and may allow a temporary lane closing for additional buffer area.

- Road Closure-If alternate routes are available to handle detoured traffic, the road may be closed temporarily during times of greatest worker hazard-which, in addition to offering maximum worker safety, may facilitate quicker project completion and thus further reduce worker vulnerability.

Like other provisions of work area safety set forth in this manual, the various traffic control techniques must be applied by qualified persons after appropriate engineering studies and with sound engineering judgment and common sense.

6E. HAND-SIGNALING CONTROL

6E-1. FUNCTION

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

6E-2. QUALIFICATIONS FOR FLAGGERS

Because flaggers are responsible for public safety and make the greatest number of public contacts of all highway workers, they should have the following minimum qualifications:

- Sense of responsibility for the safety of the public and workers
- Training in safe traffic control practices
- Average intelligence
- Good physical condition, including sight and hearing
- Mental alertness and the ability to react in an emergency
- Courteous but firm manner
- Neat appearance

6E-3. HIGH-VISIBILITY CLOTHING

For daytime work, the flagger's vest, shirt, or jacket shall be orange, yellow, strong yellow green or fluorescent versions of these colors. For nighttime work, similar outside garments shall be retroreflective. The retroreflective material shall be orange, yellow, white, silver, strong yellow-green, or a fluorescent version of one of these colors and shall be visible

at a minimum distance of 1,000 feet. The retroreflective clothing shall be designed to identify clearly the wearer as a person and be visible through the full range of body motions.

Uniformed law enforcement officers may be used as flaggers in some locations, such as an urban intersection, where enforcement of traffic movements is important. Uniformed law enforcement officers may also be used on freeways where traffic is channelled around work sites and it is necessary to assure that advisory and regulatory speeds are being enforced. For nighttime work and in low-visibility situations, a retroreflective garment as described above should be worn.

6E-4. HAND-SIGNALING DEVICES

Hand-signaling devices, such as STOP/SLOW paddles, lights, and red flags are used to control traffic through temporary traffic control zones. The STOP/SLOW paddle, which gives drivers more positive guidance than red flags, should be the primary hand-signaling device. The standard STOP/SLOW sign paddle shall be 18 inches square with letters at least 6 inches high. A rigid handle should be provided. This combination sign should be fabricated from light semirigid material, and shall have an octagonal shape. The background of the STOP face shall be red with white letters and border. To improve conspicuity, the STOP face may be supplemented by one or two symmetrically positioned alternately flashing high-intensity lamps. The background of the SLOW face shall be orange with black letters and border. When used at night, the STOP/SLOW paddle shall be retroreflectorized in the same manner as signs.

Flag use should be limited to emergency situations and at low-speed and/or low-volume locations which can best be controlled by a single flagger. Flags used for signaling shall be a minimum of 24 inches square, made of a good grade of red material, and securely fastened to a staff about 3 feet long. The free edge should be weighted so the flag will hang shall be retroreflective red.

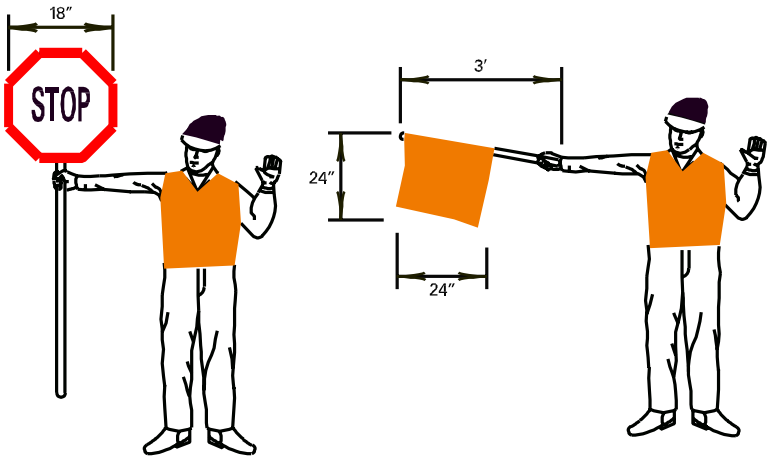
6E-5. HAND-SIGNALING PROCEDURES

STOP/SLOW paddle and flag use are illustrated in Figure 4. The following methods of signaling with STOP/SLOW paddles should be used:

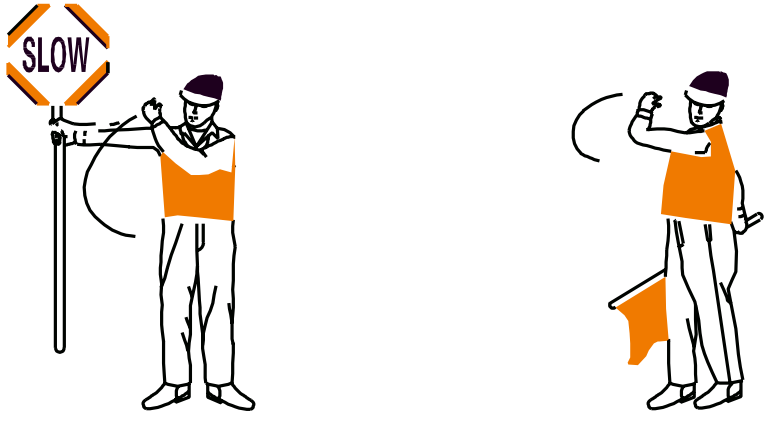
- To Stop Traffic-The flagger shall face traffic and extend the STOP sign paddle in a stationary position with the arm extended horizontally away from the body. The free arm should be raised with the palm toward approaching traffic.

PADDLE

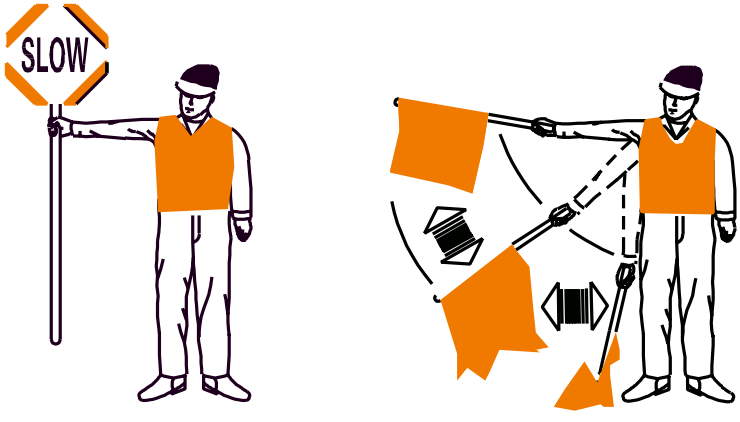
FLAG



To Stop Traffic



Traffic Proceed



To Alert and
Slow Traffic

USE OF HAND SIGNALING DEVICES BY FLAGGER.

FIGURE 4

- To Direct Stopped Traffic to Proceed-The flagger shall face traffic with the SLOW paddle held in a stationary position with the arm extended horizon-tally away from the body. The flagger should motion with the free hand for traffic to proceed.

- To Alert or Slow Traffic-The flagger shall face traffic with the SLOW sign paddle held in a stationary position with the arm extended horizontally away from the body. The flagger may motion up and down with the free hand, palm down, indicating that the vehicle should slow down.

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

- To Stop Traffic-The flagger shall face traffic and extend the flag staff horizontally across the traffic lane in a stationary position, so that the full area of the flag is visible hanging below the staff. The free arm should be raised with the palm toward approaching traffic.

- To Direct Stopped Traffic to Proceed-The flagger shall face traffic with the flag and arm lowered from view of the driver. With the free hand, the flagger should option traffic to proceed. Flags shall not be used to signal traffic to proceed.

- To Alert or Slow Traffic-The flagger shall face traffic 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.

6E-6. FLAGGER STATIONS

Flagger stations shall be located far enough ahead of the workspace so that approaching traffic has sufficient distance to stop before entering the workspace. Table 1, "Guidelines for length of longitudinal buffer space," may be used for locating flagger stations in advance of the workspace. This distance is related to approach speeds, friction factors, and pavement and tire conditions. These distances may be increased for down- grades[2] and physical conditions at the site; however, 200 to 300 feet is desirable. In urban areas where speeds are low and streets closely spaced, the distance should be decreased.

[2]Table III-2. A Policy on Geometric Design of Highways and Streets, AASHTO, 1990, p. 125.

The flagger should stand either on the shoulder adjacent to the traffic being controlled or in the barricaded lane. At a "spot" obstruction, a position may have to be taken on the shoulder opposite the barricaded section to operate effectively. A flagger should stand only in the lane being used by moving traffic after traffic has stopped, and the flagger needs to be visible to other traffic or to communicate with drivers. Because of the various roadway geometrics, flaggers should be clearly visible to approaching traffic at all times. For this reason the flagger should stand-alone. Other workers should not be permitted to congregate around the flagger station. The flagger should be stationed far enough ahead of the work force to warn them (for example with horns, whistles etc.) of approaching danger, such as vehicles out of control.

Flagger stations should be visible far enough ahead to permit all vehicles to stop. Table 1, Guidelines for length of longitudinal buffer space, may be used in selecting the location of flaggers. This distance is related to approach speeds, friction factors, and pavement and tire conditions. These distances may be increased for downgrades.[3] These distances are calculated in a manner similar to those calculated in the first paragraph of 6E-6. Flagger stations should be preceded by proper advance warning signs. Under certain geometric and traffic situations, more than one flagger station may be required for each direction of traffic. At night, flagger stations should be illuminated.

At two-way, unusually low-volume and/or unusually low-speed short lane closings where adequate sight distance is available for the safe handling of traffic, the use of one flagger may be sufficient.

6F. TYPES OF DEVICES

The design and applications of traffic control devices used in temporary traffic control zones are described in this chapter. A traffic control device is a sign, signal, marking or other device placed on or adjacent to a street or highway (by authority of a public body or official having jurisdiction) to regulate, warn, or guide traffic. Specific crashworthy information on devices described in this section can be found in the AASHTO Roadside Design Guide.[3]
[1]

[3] Table III-2. A Policy on Geometric Design of Highways and Streets, AASHTO, 1990, p. 125.

[1.] AASHTO, 44 North Capitol Street, N.W., Suite 225, Washington, D.C. 20001.

6F-1.SIGNS

Temporary traffic control zone signs convey both general and specific messages by means of words or symbols and have the same three categories as all traffic signs: namely, regulatory signs, warning signs, and guide signs. The colors for regulatory signs shall follow the standard for regulatory signs in section 2B-3 of the MUTCD. Warning signs in temporary traffic control zones shall have a black legend on an orange background. Yellow warning signs within the traffic control zone which are still applicable may remain in place. Colors for guide signs follow the standard in section 2D-3 of the MUTCD, except for special information signs as noted below in section 6F-1C.

Where the color orange is specified, fluorescent red-orange or fluorescent yellow-orange colors may be used. The fluorescent versions of orange provide higher conspicuity than standard orange, especially during twilight.

All signs used at night shall be either retroreflective, with a material that has a smooth, sealed outer surface, or illuminated to show similar shape and color both day and night. Sign illumination may be either internal or external. Roadway lighting does not meet the requirements for sign illumination.

Standard orange flags or Type B high-intensity flashing warning lights may be used in conjunction with signs. However, they must not block the sign legend.

The dimensions of signs shown herein are for standard sizes, which may be increased wherever necessary for greater legibility or emphasis. On secondary highways and city streets, smaller signs may be used if authorized by lawful authority. Deviations from standard sizes as prescribed herein shall be in 6-inch increments. Sign design details are contained in Standard Highway Signs.[4]

As a general rule, signs should be located on the right-hand side of the roadway. When special emphasis is needed, signs may be placed on both the left and right sides of the roadway. Signs may be mounted on portable supports placed within the roadway itself. Signs, although ordinarily mounted on posts, may also be mounted on or above barricades.

Guidelines for height and lateral clearance of temporary post-mounted roadside signs are shown in Detail "B" (Figure 8). Signs erected at the side of the road should be mounted at a height of at least 7 feet, measured from the bottom of the sign

[5]Standard Highway Signs, Stock No. 950-044-00000-4. Available from the Government Printing Office, Superintendent of Documents, Washington D.C. 20402. Telephone 202-783-3238.

to the near edge of the pavement. The height to the bottom of a secondary sign mounted below another sign may be 1 foot less than the appropriate height specified above.

Methods of mounting signs other than on posts are illustrated in Detail "B" (Figure 8). Signs may be mounted on portable supports for short-term, short-duration, and mobile conditions (see section 6G-2). 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. Unprotected sign systems should be crashworthy (refer to the Roadside Design Guide, chapter Nine, for additional guidance)[2]. The bottom of signs mounted on barricades or temporary supports shall be no less than 1 foot above the traveled way.

For the best mobility of maintenance operations, a large sign may be mounted on a maintenance vehicle stationed in advance of the work or moving along with it. This may be either the work vehicle or the protection vehicle. A mobile sign display may be mounted on a trailer.

Signs used in temporary traffic control zones are moved frequently, loaded and unloaded from trucks, and in general receive much harsher treatment than permanent signs. For this reason, particular attention must be given to maintaining signs properly for cleanliness, visibility, and correct positioning. Signs are excessively worn, scratched, bent, or have lost a significant amount of retroreflectivity should be promptly replaced.

a. Regulatory Signs

(1) Authority

Regulatory signs inform highway users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent. Because regulatory signs impose legal obligations on all drivers, they shall be authorized by the West Virginia Division of Highways and shall conform to section 2B of the MUTCD.

(2) Design

Regulatory signs are generally rectangular, with a black legend and border on a white background. Exceptions include the STOP sign, the YIELD sign, the DO NOT ENTER sign, the WRONG WAY sign, and the one-way arrow sign. The one-way arrow sign may be either a horizontal or vertical rectangular plate.

[6]AASHTO, 44 North Capitol Street, N.W., Suite 225, Washington, D.C. 20001.

Regulatory signs are illustrated in Figures 5A and 5B. Design details for all regulatory signs are given in West Virginia Division of Highways Sign Fabrication Manual.[5]

(3) Application

If temporary traffic control zones require regulatory measures different from those normally in effect, the existing permanent regulatory devices shall be temporarily removed or covered and superseded by the appropriate temporary regulatory signs and shall follow applicable ordinances or statutes of the jurisdiction, as well as comply with the sign design standards of the MUTCD.

(4) ROAD (STREET) CLOSED Sign (R11-2)

The ROAD (STREET) CLOSED sign may be used where the roadway is closed to all traffic except contractors' equipment or officially authorized vehicles and may be accompanied by appropriate detour signing. The sign should be erected at or near the center of the roadway on or above a Type III barricade that closes the roadway (section 6F-5F). The sign should have a minimum size of 48 inches by 30 inches. The words BRIDGE OUT or BRIDGE CLOSED may be substituted for ROAD CLOSED, where applicable. The ROAD (STREET) CLOSED sign shall not be used where traffic is maintained or where the actual closing is some distance beyond this sign.

(5) LOCAL TRAFFIC ONLY Signs (R11-3, R11-4)

The LOCAL TRAFFIC ONLY signs should be used where through traffic must detour to avoid a closing some distance beyond the sign, but where local traffic can move up to point of closure. The sign shall carry the legend ROAD CLOSED [10] MILES AHEAD-LOCAL TRAFFIC ONLY or, optionally for urban use, ROAD (STREET) CLOSED TO THRU TRAFFIC, and should be accompanied by appropriate warning and detour signing. The words BRIDGE OUT or BRIDGE CLOSED may be substituted for ROAD CLOSED where applicable.

(6) WEIGHT LIMIT Signs (R12-1, R12-5a)

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

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[5] West Virginia Division of Highways, "Sign Fabrication Details," Traffic Engineering Division, August, 1993, or latest edition.

(7) Special Regulatory Signs

Special word message regulatory signs may be needed based on an engineering analysis. The sign should conform to the requirements of color, shape, and alphabet size and series. The sign message should be brief, legible, and clear. Regulatory speed limits are established by law or regulation. Approval must be granted by West Virginia Division of Highways before special regulatory signs are used.

b. Warning Signs

(1) Function

Work zone warning signs notify drivers of general or specific conditions on or adjacent to a roadway.

(2) Design and Application

With some exceptions, warning signs shall be diamond-shaped with a black symbol or message on an orange background. Mounting or space considerations may justify a change from the standard diamond shape, but such variations require prior approval of the West Virginia Division of Highways.

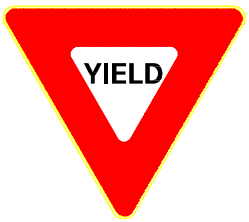
Warning signs developed exclusively and used for incident management shall have an orange background. However, in emergencies, available signs having yellow backgrounds may be used if orange signs are not readily available.

The standard size for each warning sign prescribed in this section is shown with the illustration accompanying the specification. Where roadway or traffic conditions require greater emphasis, larger signs should be used, with symbol or legend enlarged approximately in proportion to outside dimensions. Sign sizes for various type facilities can be found in the West Virginia Division of Highways Sign Fabrication Manual.[3]

Where any part of the roadway is obstructed or closed, advance warning signs are required to alert traffic well in advance of these obstructions or restrictions. These signs may be used singly or in combination. Because of their importance, they shall have a standard size of 48 inches square and shall be the standard diamond shape for warning signs, except as provided above. Signs larger than 48 inches square may be used for additional emphasis of the temporary traffic control zone.

[8]West Virginia Division of Highways "Sign Fabrication Details," Traffic Engineering Division, August, 1993, or latest edition.

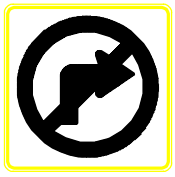
R1 – 1
36″ x 36″
(48″ x 48″)



R1 – 2
36″ x 36″ x 36″
(48″ x 48″ x 48″)

R2 – 1
36″ x 48″
(24″ x 30″)

R2 – 5c
36″ x 48″
(24″ x 30″)



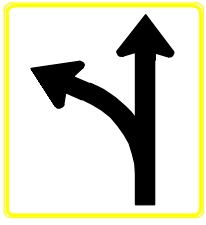
R3 – 1
36″ x 36″
(24″ x 24″)

R3 – 2
36″ x 36″
(24″ x 24″)

R3 – 3
36″ x 36″
(24″ x 24″)

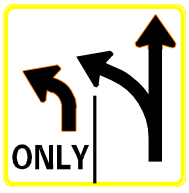
R3 – 4
36″ x 36″
(24″ x 24″)

R3 – 5L
30″ x 36″



R3 – 6L
30″ x 36″

R3 – 7
48″ x 48″
(30″ x 30″)



R3 – 8L
30″ x 30″

R4 – 1
36″ x 48″
(24″ x 30″)

R4 – 2
36″ x 48″
(24″ x 30″)

COMMONLY USED REGULATORY SIGNS.
FIGURE 5A

R4 – 7
48″ x 60″
(36″ x 48″)

R5 – 1
36″ x 36″
(30″ x 30″)

R5 – 1a
42″ x 30″
(36″ x 24″)

R6 – 1L
48″ x 18″
(36″ x 12″)

R6 – 2R
24″ x 30″
(18″ x 24″)

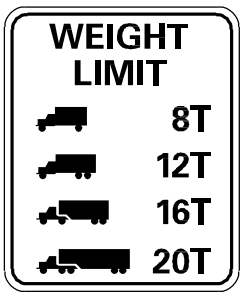
COMMONLY USED REGULATORY SIGNS.
FIGURE 5B

R11-2
48'' x 30''

R11-3r
60'' x 30''

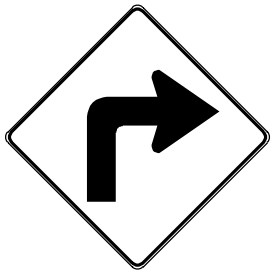
R11-4
60'' x 30''

R12-1
36'' x 48''
(24'' x 30'')

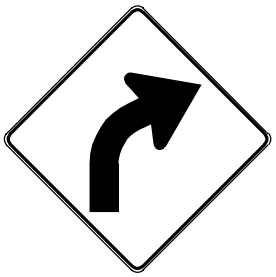


R12-5a
30'' x 42''

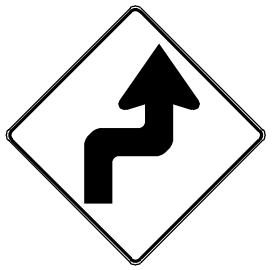
COMMONLY USED REGULATORY SIGNS
FIGURE 5C



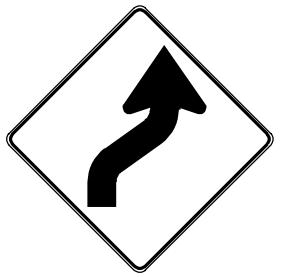
W1 – 1R
48″ x 48″



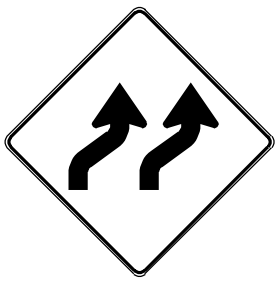
W1 – 2R
48″ x 48″



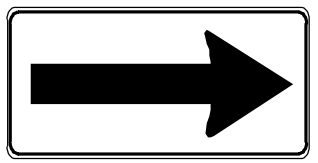
W1 – 3R
48″ x 48″



W1 – 4R
48″ x 48″



W20 – 12R
48″ x 48″



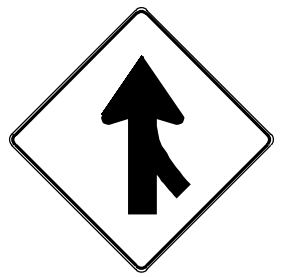
W1 – 6
72″ x 36″
(48″ x 24″)

W1 – 8
30″ x 36″
(18″ x 24″)

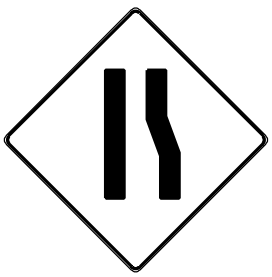
W3 – 1M
48″ x 48″

W3 – 2M
48″ x 48″

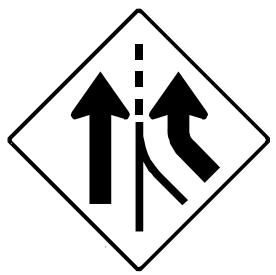
W3 – 3aM
48″ x 48″



W4 – 1
48″ x 48″



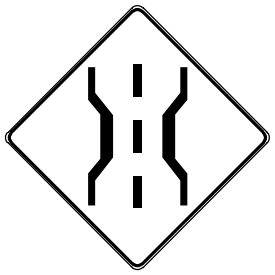
W4 – 2
48″ x 48″



W4 – 3
48″ x 48″

W5 – 1
36″ x 36″

WARNING SIGNS USED IN TEMPORARY TRAFFIC CONTROL ZONES.
FIGURE 6A

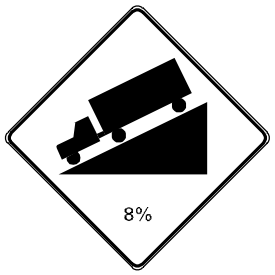


W5 – 2a
48″ x 48″
(36″ x 36″)

W5 – 3
48″ x 48″
(36″ x 36″)

W6 – 1
48″ x 48″
(36″ x 36″)

W6 – 2
48″ x 48″
(36″ x 36″)

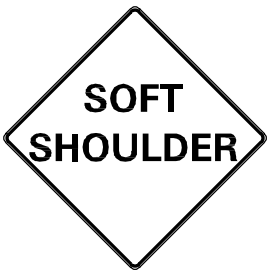


W7 – 1a
48″ x 48″
(30″ x 30″)

W8 – 1
48″ x 48″
(30″ x 30″)

W8 – 2
48″ x 48″
(30″ x 30″)

W8 – 3
48″ x 48″
(30″ x 30″)

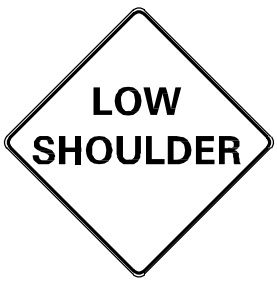


W8 – 4
48″ x 48″
(36″ x 36″)

W8 – 5
48″ x 48″
(36″ x 36″)

W8 – 7
48″ x 48″
(36″ x 36″)

W8 – 8
48″ x 48″
(30″ x 30″)

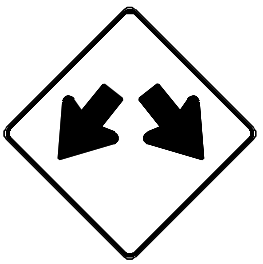


W8 – 9
48″ x 48″
(30″ x 30″)

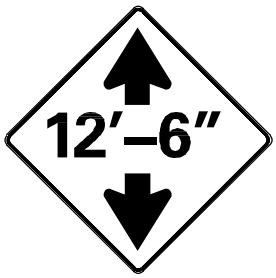
WARNING SIGNS USED IN TEMPORARY TRAFFIC CONTROL ZONES.
FIGURE 6B

W9 – 1R
48″ x 48″
(36″ x 36″)

W10 – 1
36″ DIAMETER



W12 – 1
36″ x 36″
(30″ x 30″)



W12 – 2
48″ x 48″
(36″ x 36″)

W14 – 3
36″ x 48″ x 48″

W22 – 12
48″ x 48″

WARNING SIGNS USED IN TEMPORARY TRAFFIC CONTROL ZONES.
FIGURE 6C

Where speeds and volumes are moderately low, a minimum size of 36 inches square may be used for advance warning signs, if they have a minimum letter size of 5 inches.

On secondary roads or city streets where speeds are very low, signs smaller than the standard size, but not less than 24 inches square, may be used for warning signs having short word messages or clearly understood symbols.

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

(3) Spacing of Warning Signs covered in the individual Cases as shown/noted.

Where highway conditions permit, warning signs should be placed at varying distances in advance of the work area, depending on the roadway type, condition, and speed. Where a series of two or more warning signs is used, the closest sign to the work area should be placed approximately 200 feet away for low-speed urban streets to 1,000 feet away or more for expressways and freeways.

Table 3 presents the suggested spacing of warning signs for four general roadway types for use in section 6H-3, Typical Application Diagrams.

Table 3. Suggested warning sign spacing

Road type	Distance between signs		
	A	B	C
Urban (low speed*)	200	200	200
Urban (high speed*)	350	350	350
Rural	500	500	500
Expressway/Freeway	1,OOO	1,600	2,600

*** Speed category to be determined by State highway agency in cooperation with local jurisdictions.**

In Table 3, the column headings "A", "B", and "C" are the dimensions for warning sign spacings used for the Cases. The dimensions are for marking the locations of warning signs relative to the transition or point of restriction. Sign placement distances suggested in Table II-1-A of the MUTCD are not applicable for the A, B, or C (Table 3) distances between signs in section 6H-3.

- The "A" dimension is for the sign nearest the transition or point of restriction.

- The "B" dimension is for the next sign upstream of the transition or restriction.
- The "C" dimension is for the first sign (in a three-sign series) that the driver encounters in a temporary traffic control zone.

(4) Other Approach Warning Signs

Certain conditions require other advance warning signs, such as limited sight distance or because an obstruction may require a motorist to stop. There are no specified standards for such signs. The determination of the sign or signs to be used shall be based on an engineering study using the following sections as guidelines. As an alternative to a specific distance on these advance-warning signs, the word AHEAD may be used.

(5) Application of Warning Signs for Maintenance, Minor Road Work, and Utility Sites

At many maintenance, minor road work, and utility sites, particularly on lightly traveled roads, the sequence of advance warning signs prescribed for major road work may not be needed. The signs described in the following sections will usually provide sufficient advance warning in such situations, either by themselves or with other advance warning signs.

Maintenance or minor roadwork can occur within the temporary traffic control zone limits of a major project. Maintenance or minor road work warning signs, which be needed when traffic is permitted through such zones. Maintenance and minor road work signing and traffic control should be coordinated with appropriate authorities such as City or State Traffic Engineers, so that drivers are not confused or misled by additional traffic control devices.

(6) ROAD (STREET) WORK Sign (W21-4)

The ROAD (STREET) WORK sign should be located ahead of the work space or detour, to serve as a general warning of obstructions or restrictions. It carries the legend ROAD (STREET) WORK (1,500) FT or ROAD (STREET) WORK (1/2) MILE. It may be used in conjunction with appropriate distance legends, or with other warning signs.

(7) DETOUR Sign (W20-2)

The DETOUR sign is used ahead of a detour that directs traffic onto another highway in order to bypass the temporary traffic control zone. It carries the legend DETOUR [1,000] FT or DETOUR [1/2] MILE. It may be used in conjunction with appropriate legends or with other warning signs.

(8) ROAD (STREET) CLOSED Sign (W20-3)

The ROAD (STREET) CLOSED sign is used ahead of that point where a highway is closed to all traffic or to all but local traffic. It carries the legend ROAD (STREET) CLOSED [1,000] FT or ROAD (STREET) CLOSED [1/4] MILE. It may be used in conjunction with appropriate legends or with other warning signs.

(9) ONE LANE ROAD Sign (W20-4)

The ONE LANE ROAD sign should be used ahead of that point where traffic in both directions must use a common single lane. It carries the legend ONE LANE ROAD [1,000] FT or ONE LANE ROAD [1/4] MILE. The sign may be used in conjunction with appropriate legends or with other warning signs.

If the affected one-lane roadway is not visible from one end to the other, or if the traffic is such that simultaneous arrivals at both ends occur frequently, flagging procedures or signal control should be used to control alternate traffic flows.

(10) LANE CLOSED Sign (W20-5)

The LANE CLOSED sign is used before that point where one lane of a multiple-lane roadway is closed. It carries the legend RIGHT (LEFT) LANE CLOSED [1,000] FEET or RIGHT (LEFT) LANE CLOSED [1/4] MILE. The sign may be used in conjunction with appropriate legends or with other warning signs.

(11) FLAGGER Sign (W20-7a)

The FLAGGER symbol sign (W20-7a) should be used before any point where a flagger is stationed to control traffic. A distance legend may be displayed on a supplemental plate below the symbol sign. The sign may be used in conjunction with appropriate legends or with other warning signs, such as W22-12, BE PREPARED TO STOP.

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

(12) TWO-WAY TRAFFIC Sign (W6-3)

When one roadway of a normally divided highway is closed, the TWO-WAY TRAFFIC sign should be used at the beginning of the closing and at intervals to remind drivers that they are on a two-way highway with opposing traffic.

(13) WORKERS Sign (W21-1a)

A WORKERS sign may be used to alert drivers of workers in or near the roadway.

(14) FRESH TAR Sign (W21-2)

The FRESH TAR (TAR) sign should be placed ahead of the last exit to warn drivers that resurfacing has rendered the pavement temporarily slippery and that splashing may occur.

(15) SHOULDER WORK Sign (W21-5)

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

(16) SURVEY CREW Sign (W21-6)

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

(17) Signs for Blasting Areas

Radio frequency (RF) energy can cause the premature firing of electric detonators (blasting caps) used in temporary traffic control zones or blasting zones. Drivers must be warned to turn off mobile radio transmitters and cellular telephones. The Institute of Makers of Explosives publishes information on this hazard and guidelines for safe operations.[4]

A sequence of signs should be used to direct operators of mobile radio equipment to turn off transmitters in a blasting area. A minimum safe distance of 1,000 feet should be used for warning sign placement. These signs shall be prominently displayed and covered or removed when there are no explosives in the area or the area is otherwise secured.

(17a) BLASTING ZONE Sign (W22-1)

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

(17b) TURN OFF 2-WAY RADIOS AND CELLULAR TELEPHONES Sign (W22-2)

The TURN OFF 2-WAY RADIO AND CELLULAR TELEPHONES sign should follow the BLASTING ZONE AHEAD sign and is placed at least 1,000 feet before the beginning of the blasting zone.

[4]Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electric Detonators (Blasting Caps), Safety Library Publication No. 20. Institute of Makers of Explosives, 1120 19th St., N.W. Suite 310, Washington, D.C. 20036B3605. Telephone 202-429-9280.

(17c) END BLASTING ZONE Sign (W22-3)

The END BLASTING ZONE sign shall be placed a minimum of 1,000 feet past the blasting zone, either with or preceding the END ROAD WORK

(18) SHOULDER DROP-OFF Sign (W8-9a)

The SHOULDER DROP-OFF sign should be used when a shoulder drop-off exceeds 3 inches in height and is not protected by a portable barrier.

(19) UNEVEN LANES Sign (W8-17)

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

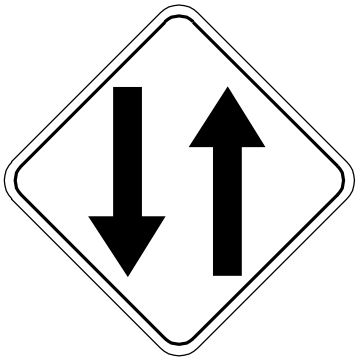
(20) Other Warning Signs

The signs pictured in Figures 8A, 8B, and 8C may also be used to provide sufficient advance warning, either by themselves or with other advance warning signs.

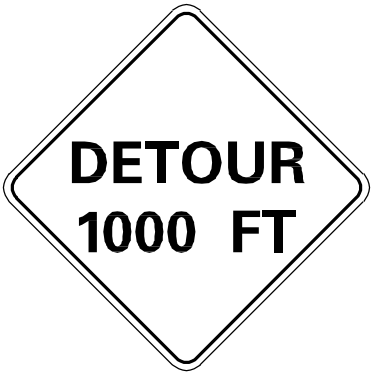
Besides the warning signs specifically related to temporary traffic control zones, several other warning signs, most of which have been standardized in part II of the this MUTCD, may apply in temporary traffic control zones. When used in temporary traffic control zones, warning signs shall have black legends on an orange background.

(21) Advisory Speed Plate (W13-1)

In combination with a warning sign, an advisory speed plate may be used to indicate a recommended safe speed through the temporary traffic control zone. When used with orange temporary traffic control zone signs, this plate shall have a black legend and border on an orange background. It shall not be used with any sign other than a warning sign, nor shall it be used alone. The sign shall be at least 24 inches square in size when used with a sign 36 inches square or larger. Except in emergencies, an advisory speed plate (W13-1) shall not be mounted until the recommended speed is determined by the highway authority.



W6-3
48'' x 48''



W20-2
48'' x 48''

W20-3
48'' x 48''

W20-4
48'' x 48''

W20-5R
48'' x 48''

W20-7a
48'' x 48''
SUPPLEMENTAL PLATE
24'' x 18''

W21-4
48'' x 48''

WARNING SIGNS USED IN TEMPORARY TRAFFIC CONTROL ZONES
FIGURE 6D

W21-1a
48" x 48"
(36" x 36")

W21-2
48" x 48"

W21-5
48" x 48"

W21-6
48" x 48"
(36" x 36")

WARNING SIGNS USED IN TEMPORARY TRAFFIC CONTROL ZONES
FIGURE 6E

W8-9a
48'' x 48''

W8-11
48'' x 48''

W13-1
24'' x 24''
(18'' x 18'')

W22-1
48'' x 48''

W22-2
42'' x 36''

W22-3
42'' x 36''

WARNING SIGNS USED IN TEMPORARY TRAFFIC CONTROL ZONES
FIGURE 6F

c. Guide Signs

(1) Function and Design of Guide Signs

Guide signs are essential along streets and roadways to give drivers information that will help them in the most simple, direct manner possible. The design of guide signs is given in part II of the MUTCD and in West Virginia Division of Highways "Signing Criteria."

The following guide signs are required at work zones:

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

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

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

(2) Length of Work Sign (G20-1)

The Length of Work sign should be erected in advance of any work zone of more than 2 miles in length; it carries the legend ROADWORK NEXT [5] MILES. The distance shall be stated to the nearest whole mile. The sign may be mounted on a Type III barricade. The sign may also be used for jobs of shorter length.

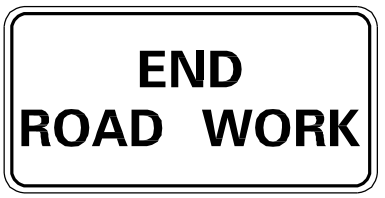
(3) END ROAD WORK Sign (G20-3)

The END ROAD WORK sign should be placed about 500 feet past the work area. The sign may be erected on the back of a warning sign facing the opposite direction of traffic or on the back of a Type III barricade.

(4) DETOUR signs and Markers (M4-8, -8a, -8b, -9, and -10).

The DETOUR ARROW sign (M4-10R or M4-10L) should be used where a detour route has been established because of the closing of a street or highway to through traffic. The sign should normally be mounted just below the ROAD CLOSED (R11-2, R11-3, or R11-4) sign. The DETOUR ARROW sign has a horizontal arrow pointed to the right or left, as required.

G20-1
60" x 24"



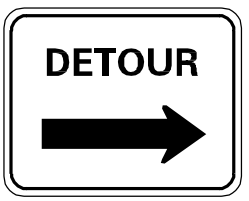
G20-3
42" x 18"

G20-4
36" x 18"

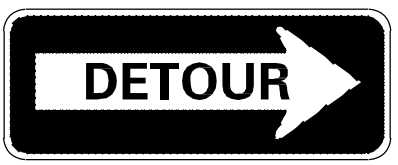
M4-6
24" x 12"
(30" x 15")

M4-8
24" x 12"
(30" x 15")

M4-9E
42" x 24"



M4-9R
30" x 24"



M4-10R
48" x 18"

COMMONLY USED GUIDE SIGNS
FIGURE 6G

Each detour shall be adequately marked with standard temporary route markers and destination signs. The DETOUR marker sign (M4-8), mounted at the top of a route marker assembly, marks a temporary route that branches from a highway, bypasses a section closed by a work zone, and rejoins the highway beyond the work zone.

The DETOUR sign (M4-9) should be used for unnumbered highways, for emergency situations, for periods of short durations, or where, over relatively short distances, traffic may be guided along the detour and back to the desired highway without route markers. A street name sign may be placed above or incorporated in the DETOUR sign to indicate the name of the street being detoured.

The END DETOUR sign (M4-9E) may be used to indicate that the detour has ended. When the END DETOUR sign is used on a numbered highway, the sign should be mounted above a marker after the end of the detour.

(5) PILOT CAR Sign (G20-4)

The Pilot Car sign shall be mounted in a conspicuous position on the rear of a vehicle used for guiding one-way traffic through or around a workspace. The legend shall be PILOT CAR-FOLLOW ME. A flagger shall be stationed on the approach to the activity area to stop traffic until the pilot car is available.

6F-2. PORTABLE CHANGEABLE MESSAGE SIGNS

a. Design

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

(1) Components: The components of a PCMS should include message sign panel, control systems, power source, and mounting and transporting equipment.

(a) Message Sign Panel

PCMS cannot always conform to the exact sign shape, color, and dimensions specified in these standards. PCMS should subscribe to the principles established in the manual, and to the extent practicable, with the design (i.e., color, letter size and shape, and borders) and applications prescribed herein. The message sign panel can vary in size and may consist

of one, two, or three lines. High-density urban freeways typically use three lines of eight characters per line. Each character module shall use, as a minimum, a five wide-pixel by seven high-pixel matrix. The front face of the sign should be covered with a protective glare-free material. Element colors for warning messages should be black on a yellow or orange background; for guide messages, white on a green background or black on an orange background; and for regulatory messages, black on a white background. Color reversals are also acceptable.

The signs should be visible from 1/2 mile under ideal day and night conditions. Each sign message should be legible from all lanes, from the sign up to a minimum of 650 feet. In the field, the PCMS should be sited and aligned to optimize driver performance. The message panel should have adjustable flash rates, so that the entire message can be read at least twice at the posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated operating speed.

Under low light level conditions, the sign shall automatically adjust its light source so as to meet the legibility requirements and not impair the drivers' vision.

(b) Control System

The control system shall include the following features:

- A display screen upon which messages can be reviewed before display on the message sign.
- A capability to provide an automatic programmed default message if power failure occurs.
- A backup battery to maintain memory when power is unavailable.

(c) Power Source

The PCMS shall be equipped with a power source and a battery back-up to provide continuing operation when failure of the primary power source occurs.

(d) Mounting

The mounting of the PCMS shall be such that the bottom of the message sign panel shall be a minimum of 7 feet above the roadway when it is in the operating mode.

b. Application

PCMS have a wide variety of applications in temporary traffic control zones, including roadway or ramp closures, accident or emergency incident management, width restriction information, advisories on roadwork scheduling, traffic management and diversion, warning of adverse conditions, and operation control. PCMS should be used with conventional signs, pavement markings, and lighting.

The primary purpose of PCMS in temporary traffic control zones is to advise the driver of unexpected traffic and routing situations. Some typical applications include the following:

- Where speed of traffic is expected to drop substantially
- Where significant queuing and delays are expected
- Where adverse environmental conditions are present
- Where there are changes in alignment or surface conditions
- To provide advance notice of ramp, lane, or roadway closures
- For accident or incident management

PCMS should be placed to be visible from at least 1/2 mile under both day and night conditions. Placement in advance of the work zone or incident should, as much as possible, take into account the following factors:

- PCMS will typically be placed in advance of any other work zone signing and should not replace any required signing. **DO NOT** use a PCMS to merely duplicate information on required signing.
- Where used for route diversion, PCMS should be placed far enough in advance of the work site to allow traffic ample opportunity to exit the affected highway.
- PCMS are normally placed on the shoulder of the roadway. However, if practical, placement further from the traveled lane is desirable.

- When two signs are needed to communicate multiple messages, they should be placed on the same side of the roadway, separated by at least 1,000 feet.

PCMS messages should be readily understood by drivers and thus will allow them adequate time to react. Messages should be designed taking into account the following factors:

- No more than two displays should be used within any message cycle. Use a blank time of one (1) second to delineate the end of the message before the sequence is repeated.

- Each display should convey a single thought, while conveying the complete meaning. The information must be perceived as significant and accurate. It is essential that enough information is presented for the driver to make required decisions.

- Messages should be as brief as possible.

- When abbreviations are used, they should be easily understood. See the subsequent list for acceptable abbreviations.

- The entire message cycle should be readable at least twice at the posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated operating speed. Assume reading time as one (1) second per word excluding prepositions. A good rule of thumb is that an approaching speed of 55 mph requires 8 words or less.

- Messages shall not scroll horizontally or vertically across the face of the sign.

ACCEPTED ABBREVIATIONS

85% of the driving public would understand the following set of abbreviations if they appeared on a road sign:

Word	Abbreviation	Word	Abbreviation
Boulevard	BLVD	Maintenance	MAINT
Center	CNTR	Normal	NORM
Emergency	EMER	Parking	PKING
Entrance	ENT	Road	RD
Enter	ENT	Service	SERV
Expressway	EXPWY	Shoulder	SHLDR
Freeway	FRWY, FWY	Slippery	SLIP
Highway	HWY	Speed	SPD
Information	INFO	Travelers	TRVLRS
Left	LFT	Warning	WARN

The following words will likely be understood (>85%) when used in conjunction with a particular word (prompt word) commonly

The following words will likely be understood (>85%) when used in conjunction with a particular word (prompt word) commonly associated with it.

Word	Abbreviation	Prompt Word
Ahead	AHD	*Fog
Blocked	BLKD	*Lane
Access	ACCS	Road
Bridge	BRDG	*Name
Chemical	CHEM	Spill
Construction	CONST	Ahead
Exit	EX, EXT	*Next
Express	EXP	Lane
Hazardous	HAZ	Driving
Interstate	I	(Number)
Major	MAJ	Accident
Minor	MIN	Accident
Mile	MI	*Number
Minutes	MIN	*Number
Oversized	OVRSZ	Load
Prepare	PREP	To Stop
Pavement	PVMT	*Wet
Quality	QLTY	*Air
Route	RT	*Best
Turnpike	TRNPK	*(Name)
Vehicle	VEH	*Stalled
Cardinal Directions	N,E,S,W	(Name)
Upper, Lower	UPR, LWR	Level

*Prompt word given first

Certain abbreviations are prone to inviting confusion because another word is abbreviated or could be abbreviated in the same way. The following are the abbreviation, the word intended, and the word commonly confused. **AVOID USING THESE ABBREVIATIONS** without prompt words to provide context clues.

Abbreviation	Intended Word	Word Assumed
WRNG	Warning	Wrong
ACC	Accident	Access
DLY	Delay	Daily
LT	Light (Traffic)	Left
STAD	Stadium	Standard
L	Left	Lane
PARK	Parking	Park
REDUCE	Reduce	Red
POLL	Pollution	Poll
FDR	Feeder	Federal
LOC	Local	Location
TEMP	Temporary	Temperature
CLRS	Clears	Colors

6F-3. ARROW DISPLAYS (ELECTRIC ARROW)

An arrow display is a sign with a matrix of elements. The matrix, capable of flashing displays, is intended to provide additional warning and directional information to assist in merging and controlling traffic through or around a temporary traffic control zone. An arrow display should be used in combination with appropriate signs, barricades, or other traffic control devices.

a. Arrow Display Specifications

Arrow displays shall meet the size and the requirements of the current West Virginia Division of Highways Specifications.

An arrow display shall be rectangular, of solid appearance, and finished in nonreflective black. The panel shall be mounted on a vehicle, a trailer, or other suitable support. A vehicle-mounted panel should be provided with remote controls. Minimum mounting height should be 7 feet from the roadway to the bottom of the panel, except on vehicle-mounted panels, which should be as high as practicable.

An arrow display shall have the following mode selections:

- A flashing arrow
- Flashing Double Arrow mode
- Flashing Caution mode

Arrow display elements shall be capable of a minimum 50 percent dimming from their full-rated lamp voltage. Full lamp voltage should be used for day, and dimmed mode shall be used for night.

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

Minimum element "on time" shall be 50 percent for the flashing mode. The flashing rate shall be no fewer than 25 nor more than 40 flashes per minute.

b. Arrow Display Application

An arrow display in the arrow mode may be used for stationary or moving lane closures. An arrow display in the caution mode shall be used only for shoulder work, blocking the shoulder, or roadside work near the shoulder.

For a stationary lane closing, the arrow display should be located on the shoulder at the beginning of the taper.

Where the shoulder is narrow, the arrow display should be located in the closed lane. If arrow displays are used when multiple lanes are closed in tandem, the preferred position for additional arrow displays is in the closed lane at the start of the merge taper. Under various situations, such as for narrow shoulders, placement may be in the middle or at the end of the merge taper but always behind the channelizers. The panel shall be located behind any channelizing devices used to transition traffic from the closed lane.

For mobile operations where a lane is closed, the arrow display should be located to provide adequate separation from the work operation to allow for appropriate reaction by approaching drivers. A vehicle displaying an arrow display shall be equipped with appropriate signing and/or lighting.

An arrow display shall not be used on a two-lane, two-way roadway for temporary one-lane operation.

An arrow display shall not be used on a multilane roadway to laterally shift all lanes of traffic, because unnecessary lane changing may result.

6F-4. HIGH-LEVEL WARNING DEVICES

The high-level warning device (flag tree) may supplement other traffic control devices in work zones. It is designed to be seen over the top of vehicles. A typical high-level warning device is shown in Detail "A" (Figure 7).

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 no less than 8 feet. The flags shall be 16 inches square or larger and shall be orange or fluorescent versions of orange in color. An appropriate warning sign may be mounted below the flags.

High-level warning devices are most commonly used in urban high-density traffic situations to warn motorists of short-term operations.

6F-5. CHANNELIZING DEVICES

a. General

The function of channelizing devices is to warn and alert drivers of conditions created by temporary traffic control activities in or near the traveled way, to protect workers in the temporary traffic control zone, and to guide drivers and pedestrians safely. Channelizing devices include but are not limited to cones, flexible markers, vertical panels, drums, barricades, temporary raised islands, and barriers.

Devices used for channelization should provide for smooth and gradual traffic movement from one lane to another, onto a bypass or detour, or to reduce the width of the traveled way. They may also be used to separate traffic from the workspace, pavement drop-offs, pedestrian paths, or opposing directions of traffic.

Channelizing devices should be constructed and ballasted to perform in a predictable manner when inadvertently struck by a vehicle. If struck, they should yield or break away, and fragments or other debris from the device should not penetrate the passenger compartment of the vehicle or be a potential hazard to workers or pedestrians in the immediate area.

Spacing of channelizing devices should not exceed a distance in feet equal to the speed when used for the taper channelization, and a distance in feet of twice the speed when used for tangent channelization.

Warning lights on channelizing devices. Consideration should be given to fog or snow areas, severe roadway curvature, and usually cluttered environments. Flashing warning lights may be placed on channelizing devices used singly or in groups to mark a spot condition. Warning lights on channelizing devices used in a series shall be steady-burn.

The retroreflective material used on channelizing devices shall have a smooth, sealed outer surface.

Channelizing devices are elements in a total system of traffic control devices for use in temporary traffic control zones. These elements shall be preceded by a subsystem of warning devices that are adequate in size, number, and placement for the type of highway on which the work is to take place. Standard designs of channelizing devices are shown in Detail "A" (Figure 7).

The name and telephone number of the agency, contractor, or supplier may be shown on the non-retroreflective surface of all channelizing devices. The letters and numbers shall be a non-retroreflective color and not over 2 inches in height.

Particular attention should be given to assuring that channelizing devices are maintained and kept clean, visible, and properly positioned at all times. Devices shall be replaced that are damaged and have lost a significant amount of their retroreflectivity and effectiveness.

FIGURE 7

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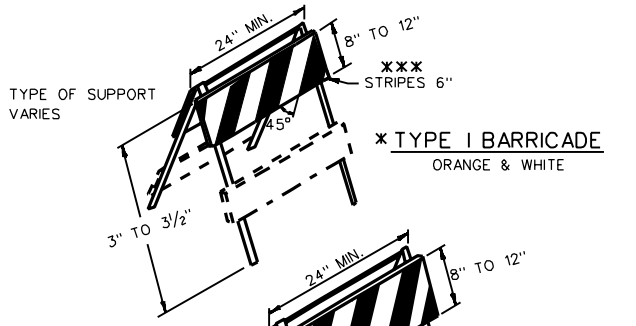
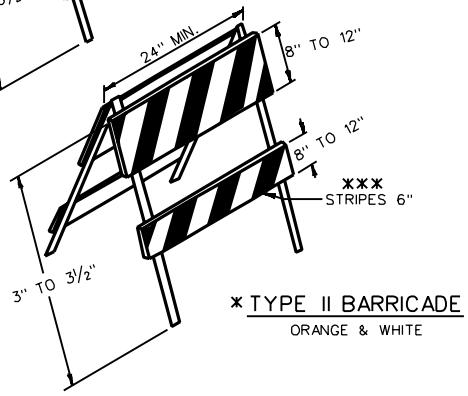
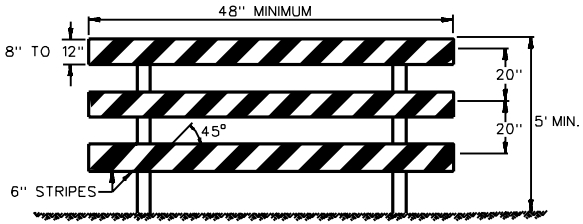
BARRICADE TYPES



* TYPE I BARRICADE
ORANGE & WHITE



* TYPE II BARRICADE
ORANGE & WHITE

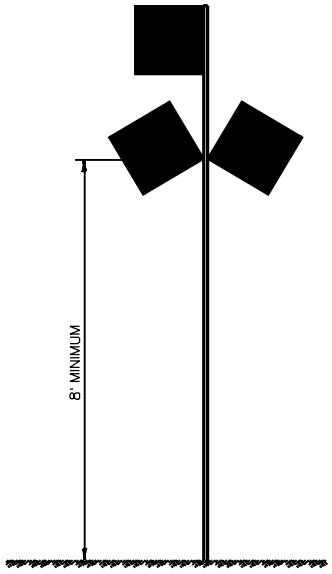


TYPE III BARRICADE
ORANGE & WHITE

** BARRICADE CHARACTERISTICS

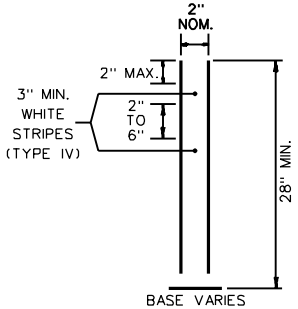
	TYPE I	TYPE II	TYPE III
NUMBER OF REFLECTORIZED RAIL FACES	TWO (ONE IN EACH DIRECTION)	FOUR (TWO IN EACH DIRECTION)	3 IF FACING TRAFFIC ONE DIRECTION 6 IF FACING TRAFFIC BOTH DIRECTIONS
WIDTH OF RAIL	12"	8" MIN. - 12" MAX.	8" MIN. - 12" MAX.
LENGTH OF RAIL	24" MINIMUM VARIABLE MAXIMUM	24" MINIMUM VARIABLE MAXIMUM	48" MINIMUM VARIABLE MAXIMUM
WIDTH OF STRIPES	6" ***	6" ***	6"
HEIGHT	3' MIN.	3' MIN.	5' MIN.
TYPE OF FRAME	DEMOUNTABLE OR "A" FRAME	LIGHT "A" FRAME	POST OR SKIDS
FLEXIBILITY	ESSENTIALLY MOVABLE	PORTABLE	ESSENTIALLY PERMANENT

* COMMERCIALLY MANUFACTURED BARRICADES MAY BE USED PROVIDED APPROXIMATE SIZE, COLOR AND REFLECTIVITY IS CORRECT.
** FOR WOOD BARRICADES, NOMINAL LUMBER DIMENSIONS WILL BE SATISFACTORY.
*** FOR RAILS LESS THAN 3' LONG, 4" WIDE STRIPES MAY BE USED.

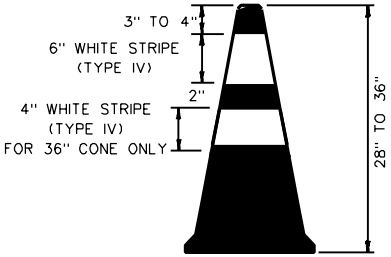


HIGH LEVEL WARNING DEVICE

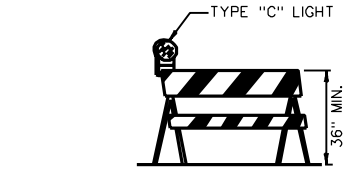
CHANNELIZING DEVICES



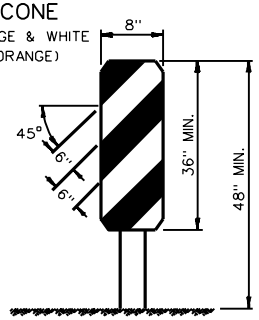
TUBULAR MARKER
ORANGE & WHITE



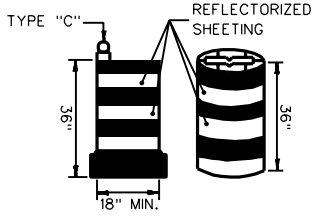
CONE
ORANGE & WHITE (ORANGE)



WARNING LIGHT ON TYPE II BARRICADE



VERTICAL PANEL
ORANGE AND WHITE



FLEXIBLE PLASTIC DRUMS

DRUMS

ORANGE AND WHITE

ADJUSTMENT DUE TO ODD SIZE DRUMS SHOULD BE DIVIDED BETWEEN THE UPPER AND LOWER STRIPE.

EACH DRUM TO HAVE A MINIMUM OF TWO ORANGE AND TWO WHITE STRIPES.

COLLARS OPTIONAL - BUT DOH APPROVED.

STEEL DRUMS PROHIBITED.

BARRICADE NOTES

1. BARRICADE LEGS OR SUPPORTS SHALL BE CONSTRUCTED OF LIGHTWEIGHT MATERIAL AND SHALL BE GALVANIZED OR WHITE IN COLOR.
2. ALL REFLECTORIZED MATERIAL SHALL HAVE A SMOOTH SEALED SURFACE COVERING THE REFLECTIVE ELEMENTS (TYPE II REFLECTORIZED SHEETING).
3. ALL BARRICADES SHALL HAVE ALTERNATED ORANGE AND WHITE REFLECTORIZED STRIPES AT 45° FROM VERTICAL.
4. TYPE I OR TYPE II BARRICADES SHALL BE STRIPED ON BOTH SIDES IF FACING TRAFFIC IN BOTH DIRECTIONS.
5. DIAGONAL STRIPES ON THE BARRICADES SHALL SLOPE DOWN TOWARD THE SIDE OF THE BARRICADES ON WHICH TRAFFIC WILL PASS.
6. SIGNS AND SUPPORTS MOUNTED ON BARRICADES SHALL BE ATTACHED WITH GALVANIZED BOLTS, NUTS AND WASHERS.

CHANNELIZING NOTES

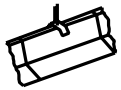
1. THE STRIPES ON THE VERTICAL PANEL SHALL BE TYPE II AND SLOPE DOWN TOWARD THE SIDE OF THE PANEL ON WHICH TRAFFIC IS TO PASS.
2. THE STRIPES ON THE DRUMS SHALL BE HORIZONTAL, CIRCUMFERENTIAL, ORANGE AND WHITE 6" WIDE, USING A REFLECTIVE MATERIAL HAVING A SMOOTH, SEALED OUTER SURFACE (TYPE IV REFLECTORIZED SHEETING).
3. SEE SECTION FOR MAXIMUM VOLUME OF BALLAST FOR DRUMS.

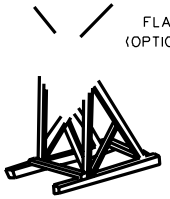
THE WEST VIRGINIA DIVISION OF HIGHWAYS

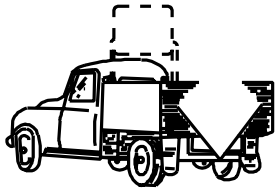
BARRICADES AND CHANNELIZING DEVICES FOR CONSTRUCTION AND MAINTENANCE OPERATIONS

STANDARD DETAIL "A"

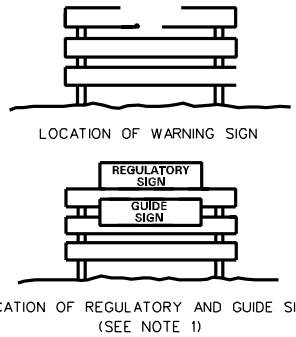
PORTABLE AND TEMPORARY MOUNTING



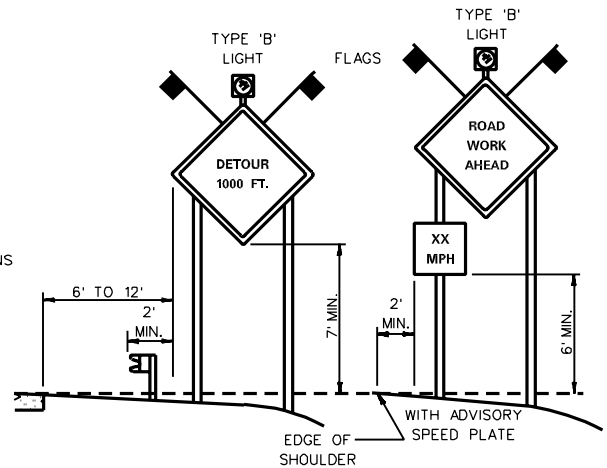




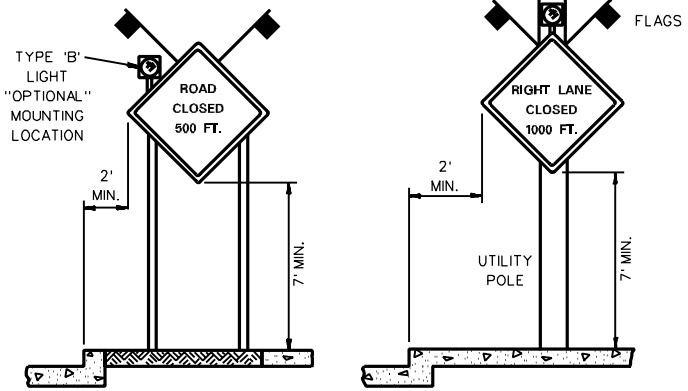
MOUNTING ON TYPE III BARRICADES



FIXED SUPPORTS



ROADSIDE SIGN
RURAL DISTRICT



ROADSIDE SIGN
URBAN DISTRICT

HEIGHT AND LATERAL LOCATION OF SIGNS - TYPICAL INSTALLATIONS

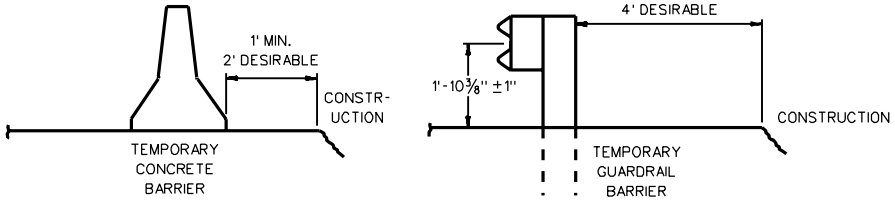
GENERAL NOTES:

1. SIGNS MOUNTED ON BARRICADES OR PORTABLE SUPPORTS MAY BE AT LOWER HEIGHTS BUT THE BOTTOM OF THE SIGN SHALL NOT BE LESS THAN 12" ABOVE THE PAVEMENT. WHEN PARKING IS PERMITTED WITHIN 200' OF THE SIGN, ALL SIGNS SHALL BE MOUNTED AT A MINIMUM OF .
2. FLAGS SHALL BE OF A GOOD GRADE OF MATERIAL ORANGE IN COLOR. THE MINIMUM SIZE SHALL BE 18 IN. X 18 IN. THE FLAG SHOULD BE MADE OF WATER REPELLENT MATERIAL.
3. TYPE 'B' LIGHTS ARE TO BE MOUNTED AS SHOWN ON DETAIL.
4. ALL SUPPORTS FOR SIGNING SHALL BE INSTALLED WITH BREAKAWAY OR YIELDING FEATURES FOR MOTORIST SAFETY. TWO POUND U-CHANNEL OR 4" X 4" MAX. WOOD POSTS MAY BE USED.
5. SEE SECTION FOR MAXIMUM ALLOWABLE BALLAST VOLUME IN DRUMS.
6. TYPE 'B' LIGHTS SHALL BE MOUNTED IN SUCH A MANNER THAT NO PART OF THE LAMP ASSEMBLY OR BATTERY BOX WILL COVER THE SIGN FACE.

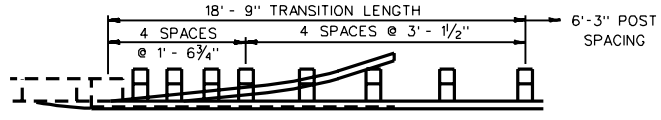
THE WEST VIRGINIA
DIVISION OF HIGHWAYS
SIGN MOUNTING
FOR
CONSTRUCTION AND MAINTENANCE OPERATIONS
STANDARD DETAIL "B"

BARRIER PLACEMENT

NOTE: THIS DETAIL SHOWS REQUIRED OFFSETS FROM BACK OF BARRIER TO CONSTRUCTION LIMITS.



BARRIER CONNECTIONS

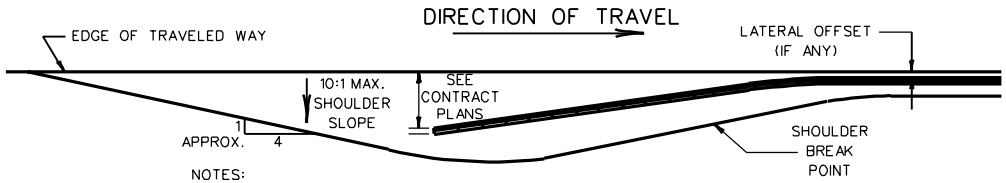


PLAN

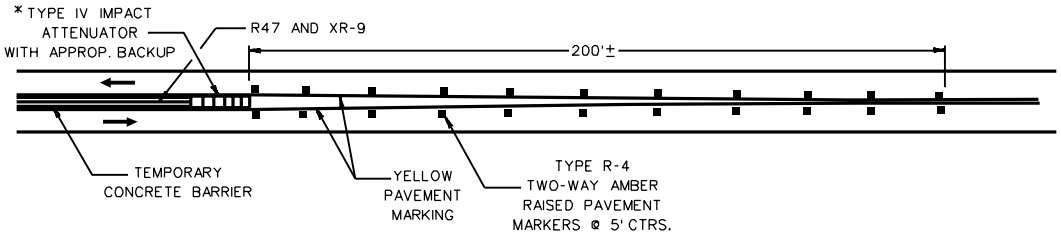
ELEVATION

ATTACHMENT OF TEMPORARY GUARDRAIL BARRIER TO PERMANENT OR TEMPORARY CONCRETE BARRIER, PARAPET, OR OTHER FIXED OBJECT OR TEMPORARY CONCRETE BARRIER TO EXISTING GUARDRAIL. (ALSO SEE GR 7).

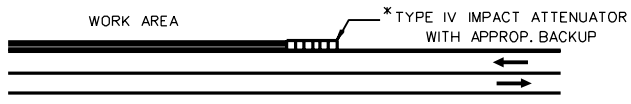
BARRIER END PROTECTION



NOTES:
1. THIS DETAIL IS A CONCEPT. ACTUAL DIMENSIONS OF FLARE RATE, OFFSET, AND/OR CLEAR ZONE WILL BE SHOWN IN THE PLANS. IF THEY ARE NOT IN THE PLANS, CONTACT TRAFFIC ENGINEERING DIVISION, TO DETERMINE THE FLARE RATE, OFFSET, AND/OR CLEAR ZONE.
2. IF THE FLARE RATE OR CLEAR ZONE CANNOT BE MAINTAINED, AN IMPACT ATTENUATOR SHALL BE USED. (CONTACT TRAFFIC ENGINEERING DIVISION FOR DETAILS).
3. GUARDRAIL TREATMENT WITH A MELT, AS SHOWN IN STANDARD DETAIL GR 5 MAY BE SUBSITITUTED FOR FLARE AND/OR IMPACT ATTENUATOR IF APPROVED BY THE ENGINEER.
4. DRAINAGE MAY BE MAINTAINED THROUGH SHOULDER TREATMENT BY USING TEMPORARY PIPE.



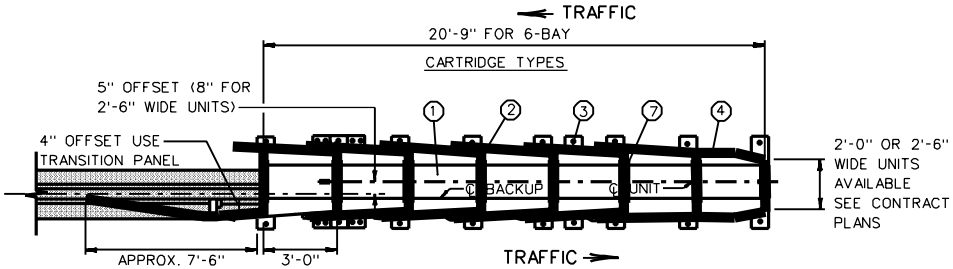
TREATMENT FOR SEPERATION OF TWO-LANE, TWO-WAY OPPOSING TRAFFIC
(WITH TEMPORARY CONCRETE BARRIER)



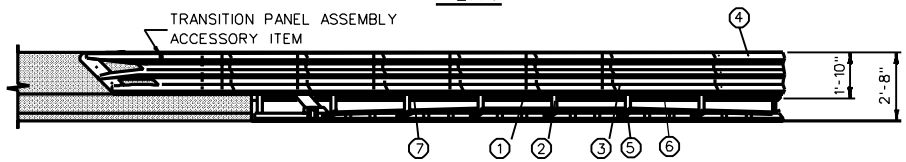
TREATMENT FOR SEPERATION OF TRAFFIC FROM WORK AREA
TO BE USED (WHEN FLARE CANNOT BE UTILIZED)

*FOR DETAILS CONTACT TRAFFIC ENGINEERING DIVISION (OTHERWISE, 6-BAY, 2'-0" WIDE, BIDIRECTIONAL).

NOTES:
1. SEE GR STANDARDS (VOLUME I) FOR DETAILS WHICH ARE NOT COVERED IN THIS DETAIL.
2. TEMPORARY CONCRETE BARRIER ADJOINING A BRIDGE PARAPET OR OTHER ESSENTIALLY NON-YIELDING BARRIER OR OBSTACLE SHALL BE PLACED IN A MANNER TO MAINTAIN BARRIER CONTINUITY AND PREVENT VEHICLE SNAGGING DURING IMPACT. A CONNECTING DEVICE SHALL BE USED TO MAINTAIN CONTINUITY IF THEY CANNOT BE JOINED IN THIS MANNER (SEE CONTRACT PLANS).



PLAN



ELEVATION

KEY
1. HEX-FOAM CARTRIDGE
2. DIAPHRAGM
3. THRIE-BEAM FENDER PANEL
4. NOSE COVER
5. PLATFORM
6. RESTRAINING CABLE
7. HEX-FOAM BRACKET

NOTES:
1. ATTACH UNIT TO 6" MIN. REINFORCED PORTLAND CEMENT CONCRETE PAD OR DECK STRUCTURE USING MP-3 ANCHOR BOLTS. ANCHOR PINS MAY BE USED ON 3" MIN. ASPHALTIC SURFACES THAT HAVE A PREPARED COMPACTED SUB-BASE.
2. PROVISION SHALL BE MADE FOR REAR FENDER PANELS TO MOVE REARWARD UPON IMPACT.

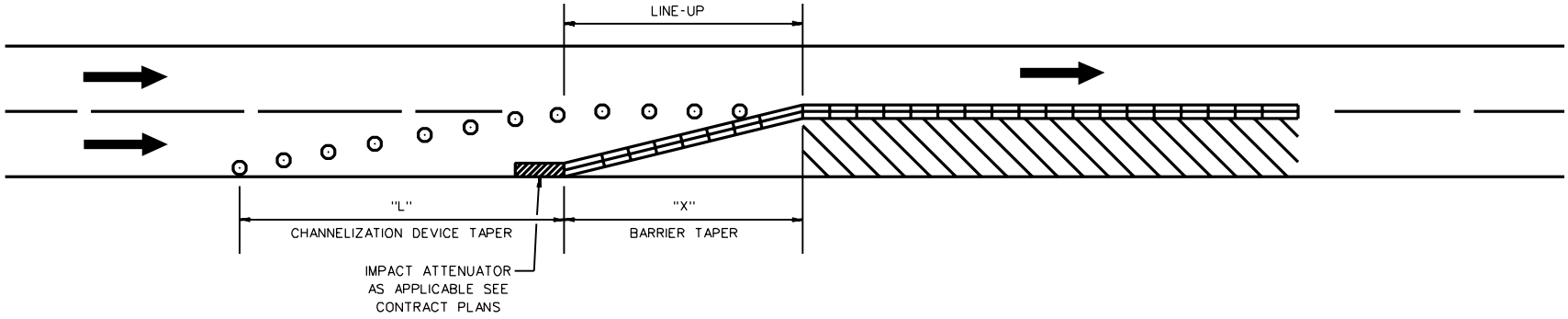
TYPE IV IMPACT ATTENUATOR
(6-BAY SHOWN) (BACKUP PER MANUFACTURER'S RECOMMENDATIONS)

THE WEST VIRGINIA DIVISION OF HIGHWAYS

TEMPORARY CONCRETE AND GUARDRAIL BARRIER PLACEMENT, CONNECTION AND END PROTECTION DETAILS

STANDARD DETAIL "C"

FIGURE 10



NOTE:

1. FULL LANE CLOSURE SHALL BE MADE PRIOR TO BEGINNING OF BARRIER TAPER.
2. "X" = FLARE RATE X OFFSET

CLOSURE OF ONE TRAFFIC LANE USING TEMPORARY CONCRETE BARRIER

THE WEST VIRGINIA
DIVISION OF HIGHWAYS

ONE LANE CLOSURE USING POSITIVE BARRIER

STANDARD DETAIL "D"

b. Cones

(1) Cone Design

Cones shall be predominantly orange, fluorescent red-orange, or fluorescent yellow-orange, not less than 28 inches in height, and shall be made of a material that can be struck without damaging vehicles on impact. Cones shall be a minimum of 28 inches in height when they are used on freeways and other high-speed highways, on all highways during nighttime, or whenever more conspicuous guidance is needed.

For nighttime use, cones shall be retroreflective or equipped with lighting devices for maximum visibility. Retroreflection of 28-inch or larger cones shall be provided by a white band 6 inches wide, no more than 3 to 4 inches from the top of the cone, and an additional 4-inch-wide white band a minimum of 2 inches below the 6-inch band.

(2) Cone Application

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

Steps should be taken to ensure that cones will not be blown over or displaced by wind or moving traffic. Cones can be doubled up to increase their weight. Some cones are constructed with bases that can be filled with ballast. Others have special weighted bases, or weights such as sandbag rings that can be dropped over the cones and onto the base to provide added stability. Ballast, however, should not present a hazard if the cones are inadvertently struck.

c. Tubular Markers

(1) Design

Tubular markers shall be predominantly orange, not less than 28 inches high, minimum 2 inches wide when facing traffic, and made of a material that can be struck without damaging impacting vehicles. Tubular markers shall be a minimum of 36 inches high when used on freeways and other high-speed highways, on all highways during nighttime, or whenever more conspicuous guidance is needed.

For nighttime use, tubular markers shall be retroreflective. Retroreflection of tubular markers shall be provided by two 3-inch-wide white bands placed a maximum of 2 inches from the top, with a maximum of 6 inches between the bands.

(2) Application

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

Steps should be taken to assure that tubular markers will not be blown over or displaced by traffic by either affixing them to the pavement with anchor bolts or adhesive, using weighted bases, or weights that can be dropped over the tubular markers and onto the base to provide added stability. Ballast, however, should not be allowed to present a hazard if the tubular markers are inadvertently struck. If a noncylindrical device is used, and it could be displayed with a width less than the minimum facing traffic, it shall be attached to the pavement to ensure that the width facing traffic meets the minimum requirements.

d. Vertical Panels

(1) Design

Vertical panels shall be 8 to 12 inches wide and at least 24 inches high. They shall have orange (fluorescent red-orange or fluorescent yellow-orange) and white stripes, and be retroreflectorive. Panel stripe widths shall be 6 inches, except where panel heights are less than 36 inches, when 4-inch stripes may be used. If used for two-way traffic, back-to-back panels shall be used.

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

(2) Application

Vertical panels may be used to channel traffic, divide opposing lanes of traffic, divide traffic lanes or in place of barricades where space is limited.

e. Drums

(1) Design

Drums used for traffic warning or channelization shall be constructed of lightweight, flexible, and deformable materials

and be a minimum of 36 inches in height; and have at least an 18-inch minimum width, regardless of orientation. Steel drums shall not be used. The markings on drums shall be horizontal, circumferential, alternating orange and white retroreflective stripes 6 to 8 inches wide. Each drum shall have a minimum of two orange and two white stripes. Any non-retroreflective spaces between the horizontal orange and white stripes, shall not exceed 2 inches wide. Drums shall have closed tops that will not allow collection of roadwork or other debris.

(2) Application

Drums are most commonly used to channelize or delineate traffic flow but may also be used singly or in groups to mark specific locations. Drums are highly visible and have good target value, given the appearance of being formidable obstacles and, therefore, command the respect of drivers. They are portable enough to be shifted from place to place within a temporary traffic control project to accommodate changing conditions but are generally used in situations where they will remain in place for a prolonged period.

Drums should not be weighted with sand, water, or any material to an extent that would make them hazardous to motorists, pedestrians, or workers. When they are used in regions susceptible to freezing, they should have drainage holes in the bottom so water will not accumulate and freeze, causing a hazard if struck by a motorist. Ballast shall not be placed on top of the drum.

f. Barricades

(1) Design

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

Barricades shall be of three types: Type I, Type II, or Type III.

Stripes on barricade rails shall be alternating orange and white retroreflective stripes (sloping downward at an angle of 45 degrees in the direction traffic is to pass). The stripes shall be 6 inches wide, except where rail lengths are less than 36 inches, when 4-inch-wide stripes may be used. The minimum rail length is 24 inches. Barricades used on expressways, freeways, and other high-speed roadways shall have a minimum of 270 square inches of retroreflective area facing traffic.

Where a barricade extends entirely across a roadway, the stripes should slope downward in the direction toward which traffic must turn. Where both right and left turns are provided, the stripes may slope downward in both directions from the center of the barricade or barricades. Where no turns are intended, the stripes should 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 motorist and provide a stable support not easily blown over by the wind or traffic. For Type I barricades, the support may include other unstriped horizontal panels necessary to provide stability.

Barricades are located adjacent to traffic and are therefore subject to impact by errant vehicles. Because of their vulnerable position and the hazard they could create, they should be constructed of lightweight materials and have no rigid stay bracing for A-frame designs.

On high-speed expressways or in other situations where barricades may be susceptible to overturning in the wind, sandbags should be used for ballasting. Sandbags may be placed on lower parts of the frame or stays to provide the required ballast but shall not be placed on top of any striped rail. Barricades shall not be ballasted by heavy objects such as rocks or chunks of concrete.

(2) Application

Type I or Type II barricades are intended for use in situations where traffic is maintained through the temporary traffic control zone. They may be used singly or in groups to mark a specific condition, or they may be used in a series for channelizing traffic. Type I barricades normally would be used on conventional roads or urban streets and arterials. Type II barricades have more retroreflective area and are intended for use on expressways and freeways or other high-speed roadways.

Type III barricades used at a road closure may extend completely across a roadway or from curb to curb. Where provision is made for access of authorized equipment and vehicles, the responsibility for the Type III barricades should be assigned to a person to ensure proper closure at the end of each workday.

When a highway is legally closed but access must still be allowed for local traffic, the Type III barricade should not be extended completely across a roadway. A sign with the appropriate legend concerning permissible use by local traffic shall be mounted. (See section 6F-1.a.5.)

Signs may be erected on barricades, particularly those of the fixed type, that offer a most advantageous facility for this purpose. The ROAD CLOSED and DETOUR ARROW signs, and the LARGE ARROW warning signs, for example, can be mounted effectively on or above the barricade that closes the roadway.

g. Portable Barriers

The need for portable barriers should be determined by engineering analysis and the protective requirements of the location, not the channelizing needs. They should be designed according to chapter 9 of the AASHTO Roadside Design Guide.[6]

When serving the additional function of channelizing traffic, the barrier taper shall meet standard channelizing taper lengths. The channelizing barrier shall be supplemented by standard delineators, channelizing devices, or pavement markings. Channelizing barriers should not be used for a merging taper except in low-speed urban areas.

h. Temporary Raised Islands

The temporary raised island should only be used on roadways with speeds of 45 mph or less except when recommended by an engineering study.

Temporary raised islands, not to exceed 4 inches in height, may be used to supplement channelizing devices and pavement markings to separate traffic flows in two-lane, two-way operations (TLTWO). Pavement edge lines may be placed on the island itself. Islands may also have application in other than TLTWO where physical separation of traffic from the work zone is not required.

One type of temporary raised island is 4 inches high by 18 inches wide and has rounded or chamfered corners. They may be constructed of Portland cement concrete or bituminous concrete. They should be designed according to chapter 9 of the AASHTO Roadside Design Guide.[11]

i. Other Channelizing Devices

Channelizing devices, other than those specified above, may be required for special situations based on an engineering study. Such devices should conform to the general size, color, stripe pattern, retroreflection, and placement characteristics established for standard devices.

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6F-6. MARKINGS

a. Pavement Marking Applications

Adequate pavement markings shall be maintained along paved streets and highways in temporary traffic control zones. Obliterated markings shall be unidentifiable as pavement markings under day or night, wet or dry conditions. The work should be planned and staged to provide the best possible conditions for the placement and removal of the pavement markings.

It is intended, to the extent possible, that motorists be provided markings within a work area comparable to the markings normally maintained along adjacent roadways, particularly at either end of the work area. The following guidelines set forth the level of markings and delineation for various work area situations.

(1) All markings shall be in accordance with Part IIIA and Part IIIB, except as indicated under 6F-6b (Interim Markings) of this manual.

(2) Markings shall be maintained in long-term stationary work areas and shall match and meet the markings in place at both ends of the work area.

(3) Markings shall be placed, along the entire length of any surfaced detour or temporary roadway, such detour or roadway is opened to traffic.

(4) Centerline/lane lines should be placed, replaced, or delineated where appropriate before the roadway is opened to traffic.

(5) Markings should be provided in intermediate-term stationary work areas, to the extent practicable.

(6) In any work area where it is not practical to provide a clear path by markings, appropriate warning signs, channelizing devices, and delineation shall be used to indicate the required vehicle paths.

All markings and devices used to delineate vehicle and pedestrian paths shall be carefully reviewed during daytime and nighttime periods to avoid inadvertently leading drivers or pedestrians from the intended path.

Proper pavement marking obliteration leaves a minimum of pavement scars and completely removes old marking materials. Obliterated markings shall be unidentifiable as pavement markings under day or night, wet or dry conditions. Overlaying existing stripes with black paint or asphalt does not meet the requirements of covering, removal, or obliteration; however, the use of removable, nonreflective, preformed tape is permitted where markings need to be covered temporarily.

b. Interim Markings

Interim pavement markings are those that may be used until it is practical and possible to install pavement markings that meet the full MUTCD standards for pavement markings. Normally, it should not be necessary to leave interim pavement markings in place for more than 2 weeks. All interim pavement markings, including pavement markings for no-passing zones, shall conform to the requirements of sections 3A and 3B of the MUTCD with the following exceptions:

(1) All interim broken-line pavement markings shall use the same cycle length as permanent markings and be at least 4 feet long, except that half-cycle lengths with a minimum of 2-foot stripes may be used for roadways with severe curvature. (See section 3A-6 of the MUTCD.) This applies to white lane lines for traffic moving in the same direction and yellow center lines for two-lane roadways when it is safe to pass.

(2) For those interim situations of 3 calendar days or less for a two- or three-lane road, no-passing zones may be identified by using signs rather than pavement markings. (See sections 3B-4, 3B-5, and 3B-6 of the MUTCD.) Also, signs may be used in lieu of pavement markings on low-volume roads for longer periods, when this practice is in keeping with the State's or highway agency's policy. These signs should be placed in accordance with sections 2B-21, 2B-22, and 2C-38 of the MUTCD.

(3) The interim use of edgelines, channelizing lines, lane reduction transitions, gore markings and other longitudinal markings, and the various non-longitudinal markings (stop line, railroad crossings, crosswalks, words, symbols, etc.) should be in keeping with the policy for such of the West Virginia Division of Highways and "Standard Details Book, Volume II" latest edition (TEM-1, TEM-2, TEM-3).

c. Raised Pavement Markers

Raised/recessed pavement markers should be considered for use along surfaced detour or temporary roadways, and other changed or new travel lane alignments, because of the need to accentuate changed travel paths and their adverse weather performance capabilities.

Retroreflective raised/recessed pavement markers, or non-retroreflective raised/recessed pavement markers supplemented by retroreflective markers, may be substituted for, or used as a supplement to markings prescribed in sections 3A and 3B of the MUTCD and subsection b, above.

d. Delineators

Delineators may be used in work areas to indicate the alignment of the roadway and to outline the required vehicle path

through the work zone. Delineators, when used, shall be used in combination with, or be supplemental to, other traffic control devices.

When used, delineators shall be mounted on suitable supports so that the reflecting unit is about 4 feet 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. Spacing along roadway curves should be as set forth in "Standard Details Book, Volume II," latest edition (TE11-1, 11-2, 11-3, 11-4, and 11-5) and should be spaced so that several delineators are always visible to the driver.

6F-7. LIGHTING DEVICES

a. Function

Temporary traffic control activities often create conditions on or near the traveled way that are particularly unexpected at night, when drivers' visibility is sharply reduced. It is often desirable and necessary to supplement retroreflectorized signs, barriers, and channelizing devices with lighting devices.

Four types of lighting devices are commonly used: floodlights, hazard identification beacons, steady-burning electric lamps, and warning lights.

In work areas where a study indicates a nighttime accident problem can be corrected with area illumination, consideration may be given to providing roadway lighting.

b. Floodlights

On temporary traffic control projects, floodlights have a limited but important application. Temporary traffic control activities on urban freeways must frequently be conducted during nighttime periods when traffic volumes are lower. Sometimes, large temporary traffic control contracts are also operated on double shift, requiring night work. When nighttime work is required for these or similar types of projects, floodlights should be used to illuminate flagger stations, equipment crossings, and other areas where existing light is not adequate for the work to be performed safely.

In no case shall floodlighting be permitted to create a disabling glare for drivers. The adequacy of the floodlight placement and elimination of potential glare can best be determined by driving through and observing the floodlighted area from each direction on the main roadway after initial floodlight setup.

Maintenance activities on urban freeways with high-volume, high-density traffic conditions are frequently conducted during nighttime periods (with low traffic volumes). Good floodlighting of the work site is needed because the workers need to see what

they are doing, and because the workers and the workspace be protected from, and seen by, passing drivers.

c. Flashing Identification Beacons (Flashing Electric Lights)

A flashing identification beacon is a flashing yellow light (minimum diameter, 8 inches) used at points of special to alert drivers' attention to these conditions. When used, the flashing beacon should operate 24 hours a day. Such shall meet the requirements of West Virginia Department of Transportation, Division of Highways, Specifications Subsection 715.42, latest edition.

On temporary traffic control projects, because of the time and effort required to install these units and put them into operation, they are generally used at locations where frequent changes would not be required.

On projects where an existing dual highway is being upgraded to freeway standards (which requires the use of crossovers to permit stage construction), flashing beacons have been used effectively to call drivers' attention to the condition created by the channelizing devices. Similarly, the temporary terminus of a freeway (where all traffic is channelized into an exit) is a location where beacons have alerted drivers of the speed reduction necessary in transitioning from freeway to local road operations.

Flashing identification beacons may be used singly or in groups containing more than one unit.

During normal daytime maintenance operations, the functions of flashing beacons are adequately provided by rotating dome or strobe lights on maintenance vehicles. However, flashing beacons may be installed at locations where maintenance activity requires an obstruction to remain in the roadway at night.

d. Steady-Burning Electric Lamps

As used herein, steady-burning electric lamps shall mean a series of low-wattage yellow electric lamps. They may be used to mark obstructions, but they are generally less effective than flashing lights for such use, because of their attention-getting effect. However, lights are needed to delineate the traveled way through and around obstructions in a temporary traffic control zone, the delineation shall be accomplished by steady-burning lamps.

Steady-burning lamps, placed in a line on appropriate channelizing devices, are effective in delineating the proper vehicle path through temporary traffic control zones that require changing patterns of traffic movement. Steady-burning lamps are also used on detours, on lane closures, when the roadway alignment changes in tapers, and other situations where the headlights do not provide retroreflection to delineate the intended vehicle path.

The application of these devices during maintenance work is infrequent due to the generally short-term nature of the work. A type of maintenance activity where steady-burning lamps could be used is removal and replacement of a part of a bridge deck. The lamps could be mounted on barricades and help channel traffic around the work space.

e. Warning Lights

The light weight and portability of warning lights are advantages that make these devices useful as supplements to the retroreflectorization on hazard warning devices. The flashing lights are effective in attracting a driver's attention and, therefore, provide an excellent means of identifying the hazard.

As used herein, warning lights are portable, lens-directed, enclosed lights. The color of the light emitted shall be yellow. They may be used in either a steady-burn or flashing mode. Warning lights shall be in accordance with the current requirements and Specifications of the West Virginia Department of Transportation, Division of Highways, Section 715.9.5.

Warning lights shall have a minimum mounting height of 30 inches to the bottom of the lens. Type A low-intensity flashing warning lights are most commonly mounted on barricades and are intended to warn drivers that they are approaching or in a hazardous area.

Type B high-intensity flashing warning lights are normally mounted on advance warning signs. Extremely hazardous site conditions within temporary traffic control zones may require that the lights be effective in daylight as well as dark. They are designed to operate 24 hours per day. Flashers shall not be used for delineation, as they would tend to obscure the desired vehicle path.

Type C steady-burn lights are intended to be used to delineate the edge of the traveled way on detour curves, on lane changes, on lane closures, and on other similar conditions.

Type A low intensity flashing warning lights and Type C steady-burn warning lights shall be maintained so as to be visible on a clear night from a distance of 3,000 feet. Type B high intensity flashing warning lights shall be maintained so as to be visible on a sunny day, when viewed without the sun directly on or behind the device from a distance of 1,000 feet.

6F-8. OTHER DEVICES

a. Impact Attenuators

Impact attenuators are systems that mitigate the effects of errant vehicles that strike hazards, either by smoothly decelerating the vehicle to a stop when hit head-on, or by redirecting the errant vehicle. Impact attenuators in work zones protect the motorists from the exposed ends of barriers, fixed objects, and other hazards. Two types of impact attenuators used in work zones are roadside attenuators and truck-mounted attenuators (TMA's). Specific information on each type can be found in the AASHTO Roadside Design Guide, Chapters 8 and 9, respectively.[12]

Attenuators must meet the requirements of Specifications, Section 715.41 of the West Virginia Department of Transportation, Division of Highways and be designed by West Virginia Division of Highways personnel for each application to ensure performance that will safely stop or redirect errant vehicles. Periodic inspection of these devices is necessary to assure that attenuators function as intended throughout their useful life or that they undergo prompt repair/replacement if hit or damaged.

(1) Roadside Attenuators

Roadside attenuators are used in the same manner as permanent highway installations to protect motorists from the exposed ends of barriers, fixed objects, and other hazards. Two types of stationary attenuators are commonly used and must be designed for the specific application intended as follows:

(a) Redirective Type

The redirective type is an assembled unit designed to absorb head-on vehicle impacts and telescope toward the rear; also it may be capable of absorbing side impacts by redirecting a vehicle.

Redirective attenuators normally are used when the exposed object is narrow, or when space for a nonredirective type is unavailable, such as on surface streets near adjacent intersecting roadways. The attenuator width must be wider than the hazard object, but as close to the object width as possible, to prevent its lateral intrusion into the traffic lanes.

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(b) Nonredirective Type

The nonredirective type may be struck head-on, and may be the sand-filled plastic barrel system or other acceptable energy-absorbing device designed to stop errant vehicles safely.

Nonredirective impact attenuators must be checked frequently for vehicle impacts because, once hit, they may not function as designed for a second hit. When sand-filled barrels are fractured, the sand is scattered, site cleanup is needed, and the attenuator must be restored with replacement barrels and sand.

(2) Truck-Mounted Attenuators

Trucks or trailers are often used as protective vehicles to protect workers or work equipment from errant vehicles. These protective vehicles are normally equipped with flashing arrows, changeable message signs, and/or flashers, and must be located properly in advance of the workers and/or equipment they are protecting. However, these protective vehicles may themselves cause injuries to occupants of the errant vehicles if they are not equipped with truck-mounted attenuators (TMA's).

TMA's capable of absorbing the impact of errant vehicles can be attached to the rear of these protective vehicles to reduce, the severity of rear-end crashes. There are a variety of TMA designs available.

The protective truck must be positioned a sufficient distance in front of the workers or equipment being protected to allow for appropriate vehicle roll-ahead, but not so far that errant vehicles will travel around the vehicle and strike the workers/equipment. The attenuator should be in the full down-and-locked position. For stationary operations, the truck's parking brake should be set and, when possible, the front wheels turned away from the work site.

b. Portable Barriers

Portable barriers are designed to prevent vehicles from penetrating work areas behind the barrier while minimizing occupant injuries. They may also be used to separate two-way traffic. These devices may be constructed of concrete, metal, or any material that can physically prevent vehicular penetration.

Portable barriers may serve to channelize traffic. Use for a specific project should be determined by engineering analysis. However, the protective requirements of the work area, not the channelizing needs, govern the use of portable barriers. When serving the additional function of channelizing traffic, portable barriers should be of a light color for increased visibility. For nighttime visibility, barriers shall be supplemented with standard

delineation, markings, or channelizing devices. (For further details on barrier delineation, see Standard Detail TE11-5.) More specific information on the use of portable barriers and impact attenuators can be obtained from chapters 8 and 9 respectively, of the AASHTO Roadside Design Guide.[7]

Warning lights may be mounted on continuous barriers. On each side of the roadway only the first two yellow warning lights at the start of a continuous barrier should be Type B flashing. Subsequent warning lights on the barrier shall be Type C yellow, steady-burning for channelization.

The effect of striking the ends of barriers should be mitigated by use of impact attenuators or by flaring the ends of barriers away from the traveled way.

c. Temporary Traffic Signals

Temporary traffic signals can be used for special applications to control traffic flow at work zones. These applications include a highway intersection with a temporary haul road or equipment crossing, and temporary traffic control zones with alternate one-way traffic flow, such as bridge construction.

All traffic signal and control equipment shall meet the standards and specifications prescribed in part IV of the MUTCD and latest edition of Section 660 of the Specifications of the West Virginia Department of Transportation, Division of Highways.

One-way traffic flow requires an all-red interval of sufficient duration for traffic to clear the portion of the work zone controlled by the traffic signals. To avoid the display of conflicting signals at each end of the work zone, traffic signals shall be hard-wired.

d. Rumble Strips

Rumble strips are transverse strips of rough-textured surface used to supplement standard or conventional traffic control devices. Rumble strips provide a vibratory and audible warning that supplements visual stimuli. Rumble strips may be used on the approach to a condition requiring motorists to reduce their speed by 20 mph or more, to alert drivers of unusual or unexpected changes in alignment, or in situations where visibility is limited to an approaching condition requiring speed reductions. They should only be installed in conjunction with advance warning signs located closely enough that the motorist will associate the sign with the rumble strip. The advance warning sign for the given condition shall be placed at least 100 feet (normally according to Table II-1 of the MUTCD) before the first group of rumble strips is encountered.

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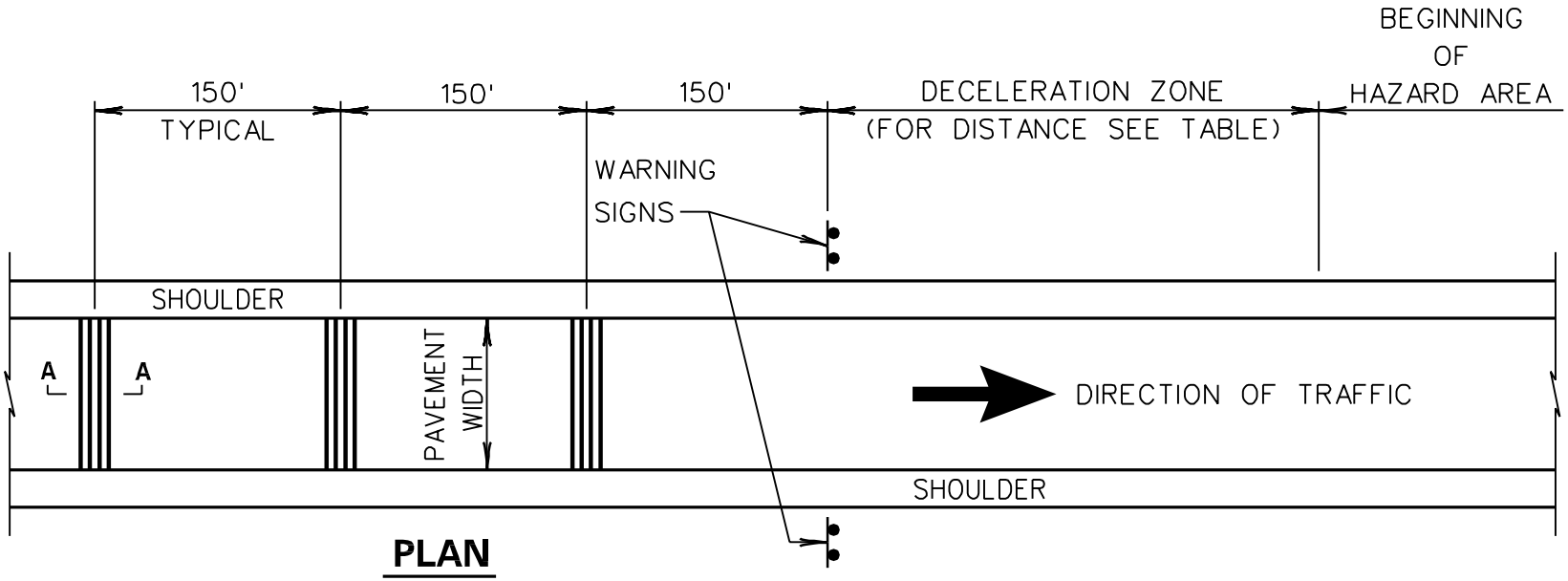
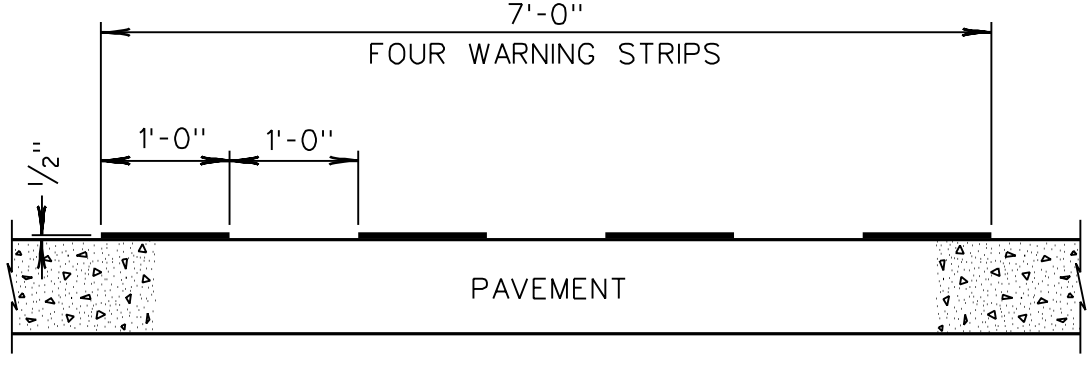


PLAN



SECTION A–A

DESIGN SPEED M.P.H.	BRAKING DISTANCE (WET PAVEMENT)
30	86 FEET
40	167 FEET
50	278 FEET
60	414 FEET
65	485 FEET
70	584 FEET
75	670 FEET
80	790 FEET

RUMBLE STRIPS
FIGURE 11

A rumble strip shall consist of raised strips or depressed grooves. The cross-section may be rectangular, domed, or trapezoidal in shape. There should be four (4) to twenty (20) grooves or raised strips (normally four placed in a rumble strip pad). The strips or grooves should be placed transverse to the direction of traffic. The intervals between rumble strip pads should be reduced as the distance to the hazard diminishes, to create a sensation of acceleration for motorists.

The first rumble strip pad should be placed before the advance warning devices. The last rumble strip pad should be placed a minimum of 250 feet in advance for a stop condition and a minimum of 150 feet in advance for a change in alignment or similar condition which requires the motorist to slow but not to stop. Rumble strip pads should not be placed on short horizontal or vertical curves where loss of vehicle control may occur because of the action of the rumble strips on a vehicle's suspension system. Rumble strips may be portable devices.

A sign warning drivers of the presence of rumble strips may be placed in advance of the strips. A recommended configuration for rumble strips is shown on Figure 11.

e. Screens (Glare Barriers)

Screening is used to block the driver's view of activities that can distract from the driving task. Screening also contains the work area and keeps dust and debris off the pavement. Screens are primarily useful on long-term temporary traffic control projects.

Screens may improve safety and traffic flow where traffic volumes approach the roadway capacity because they discourage "gawking" and reduce headlight glare from oncoming traffic.

Screens may be mounted on the top of portable concrete barriers that separate two-way traffic. Screens should not be mounted where they could restrict driver visibility and sight distance. Additional information regarding screens can be obtained from Chapter 9 of the AASHTO Roadside Design Guide.[14]

f. Opposing Traffic Lane Divider

Opposing traffic lane dividers are delineation devices used as center lane dividers to separate opposing traffic on a two-lane, two-way operation. The upright, orange-colored panel shall be approximately 12 inches wide by 18 inches high. The legend on the divider shall be two opposing arrows, similar to those in the legend on the TWO-WAY TRAFFIC sign (W6-3). The divider should be made of lightweight material.

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6G. TYPES OF TEMPORARY TRAFFIC CONTROL ZONE ACTIVITIES

Each traffic control zone is different. Many variables, such as location of work, road type, speed, volume, geometrics, vertical and horizontal alignment, pedestrians, and intersections affect the needs of each zone. The goal of traffic control in work areas is safety with minimum disruption to traffic, and the key factor in making the temporary traffic control zone safe and efficient is proper judgment.

Bicyclists also need protection and access to the roadway. If a bicycle path is closed because of work in progress, a signed alternate route should be provided. Bicyclists should not be directed onto the same path used by pedestrians. For more details on controlling bicycle traffic, see part IX of the MUTCD.

Utility work takes place both within the roadway and outside the shoulder, to construct and maintain the hardware and equipment used to provide power, light, water, gas, and telephone service. Utility operations are generally short daytime operations, except under emergency conditions. Often they are performed on low-volume, low-speed streets. Operations often involve intersections, as that is where many of the network junctions occur. The crew size is usually small, only a few vehicles are involved, and the number and types of traffic control devices placed in the temporary traffic control zone may be minimal. As discussed in section 6G-20a.(4), however, the reduced number of devices in this situation should be offset by the use of high-visibility devices, such as special lighting units on work vehicles. Cases C1, C2, C3, C4, and C5 are examples. Other typicals may apply as well.

In this section, typical temporary traffic control zone situations are organized according to duration and location of work and highway type. Section 6H, which follows the same organization, presents layouts of these typical temporary traffic control zone situations.

6G-1. TYPICAL APPLICATIONS

Typical applications include a variety of traffic control methods, but do not include a layout for every conceivable work situation. Typical applications should be altered, when necessary, to fit the conditions of a particular temporary traffic control zone. Standards presented in sections 6A-6F should be given priority over the examples given in the typical applications.

The typical applications illustrated in section 6H generally represent highway agency norms. Other devices may be added to supplement the devices shown in the typical applications, and sign spacings and taper lengths may be increased to provide additional time or space for driver response. In some situations, however, such as an urban setting, too many devices can spread signing over too long a distance to be meaningful. When conditions are not as difficult as those depicted in the typical application, fewer devices may suffice.

Although portable barriers are sometimes indicated in the typical applications of section 6H, they are not traffic control devices in themselves. However, when placed in a position identical to a line of channelizing devices and marked and/or equipped with appropriate channelizing features to give guidance and warning both day and night, they serve as traffic control devices and, therefore, must conform to all requirements for such devices set forth throughout this manual.

6G-2. SELECTING THE TYPICAL APPLICATION

Selecting the most appropriate typical application and modifications for a temporary traffic control zone requires knowledge and understanding of that zone. Although there are many ways of categorizing temporary traffic control zone applications, the three factors mentioned earlier (work duration, work location, and highway type) have been used to characterize the typicals illustrated in section 6H.

a. Duration of Work

Work duration is a major factor in determining the number and types of devices used in temporary traffic control zones. The five categories of work duration and their time at a location are as follows:

- Long-term stationary-Work that occupies a location more than 3 days.
- Intermediate-term stationary-Work that occupies a location from overnight to 3 days.
- Short-term stationary-Daytime work that occupies a location from 1 to 12 hours.
- Short duration-Work that occupies a location up to 1 hour.
- Mobile-Work that moves intermittently or continuously

(1) Long-term Stationary

At long-term stationary temporary traffic control zones, there is ample time to install and realize benefits from the full range of traffic control procedures and devices that are available for use. Generally, larger channelizing devices are used, as they have more retroreflective material and offer better nighttime visibility. The larger devices are also less likely to be displaced or tipped over-an important consideration during those periods when the work crew is not present. Furthermore, as long-term operations extend into nighttime, retroreflective and/or illuminated devices are required. Temporary roadways and barriers can be provided, and

(2) Intermediate-term stationary

During intermediate-term stationary work, it may not be feasible or practical to use procedures or devices that would be desirable for long-term stationary temporary traffic control zones, such as altered pavement markings, 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 payback time to make more elaborate traffic control economically attractive.

(3) Short-term stationary

Most maintenance and utility operations are short-term stationary work. The work crew is present to maintain and monitor the temporary traffic control zone. The use of flagger is an option. Lighting and/or retroreflective devices should be chosen to accommodate varying seasonal, climatic, and visibility situations.

(4) Short duration

During short-duration work, there are hazards involved for the crew in setting up and taking down the traffic controls. Also, since the work time is short, the time during which motorists are affected is significantly increased as the traffic control is expanded. Considering these factors, it is generally held that simplified control procedures may be warranted for short-duration work. Such shortcomings may be offset by the use of other, more dominant devices such as special lighting units on work vehicles.

(5) Mobile

Mobile operations are work activities that move along the road either intermittently or continuously. Mobile operations often involve frequent short stops, each as much as 15 minutes long, for activities such as litter cleanup, pothole patching, or utility operations and are similar to stationary operations. Warning signs, flashing vehicle lights, flags, and/or channelizing devices should be used.

Mobile operations also include work activities in which workers and equipment move along the road without stopping, usually at slow speeds. The advance warning area moves with the work area. Traffic should be directed to pass safely. Parking may be prohibited, and work should be scheduled during off-peak hours. For some continuously moving operations-such as street-sweeping- where volumes are light and visibility is good, a well-marked and well-signed vehicle may suffice. If volumes and/or speeds are higher, a shadow or backup vehicle equipped as a sign truck, preferably supplied with a flashing arrow display, should follow the work vehicle. Where feasible, warning signs should be placed along the roadway and moved periodically as the work progresses. In addition, vehicles may be equipped with such devices as flags, flashing vehicle

lights, truck-mounted attenuators, and appropriate signs. These devices may be required individually or in various combinations, including all of them, including all of them, as determined necessary.

Safety should not be compromised by using fewer devices simply because the operation will frequently change its location. Portable devices should be used. Flaggers may be used, but caution must be exercised so they are not exposed to unnecessary hazards. The control devices should be moved periodically to keep them near the work area. If mobile operations are in effect on a high-speed travel lane of a multilane divided highway, flashing electric arrow displays should be used.

b. Location of Work

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

Work can take place in the following locations:

(1) **Outside of the shoulder edge**. Devices may not be needed if work is confined to an area 15 or more feet from the edge of the shoulder. Consideration should be given to roadway characteristics, roadway geometrics, and vehicle speed. A general warning sign, such as ROAD WORK AHEAD, should be used if workers and equipment must occasionally move closer to the highway.

(2) **On or near the shoulder edge**. The shoulder should be signed as if work were on the road itself, since it is part of the drivers' "recovery area." Advance warning signs are needed. Channelizing devices are used to close the shoulder, direct traffic, and keep the work space visible to the motorist. Portable barriers may be needed to prevent encroachment of errant vehicles into the work space and to protect workers.

(3) **On the median of a divided highway**. Work in the median may require traffic control for both directions of traffic, through the use of advance warning signs and channelization devices. If the median is narrow, with a significant chance for vehicle intrusion into long-term work sites and/or crossover accidents, portable barriers should be used.

(4) **On the traveled way**. Work on the traveled way demands optimum protection for workers and maximum advance warning for drivers. Advance warning must provide a general message that work is taking place, information about specific hazards, and actions the driver must take to drive through the temporary traffic control zone.

c. Roadway Type

Roadway type is also a primary factor in the use of temporary traffic control zone traffic control devices. Typical application diagrams of the following categories of roadway type are included in section 6H:

(1) Rural Two-lane Roadways
(2) Urban Arterial Roads
(3) Other Urban Streets
(4) Rural or Urban Multilane Divided and Undivided Highways
(5) Intersections
(6) Freeways

Rural two-lane roadways are characterized by relatively low volumes and high speeds. Urban arterial roads often have lower speeds, but they may require significant controls because of higher traffic volumes and closer spacing of such design features as intersections. Other urban streets with light traffic volumes will generally require fewer but more closely spaced devices. Major arterial and freeways need the highest type of traffic control, primarily because of high speeds and often high volumes of traffic.

To improve safety, typical designs may be modified to a more elaborate treatment, as indicated by the following:

- Additional devices
  - Additional signs
  - Flashing arrow displays
  - More channelizing devices at closer spacing
  - Temporary raised pavement markers
  - High-level warning devices
  - Portable changeable message signs
  - Portable traffic signals
  - Portable barriers
  - Impact attenuators
  - Screens (Glare Barriers)
  - Rumble strips
- Upgrading of devices
  - A full complement of standard pavement markings in areas of high hazard
  - Brighter and/or wider pavement markings
  - Larger signs
  - Higher type channelizing devices
  - Barriers in place of channelizing devices
- Improved geometrics at detours or crossovers, giving particular attention to the provisions set forth in section 6B of the MUTCD.

- o Increased distances
  - Longer advance warning area
  - Longer tapers

- o Lighting
  - Temporary roadway lighting
  - Steady-burn lights used with channelizing devices
  - Flashing lights for isolated hazards
  - Illuminated signs
  - Floodlights

When conditions are not as difficult as those depicted in the typical applications, fewer devices may suffice. However, uniformity of devices and their application is always extremely important.

6G-3. WORK OUTSIDE THE SHOULDER

Traffic control depends primarily on devices such as advance warning signs, flashing vehicle lights, and flags. An advance warning sign should be used when any of the following conditions occur:

- o Work will be performed immediately adjacent to the shoulder at certain stages of the activity.

- o Equipment may be moved along or across the highway.

- o Motorists may be distracted by the work activity.

A typical sign for this situation may be ROAD WORK AHEAD. If the equipment travels on or crosses the roadway, it should be equipped with appropriate flags, flashing lights, and/or a SLOW MOVING VEHICLE symbol.

A typical layout for stationary work outside of the shoulder is shown in Case A1. Special signing for a blasting zone is shown in Case D1. A typical layout for short-duration, mobile and moving work outside of the shoulder and on the shoulder is shown in Case A7.

6G-4. WORK ON THE SHOULDER

This section describes typical applications that cover shoulder work. It is divided into shoulder work that does and does not interfere with traffic.

a. No Encroachment on Traveled Way

There is no direct interference with traffic. When the shoulder is occupied or closed, the drivers should be advised and the workers should be protected. In some instances, this may require the use of

portable barriers if work is directly adjacent to the travel lane. Usually, the single warning sign, SHOULDER WORK, is adequate. When an improved shoulder is closed on a high-speed roadway, it should be treated as a closing of a portion of the road system because drivers expect to be able to use it in emergencies. Motorists should be given ample advance warning that shoulders are closed to use as refuge areas throughout a specified length of the approaching temporary traffic control zone. The signs should read SHOULDER CLOSED with distances indicated. The work space on the shoulder should be closed off by a taper of channelizing devices with a length of 1/3 L, using the formulas in section 6C-3 of the MUTCD. Flashing arrow displays should be used only in the caution mode.

b. Minor Encroachment on Traveled Way

When work is on the shoulder or takes up part of a lane, traffic volumes, vehicle mix (buses, trucks, and cars), speed, and capacity should be analyzed to determine whether the affected lane should be closed. The lane encroachment should permit a remaining lane width of 10 feet or the lane should be closed. However, 9 feet is acceptable for short-term use on low-volume, low-speed roadways for traffic that does not include longer and wider heavy commercial vehicles. Case A4 illustrates a method for handling traffic where the stationary or short duration work space encroaches slightly into the traveled way.

6G-5. WORK WITHIN TRAVELED WAY-RURAL TWO-LANE

a. Detours

Typical layouts for detours of two-lane highways are shown in Cases A12, B5 and B7. Case A12 illustrates the controls around an area where a section of roadway has been closed and a bypass constructed. Channelizing devices and pavement markings are used to indicate the transition to the temporary roadway.

Detour signing is usually handled by the traffic engineer with authority over the roadway because it is considered a traffic routing problem. Detour signs are used to direct traffic onto another roadway. When the detour is long, signs should be installed to periodically remind and reassure drivers that they are still on a detour. This is done by using the DETOUR MARKER (M4-8) or DETOUR (M4-9) signs.

When an entire roadway is closed, as illustrated in Case B5, a detour should be provided and traffic should be warned in advance of the closure. This illustration is an example for a closing 10 miles from the intersection. If local traffic is allowed to use the roadway up to the closure, the ROAD CLOSED TO THRU TRAFFIC sign should be used. The portion of the road open to local traffic should have adequate signing, marking, and protection.

Detours should be signed so that traffic will be able to get through the entire area and back to the original roadway as shown in Case B7.

b. One-Way Traffic Control

When one lane is closed on two-lane, two-way roads, the remaining lane must be used by traffic traveling in both directions. Techniques for controlling traffic under such conditions are described in section 6C-5 of the MUTCD.

6G-6. WORK WITHIN TRAVELED WAY-URBAN STREETS OR ARTERIAL

Urban temporary traffic control zones may be divided into segments. Decisions must be reached as to how to control vehicular traffic, how many lanes are required, or whether any turns should be prohibited at intersections. Pedestrian traffic must be considered. If work will be done on the sidewalk, will it be necessary to close the sidewalk and assign the pedestrians to another path? Next, decisions must be reached as to how to maintain access to business, industrial, and residential areas. Even if the road is closed to vehicles, pedestrian access and walkways must be provided.

Bicyclists' protection and access are especially needed on these types of roadways. If a bicycle path 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. For more details on controlling bicycle traffic, see part IX of the MUTCD.

Utility work takes place both within the roadway and outside the shoulder to construct and maintain the hardware and equipment used to provide power, light, water, gas, or telephone service. Utility operations are generally short daytime operations, except under emergency conditions. Often they are performed in low-volume and low-speed streets. Operations often involve intersections, since that is where many of the network junctions occur. The crew size is usually small, only a few vehicles are involved, and the number and types of traffic control devices placed in the temporary traffic control zone may be minimal. As discussed in section 6G-2.a. (4), however, in this situation the reduced number of devices should be offset by the use of high-visibility devices, such as special lighting units on work vehicles. Cases A6, C1, C2, C3, B4A, B4B, B4C, E4, and E6 are examples of typical applications for utility operations. Other typicals may apply as well.

6G-7. WORK WITHIN TRAVELED WAY-RURAL OR URBAN, MULTILANE DIVIDED AND UNDIVIDED, NON-ACCESS CONTROLLED

This section describes typical applications for work on multilane (four or more) streets or highways. It is divided into right lane closures, left lane closures, multiple-lane closures, and closures on five-lane roadways.

Portable concrete barriers are sometimes used during lane closing. As described in section 6F-8, portable barriers are not in themselves traffic control devices but, if placed along an adequate taper, transition, or tangent section, they may serve as traffic control devices to provide guidance and warning to passing traffic. In serving this traffic control function, portable barriers must be equipped with appropriate channelizing devices, delineation, and/or other traffic control devices in order to perform acceptably during day and night operations. When determined necessary by an engineering analysis, barriers should be used for added safety to prevent incursions of errant vehicles beyond their designated travel lanes. The four primary functions of barriers are as follows:

- To keep traffic from entering work areas, such as excavations or material storage sites.
- To provide protection for workers and pedestrians.
- To separate two-way traffic.
- To protect roadwork such as false work for bridges and other exposed objects.

a. Right Lane Closed

Traffic control similar to that shown in Cases E4, E6, and E7 may be used for undivided or divided four-lane roads. If traffic volumes are high, traffic may back up. If morning and evening peak hourly traffic volumes in the two directions are uneven and the greater volume is on the side where the work is being done, the inside lane for opposing traffic may be closed and made available to the side with heavier traffic. A volume check in both directions should be made before this method is used.

If the heavier traffic changes to the opposite direction, the traffic control can be changed to allow two lanes for opposing traffic by moving the devices from the opposing lane back to the centerline. If these changes occur frequently, cones or tubes should be used at close spacing to emphasize the centerline.

b. Left Lane Closed

If the work activity can be contained entirely within the left (or inside) lane, it may be appropriate to close only that lane. Channelizing devices should be placed along the centerline and outside of the work activity to give advance warning to the opposing traffic. An alternative is to close the two center lanes to give motorists and workers additional protection and to provide easier access to the work space. Overall safety needs, evaluated on the basis of

c. Multiple Lanes Closed

When the work occupies multiple lanes for one direction of traffic, the number of lanes remaining open may be reduced to one for each direction as shown in Case E12. A capacity analysis is necessary before this method is initiated. Traffic should be moved over one lane at a time and the tapers should be separated by a distance of 2L, as shown in Case E5. When a roadway must be closed on a divided highway, a median crossover may be used [see section 6G-9(b) and (c)]. When the 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, should be covered, removed, or obliterated.

d. Five-Lane Roads

Traffic control for lane closures on five-lane urban or rural roads is similar to other multilane undivided roads. Cases E13, E14, E15 and E16 should be adapted for use on five-lane roads.

For short-duration and mobile operations, see Case E7.

6G-8. WORK WITHIN TRAVELED WAY-INTERSECTIONS

For work at an intersection, advance-warning signs, devices, and markings are to be used as appropriate on all cross streets. The effect of the work upon signal operation should be considered, such as signal phasing for adequate capacity and for maintaining or adjusting detectors in the pavement.

A shoulder closing is done as shown in Case A1. A minor encroachment is done as shown in Case A3.

When a lane is closed on the approach side of an intersection, standard lane closure and taper techniques apply, as shown in Case B4C. A turn lane may be used for through traffic.

When a lane must be closed on the far side of an intersection, that lane should be closed on the near side approach, or converted to an exclusive turn lane, as shown in Cases B4B and B4C.

If the work is within the intersection, several options exist as follows:

- Keep the work space small so that traffic can move around it, as shown in Case B4A.
- Use flaggers to assign the right-of-way, as shown in Case B4A.
- Do the work in stages so the work space is kept small.
- Reduce traffic volumes by road closing or upstream diversions.

6G-9. WORK WITHIN TRAVELED WAY-FREEWAYS

Serious problems of traffic control occur under the special conditions encountered where traffic must be moved through or around temporary traffic control zones on high-speed, high-volume roadways. Although the general principles outlined in the previous sections of the manual are applicable to all types of highways, special consideration should be given to modern, high-speed, access-controlled highways to accommodate traffic in a safe and efficient manner that also adequately protects work forces. The density of traffic on these facilities requires that the most careful traffic control procedures be implemented, such as inducing critical merging maneuvers well in advance of work spaces and in a manner that creates minimum turbulence and delay in the traffic stream. These situations may require more conspicuous devices than specified for normal rural or urban street use. However, the same important basic considerations of uniformity and standardization of general principles apply for all roadways.

The year-round, night-and-day intensity of use of expressways and freeways means that there is no season during which work can be scheduled when traffic volumes and density are low. These activities therefore must be performed under extremely heavy traffic conditions.

Traffic controls for short-duration and mobile operations are shown in Case E1.

a. Problem Areas

The performance of work under high-speed, high-density traffic on controlled access highways is complicated by many of the design and operational features inherent to their use.

The presence of median dividers that establish separate roadways for directional traffic may also prohibit the closing of that roadway or the diverting of traffic to other lanes. A typical layout for shifting traffic lanes around a work space is shown in Case E8.

Lack of access to and from adjacent roadways prohibits rerouting of traffic away from the work space in many cases.

A major consideration in the establishment of traffic control is the vehicular speed differential which exists and the limited time available for drivers to react safely to unusual conditions while still providing an activity area that protects workers. Traffic control for a typical lane closure is shown in Case E4. Traffic control for multiple and center lane closings is shown in Case E5.

Other conditions exist where work must be limited to night hours, thereby necessitating increased use of warning lights, illumination of work spaces, and advance warning systems. To reduce congestion as much as possible, work should be encouraged during nighttime and/or other low-volume, off-peak hours.

b. Two-Lane, Two-Way Traffic on One Roadway of a Normally Divided Highway

Two-lane, two-way operations (TLTWO) on one roadway of a normally divided highway is a typical application that requires special consideration in the planning, design, and construction phases. As unique operational problems (for example, increasing the risk of serious head-on collisions) can arise with the TLTWO, this typical application will be discussed here.

Before including a TLTWO in the traffic control plan for a project, careful consideration should be given to its appropriateness. The following items should be considered during in the decision-making process:

- Is a suitable detour available?
- What are the characteristics of the traffic?
- Can traffic be maintained on the shoulder?
- Can temporary lanes be constructed in the median?
- Can the work be accomplished by closing only one directional lane? If this option is selected for consideration, will it result in additional hazard to work zone personnel?
- If a TLTWO selected, will this result in a shorter contract time?
- Will the TLTWO allow a contractor to perform the work more efficiently and thus result in a substantial decrease in contract cost?
- What is the "track record" of similar installations?
- Are there any width or height restrictions that would preclude the TLTWO or the use of a shoulder or the median as a temporary lane?
- What are the condition of the pavement and the shoulders in the proposed TLTWO section? Due to width restriction, traffic may drive on the shoulders, which must be structurally adequate.

The traffic control plan as shown in Case E9 shall include provision for separate opposing traffic whenever two-way traffic must be maintained on one roadway of a normally divided highway. The TLTWO shall be used only after careful consideration of other available methods of traffic control.

When traffic control must be maintained on one roadway of a normally divided highway, opposing traffic shall be separated either with portable barriers (concrete safety-shape or approved alternate),

or with channelizing devices throughout the length of the two-way operation. The use of striping, raised pavement markers, and complementary signing, either alone or in combination is not considered acceptable for separation purposes.

Treatments for entrance and exit ramps within the two-way roadway segment of this type of work are shown in Cases F4 and F8.

c. Crossovers

The following are good guiding principles for the design of crossovers:

- Tapers for lane drops should not be contiguous with crossovers.
- Crossovers should be designed for speeds not less than 10 miles per hour below the posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated operating speed of the roadway, unless unusual site conditions require that a lower design speed be used.
- A full array of channelizing devices, delineators, and full-length, properly placed pavement markings are important in providing drivers with a clearly defined travel path.
- Portable concrete barriers and the excessive use of traffic control devices cannot compensate for poor geometric design of crossovers.
- The design of the crossover should accommodate all roadway traffic including trucks and buses.
- A clear area should be provided adjacent to the crossover.

d. Interchanges

Access to interchange ramps on limited access highways should be maintained even if the work space is in the lane adjacent to the ramps. If access is not possible, ramps may be closed by using signs and Type III barricades. Early coordination with officials having jurisdiction over the affected cross streets is needed before ramp closings.

Egress to exit ramps should be clearly marked and outlined with channelizing devices. For long-term projects, old pavement markings should be removed and new ones placed. As the work space changes, the access area may be changed, as shown in Case F3. Traffic control work in the exit ramp may be handled as shown in Case F2.

When a work space interferes with an entrance ramp, a lane may need to be closed on the freeway. Work in the entrance ramp may require shifting ramp traffic. Traffic control for both operations is shown in Case F7.

6G-10. CONTROL OF TRAFFIC THROUGH INCIDENT AREAS

The primary function of traffic control at an incident area is to move traffic safely and expeditiously through or around the incident. An incident is an emergency traffic accident, natural disaster, or special event. Examples include a stalled vehicle blocking a lane, a traffic accident blocking the traveled way, a hazardous chemical spill closing a highway, floods and severe storm damage, a planned visit by a dignitary, or a major sporting event.

Emergencies and disasters may pose severe and unpredictable problems. The ability to install proper traffic control may be greatly reduced in an emergency, and any devices on hand may be used for the initial response as long as they do not themselves create unnecessary additional hazards. If the situation is prolonged, the standard procedures and devices set forth in this part of the manual shall be used. Special events, on the other hand, can be properly planned for and coordinated. This manual provides standards for the proper procedure for closing portions or entire roadways in conjunction with such activities.

Truck Route National Network and hazardous cargo signs are included in section 2B-43 of the MUTCD. During incidents, longer vehicles may need to follow a different route from automobiles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous materials may need to follow a different route from auto drivers.

The control of traffic through incident areas is an essential part of fire and enforcement operations. For these operations there must be adequate legislative authority for the implementation and enforcement of needed traffic regulations, parking controls, and speed zoning. Such statutes should provide sufficient flexibility in the application of traffic control to meet the needs of the changing conditions in incident areas.

Maintaining good public relations is necessary. The cooperation of the news media in publicizing the existence of, and reasons for, incident areas and their traffic control can be of great assistance in keeping the motoring public well informed.

Street or highway incident management signs fall into two major categories: regulatory signs and warning signs. Specifications for incident sign design are presented in section 6F-1.

The channelizing devices discussed in section 6F-5 should be used whenever possible. Flares may be used to initiate traffic control at all incidents or for short-term traffic control such as clearing incident sites, but should be replaced by more permanent devices as soon as practicable.

A short-term road closing caused by an incident such as a traffic accident may block the traveled way. Traffic may be detoured around the incident and back to the original roadway. The jurisdiction having control of the roadway will probably need to determine the detour route and install the signs. Large trucks are a primary concern in such a detour.

An incident such as a hazardous chemical spill may require closure of an entire highway. Local traffic can adjust to the closure, but through traffic must be guided around the incident and back to the original route.

6H. APPLICATION OF DEVICES

6H-1. TYPICAL APPLICATIONS

Section 6G contains discussions of typical activities. Section 6H presents typical application diagrams for a variety of situations commonly encountered. While not every situation is addressed, the procedures illustrated can generally be adapted to a broad range of conditions. In many instances, it will be necessary to combine features from various typical application diagrams. For example, work at an intersection may present a near-side work area for one street and a far-side work area for the other street. These treatments are found in two different diagrams, and a third diagram shows how to handle pedestrian crosswalk closings.

Procedures for establishing temporary traffic control zones vary with such conditions as road configuration, location of the work, work activity, duration, traffic speed, traffic volume, and pedestrians. Examples presented in this chapter are guides showing how to apply principles and standards. Judgment is needed in applying these guidelines to actual situations and adjusting to field conditions. In general, the procedures illustrated represent the minimum needs for the situation depicted. Other devices may be added to supplement the devices and device spacing may be adjusted to provide additional reaction time or protection. Where the situation being addressed is less than typical, actual conditions may require fewer devices.

6H-2. GENERAL NOTES

General notes for various application categories are provided below. Numerous figures and tables found throughout this manual provide guidance for the development of traffic control plans and procedures.

a. Work Performed on the Roadside (Outside Shoulder)

When work is being performed off the roadway (beyond shoulders yet within the right-of-way), little or no temporary traffic control may be needed. If there is no effect upon traffic, no devices are needed, but this is rarely the case. More commonly, there may be driver distraction, vehicles may be parked on the shoulder, vehicles may be accessing the work site via the highway, or equipment may on occasion need to travel on or cross the roadway to perform the work operation (e.g., mowing). Where these situations pertain, a single warning sign, such as ROAD WORK AHEAD, will generally suffice.

If vehicles are using the shoulder, a SHOULDER WORK sign is appropriate. For mowing operations, the sign MOWING AHEAD may be used. Where the activity is spread out over a distance of more than 2 miles, the sign should be repeated every 2 miles. A supplementary plate with the message NEXT [X] MILES may be placed below the initial warning sign.

b. Work Performed on Shoulders

When a highway shoulder is occupied, warning is needed to advise the driver and protect the workers. As a minimum, the single warning sign SHOULDER WORK is adequate. When work is performed on a paved shoulder 8 or more feet wide, a transition area is needed in which channelizing devices are placed on a taper of length that conforms to the requirements of a shoulder taper. When paved shoulders of width of 8 feet or more are closed on freeways and expressways, additional treatment is generally needed to alert traffic to the possibility of a disabled vehicle that cannot get off the traveled way. An initial general warning sign is needed (e.g., ROAD WORK AHEAD), followed by a RIGHT or LEFT SHOULDER CLOSED sign. Where the end of the shoulder closure extends beyond the distance that can be perceived by motorists, a supplementary plate bearing the message NEXT [X] FEET (or MILES) should be placed below the SHOULDER CLOSED sign.

When the shoulder is not occupied but work has adversely affected its condition, the LOW SHOULDER or SOFT SHOULDER sign should be used, if appropriate. Where the condition extends over a distance in excess of 1 mile, the sign should be repeated at 1-mile intervals. In addition, a supplementary plate bearing the message NEXT [X] MILES may be placed below the first such warning sign.

On multilane, divided highways, signs advising of shoulder work or the condition of the shoulder should be placed only on the side of the affected shoulder.

c. Mobile and Short-Duration Operations

As compared to stationary operations, mobile and short-duration operations are distinct activities that may involve different treatments. More mobile devices are needed (e.g., signs mounted on trucks), and larger, more imposing, and more visible devices can be

used effectively and economically. For example, appropriately colored and marked vehicles with flashing or rotating lights, perhaps augmented with signs or arrow displays, may be used in place of signs and channelizing devices. The trade-off is economical because work duration is short. Mobility is essential, the crew is always onsite, and some of the vehicles may be required for the work activity or crew transportation. Safety is not compromised, as numerous small devices are merely replaced by fewer, more dominant and effective devices.

(1) Short-Duration

Short-duration activities are generally considered to be those in which it takes longer to set up and remove the traffic control zone than to perform the work. Typically, such operations can be accomplished in 60 minutes or less.

There are hazards involved for the crew in setting up and taking down a traffic control zone. Also, as the work time is short, the time during which motorists are affected is significantly increased when additional devices are installed and removed. Considering these factors, it is generally held that simplified control procedures are warranted for short-duration activities. Such shortcomings may be offset by the use of other, more dominant devices, such as special lighting units on work vehicles.

(2) Mobile Operations

Mobile operations include activities that stop intermittently and then move on (e.g., pothole patching and litter pickup) and those that move continuously (e.g., pavement striping).

With operations that move slowly (less than 3 mph), it may be feasible to use stationary signing that is periodically retrieved and repositioned in the advance warning area. At higher speeds, trucks are typically used as components of the traffic control zones. Appropriately colored and marked vehicles with signs, flashing or rotating lights, and special lighting panels move as part of a train behind the work vehicles.

Mobile operations that move at speeds greater than 20 mph, such as snowplowing operations, shall have appropriate devices on the equipment, (i.e., rotating lights, signs, or special lighting), or shall use a protection vehicle with appropriate warning devices.

d. Lane Closings on Two-Lane Roads

When one lane of a two-lane road is closed, the remaining lane must accommodate both directions of travel. The typical procedure for short-term work is to utilize flaggers to alternate traffic flow, as shown in Case A6. For long-term operations, a temporary traffic signal, as shown in Case A12, is an alternative. For low traffic volumes on a minor road, where traffic may be self-regulating, the procedure illustrated in Case A11 may be used.

e. Lane Closings on Multilane Roads

When a lane is closed on a multilane road, a transition area containing a merging taper is needed. Typically, the advance warning area contains three warning signs, such as ROAD WORK AHEAD, RIGHT or LEFT LANE CLOSED AHEAD, and the Lane Reduction Transition sign.

When an interior lane is closed for use as a work space, consideration should be given to closing an adjacent lane also. This procedure provides additional space for vehicles and materials and facilitates the movement of equipment within the work space. On multilane undivided roads and streets where the left lane is closed, such additional space can be obtained by also closing the left lane in the opposing direction.

f. Work Performed in the Vicinity of Intersections

The typical application diagrams contained herein depict typical urban intersections on arterial streets. Where the posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated speed of traffic equals or exceeds 45 mph, additional warning signs may be needed in the advance warning area.

The typical application diagrams for intersections are classified according to the location of the work space with respect to the intersection area (as defined by the extension of curb or edge lines.) Thus, there are three classifications-near-side, far-side and in-the-intersection.

Traffic control zones in the vicinity of intersections may block movements and interfere with normal traffic flows. Such conflicts frequently occur at complex signalized intersections having such features as traffic signal heads over particular lanes, lanes allocated to specific movements, multiple signal phases, and signal detectors for actuated control. Where such potential problems exist, the traffic engineering staff having jurisdiction should be contacted.

It should be recognized that some work spaces may extend into more than one portion of the intersection. For example, work in one quadrant may create a near-side work space on one street and a far-side work space on the cross street. In such instances, the traffic control zone should incorporate features shown in two or more of the intersection and pedestrian typical application diagrams shown herein.

(1) Work Space on the Near Side of Intersections

Near-side work spaces, as depicted in Case B4C, are simply handled as a mid-block lane closure. Where space is restricted, as with short block spacings, two warning signs may be used in the advance warning area, and a third "action-type" warning or regulatory sign (e.g., KEEP LEFT) is placed within the transition area. The one

significant problem that may occur with a near-side lane closure is a reduction in capacity, which during certain hours of operation could result in congestion and backups.

(2) Work Space on the Far Side of Intersections

Far-side work spaces require additional treatment because motorists typically may enter the activity area by straight-through and left- or right-turning movements. Merging movements within the intersection should be avoided. Therefore, the applicable principle is to close any lanes on the near-side intersection approach that do not carry through the intersection as lanes shown in Cases B4A, B4B, and B4C. If, however, there is a significant number of vehicles turning from this lane, then it may be advantageous to convert the lane to an exclusive turn lane.

(3) Work Space Within the Intersection

Case B4A provides guidance as to applicable procedures for work performed within the intersection. When directing traffic within the intersection, consideration should be given to using a uniformed police officer.

g. Incident Management Situations

The immediate response to an emergency situation must by necessity make use of available devices and equipment. Given the opportunity, however, longer term emergencies should be treated in a manner similar to other temporary traffic control work sites.

h. Features That May Be Added to the Diagrams

The measures described below are useful in increasing conspicuity and visibility of traffic control devices.

(1) Flags on Signs

Flags may be placed above signs to enhance their target value and increase motorists' awareness. Flags are useful for daytime operations only.

(2) Flashing Lights on Signs

Portable warning lights may be placed above signs to enhance their target value and increase motorists' awareness. Type A low-intensity warning lights are effective at night. Type B high-intensity warning lights are effective for both day and night.

(3) Sign Illumination

The retroreflective material used on sign faces returns light to a light source. In some instances, vehicular headlight beams may not illuminate a sign, such as those placed on sharp curves or on crossroads. Likewise, some road users, such as pedestrians and cyclists, may have inadequate head lamps or no head lamps at all.

When these situations are encountered, adequate nighttime sign visibility may be obtained using internal or external sign illumination.

(4) Lights on Channelizing Devices

For intermediate and long-term operations, consideration should be given to placing portable warning lights on channelizing devices. Lights are especially effective in the following applications: where new travel patterns are established at tapers, shifts, and runarounds; at road closings; on devices placed on horizontal and vertical curves; where headlights may not adequately illuminate retroreflective material on channelizing devices; and when adverse weather conditions are anticipated.

Table 3. Suggested advance warning sign spacing

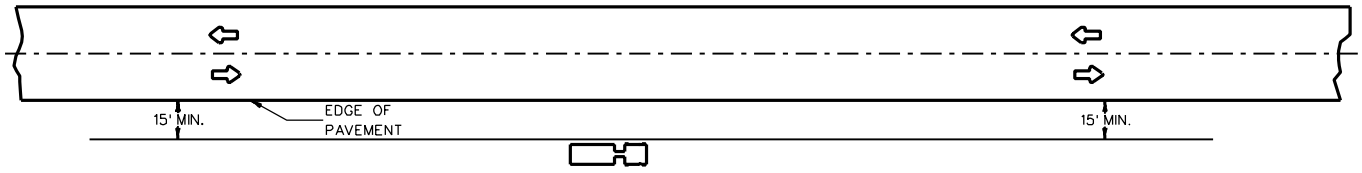
Road type	Distance between signs		
	A	B	C
Urban (low speed*)	**200**	**200**	**200**
Urban (high speed*)	**350**	**350**	**350**
Rural	**500**	**500**	**500**
Expressway/Freeway	**1,000**	**1,600**	**2,600**

Formulas for L**

SPEED	FORMULA
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or greater	$L = W \times S$

* Speed category to be determined by State highway agency in cooperation with local jurisdictions.

** L = Taper length in feet.
W = Width of offset in feet.
S = Posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.



TYPICAL APPLICATIONS

LANDSCAPING WORK.
UTILITY OPERATIONS.
FENCING CONTRACTS AND MAINTENANCE.
CLEANING CULVERTS.

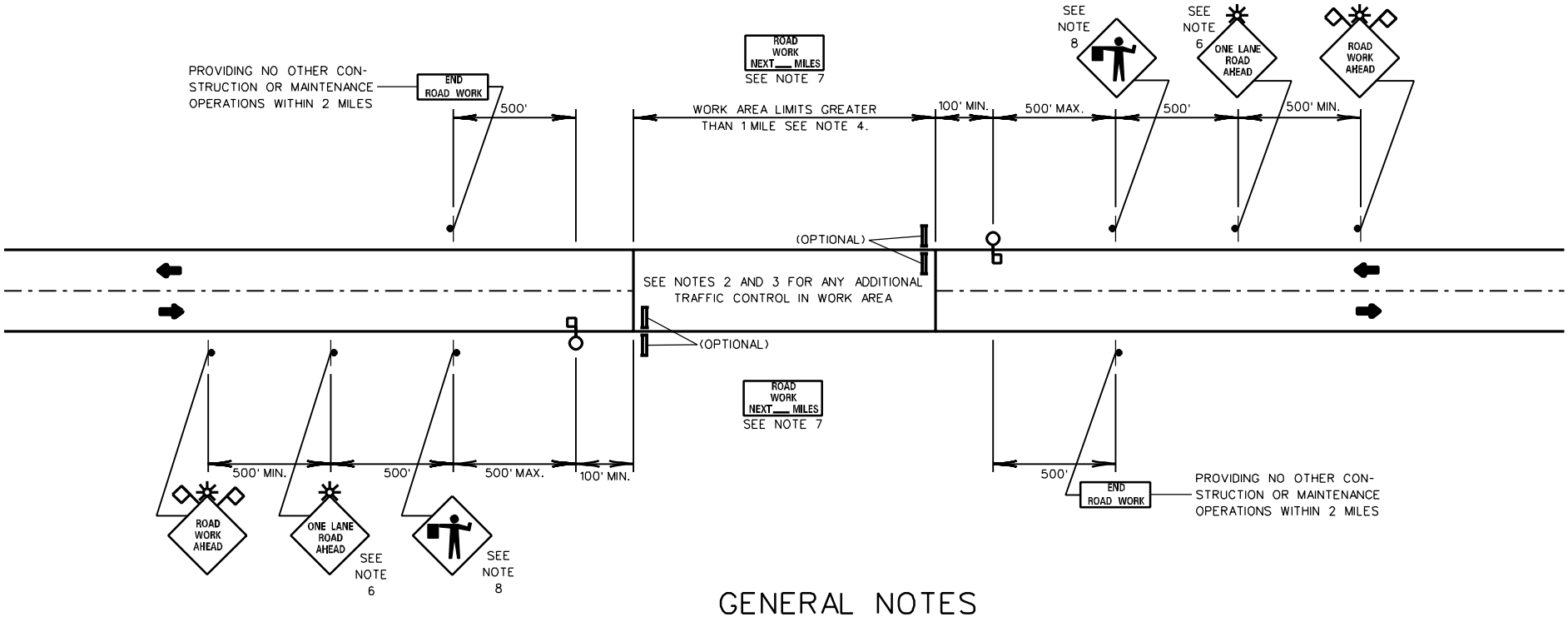
GENERAL NOTES

1. IF THE WORK OPERATION REQUIRES THAT TWO OR MORE WORK VEHICLES CROSS THE 15 FT. CLEAR ZONE IN ANY ONE HOUR TRAFFIC CONTROL WILL BE IN CONFORMANCE WITH CASE A3.

2. NO SPECIAL SIGNING IS REQUIRED.

CASE A1

TWO-LANE, TWO-WAY TRAFFIC.
WHERE, AT ALL TIMES, ALL VEHICLES EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE MORE THAN 15 FT. FROM THE EDGE OF PAVEMENT.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED).
- TYPE III BARRICADE
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE

TYPICAL APPLICATIONS

RESURFACING
WIDENING
ROADWAY STABILIZATION
SHOULDER STABILIZATION

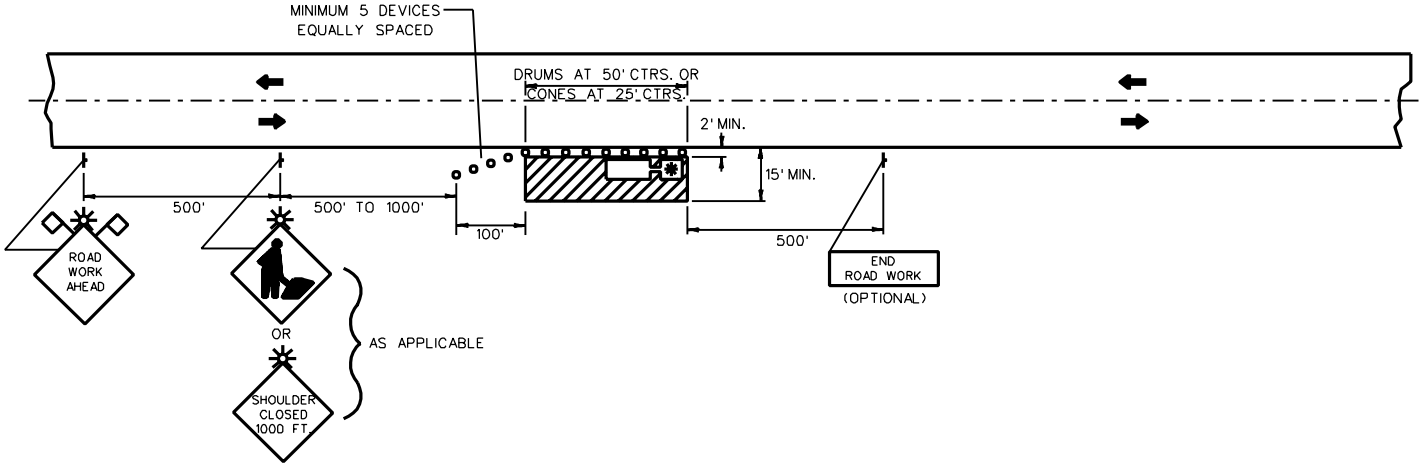
GENERAL NOTES

1. FOR PROJECTS LESS THAN 1 MILE IN LENGTH THE APPROPRIATE CASE FOR THE SPECIFIC WORK AREA SHALL BE USED UNLESS DIRECTED BY THE ENGINEER.
2. ADDITIONAL TRAFFIC CONTROL IN THE WORK AREA MAY BE NECESSARY. TYPE OF CONTROL WILL BE DETERMINED BY WORK BEING PERFORMED. REFER TO CASE THAT IS APPLICABLE. (EXAMPLE: CASE A6).
3. WHERE THE WORK AREA EXTENDS THROUGH AN INTERSECTION, ADDITIONAL WARNING SIGNS AND TRAFFIC CONTROL (SUCH AS CASE A6) SHALL BE PROVIDED FOR THAT APPROACH.
4. THE MAXIMUM CLOSURE DISTANCE SHALL BE DETERMINED BY THE ENGINEER, BUT SHALL NOT EXCEED THE LENGTH OF ½ DAYS OPERATION OR TWO MILES, WHICHEVER IS LESS.
5. THE FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATIONS AT ALL TIMES.
6. WHEN SUCH SIGNS ARE NO LONGER FUNCTIONAL, E.G. NIGHTTIME, SUCH SIGNS SHALL BE COVERED OR REMOVED.
7. SUCH SIGNS SHALL BE ERECTED AS DIRECTED BY THE ENGINEER BUT NORMALLY SHALL BE ERECTED AT ½ MILE INCREMENTS FOR PROJECTS GREATER THAN 2 MILES IN LENGTH.
8. CONTROLS THE OPERATIONS OF PILOT TRUCK IF APPLICABLE.

CASE A2

TWO-LANE, TWO WAY TRAFFIC DAY OPERATIONS (NIGHTTIME IF APPROVED BY THE ENGINEER)

WHERE, AT ANY TIME, THE PROJECT LIMITS ARE GREATER THAN 1 MILE.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 3).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- CONES OR DRUMS.

TYPICAL APPLICATIONS

CULVERT EXTENSIONS.
SIDE SLOPE CHANGES.
GUARDRAIL INSTALLATION AND MAINTENANCE.
DELINEATOR INSTALLATION AND MAINTENANCE.
LANDSCAPING OPERATIONS.
CLEANING DITCHES AND DRAINAGE STRUCTURES.
SHOULDER REPAIR.
SIGNING OPERATIONS.

GENERAL NOTES

1. OVERNIGHT OPERATIONS ILLUSTRATED AND IF SUCH, USE DRUMS. FOR DAYLIGHT OPERATIONS ONLY, DELETE TYPE 'B' LIGHTS AND USE CONES OR DRUMS AS DIRECTED BY THE ENGINEER.
2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS. (TYPE "A").
3. IF THE WORK OPERATION REQUIRES THAT FOUR OR MORE WORK VEHICLES ENTER THE THROUGH TRAFFIC LANES IN A ONE HOUR PERIOD A FLAGGER SHALL BE PROVIDED AND THE FLAGGER. SIGN SHALL BE USED (AT 500 FT. IN ADVANCE).
4. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

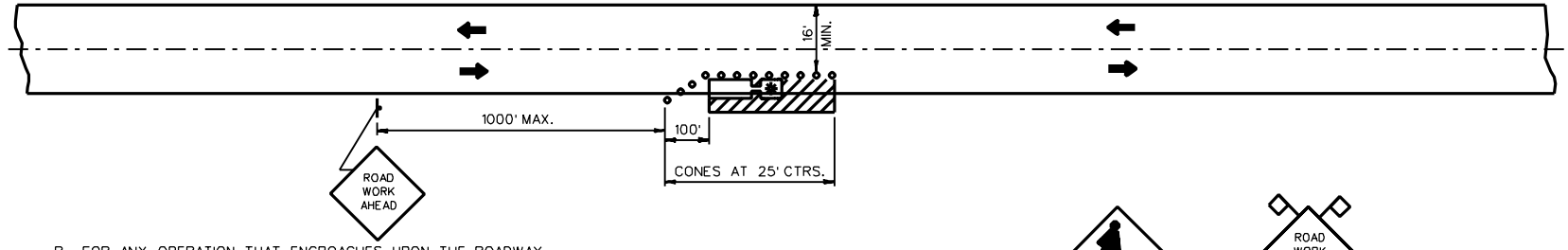
* WORK VEHICLE (IF USED) SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

CASE A3

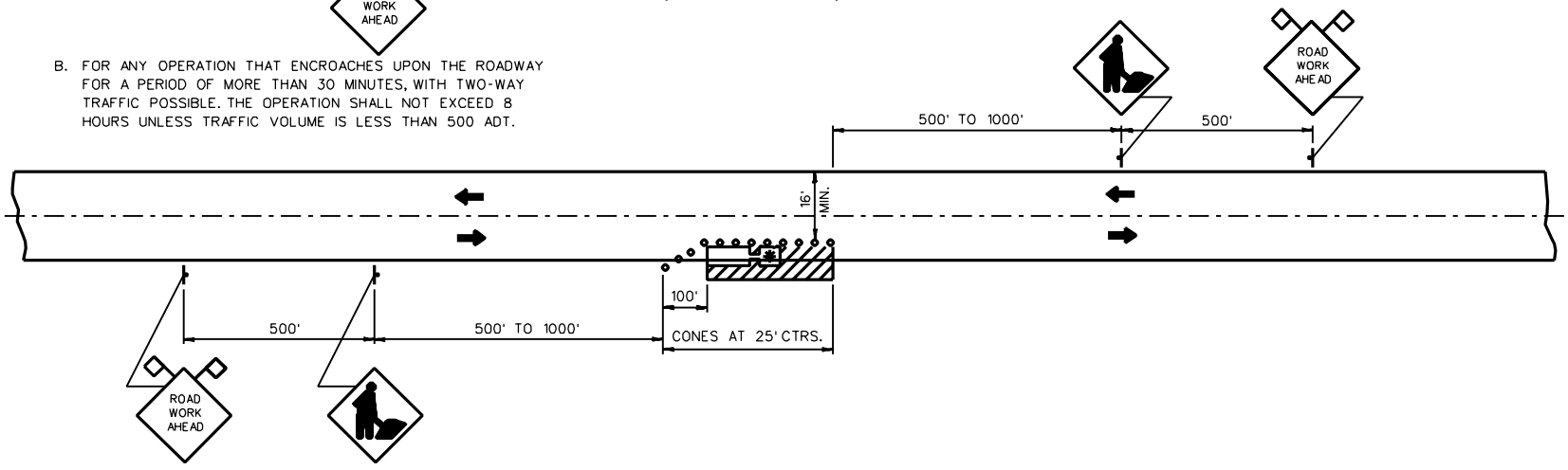
TWO-LANE, TWO-WAY TRAFFIC.
DAY OR NIGHT OPERATIONS.
(STATIONARY)

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE AREA BETWEEN 2 FT. AND 15 FT. FROM THE EDGE OF PAVEMENT.

A. FOR ANY OPERATION THAT ENCROACHES UPON THE ROADWAY FOR A PERIOD OF LESS THAN 30 MINUTES, WITH TWO-WAY TRAFFIC POSSIBLE.



B. FOR ANY OPERATION THAT ENCROACHES UPON THE ROADWAY FOR A PERIOD OF MORE THAN 30 MINUTES, WITH TWO-WAY TRAFFIC POSSIBLE. THE OPERATION SHALL NOT EXCEED 8 HOURS UNLESS TRAFFIC VOLUME IS LESS THAN 500 ADT.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN)
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- CONES

GENERAL NOTES

1. IF THE WORK OPERATION REQUIRES THAT FOUR OR MORE WORK VEHICLES ENTER THE THROUGH TRAFFIC LANES IN A ONE HOUR PERIOD A FLAGGER SHALL BE PROVIDED AND THE FLAGGER SIGN SHALL BE USED OR SUBSTITUTED FOR THE SECOND ROAD WORK AHEAD SIGN.
2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE "A").
3. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.
4. IF IT BECOMES NECESSARY TO OPERATE ONE LANE TRAFFIC, CASE A6 OR CASE A11 SHALL APPLY AS APPROPRIATE.

✱ WORK VEHICLE SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

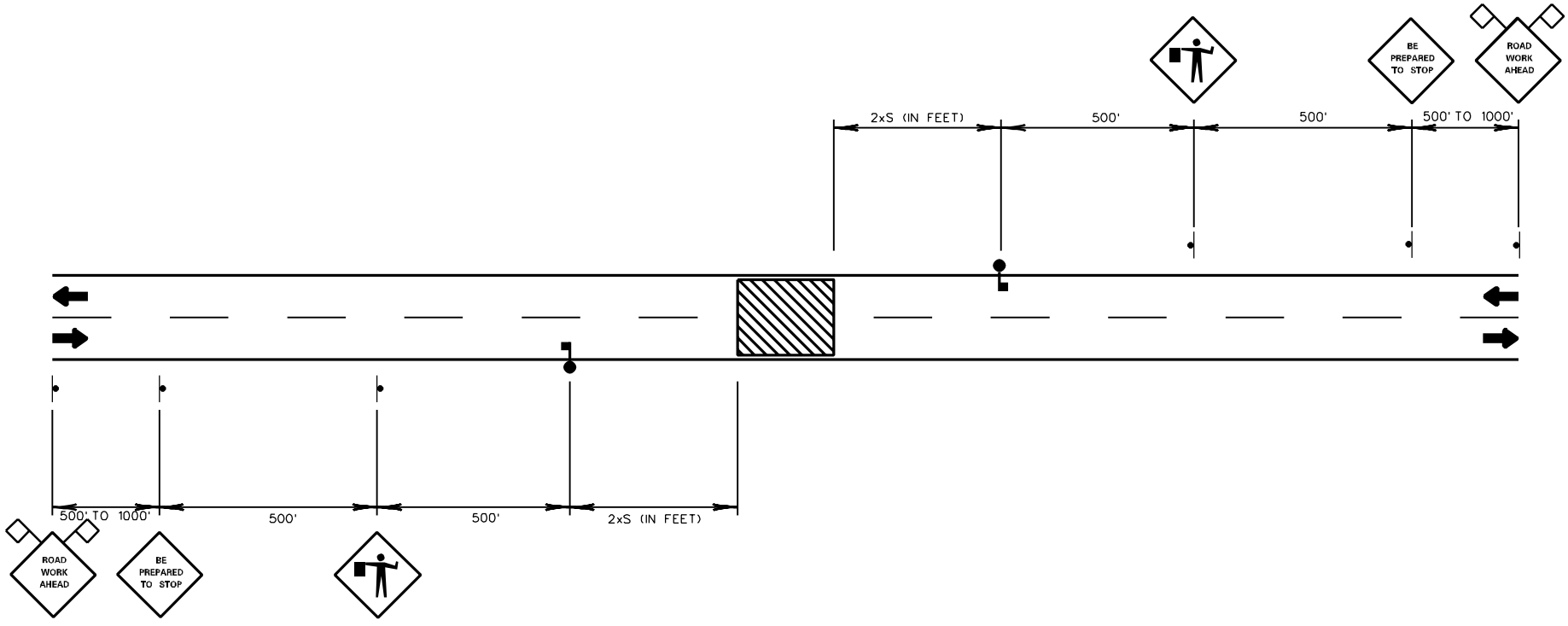
TYPICAL APPLICATIONS

SIGNING OPERATIONS.
MAINTENANCE OPERATIONS.
GUARDRAIL MAINTENANCE.
SIGNAL AND LIGHTING MAINTENANCE.
UTILITY OPERATIONS.

CASE A4

TWO-LANE, TWO-WAY TRAFFIC,
DAY OR NIGHT OPERATIONS.
FOR LESS THAN 30 MINUTES
OR FOR LESS THAN 500 ADT

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH UPON THE ROADWAY, MAINTAINING TWO-WAY TRAFFIC



SYMBOLS

WORK AREA.

SIGN ON PORTABLE OR PERMANENT SUPPORT.

FLAGGER WITH PADDLE.

GENERAL NOTES

1. CONDITIONS REPRESENTED ARE FOR WORK THAT REQUIRES CLOSINGS DURING DAYTIME HOURS ONLY.
2. THIS APPLICATION IS INTENDED FOR A PLANNED SHORT TIME CLOSING.
3. THE FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES.

S- POSTED SPEED OFF-PEAK 85th PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED IN MPH.

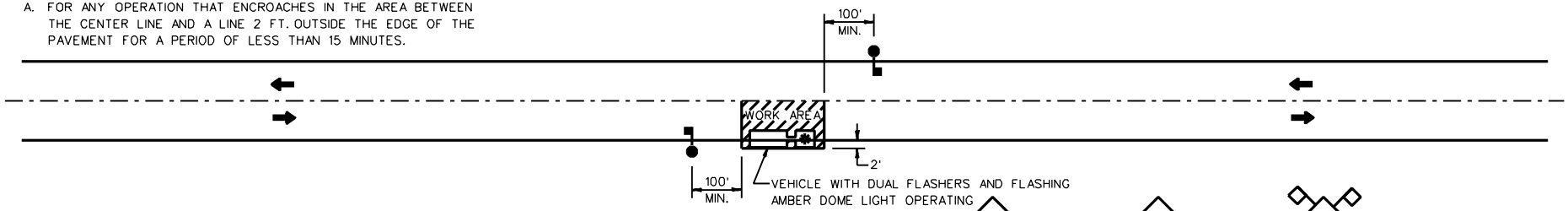
TYPICAL APPLICATIONS

SHORT TERM CLOSING
SHORT TERM UTILITY CROSSING FOR TWO OR THREE LANE ROADWAYS
HAUL ROADS

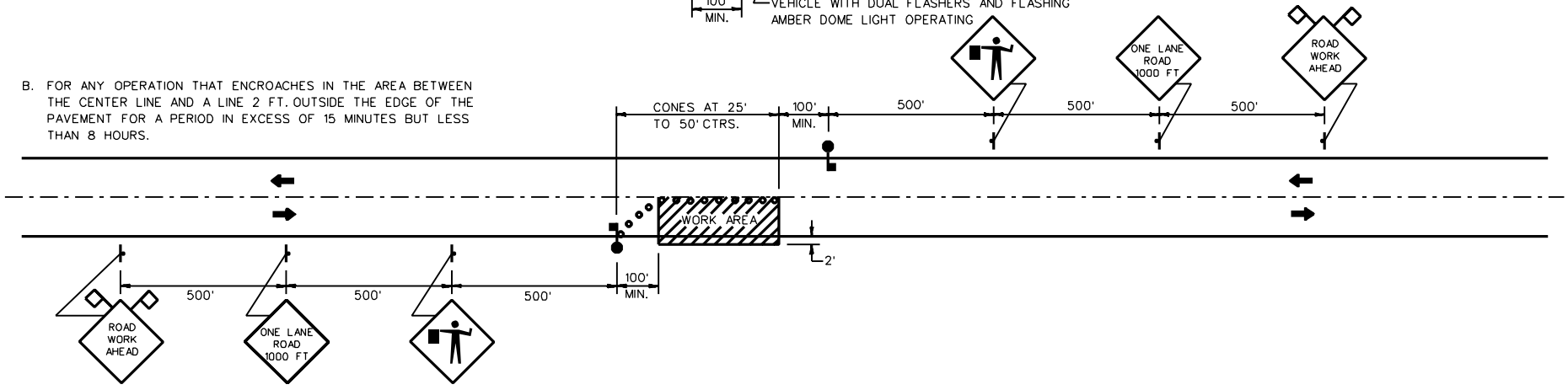
CASE A5

TWO-LANE, TWO-WAY TRAFFIC.
SHORT TERM OPERATIONS.
DAYTIME ONLY.

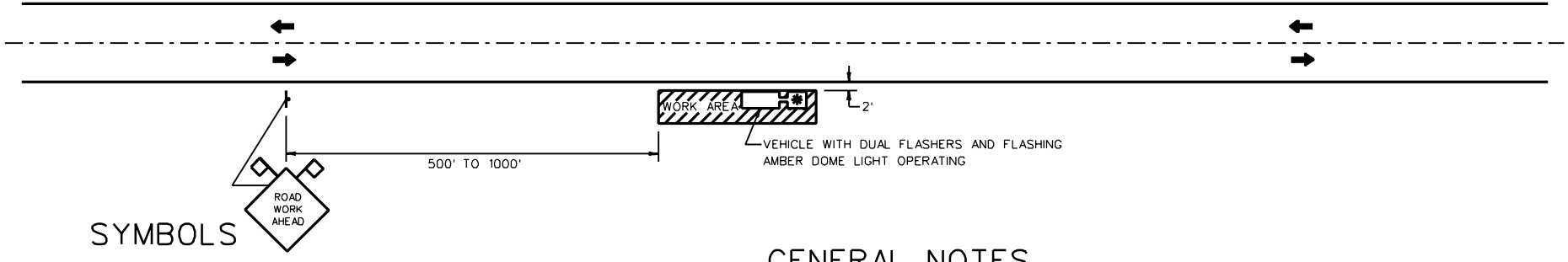
A. FOR ANY OPERATION THAT ENCROACHES IN THE AREA BETWEEN THE CENTER LINE AND A LINE 2 FT. OUTSIDE THE EDGE OF THE PAVEMENT FOR A PERIOD OF LESS THAN 15 MINUTES.



B. FOR ANY OPERATION THAT ENCROACHES IN THE AREA BETWEEN THE CENTER LINE AND A LINE 2 FT. OUTSIDE THE EDGE OF THE PAVEMENT FOR A PERIOD IN EXCESS OF 15 MINUTES BUT LESS THAN 8 HOURS.



C. FOR ANY OPERATION THAT IS MORE THAN 2 FT. OUTSIDE THE EDGE OF THE PAVEMENT FOR A PERIOD OF LESS THAN 60 MINUTES.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE.
- CONES

TYPICAL APPLICATIONS

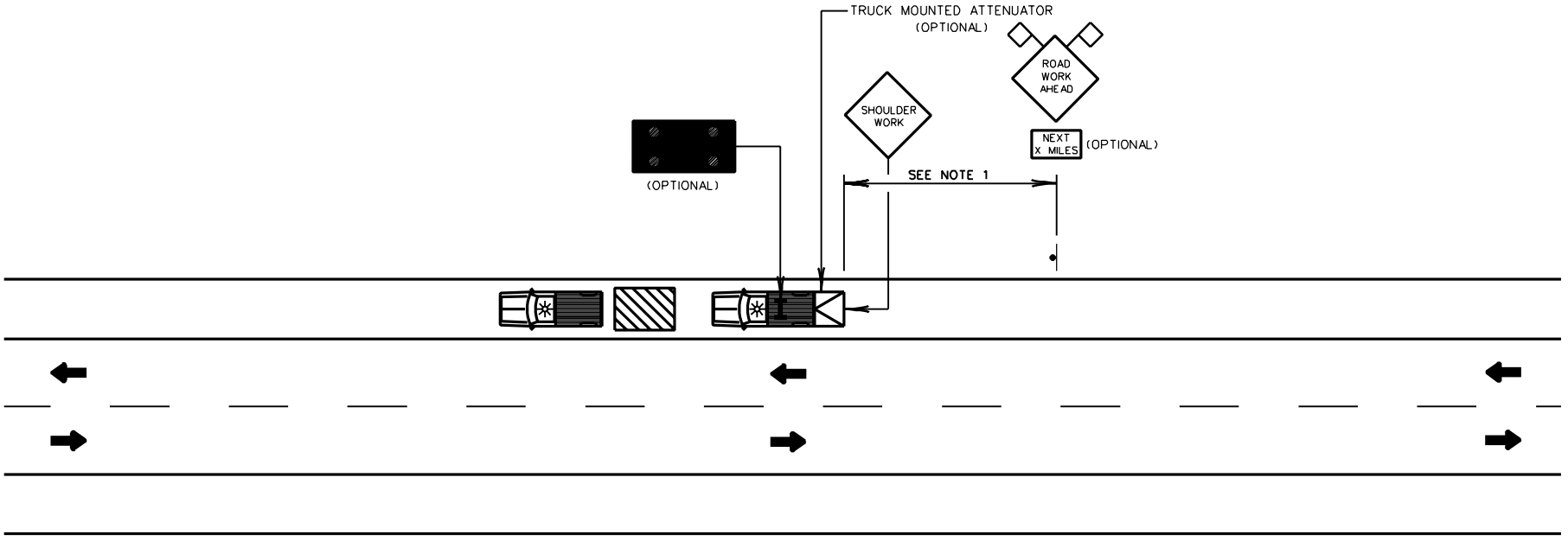
PATCHING PAVEMENT.
FIELD SURVEY.
CLEANING UP DEBRIS ON PAVEMENT.
CROSSWALK PAINTING.

GENERAL NOTES

1. CONSTRUCTION OPERATIONS SHALL BE CONFINED TO ONE TRAFFIC LANE, LEAVING THE OPPOSITE LANE OPEN TO TRAFFIC. AT LEAST 500 FT. OF BOTH TRAFFIC LANES SHALL BE AVAILABLE FOR TRAFFIC MOVEMENT AT INTERVALS NOT GREATER THAN 1,000 FT. A COMPLETE TRAFFIC CONTROL PLAN MUST BE APPROVED FOR ANY PROJECT EXPECTING TO EXCEED 1,000 FT. IN LENGTH INCLUDING BOTH TAPER AND WORK AREAS.
2. THE FLAGGER SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES.
3. ALL SIGNS ARE TO BE REMOVED AT COMPLETION OF THE DAY'S OPERATIONS.
4. FOR MULTILANE DIVIDED ROADWAYS THE ADVANCE WARNING SIGNS FOR TRAFFIC APPROACHING FROM THE OPPOSITE DIRECTION MAY BE OMITTED IF APPROVED BY THE ENGINEER.
5. WHEN WORKING TWO FEET OR MORE OFF THE EDGE OF PAVEMENT FOR LESS THAN FIFTEEN MINUTES NO SIGNING IS REQUIRED.

CASE A6

TWO-LANE, TWO-WAY TRAFFIC
SHORT-TIME OPERATIONS
DAYTIME ONLY



SYMBOLS

SIGN ON PORTABLE OR PERMANENT SUPPORT.

FLASHING VEHICLE LIGHT

GENERAL NOTES

1. IN THOSE SITUATIONS WHERE MULTIPLE WORK LOCATIONS WITHIN A LIMITED DISTANCE MAKE IT PRACTICABLE TO PLACE STATIONARY SIGNS, THE MAXIMUM SPACING FOR THE ADVANCE WARNING SIGN IS 5 MILES IN ADVANCE OF THE WORK.

2. THE LENGTH OF ACTIVITY AREA SIGN (G20-1) MAY BE USED AS THE STATIONARY ADVANCE WARNING SIGN IF THE WORK LOCATIONS OCCUR OVER A DISTANCE OF MORE THAN 2 MILES.

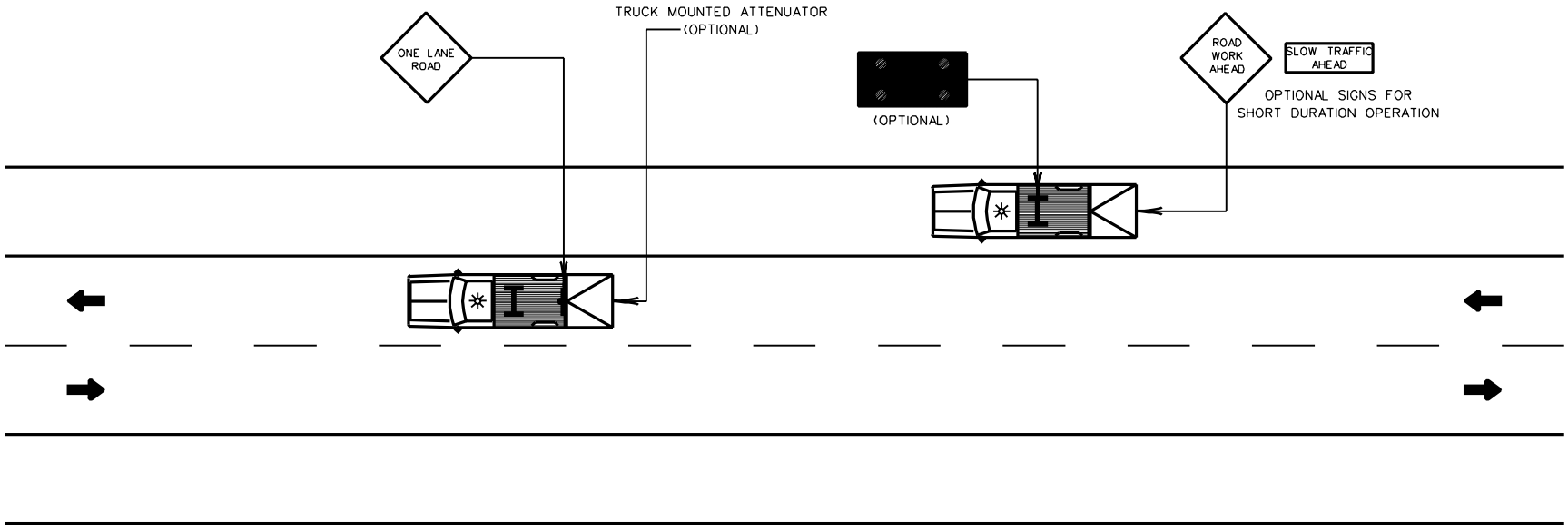
3. THE WARNING SIGN(S) ARE NOT REQUIRED IF THE WORK VEHICLE DISPLAYS A FLASHING OR REVOLVING YELLOW LIGHT, IF THE DISTANCE BETWEEN WORK LOCATIONS IS A MILE OR MORE, AND IF THE WORK VEHICLE TRAVELS AT TRAFFIC SPEEDS BETWEEN LOCATIONS.

TYPICAL APPLICATIONS

SHOULDER REPAIR

CASE A7

MOBILE OPERATION ON SHOULDER



SYMBOLS

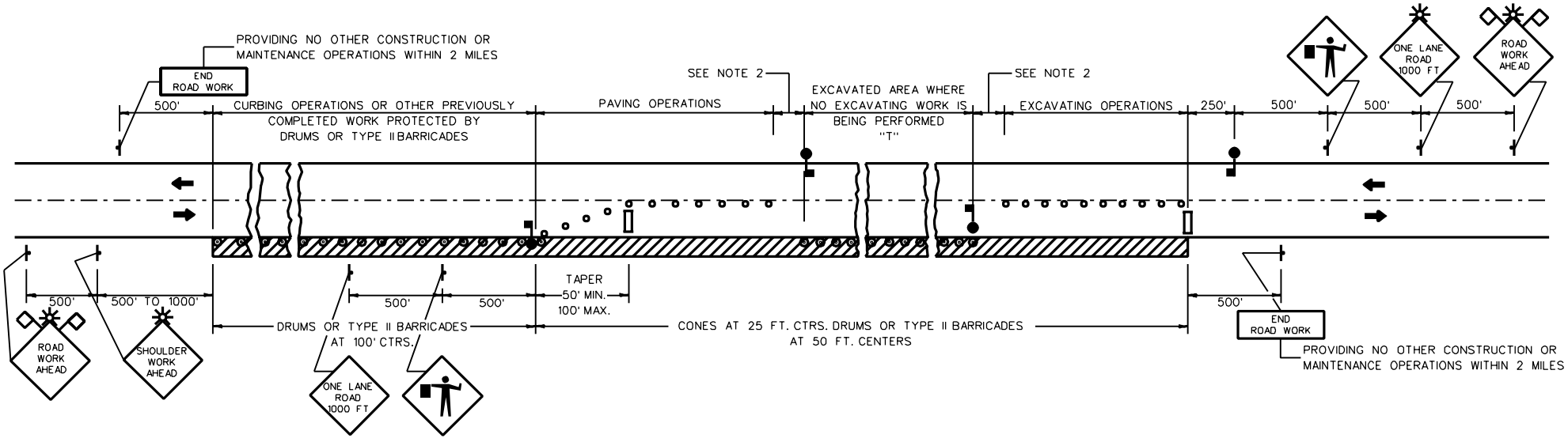
TYPICAL APPLICATIONS

GENERAL NOTES

1. WHERE PRACTICABLE AND WHEN NEEDED, THE WORK AND PROTECTION VEHICLES SHOULD PULL OVER PERIODICALLY TO ALLOW TRAFFIC TO PASS. IF THIS CAN BE DONE FREQUENTLY, AS AN ALTERNATIVE, A DO NOT PASS SIGN MAY BE PLACED ON THE REAR OF THE VEHICLE BLOCKING THE LANE.
2. THE DISTANCE BETWEEN THE WORK AND PROTECTION VEHICLES MAY VARY ACCORDING TO TERRAIN, PAINT DRYING TIME AND OTHER FACTORS. PROTECTION VEHICLES ARE USED TO WARN TRAFFIC OF THE OPERATION AHEAD. WHENEVER ADEQUATE STOPPING SIGHT DISTANCE EXISTS TO THE REAR, THE PROTECTION VEHICLE SHOULD MAINTAIN THE MINIMUM DISTANCE AND PROCEED AT THE SAME SPEED AS THE WORK VEHICLE. THE PROTECTION VEHICLE SHOULD SLOW DOWN IN ADVANCE OF VERTICAL OR HORIZONTAL CURVES WHICH RESTRICT SIGHT DISTANCE.
3. ADDITIONAL PROTECTION VEHICLES TO WARN AND REDUCE THE SPEED OF ONCOMING OR OPPOSING TRAFFIC MAY BE USED. POLICE PATROL CARS MAY BE USED FOR THIS PURPOSE.
4. THE USE OF IMPACT ATTENUATORS MOUNTED ON THE REAR OF PROTECTION VEHICLES AND/OR SLOW-MOVING WORK VEHICLES OPERATING IN THE TRAVELED WAY SHOULD BE CONSIDERED.
5. PROTECTION VEHICLES SHALL BE EQUIPPED WITH TWO HIGH-INTENSITY FLASHING LIGHTS MOUNTED ON REAR ADJACENT TO THE SIGN. PROTECTION AND WORK VEHICLES SHOULD DISPLAY FLASHING OR ROTATING BEACONS BOTH FORWARD AND TO THE REAR.
6. VEHICLE-MOUNTED SIGNS SHALL BE MOUNTED WITH THE BOTTOM OF THE SIGN AT A MINIMUM HEIGHT OF 4' ABOVE THE PAVEMENT. SIGN LEGENDS SHALL BE COVERED OR TURNED FROM VIEW WHEN WORK IS NOT IN PROGRESS.
7. ARROW PANELS SHALL BE AS A MINIMUM TYPE B, 60"X30".
8. WHERE A WIDE SHOULDER EXISTS, THE PROTECTION VEHICLE MAY DRIVE ON THE SHOULDER.

CASE A8

MOBILE OPERATIONS ON TWO-LANE ROAD



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN AND TYPE 'B' LIGHTS. SEE NOTE 8).
- CONES OR DRUMS. (TYPE II BARRICADES OPTIONAL) AS APPLICABLE
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE.
- TYPE III BARRICADE.
- CHANNELIZATION DEVICES (DRUMS OR CONES).

TYPICAL APPLICATIONS

PAVEMENT WIDENING.
SHOULDER WORK.

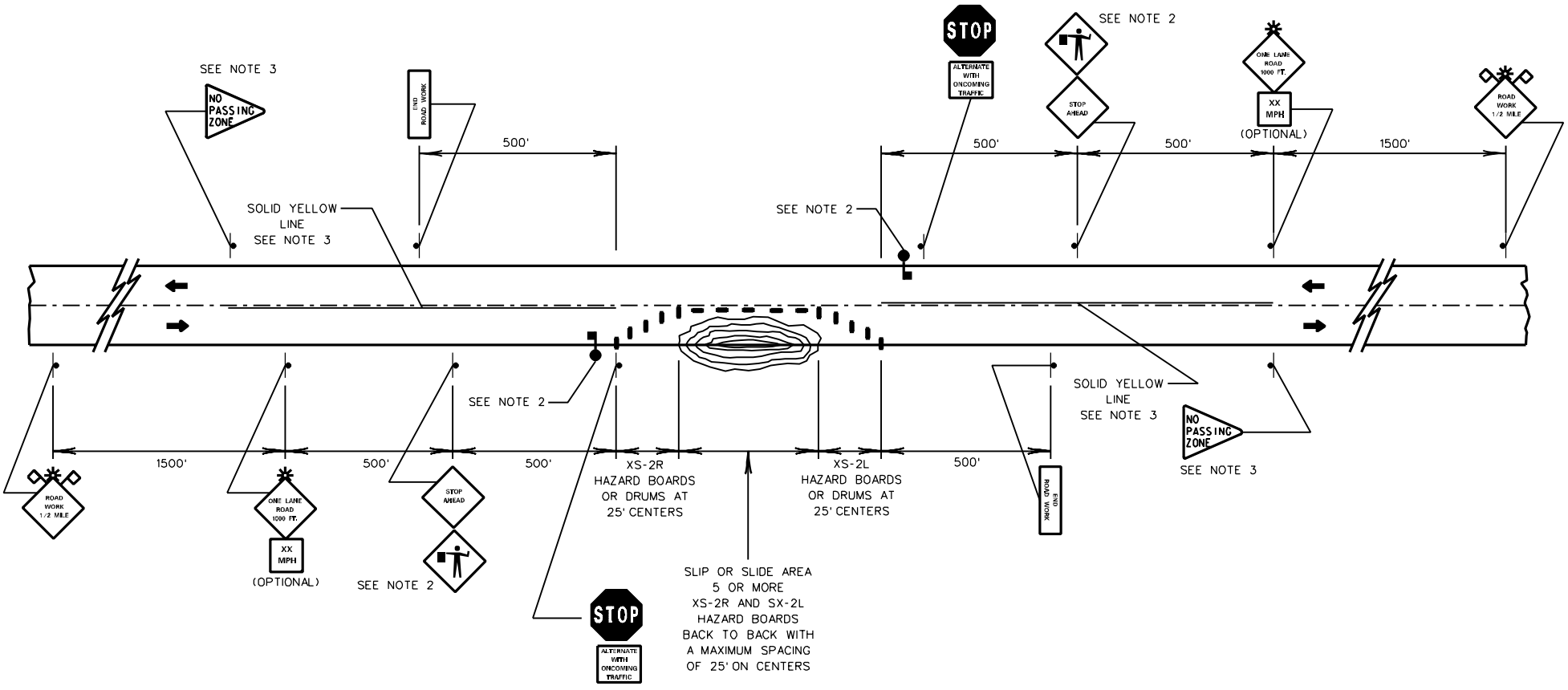
GENERAL NOTES

1. WHERE DISTANCE "T" EXCEEDS 1,500 FT. ADDITIONAL ONE LANE ROAD 1,000 FT., AND FLAGGER SIGNS (AS NECESSARY) SHALL BE INSTALLED. THE CONES, DRUMS, OR BARRICADES MAY BE REMOVED THROUGH THE "T" AREA, AN ADDITIONAL TAPER SHALL BE FORMED BY CONES OR DRUMS IN ADVANCE OF THE EXCAVATING OPERATIONS, ADDITIONAL FLAGGER WILL BE REQUIRED AND THE EXCAVATED AREA SHALL BE PROTECTED BY DRUMS OR TYPE II BARRICADES AT 50 FT. CENTERS.
2. MINIMUM DISTANCE IS 100 FT. WHEN "T" EXCEEDS 1,500 FT., DISTANCE SHALL BE 250 FT.
3. NO PAVING OR EXCAVATING OPERATIONS SHALL BE PERFORMED AT NIGHT UNLESS AUTHORIZED BY THE ENGINEER. WHEN THESE OPERATIONS ARE SUSPENDED ALL VEHICLES AND EQUIPMENT INCLUDING APPROPRIATE TRAFFIC CONTROL DEVICES SHALL BE REMOVED FROM THE PAVEMENT AND THE EXCAVATED AREA SHALL BE PROTECTED BY DRUMS OR TYPE II BARRICADES AT 50-FOOT CENTERS. ROAD WORK AHEAD AND SHOULDER WORK AHEAD SIGNS SHALL BE INSTALLED AS SHOWN TO PROTECT THE CURING OPERATIONS; ROAD WORK AHEAD AND ROAD WORK 1000 FT. SIGNS SHALL BE INSTALLED FOR TRAFFIC IN THE OPPOSITE DIRECTION.
4. CONSTRUCTION OPERATIONS SHALL BE CONFINED TO ONE TRAFFIC LANE AT A TIME LEAVING THE OPPOSITE LANE OPEN TO TRAFFIC. AT LEAST 500 FT. OF BOTH TRAFFIC LANES SHALL BE AVAILABLE FOR TRAFFIC MOVEMENT AT INTERVALS NOT GREATER THAN 1,500 FT. A COMPLETE TRAFFIC CONTROL PLAN MUST BE APPROVED FOR ANY PROJECT EXPECTED TO EXCEED 5,000 FT. IN LENGTH INCLUDING BOTH TAPER AND WORK AREA.
5. THE FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES.
6. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
7. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

CASE A9

TWO-LANE, TWO-WAY TRAFFIC
WIDENING OF PAVEMENT
DAY OR NIGHT OPERATIONS

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON THE PAVEMENT DURING PAVEMENT WIDENING OPERATIONS.



TYPICAL APPLICATIONS

SLIP AREA
SLIDE AREA

GENERAL NOTES

1. TO BE USED WHEN:
   A. TRAFFIC VOLUMES ARE SUCH THAT SUFFICIENT GAPS EXIST FOR TRAFFIC TO ALTERNATE WITH OUT EXTENSIVE BACKUPS (SAY 5 MINUTES).
   B. TRAFFIC APPROACH SPEEDS ARE SUCH THAT DRIVERS HAVE SUFFICIANT TIME TO STOP IN A SAFE MANNER TO INCLUDE ANY BACKUP EVENTS THAT MAY OCCUR.

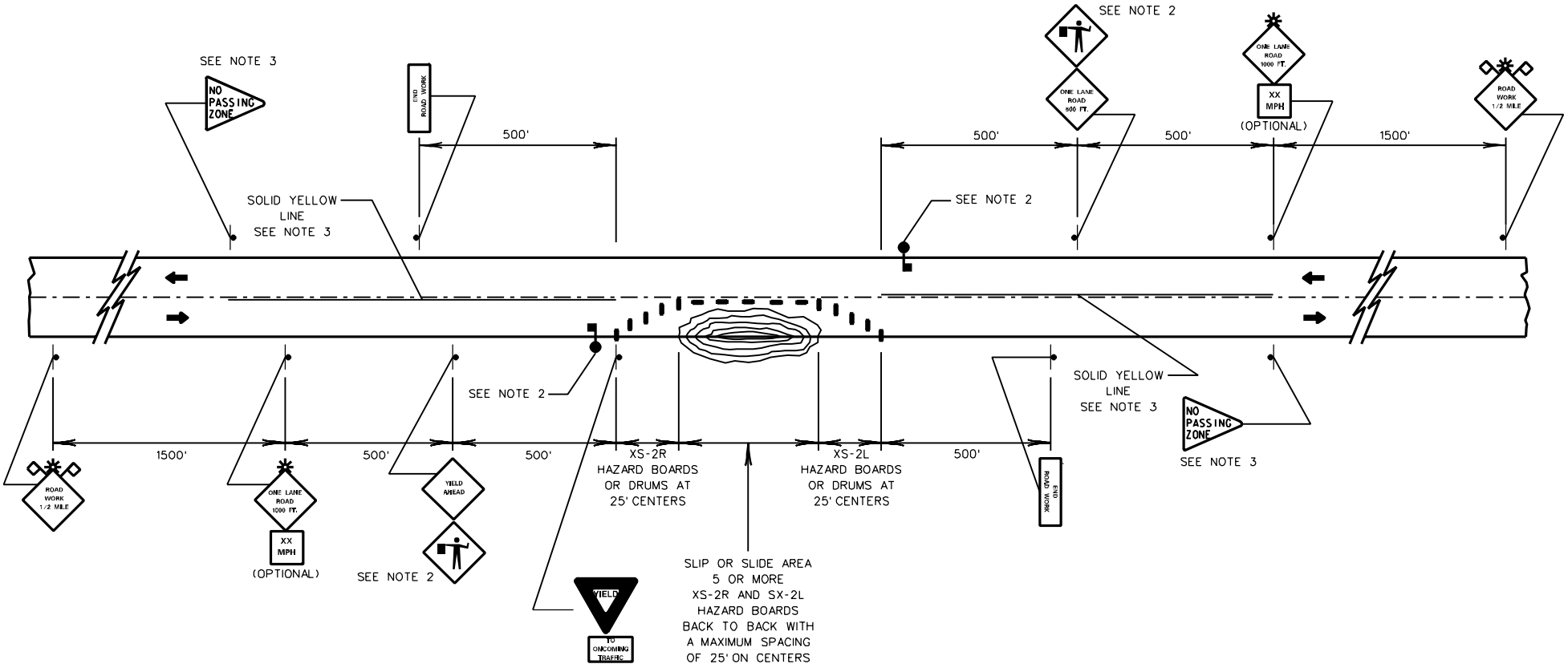
2. FLAGGERS MAY BE USED DURING DAYLIGHT WORKING HOURS BUT IF SO THEN:
   A. COVER BOTH STOP SIGNS
   B. SUBSITUTE FLAGGER SIGNS FOR BOTH STOP AHEAD SIGNS.

3. THE INSTALLATION OF THE YELLOW LINES AND NO PASSING ZONE SIGNS SHALL BE MADE IF THE ONE WAY CONDITION WILL EXIST FOR LONGER THAN 30 DAYS, OR IF DIRECTED BY THE ENGINEER.

CASE A10

TWO-LANE, TWO WAY TRAFFIC
DAY OR NIGHT OPERATION

WHERE A SLIP OR SLIDE RESULTS IN CLOSURE OF A LANE, RESULTING IN ONE-LANE TWO WAY TRAFFIC.



TYPICAL APPLICATIONS

SLIP AREA
SLIDE AREA

GENERAL NOTES

1. TO BE USED WHEN:
   A. TRAFFIC VOLUMES ARE SUCH THAT SUFFICIENT GAPS EXIST FOR TRAFFIC WHICH MUST YIELD.
   B. DRIVERS FROM BOTH DIRECTIONS MUST BE ABLE TO SEE APPROACHING TRAFFIC THROUGH AND BEYOND THE WORK SITE.

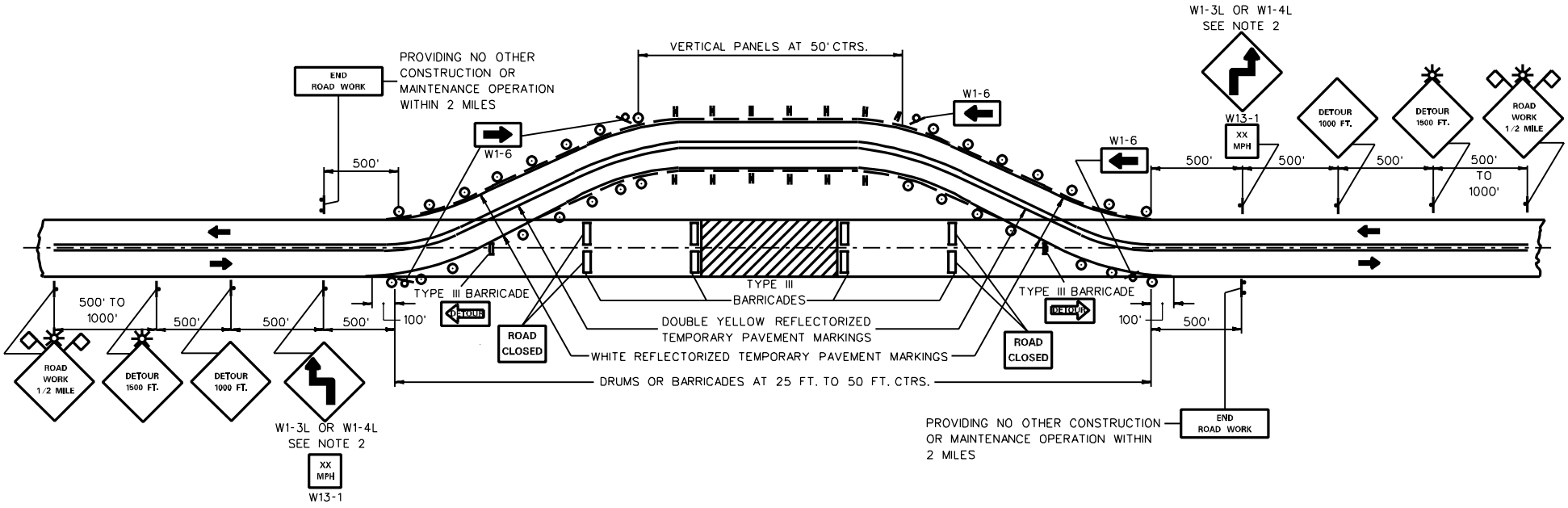
2. FLAGGERS MAY BE USED DURING DAYLIGHT WORKING HOURS BUT IF SO THEN:
   A. COVER YIELD SIGN
   B. SUBSITUTE FLAGGER SIGN FOR YIELD AHEAD SIGN.
   C. SUBSITUTE FLAGGER FOR ONE LANE ROAD 500 FT. SIGN.

3. THE INSTALLATION OF THE YELLOW LINES AND NO PASSING ZONE SIGNS SHALL BE MADE IF THE ONE WAY CONDITION WILL EXIST FOR LONGER THAN 30 DAYS, OR IF DIRECTED BY THE ENGINEER.

CASE A11

TWO-LANE, TWO WAY TRAFFIC
DAY OR NIGHT OPERATION

WHERE A SLIP OR SLIDE RESULTS IN CLOSURE OF A LANE, RESULTING IN ONE-LANE TWO WAY TRAFFIC.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED OR NOTED).
- TYPE III BARRICADES
- SIGN ON PORTABLE OR PERMANENT SUPPORT
- DRUM
- VERTICAL PANELS

GENERAL NOTES

1. ON PAVED RUNAROUNDS, PAVEMENT MARKINGS SHALL BE USED WHEN THE CLOSURE TIME EXCEEDS SEVEN DAYS OR WHEN THE NORMAL POSTED SPEED OUTSIDE THE AREA OF OPERATIONS EXCEEDS 50 M.P.H. TEMPORARY PAVEMENT MARKINGS (TAPE OR PAINT) SHALL BE USED FOR MARKING TEMPORARY CENTER LINES AND EDGE LINES ON PAVED RUNAROUNDS. ALL EXISTING MARKINGS WHICH CONFLICT WITH THE REVISED TRAFFIC PATTERN WILL BE ERADICATED ON THE PAVED RUNAROUNDS.
2. WHERE CROSSOVER SPEEDS ARE GREATER THAN 30 MPH, THE REVERSE CURVE (W1-4) SHALL BE USED. WHERE CROSSOVER SPEEDS ARE 30 MPH OR LESS, THE REVERSE TURN (W1-3) SHALL BE USED.
3. THE ADVISORY SAFE SPEED TO BE SHOWN BELOW THE REVERSE CURVE (TURN) SIGNS SHALL BE DETERMINED AT THE SITE AND APPROVED BY TRAFFIC ENGINEERING DIVISION.
4. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
5. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED, ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS NOTED IN THE PLANS OR AS DIRECTED BY THE ENGINEER.
6. TEMPORARY RAISED PAVEMENT MARKERS MAY BE USED TO SUPPLEMENT PAVEMENT MARKINGS ON THE DETOUR AND APPROACHES.

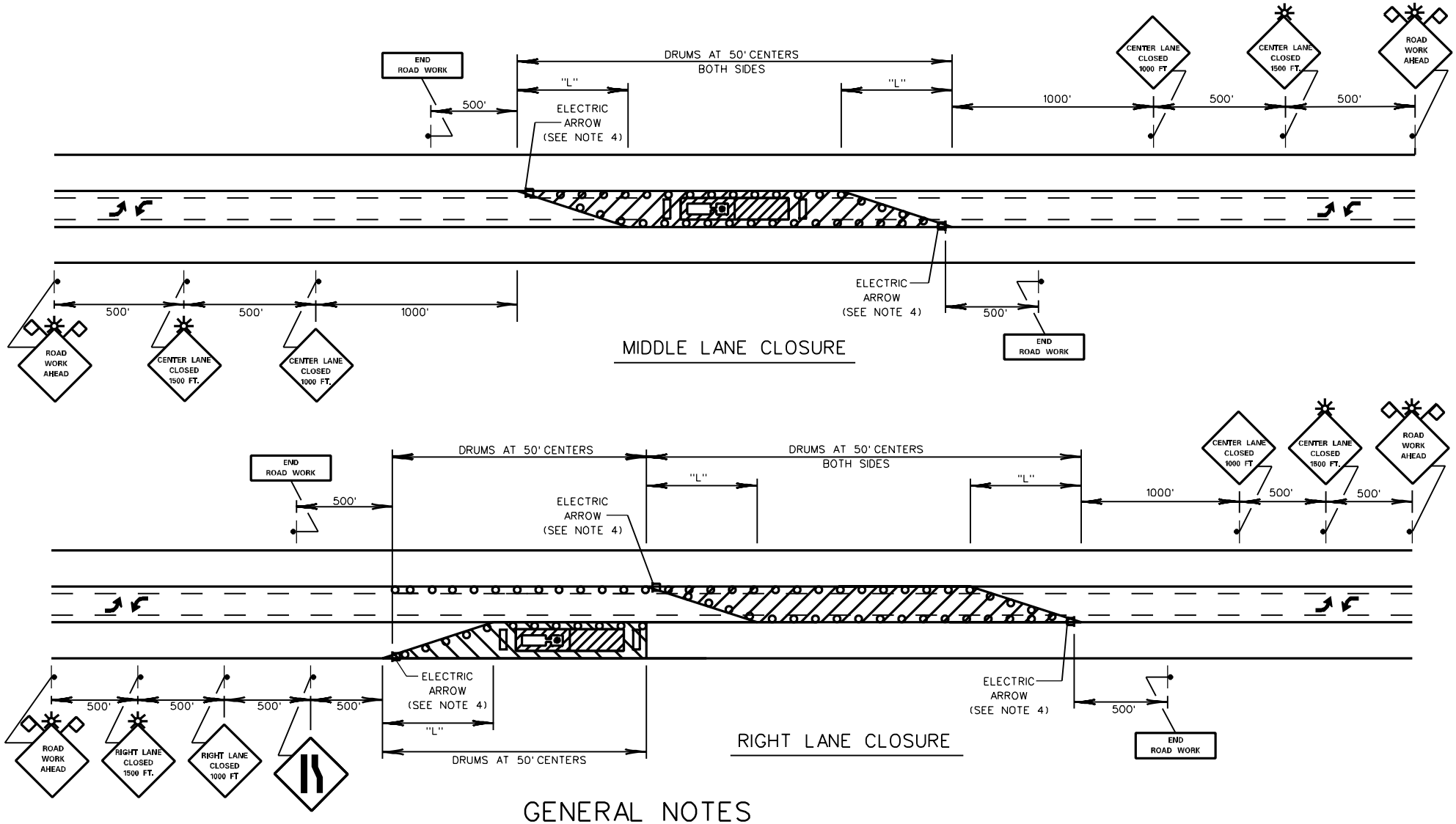
TYPICAL APPLICATIONS

BRIDGE CONSTRUCTION.
CULVERT CONSTRUCTION.

CASE A12

TWO-LANE, TWO-WAY TRAFFIC, TEMPORARY RUNAROUND, DAY OR NIGHT OPERATIONS.

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE THE CLOSURE OF BOTH LANES AND A TEMPORARY RUNAROUND IS CONSTRUCTED.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT AS REQUIRED.
- TYPE III BARRICADE
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUMS

TYPICAL APPLICATIONS

RESURFACING
PATCHING LEVELING
PAVEMENT MARKINGS

GENERAL NOTES

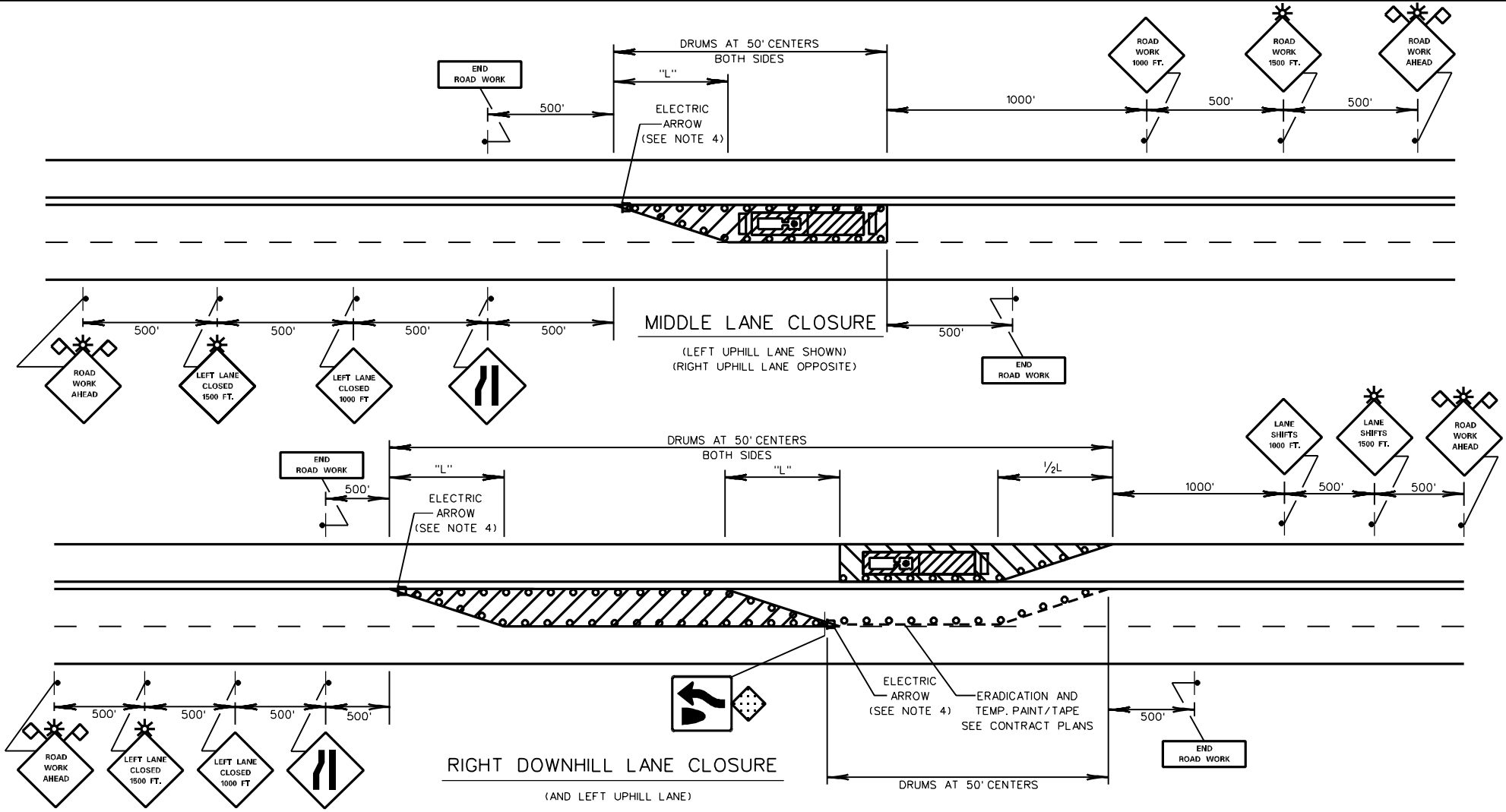
1. OVERNIGHT OPERATIONS ILLUSTRATED AND IF SUCH, USE DRUMS. FOR DAYLIGHT OPERATIONS ONLY, DELETE TYPE 'B' LIGHTS (MAY ALSO SUBSTITUTE CONES FOR DRUMS).
2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE 'A').
3. WHERE THE WORK ZONE EXTENDS THROUGH AN INTERSECTION, ADDITIONAL WARNING SIGNS AND TRAFFIC CONTROL (SUCH AS CASE A6) SHALL BE PROVIDED FOR THAT APPROACH.
4. FOR LOW SPEED ENVIROMENTS AND/OR FOR SHORT DURATION OPERATIONS, A FLAGGER - ADVANCE FLAGGER SIGN, AND R4-7A (KEEP RIGHT) OR R4-8A (KEEP LEFT) SIGN MAY BE SUBSTITUTED FOR THE ELECTRIC ARROW.

* WORK VEHICLE (IF USED) SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

SPEED	L-TAPER (IN FEET)
25	125
30	180
35	250
40	320
45	540
50	600
55	660

CASE A13

THREE LANE, DOUBLE LEFT TURN LANE, TWO-WAY TRAFFIC



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT AS REQUIRED.
- TYPE III BARRICADE
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUMS

TYPICAL APPLICATIONS

RESURFACING
PATCHING LEVELING
SLIDES

GENERAL NOTES

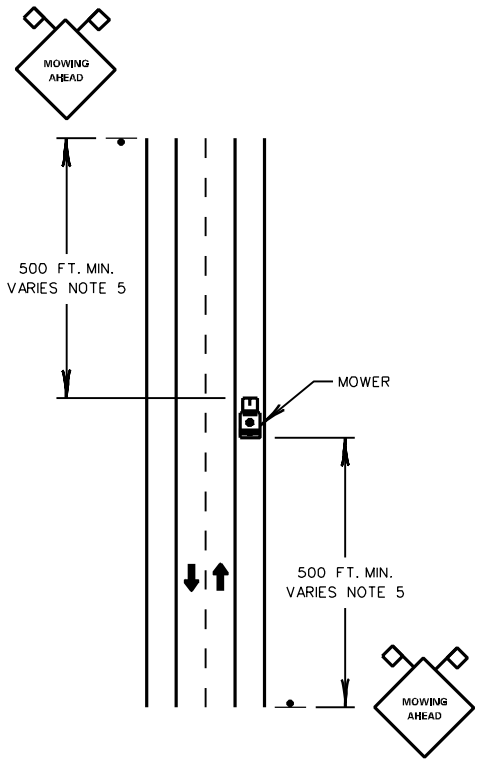
1. OVERNIGHT OPERATIONS ILLUSTRATED AND IF SUCH, USE DRUMS. FOR DAYLIGHT OPERATIONS ONLY, DELETE TYPE 'B' LIGHTS (MAY ALSO SUBSTITUTE CONES FOR DRUMS).
2. ANY UNATTACHED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE 'A').
3. WHERE THE WORK ZONE EXTENDS THROUGH AN INTERSECTION, ADDITIONAL WARNING SIGNS AND TRAFFIC CONTROL (SUCH AS CASE A6) SHALL BE PROVIDED FOR THAT APPROACH.
4. FOR LOW SPEED ENVIROMENTS AND/OR FOR SHORT DURATION OPERATIONS, A FLAGGER - ADVANCE FLAGGER SIGN, AND R4-7A (KEEP RIGHT) OR R4-8A (KEEP LEFT) SIGN MAY BE SUBSTITUTED FOR THE ELECTRIC ARROW.

* WORK VEHICLE (IF USED) SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

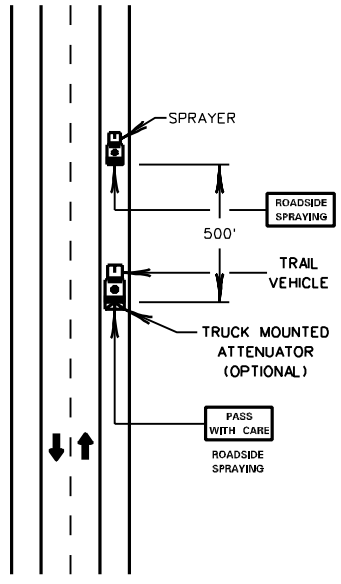
SPEED	L-TAPER (IN FEET)
25	125
30	180
35	250
40	320
45	540
50	600
55	660

CASE A14

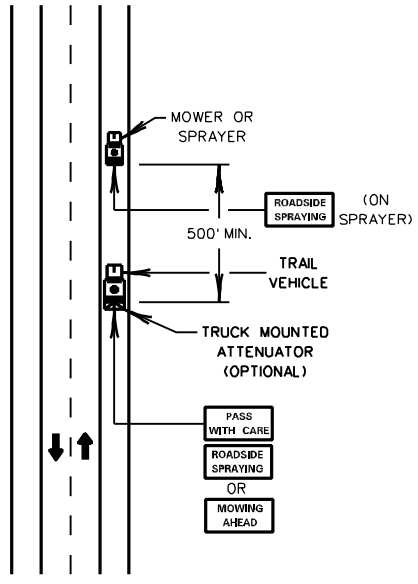
THREE LANE, CLIMBING LANE, TWO-WAY TRAFFIC



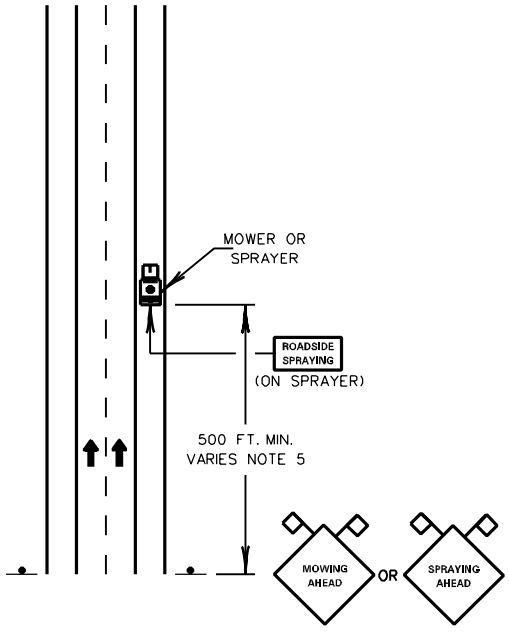
A. MOWING - NO ENCROACHMENT ON TRAVEL LANES; TWO LANE TWO WAY OPERATION



B. SPRAYING - NO ENCROACHMENT ON TRAVEL LANES; TWO LANE TWO WAY OPERATION



C. MOWING OR SPRAYING - ENCROACHMENT ON TRAVEL LANE; TWO LANE TWO WAY OPERATION



D. MOWING OR SPRAYING - NO ENCROACHMENT ON TRAVEL LANES; MULTILANE HIGHWAY

GENERAL NOTES

1. ALL WORK VEHICLES WILL BE EQUIPPED WITH 2 FLAGS AND ONE ROTATING HIGH INTENSITY AMBER LIGHT, AND THE SLOW MOVING TRIANGLE MOUNTED ON THE REAR OF THE VEHICLE. THIS APPLIES TO ALL CASES DURING DAY TIME OPERATIONS.

2. WHERE THE SHOULDER AREA TO BE MOWED OR SPRAYED PERMITS, 48" X 48" WARNING SIGNS SHOULD BE USED IN LIEU OF 36" X 36" SIGNS. THE OTHER SIGNS SHALL BE 54" X 30".

3. WHERE PRACTICABLE AND WHEN NEEDED, THE WORK AND PROTECTION VEHICLES SHOULD PULL OVER PERIODICALLY TO ALLOW TRAFFIC TO PASS. IF THIS CAN BE DONE FREQUENTLY, A "DO NOT PASS" SIGN MAY BE PLACED ON THE TRAIL VEHICLE INSTEAD OF "PASS WITH CARE. THE TRAIL VEHICLE WILL NORMALLY MAINTAIN VISUAL CONTACT WITH THE WORK VEHICLE (APPROXIMATELY 500 FT.) EXCEPT ON CURVES, IN WHICH CASE THE TRAIL VEHICLE WILL DROP BACK FURTHER SO THAT APPROACHING TRAFFIC WILL SEE THAT THEIR LANE IS BLOCKED.

4. ON LOW TRAFFIC VOLUME ROADS WITH LOWER OPERATING SPEEDS, THE SUPERVISOR MAY USE DETAIL A ABOVE AT HIS DISCRETION EVEN THOUGH THERE ARE SOME TRAVEL LANE ENCROUCHMENTS.

5. MAXIMUM DISTANCE TO BE MOWED OR SPRAYED WITHIN THE SIGNS SHALL BE WHICHEVER IS LESS; ½ DAYS MOWING, 3 MILES ON 2 LANES, OR 5 MILES ON MULTILANES.

6. FOR MEDIAN DIVIDED HIGHWAYS, THE SHOULDER SIGNS SHALL BE PLACED ON BOTH THE RIGHT AND LEFT SIDE OF ROADWAY EVEN THOUGH THE MOWER OR SPRAYER MAY ONLY BE ON ONE SIDE.

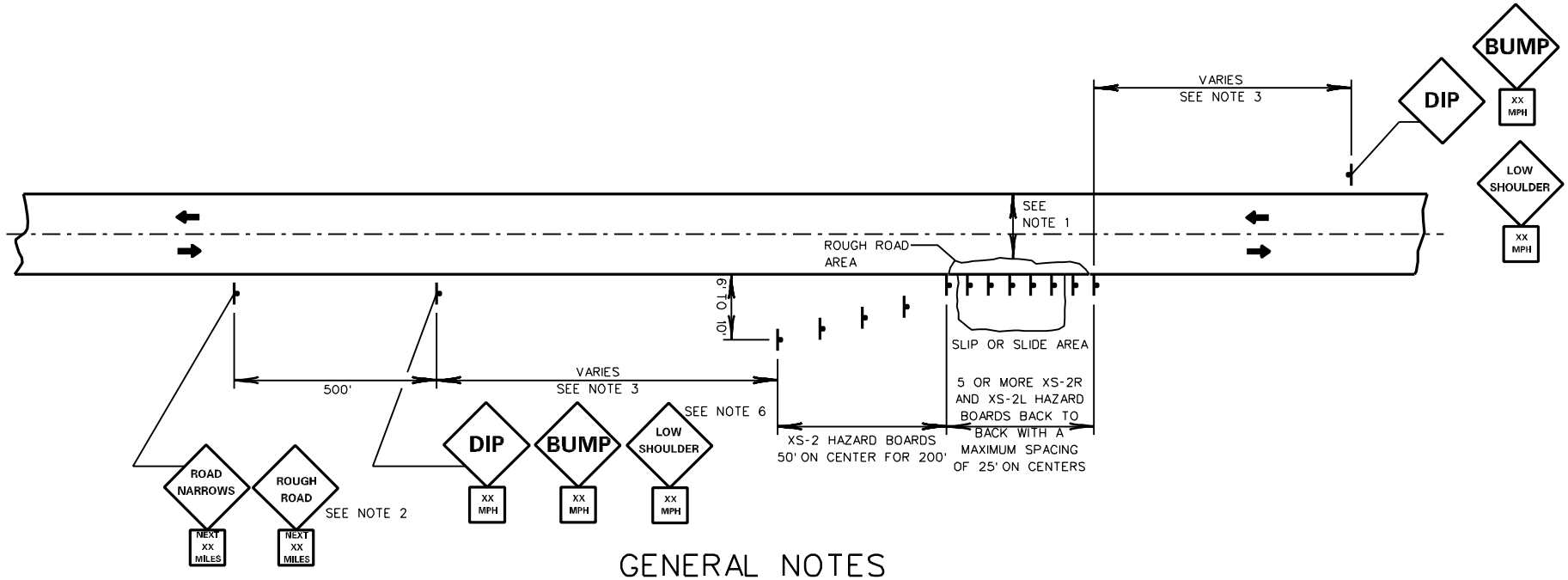
TYPICAL APPLICATION

MOWING OPERATION
SPRAYING (HERBICIDE) OPERATION

CASE A15

MOVING OPERATION
DAY OPERATION ONLY

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE AN INTERMITTENT OR CONTINUOUS MOVING OPERATION ON THE SHOULDER



GENERAL NOTES

1. WHEN CONDITIONS REQUIRE THAT ONE LANE TRAFFIC OPERATE, CASE A10 OR CASE A11 SHALL APPLY. ALSO A 16' MINIMUM ROADWAY WIDTH IS REQUIRED. IF WIDTH IS LESS THAN 16' THEN CASE A10 OR CASE A11 APPLIES.

2. WHEN A SERIES OF SLIPS AND SLIDES ARE PRESENT ON A ROADWAY, THE ROUGH ROAD SIGN CAN BE USED WITH A PLAQUE SHOWING THE LENGTH OF ROADWAY UNDER THESE CONDITIONS. ROAD NARROWS SIGN MAY BE SUBSTITUTED FOR ROUGH ROAD SIGN WHEN CONDITIONS WARRANT.

3. THE DISTANCE IN ADVANCE OF THE SLIDE OR SLIP TO BE USED FOR THE PLACEMENT OF THE WARNING SIGN IS RELATED TO THE APPROACH SPEED AND THE ADVISORY SPEED THROUGH THE SLIDE OR SLIP AREA. THE FOLLOWING CHART IS TO BE USED TO FIND THE MINIMUM DISTANCE TO THE WARNING SIGN.

SPEED REDUCTION M.P.H.	DISTANCE TO WARNING SIGN FEET (MIN.)
10	250
15	275
20	300
25	325
30	350
35	375
40	425
45	500
50	550

4. IF CONDITIONS EXIST IN BOTH LANES OR ON BOTH SIDES OF ROADWAY, THE HAZARD BOARDS (XS-2) SHALL BE INSTALLED ON BOTH SIDES OF ROADWAY.

5. THE ADVISORY SPEED THROUGH THE AREA SHOULD BE DETERMINED BY TEST RUNS THROUGH THE AREA.

6. THE DIP SIGN SHALL BE USED FOR A DEPRESSION. THE BUMP SIGN SHALL BE USED FOR A SHARP RISE IN THE PAVEMENT. THE LOW SHOULDER SIGN SHALL BE USED WHEN SHOULDER AREA IS LOWER THAN THE PAVEMENT CREATING A HAZARDOUS CONDITION OTHER THAN A DIP OR BUMP.

TYPICAL APPLICATIONS

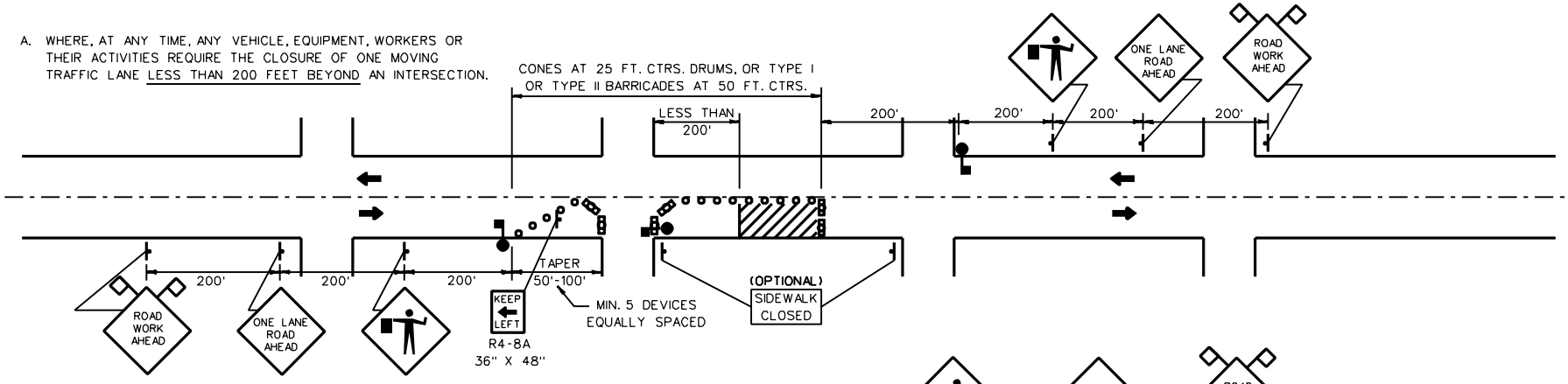
SLIP AREA
SLIDE AREA
LOW SHOULDER

CASE A16

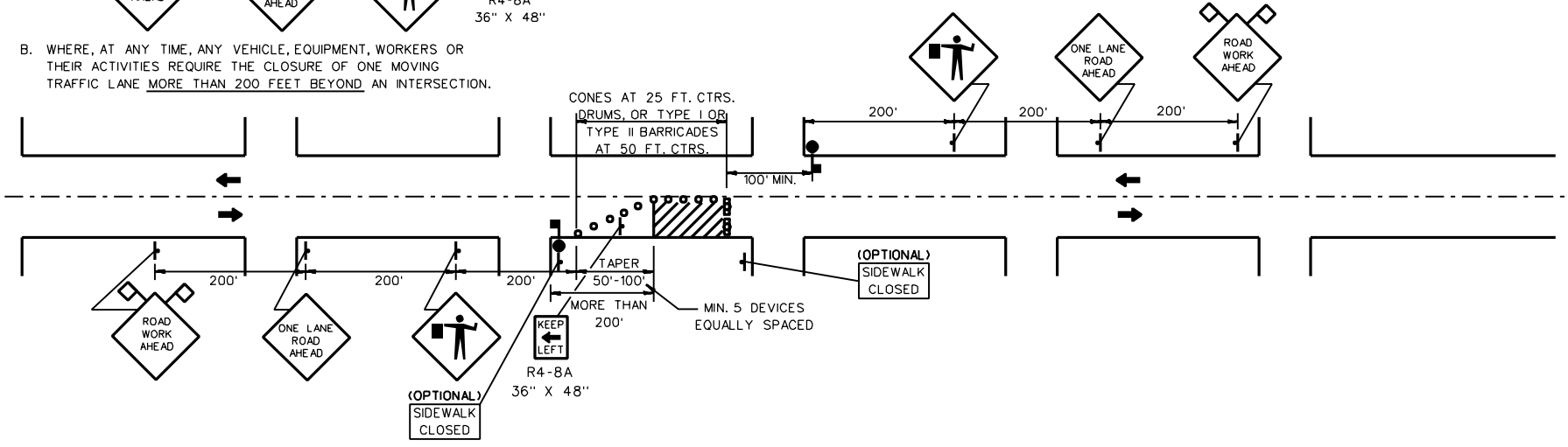
TWO-LANE, TWO-WAY TRAFFIC
DAY OR NIGHT OPERATION

WHERE A SLIP OR SLIDE RESULTS IN CLOSURE OF A SHOULDER AREA. ROADWAY WIDTH IS SUFFICENT FOR TWO WAY TRAFFIC.

A. WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE THE CLOSURE OF ONE MOVING TRAFFIC LANE LESS THAN 200 FEET BEYOND AN INTERSECTION.



B. WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE THE CLOSURE OF ONE MOVING TRAFFIC LANE MORE THAN 200 FEET BEYOND AN INTERSECTION.



SYMBOLS

- TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHT (TYPE "A").
- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN).
- CONES OR DRUMS (TYPE II BARRICADES OPTIONAL).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE.

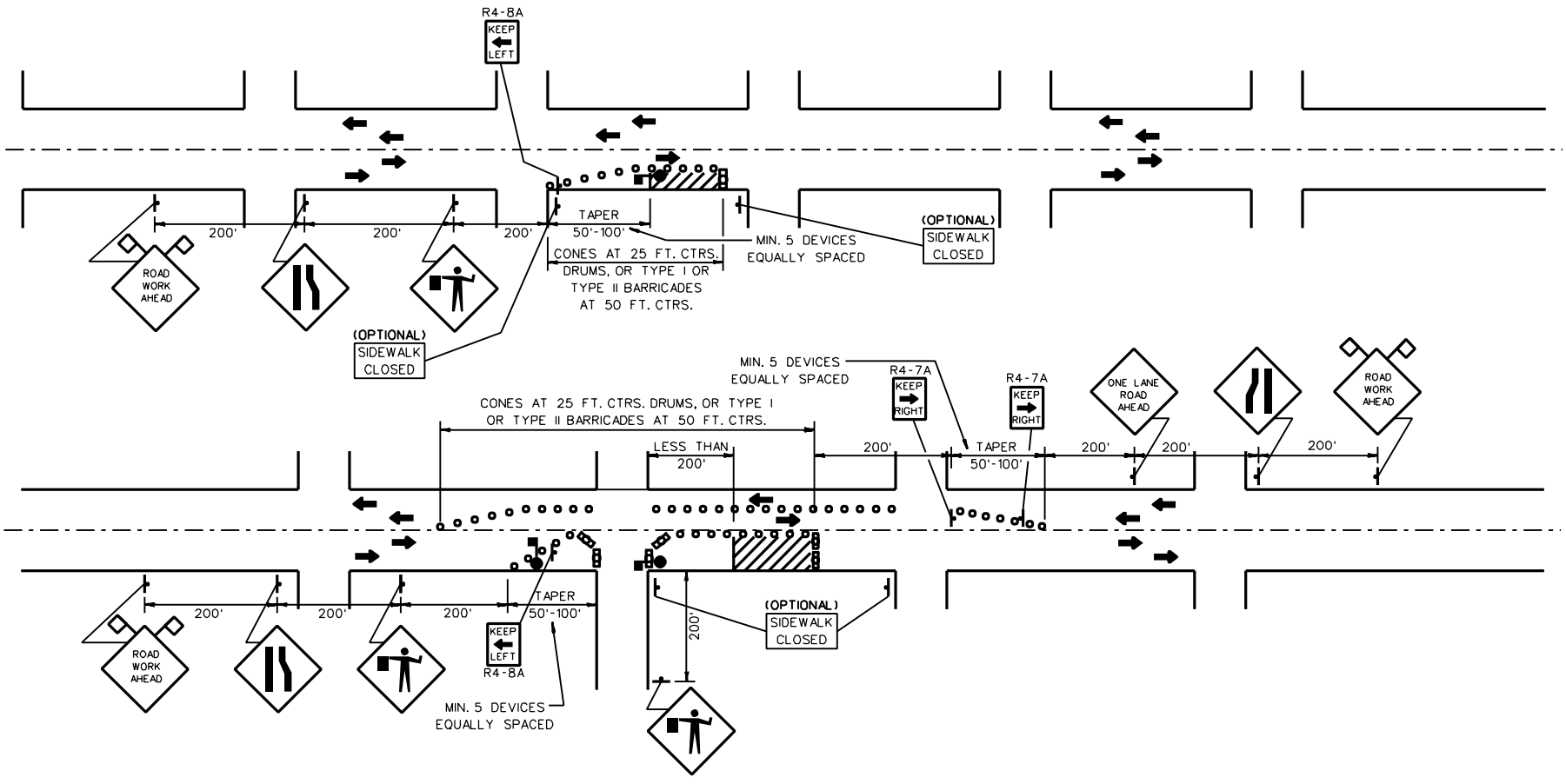
GENERAL NOTES

1. DRUMS OR TYPE II BARRICADES SHALL BE USED IN LIEU OF CONES FOR NIGHT OPERATIONS.
2. IF THE WORK OPERATION PERFORMED DOES NOT EXCEED 15 MINUTES, SIGNING SHALL BE IN CONFORMANCE WITH CASE A6.
3. WHERE THE WORK AREA EXTENDS THROUGH THE INTERSECTION, BARRICADES AND/OR ADEQUATE WARNING SIGNS SHALL BE ERECTED ON THE CROSS STREET.
4. IF THE WORK AREA IS IN THE PARKING LANE A ROAD WORK AHEAD SIGN SHALL BE INSTALLED 200 FT. IN ADVANCE OF THE WORK AREA AND THE WORK AREA PROTECTED WITH CONES, DRUMS OR BARRICADES.
5. CONSTRUCTION OPERATIONS SHALL BE CONFINED TO ONE TRAFFIC LANE, LEAVING THE OPPOSITE LANE OPEN TO TRAFFIC. AT LEAST 500 FT. OF BOTH TRAFFIC LANES SHALL BE AVAILABLE FOR TRAFFIC MOVEMENT AT INTERVALS NOT GREATER THAN 1,000 FT.
6. THE FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES.
7. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
8. FOR NIGHT OPERATIONS FLASHING LIGHTS SHALL BE INSTALLED ABOVE THE FIRST TWO SIGNS ON EACH APPROACH. (TYPE "B").
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 ENGINEER.

CASE B1

TWO-LANE, TWO-WAY TRAFFIC
UNDIVIDED, URBAN, DAY OR NIGHT OPERATIONS

WHERE, AT ANY TIME, ANY VEHICLE EQUIPMENT, WORKERS OR THEIR ACTIVITIES ENCROACH ON THE PAVEMENT REQUIRING THE CLOSURE OF ONE TRAFFIC LANE.



SYMBOLS

- TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHT (TYPE "A").
- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN).
- CONES OR DRUMS (TYPE II BARRICADES OPTIONAL).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE.

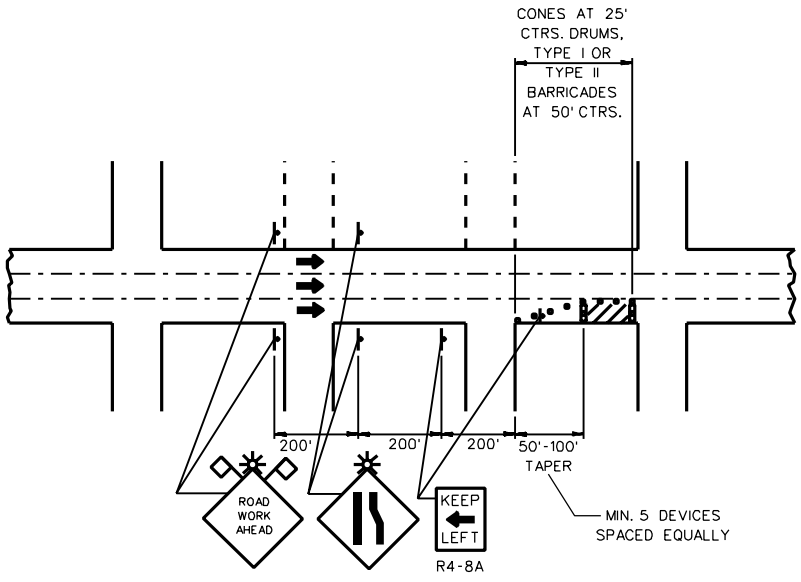
GENERAL NOTES

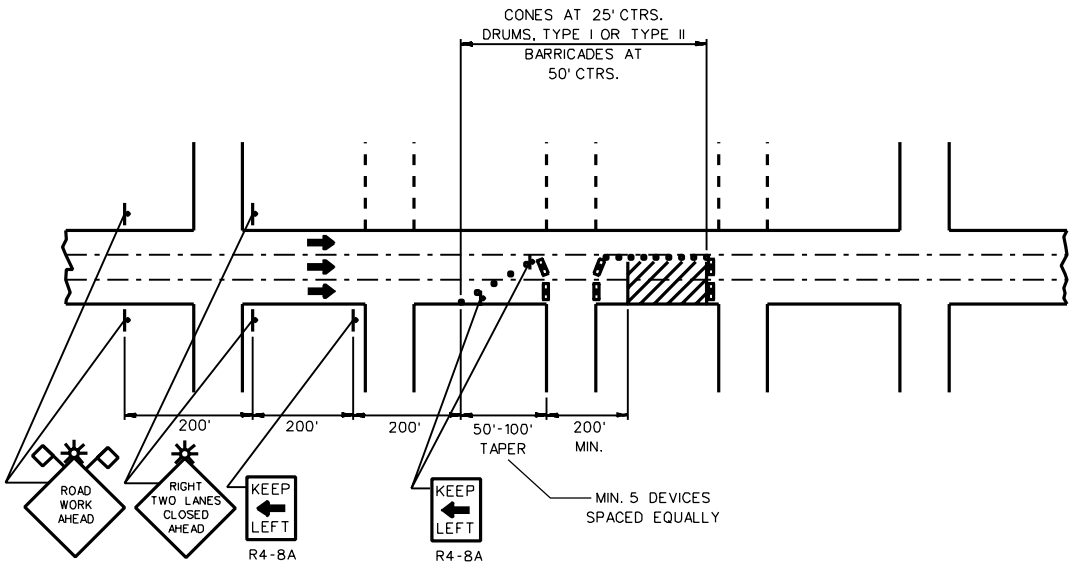
1. DRUMS OR TYPE II BARRICADES SHALL BE USED IN LIEU OF CONES FOR NIGHT OPERATIONS.
2. IF THE WORK OPERATION PERFORMED DOES NOT EXCEED 15 MINUTES SIGNING SHALL BE IN CONFORMANCE WITH CASE A6.
3. WHERE THE WORK AREA EXTENDS THROUGH THE INTERSECTION, BARRICADES AND/OR ADEQUATE WARNING SIGNS SHALL BE ERECTED ON THE CROSS STREET..
4. IF THE WORK AREA IS ON THE PARKING LANE A ROAD WORK AHEAD SIGN SHALL BE INSTALLED 200 FT. IN ADVANCE OF THE WORK AREA PROTECTED WITH CONES, DRUMS OR BARRICADES.
5. WHEN THERE IS NO WORK BEING PERFORMED FLAGGER AHEAD SIGN(S) AND THE FLAGGER WILL NOT BE REQUIRED. ONE LANE ROAD AHEAD SIGN(S) SHALL BE INSTALLED IN PLACE OF THE FLAGGER AHEAD SIGN(S).
6. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
7. FOR NIGHT OPERATIONS FLASHING LIGHTS SHALL BE INSTALLED ABOVE THE FIRST TWO SIGNS ON EACH APPROACH. (TYPE "B").
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 ENGINEER.
9. WHERE PARKED VEHICLES BLOCK THE LINE OF SIGHT TO NORMAL SIGN LOCATIONS, OR SIGNS ENCROACHED ON A NORMAL PEDESTRIAN WALKWAY, THE SIGNS SHALL BE POST MOUNTED WITH THE BOTTOM NOT LESS THAN 7 FT. ABOVE THE EDGE OF THE ROADWAY.

CASE B2

MULTILANE TWO WAY TRAFFIC UNDIVIDED URBAN, OR MULTILANE TWO WAY TRAFFIC DIVIDED URBAN WITH MOUNTABLE MEDIAN, DAY OR NIGHT OPERATION.

WHERE, AT ANY TIME, ANY VEHICLE EQUIPMENT, WORKERS OR THEIR ACTIVITIES ENCROACH ON THE PAVEMENT REQUIRING THE CLOSURE OF AT LEAST ONE TRAFFIC LANE.





SYMBOLS

- TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHT (TYPE "A")
- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN).
- CONES OR DRUMS (TYPE II BARRICADES OPTIONAL).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.

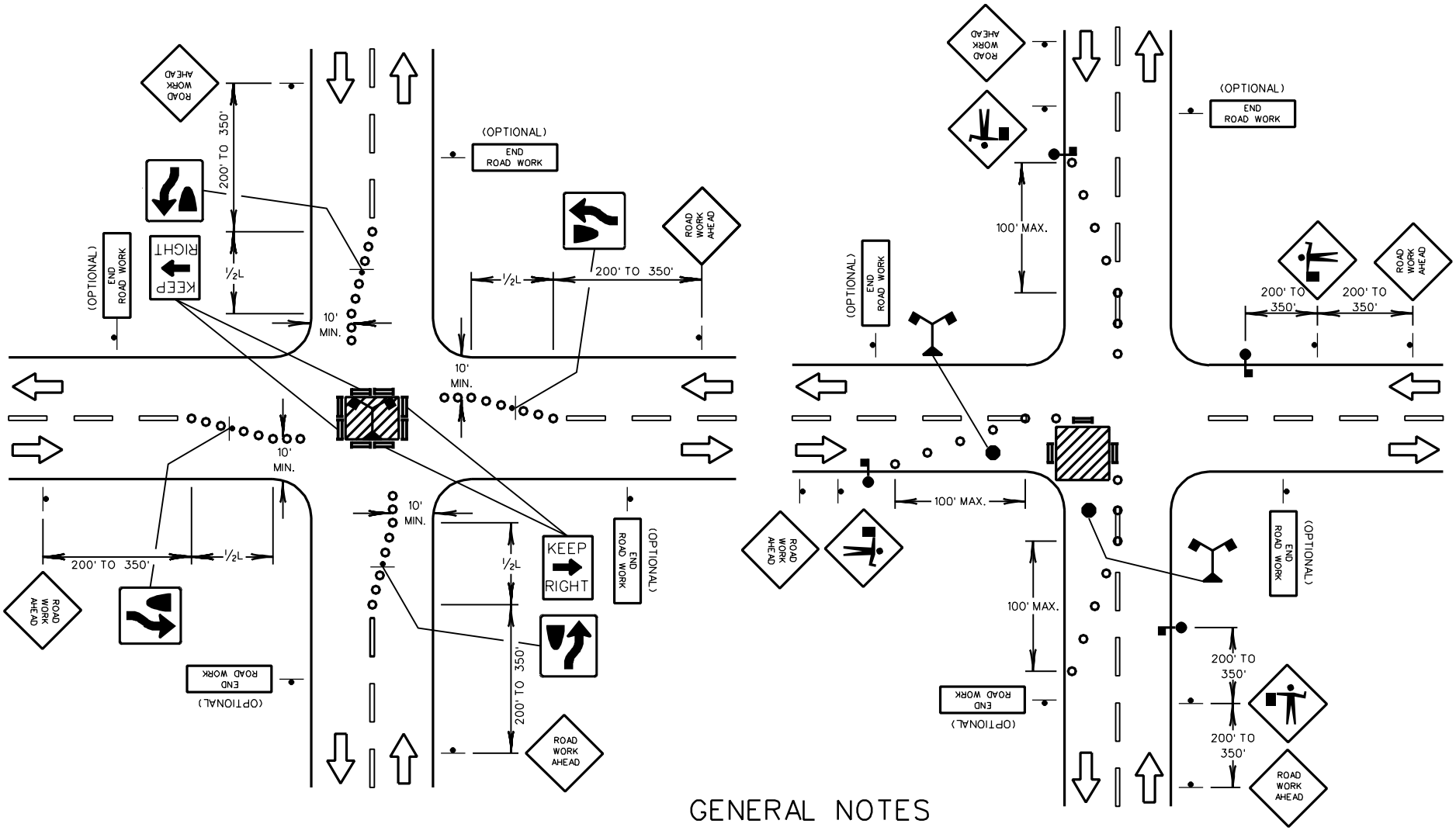
GENERAL NOTES

1. DRUMS OR TYPE II BARRICADES SHALL BE USED IN LIEU OF CONES FOR NIGHT OPERATIONS.
2. IF THE WORK OPERATION PERFORMED DOES NOT EXCEED 15 MINUTES, SIGNING SHALL BE IN ACCORDANCE WITH CASE A6.
3. WHERE THE WORK AREA EXTENDS THROUGH THE INTERSECTION, BARRICADES AND/OR ADEQUATE WARNING SIGNS SHALL BE ERECTED ON THE CROSS STREET.
4. IF THE WORK AREA IS IN THE PARKING LANE A ROAD WORK AHEAD SIGN SHALL BE INSTALLED 200 FT. IN ADVANCE OF THE WORK AREA AND THE WORK AREA PROTECTED WITH CONES, DRUMS OR BARRICADES.
5. THIS CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE EXTREME LEFT LANE OR LANES. UNDER THESE CONDITIONS THE APPROPRIATE PAVEMENT WIDTH TRANSITION SIGN SHALL BE USED, AND KEEP RIGHT SIGNS SUBSTITUTED FOR THE KEEP LEFT SIGNS.
6. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
7. ALL VEHICLES, EQUIPMENT, WORKERS OR THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

CASE B3

MULTILANE, ONE WAY TRAFFIC WITH NON TRAVERSABLE MEDIAN, OR MULTILANE ONE WAY TRAFFIC, URBAN, DAY OR NIGHT OPERATION

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES ENCROACH ON THE PAVEMENT REQUIRING THE CLOSURE OF ONE OR MORE TRAFFIC LANES.



SYMBOLS

- WORK AREA.
- TYPE II BARRICADE DAY OPERATIONS
  TYPE III BARRICADE NIGHT OPERATIONS
  WITH FLASHING LIGHT (TYPE 'A')
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE
- CONES OR DRUMS (AT 25 FT. CENTERS OR LESS)
- HIGH LEVEL WARNING DEVICE (FLAG TREE)

GENERAL NOTES

1. DAYLIGHT OPERATIONS ILLUSTRATED; IF NIGHT OPERATIONS, INSTALL TYPE 'B' FLASHING LIGHT ON FIRST ADVANCE SIGN (FIRST ROAD WORK SIGN).

2.

SPEED	L-TAPER (IN FEET)
25	125
30	180
35	250
40	320
45	540
50	600
55	660

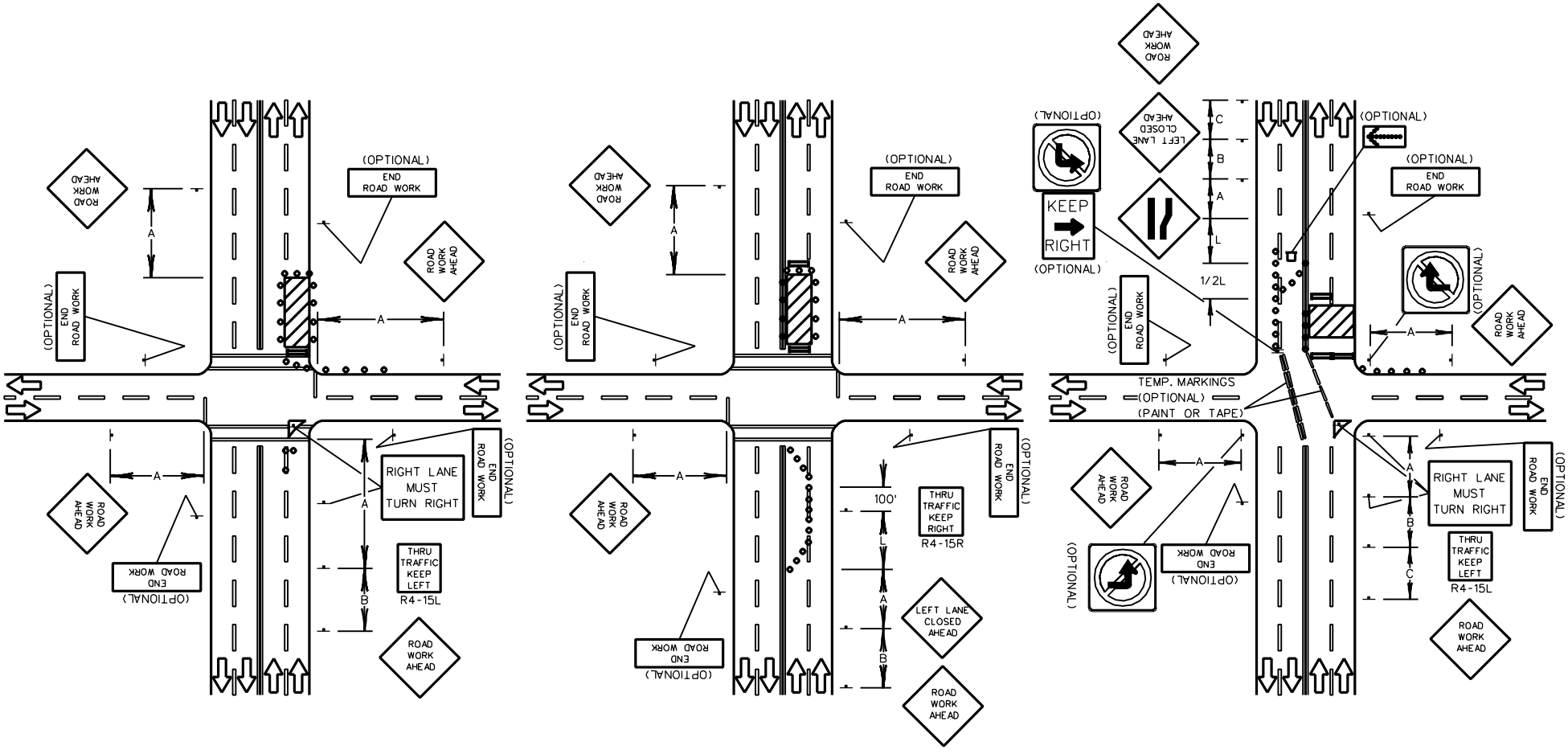
3. IF THE WORK OPERATION DOES NOT EXCEED 15 MINUTES, USE CASE A6 FOUR DIRECTIONS.

4. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

5. WHEN NO WORK IS BEING PERFORMED, FLAGGER AHEAD SIGNS SHALL BE COVERED OR REMOVED AND ONE LANE ROAD AHEAD SIGNS SUBSTITUTED.

CASE B4A

TWO-LANE, TWO-WAY
TRAFFIC, UNDIVIDED
URBAN DAY OR
NIGHT OPERATIONS



SYMBOLS

- WORK AREA.
- TYPE II BARRICADE DAY OPERATIONS
  TYPE III BARRICADE NIGHT OPERATIONS
  WITH FLASHING LIGHT (TYPE 'A')
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE
- CONES OR DRUMS (AT 25 FT. CENTERS OR LESS)

GENERAL NOTES

1. DAYLIGHT OPERATIONS ILLUSTRATED; IF NIGHT OPERATIONS, INSTALL TYPE 'B' FLASHING LIGHT ON FIRST ADVANCE SIGN (FIRST ROAD WORK SIGN).

2.

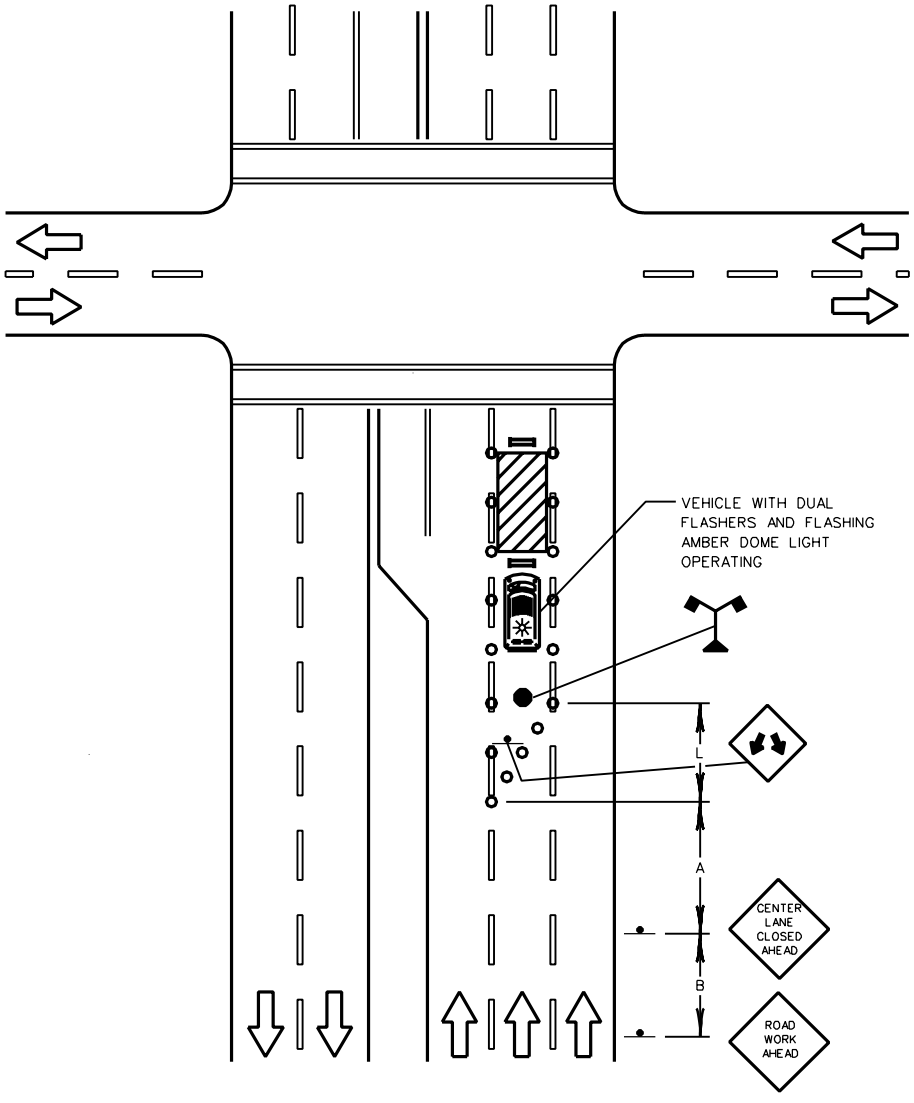
SPEED	L-TAPER (IN FEET)
25	125
30	180
35	250
40	320
45	540
50	600
55	660

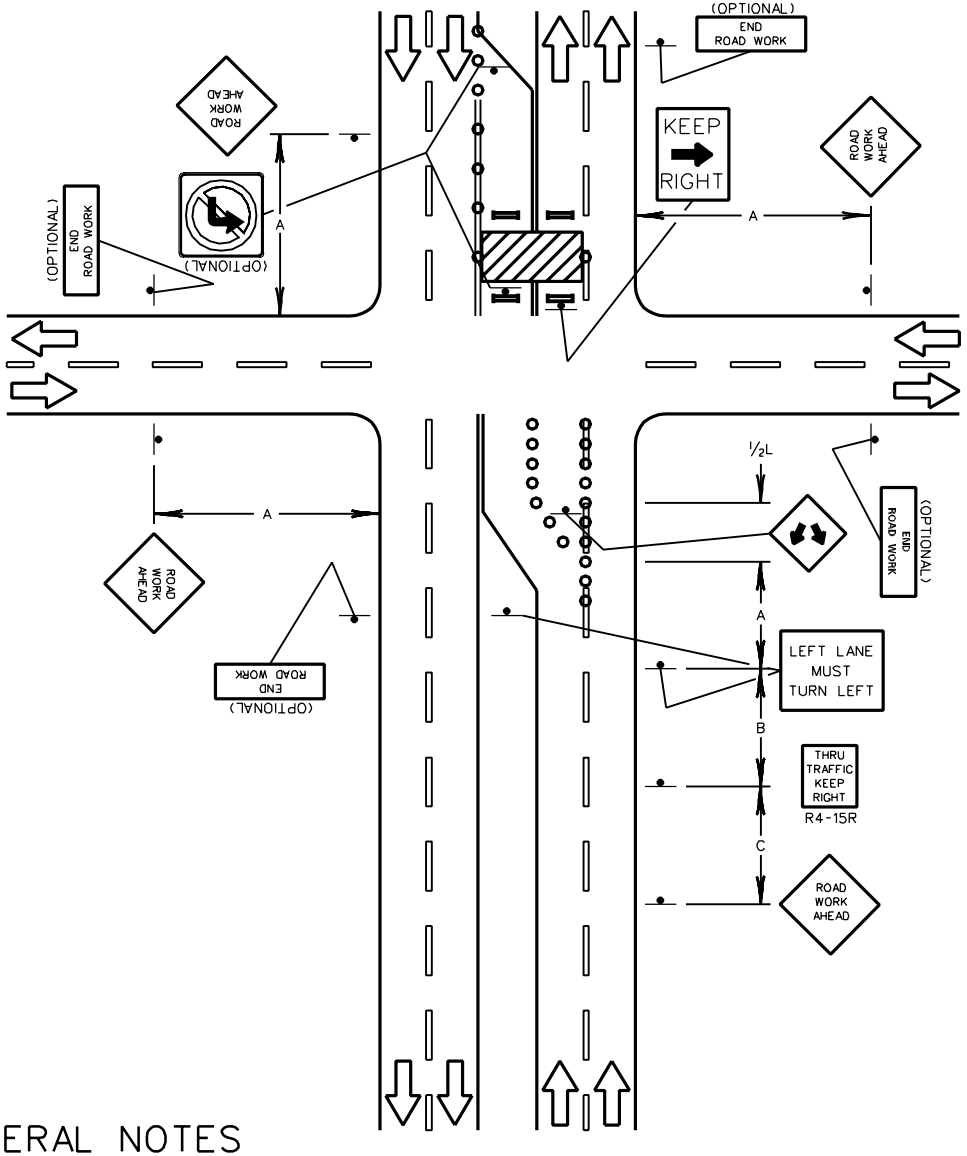
3. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

A - 200 FT. TO 350 FT.
B - 200 FT. TO 350 FT.
C - 200 FT. TO 350 FT.
IF RURAL - ALL 500 FT.

CASE B4B

MULTI-LANE, TWO-WAY
TRAFFIC, UNDIVIDED
URBAN DAY OR
NIGHT OPERATIONS





SYMBOLS

- WORK AREA.
- TYPE II BARRICADE DAY OPERATIONS
  TYPE III BARRICADE NIGHT OPERATIONS
  WITH FLASHING LIGHT (TYPE 'A')
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE
- CONES OR DRUMS (AT 25 FT. CENTERS OR LESS)
- HIGH LEVEL WARNING DEVICE (FLAG TREE)

GENERAL NOTES

1. DAYLIGHT OPERATIONS ILLUSTRATED: IF NIGHT OPERATIONS, INSTALL TYPE 'B' FLASHING LIGHT ON FIRST ADVANCE SIGN (FIRST ROAD WORK SIGN).

2.

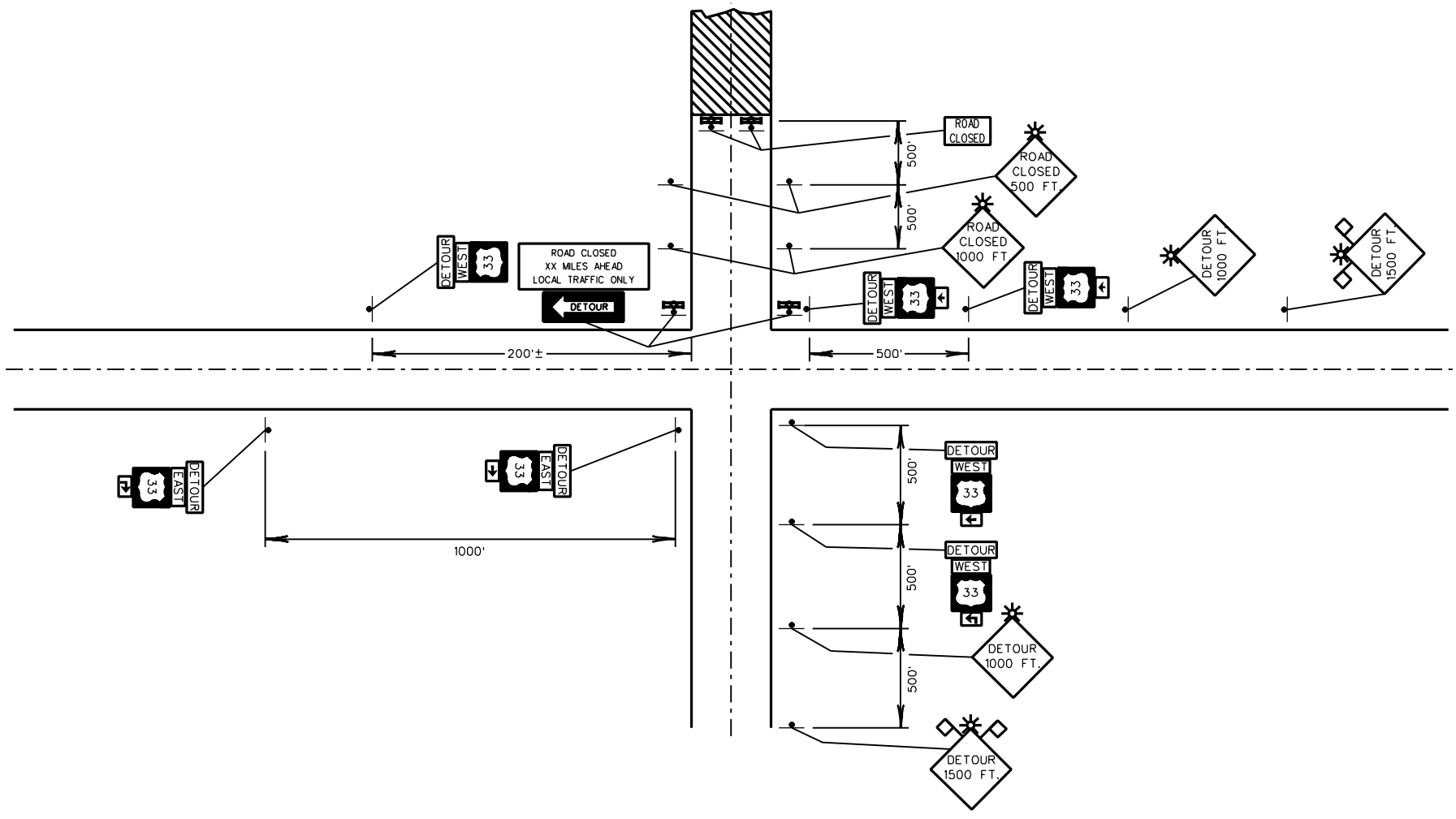
SPEED	L-TAPER (IN FEET)
25	125
30	180
35	250
40	320
45	540
50	600
55	660

3. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

A = 200 FT. TO 350 FT.
B = 200 FT. TO 350 FT.
C = 200 FT. TO 500 FT.
IF RURAL - ALL 500 FT.

CASE B4C

MULTI-LANE, TWO-WAY TRAFFIC, DIVIDED URBAN DAY OR NIGHT OPERATIONS



SYMBOLS

CLOSED AREA.

SIGNS WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 2).

TYPE II OR TYPE III BARRICADES WITH FLASHING LIGHT. (TYPE "A").

SIGN ON PORTABLE OR PERMANENT SUPPORT.

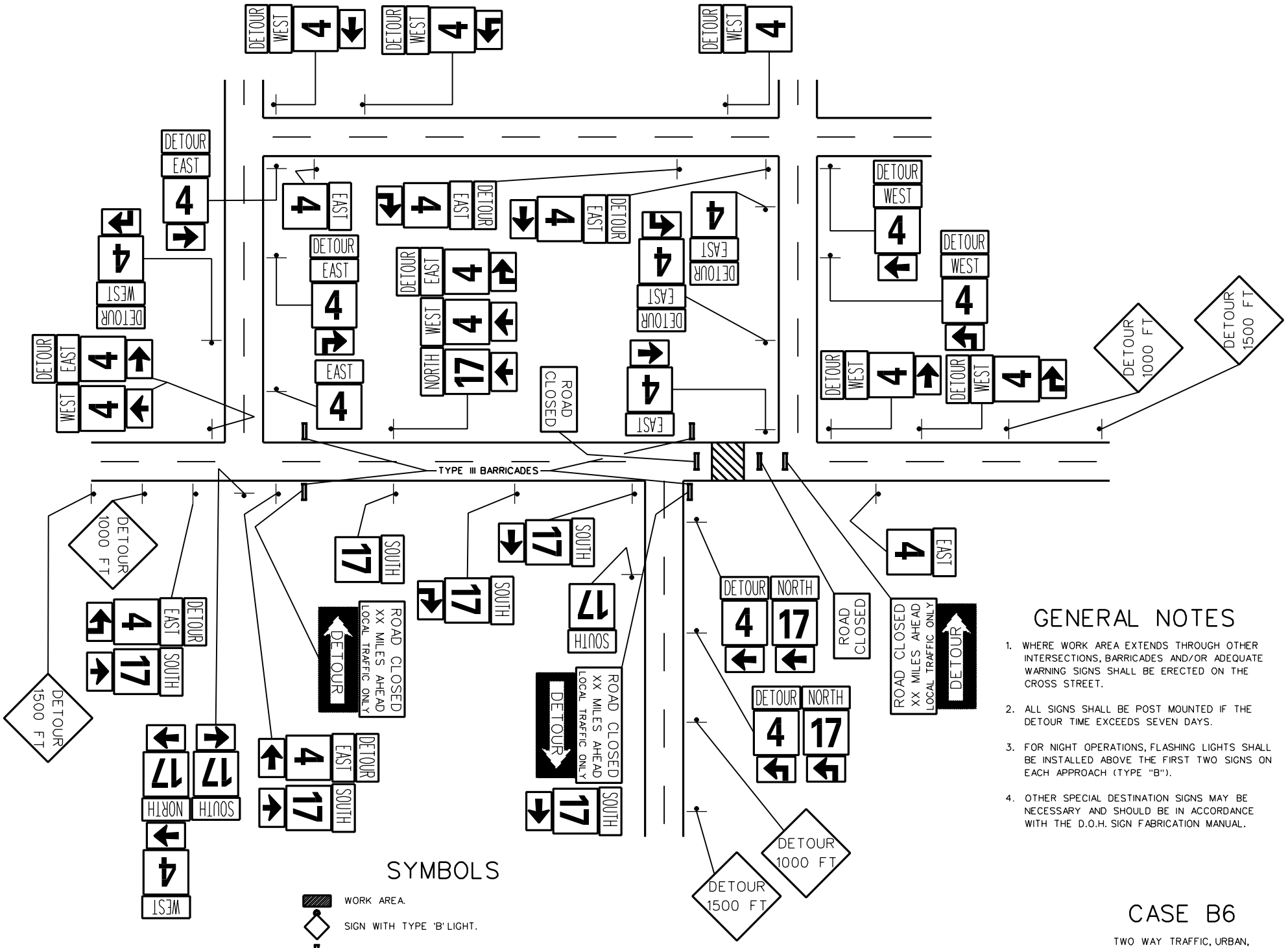
GENERAL NOTES

1. ALL SIGNS ARE TO BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
2. FOR NIGHT OPERATION FLASHING LIGHTS SHALL BE INSTALLED ABOVE THE FIRST SIGN ON EACH APPROACH EXCEPT THE ROAD CLOSED SIGN SHALL HAVE FLASHERS ON BOTH ADVANCE SIGNS. (TYPE "B").
3. OTHER SPECIAL DESTINATION SIGNS MAY BE NECESSARY AND SHOULD BE IN ACCORDANCE WITH THE CONTRACT PLANS.

CASE B5

TWO-LANE, TWO-WAY TRAFFIC
RURAL DAY OR NIGHT OPERATIONS

WHERE AT ANY TIME THE ROAD IS TO BE CLOSED FOR MORE THAN A 24 HOUR PERIOD.



SYMBOLS

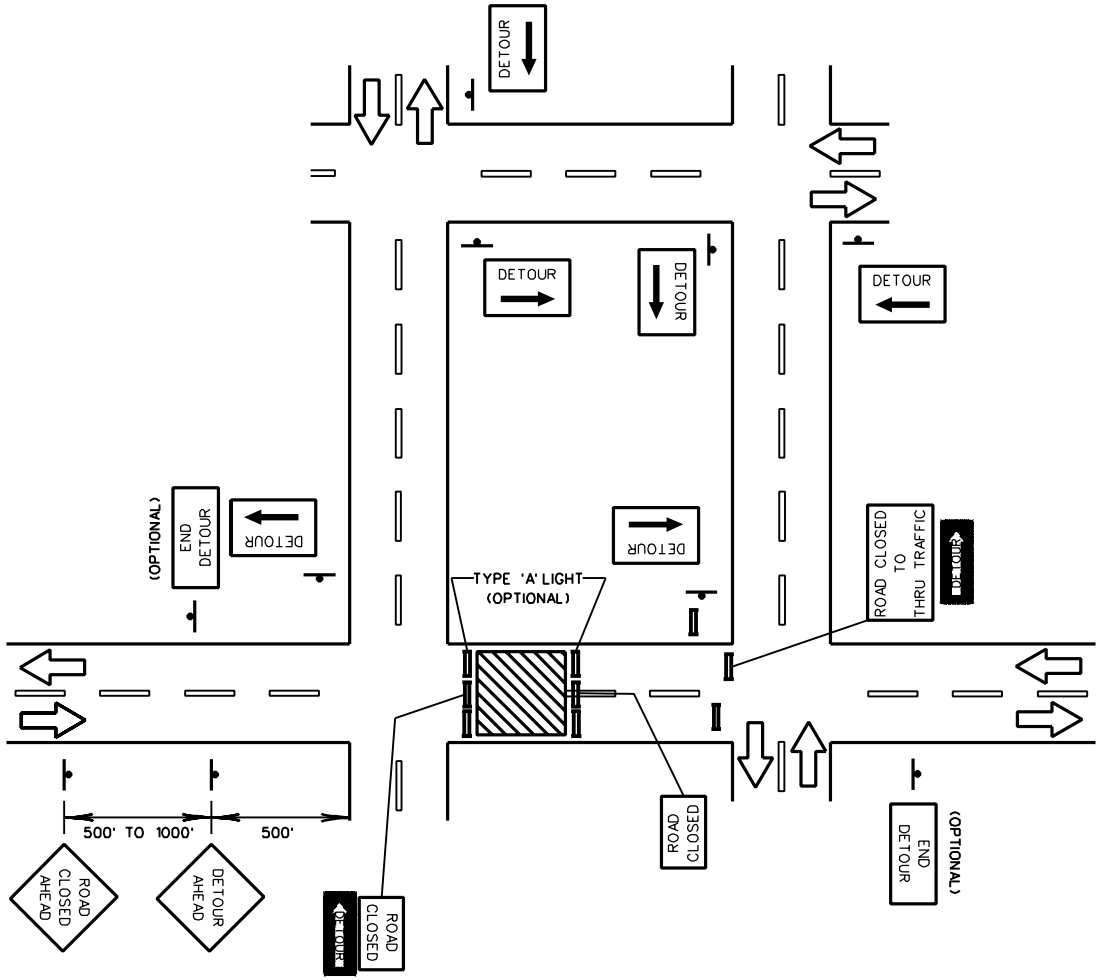
- WORK AREA.
- SIGN WITH TYPE 'B' LIGHT.
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.

GENERAL NOTES

1. WHERE WORK AREA EXTENDS THROUGH OTHER INTERSECTIONS, BARRICADES AND/OR ADEQUATE WARNING SIGNS SHALL BE ERECTED ON THE CROSS STREET.
2. ALL SIGNS SHALL BE POST MOUNTED IF THE DETOUR TIME EXCEEDS SEVEN DAYS.
3. FOR NIGHT OPERATIONS, FLASHING LIGHTS SHALL BE INSTALLED ABOVE THE FIRST TWO SIGNS ON EACH APPROACH (TYPE "B").
4. OTHER SPECIAL DESTINATION SIGNS MAY BE NECESSARY AND SHOULD BE IN ACCORDANCE WITH THE D.O.H. SIGN FABRICATION MANUAL.

CASE B6

TWO WAY TRAFFIC, URBAN,
DAY OR NIGHT OPERATION



SYMBOLS

WORK AREA.

SIGN WITH TYPE 'B' LIGHT

TYPE III BARRICADE

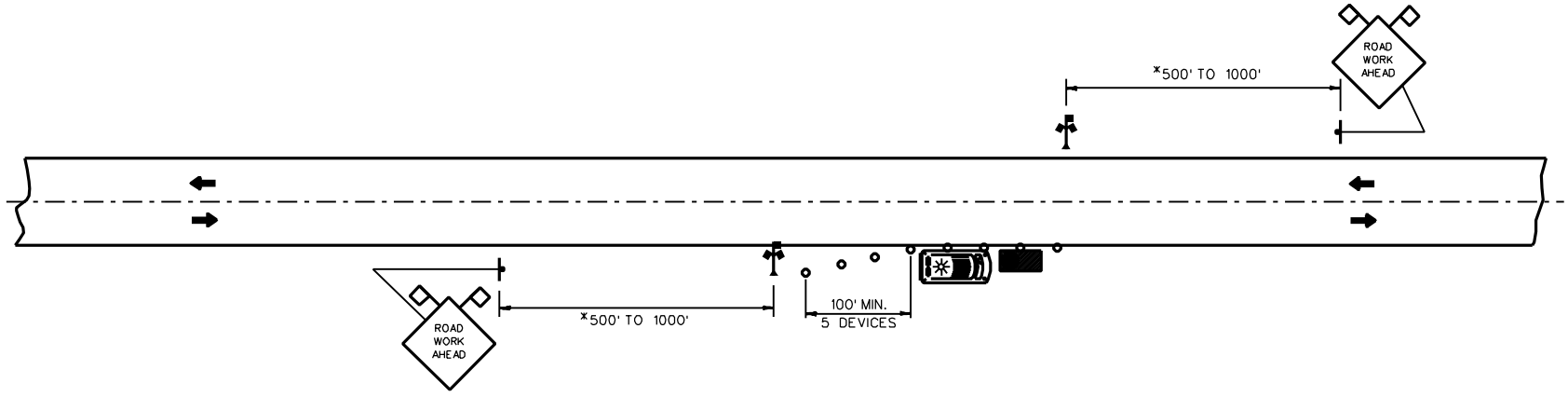
SIGN ON PORTABLE OR PERMANENT SUPPORT.

GENERAL NOTES

1. SIGNS SHOWN FOR ONE DIRECTION ONLY. ERECT SIMILAR SIGNS AND DEVICES FOR OPPOSITE DIRECTION.
2. GENERALLY USED FOR CITY STREETS.
3. USE OF STREET NAME SIGN (PLATE) OPTIONAL. STREET NAME SIGN MAY BE EITHER BLACK ON ORANGE OR WHITE ON GREEN.
4. ALL SIGNS SHALL BE POST MOUNTED IF THE DETOUR TIME EXCEEDS SEVEN DAYS.
5. FOR NIGHT OPERATIONS, FLASHING LIGHTS SHALL BE INSTALLED ABOVE THE FIRST TWO SIGNS ON EACH APPROACH (TYPE "B").

CASE B7

TWO WAY TRAFFIC, URBAN, DAY OR NIGHT OPERATION



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED (2 FLAGS PER SIGN).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- HIGH LEVEL WARNING DEVICE.
- FLASHING VEHICLE LIGHT.
- CONES ON 25' CENTERS MAX.

TYPICAL APPLICATIONS

UTILITY OPERATIONS ONLY

GENERAL NOTES

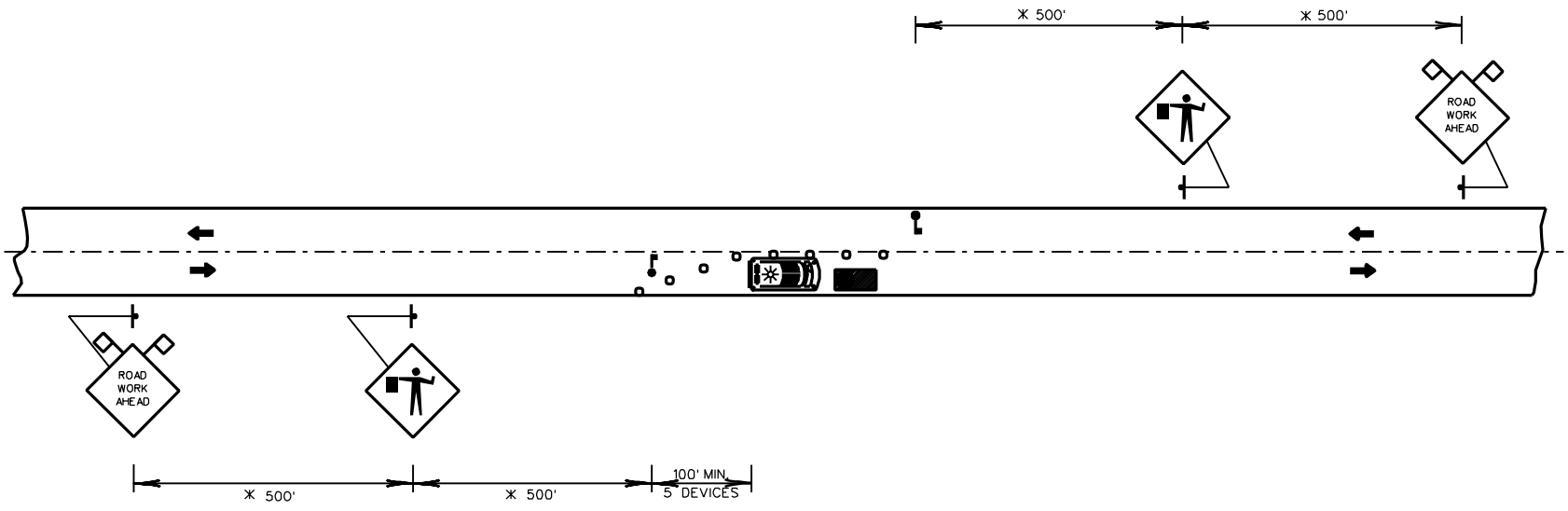
1. ROAD WORK AHEAD SIGNS ARE TO BE REMOVED WHEN NO WORK IS BEING PERFORMED. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS. (TYPE "A").
2. IF THE WORK OPERATION REQUIRES THAT FOUR OR MORE WORK VEHICLES ENTER THE THROUGH TRAFFIC LANES IN A ONE-HOUR PERIOD A FLAGGER SHALL BE PROVIDED AND THE FLAGGER SIGN SHALL BE ERECTED ACCORDINGLY.
3. 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 ENGINEER.

* - MAY BE DECREASED TO 200' TO 350' FOR URBAN AREA

CASE C1

TWO-LANE, TWO-WAY TRAFFIC
DAYLIGHT OPERATIONS ONLY

WHERE, AT ANY TIME, ANY VEHICLES, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE AREA BETWEEN 2 FT. AND 15 FT. FROM THE EDGE OF PAVEMENT.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED (2 FLAGS PER SIGN).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- FLAGGER WITH PADDLE.
- FLASHING VEHICLE LIGHT.
- CONES ON 25' CENTERS MAX.

TYPICAL APPLICATIONS

UTILITY OPERATIONS ONLY

GENERAL NOTES

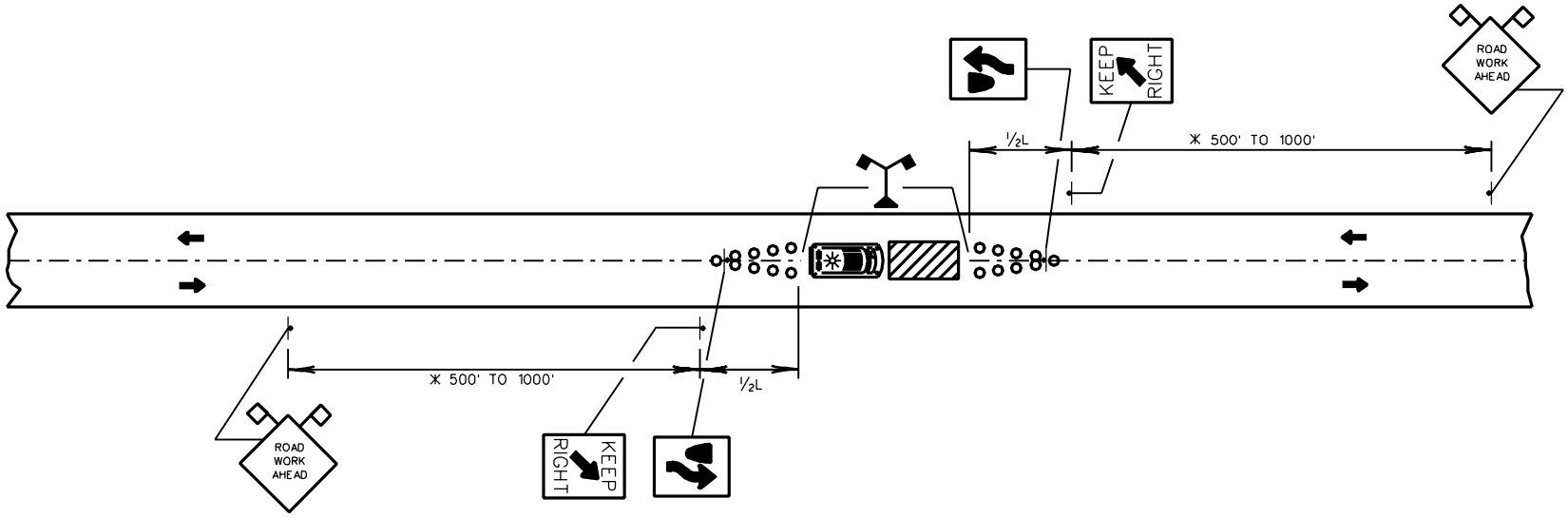
1. CONSTRUCTION OPERATIONS SHALL BE CONFINED TO ONE TRAFFIC LANE, LEAVING THE OPPOSITE LANE OPEN TO TRAFFIC.
2. IF THE WORK OPERATION DOES NOT EXCEED 60 MINUTES, TRAFFIC CONTROL WILL BE IN CONFORMANCE WITH CASE A6.
3. THE FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES.
4. IN LIGHT TRAFFIC WHEN THERE IS NO WORK BEING PERFORMED FLAGGER SIGN(S) AND THE FLAGGER MAY NOT BE REQUIRED (AT THE OPTION OF THE ENGINEER). IN THIS CASE ONE LANE ROAD SIGN(S) SHALL BE INSTALLED IN PLACE OF THE FLAGGER SIGN(S).
5. ALL SIGNS ARE TO BE REMOVED AT COMPLETION OF THE WORK AND THE DAYS OPERATIONS.
6. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.
7. ALL VEHICLES, EQUIPMENT, WORKERS (EXCEPT FLAGGER) AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

* - MAY BE DECREASED TO 200' TO 350' FOR URBAN AREAS

CASE C2

TWO-LANE, TWO-WAY TRAFFIC
DAYLIGHT OPERATIONS ONLY

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE AREA BETWEEN THE CENTER LINE AND A LINE 2 FT. OUTSIDE THE EDGE OF PAVEMENT.



SPEED	L-TAPER (IN FEET)
25	125
30	180
35	250
40	320
45	540
50	600
55	660

SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- CONES ON 25' CENTERS MAX.
- FLASHING VEHICLE LIGHT.

TYPICAL APPLICATIONS

UTILITY OPERATIONS ONLY

GENERAL NOTES

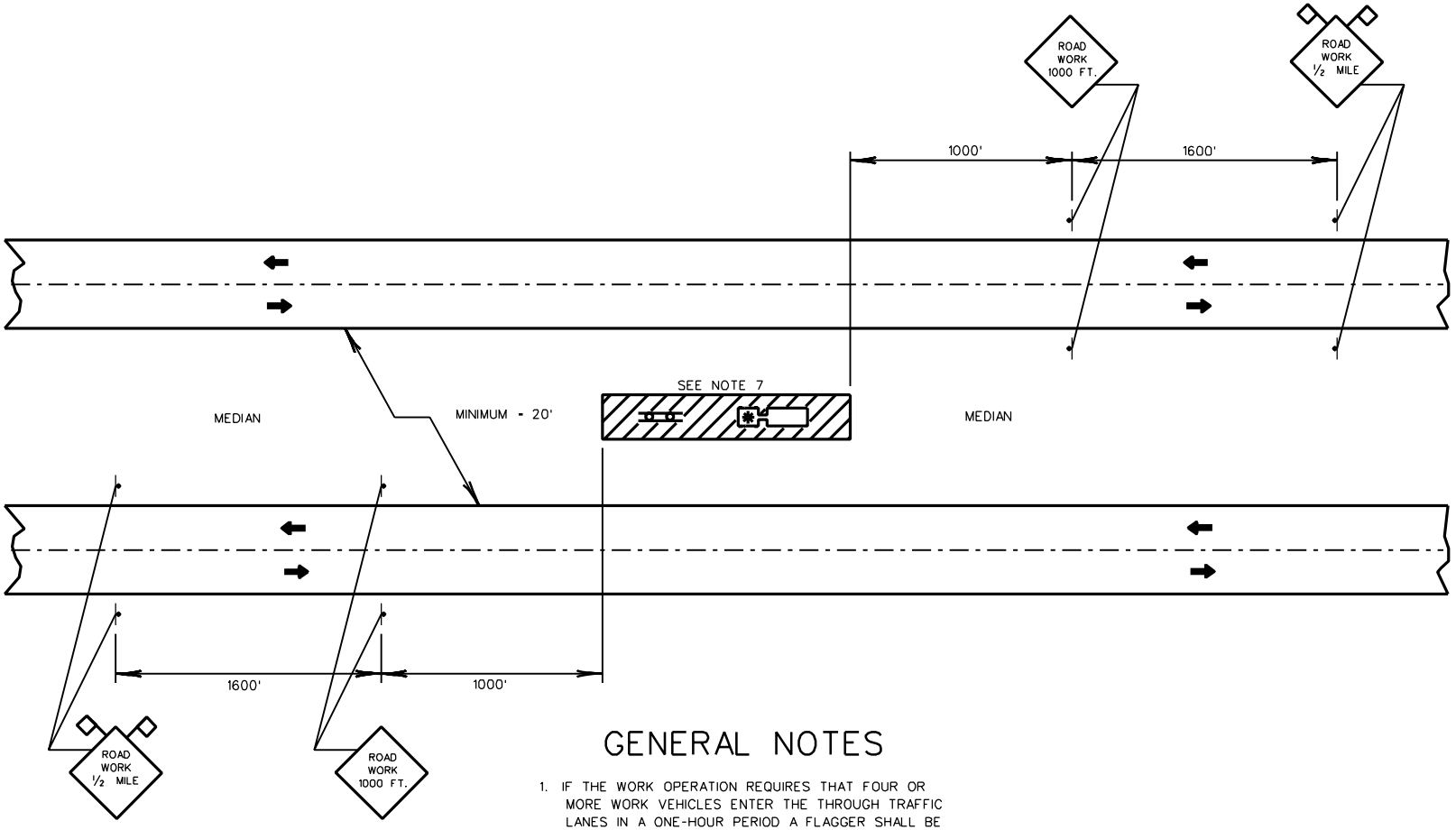
1. THE LANES ON EITHER SIDE OF THE CENTER WORK SPACE SHOULD HAVE A MINIMUM WIDTH OF 10 FEET AS MEASURED FROM THE NEAR EDGE OF OUTSIDE EDGE OF PAVED SHOULDER.
2. WHEN NO WORK IS BEING PERFORMED, ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE "A").
3. IF IT BECOMES NECESSARY TO OPERATE ONE LANE TRAFFIC. CASE A6 SHALL APPLY.
4. ALL VEHICLE, EQUIPMENT, WORKERS (EXCEPT FLAGGER) AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO WORK AREA UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

* - MAY BE DECREASED TO 200' TO 350' FOR URBAN AREAS.

CASE C3

TWO-LANE, TWO WAY OR MULTILANE, TWO WAY TRAFFIC UNDIVIDED, DAY OPERATIONS ONLY.

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE CENTERLINE AREA.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- TEMPORARY SUPPORT STRUCTURE
- FLASHING VEHICLE LIGHT.

TYPICAL APPLICATIONS

UTILITY OPERATIONS ONLY

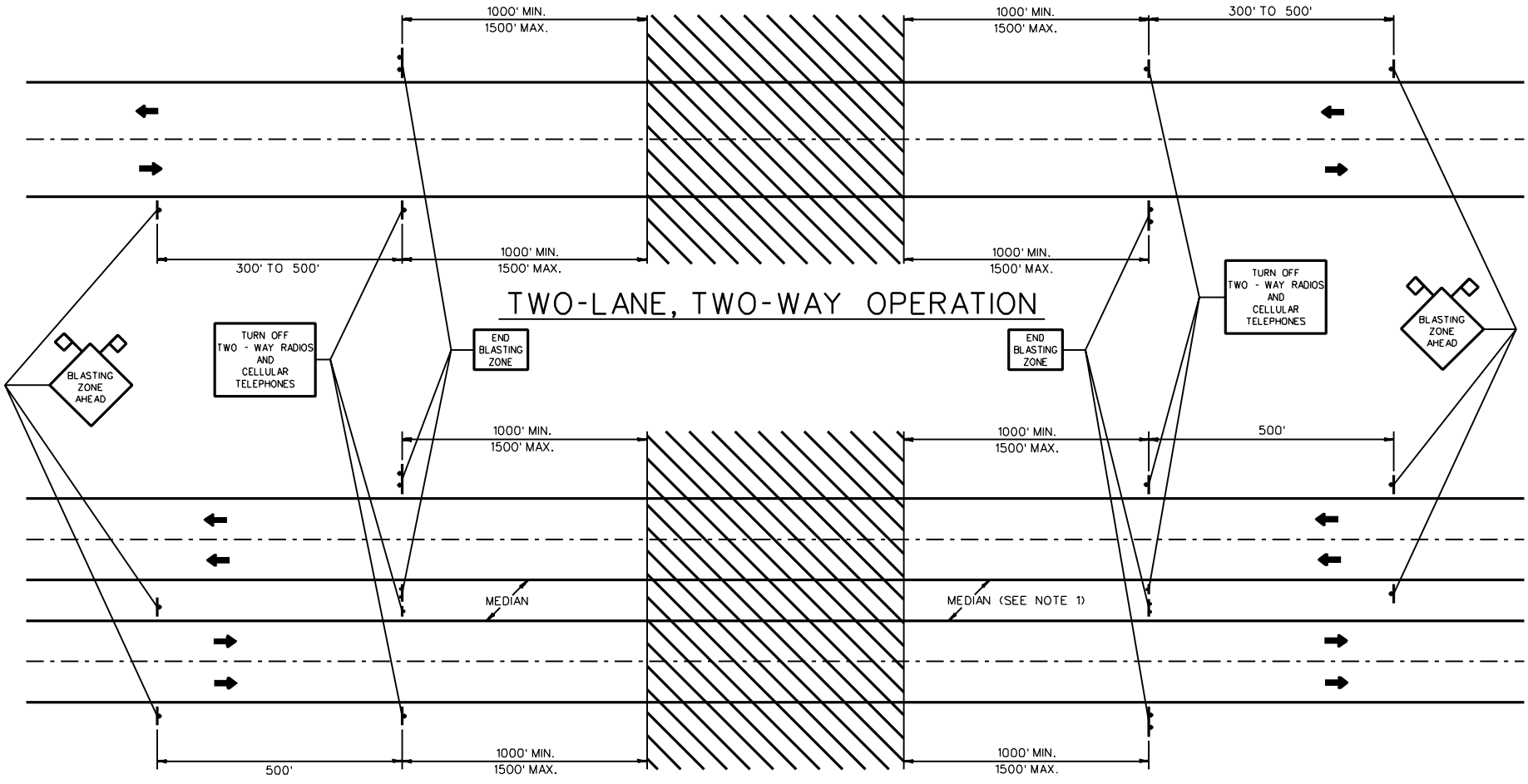
GENERAL NOTES

1. IF THE WORK OPERATION REQUIRES THAT FOUR OR MORE WORK VEHICLES ENTER THE THROUGH TRAFFIC LANES IN A ONE-HOUR PERIOD A FLAGGER SHALL BE PROVIDED AND THE FLAGGER SHALL ALSO BE USED AT 500' IN ADVANCE OF FLAGGER.
2. THIS CASE APPLIES TO WORK PERFORMED IN THE MEDIAN AREA MORE THAN 2 FT. FROM THE EDGE OF EITHER ROADWAY.
3. IF THE WORK OPERATION DOES NOT EXCEED 60 MINUTES TRAFFIC CONTROL WILL BE IN A CONFORMANCE WITH CASE A6.
4. ALL SIGNS ARE TO BE REMOVED AT COMPLETION OF WORK OR THE DAYS OPERATION.
5. UTILITY COMPANIES MAY WORK ON UTILITY CROSSINGS ON FULLY ACCESS CONTROLLED FREEWAYS UNDER EMERGENCY CONDITIONS AND BY PERMISSION OF THE WEST VIRGINIA DIVISION OF HIGHWAYS ONLY.
6. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.
7. TEMPORARY SUPPORT STRUCTURES SHALL BE PROTECTED BY EITHER TEMPORARY GUARDRAIL BARRIER IN CONFORMANCE WITH GUARDRAIL STANDARDS OR TEMPORARY CONCRETE BARRIER WITH STANDARD FLARE END TREATMENT AS SHOWN ON DETAIL "C".

CASE C4

MULTILANE, DIVIDED

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE MEDIAN AREA.



SYMBOLS

SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED.

BLASTING ZONE

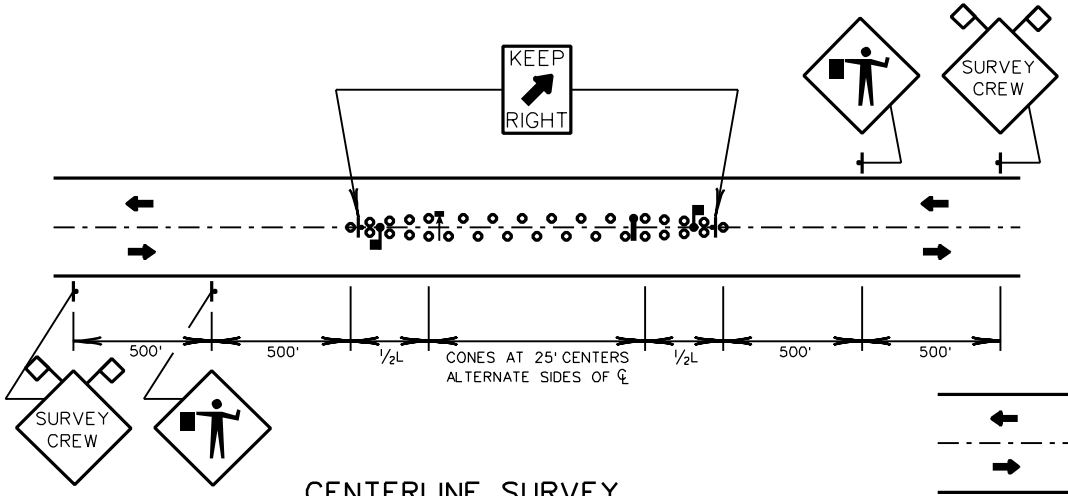
SIGN ON PORTABLE OR PERMANENT SUPPORT.

GENERAL NOTES

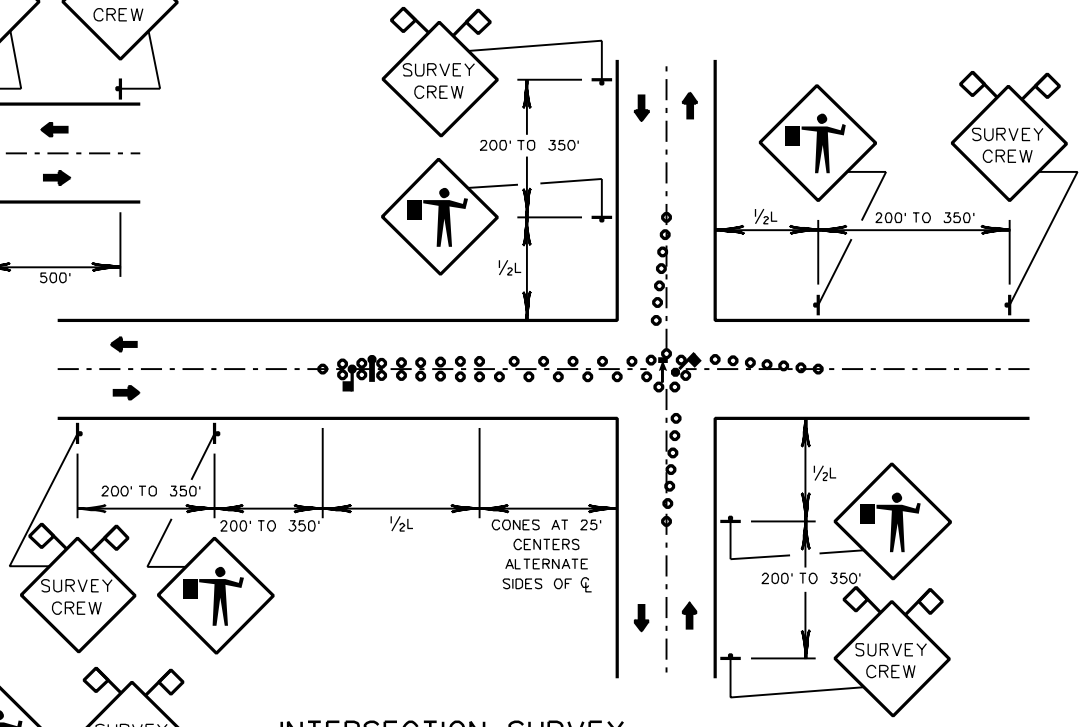
1. THIS CASE ALSO APPLIES WHEN BLASTING IS BEING PERFORMED ON A MULTILANE UNDIVIDED HIGHWAY. UNDER THESE CONDITIONS THE SIGNS AND WARNING LIGHTS NORMALLY MOUNTED IN THE MEDIAN SHALL BE OMITTED.
2. ALL SIGNS SHALL BE POST MOUNTED IF BLASTING TIME EXCEEDS SEVEN DAYS.
3. COORDINATE ALL BLASTING ZONE SIGNING WITH ANY OTHER SIGNING.
4. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH BLASTING IS BEING PERFORMED, ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

CASE D1

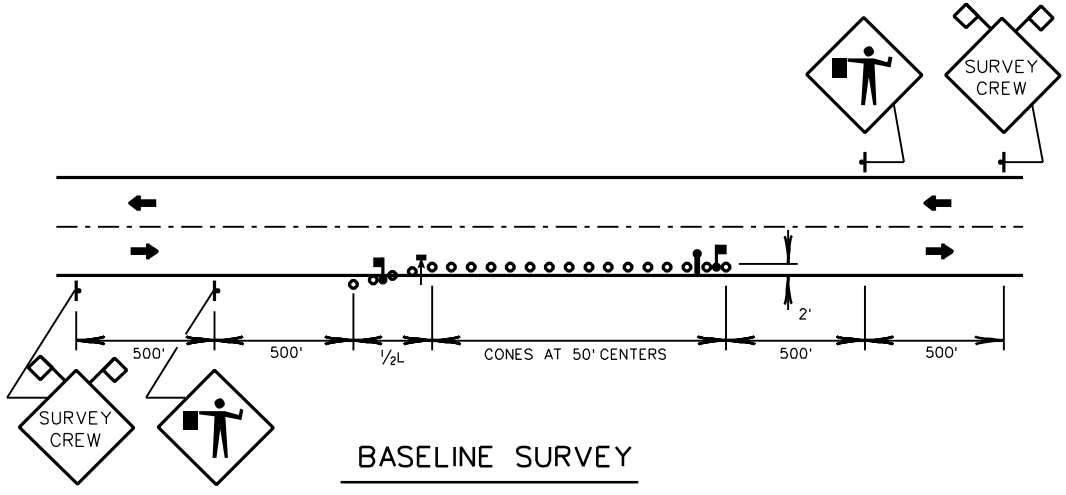
BLASTING ZONE SIGNING



CENTERLINE SURVEY



INTERSECTION SURVEY



BASELINE SURVEY

SPEED	L-TAPER (IN FEET)
25	125
30	180
35	250
40	320
45	540
50	600
55	660

SYMBOLS

- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED.
- SIGN ON PORTABLE SUPPORT.
- CONES
- FLAGGER
- INSTRUMENTMAN.
- RODMAN

GENERAL NOTES

1. THE BASELINE SURVEY ALSO APPLIES ON MULTILANE HIGHWAYS EXCEPT INCREASE 500 FT. DISTANCES TO 1000 FT. AND 1500 FT..
2. CONES MAY BE OMITTED FOR CROSS SECTION SURVEYS.

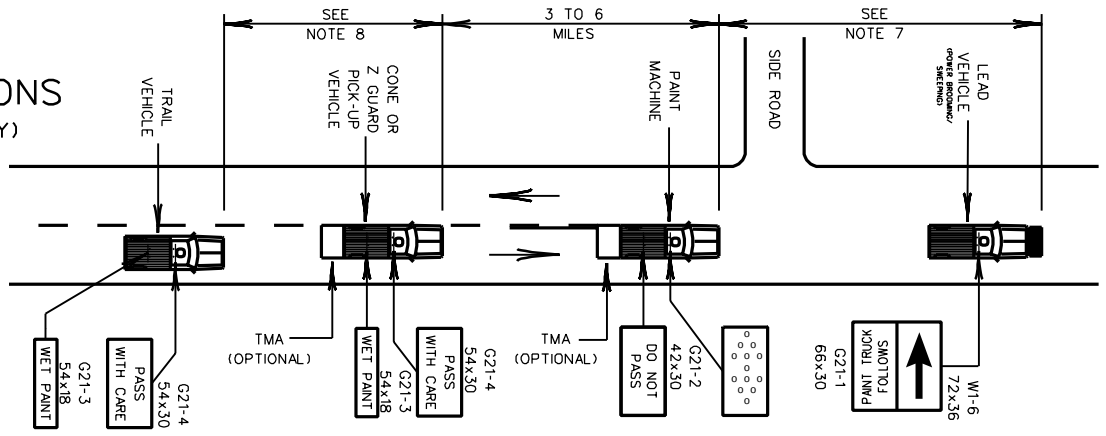
CASE D2

TWO-LANE, TWO-WAY AND INTERSECTION DAYLIGHT OPERATIONS ONLY.

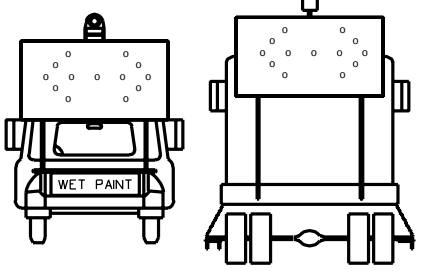
SURVEY PARTY TRAFFIC CONTROL.

CENTER LINE OR EDGE LINE OPERATIONS

(TWO LANE OPERATIONS ONLY)



SEE NOTE 1 FOR ALL FLASHING ARROW PANELS **

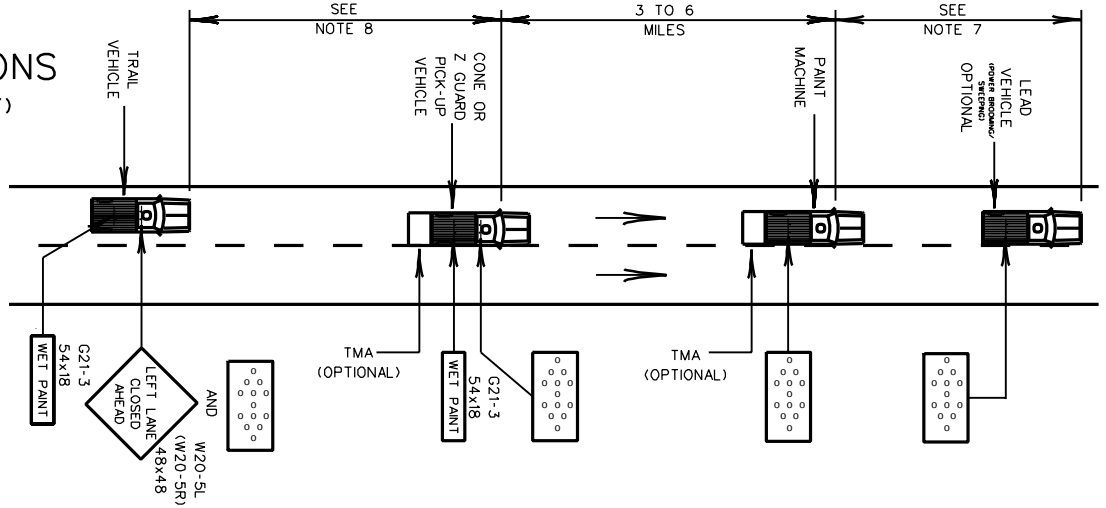


TYPICAL SIGN LOCATION ON VEHICLES

LANE LINE OR EDGE LINE OPERATIONS

(MULTILANE OPERATIONS ONLY)

LANE LINE OPERATION MAY BE PERFORMED FROM EITHER THE LEFT OR RIGHT LANE (RIGHT LANE PREFERRED).



GENERAL NOTES

1. FLASHING ARROW PANELS SHALL BE USED TO DIRECT TRAFFIC RIGHT OR LEFT AS INDICATED. MINIMUM SIZE SHALL BE 60"x30" FOR EDGE LINE OPERATIONS; NORMAL SIZE SHALL BE 96"x48" THE FLASHING ARROW PANEL SHALL BE MOUNTED A MINIMUM OF SEVEN (7) FEET ABOVE THE ROADWAY SURFACE.
2. THE LEAD VEHICLE SHALL BE EQUIPPED WITH A 360° ROTATING YELLOW FLASHER ON THE CAB PLUS LIGHTED HEADLIGHTS AND TAILLIGHTS.
3. THE PAINT VEHICLE SHALL BE EQUIPPED WITH SIGNS AS INDICATED, PLUS HI-INTENSITY STROBE LIGHTS ON THE CAB AND REAR PLUS LIGHTED HEADLIGHTS AND TAILLIGHTS.
4. THE TRAIL VEHICLES SHALL BE EQUIPPED WITH A 360° ROTATING YELLOW FLASHER ON CAB PLUS LIGHTED HEADLIGHTS AND TAILLIGHTS.
5. ALL CENTERLINE MARKING OPERATIONS SHALL BE CONDUCTED BY ALLEVIATING TRAFFIC CONGESTION EVERY 10 MINUTES OR AFTER A 10 VEHICLE BACKLOG WHICHEVER OCCURS FIRST.
6. TWO-WAY RADIO COMMUNICATIONS SHALL BE MAINTAINED BETWEEN THE PAINT VEHICLE AND THE PICK-UP VEHICLE OR TRAIL VEHICLE.
7. LEAD VEHICLE SHALL NORMALLY MAINTAIN VISUAL CONTACT WITH THE PAINT VEHICLE IN ORDER TO COORDINATE ON AND OFF ROAD MANEUVERS WHEN ALLEVIATING TRAFFIC BACKLOG.
8. IN OPERATIONS INVOLVING THE PICK-UP VEHICLE, THE TRAIL VEHICLE WILL NORMALLY MAINTAIN VISUAL CONTACT WITH THE PICK-UP VEHICLE, EXCEPT ON CURVES WHERE THE TRAIL VEHICLE WILL DROP BACK AS PROTECTION THE PICK-UP VEHICLE.
9. CONES OR Z GUARDS SHALL BE PLACED WHENEVER THE TRACK FREE TIME EXCEEDS TWO (2) MINUTES. THESE DEVICES SHALL NOT BE REMOVED UNTIL THE LINE HAS DRIED TO A TRACK FREE CONDITION. THE DEVICES USED SHALL NORMALLY BE SPACED BETWEEN 150 AND 200 FEET. IN AREAS OF TRAFFIC CONGESTION, FOR CURVES OR WHERE TRACKING OF THE WET LINE IS EXPECTED, SPACINGS SHALL BE AS CLOSE AS 25 FEET. TOTAL CLOSURE MAY BE REQUIRED SOMETIMES (SEE CASES E6, B4A, B4B, B4C).
10. WHEN THE PAINT VEHICLE BECOMES STATIONARY, THE LEAD VEHICLE SHALL MOVE TO A POSITION 30 TO 50 FEET IN ADVANCE OF THE PAINT VEHICLE TO PROVIDE PROTECTION.

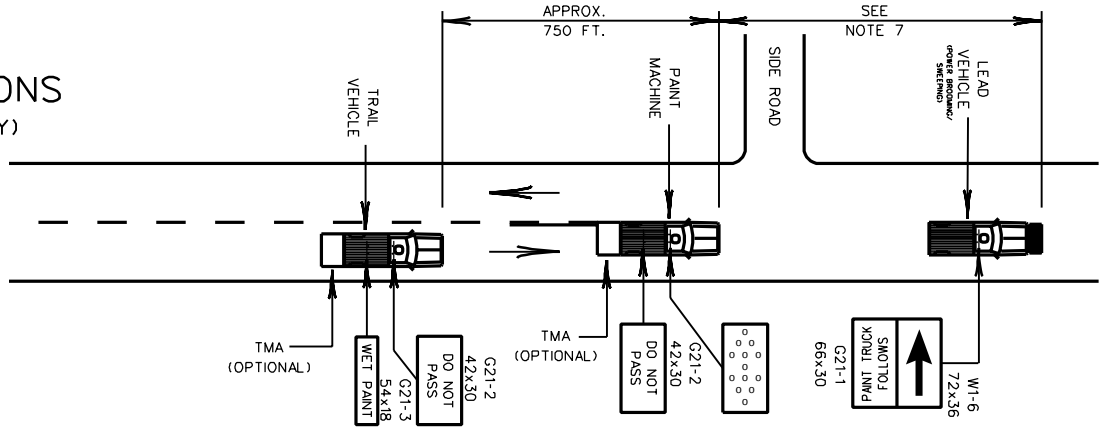
** THIS LIGHT SHALL BE MOUNTED ON TELESCOPING PIPE SO THAT IT MAY BE RAISED TO A HEIGHT OF 12 FEET ABOVE THE GROUND.

CASE D3

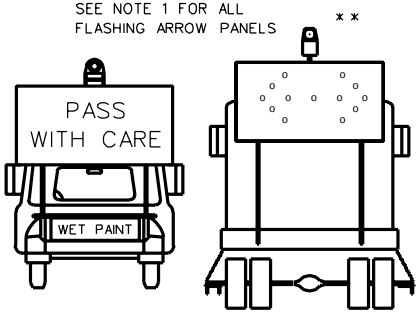
REGULAR DRY PAINT APPLICATION

CENTER LINE OR EDGE LINE OPERATIONS

(TWO LANE OPERATIONS ONLY)



SEE NOTE 1 FOR ALL FLASHING ARROW PANELS

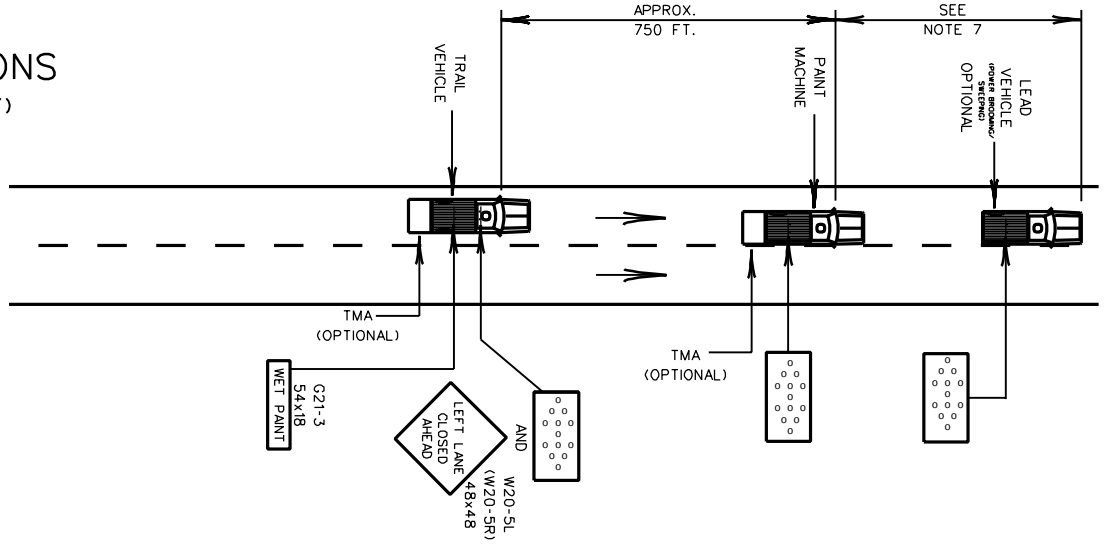


TYPICAL SIGN LOCATION ON VEHICLES

LANE LINE OR EDGE LINE OPERATIONS

(MULTILANE OPERATIONS ONLY)

LANE LINE OPERATION MAY BE PERFORMED FROM EITHER THE LEFT OR RIGHT LANE (RIGHT LANE PREFERRED).



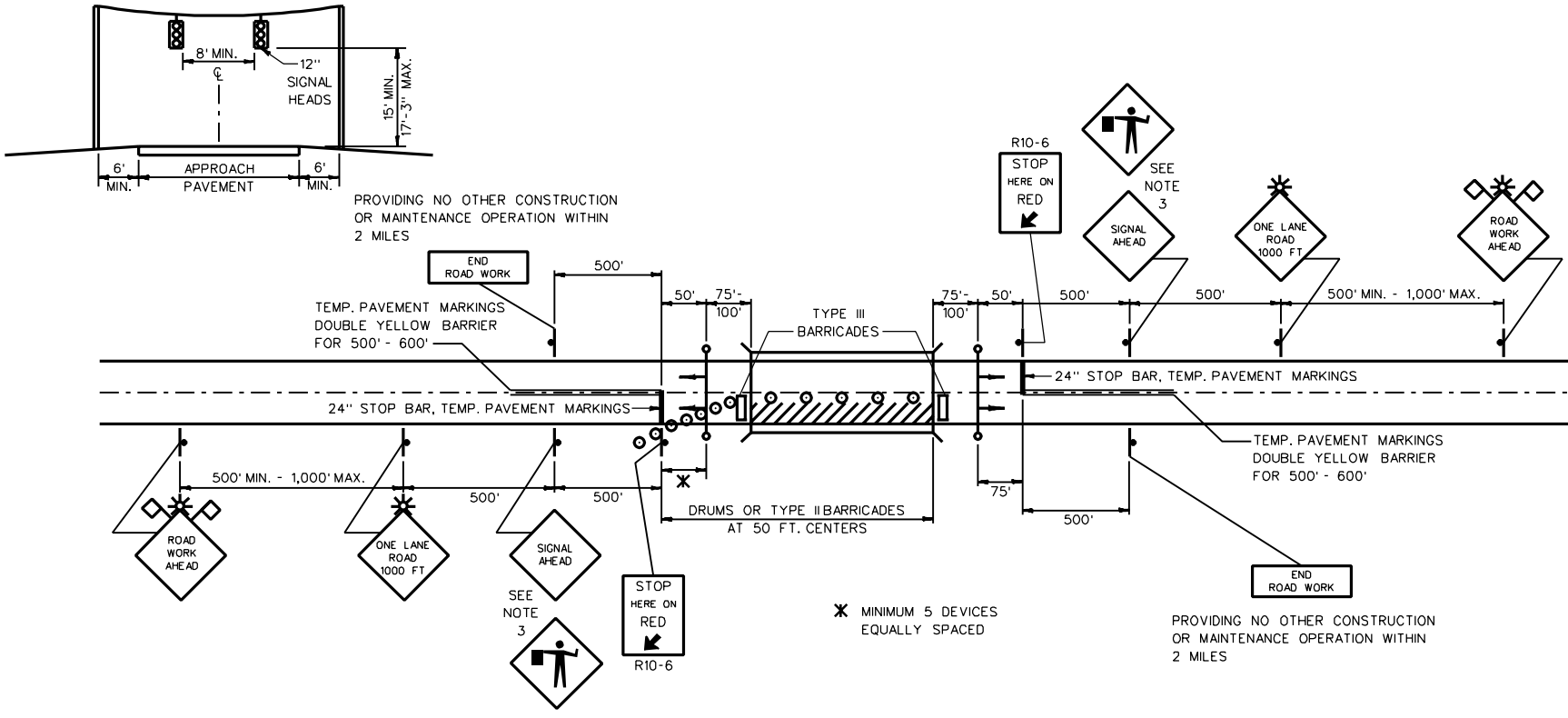
GENERAL NOTES

1. FLASHING ARROW PANELS SHALL BE USED TO DIRECT TRAFFIC RIGHT OR LEFT AS INDICATED. MINIMUM SIZE SHALL BE 60"x30" FOR EDGE LINE OPERATIONS; NORMAL SIZE SHALL BE 96"x48" THE FLASHING ARROW PANEL SHALL BE MOUNTED A MINIMUM OF SEVEN (7) FEET ABOVE THE ROADWAY SURFACE.
2. THE LEAD VEHICLE SHALL BE EQUIPPED WITH A 360° ROTATING YELLOW FLASHER ON THE CAB PLUS LIGHTED HEADLIGHTS AND TAILLIGHTS.
3. THE PAINT VEHICLE SHALL BE EQUIPPED WITH SIGNS AS INDICATED, PLUS HI-INTENSITY STROBE LIGHTS ON THE CAB AND REAR PLUS LIGHTED HEADLIGHTS AND TAILLIGHTS.
4. THE TRAIL VEHICLES SHALL BE EQUIPPED WITH A 360° ROTATING YELLOW FLASHER ON CAB PLUS LIGHTED HEADLIGHTS AND TAILLIGHTS.
5. ALL CENTERLINE MARKING OPERATIONS SHALL BE CONDUCTED BY ALLEVIATING TRAFFIC CONGESTION EVERY 10 MINUTES OR AFTER A 10 VEHICLE BACKLOG WHICHEVER OCCURS FIRST.
6. TWO-WAY RADIO COMMUNICATIONS SHALL BE MAINTAINED BETWEEN THE PAINT VEHICLE AND THE TRAIL VEHICLE.
7. LEAD VEHICLE SHALL NORMALLY MAINTAIN VISUAL CONTACT WITH THE PAINT VEHICLE IN ORDER TO COORDINATE ON AND OFF ROAD MANEUVERS WHEN ALLEVIATING TRAFFIC BACKLOG.
8. WHEN THE PAINT VEHICLE BECOMES STATIONARY, THE TRAIL VEHICLE SHALL MOVE TO A POSITION 30 TO 50 FEET IN ADVANCE OF THE PAINT VEHICLE TO PROVIDE PROTECTION.

* * THIS LIGHT SHALL BE MOUNTED ON TELESCOPING PIPE SO THAT IT MAY BE RAISED TO A HEIGHT OF 12 FEET ABOVE THE GROUND.

CASE D4

FAST DRY PAINT APPLICATION



SYMBOLS

- SIGNAL HEADS (12")
- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHTS (AS REQUIRED. SEE NOTE 5).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM

TYPICAL APPLICATIONS

BRIDGE REPAIRS
SLIDES

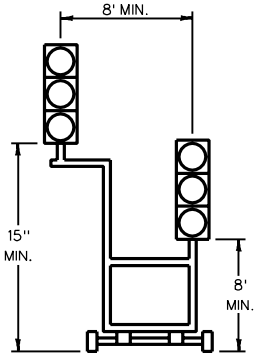
GENERAL NOTES

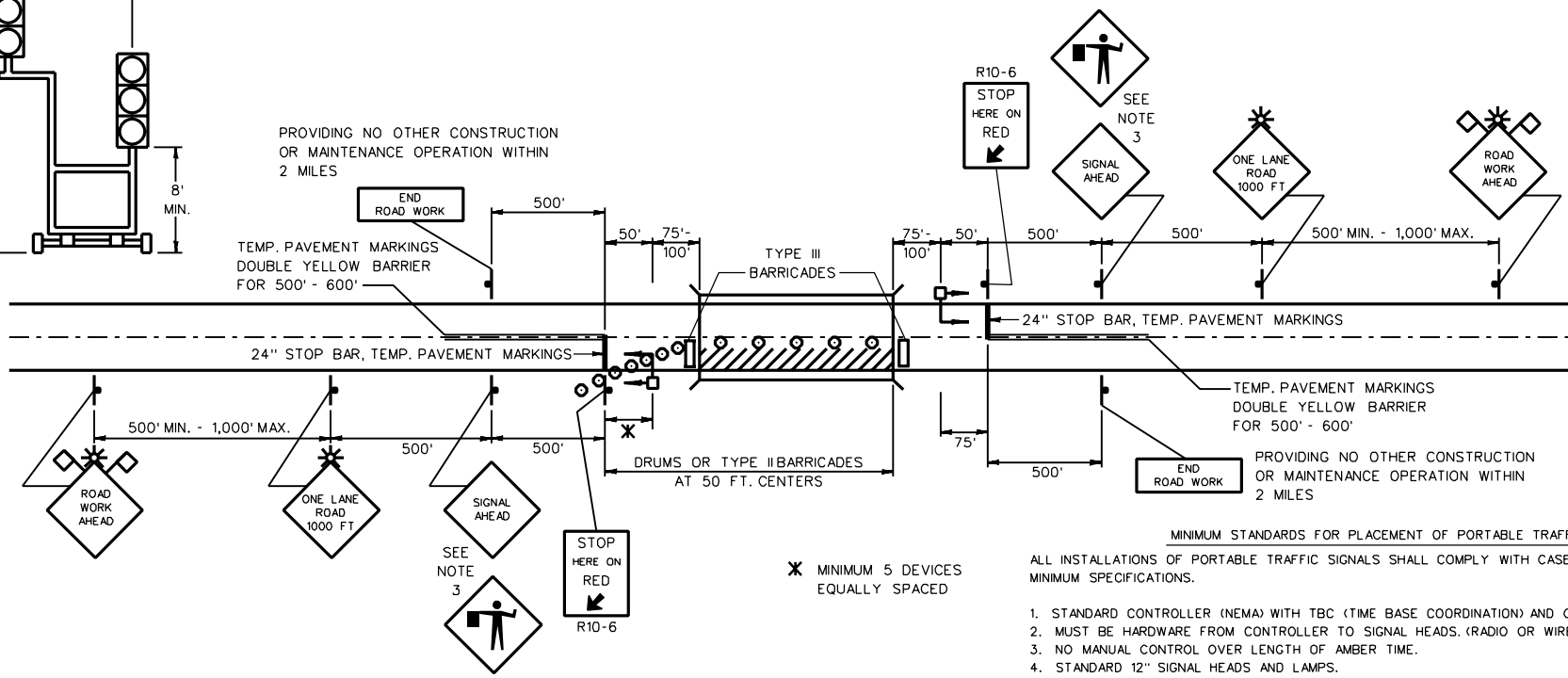
1. THIS CASE ILLUSTRATES OVERHEAD INSTALLATION, FOR PORTABLE INSTALLATION (IF APPROVED), SEE CASE D5B.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF THE TRAFFIC SIGNAL SYSTEM IN PLACE FOR THIS PROJECT. THIS RESPONSIBILITY SHALL BEGIN WITH THE INITIALIZATION OF THE WORK AND CONTINUE FOR THE LIFE OF THE CONTRACT. MAINTENANCE SHALL INCLUDE BUT NOT BE LIMITED TO REPAIR OF ACTS OF VANDALISM AS WELL AS NORMAL WEAR AND BURN OUT. ITEMS TO BE MAINTAINED AND/OR REPAIRED SHALL INCLUDE CONTROLLER, CABINETS, DETECTORS, SIGNAL HEADS, SUPPORT POSTS AND ANY OTHER EQUIPMENT OR MISCELLANEOUS ITEMS IN PLACE FOR THIS SIGNAL INSTALLATION.
3. SIGNAL TIMING INFORMATION WILL BE FURNISHED BY THE DIVISION OF HIGHWAYS AND MAY NOT BE MODIFIED WITHOUT APPROVAL OF THE DIVISION OF HIGHWAYS.
4. IF DUE TO EQUIPMENT FAILURES OR OTHER REASONS THE SIGNAL MUST BE PUT ON FLASH OR SHUT DOWN, THE CONTRACTOR IS REQUIRED TO FURNISH OR COMPENSATE THE FLAGGERS OR LAW ENFORCEMENT OFFICERS REQUIRED TO CONTROL TRAFFIC. IF TRAFFIC CONTROL IS DONE BY CONTRACTOR PERSONNEL AND IS IN LINE WITH THEIR NORMAL WORKING DUTIES, NO COMPENSATION MAY BE REQUIRED. IN NO CASE SHALL THE SIGNAL SYSTEM BE DOWN FOR MORE THAN 24 HOURS UNLESS APPROVED BY THE ENGINEER OR OTHERWISE STATED IN THE PLANS.
5. IF THE SIGNAL IS NOT NEEDED FOR A PERIOD OF GREATER THAN 24 HOURS, DUE TO NORMAL OR NEAR NORMAL TRAFFIC CONDITIONS BEING RESTORED, THE CONTRACTOR MUST COVER THE SIGNAL HEADS.
6. IF FLAGGERS ARE USED INSTEAD OF SIGNALS THEY SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES AND SIGNAL AHEAD SIGNS SHALL BE REPLACED WITH ADVANCE FLAGGER SIGNS.
7. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
8. MINIMUM ADVANCE SIGHT DISTANCE ON ALL SIGNALS SHALL BE AS SPECIFIED IN PART 4B-12 OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION. EXACT LOCATION OF ALL SIGNALS HEADS SHALL BE AS DIRECTED BY THE ENGINEER.
9. FOR TEMPORARY TRAFFIC SIGNALS USED IN CONJUNCTION WITH OR AS PART OF EXISTING TRAFFIC SIGNALS - SEE CONTRACT PLANS.

CASE D5A

TWO-LANE, TWO-WAY TRAFFIC
ONE LANE CLOSURE
OVERHEAD INSTALLATION
DAY OR NIGHT OPERATIONS

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ONE LANE OF A BRIDGE DECK AND TRAFFIC SIGNALS ARE REQUIRED.





GENERAL NOTES

1. THIS CASE ILLUSTRATES PORTABLE INSTALLATION, FOR OVERHEAD INSTALLATION, SEE CASE D5A.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF THE TRAFFIC SIGNAL SYSTEM IN PLACE FOR THIS PROJECT. THIS RESPONSIBILITY SHALL BEGIN WITH THE INITIALIZATION OF THE WORK AND CONTINUE FOR THE LIFE OF THE CONTRACT. MAINTENANCE SHALL INCLUDE BUT NOT BE LIMITED TO REPAIR OF ACTS OF VANDALISM AS WELL AS NORMAL WEAR AND BURN OUT. ITEMS TO BE MAINTAINED AND/OR REPAIRED SHALL INCLUDE CONTROLLER, CABINETS, DETECTORS, SIGNAL HEADS, SUPPORT POSTS AND ANY OTHER EQUIPMENT OR MISCELLANEOUS ITEMS IN PLACE FOR THIS SIGNAL INSTALLATION.

3. SIGNAL TIMING INFORMATION WILL BE FURNISHED BY THE DIVISION OF HIGHWAYS AND MAY NOT BE CHANGED OR MODIFIED WITHOUT APPROVAL OF THE DIVISION OF HIGHWAYS.

4. IF DUE TO EQUIPMENT FAILURES OR OTHER REASONS THE SIGNAL MUST BE PUT ON FLASH OR SHUT DOWN, THE CONTRACTOR IS REQUIRED TO FURNISH OR COMPENSATE THE FLAGGERS OR LAW ENFORCEMENT OFFICERS REQUIRED TO CONTROL TRAFFIC. IF TRAFFIC CONTROL IS DONE BY CONTRACTOR PERSONNEL AND IS IN LINE WITH THEIR NORMAL WORKING DUTIES, NO COMPENSATION MAY BE REQUIRED. IN NO CASE SHALL THE SIGNAL SYSTEM BE DOWN FOR MORE THAN 24 HOURS UNLESS APPROVED BY THE ENGINEER OR OTHERWISE STATED IN THE PLANS.

5. IF THE SIGNAL IS NOT NEEDED FOR A PERIOD OF GREATER THAN 24 HOURS, DUE TO NORMAL OR NEAR NORMAL TRAFFIC CONDITIONS BEING RESTORED, THE CONTRACTOR MUST COVER THE SIGNAL HEADS.

6. IF FLAGGERS ARE USED INSTEAD OF SIGNALS THEY SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES AND SIGNAL AHEAD SIGNS SHALL BE REPLACED WITH ADVANCE FLAGGER SIGNS.

MINIMUM STANDARDS FOR PLACEMENT OF PORTABLE TRAFFIC SIGNALS

ALL INSTALLATIONS OF PORTABLE TRAFFIC SIGNALS SHALL COMPLY WITH CASE D5B AND WITH THE FOLLOWING MINIMUM SPECIFICATIONS.

1. STANDARD CONTROLLER (NEMA) WITH TBC (TIME BASE COORDINATION) AND CONFLICT MONITOR.
2. MUST BE HARDWARE FROM CONTROLLER TO SIGNAL HEADS. (RADIO OR WIRELESS ARE NOT ACCEPTABLE.
3. NO MANUAL CONTROL OVER LENGTH OF AMBER TIME.
4. STANDARD 12" SIGNAL HEADS AND LAMPS.
5. MINIMUM HORIZONTAL SIGNAL FACE SEPARATION OF 8 FEET.
6. ONE SIGNAL HEAD MOUNTED A MINIMUM OF 15 FEET OVER APPROACH ROADWAY AND THE OTHER A MINIMUM OF 8 FEET ABOVE THE ROADWAY.
7. POWER SUPPLY SHALL BE BY POWER COMPANY SERVICE OR GENERATOR.
8. GENERATOR POWER SUPPLY SHALL HAVE A BATTERY BACKUP IF GENERATOR SHOULD FAIL.

THE GENERAL GUIDLINES ARE THAT THE HIGH/LOW SIGNAL SHOULD BE PLACED ON THE SAME SIDE OF THE ROAD THAT THE DRIVER MUST STOP. THIS MAY REQUIRE THE TRAILER WITH SIGNALS TO BE PLACED BEHIND GUARDRAIL OR SOME METHOD TO PLACE THE TRAILER OFF THE ROADWAY. WHEN USED AS A THREE PHASE SIGNAL FOR AN ADDITIONAL SIGNALIZED APPROACH. A THIRD TRAILER OR TEMPORARY SUPPORT SHOULD BE USED TO PROVIDE HIGH/LOW INDICATIONS SEPARATED HORIZONTALLY BY 8 FEET.

GENERAL NOTES - CONT.

7. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

8. MINIMUM ADVANCE SIGHT DISTANCE ON ALL SIGNALS SHALL BE AS SPECIFIED IN PART 4B-12 OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION. EXACT LOCATION OF ALL SIGNALS HEADS SHALL BE AS DIRECTED BY THE ENGINEER.

9. FOR TEMPORARY TRAFFIC SIGNALS USED IN CONJUNCTION WITH OR AS PART OF EXISTING TRAFFIC SIGNALS - SEE CONTRACT PLANS.

SYMBOLS

- SIGNAL HEADS (12")
- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHTS (AS REQUIRED. SEE NOTE 5).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM

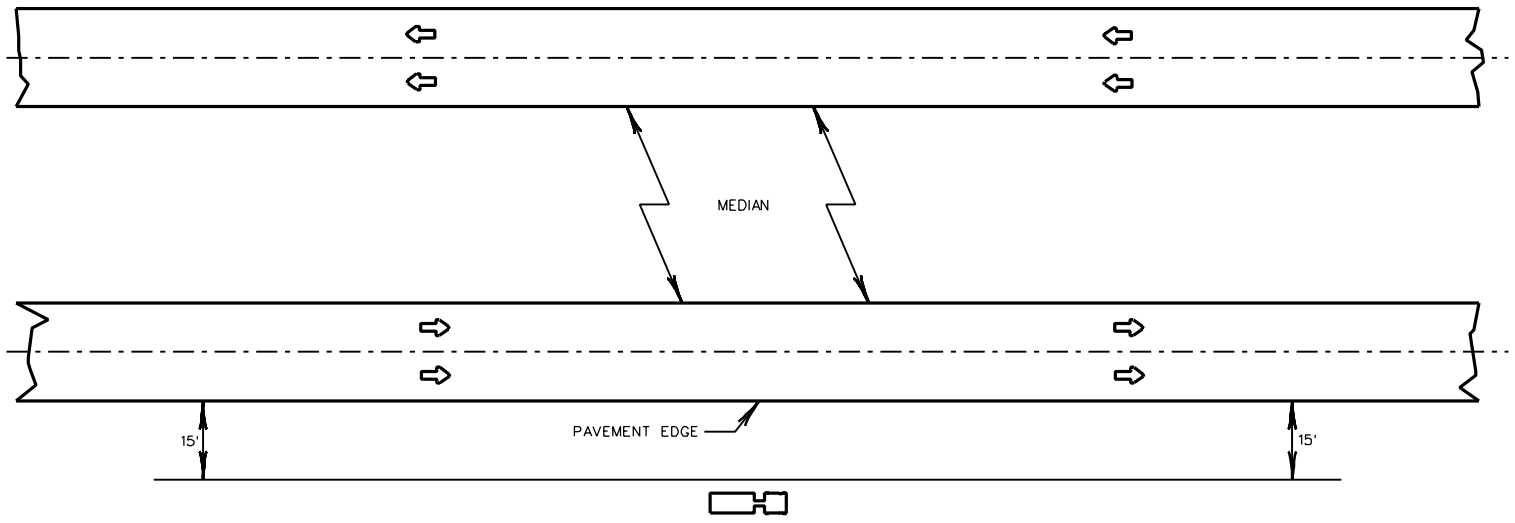
TYPICAL APPLICATIONS

BRIDGE REPAIRS
SLIDES

CASE D5B

TWO-LANE, TWO-WAY TRAFFIC
ONE LANE CLOSURE
PORTABLE INSTALLATION
DAY OR NIGHT OPERATIONS

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ONE LANE OF A BRIDGE DECK AND TRAFFIC SIGNALS ARE REQUIRED.



TYPICAL APPLICATIONS

LANDSCAPING WORK
FENCING CONTRACTS AND MAINTENANCE.
CLEANING CULVERTS.

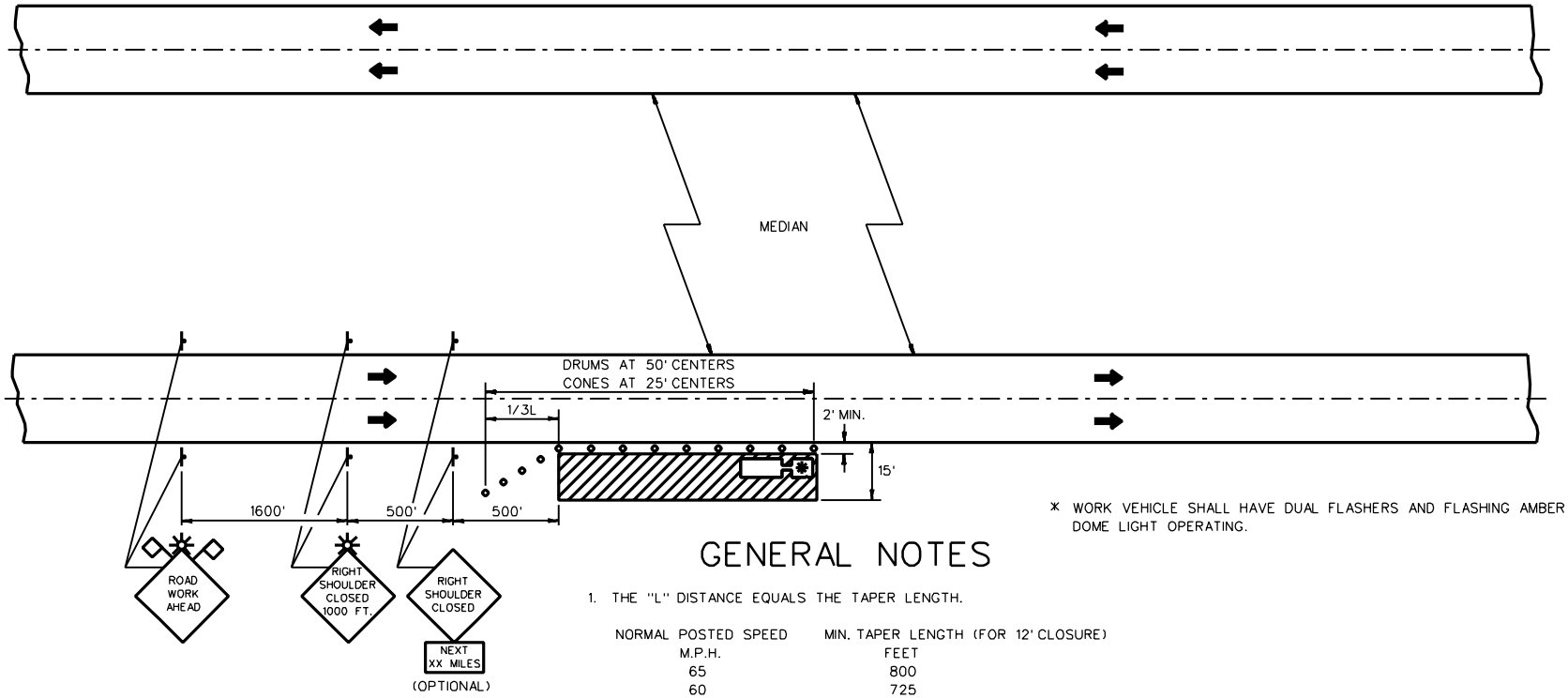
GENERAL NOTES

1. NO SPECIAL SIGNING IS REQUIRED.
2. IF THE WORK OPERATION REQUIRES THAT TWO OR MORE WORK VEHICLES CROSS THE 15 FT. CLEAR ZONE IN ANY ONE HOUR, TRAFFIC CONTROL WILL BE IN CONFORMANCE WITH CASE E3.
3. THIS CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED ON A MULTILANE UNDIVIDED HIGHWAY.

CASE E1

MULTILANE DIVIDED
DAY OR NIGHT OPERATIONS

WHERE, AT ALL TIMES, ALL VEHICLES, EQUIPMENT, WORKERS OR THEIR ACTIVITIES ARE AT ALL TIMES MORE THAN 15 FT. FROM THE EDGE OF PAVEMENT.



* WORK VEHICLE SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	MIN. TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. OVERNIGHT OPERATIONS ILLUSTRATED AND IF SUCH, USE DRUMS. FOR DAYLIGHT OPERATIONS ONLY. DELETE TYPE 'B' LIGHTS AND USE CONES OR DRUMS AS DIRECTED BY THE ENGINEER (MORE THAN 24 HOURS - USE DRUMS).

3. IF THE WORK OPERATION REQUIRES THAT FOUR OR MORE WORK VEHICLES ENTER THE THROUGH TRAFFIC LANES IN A ONE-HOUR PERIOD A FLAGGER SHALL BE PROVIDED AND THE FLAGGER SIGN SHALL BE ERECTED ACCORDINGLY.

4. THIS CASE ALSO APPLIES TO WORK PERFORMED IN THE MEDIAN AREA MORE THAN 2 FT. BUT LESS THAN 15 FT. FROM THE EDGE OF EITHER PAVEMENT.

5. ANY UNATTACHED OBSTACLE OR EXCAVATION IN THE WORK AREA SHALL BE PROTECTED BY CHANNELIZATION DEVICES WITH FLASHING LIGHTS. (TYPE "A").

6. 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.

7. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

8. IF THE WORK OPERATION DOES NOT EXCEED 15 MINUTES, TRAFFIC CONTROL SHALL BE IN CONFORMANCE WITH CASE A6.

SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- CONES OR DRUMS

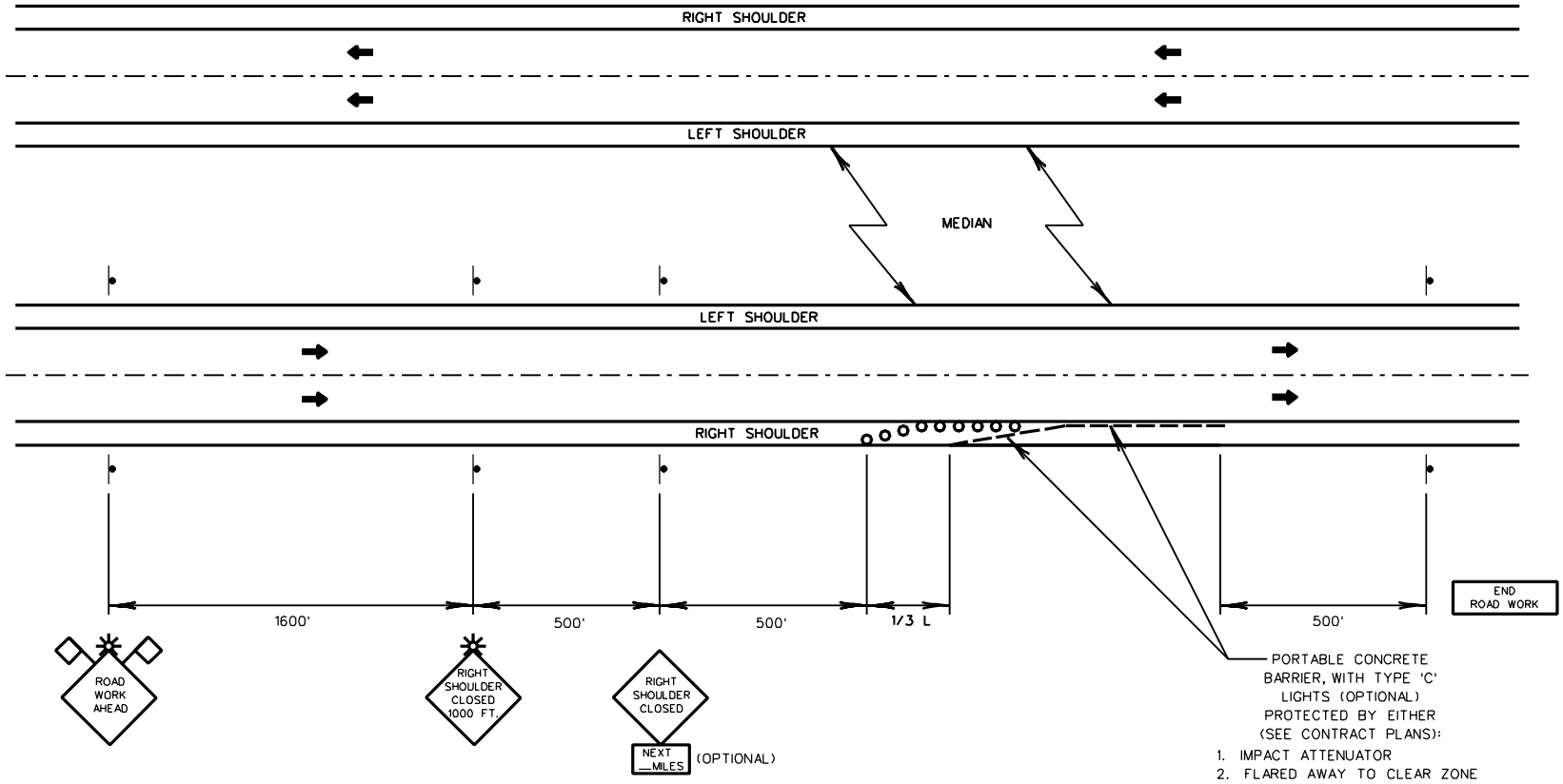
TYPICAL APPLICATIONS

UTILITY OPERATIONS.
CULVERT EXTENSIONS.
SIDE SLOPE CHANGES.
GUARDRAIL INSTALLATIONS AND MAINTENANCE.
DELINEATOR INSTALLATIONS AND MAINTENANCE.
LANDSCAPING OPERATIONS.
CLEANING DITCHES AND DRAINAGE STRUCTURES.
SIGN INSTALLATIONS AND MAINTENANCE.
SHOULDER REPAIR.

CASE E2

MULTILANE, DIVIDED,
DAY OR NIGHT OPERATIONS.
AND MOBILE OPERATIONS

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE AREA BETWEEN 2 FT. AND 15 FT. FROM THE EDGE OF PAVEMENT.



SYMBOLS

SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).

SIGN ON PORTABLE OR PERMANENT SUPPORT.

CONES

TYPICAL APPLICATIONS

LANDSCAPING WORK.
FENCING WORK.
CLEANING CULVERTS.
SHOULDER WORK.

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	MIN. TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. IF THE WORK OPERATION REQUIRES THAT FOUR OR MORE WORK VEHICLES ENTER THE THROUGH TRAFFIC LANES IN A ONE-HOUR PERIOD A FLAGGER SHALL BE PROVIDED AND THE FLAGGER SIGN SHALL BE ERECTED ACCORDINGLY.

3. THIS CASE ALSO APPLIES TO WORK PERFORMED IN THE MEDIAN AREA MORE THAN 2 FT. BUT LESS THAN 15 FT. FROM THE EDGE OF EITHER PAVEMENT.

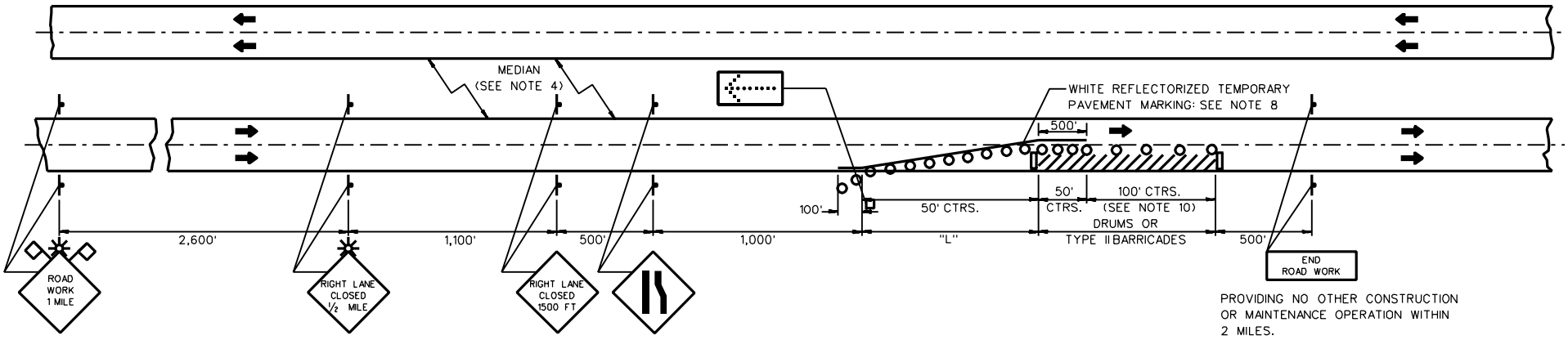
4. THIS CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED ON A MULTILANE UNDIVIDED HIGHWAY. UNDER THESE CONDITIONS THE SIGNS NORMALLY MOUNTED IN THE MEDIAN SHALL BE OMITTED.

5. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

CASE E3

MULTILANE DIVIDED
DAY OR NIGHT OPERATIONS
SHOULDER CLOSED

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE AREA BETWEEN 2 FT. AND 15 FT. FROM THE EDGE OF PAVEMENT.



PROVIDING NO OTHER CONSTRUCTION OR MAINTENANCE OPERATION WITHIN 2 MILES.

SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUMS
- ELECTRIC ARROW.

TYPICAL APPLICATIONS

PAVEMENT REPAIRS
SLIDES
BRIDGE DECK REPAIRS

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	MIN. TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. WHEN CONSTRUCTION OPERATIONS CAUSE EQUIPMENT TO ENCROACH ON THE TRAVELED WAY, A FLAGGER WILL BE REQUIRED IN THE WORK ZONE WITH A FLAGGER SIGN PLACED 500' IN ADVANCE OF THE FLAGGER.

3. THE CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE LANE ADJACENT TO THE MEDIAN ON A DIVIDED HIGHWAY. UNDER THESE CONDITIONS LEFT LANE CLOSED SIGNS SHALL BE SUBSTITUTED FOR RIGHT LANE CLOSED SIGNS.

4. THE CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE LANE ADJACENT TO THE CENTER LINE ON AN UNDIVIDED HIGHWAY. UNDER THESE CONDITIONS LEFT LANE CLOSED SIGNS (S) SHALL BE SUBSTITUTED FOR RIGHT LANE CLOSED SIGNS (S). UNDER THESE CONDITIONS THE SIGNS NORMALLY MOUNTED IN THE MEDIAN SHALL BE OMITTED. SIGNS SHALL BE ADDED IN THE OPPOSITE DIRECTION IN CONFORMANCE WITH CASE A4 AND ADDITIONAL CHANNELIZATION DEVICES SHALL BE PLACED ALONG THE CENTER LINE THROUGH THE TAPER AND WORK AREA AS SHOWN IN THE CONTRACT PLANS.

5. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

6. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

7. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED OR MAINLINE OPPOSITE DIRECTION IS AFFECTED, ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

8. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

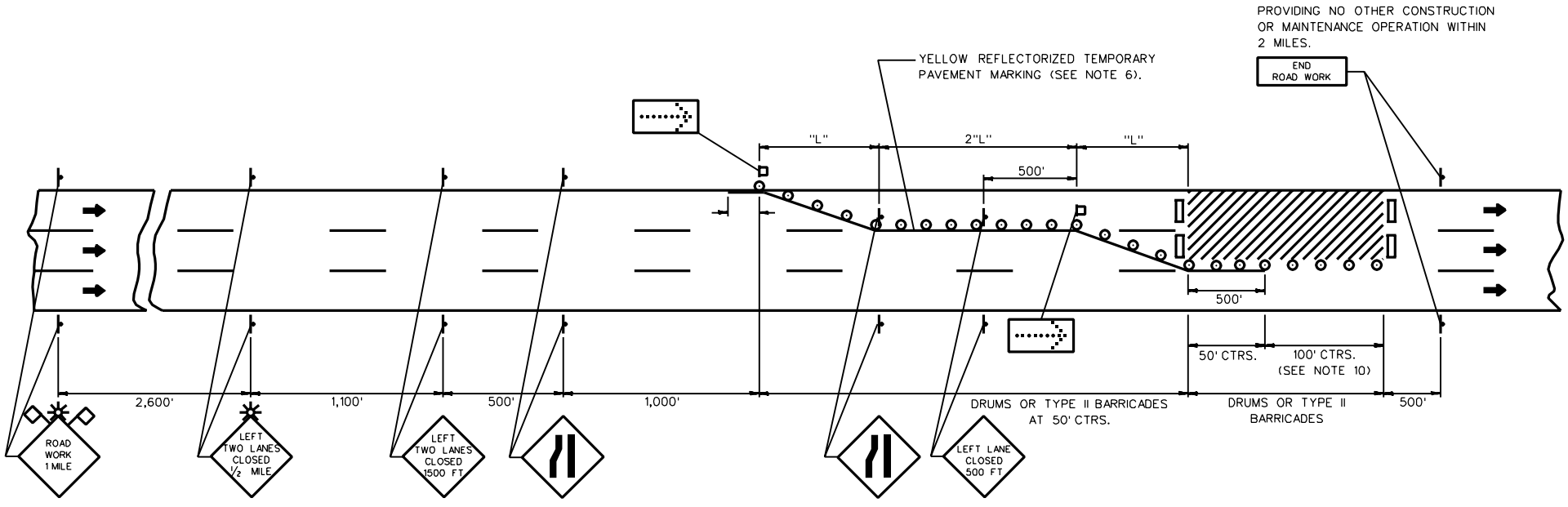
9. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

10. DEVICES SHALL BE SPACED AT 50' CENTERS WHEN WORK IS PERFORMED IN THIS AREA.

CASE E4

MULTILANE, DIVIDED AND UNDIVIDED OPERATIONS EXCEEDING ONE DAYLIGHT OPERATION

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE SHOULDER OR ON THE SHOULDER WITHIN 2 FEET OF THE EDGE OF PAVEMENT.



GENERAL NOTES

SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- CHANNELIZATION DEVICE.
- ELECTRIC ARROW

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	MINIMUM TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. OVERNIGHT OPERATIONS ILLUSTRATED, AND IF SUCH, USE DRUMS. FOR DAYLIGHT OPERATIONS ONLY, DELETE TYPE 'B' LIGHTS (MAY ALSO SUBSTITUTE CONES FOR DRUMS).

3. WHEN CONSTRUCTION OPERATIONS CAUSE EQUIPMENT TO ENCROACH ON THE TRAVELED WAY, A FLAGGER WILL BE REQUIRED IN THE WORK ZONE WITH A FLAGGER SIGN PLACED 500' IN ADVANCE OF THE FLAGGER.

4. THIS CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE TWO LANES ADJACENT TO THE SHOULDER ON A DIVIDED HIGHWAY. UNDER THESE CONDITIONS ALL SIGNS SHALL BE CHANGED TO REFLECT THE CLOSURE OF THE RIGHT LANES.

5. ALL SIGNS EXCEPT THOSE IN ROADWAY SHALL BE POST MOUNTED IF CLOSURE TIME EXCEEDS SEVEN DAYS.

6. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

7. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED OR MAINLINE OPPOSITE DIRECTION IS AFFECTED, ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

8. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO THE WORK AREA SIDE OF THE TRAFFIC CONTROL DEVICES UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

9. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. THEY SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

10. DEVICES SPACED AT 50' CENTERS SHALL BE USED TO SUPPLEMENT DEVICES SPACED AT 100' CENTERS WHEN WORK IS PERFORMED IN THIS AREA.

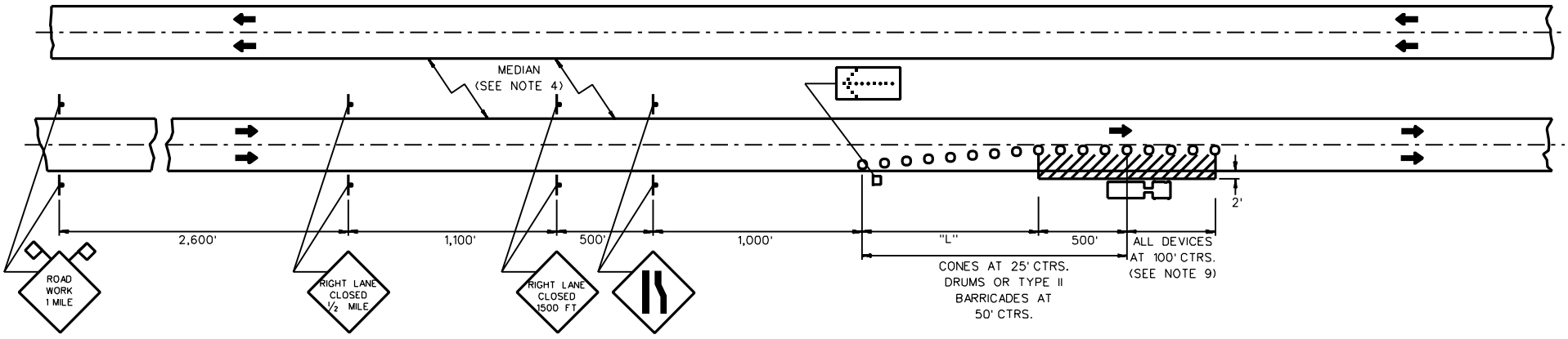
TYPICAL APPLICATIONS

PAVEMENT REPAIR
SLIDES
BRIDGE DECK REPAIRS

CASE E5

MULTILANE, ONE WAY TRAFFIC, OPERATIONS

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE TWO LANES IMMEDIATELY ADJACENT TO THE SHOULDER OR MEDIAN.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN).
- CONES, DRUMS OR TYPE II BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- ELECTRIC ARROW.

TYPICAL APPLICATIONS

PAVEMENT PATCHING
UTILITY OPERATIONS.
PAVEMENT MARKINGS

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	MIN. TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. DAYLIGHT OPERATIONS ILLUSTRATED AND IF SUCH, USE DRUMS. OR CONES AS DIRECTED BY THE ENGINEER. FOR NIGHT OPERATIONS, USE DRUMS AND FLASHING LIGHTS SHALL BE INSTALLED ABOVE FIRST TWO SETS OF SIGNS ON EACH APPROACH (TYPE 'B').

3. THE CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE LANE ADJACENT TO THE MEDIAN ON A DIVIDED HIGHWAY. UNDER THESE CONDITIONS LEFT LANE CLOSED SIGNS SHALL BE SUBSTITUTED FOR RIGHT LANE CLOSED SIGNS.

4. THE CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE LANE ADJACENT TO THE CENTER LINE ON AN UNDIVIDED HIGHWAY. UNDER THESE CONDITIONS LEFT LANE CLOSED SIGNS (S) SHALL BE SUBSTITUTED FOR RIGHT LANE CLOSED SIGNS (S). UNDER THESE CONDITIONS THE SIGNS NORMALLY MOUNTED IN THE MEDIAN SHALL BE OMITTED. SIGNS SHALL BE ADDED IN THE OPPOSITE DIRECTION IN CONFORMANCE WITH CASE A4 AND ADDITIONAL CHANNELIZATION DEVICES SHALL BE PLACED ALONG THE CENTER LINE THROUGH THE TAPER AND WORK AREA.

5. WHEN CONSTRUCTION OPERATIONS CAUSE EQUIPMENT TO ENCROACH UPON THE TRAVELED WAY, A FLAGGER WILL BE REQUIRED IN THE WORK ZONE WITH A FLAGGER SIGN PLACED 500' IN ADVANCE OF THE FLAGGER.

6. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED OR MAINLINE OPPOSITE DIRECTION IS AFFECTED, ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

7. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

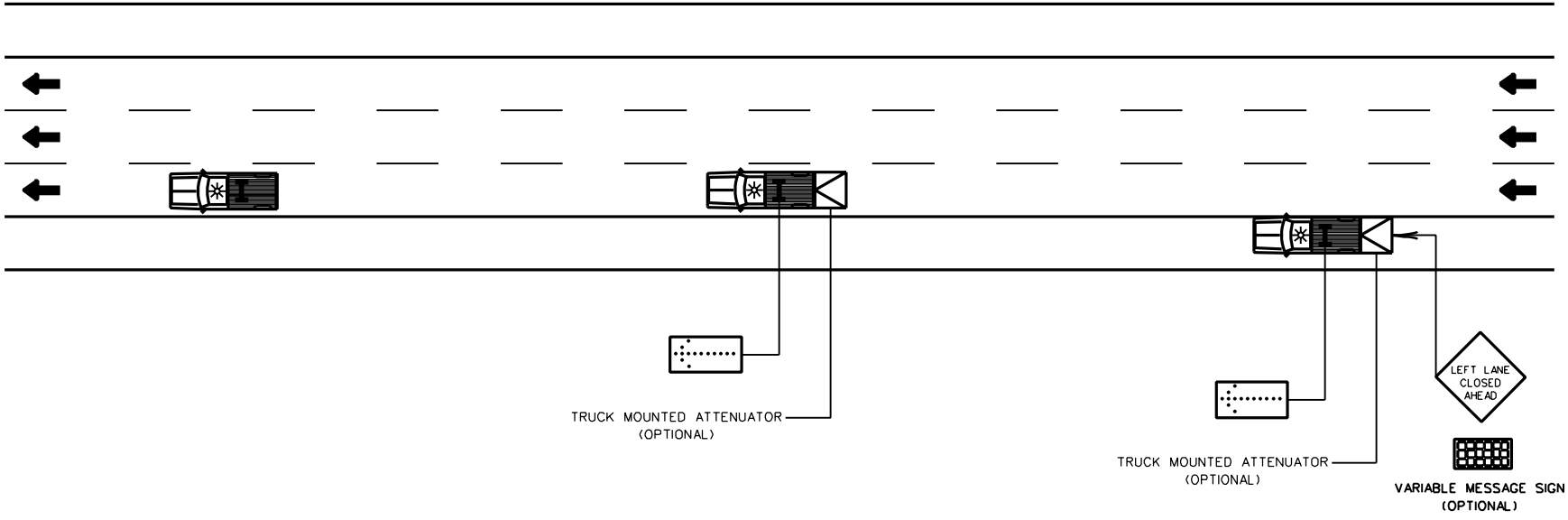
8. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

9. DEVICES SHALL BE SPACED AT 50' CENTERS WHEN WORK IS PERFORMED IN THIS AREA.

CASE E6

MULTILANE, DIVIDED AND
UNDIVIDED DAY OPERATIONS
ONLY

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE SHOULDER OR ON THE SHOULDER WITHIN 2 FEET OF THE EDGE OF PAVEMENT.



SYMBOLS

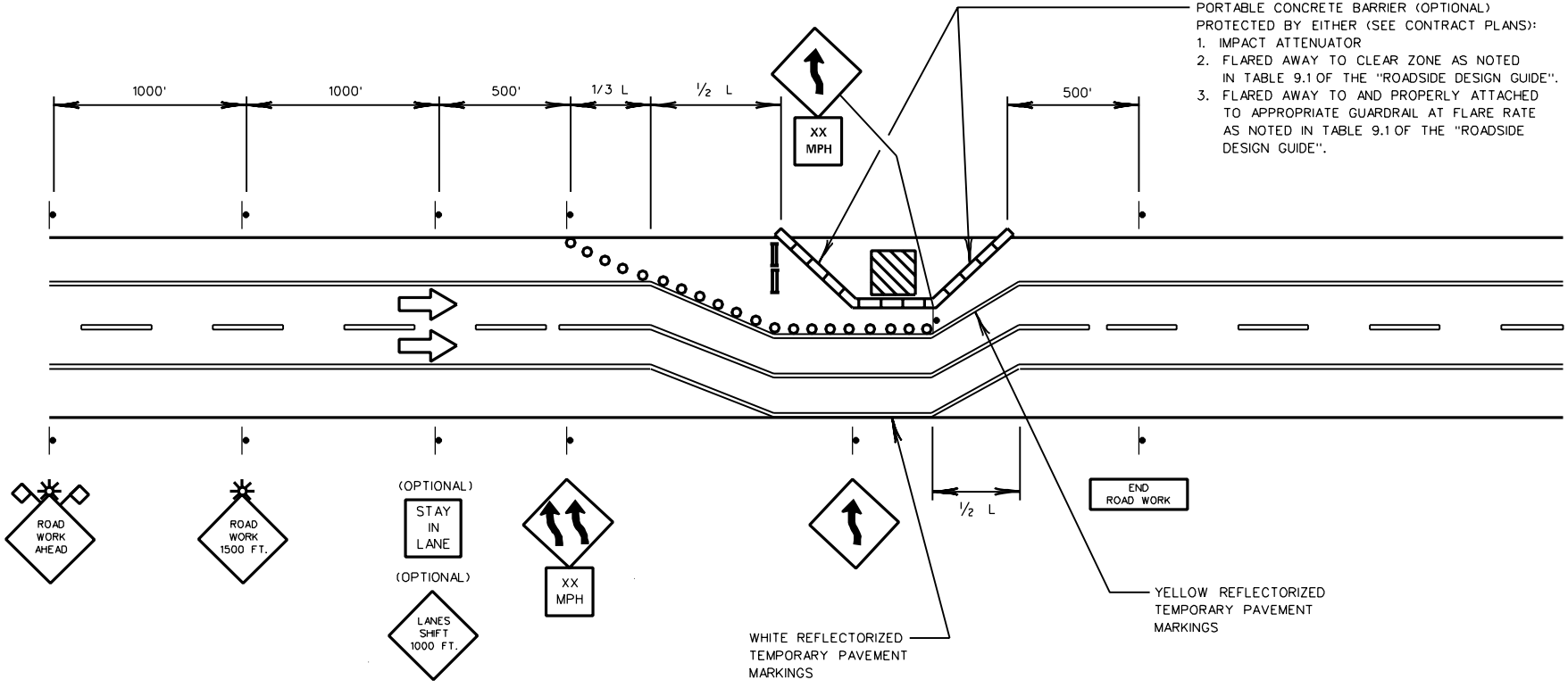
TYPICAL APPLICATIONS

GENERAL NOTES

1. VEHICLES USED FOR THESE OPERATIONS SHOULD BE MADE HIGHLY VISIBLE WITH APPROPRIATE EQUIPMENT, SUCH AS: FLASHING LIGHTS, ROTATING BEACONS, FLAGS, SIGNS OR ARROW PANELS.
2. PROTECTION VEHICLE #2 SHOULD BE EQUIPPED WITH AN ARROW PANEL AND TRUCK-MOUNTED ATTENUATOR.
3. PROTECTION VEHICLE #1 SHOULD BE EQUIPPED WITH AN ARROW PANEL. AN APPROPRIATE LANE CLOSURE SIGN SHOULD BE PLACED ON PROTECTION VEHICLE #1 SO AS NOT TO OBSCURE THE ARROW PANEL.
4. PROTECTION VEHICLE #1 SHOULD TRAVEL AT A VARYING DISTANCE FROM THE WORK OPERATION SO AS TO PROVIDE ADEQUATE SIGHT DISTANCE FOR TRAFFIC APPROACHING FROM THE REAR.
5. WHERE ADEQUATE SHOULDER WIDTH IS NOT AVAILABLE, PROTECTION VEHICLE #1 SHOULD BE ELIMINATED.
6. ON HIGH-SPEED ROADWAYS, A THIRD PROTECTION VEHICLE SHOULD BE USED -- VEHICLE #1 ON THE SHOULDER (IF POSSIBLE), VEHICLE #2 STRADDLING THE EDGE LINE, AND VEHICLE #3 IN THE CLOSED LANE.
7. ARROW PANELS SHALL BE AS A MINIMUM TYPE B, 60"X30".
8. WORK SHOULD NORMALLY BE ACCOMPLISHED DURING OFF-PEAK HOURS.

CASE E7

MOBILE OPERATIONS ON MULTILANE ROAD



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM.
- POSITIVE SEPARATION (E.G. TEMPORARY CONCRETE BARRIER, SEE CONTRACT PLANS.

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. 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.

3. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

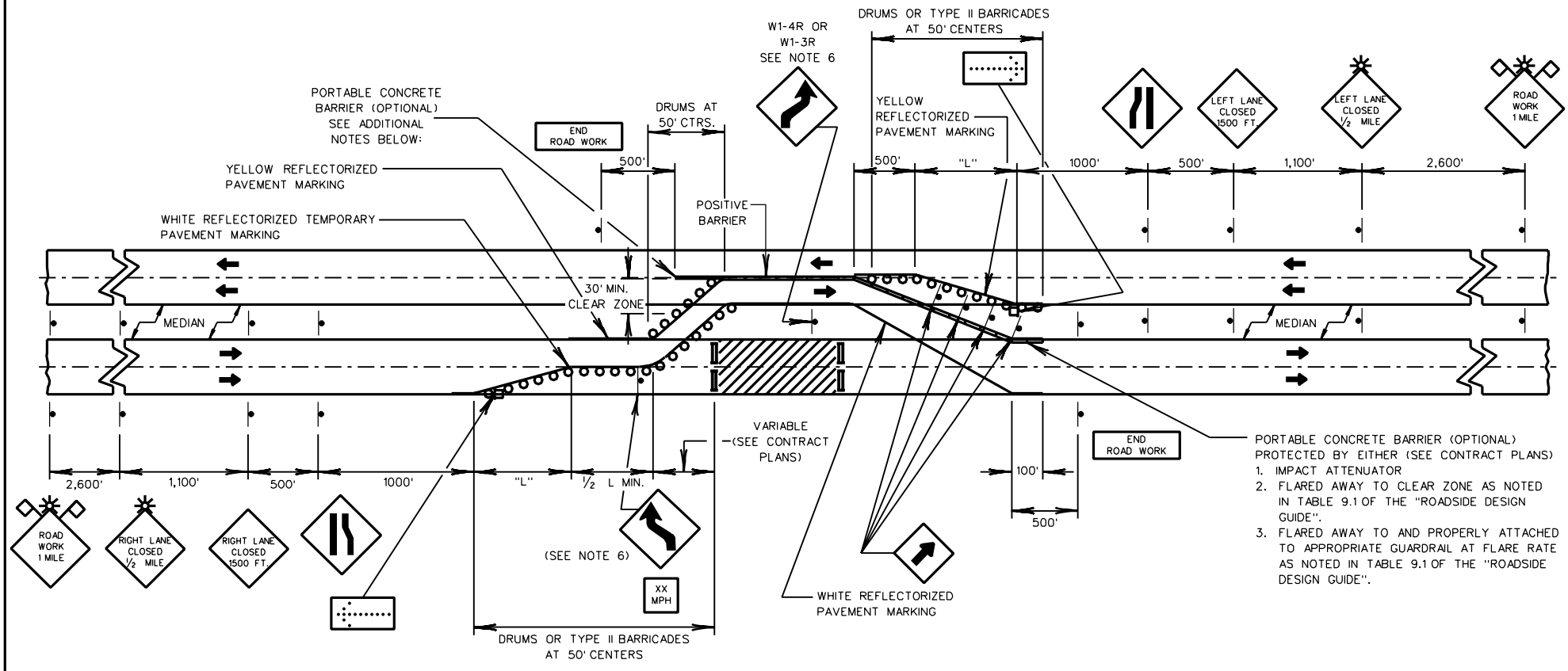
4. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED OR MAINLINE OPPOSITE DIRECTION IS AFFECTED, ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

CASE E8

LANE SHIFT ON FREEWAY/EXPRESSWAY

MULTILANE ONE WAY TRAFFIC OPERATIONS EXCEEDING ONE DAYLIGHT OPERATION

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE SHOULDER OR MEDIAN.



GENERAL NOTES

SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW.

1. TEMPORAY PAVEMENT MARKINGS (PAINT OR TAPE) SHALL BE USED WHEN THE CLOSURE TIME EXCEEDS SEVEN DAYS. TEMPORARY PAVEMENT MARKINGS SHALL BE USED FOR MAKING A NEW CENTER LINE AND EDGE LINE ON THE EXISTING PAVEMENT. ALL EXISTING MARKINGS WHICH CONFLICT WITH THE REVISED TRAFFIC PATTERN WILL BE ERADICATED.
2. ALL CROSSOVER PAVEMENT MARKINGS SHALL BE REMOVED WHEN TRAFFIC NO LONGER CROSSES OVER AND/OR AT THE COMPLETION OF THE PROJECT.
3. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

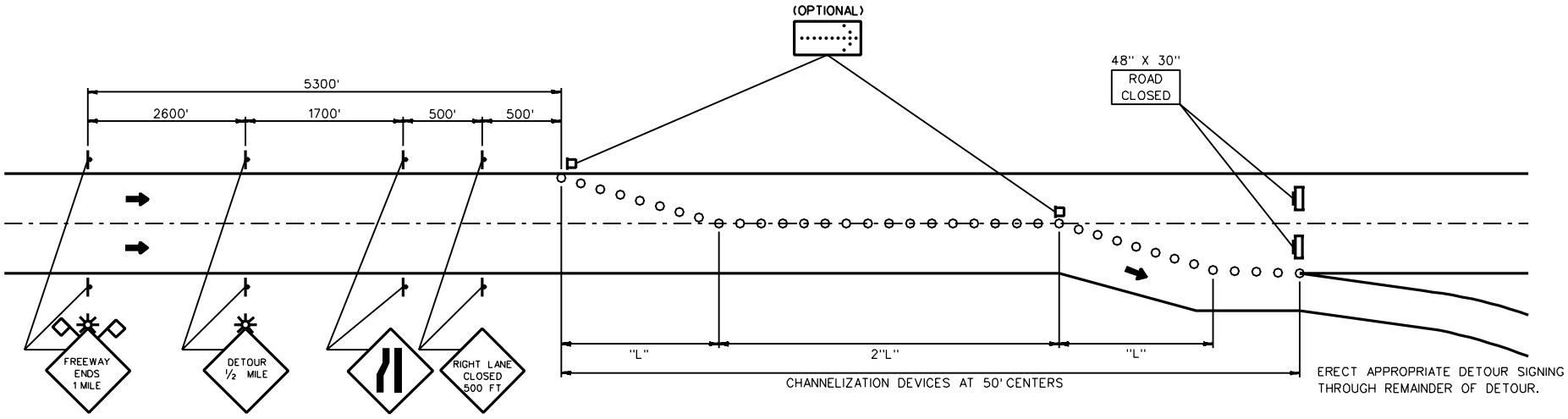
NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

4. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST.
5. WHEN CROSSOVER SPEED IS GREATER THAN 30 M.P.H., REVERSE CURVE (W1-4) SIGN SHALL BE USED. WHEN SPEED IS 30 M.P.H. OR LESS, REVERSE TURN (W1-3) SIGN SHALL BE USED.
6. TWO-WAY TRAFFIC SHALL BE SEPARATED BY A POSITIVE BARRIER, (FOR TYPE - SEE CONTRACT PLANS)
7. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE MEDIAN.

CASE E9

MULTILANE, TWO-WAY TRAFFIC, DIVIDED
DAY OR NIGHT OPERATIONS.

WHERE AT ANY TIME ANY VEHICLE EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE THE CLOSURE OF TWO ADJACENT LANES AND A TEMPORARY CROSSOVER IS PROVIDED BY MAKING USE OF ONE LANE OF PAVEMENT NORMALLY USED BY THE OPPOSING FLOW OF TRAFFIC.



GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. THIS CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED ON MULTULANE UNDIVIDED HIGHWAYS. UNDER THESE CONDITIONS THE SIGNS AND WARNING LIGHTS NORMALLY MOUNTED IN THE MEDIAN SHALL BE OMITTED.

3. ALL SIGNS EXCEPT FOR THOSE IN ROADWAY SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

4. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

5. WHEN THE ELECTRIC ARROW IS USED CARE MUST BE TAKEN TO INSURE CONTINUOUS OPERATION. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1000 FT.

SYMBOLS

- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- ELECTRIC ARROW.
- TYPE III BARRICADES.
- CHANNELIZATION DEVICE.

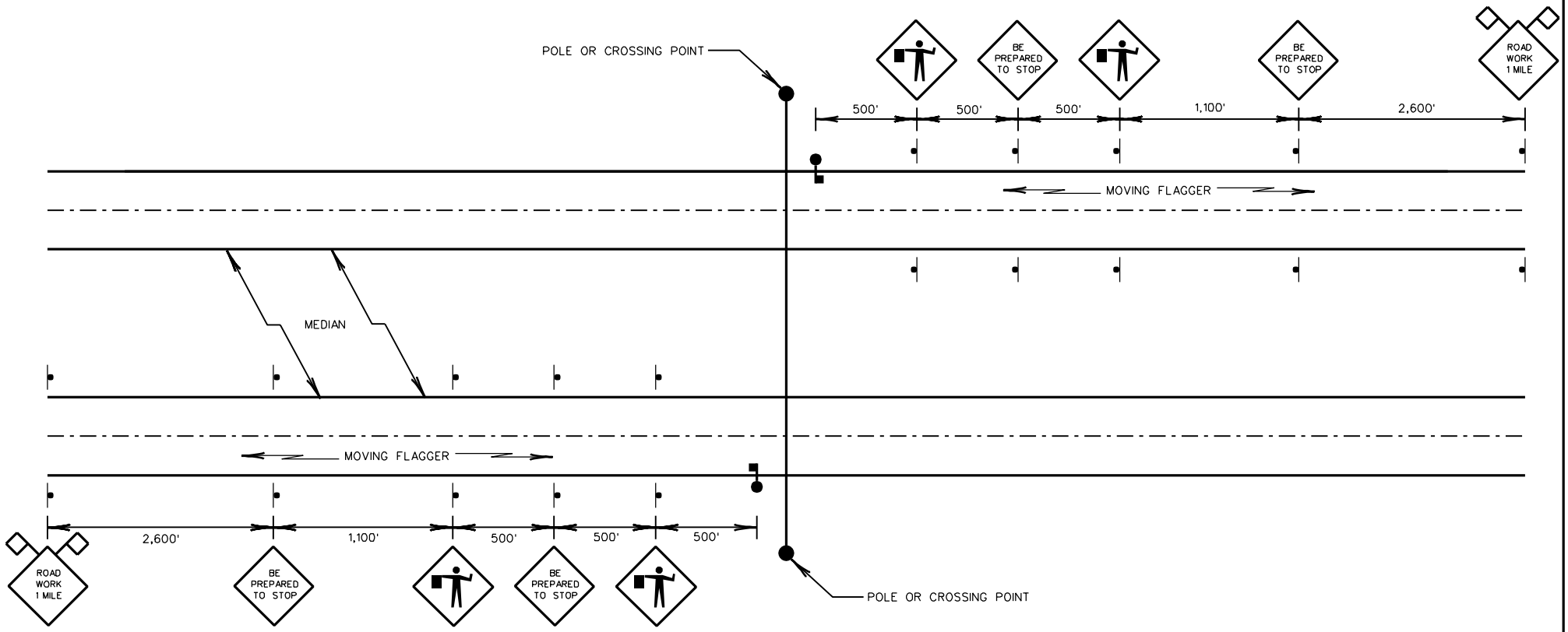
TYPICAL APPLICATIONS

HAZARDOUS MATERIAL SPILLS
STRUCTURES COLLAPSE
OTHER MAJOR INCIDENTS

CASE E10

MULTILANE, ONE WAY TRAFFIC,
EXPRESSWAY CLOSURE.

FOR EMERGENCY USE ONLY



SYMBOLS

SIGN ON PORTABLE OR PERMANENT SUPPORT.

FLAGGER WITH PADDLE

GENERAL NOTES

1. THIS CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED ON MULTILANE UNDIVIDED HIGHWAYS. UNDER THESE CONDITIONS THE SIGNS AND WARNING LIGHTS NORMALLY MOUNTED IN THE MEDIAN SHALL BE OMITTED.

2. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

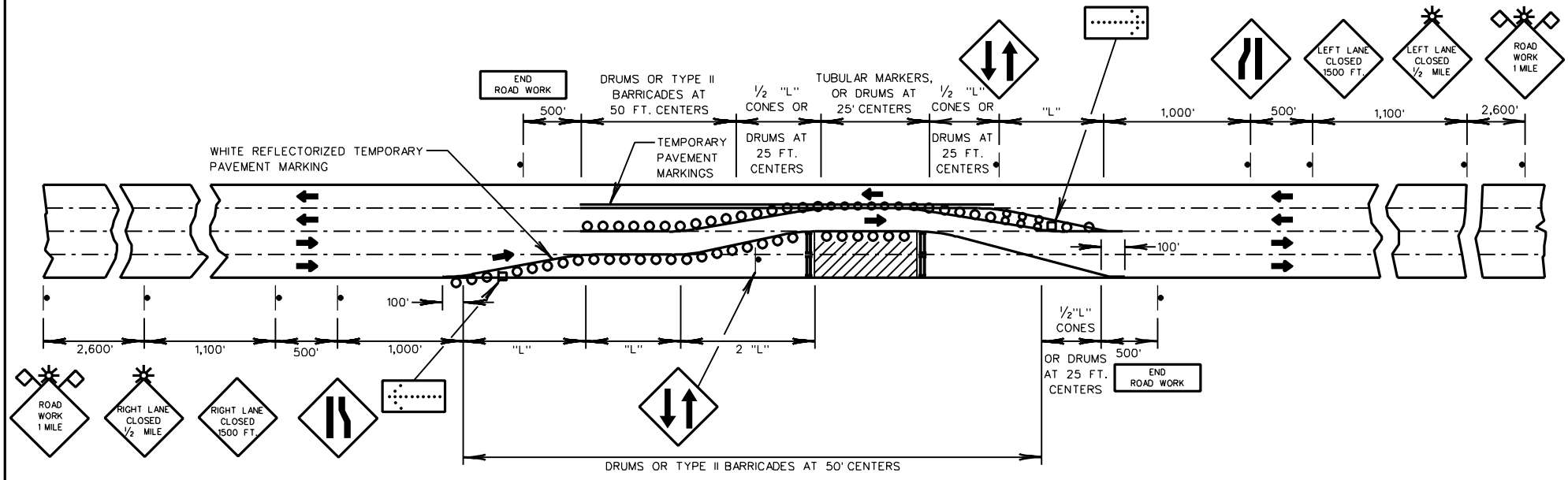
3. THE SITE SHALL BE COMPLETELY PREPARED (SIGNS, DEVICES, WORK EQUIPMENT, ETC.) THEN TRAFFIC STOPPED FOR MAXIMUM OF 15 MINUTES; THEN PERIODICALLY PLATOONS OF VEHICLES SHALL BE ALLOWED TO PROCEED FOLLOWED BY OTHER STOPPAGES.

4. THIS OPERATION SHALL ONLY OCCUR ON A SUNDAY MORNING PRIOR TO 11:00 AM (OTHER TIMES MUST BE APPROVED BY THE DISTRICT ENGINEER OR TRAFFIC ENGINEERING DIVISION).

5. MOVING FLAGGER SPECIAL PROVISION
ALL FLAGGERS SHALL BE FURNISHED BY THE CONTRACTOR AND ALL FLAGGING SHALL BE HIS RESPONSIBILITY. WHERE MOVING FLAGGER IS NOTED OR CALLED FOR, TWO FLAGGERS SHALL BE PROVIDED AT EACH END OF THE AREAS WHERE TRAFFIC IS BEING STOPPED. ONE FLAGGER IS TO BE POSITIONED IN ACCORDANCE WITH THE MANUAL, WHILE THE OTHER FLAGGER IS TO CONTINUALLY MOVE WITH STOPPING TRAFFIC. TWO-WAY RADIOS SHALL BE PROVIDED TO THE FLAGGERS WHEN THEY ARE OUT OF SIGHT OF EACH OTHER.

CASE E11

SHORT TERM UTILITY CROSSINGS
OF MULTILANE EXPRESSWAYS



GENERAL NOTES

1. TEMPORARY PAVEMENT MARKINGS (TAPE OR PAINT) SHALL BE USED WHEN THE CLOSURE TIME EXCEEDS SEVEN DAYS. TEMPORARY PAVEMENT MARKINGS SHALL BE USED FOR MARKING A NEW CENTER LINE AND EDGE LINE ON THE EXISTING PAVEMENT. ALL EXISTING MARKINGS WHICH CONFLICT WITH THE REVISED TRAFFIC PATTERN SHALL BE ERADICATED.

2. ALL CROSSOVER PAVEMENT MARKINGS SHALL BE REMOVED WHEN TRAFFIC NO LONGER CROSSES OVER AND/OR AT THE COMPLETION OF THE PROJECT.

3. CONES MAY BE SUBSTITUTED FOR CHANNELIZING DEVICES FOR DAYTIME ONLY OPERATIONS.

4. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

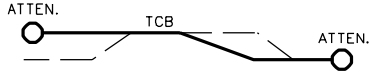
5. CARE MUST BE TAKEN TO ENSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST.

6. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

7. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

8. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

9. PORTABLE CONCRETE BARRIER MAY BE USED (SEE CONTRACT PLANS) AND IF SO IT WOULD BE PROTECTED BY IMPACT ATTENUATORS AND CONFIGURED AS FOLLOWS:



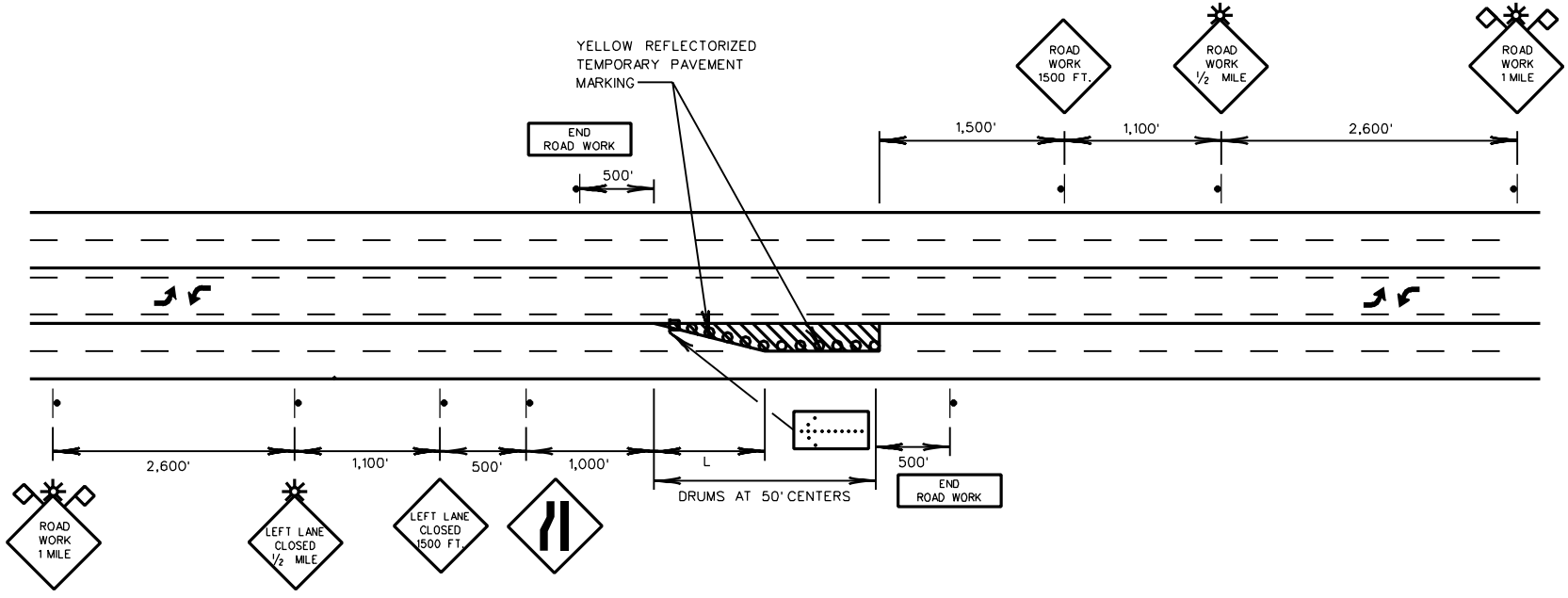
SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM.
- ELECTRIC ARROW

CASE E12

MULTILANE, TWO-WAY TRAFFIC, UNDIVIDED, DAY OR NIGHT OPERATIONS.

WHERE, AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE THE CLOSURE OF TWO ADJACENT LANES AND A TEMPORARY RUNAROUND IS PROVIDED BY MAKING USE OF ONE LANE OF PAVEMENT NORMALLY USED BY THE OPPOSING FLOW OF TRAFFIC.



GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE 'A').

3. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

4. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

6. WORK VEHICLE, IF USED, SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

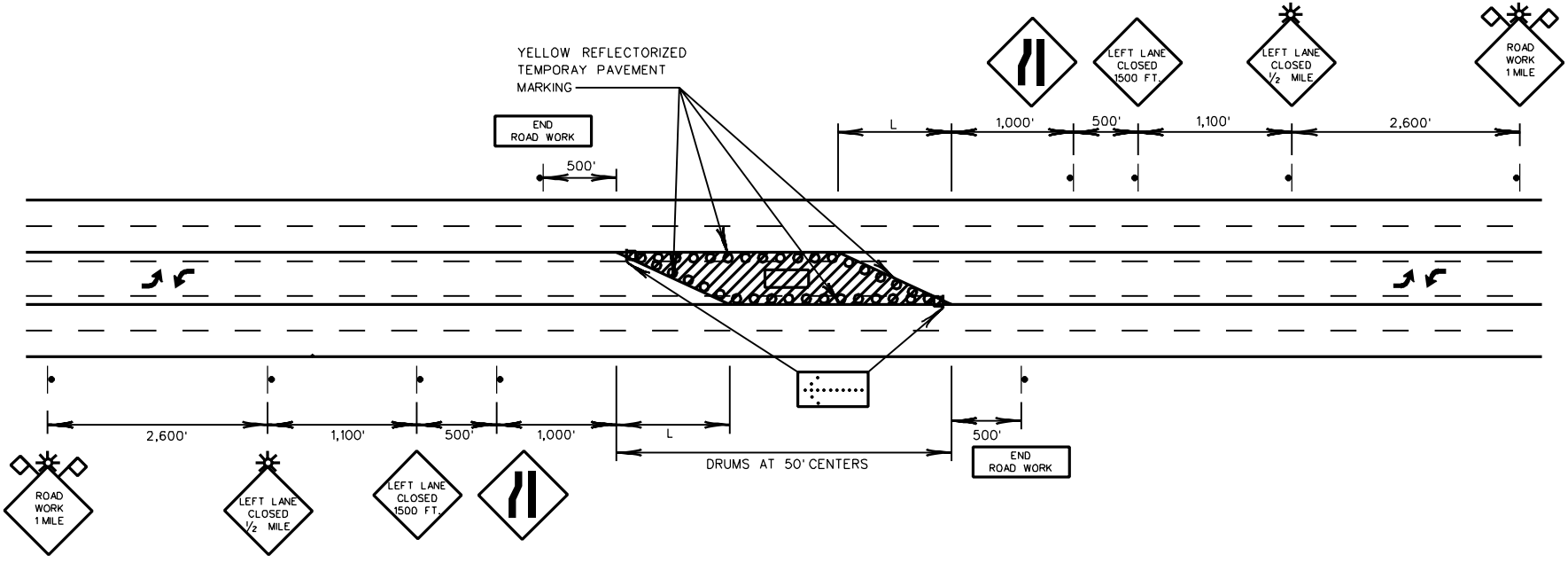
SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW.

CASE E13

FIVE LANE, DOUBLE LEFT TURN LANE, UNDIVIDED DAY OR NIGHT OPERATION

SECOND LANE CLOSED
(OUTSIDE LANE SIMILAR)



GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE 'A').

3. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

4. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

6. WORK VEHICLE, IF USED, SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

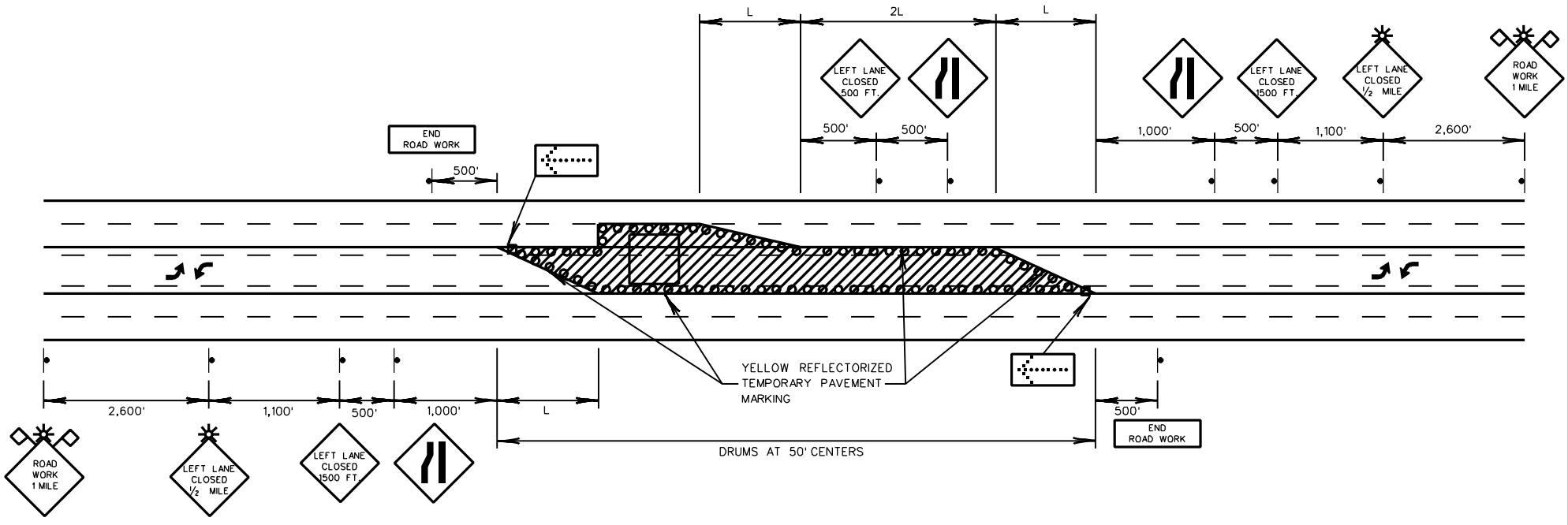
SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW.

CASE E14

FIVE LANE, DOUBLE LEFT TURN LANE, UNDIVIDED DAY OR NIGHT OPERATION

MIDDLE LANE CLOSED



GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE 'A').

3. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

4. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

6. WORK VEHICLE, IF USED, SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

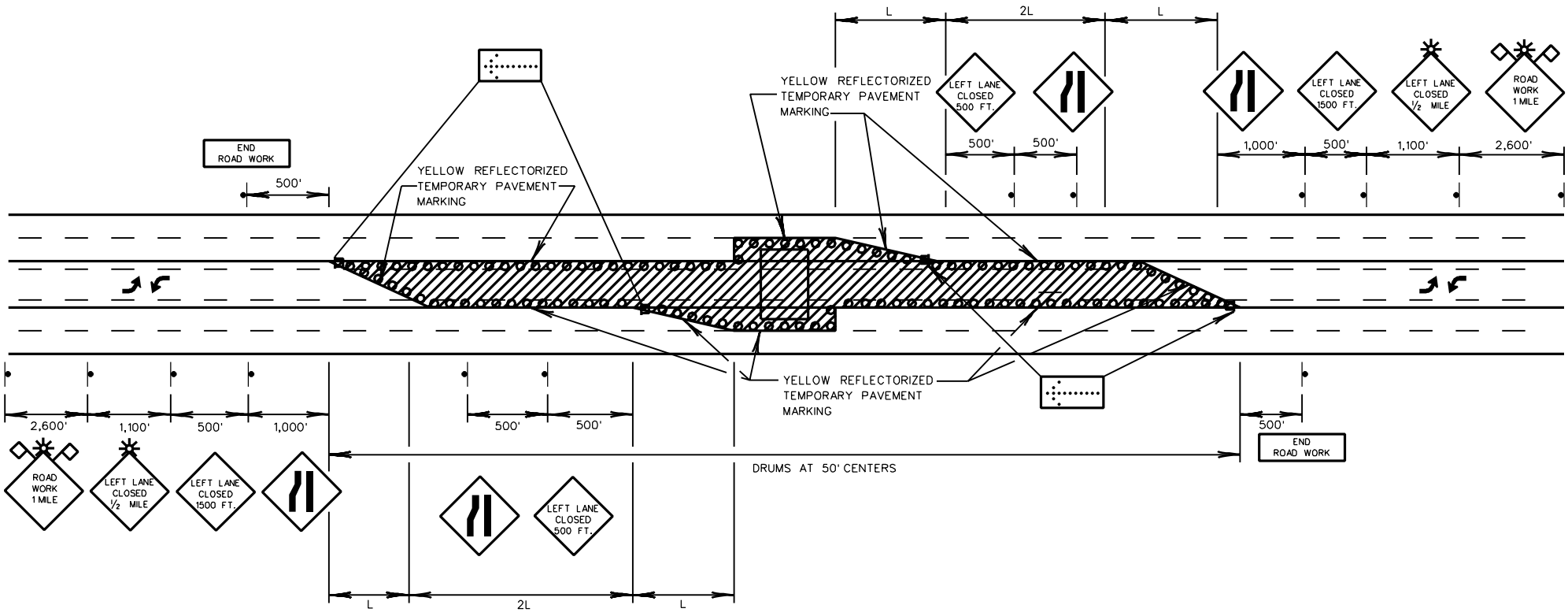
SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW.

CASE E15

MULTILANE, FIVE LANE UNDIVIDED DAY OR NIGHT OPERATION

MIDDLE LANE AND ONE INSIDE LANE CLOSED



GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE 'A').

3. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

4. CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

6. WORK VEHICLE, IF USED, SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

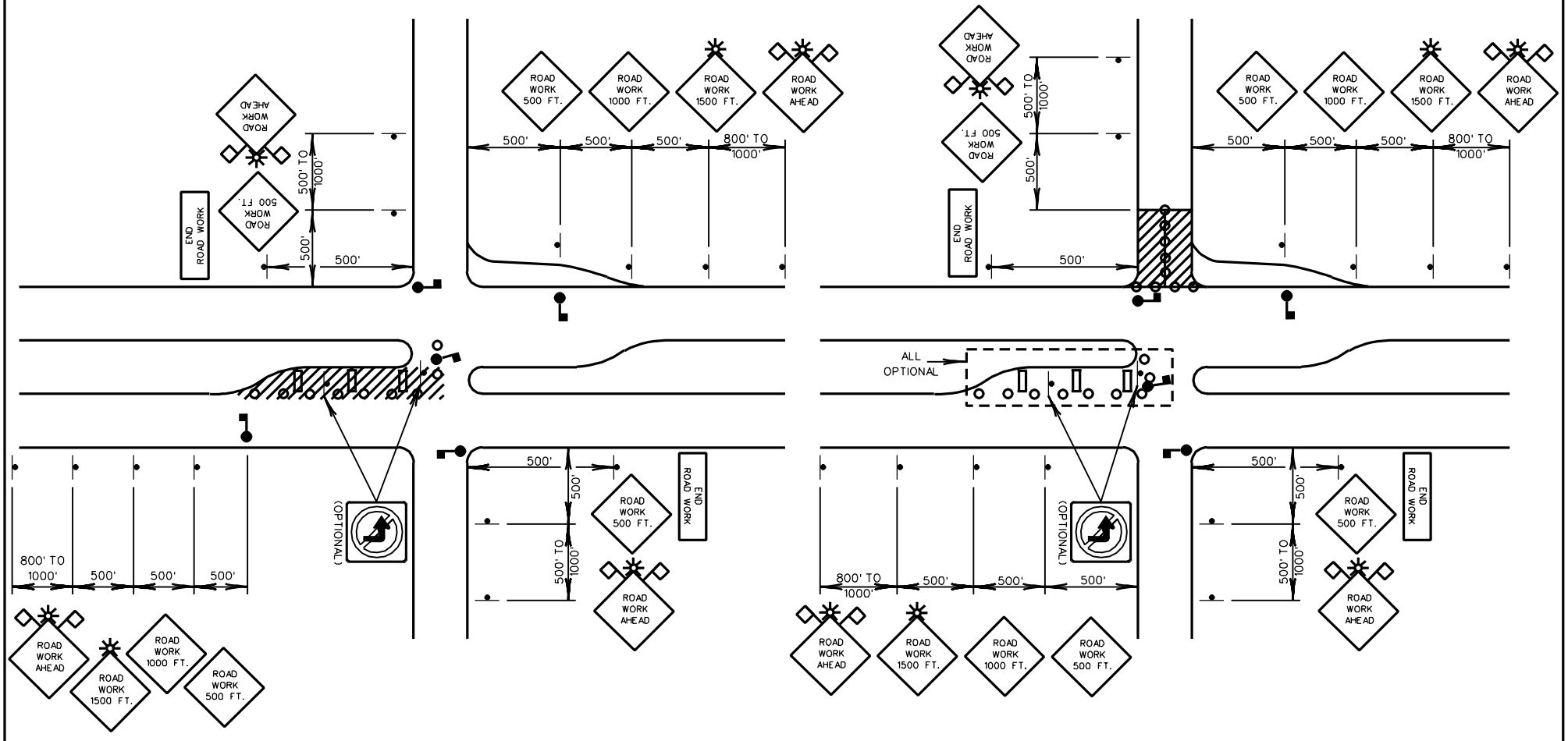
SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW.

CASE E16

FIVE LANE, DOUBLE LEFT TURN LANE UNDIVIDED DAY OR NIGHT OPERATION

MIDDLE LANE AND BOTH INSIDE LANES CLOSED



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- FLAGGER AND ADVANCE FLAGGER SIGNS AS REQUIRED

GENERAL NOTES

1. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
2. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA OVERNIGHT SHALL BE PROTECTED BY TYPE I OR TYPE II BARRICADES WITH FLASHING LIGHTS (TYPE 'A').
3. WORK VEHICLE, IF USED, SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

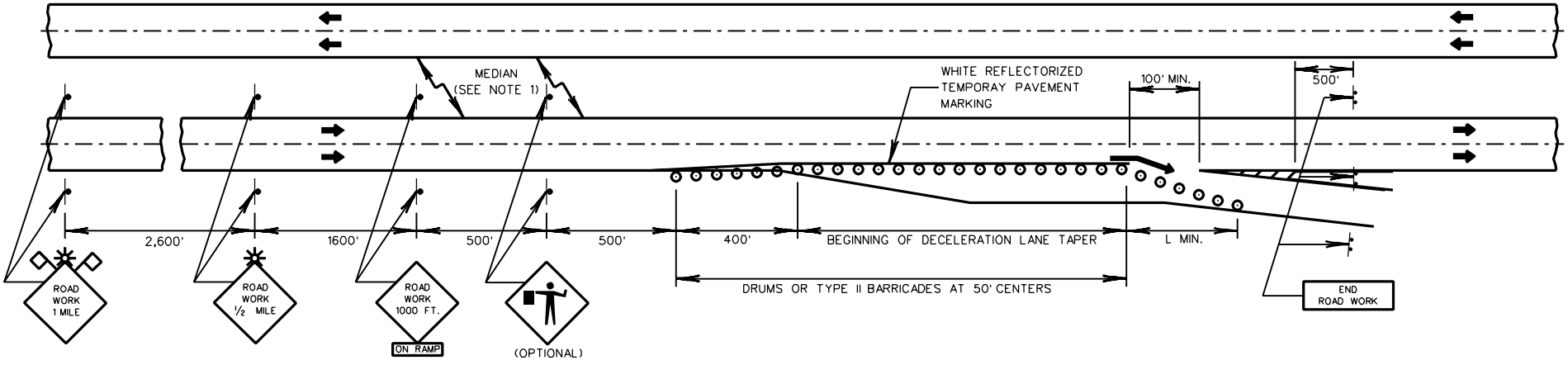
TYPICAL APPLICATIONS

EXPRESSWAY - SIDEROAD CONSTRUCTION
EXPRESSWAY - LEFT TURN LANE CONSTRUCTION
EXPRESSWAY - SIDEROAD AND TURN LANE CONSTRUCTION

CASE E17

MULTILANE DIVIDED
DAY OR NIGHT OPERATIONS

FOR TURNING LANE AND OR
SIDE ROAD OPERATIONS



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED).
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- CHANNELIZATION DEVICE

GENERAL NOTES

1. 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.
2. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
3. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.
4. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

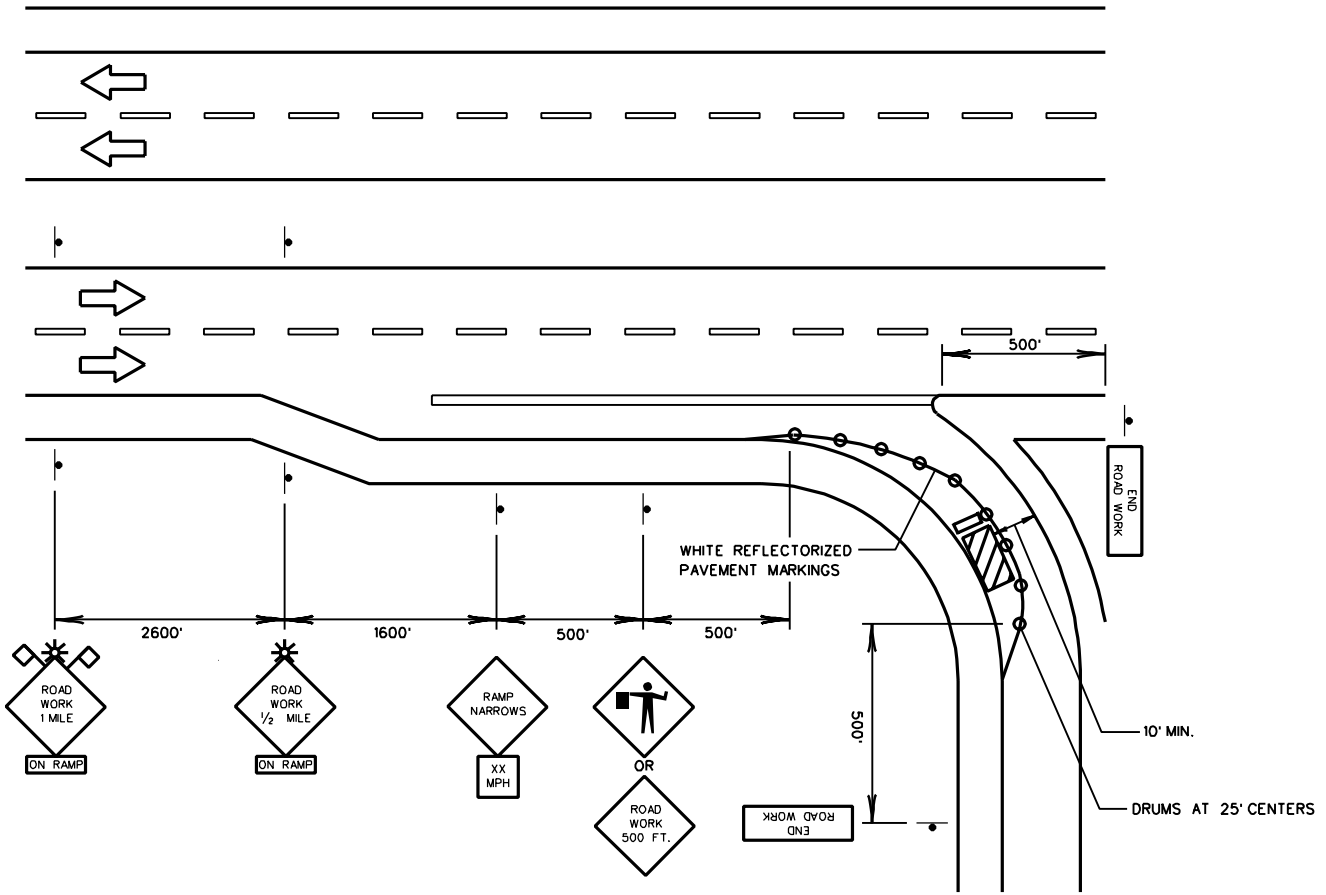
TYPICAL APPLICATIONS

PAVEMENT REPAIR
BRIDGE DECK REPAIR

CASE F1

MULTILANE, DIVIDED OPERATION
EXCEEDING ONE DAYLIGHT OPERATION

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE DECELERATION LANE OR ON THE SHOULDER WITHIN 2 FEET OF THE EDGE OF MAINLINE.



SYMBOLS

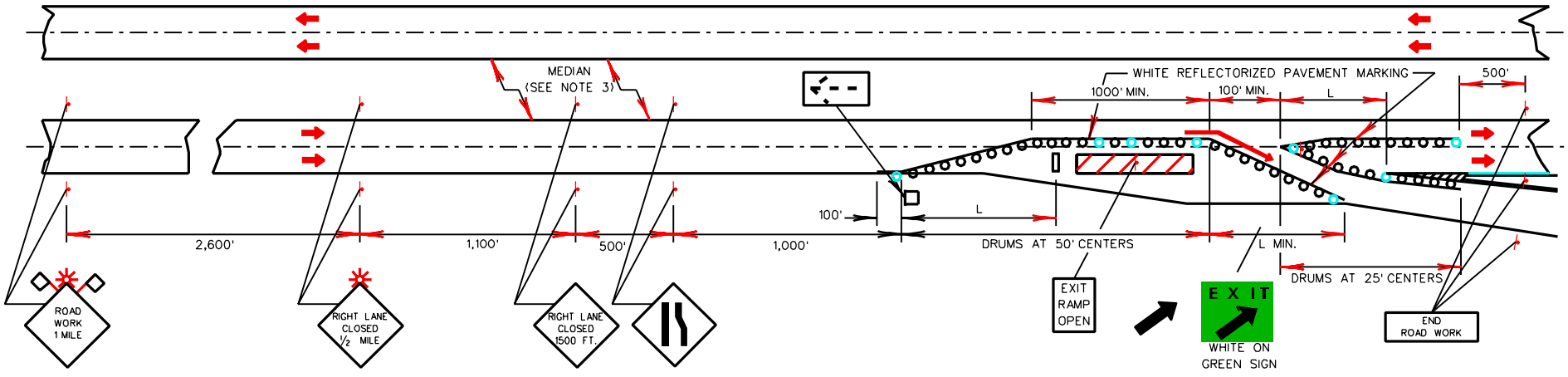
- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM

GENERAL NOTES

1. CONES MAY BE SUBSTITUTED FOR CHANNELIZING DEVICES DURING DAY OPERATIONS.
2. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
3. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

CASE F2

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE RAMP OR ON THE RAMP SHOULDER WITHIN 2 FEET OF THE EDGE OF THE RAMP.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. CONES MAY BE SUBSTITUTED FOR CHANNELIZING DEVICES DURING DAY OPERATIONS.

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. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

6. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

7. WHEN ELECTRIC ARROW IS USED CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE SHALL BE 1000 FT.

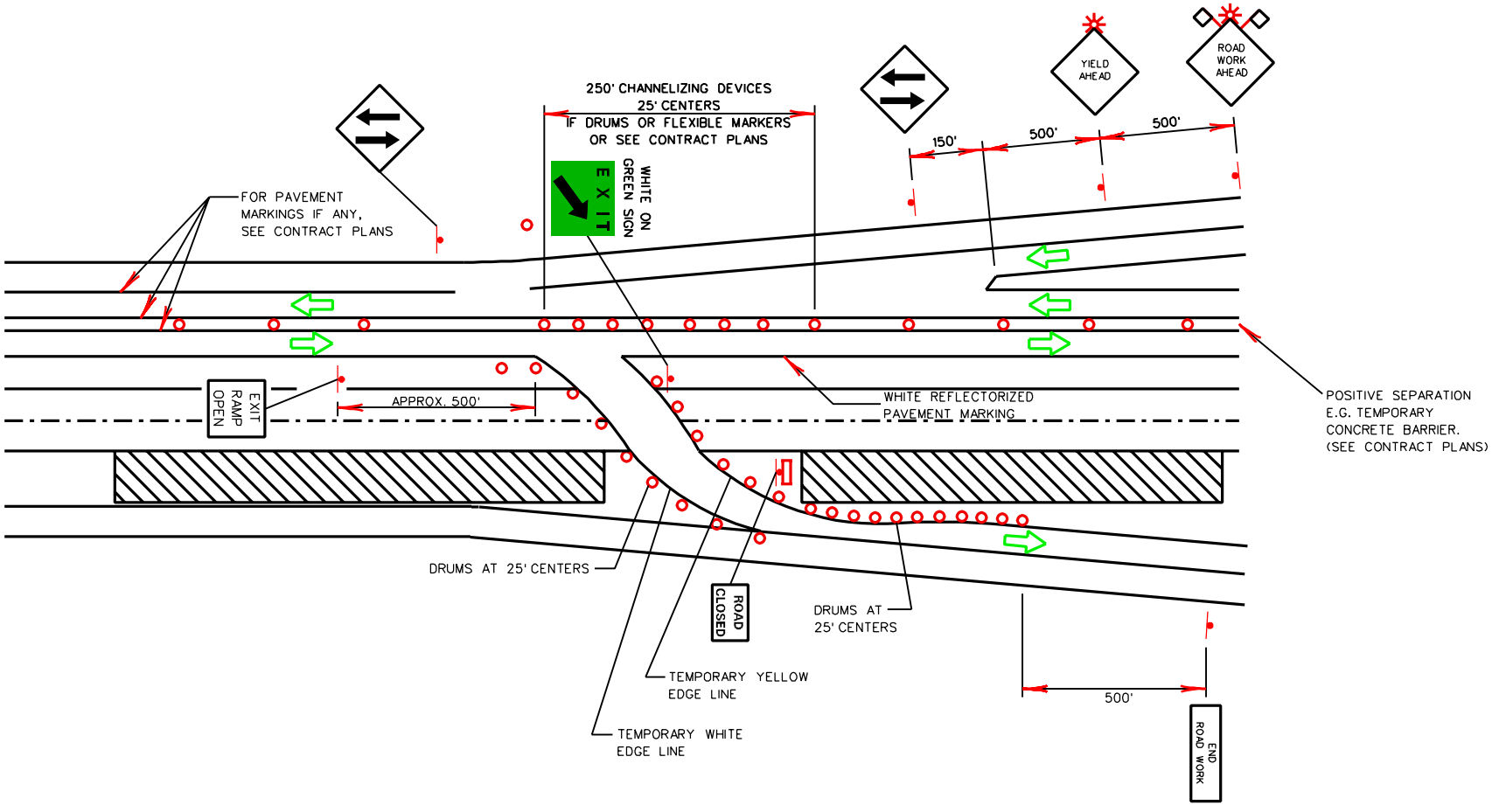
TYPICAL APPLICATIONS

PAVEMENT REPAIR

CASE F3

MULTILANE, DIVIDED OPERATION
EXCEEDING ONE DAYLIGHT OPERATION

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE DECELERATION LANE.



SYMBOLS

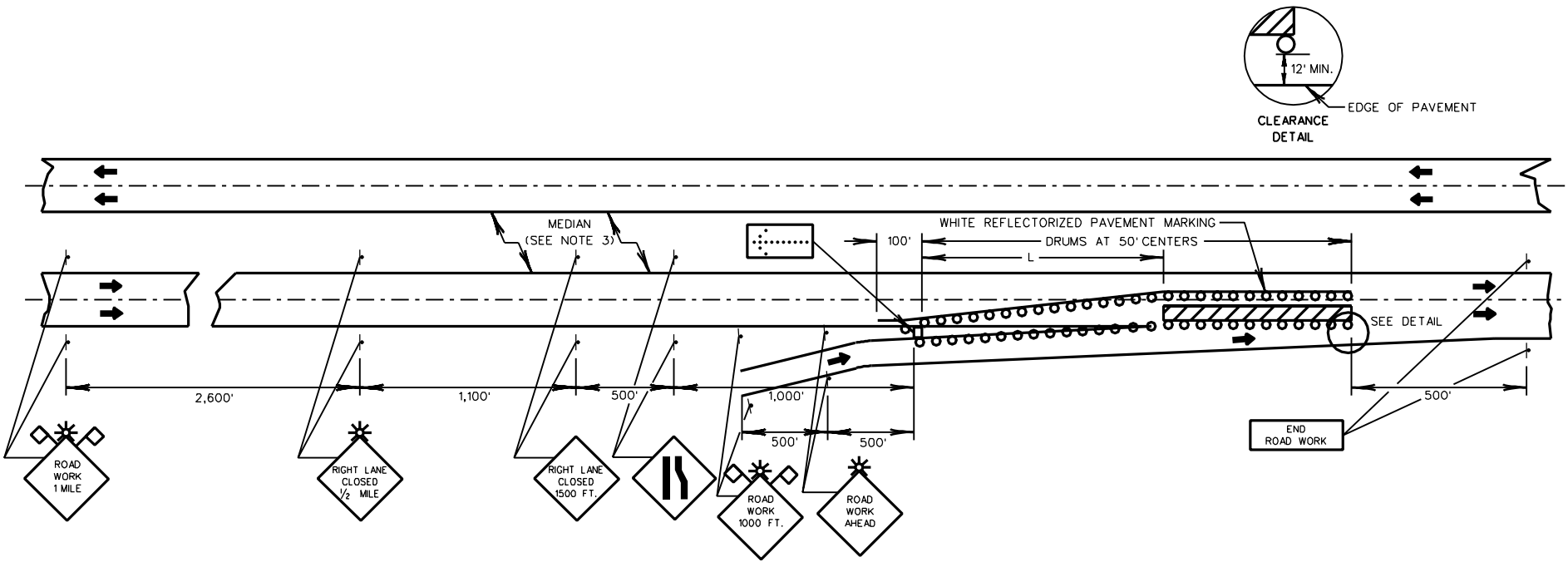
- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM

GENERAL NOTES

1. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

CASE F4

MEDIAN CROSSOVER FOR EXIT RAMP
MULTILANE, DIVIDED HIGHWAY TRAFFIC
ON ONE SIDE (TWO-LANE, TWO-WAY)



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT AS REQUIRED.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. CONES MAY BE SUBSTITUTED FOR CHANNELIZING DEVICES DURING DAY OPERATIONS.
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. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.
6. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.
7. WHEN ELECTRIC ARROW IS USED CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE SHALL BE 1000 FT.

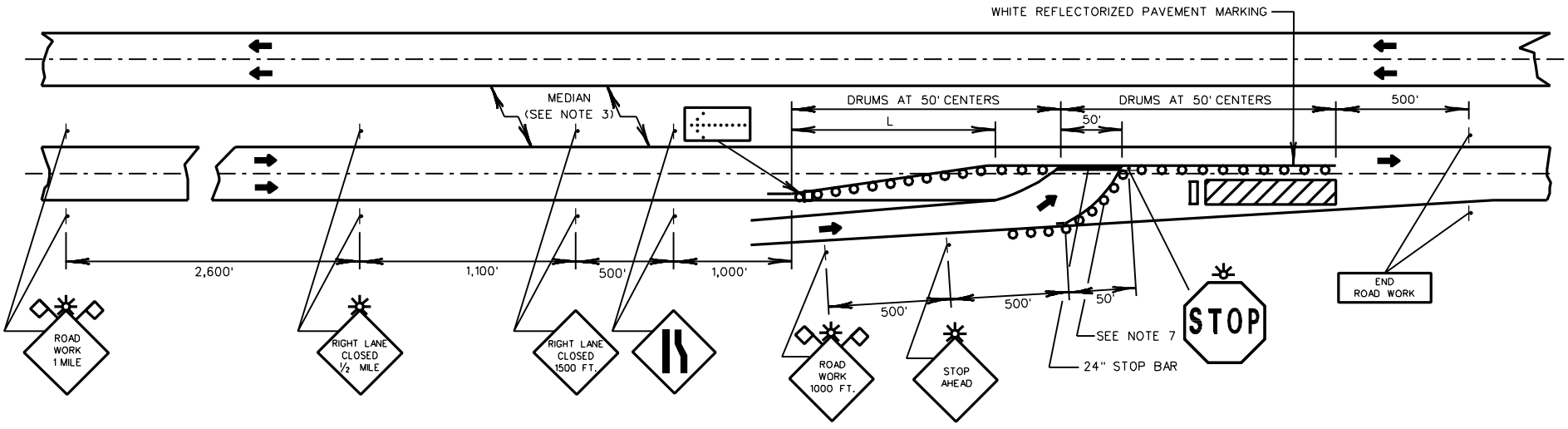
TYPICAL APPLICATIONS

PAVEMENT REPAIR

CASE F5

MULTILANE, DIVIDED OPERATION EXCEEDING ONE DAYLIGHT OPERATION

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE ACCELERATION LANE.



SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT AS REQUIRED.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW
- TYPE III BARRICADE

TYPICAL APPLICATIONS

PAVEMENT REPAIR

GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

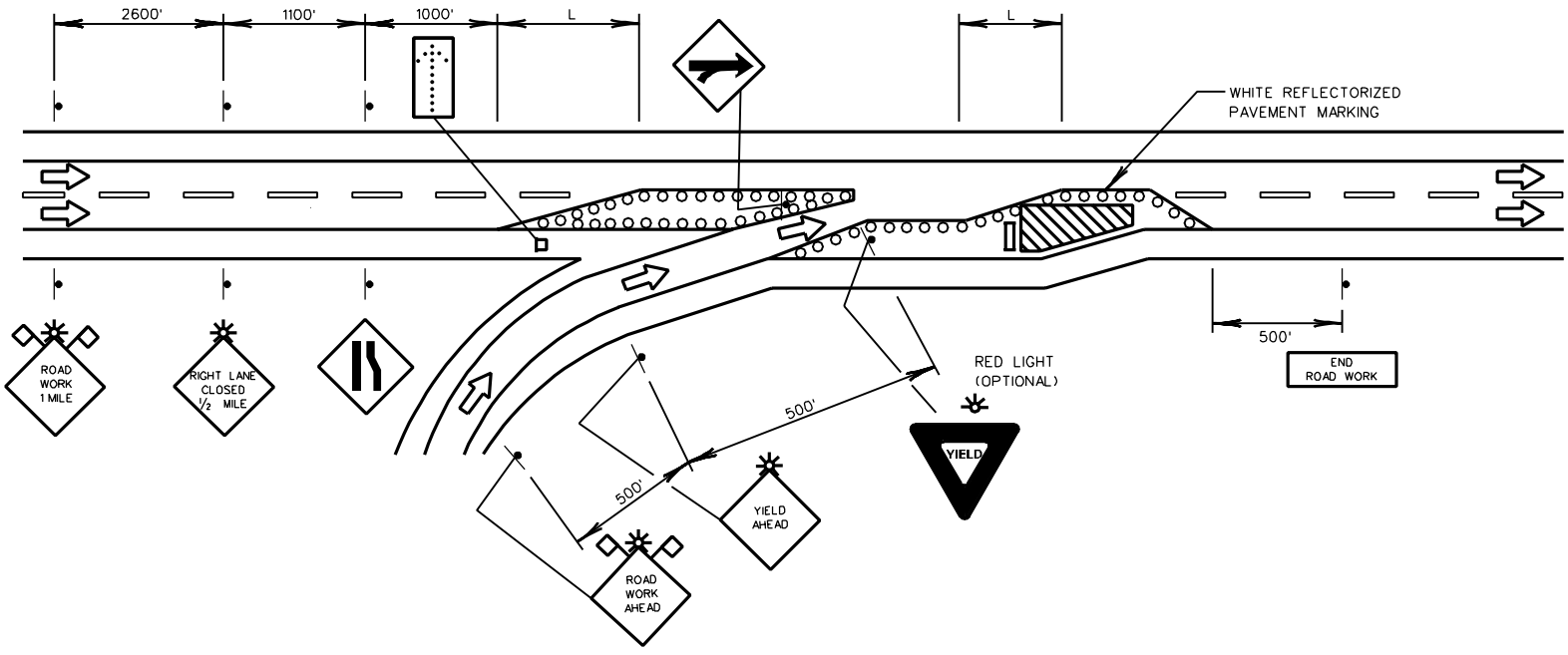
NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. CONES MAY BE SUBSTITUTED FOR CHANNELIZING DEVICES DURING DAY OPERATIONS.
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. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.
5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.
6. CONES OR DRUMS SHALL BE SPACED AT 10 FOOT CENTERS ALONG THE LAST 100 FT. OF MAINLINE AND ON RAMP.
7. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.
8. WHEN ELECTRIC ARROW IS USED CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE SHALL BE 1000 FT.

CASE F6

MULTILANE, DIVIDED OPERATION EXCEEDING ONE DAYLIGHT OPERATION

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE ACCELERATION LANE OR ON THE ACCELERATION LANE WITHIN 2 FT. OF THE EDGE OF PAVEMENT.



GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

NORMAL POSTED SPEED M.P.H.	TAPER LENGTH (FOR 12' CLOSURE) FEET
65	800
60	725
55	650
50	600
45	550
40 OR LESS	350

2. CONES MAY BE SUBSTITUTED FOR CHANNELIZING DEVICES DURING DAY OPERATIONS.

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. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS SEVEN DAYS.

5. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

6. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

7. WHEN ELECTRIC ARROW IS USED CARE MUST BE TAKEN TO INSURE 24 HOUR OPERATION. IT SHALL BE POSITIONED BEHIND THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE SHALL BE 1000 FT.

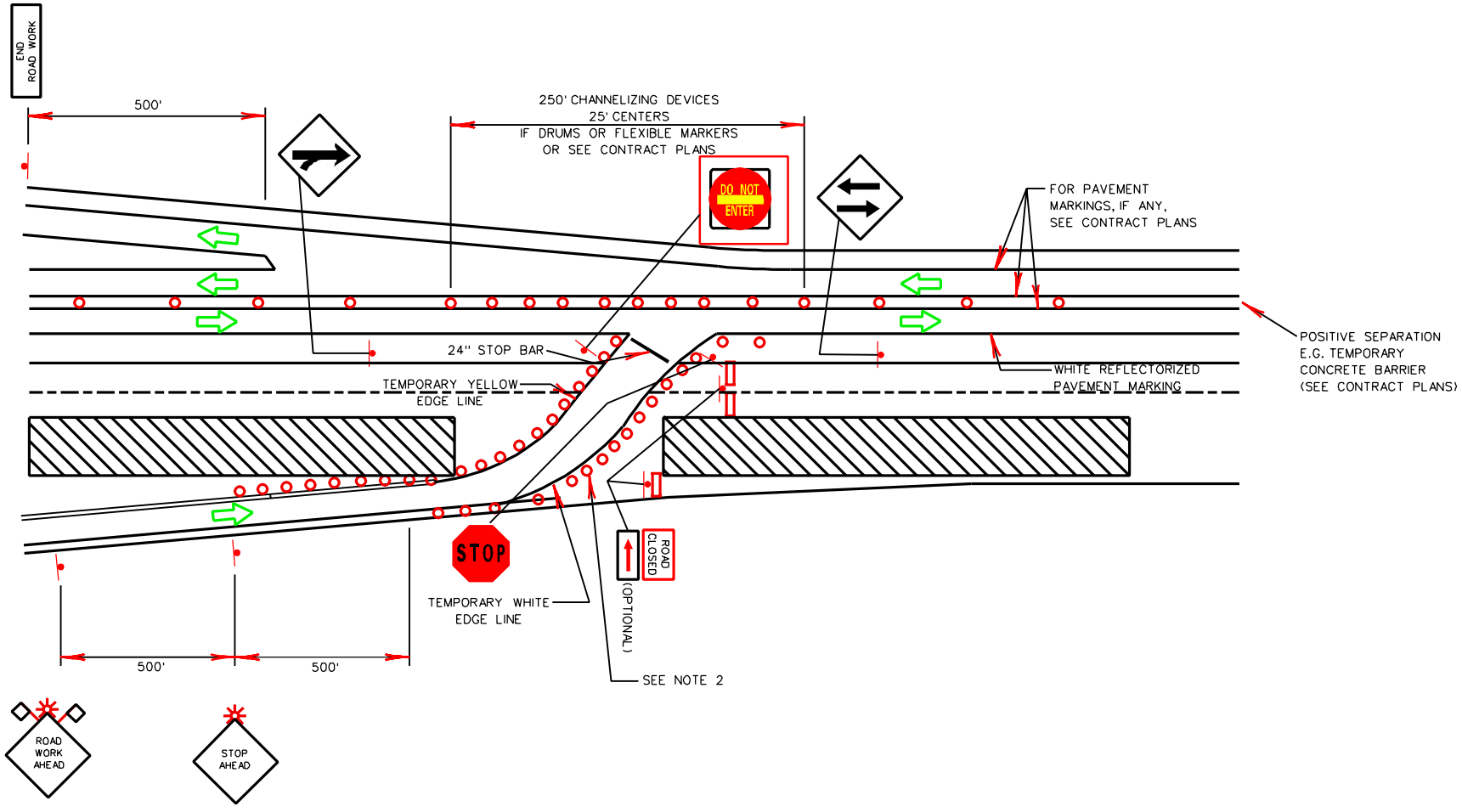
SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM
- ELECTRIC ARROW

CASE F7

MULTILANE, DIVIDED OPERATION EXCEEDING ONE DAYLIGHT OPERATION

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE ACCELERATION LANE.



GENERAL NOTES

1. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

2. CONES OR DRUMS SHALL BE SPACED AT 10 FOOT ALONG THE LAST 100 FT. OF MAINLINE AND THE RAMP.

SYMBOLS

- WORK AREA.
- SIGN WITH 18 IN. BY 18 IN. (MINIMUM) ORANGE FLAGS ATTACHED. (2 FLAGS PER SIGN) AND TYPE 'B' LIGHT (AS REQUIRED. SEE NOTE 6).
- TYPE III BARRICADES.
- SIGN ON PORTABLE OR PERMANENT SUPPORT.
- DRUM

CASE F8

MEDIAN CROSSOVER FOR ENTRANCE RAMP MULTILANE, DIVIDED HIGHWAY, TRAFFIC ON ONE SIDE (TWO-LANE, TWO-WAY)