PART 6. TEMPORARY TRAFFIC CONTROL

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PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6A. General

6A.1 General

SUPPORT:

Whenever the acronym "TTC " is used in Part 6, it refers to "temporary traffic control."

STANDARD:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, or on private roads open to public travel (see definition in Section 1A.13), including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

SUPPORT:

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

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

Of equal importance to the public traveling through the TTC zone is the safety of workers performing the many varied tasks within the work space. TTC zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers on or near the roadway (see Section 6D.3). At the same time, the TTC zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway.

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

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

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

Operational improvements might be realized by using intelligent transportation systems (ITS) in work zones. The use in work zones of ITS technology, such as portable camera systems, highway advisory radio, variable speed limits, ramp metering, traveler information, merge guidance, and queue detection information, is aimed at increasing safety for both workers and road users and helping to ensure a more efficient traffic flow. The use in work zones of ITS technologies has been found to be effective in providing traffic monitoring and management, data collection, and traveler information.

STANDARD:

TTC plans and devices shall be the responsibility of the authority of a public body or official having jurisdiction for guiding road users. There shall be adequate statutory authority for the implementation and enforcement of needed road user regulations, parking controls, speed zoning, and management of traffic incidents. Such statutes shall provide sufficient flexibility in the application of TTC to meet the needs of changing conditions in the TTC zone.

SUPPORT:

Temporary facilities, including pedestrian routes around work sites, are also covered by the accessibility requirements of the Americans with Disabilities Act of 1990 (ADA) (Public Law 101-336, 104 Stat. 327, July 26, 1990. 42 USC 12101-12213 (as amended)).

GUIDANCE:

The TTC plan should start in the planning phase and continue through the design, construction, and restoration phases. The TTC plans and devices should follow the principles set forth in Part 6. The management of traffic incidents should follow the principles set forth in Chapter 6G.

OPTION:

TTC plans may deviate from the typical applications described in Chapter 6H to allow for conditions and requirements of a particular site or jurisdiction.

SUPPORT:

The provisions of Part 6 apply to both rural and urban areas. A rural highway is normally characterized by lower volumes, higher speeds, fewer turning conflicts, and less conflict with pedestrians. An urban street is typically characterized by relatively low speeds, wide ranges of road user volumes, narrower roadway lanes, frequent intersections and driveways, significant pedestrian activity, and more businesses and houses.

The determination as to whether a particular facility at a particular time of day can be considered to be a high-volume roadway or can be considered to be a low-volume roadway is made by the public agency or official having jurisdiction.

PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6B. Fundamental Principles

6B.1 Fundamental Principles of Temporary Traffic Control

SUPPORT:

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

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

During TTC activities, commercial vehicles might need to follow a different route from passenger vehicles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous materials might need to follow a different route from other vehicles. . The Hazardous Materials and National Network signs are included in Sections 2B.62 and 2B.63, respectively.

Experience has shown that following the fundamental principles of Part 6 will assist road users and help protect workers in the vicinity of TTC zones. While these principles provide guidance for good TTC for the practitioner, they do not establish standards and warrants.

GUIDANCE:

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

SUPPORT:

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

GUIDANCE:

The following are the seven fundamental principles of TTC:

1. General plans or guidelines should be developed to provide safety for motorists, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipment, with the following factors being considered:
   A. The basic safety principles governing the design of permanent roadways and roadsides should also govern the design of TTC zones. The goal should be to route road users through such zones using roadway geometrics, roadside features, and TTC devices as nearly as possible comparable to those for normal highway situations.
   B. A TTC plan, in detail appropriate to the complexity of the work project or incident, should be prepared and understood by all responsible parties before the site is occupied. Any changes in the TTC plan should be approved by an official knowledgeable (for example, trained and/or certified) in proper TTC practices.
2. Road user movement should be inhibited as little as practical, based on the following considerations:
   A. TTC at work and incident sites should be designed on the assumption that drivers will only reduce their speeds if they clearly perceive a need to do so (see Section 6C.1).
   B. Frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions that require rapid maneuvers, should be avoided.
   C. Work should be scheduled n a manner that minimizes the need or lane closures or alternate routes, while still getting the work completed quickly and the lanes or roadway open to traffic as soon as possible.
   D. Attempts should be made to reduce the volume of traffic using the roadway or freeway to match the restricted capacity conditions. Road users should be encouraged to use alternative routes. For high-volume roadways and freeways, the closure of selected entrance ramps or other access points and the use of signed diversion routes should be evaluated.
   E. Bicyclists and pedestrians should be provided with access and reasonably safe passage through the TTC zone.

F. If work operations permit, lane closures on high-volume streets and highways should be scheduled during off-peak hours. Night work should be considered if the work can be accomplished with a series of short-term operations.

G. Early coordination with of officials having jurisdiction over the affected cross streets and providing emergency services should occur if significant impacts to roadway operations are anticipated.

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

   A. Adequate warning, delineation, and channelization should be provided to assist in guiding road users in advance of and through the TTC zone or incident site by using proper pavement marking, signing, or other devices that are effective under varying conditions. Providing information that is in usable formats by pedestrians with visual disabilities should also be considered.

   B. TTC devices inconsistent with intended travel paths through TTC zones should be removed or covered. However, in intermediate-term stationary, short-term, and mobile operations, where visible permanent devices are inconsistent with intended travel paths, devices that highlight or emphasize the appropriate path should be used. Providing traffic control devices that are accessible to and usable by pedestrians with disabilities should be considered.

   C. Flagging procedures, when used, must provide positive guidance to road users traversing the TTC zone.

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

   A. Individuals who are knowledgeable (for example, trained and/or certified) in the principles of proper TTC should be assigned responsibility for safety in TTC zones. The most important duty of these individuals should be to check that all TTC devices of the project are consistent with the TTC plan and are effective for motorists, bicyclists, pedestrians, and workers.

   B. As the work progresses, temporary traffic controls and/or working conditions should be modified, if appropriate, in order to provide mobility and positive guidance to the road user and to promote worker safety. The individual responsible for TTC should have the authority to halt work until applicable or remedial safety measures are taken.

   C. TTC zones should be carefully monitored under varying conditions of road user volumes, light, and weather to check that applicable TTC devices are effective, clearly visible, clean, and in compliance with the TTC plan.

   D. When warranted, an engineering study should be made (in cooperation with law enforcement officials) of reported crashes occurring within the TTC zone. Crash records in TTC zones should be monitored to identify the need for changes in the TTC zone.

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

   A. To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical.

   B. Channelization of road users should be accomplished by the use of pavement markings, signing, and crashworthy channelizing devices.

   C. Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.

6. Each person whose actions affect TTC zone safety, from the upper-level management through the field workers, should receive training appropriate to the job decisions each individual is required to make. Only those individuals who are trained in proper TTC practices and have a basic understanding of the principles (established by applicable standards and guidelines, including those of this Manual) should supervise the selection, placement, and maintenance of TTC devices used for TTC zones and for incident management.

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

   A. The needs of all road users should be assessed such that appropriate advance notice is given and clearly defined alternative paths are provided.

   B. The cooperation of the various news media should be sought in publicizing the existence of and reasons for TTC zones because news releases can assist in keeping the road users well informed.

   C. The needs of abutting property owners, residents, and businesses should be assessed and appropriate accommodations made.

   D. The needs of emergency service providers (police, fire, and medical) should be assessed and appropriate coordination and accommodations made.

E. The needs of railroads and transit should be assessed and appropriate coordination and accommodations made.
F. The needs of operators of commercial vehicles such as buses and large trucks should be assessed and appropriate accommodations made.

STANDARD:

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

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

PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6C. Temporary Traffic Control Elements

6C.1 Temporary Traffic Control Plans

SUPPORT:

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

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

GUIDANCE:

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

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

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

Provisions for effective continuity of accessible circulation paths for pedestrians should be incorporated into the TTC process. Where existing pedestrian routes are blocked or detoured, information should be provided about alternative routes that are usable by pedestrians with disabilities, particularly those who have visual disabilities. Access to temporary bus stops, travel across intersections with accessible pedestrian signals (see Section 4E.6), and other routing issues should be considered where temporary pedestrian routes are channelized. Barriers and channelizing devices that are detectable by people with visual disabilities should be provided.

OPTION:

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

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

GUIDANCE:

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

Provisions for effective continuity of transit service should be incorporated into the TTC planning process because often public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). Where applicable, the TTC plan should provide for features such as temporary bus stops, pull-outs, and satisfactory waiting areas for transit patrons, including persons with disabilities, if applicable (see Section 10A.5 for additional light rail transit issues to consider for TTC).

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

Reduced speed limits should be used only in the specific portion of the TTC zone where conditions or restrictive features are present. However, frequent changes in the speed limit should be avoided. A TTC plan should be designed so vehicles can safely travel through the TTC zone with a speed limit reduction of no more than 15 mph.

A reduction of more than 15 mph in the speed limit should be used only when required by restrictive features in the TTC zone. Where restrictive features justify a speed reduction of more than 15 mph, additional driver notification should be provided. The speed limit should be stepped down in advance of the location requiring the lowest speed, and additional TTC warning devices should be used.

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

SUPPORT:

Research has demonstrated that large reductions in the speed limit, such as a 30 mph reduction, increase speed variance and the potential for crashes. Smaller reductions in the speed limit of up to 15 mph cause smaller changes in speed variance and lessen the potential for increased crashes. A reduction in the regulatory speed limit of only up to 15 mph from the normal speed limit has been shown to be more effective.

6C.2 Temporary Traffic Control Zones

SUPPORT:

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

A work zone is an area of a highway with construction, maintenance, or utility work activities. A work zone is typically marked by signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or high-intensity rotating, flashing, oscillating, or strobe lights on a vehicle to the END ROAD WORK sign or the last TTC device. TTC zones are established to provide safe traffic movement when the normal function of the roadway is suspended by scheduled activities, unscheduled activities or incidents.

An incident zone is an area of a highway where temporary traffic controls are imposed by authorized officials in response to a traffic incident (see Section 6I.1). It extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a point where road users return to the original lane alignment and are clear of the incident.

A planned special event often creates the need to establish altered traffic patterns to handle the increased traffic volumes generated by the event. The size of the TTC zone associated with a planned special event can be small, such as closing a street for a festival, or can extend throughout a municipality for larger events. The duration of the TTC zone is determined by the duration of the planned special event.

6C.3 Components of Temporary Traffic Control Zones

SUPPORT:

Most TTC zones are divided into four areas: the advance warning area, the transition area, the activity area, and the termination area. Figure 6C-1 illustrates these four areas. These four areas are described in Sections 6C.4 through 6C.7.

6C.4 Advance Warning Area

SUPPORT:

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

Posted Speed Limit Prior to Work Starting (mph)	Distance Between Advance Warning Signs (feet)
0 - 30	250
35 - 40	325
45 - 50	600
55	750
60 - 65	1000
70 - 75	1200

Table 6C-1 Advance Warning Sign Placement

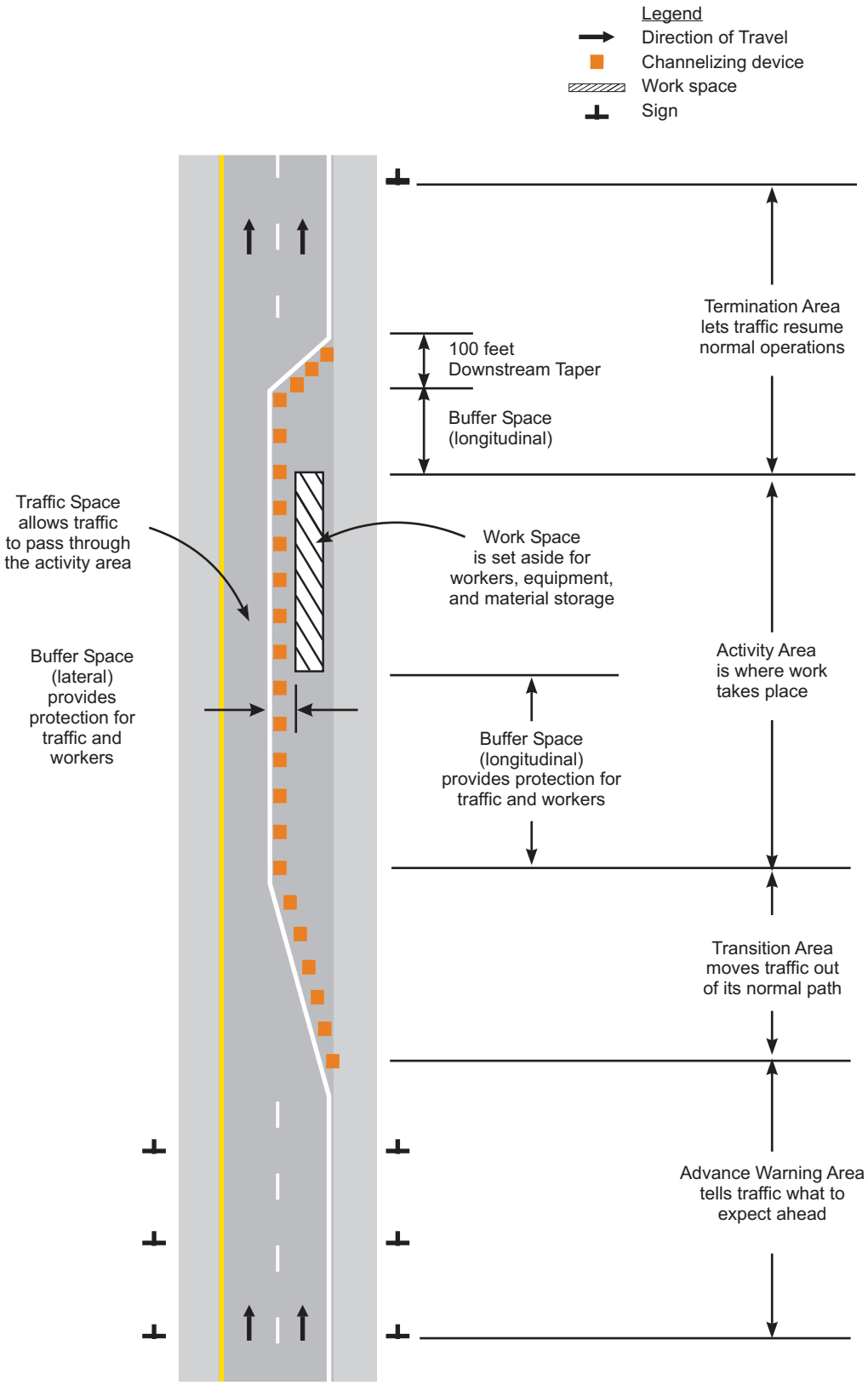

Figure 6C-1 Component Parts of a Temporary Traffic Control Zone

OPTION:

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

GUIDANCE:

Typical distances for placement of advance warning signs on freeways and expressways should be longer because drivers are conditioned to uninterrupted flow. Therefore, the advance warning sign placement should extend on these facilities as far as 1/2 mile or more.

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

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

The distances contained in Table 6C-1 are approximate, are intended for guidance purposes only, and should be applied with engineering judgment. These distances should be adjusted for field conditions, if necessary, by increasing or decreasing the recommended distances.

SUPPORT:

The need to provide additional reaction time for a condition is one example of justification for increasing the sign spacing. Conversely, decreasing the sign spacing might be justified in order to place a sign immediately downstream of an intersection or major driveway such that traffic turning onto the roadway in the direction of the TTC zone will be warned of the upcoming condition.

OPTION:

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

6C.5 Transition Area

SUPPORT:

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

STANDARD:

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

OPTION:

Because it is impractical in mobile operations to redirect the road user's normal path with stationary channelization, more dominant vehicle-mounted traffic control devices, such as arrow boards, portable changeable message signs, and high-intensity rotating, flashing, oscillating, or strobe lights, may be used instead of channelizing devices to establish a transition area.

6C.6 Activity Area

SUPPORT:

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

The work space is that portion of the highway closed to road users and set aside for workers, equipment, and material, and a shadow vehicle if one is used upstream. Work spaces are usually delineated for road users by channelizing devices or, to exclude vehicles and pedestrians, by temporary barriers.

OPTION:

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

GUIDANCE:

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

SUPPORT:

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

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

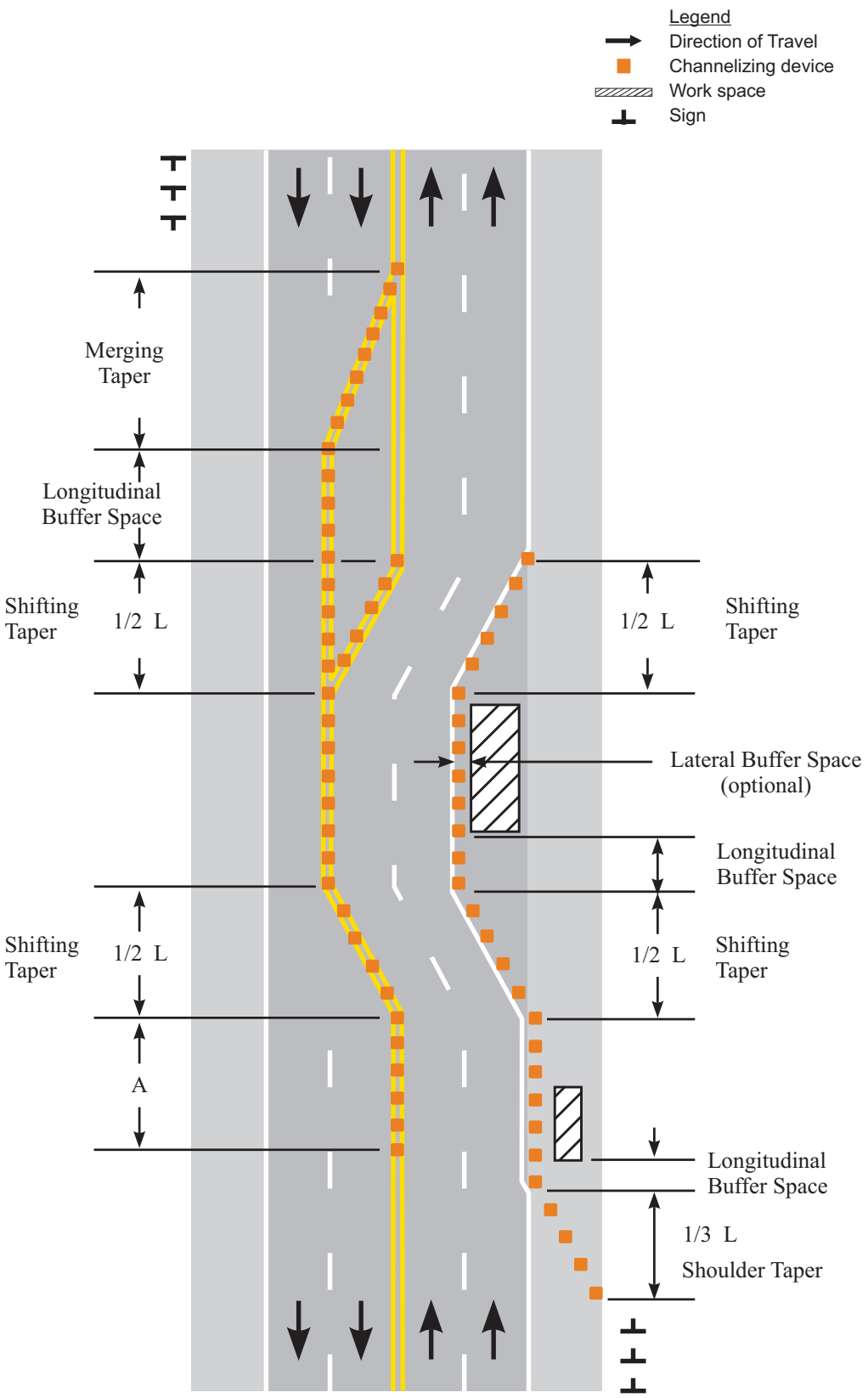

Figure 6C-2 Types of Tapers and Buffer Spaces

Posted Speed Limit Prior to Work Starting (mph) *	Length * (feet)
20	35
25	55
30	85
35	120
40	170
45	220
50	280
55	335
60	415
65	485
70	540
75	670

* This distance is related to approach speeds, friction factors, and pavement and tire conditions. These distances may be increased for downgrades.

Table 6C-2 Guidelines for the Length of a Longitudinal Buffer

GUIDANCE:

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

OPTION:

Buffer spaces may be positioned either longitudinally or laterally with respect to the direction of road user flow. The activity area may contain one or more lateral or longitudinal buffer spaces.

A longitudinal buffer space may be placed in advance of a work space.

The longitudinal buffer space may also be used to separate opposing road user flows that use portions of the same traffic lane, as shown in Figure 6C-2.

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

SUPPORT:

Typically, the buffer space is formed as a traffic island and defined by channelizing devices.

When a shadow vehicle, arrow board, or changeable message sign is placed in a closed lane in advance of a work space, only the area upstream of the vehicle, arrow board, or changeable message sign constitutes the buffer space.

OPTION:

The lateral buffer space may be used to separate the traffic space from the work space, as shown in Figures 6C-1 and 6C-2, or such areas as excavations or pavement edge drop-offs. A lateral buffer space also may be used between two travel lanes, especially those carrying opposing flows.

RECOMMENDED TAPER LENGTHS based on a 12 foot lane width					
Posted Speed Limit Prior to Work Starting (mph)	Merging Taper (L) (feet)	Shifting Taper (feet)	Shoulder Taper (feet)	Two-Way Traffic Taper (feet)	Downstream Taper (minimum) (feet)
30	200	100	75	50	100
35	250	125	100	50	100
40	325	175	125	50	100
45	550	275	200	50	100
50	600	300	200	50	100
55	700	350	250	50	100
60 - 65	800	400	270	50	100
70 - 75	900	450	300	50	100

Type of Taper

Taper

Upstream Tapers

Merging Taper	L minimum
Shifting Taper	½ L minimum
Shoulder Taper	⅓ L minimum
Two-Way Traffic Taper	50 feet
Downstream Tapers (use is optional)	100 foot minimum

Formulas for L

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

T = Taper length in feet.
W = Width of offset in feet.
S = Posted speed prior to work starting in mph.

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

GUIDANCE:

Guide for the length of longitudinal buffer space is shown in Table 6C-2. These distances are based upon the braking distance portion of stopping sight distance for wet and level pavements (A Policy on Geometric Design of Highways and Streets, AASHTO (see page ii), 2001, p. 112). The length may be adjusted to satisfy individual agency needs.

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

OPTION:

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

6C.7 Termination Area

SUPPORT:

The termination area is the section of the highway where road users are returned to their normal driving path. The termination area extends from the downstream end of the work area to the last TTC device such as END ROAD WORK signs, if posted.

OPTION:

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

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

6C.8 Tapers

OPTION:

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

SUPPORT:

Tapers are created by using a series of channelizing devices and/or pavement markings to move traffic out of or into the normal path. Types of tapers are shown in Figure 6C-2.

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

GUIDANCE:

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

The maximum distance in feet between devices in a taper should not exceed 1.0 times the speed limit in mph.

SUPPORT:

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

GUIDANCE:

A merging taper should be long enough to enable merging drivers to have adequate advance warning and sufficient length to adjust their speeds and merge into an adjacent lane before the downstream end of the transition.

SUPPORT:

A shifting taper is used when a lateral shift is needed. When more space is available, a longer than minimum taper distance can be beneficial. Changes in alignment can also be accomplished by using horizontal curves designed for normal highway speeds.

GUIDANCE:

A shifting taper should have a length of approximately 1/2 L (see Tables 6C-3 .

SUPPORT:

A shoulder taper might be beneficial on a high-speed roadway where shoulders are part of the activity area and are closed, or when improved shoulders might be mistaken as a driving lane. In these instances, the same type, but abbreviated, closure procedures used on a normal portion of the roadway can be used.

GUIDANCE:

If used, shoulder tapers should have a length of approximately 1/3 L (see Table 6C-3). If a shoulder is used as a travel lane, either through practice or during a TTC activity, a normal merging or shifting taper should be used.

SUPPORT:

A downstream taper might be useful in termination areas to provide a visual cue to the driver that access is available back into the original lane or path that was closed.

GUIDANCE:

If used, a downstream taper should have a minimum length of 50 feet and a maximum length of 100 feet with devices placed at a spacing of approximately 20 feet.

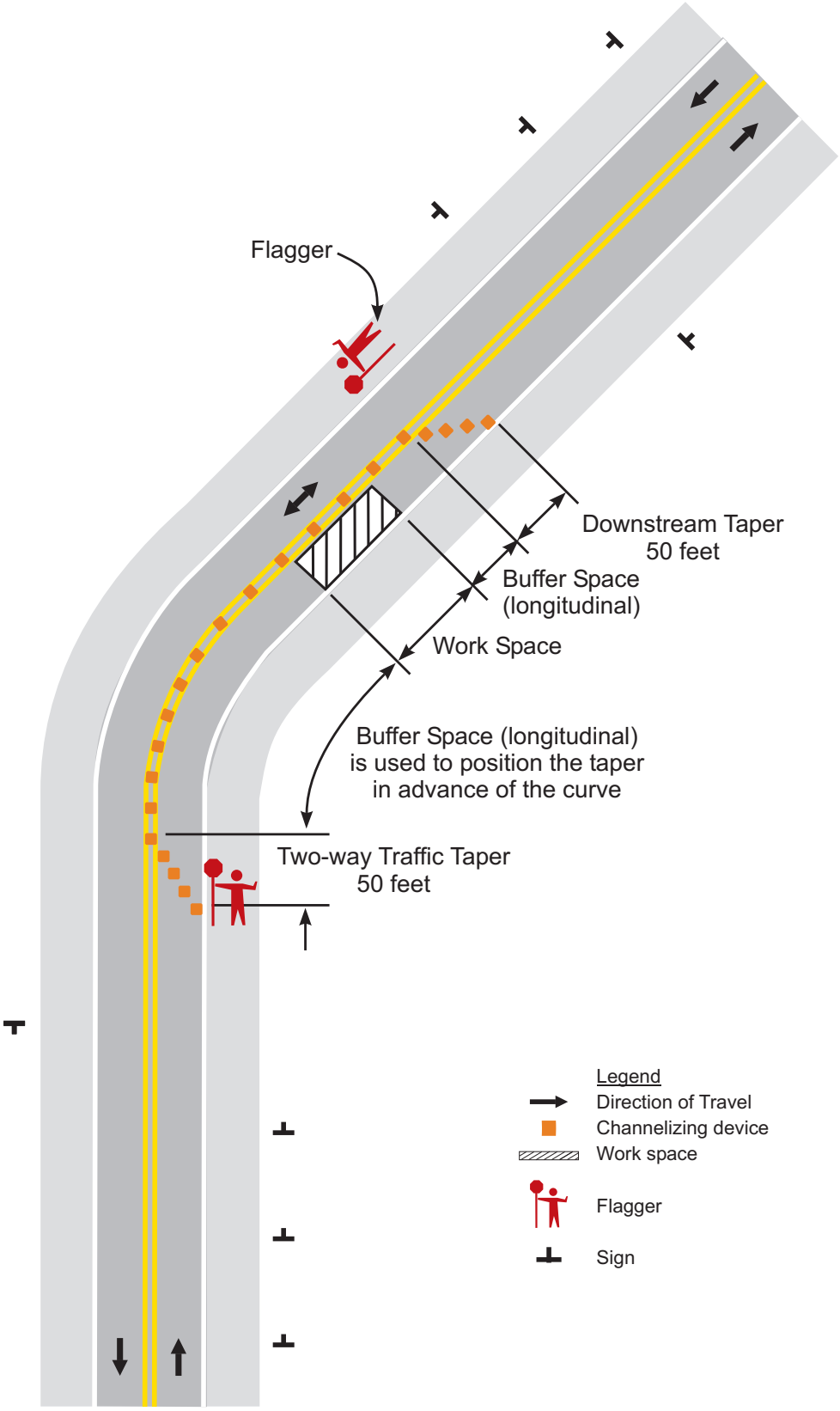

Figure 6C-3 Example of a One-Lane, Two-Way Traffic Taper

SUPPORT:

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

GUIDANCE:

Traffic should be controlled by a flagger or temporary traffic signal (if sight distance is limited), or a STOP or YIELD sign. A short taper having a maximum length of 50 feet with channelizing devices at approximately 12 foot spacings should be used to guide traffic into the one-way section.

SUPPORT:

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

6C.9 Detours and Diversions

SUPPORT:

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

GUIDANCE:

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

SUPPORT:

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

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

STANDARD:

Except as provided in the following Option, when traffic in both directions must use a single lane for a limited distance, movements from each end shall be coordinated.

GUIDANCE:

Provisions should be made for alternate one-way movement through the constricted section via methods such as flagger control, a flag transfer, a pilot car with a flagger used as described in Section 6F.54, traffic control signals, or stop or yield control.

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

If traffic on the affected one-lane roadway is not visible from one end to the other, then flagging procedures, a pilot car with a flagger used as described in Section 6C.13, or a traffic control signal should be used to control opposing traffic flows.

OPTION:

If the work space on a low-volume street or road is short and road users from both directions are able to see the traffic approaching from the opposite direction through and beyond the worksite, the movement of traffic through a one-lane, two-way constriction may be self-regulating.

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

GUIDANCE:

Except as provided in 2, traffic should be controlled by a flagger at each end of a constricted section of roadway. One of the flaggers should be designated as the coordinator. To provide coordination of the control of the traffic, the flaggers should be able to communicate with each other orally, electronically, or with manual signals. These manual signals should not be mistaken for flagging signals.

OPTION:

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

GUIDANCE:

When a single flagger is used, the flagger should be stationed in the closed lane at the beginning of the taper or in a position where good visibility and traffic control can be maintained at all times. When good visibility and traffic control cannot be maintained by one flagger station, traffic should be controlled by a flagger at each end of the section.

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

SUPPORT:

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

GUIDANCE:

The flag transfer method should be employed only where the one-way traffic is confined to a relatively short length of a road, usually no more than 1 mile in length.

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

OPTION:

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

GUIDANCE:

The pilot car should have the name of the contractor or contracting authority prominently displayed.

STANDARD:

The PILOT CAR FOLLOW ME (G20-4) sign (see Section 6F.58) shall be mounted on the rear of the pilot vehicle.

A flagger shall be stationed on the approach to the activity area to control vehicular traffic until the pilot vehicle is available.

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

OPTION:

Traffic control signals may be used to control vehicular traffic movements in one-lane, two-way TTC zones zones (see Figure 6H-12 and Chapter 4H).

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

OPTION:

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

GUIDANCE:

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

PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6D. Pedestrian and Worker Safety

6D.1 Pedestrian Considerations

SUPPORT:

A wide range of pedestrians can be expected at work sites, including the young, elderly, and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path. Considerations for pedestrians with disabilities are addressed in Section 6D.2.

STANDARD:

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

Advance notification of sidewalk closures shall be provided by the maintaining agency.

If the TTC zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.

OPTION:

If establishing or maintaining an alternate pedestrian route is not feasible during the project, an alternate means of providing for pedestrians may be used, such as adding free bus service around the project or assigning someone the responsibility to assist pedestrians with disabilities through the project limits.

If an existing pedestrian route is impacted by a short-term or short-duration work zone that is attended with project personnel, establishing an alternate pedestrian route may not be necessary if the work can be stopped and pedestrians can navigate the work zone safely. Pedestrians may be delayed for a short period of time for project personnel to move equipment and material to facilitate passage. Work zone personnel may also provide assistance to the pedestrian as necessary.

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SUPPORT:

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

GUIDANCE:

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

A. Pedestrians should not be led into conflicts with vehicles, equipment, and operations.
B. Pedestrians should not be led into conflicts with vehicles moving through or around the work site.
C. Pedestrians should be provided with a convenient and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or a footpath(s).

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

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

SUPPORT:

Layouts 6J-24 and 6J-25 as well as Layouts 84 and 85 in Chapter 6K show typical TTC device usage and techniques for pedestrian movement through work zones.

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GUIDANCE:

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

A. Provisions for continuity of accessible paths for pedestrians should be incorporated into the TTC plan.
B. Access to transit stops should be maintained.
C. A smooth, continuous hard surface should be provided throughout the entire length of the temporary pedestrian facility. There should be no curbs or abrupt changes in grade or terrain that could cause tripping or be a barrier to wheelchair use. The geometry and alignment of the facility should meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11).
D. The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 60 inches throughout the entire length of the pedestrian pathway, a 60 x 60-inch

passing space should be provided at least every 200 feet to allow individuals in wheelchairs to pass.

E. Blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing devices such as audible information devices, accessible pedestrian signals, or barriers and channelizing devices that are detectable to the pedestrians traveling with the aid of a long cane or who have low vision. Where pedestrian traffic is detoured to a TTC signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals should be considered for crossings along an alternate route.

F. When channelization is used to delineate a pedestrian pathway, a continuous detectable edging should be provided throughout the length of the facility such that pedestrians using a long cane can follow it. These detectable edgings should comply with the provisions of Section 6F.74.

G. Signs and other devices mounted lower than 7 feet above the temporary pedestrian pathway should not project more than 4 inches into accessible pedestrian facilities.

OPTION:

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

GUIDANCE:

Fencing should not create sight distance restrictions for road users. Fences should not be constructed of materials that would be hazardous if impacted by vehicles. Wooden railing, fencing, and similar systems placed immediately adjacent to motor vehicle traffic should not be used as substitutes for crashworthy temporary traffic barriers.

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

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

Access to the work space by workers and equipment across pedestrian walkways should be minimized because the access often creates unacceptable changes in grade, and rough or muddy terrain, and pedestrians will tend to avoid these areas by attempting non-intersection crossings where no curb ramps are available.

OPTION:

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

GUIDANCE:

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

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

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

SUPPORT:

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

STANDARD:

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

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

OPTION:

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

SUPPORT:

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

GUIDANCE:

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

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SUPPORT:

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

GUIDANCE:

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

In general, pedestrian routes should be preserved in urban and commercial suburban areas. Alternative routing should be discouraged.

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

6D.2 Accessibility Considerations

SUPPORT:

Additional information on the design and construction of accessible temporary facilities is found in publications listed in Section 1A.11 (see Publications 12, 38, 39, and 42).

GUIDANCE:

The extent of pedestrian needs should be determined through engineering judgment or by the individual responsible for each TTC zone situation. Adequate provisions should be made for pedestrians with disabilities.

STANDARD:

When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Where pedestrians with visual disabilities normally use the closed sidewalk, a barrier that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.

SUPPORT:

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

GUIDANCE:

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

SUPPORT:

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

GUIDANCE:

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

OPTION:

The Pedestrian Accessibility Checklist (see Figure 6D-1) may be used by the project designer during the TTC design stage of a project to assure that all considerations have been made to accommodate the needs of pedestrians, including those with disabilities.

6D.3 Worker Considerations

SUPPORT:

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

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

GUIDANCE:

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

A. Training-all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific TTC responsibilities should be trained in TTC techniques, device usage, and placement.

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

C. Speed Reduction - reducing the speed of vehicular traffic, mainly through regulatory speed zoning, funneling, lane reduction, or the use of uniformed law enforcement officers or flaggers, should be considered.

D. Activity Area - planning the internal work activity area to minimize backing-up maneuvers of construction vehicles should be considered to minimize the exposure to risk.

E. Worker Safety Planning-a trained person designated by the employer should conduct a basic hazard assessment for the worksite and job classifications required in the activity area. This safety professional should determine whether engineering, administrative, or personal protection measures should be implemented. This plan should be in accordance with the Occupational Safety and Health Act of 1970, as amended, "General Duty Clause" Section 5(a)(1) - Public Law 91-596, 84 Stat. 1590, December 29, 1970, as amended, and with the requirement to assess worker risk exposures for each job site and job classification, as per 29 CFR 1926.20 (b)(2) of "Occupational Safety and Health Administration Regulations, General Safety and Health Provisions" (see Section 1A.11).

MN Rev. 1

STANDARD:

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

Compliance Date: December 31, 2011

OPTION:

Emergency and incident responders and law enforcement personnel within the TTC zone may wear high visibility safety apparel that meets the performance requirements of the ANSI/ISEA 207-2006 publication entitled "American National Standard for High-Visibility Public Safety Vests" (see Section 1A.11), or equivalent revisions, and labeled as ANSI 207-2006, in lieu of ANSI/ISEA 107-2004 apparel.

GUIDANCE:

When working in an area that does not require the use of a hard hat for head protection, a high visibility hat in the above colors should be worn.

STANDARD:

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

Except as provided in the following Option, firefighters or other emergency responders working within the right-of-way shall wear high-visibility safety apparel as described in this Section.

Compliance Date: December 31, 2011

OPTION:

MN Rev. 1

Firefighters or other emergency responders working within the right-of-way and engaged in emergency operations that directly expose them to flame, fire, heat, and/or hazardous materials may wear retroreflective turnout gear that is specified and regulated by other organizations, such as the National Fire Protection Association.

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

A. Shadow Vehicle - in the case of mobile and constantly moving operations, such as pothole patching and striping operations, a shadow vehicle, equipped with appropriate lights and warning signs may be used to protect the workers from impacts by errant vehicles. The shadow vehicle may be equipped with a rear-mounted attenuator.

B. Road Closure - if alternate routes are available to handle road users, the road may be closed temporarily. This may also facilitate project completion and thus further reduce worker vulnerability.

C. Law Enforcement Use - in highly vulnerable work situations, particularly those of relatively short duration, law enforcement units may be stationed to heighten the awareness of passing motor vehicle traffic and to improve safety through the TTC zone.

Pedestrian Accessibility Considerations in Temporary Traffic Control Zones
Check List

This project has been reviewed for the various temporary traffic control provisions for pedestrian accessibility considerations contained in MN MUTCD Part 6. These provisions have been applied by knowledgeable persons after appropriate evaluation and engineering judgment. Considerations as listed below have been reviewed and where applicable, deviations and/or exceptions from Part 6 are documented.

Engineer's Signature : _____ **Date :** _____

Project Number: _____ **Project Location:** _____

IS IT REASONABLE TO EXPECT THAT PEDESTRIANS WILL BE PRESENT WITHIN THE VICINITY OF THE PROPOSED TEMPORARY TRAFFIC CONTROL ZONE?

Consider features such as schools, parks, paths / trails, transit stops, commercial property, residential areas, assisted living centers, office complexes, or other pedestrian generators in the area. Special events during the time of construction must also be considered, such as community festivals or other unusual situations that generate temporary pedestrian traffic.

☐ **YES** - complete the following checklist
☐ **NO** - document your conclusion

MN MUTCD 6D.01 Standard:
The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a temporary traffic control zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

MN MUTCD 6D.02 Standard:
When existing pedestrian facilities (routes) are disrupted, closed, or relocated in a temporary traffic control zone, the temporary facilities **shall be** detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

Guidance:
To accommodate the needs of pedestrians, including those with disabilities, many considerations should be addressed when temporary pedestrian pathways in temporary traffic control zones are designed or modified. Use the following checklist to document your decisions. **Refer to the MN MUTCD Part 6 for additional standards, and guidance and/or clarification on pedestrian and ADA requirements in temporary traffic control zones.**

A. Will a reasonably safe, convenient, and accessible path be provided that replicates as much as practical the desirable characteristics of the existing pedestrian facilities?
☐ **YES** ☐ **NO (partially) document your decision**

B. Will access be provided to current or temporary transit stops?
☐ **YES** ☐ **NO (partially) document your decision**

C. Will all pedestrian facilities near temporary traffic control zones be separated from the worksite by appropriate barriers that maintain the accessibility and detectability for pedestrians with disabilities?
☐ **YES** ☐ **NO (partially) document your decision**

Figure 6D-1 Pedestrian Accessibility Checklist

(Sheet 1 of 2)

D. Will blocked routes, alternate crossings, sign and signal information be communicated to pedestrians with visual disabilities?

- Devices should include audible information devices, accessible pedestrian signals, or barriers / channelizing devices that are detectable to the pedestrians traveling with the aid of a long cane or who have low vision.
- Where pedestrian traffic is detoured to a temporary traffic control signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals should be considered for crossings along an alternate route.

☐ **YES** ☐ **NO (partially) document your decision**

E. Will sidewalk(s) be closed properly with advance notification to the maintaining agency?

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

☐ **YES** ☐ **NO (partially) document your decision**

F. Will channelization with continuous edging be used to delineate a pedestrian pathway throughout the length of the facility such that pedestrians using a long cane can follow it?

- These detectable edgings should adhere to the provisions of Section 6F.68.

☐ **YES** ☐ **NO (partially) document your decision**

G. Will a smooth, continuous hard surface that will not cause tripping or restrict wheelchair use be provided throughout the entire length of the temporary pedestrian facility?

☐ **YES** ☐ **NO (partially) document your decision**

H. Will the width of the existing pedestrian facility be provided for the temporary facility?

- Where it is not possible to maintain a minimum width of 1500 mm (60 in) throughout the entire length of the pedestrian pathway, a 1500x1500 mm (60 x 60 in) passing space should be provided at least every 60 m (200 ft), to allow individuals in wheelchairs to pass.

☐ **YES** ☐ **NO (partially) document your decision**

I. Will traffic control devices and other construction materials and features NOT intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility?

- Signs and other devices mounted lower than 2.1 m (7 ft) above the temporary pedestrian pathway should not project more than 100 mm (4 in) into accessible pedestrian facilities.
- Barricade rail supports should not project into pedestrian circulation routes more than 100 mm (4 in) from the support between 675 mm (27 in) and 2000 mm (80 in) from the surface. Ballast **shall not** extend into the accessible passage width of 1500 mm (60 in). Refer to Section 6F.63 for more details.

☐ **YES** ☐ **NO (partially) document your decision**

Figure 6D-1 Pedestrian Accessibility Checklist

(Sheet 2 of 2)

D. Lighting - for nighttime work, the TTC zone and approaches may be lighted.

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

F. 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, anticipated effects upon traffic, 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 space.

SUPPORT:

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

PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6E. Flagger Control

6E.1 Qualifications for Flaggers

SUPPORT:

Minnesota Statute 169.06, subd. 4(e), allows a flagger to stop and hold traffic as necessary to ensure the safety of highway workers and the motoring public.

Minnesota Statute 169.06, subd. 4(a) requires the driver of any vehicle to obey the instructions of any official traffic-control device placed in accordance with the provisions of Chapter 169, unless otherwise directed by a traffic or police officer.

GUIDANCE:

Because flaggers are responsible for public safety and make the greatest number of contacts with the public of all highway workers, they should be trained in safe traffic control practices and public contact techniques. Flaggers should be able to satisfactorily demonstrate the following abilities:

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

6E.2 High-Visibility Safety Apparel

STANDARD:

MN Rev. 1

High visibility apparel shall comply with current Minnesota OSHA Rules 5207.0100 and 5207.1000 and your agency's policies.

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

MN Rev. 1

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

MN Rev. 1

STANDARD:

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

OPTION:

In lieu of ANSI/ISEA 107-2004 apparel, law enforcement personnel within the TTC zone may wear high-visibility safety apparel that meets the performance requirements of the ANSI/ISEA 207-2006 publication entitled "American National Standard for High-Visibility Public Safety Vests" (see Section 1A.11) and labeled as ANSI 207-2006.

Compliance Date: December 31, 2011

6E.3 Hand-Signaling Devices

MN Rev. 1

GUIDANCE:

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

STANDARD:

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

GUIDANCE:

The STOP/SLOW paddle should be fabricated from light semi-rigid material.

SUPPORT:

The optimum method of displaying a STOP or SLOW message is to place the STOP/SLOW paddle on a rigid staff that is tall enough that when the end of the staff is resting on the ground, the message is high enough to be seen by approaching or stopped traffic.

OPTION:

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

A. Two white or red lights, one centered vertically above and one centered vertically below the STOP legend; and/or two white or yellow lights, one centered vertically above and one centered vertically below the SLOW legend;
B. Two white or red lights, one centered horizontally on each side of the STOP legend; and/or two white or yellow lights, one centered horizontally on each side of the SLOW legend;
C. One white or red light centered below the STOP legend; and/or one white or yellow light centered below the SLOW legend;
D. A series of eight or more small white or red lights no larger than 1/4 inch in diameter along the outer edge of the paddle, arranged in an octagonal pattern at the eight corners of the border of the STOP face; and/or a series of eight or more small white or yellow lights no larger than 1/4 inch in diameter along the outer edge of the paddle, arranged in a diamond pattern along the border of the SLOW face; or
E. A series of white lights forming the shapes of the letters in the legend.

STANDARD:

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

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

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

Flags, when used, shall be red or fluorescent orange-red in color, shall be a minimum of 24 inches square, and shall be securely fastened to a staff that is approximately 36 inches in length.

GUIDANCE:

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

STANDARD:

When used at nighttime, flags shall be retroreflectorized red or fluorescent orange-red.

OPTION:

When flagging in an emergency situation at night in a non-illuminated flagger station, a flagger may use a flashlight with a red glow cone to supplement the STOP/SLOW paddle or flag.

STANDARD:

When a flashlight is used for flagging in an emergency situation at night in a non-illuminated flagger station, the flagger shall hold the flashlight in the left hand, shall hold the paddle or flag in the right hand as shown in Figure 6E-3, and shall use the flashlight in the following manner to control approaching road users:

A. To inform road users to stop, the flagger shall hold the flashlight with the left arm extended and pointed down toward the ground, and then shall slowly wave the flashlight in front of the body in a slow arc from left to right such that the arc reaches no farther than 45 degrees from vertical.
B. To inform road users to proceed, the flagger shall point the flashlight at the vehicle's bumper, slowly aim the flashlight toward the open lane, then hold the flashlight in that position. The flagger shall not wave the flashlight.
C. To alert or slow traffic, the flagger shall point the flashlight toward oncoming traffic and quickly wave the flashlight in a figure eight motion.

6E.4 Automated Flagger Assistance Devices

SUPPORT:

Automated Flagger Assistance Devices (AFADs) enable a flagger(s) to be positioned out of the lane of traffic and are used to control road users through temporary traffic control zones. These devices are designed to be remotely operated either by a single flagger at one end of the TTC zone or at a central location, or by separate flaggers near each device's location.

There are two types of AFADs:

A. An AFAD (see Section 6E.5) that uses a remotely controlled STOP/SLOW sign on either a trailer or a movable cart system to alternately control right-of-way.
B. An AFAD (see Section 6E.6) that uses remotely controlled red and yellow lenses and a gate arm to alternately control right-of-way.

AFADs might be appropriate for short-term and intermediate-term activities (see Section 6G.2). Typical applications include TTC activities such as, but not limited to:

A. Bridge maintenance;
B. Haul road crossings; and
C. Pavement patching.

STANDARD:

AFADs shall only be used in situations where there is only one lane of approaching traffic in the direction to be controlled.

When used at night, the AFAD location shall be illuminated in accordance with Section 6E.8.

GUIDANCE:

AFADs should not be used for long-term stationary work (see Section 6G.2).

STANDARD:

Because AFADs are not traffic control signals, they shall not be used as a substitute for or a replacement for a continuously operating temporary traffic control signal as described in Section 6F.84.

AFADs shall meet the crashworthy performance criteria contained in Section 6F.1.

GUIDANCE:

If used, AFADs should be located in advance of one-lane, two-way tapers and downstream from the point where approaching traffic is to stop in response to the device.

STANDARD:

If used, AFADs shall be placed so that all of the signs and other items controlling traffic movement are readily visible to the driver of the initial approaching vehicle with advance warning signs alerting other approaching traffic to be prepared to stop.

If used, an AFAD shall be operated only by a flagger (see Section 6E.1) who has been trained on the operation of the AFAD. The flagger(s) operating the AFAD(s) shall not leave the AFAD(s) unattended at any time while the AFAD(s) is being used.

The use of AFADs shall conform to one of the following methods:

A. An AFAD at each end of the TTC zone (Method 1), or
B. An AFAD at one end of the TTC zone and a flagger at the opposite end (Method 2).

Except as provided in the following option, two flaggers shall be used when using either Method 1 or Method 2.

OPTION:

A single flagger may simultaneously operate two AFADs (Method 1) or may operate a single AFAD on one end of the TTC zone while being the flagger at the opposite end of the TTC zone (Method 2) if both of the following conditions are present:

A. The flagger has an unobstructed view of the AFAD(s), and
B. The flagger has an unobstructed view of approaching traffic in both directions.

GUIDANCE:

When an AFAD is used, the advance warning signing should include a ROAD WORK AHEAD (W20-1) sign, a ONE LANE ROAD (W20-4) sign, and a BE PREPARED TO STOP (W3-4) sign.

STANDARD:

When the AFAD is not in use, the signs associated with the AFAD, both at the AFAD location and in advance, shall be removed or covered.

GUIDANCE:

A State or local agency that elects to use AFADs should adopt a policy, based on engineering judgment, governing AFAD applications. The policy should also consider more detailed and/or more restrictive requirements for AFAD use, such as the following:

A. Conditions applicable for the use of Method 1 and Method 2 AFAD operation,
B. Volume criteria,
C. Maximum distance between AFADs,
D. Conflicting lenses/indications monitoring requirements,
E. Fail safe procedures,
F. Additional signing and pavement markings,
G. Application consistency,
H. Larger signs or lenses to increase visibility, and
I. Use of backplates.

NOTES:

1. The approach sight distance to the Automated Flagging Assistance Device (AFAD) shall be at least the Decision Sight Distance.
2. The WAIT HERE ON RED sign shall be installed 20 feet in advance of the AFAD.
3. The distance between the AFAD stations may be extended when an operator is placed at each station.
4. The ONE LANE AHEAD sign may be omitted when the posted speed limit is 40 mph or less.
5. The two-way taper should be 50 feet in length using 5 equally spaced channelizing devices.
6. A single operator shall be located to see traffic at both AFAD locations.
7. Roads with more than 1500 ADT require an operator at each AFAD.

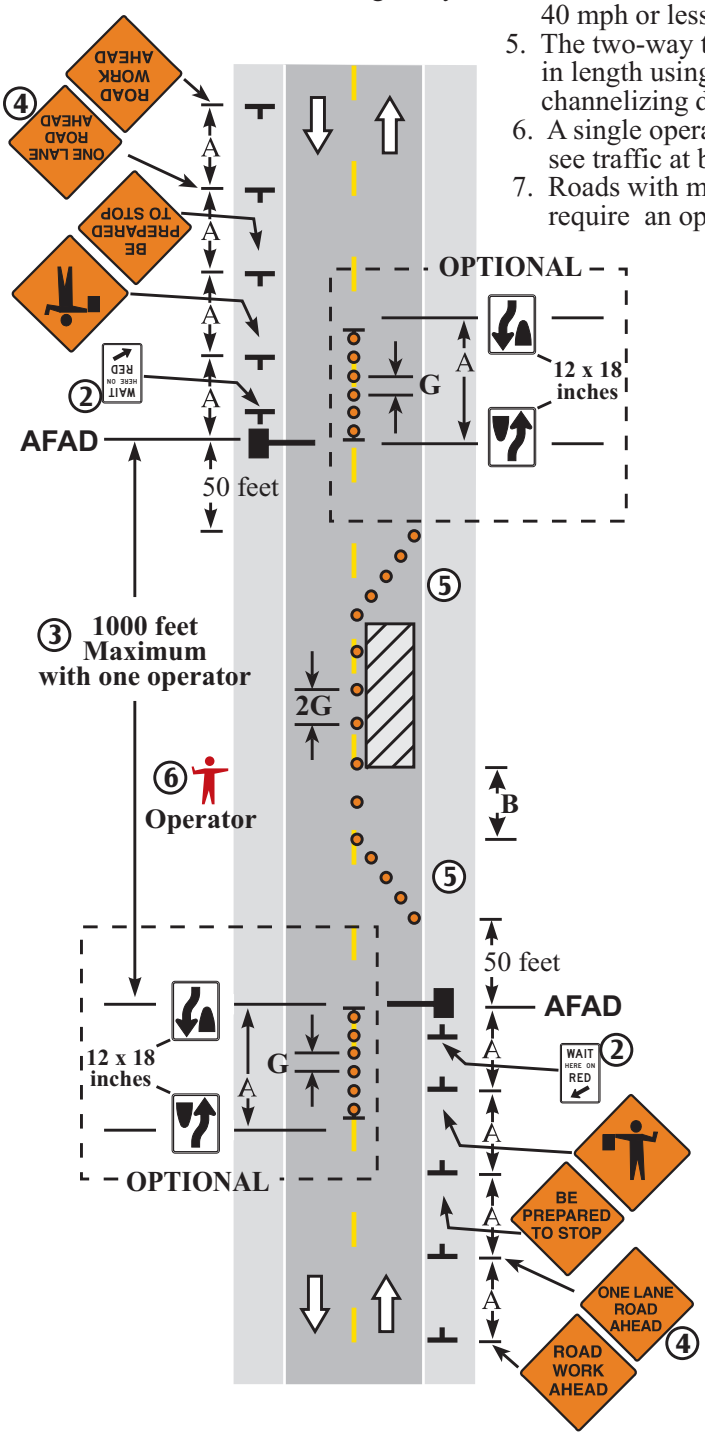

Figure 6E-1a Example of the Use of a STOP/SLOW Automated Flagger Assistance Device (AFAD)

6E.5 STOP/SLOW Automated Flagger Assistance Devices

STANDARD:

A STOP/SLOW Automated Flagger Assistance Device (AFAD) (see Section 6E.4) shall include a STOP/SLOW sign that alternately displays the STOP (R1-1) face and the SLOW (W20-8) face of a STOP/SLOW paddle (see Figure 6E-1).

The AFADs STOP/SLOW sign shall have an octagonal shape, shall be fabricated of rigid material, and shall be mounted with the bottom of the sign a minimum of 6 feet above the pavement on an appropriate support. The size of the STOP/SLOW sign shall be at least 36 x 36 inches with letters at least 12 inches high. The background of the STOP face shall be red with white letters and border. The background of the SLOW face shall be diamond shaped and orange with black letters and border. Both faces of the STOP/SLOW sign shall be retroreflectorized.

The AFADs STOP/SLOW sign shall have a means to positively lock, engage, or otherwise maintain the sign assembly in a stable condition when set in the STOP or SLOW position.

The AFADs STOP/SLOW sign shall be supplemented with active conspicuity devices by incorporating either:

A. White or red flashing lights within the STOP face and white or yellow flashing lights within the SLOW face meeting the provisions contained in Section 6E.3; or

B. A Stop Beacon (see Section 4L.5) mounted a maximum of 24 inches above the STOP face and a Warning Beacon (see Section 4L.3) mounted a maximum of 24 inches above, below, or to the side of the SLOW face. The Stop Beacon shall not be flashed or illuminated when the SLOW face is displayed, and the Warning Beacon shall not be flashed or illuminated when the STOP face is displayed. Except for the mounting locations, the beacons shall comply with the provisions of Chapter 4L.

OPTION:

Type B warning light(s) (see Section 6F.83) may be used in lieu of the Warning Beacon during the display of the SLOW face of the AFADs STOP/SLOW sign.

STANDARD:

If Type B warning lights are used in lieu of a Warning Beacon, they shall flash continuously when the SLOW face is displayed and shall not be flashed or illuminated when the STOP face is displayed.

OPTION:

The faces of the AFADs STOP/SLOW sign may include louvers to improve the stability of the device in windy or other adverse environmental conditions.

STANDARD:

If louvers are used, the louvers shall be designed such that the full sign face is visible to approaching traffic at a distance of 50 feet or greater.

GUIDANCE:

The STOP/SLOW AFAD should include a gate arm that descends to a down position across the approach lane of traffic when the STOP face is displayed and then ascends to an upright position when the SLOW face is displayed.

OPTION:

In lieu of a stationary STOP/SLOW sign with a separate gate arm, the STOP/SLOW sign may be attached to a mast arm that physically blocks the approach lane of traffic when the STOP face is displayed and then moves to a position that does not block the approach lane when the SLOW face is displayed.

STANDARD:

Gate arms, if used, shall be fully retroreflectorized on both sides, and shall have vertical alternating red and white stripes at 16-inch intervals measured horizontally as shown in Figure 8C-1. When the arm is in the down position blocking the approach lane:

A. The minimum vertical aspect of the arm and sheeting shall be 2 inches; and

B. The end of the arm shall reach at least to the center of the lane being controlled.

A separate operator shall be used for each AFAD except as noted in the following option. Each operator shall be stationed near each AFAD and shall be in direct communication with the other flagger.

If an operator is not immediately adjacent to the STOP/SLOW sign an informational sign instructing drivers shall be used. This WAIT ON STOP/GO ON SLOW (R10-X1) sign shall be mounted immediately below the STOP/SLOW sign.

OPTION:

A single operator may be used to control both AFADs on roadways with unobstructed sight lines, less than 1500 ADT and less than 1000 ft between the AFADs.

STANDARD:

When a single operator is used, the AFADs shall be equipped with auxiliary lights using Option B and have the STOP HERE ON RED (R10-6) sign installed 20 feet in advance of each automated flagger station.

To inform road users to stop, the AFAD shall display the STOP face and the red or white lights, if used, within the STOP face shall flash or the Stop Beacon shall flash. To inform road users to proceed, the AFAD shall display the SLOW face and the yellow or white lights, if used, within the SLOW face shall flash or the Warning Beacon or the Type B warning lights shall flash.

If STOP/SLOW AFADs are used to control traffic in a one-lane, two-way TTC zone, safeguards shall be incorporated to prevent the flagger(s) from simultaneously displaying the SLOW face at each end of the TTC zone. Additionally, the flagger(s) shall not display the AFADs SLOW face until all oncoming vehicles have cleared the one-lane portion of the TTC zone.

6E.6 Red/Yellow Lens Automated Flagger Assistance Devices

STANDARD:

A Red/Yellow Lens Automated Flagger Assistance Device (AFAD) (see Section 6E.4) shall alternately display a steadily illuminated CIRCULAR RED lens and a flashing CIRCULAR YELLOW lens to control traffic without the need for a flagger in the immediate vicinity of the AFAD or on the roadway (see Figure 6E-1a).

Red/Yellow Lens AFADs shall have at least one set of CIRCULAR RED and CIRCULAR YELLOW lenses that are 12 inches in diameter. Unless otherwise provided in this Section, the lenses and their arrangement, CIRCULAR RED on top and CIRCULAR YELLOW below, shall comply with the applicable provisions for traffic signal indications in Part 4. If the set of lenses is post-mounted, the bottom of the housing (including brackets) shall be at least 7 feet above the pavement. If the set of lenses is located over any portion of the highway that can be used by motor vehicles, the bottom of the housing (including brackets) shall be at least 15 feet above the pavement.

OPTION:

Additional sets of CIRCULAR RED and CIRCULAR YELLOW lenses, located over the roadway or on the left-hand side of the approach and operated in unison with the primary set, may be used to improve visibility and/or conspicuity of the AFAD.

STANDARD:

A Red/Yellow Lens AFAD shall include a gate arm that descends to a down position across the approach lane of traffic when the steady CIRCULAR RED lens is illuminated and then ascends to an upright position when the flashing CIRCULAR YELLOW lens is illuminated. The gate arm shall be fully retroreflectorized on both sides, and shall have vertical alternating red and white stripes at 16-inch intervals measured horizontally as shown in Figure 8C-1. When the arm is in the down position blocking the approach lane:

A. The minimum vertical aspect of the arm and sheeting shall be 2 inches; and
B. The end of the arm shall reach at least to the center of the lane being controlled.

A Stop Here On Red (R10-6 or R10-6a) sign (see Section 2B.53) shall be installed on the right-hand side of the approach at the point at which drivers are expected to stop when the steady CIRCULAR RED lens is illuminated.

To inform road users to stop, the AFAD shall display a steadily illuminated CIRCULAR RED lens and the gate arm shall be in the down position. To inform road users to proceed, the AFAD shall display a flashing CIRCULAR YELLOW lens and the gate arm shall be in the upright position.

If Red/Yellow Lens AFADs are used to control traffic in a one-lane, two-way TTC zone, safeguards shall be incorporated to prevent the flagger(s) from actuating a simultaneous display of a flashing CIRCULAR YELLOW lens at each end of the TTC zone. Additionally, the flagger shall not actuate the AFADs display of the flashing CIRCULAR YELLOW lens until all oncoming vehicles have cleared the one-lane portion of the TTC zone.

A change interval shall be provided as the transition between the display of the flashing CIRCULAR YELLOW indication and the display of the steady CIRCULAR RED indication. During the change interval, the CIRCULAR YELLOW lens shall be steadily illuminated. The gate arm shall remain in the upright position during the display of the steadily illuminated CIRCULAR YELLOW change interval.

A change interval shall not be provided between the display of the steady CIRCULAR RED indication and the display of the flashing CIRCULAR YELLOW indication.

GUIDANCE:

The steadily illuminated CIRCULAR YELLOW change interval should have a duration of at least 5 seconds, unless a different duration, within the range of durations recommended by Section 4D.26, is justified by engineering judgment.

6E.7 Flagger Procedures

SUPPORT:

The use of paddles and flags by flaggers are illustrated in Figure 6E-3.

STANDARD:

Flaggers shall use a STOP/SLOW paddle, a flag, or an Automated Flagger Assistance Device (AFAD) to control road users approaching a TTC zone. The use of hand movements alone without a paddle, flag, or AFAD to control road users shall be prohibited except for law enforcement personnel or emergency responders at incident scenes as described in Section 6I.1.

The following methods of signaling with paddles shall be used:

A. To stop road users, the flagger shall face road users and extend the STOP paddle face toward road users in a stationary position with the arm extended horizontally away from the body. The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic.
B. To direct stopped road users to proceed, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body. The flagger shall motion with the free hand for road users to proceed.
C. To alert or slow traffic, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body.

OPTION:

To further alert or slow traffic, the flagger holding the SLOW paddle face toward road users may motion up and down with the free hand, palm down.

STANDARD:

In emergency situations a minimum size 24 x 24 inch red flag may be used in lieu of a paddle until a paddle is available, however, as soon as a paddle is available it shall be used.

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

A. To stop road users, the flagger shall face road users and extend the flag staff horizontally across the road users' lane in a stationary position so that the full area of the flag is visibly hanging below the staff. The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic.
B. To direct stopped road users to proceed, the flagger shall face road users with the flag and arm lowered from the view of the road users, and shall motion with the free hand for road users to proceed. Flags shall not be used to signal road users to proceed.
C. To alert or slow traffic, the flagger shall face road users and slowly wave the flag in a sweeping motion of the extended arm from shoulder level to straight down without raising the arm above a horizontal position. The flagger shall keep the free hand down.

GUIDANCE:

The flagger should stand either on the shoulder adjacent to the road user being controlled or in the closed lane prior to stopping road users. A flagger should only stand in the lane being used by moving road users after road users have stopped. The flagger should be clearly visible to the first approaching road user at all times. The flagger also should be visible to other road users. The flagger should be stationed sufficiently in advance of the workers to warn them (for example, with audible warning devices such as horns or whistles) of approaching danger by out-of-control vehicles. The flagger should stand alone, away from other workers, work vehicles, or equipment.

OPTION:

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

GUIDANCE:

When a single flagger is used, the flagger should be stationed in the closed lane at the beginning of the taper or in a position where good visibility and traffic control can be maintained at all times.

6E.8 Flagger Stations

STANDARD:

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

OPTION:

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

GUIDANCE:

Flagger stations should be located such that an errant vehicle has additional space to stop without entering the work space. The flagger should identify an escape route that can be used to avoid being struck by an errant vehicle.

PREFERRED METHOD
STOP/SLOW Paddle

EMERGENCY SITUATIONS ONLY
Red Flag

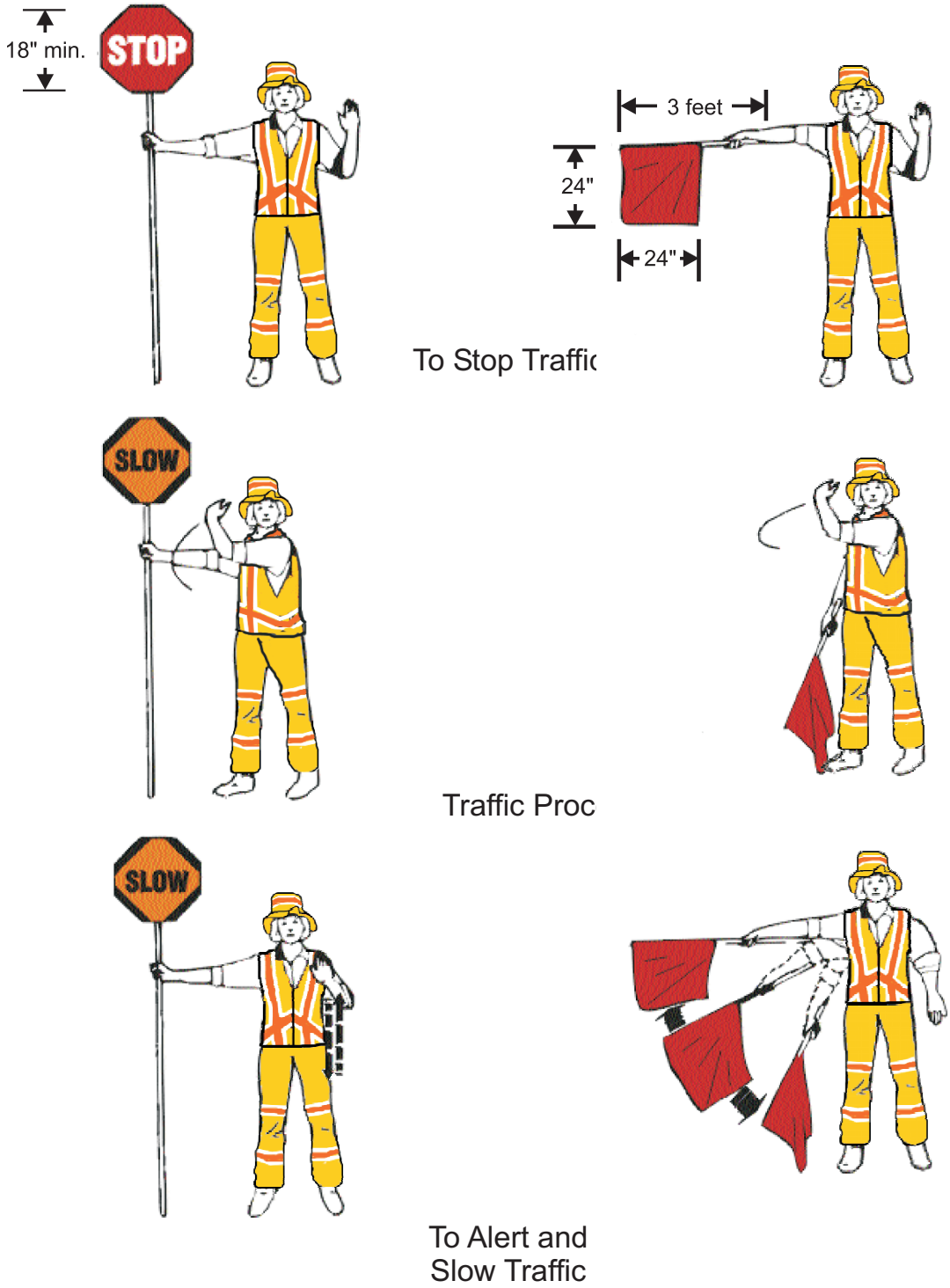

Figure 6E-3 Use of Hand-Signaling Devices by Flaggers

Posted Speed Limit Prior to Work Starting (mph)	Decision Sight Distance (feet)
0 - 30	165
35 - 40	210
45 - 50	270
55	360
60 - 65	420
70 - 75	480

Table 6E-1 Decision Sight Distance

STANDARD:

Except in emergency situations, flagger stations shall be preceded by an advance warning sign or signs. Except in emergency situations, flagger stations shall be illuminated at night.

6E.9 Flagger Method of One-Lane, Two-Way Traffic Control

OPTION:

On an intermediate volume road (less than 1500 ADT) with good visibility, a single flagger may be used to control one direction of traffic while the other direction flows free. In this situation, the flagger is positioned in the closed lane at the beginning of the taper. The flagger stops the traffic approaching in the closed lane. When the open lane is clear, the flagger allows traffic to proceed.

A single flagger may also be used to stop traffic in a lane while that lane is closed. An example would be a truck depositing material off the edge of the roadway. In this situation, the flagger would stop the traffic in this lane while the other lane flows free. When the lane is open again, the flagger allows the traffic to proceed in their normal lane. After stopped traffic is allowed to proceed, the flagger should turn the flagger paddle parallel to traffic so that no message is displayed to either direction of traffic.

STANDARD:

If the Decision Sight Distance is not available beyond the work space for a single flagger to detect oncoming traffic, two flaggers shall be used.

GUIDANCE:

When good visibility and traffic control cannot be maintained by one flagger station, traffic should be controlled by a flagger at each end of the section. One of the flaggers should be designated as the coordinator. Flaggers should be able to communicate with each other orally, electronically, or with manual signals. These manual signals should not be mistaken for flagging signals.

6E.10 Flag Transfer Method of One-Lane, Two-Way Traffic Control

GUIDANCE:

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

6E.11 Pilot Car Method of One-Lane, Two-Way Traffic Control

GUIDANCE:

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

STANDARD:

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

TTC devices, such as channelizing devices shall be utilized in all transition areas and parallel or longitudinally to buffer spaces wherever lane shifts occur. See Chapter 6K, Layout 16 titled "Pilot Car Method of One-Lane, Two-Way Traffic Control."

GUIDANCE:

Additional channelizing devices should be placed in areas that may be considered hazardous to the public or workers.

These areas include but are not limited to :

A. Full longitudinal channelizing, as stated in Section 6F.58 (Channelizing Devices), when traffic is adjacent to longitudinal drop-offs greater than 4 inches.

B. Full longitudinal channelizing, as stated in Section 6F.58 (Channelizing Devices), and barriers, as stated in Section 6F.81 (Temporary Traffic Barriers), when traffic is adjacent to longitudinal drop-offs greater than 12 inches.

C. Full longitudinal channelizing, as stated in Section 6F.58 (Channelizing Devices), when when roadway geometry, dust, weather, or darkness restricts visibility of the open travel lane.

Flagging and pilot car procedures should ensure that traffic platoons remain tightly spaced to prevent unsafe speed variations and deviations from the desired traffic lane. Flaggers should only arrow platooned vehicles to proceed behind the pilot car. Vehicles arriving late to the flagging station should not be allowed to proceed if the last vehicle has traveled more than 300 feet beyond the flagger station.

Pilot cars should lead traffic through the work zone at a safe speed, typically 10 mph below the posted speed limit. Their speed should be further reduced when:

- the vehicles in the platoon begin to separate,
- there are poor roadway surface conditions (such as gravel or bumps),
- there is an adjacent lane or shoulder drop-off,
- weather conditions or visibility are poor,
- passing work crews or equipment,
- passing another platoon of vehicles,
- maneuvering through transition areas, or
- other similar restrictions.

6E.12 Stop or Yield Control Method of One-Lane, Two-Way Traffic Control

GUIDANCE:

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

6E.13 Flagging at intersections

SUPPORT:

A flagging operation within a non-signalized intersection has the authority to override STOP and YIELD signs in the intersection. When traffic signals are set to flash red for all approaches, or turned off and temporary STOP signs are installed, the intersection may be treated as a non-signalized intersection. Only a licensed uniformed law enforcement officer has the authority to override a fully operating traffic control signal system.

GUIDANCE:

When flagging in an intersection, the following should be considered:

- The flagger should use hand signals with a flag or light wand to control traffic movements rather than the typical STOP/SLOW paddle.
- The flagger has the authority to direct vehicles to proceed through a STOP sign controlled condition while holding traffic on other approaches. Although the flagger has the authority to urge motorists to continue through the STOP, the flagger has no authority to prevent traffic from stopping and should allow for this stopping within the operation.
- The flagger should be aware of traffic conditions at adjacent intersections and should coordinate their operations to minimize traffic backups.
- The flaggers should coordinate their flagging operations to eliminate conflicts.

OPTION:

High-volume intersections, large intersections, or complicated situations may require additional flaggers.

PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6F. Temporary Traffic Control Zone Devices

6F.1 Types of Devices

GUIDANCE:

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

SUPPORT:

FHWA policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used on the National Highway System meet the crashworthy performance criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". The FHWA website at "http://safety.fhwa.dot.gov/programs/roadside_hardware.htm" identifies all such hardware and includes copies of FHWA acceptance letters for each of them. In the case of proprietary items, links are provided to manufacturers' websites as a source of detailed information on specific devices. The website also contains an "Ask the Experts" section where questions on roadside design issues can be addressed.

Various Sections of the MUTCD require certain traffic control devices, their supports, and/or related appurtenances to be crashworthy. Such MUTCD crashworthiness provisions apply to all streets, highways, and private roads open to public travel. Also, State Departments of Transportation and local agencies might have expanded the NCHRP Report 350 crashworthy criteria to apply to certain other roadside appurtenances.

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

As defined in Section 1A.13, "crashworthy" is a characteristic of a roadside appurtenance that has been successfully crash tested in accordance with a national standard such as the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

STANDARD:

Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, private roads open to public travel (see definition in Section 1A.13), pedestrian facility, or bikeway by authority of a public body or official having jurisdiction.

All traffic control devices used for construction, maintenance, utility, or incident management operations on a street, highway, or private road open to public travel (see definition in Section 1A.13) shall comply with the applicable provisions of this Manual.

All signs, barricades, drums, weighted channelizers, and vertical panels shall be retroreflectorized. Cones and tubes shall be retroreflectorized if used at night.

Devices that are excessively worn, bent, damaged or have lost a significant amount of their retroreflectivity shall be promptly removed (see Chapter 6K, Quality Standards on pages 6K-87 through 6K-104).

GUIDANCE:

Particular attention should be given to assuring that all traffic control devices are maintained and kept clean, visible, and properly positioned at all times.

6F.2 General Characteristics of Signs

SUPPORT:

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

STANDARD:

The colors for regulatory signs shall follow the Standards for regulatory signs in Table 2A-5 and Chapter 2B. Warning signs in TTC zones shall have a black legend and border on an orange background, except for the Grade Crossing Advance Warning (W10-1) sign which shall have a black legend and border on a yellow background, and except for signs that are required or recommended in Parts 2 or 7 to have fluorescent yellow-green backgrounds. Colors for guide signs shall follow the Standards in Table 2A-5 and Chapter 2D, except for guide signs as otherwise provided in Section 6F.55.

OPTION:

Where the color orange is required, the fluorescent orange color may also be used.

SUPPORT:

The fluorescent version of orange provides higher conspicuity than standard orange, especially during twilight.

OPTION:

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

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

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

STANDARD:

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

Except as provided in Section 2A.11, the sizes for TTC signs and plaques shall be as shown in Table 6F-1 and in Appendix C of this Manual. The sizes in the minimum column shall only be used on local streets or roadways where the 85th-percentile speed or posted speed limit is less than 35 mph.

OPTION:

The dimensions of signs and plaques shown in Table 6F-1 may be increased wherever necessary for greater legibility or emphasis.

STANDARD:

Deviations from standard sizes as prescribed in this Manual shall be in 6-inch increments.

SUPPORT:

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

Section 2A.6 contains additional information regarding the design of signs, including an Option allowing the development of special word message signs if a standard word message or symbol sign is not available to convey the necessary regulatory, warning, or guidance information.

STANDARD:

All signs used at night shall be retroreflective with a material that has a smooth, sealed outer surface to show the same shape and similar color both day and night.

The requirement for sign illumination shall not be considered to be satisfied by street, highway, or strobe lighting.

OPTION:

Sign illumination may be either internal or external.

Signs may be made of rigid or flexible material.

STANDARD:

Mesh nonretroreflective signs shall not be used.

6F.3 Sign Placement

GUIDANCE:

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

OPTION:

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

SUPPORT:

The provisions of this Section regarding mounting height apply unless otherwise provided for a particular sign elsewhere in this Manual.

STANDARD:

The minimum height, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement, of signs installed at the side of the road in rural areas shall be 5 feet (see Figure 6F-1).

The minimum height, measured vertically from the bottom of the sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way, of signs installed at the side of the road in business, commercial, or residential areas where parking or pedestrian movements are likely to occur, or where the view of the sign might be obstructed, shall be 7 feet (see Figure 6F-1).

The minimum height, measured vertically from the bottom of the sign to the sidewalk, of signs installed above sidewalks shall be 7 feet.

OPTION:

The height to the bottom of a secondary sign mounted below another sign may be 1 foot less than the height provided in the previous Standard.

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Stop	R1-1	6F.6	30 x 30 *	---	---
Stop (on Stop/Slow Paddle)	R1-1	6E.3	18 x 18	---	---
Yield	R1-2	6E.6	36 x 36 x 36	---	30 x 30 x 30
To Oncoming Traffic	R1-2aP	6E.6	36 x 30	48 x 36	24 x 18
Speed Limit	R2-1	6F.12	24 x 30 *	36 x 48	---
Fines Higher (plaque)	R2-6P	6F.12	24 x 18	36 x 24	---
Fines Double (plaque)	R2-6aP	6F.12	24 x 18	36 x 24	---
$XX Fine (plaque)	R2-6bP	6F.12	24 x 18	36 x 24	---
Begin Higher Fines Zone	R2-10	6F.12	24 x 30	36 x 48	---
End Higher Fines Zone	R2-11	6F.12	24 x 30	36 x 48	---
End Work Zone Speed Limit	R2-12	6F.12	24 x 36	36 x 54	---
Movement Prohibition	R3-1,2,3,4,18,27	6F.6	24 x 24 *	36 x 36	---
Mandatory Movement (1 lane)	R3-5	6F.6	30 x 36	---	---
Optional Movement (1 lane)	R3-6	6F.6	30 x 36	---	---
Right (Left) Lane Must Turn Right (Left)	R3-7	6F.6	30 x 30 *	---	---
Advance Intersection Lane Control	R3-30	6F.6	Varies x 30	---	---
Do Not Pass	R4-1	6F.6	24 x 30	36 x 48	---
Pass With Care	R4-2	6F.6	24 x 30	36 x 48	---
Keep Right	R4-7	6F.6	24 x 30	36 x 48	---
Narrow Keep Right	R4-7c	6F.6	18 x 30	---	---
Stay in Lane	R4-9	6F.11	24 x 30	36 x 48	---
Do Not Enter	R5-1	6F.6	30 x 30 *	36 x 36	---
Wrong Way	R5-1a	6F.6	36 x 30 *	42 x 30	---
One Way	R6-1	6F.6	36 x 12 *	54 x 18	---
One Way	R6-2	6F.6	24 x 30 *	36 x 48	---
No Parking (symbol)	R8-3	6F.13	24 x 24	36 x 36	---
Pedestrian Crosswalk	R9-8	6F.14	36 x 18	---	---
Sidewalk Closed	R9-9	6F.14	24 x 12	---	---
Sidewalk Closed, Use Other Side	R9-10	6F.14	24 x 12	---	---
Sidewalk Closed Ahead, Cross Here	R9-11	6F.14	24 x 18	---	---
Sidewalk Closed, Cross Here	R9-11a	6F.14	24 x 12	---	---
Wait on Stop/Go on Slow	R10-X1	6E.3	24 x 30	24 x 30	---
Road Closed	R11-2	6F.8	48 x 30	---	---
Road Closed, Local Traffic Only	R11-3a,3b,4	6F.9	60 x 30	---	---
Weight Limit	R12-1,2	6F.10	24 x 30	36 x 48	
Weight Limit (with symbols)	R12-5	6F.10	24 x 36	36 x 48	30 x 30
Turn and Curve Signs	W1-1,2,3,4	6F.16	36 x 36	48 x 48	30 x 30
Reverse Curve (2 or more lanes)	W1-4b,4c	6F.48	36 x 36	48 x 48	---
One-Direction Large Arrow	W1-6	6F.16	48 x 24	60 x 30	---
Chevron Alignment	W1-8	6F.16	18 x 24	30 x 36	30 x 30
Double Reverse Curve (1 lane)	W1-X1	6F.49	36 x 36	48 x 48	---
Double Reverse Curve (2 lanes)	W1-X1b	6F.49	---	48 x 48	---
Stop Ahead	W3-1	6F.16	36 x 36	48 x 48	30 x 30
Yield Ahead	W3-2	6F.16	36 x 36	48 x 48	30 x 30
Signal Ahead	W3-3	6F.16	36 x 36	48 x 48	30 x 30
Be Prepared to Stop	W3-4	6F.16	36 x 36	48 x 48	30 x 30

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* See Table 2B-1 for minimum size required for signs facing traffic on multi-lane conventional roads

Notes: 1. Larger signs may be used wherever necessary for greater legibility or emphasis.
2. Dimensions are shown in inches and are shown as width x height.

Table 6F-1 Temporary Traffic Control Zone Sign and Plaque Sizes (Sheet 1 of 3)

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Reduced Speed Ahead	W3-5	6F.16	36 x 36	48 x 48	30 x 30
XX MPH Speed Zone Ahead	W3-5a	6F.16	36 x 36	48 x 48	30 x 30
Traffic Control Change Ahead	W3-X5	6F.30	36 x 36	48 x 48	30 x 30
Merging traffic	W4-1,1a,5	6F.16	36 x 36	48 x 48	36 x 36
Lane Ends	W4-2	6F.24	36 x 36	48 x 48	30 x 30
Added Lane	W4-3,6	6F.16	36 x 36	48 x 48	30 x 30
No Merge Area (plaque)	W4-5P	6F.16	18 x 24	24 x 30	---
Road Narrows	W5-1	6F.16	36 x 36	48 x 48	30 x 30
Narrow Bridge	W5-2	6F.16	36 x 36	48 x 48	30 x 30
One Lane Bridge	W5-3	6F.16	36 x 36	48 x 48	30 x 30
Ramp Narrows	W5-4	6F.26	36 x 36	48 x 48	30 x 30
Divided Highway	W6-1	6F.16	36 x 36	48 x 48	30 x 30
Divided highway Ends	W6-2	6F.16	36 x 36	48 x 48	30 x 30
Two-Way Traffic	W6-3	6F.32	36 x 36	48 x 48	30 x 30
Two-Way Traffic	W6-4	6F.76	12 x 18	12 x 18	---
Hill (symbol)	W7-1	6F.16	36 x 36	48 x 48	30 x 30
Next XX Miles (plaque)	W7-3aP	6F.53	24 x 18	36 x 30	---
Bump	W8-1,1a	6F.16	36 x 36	48 x 48	30 x 30
Dip	W8-2	6F.16	36 x 36	48 x 48	30 x 30
Pavement Ends	W8-3	6F.16	36 x 36	48 x 48	30 x 30
Soft Shoulder	W8-4	6F.44	36 x 36	48 x 48	30 x 30
Slippery When Wet	W8-5	6F.16	36 x 36	48 x 48	30 x 30
Truck Crossing	W8-6	6F.36	36 x 36	48 x 48	30 x 30
Loose Gravel	W8-7	6F.16	36 x 36	48 x 48	30 x 30
Rough Road	W8-8	6F.16	36 x 36	48 x 48	30 x 30
Low Shoulder	W8-9	6F.44	36 x 36	48 x 48	30 x 30
Shoulder Drop-Off	W8-9a	6F.44.1	36 x 36	48 x 48	30 x 30
Uneven Lanes	W8-11	6F.45	36 x 36	48 x 48	30 x 30
No Center Stripe	W8-12a	6F.47	36 x 36	48 x 48	30 x 30
Fallen Rocks	W8-14	6F.16	36 x 36	48 x 48	30 x 30
Grooved Pavement	W8-15	6F.16	36 x 36	48 x 48	30 x 30
Motorcycle (plaque)	W8-15P	6F.54	24 x 18	30 x 24	---
Road May Flood	W8-18	6F.44	36 x 36	48 x 48	30 x 30
No Shoulder	W8-23	6F.44	36 x 36	48 x 48	30 x 30
Steel Plate Ahead	W8-24	6F.46	36 x 36	48 x 48	30 x 30
Shoulder Ends	W8-25	6F.16	36 x 36	48 x 48	30 x 30
Lane Ends	W9-1,2	6F.16	36 x 36	48 x 48	30 x 30
Grade Crossing Advance Warning	W10-1	6F.16	36 Diameter	---	---
Truck	W11-10	6F.36	36 x 36	48 x 48	30 x 30
Double Arrow	W12-1	6F.16	30 x 30	---	---
Low Clearance	W12-2	6F.16	36 x 36	48 x 48	30 x 30
Advisory Speed (plaque)	W13-1P	6F.52	24 x 24	30 x 30	18 x 18
On Ramp (plaque)	W13-4P	6F.25	36 x 36	36 x 36	---
No Passing Zone (pennant)	W14-3	6F.16	48 x 48 x 48	64 x 64 x 48	40 x 40 x 30
Emergency Scene Ahead	W14-X15	6I.1	36 x 36	48 x 48	---
XX Feet (plaque)	W16-2P	6F.16	24 x 18	30 x 24	---
Road Work Ahead	W20-1	6F.18	36 x 36	48 x 48	30 x 30

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* See Table 2B-1 for minimum size required for signs facing traffic on multi-lane conventional roads

Notes: 1. Larger signs may be used wherever necessary for greater legibility or emphasis.
2. Dimensions are shown in inches and are shown as width x height.

Table 6F-1 Temporary Traffic Control Zone Sign and Plaque Sizes (Sheet 2 of 3)

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Detour Ahead	W20-2	6F.19	36 x 36	48 x 48	30 x 30
Road (Street) Closed Ahead	W20-3	6F.20	36 x 36	48 x 48	30 x 30
Trail Closed Ahead	W20-3a	6F.20.1	18 x 18	---	---
One Lane Road Ahead	W20-4	6F.21	36 x 36	48 x 48	30 x 30
Flagger (symbol)	W20-7	6F.31	36 x 36	48 x 48	30 x 30
Slow (on Stop/Slow Paddle)	W20-8	6F.3	18 x 18	---	---
Merge	W20-X3	6F.24.1	36 x 36	48 x 48	30 x 30
Bypass Ahead	W20-X6	6F.16	36 x 36	48 x 48	30 x 30
Narrow Lane (width shown)	W20-X11	6F.16	36 x 36	48 x 48	30 x 30
Right Two Lanes Closed	W20-X13	6F.22	36 x 36	48 x 48	30 x 30
Lanes Narrow	W20-X17	6F.16	36 x 36	48 x 48	30 x 30
Workers	W21-1	6F.33	36 x 36	48 x 48	30 x 30
Fresh Oil (Tar)	W21-2	6F.34	36 x 36	48 x 48	30 x 30
Road Machinery Ahead	W21-3	6F.35	36 x 36	48 x 48	30 x 30
Slow Moving Vehicle	W21-4	6G.6	36 x 18	---	---
Shoulder Work	W21-5	6F.37	36 x 36	48 x 48	30 x 30
Shoulder Closed	W21-5a	6F.37	36 x 36	48 x 48	30 x 30
Survey Crew	W21-6,6a	6F.38	36 x 36	48 x 48	30 x 30
Utility Work Ahead	W21-7	6F.39	36 x 36	48 x 48	30 x 30
Mowing Ahead	W21-8	6G.6	36 x 36	48 x 48	30 x 30
No Shoulder	W21-X1	6F.44.3	36 x 36	48 x 48	30 x 30
Right (Left Lane Closed	W21-X5	6F.22	36 x 36	48 x 48	30 x 30
Center Lane Closed	W21-X5c	6F.23	36 x 36	48 x 48	30 x 30
Right (Left) Two Lanes Closed	W21-X6	6F.38.1	36 x 36	48 x 48	30 x 30
High Shoulder	W21-X9	6F.44.2	36 x 36	48 x 48	30 x 30
Blasting Zone Ahead	W22-1	6F.41	36 x 36	48 x 48	30 x 30
Turn Off 2-Way Radio and Cell Phone	W22-2	6F.42	42 x 36	42 x 36	---
End Blasting Zone	W22-3	6F.43	42 x 36	42 x 36	36 x 30
Slow Traffic Ahead	W23-1	6F.27	48 x 24	48 x 24	---
New Traffic Pattern Ahead	W23-2	6F.30	36 x 36	48 x 48	30 x 30
All Lanes (plaque)	W24-1cP	6F.49	24 x 18	30 x 24	---
Road Work Next XX Miles	G20-1	6F.56	36 x 18	48 x 24	---
End Road Work	G20-2	6F.57	36 x 18	48 x 24	---
Pilot Car Follow Me	G20-4	6F.58	36 x 18	---	---
Work Zone (plaque)	G20-5aP	6F.12	24 x 18	36 x 24	---
Road Closed Beginning XXXX XX	G20-X1	6F.56.1	72 x 60	90 x 78	---
Exit Open	E5-2	6F.28	48 x 36	48 x 36	---
Exit Closed	E5-2a	6F.28	48 x 36	48 x 36	---
Exit Only	E5-3	6F.29	48 x 36	48 x 36	---
Detour	M4-8	6F.59	24 x 12	30 x 15	---
End Detour	M4-8a	6F.59	24 x 18	24 x 18	---
End	M4-8b	6F.59	24 x 12	24 x 12	---
Detour	M4-9	6F.59	30 x 24	48 x 36	---
Bike/Pedestrian	M4-9a	6F.59	30 x 24	---	---
Pedestrian Detour	M4-9b	6F.59	30 x 24	---	---
Bike Detour	M4-9c	6F.59	30 x 24	---	---
Detour	M4-10	6F.59	48 x 18	---	---

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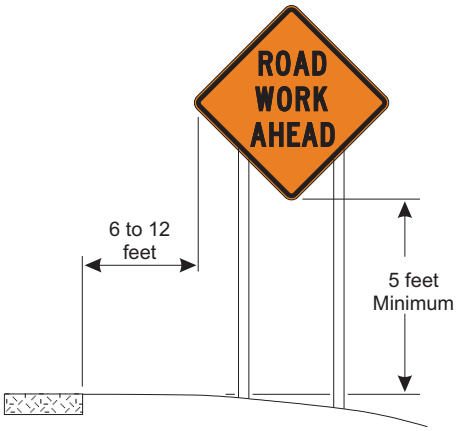
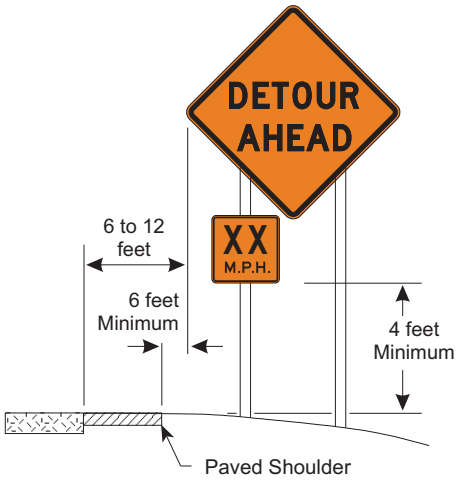
* See Table 2B-1 for minimum size required for signs facing traffic on multi-lane conventional roads

Notes: 1. Larger signs may be used wherever necessary for greater legibility or emphasis.
2. Dimensions are shown in inches and are shown as width x height.

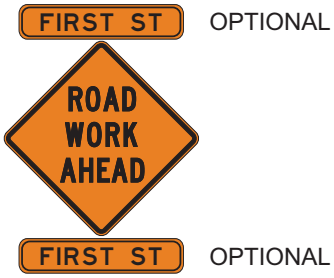
Table 6F-1 Temporary Traffic Control Zone Sign and Plaque Sizes (Sheet 3 of 3)



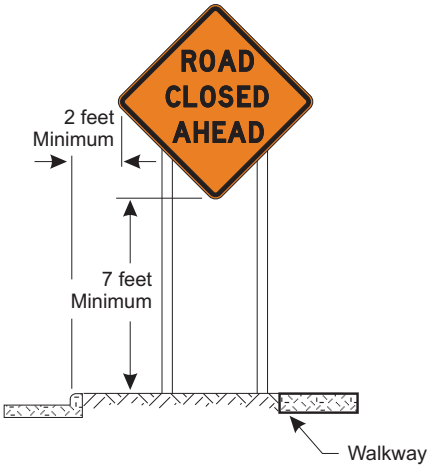
A. RURAL AREA



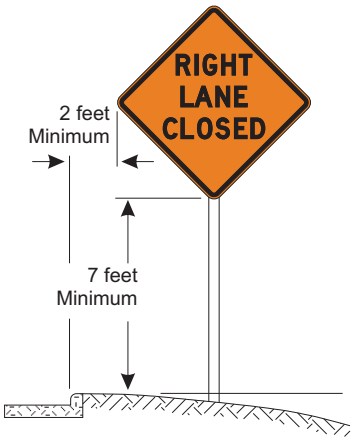
B. RURAL AREA WITH
ADVISORY SPEED PLATE



Advance street name plaques or route markers
nay be installed above or below warning signs



C. BUSINESS, COMMERCIAL,
OR RESIDENTIAL AREA



D. BUSINESS, COMMERCIAL,
OR RESIDENTIAL
AREA (WITHOUT CURB)

Figure 6F-1 Height and Lateral Location of Signs - Typical Installations

GUIDANCE:

Neither portable nor permanent sign supports should be located on sidewalks, bicycle facilities, or areas designated for pedestrian or bicycle traffic. If the bottom of a secondary sign that is mounted below another sign is mounted lower than 7 feet above a pedestrian sidewalk or pathway (see Section 6D.2), the secondary sign should not project more than 4 inches into the pedestrian facility.

STANDARD:

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

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

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GUIDANCE:

Except as provided in the following Option, signs anticipated to be in one place for more than 30 days should not be mounted on portable supports. Whenever this anticipated time period changes, signs mounted on portable supports should be re-evaluated.

OPTION:

Signs, whose location on a paved surfaces is necessary, may be mounted on portable supports for more than 30 days.

SUPPORT:

Methods of mounting signs other than on posts are illustrated in Figure 6F-2.

GUIDANCE:

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

STANDARD:

All sign supports shall be crashworthy.

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Where large signs having an area exceeding 50 square feet are installed on multiple breakaway posts, the clearance from the ground to the bottom of the sign shall be at least 7 feet.

The bottom of a sign mounted on a barricade, or other portable support, shall be at least 1 foot above the traveled way.

In addition, regulatory signs installed on barricades or other portable supports shall be installed so that the center of the sign or sign assembly is at least 4 ft above the traveled way.

OPTION:

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

SUPPORT:

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

6F.4 Sign Maintenance

GUIDANCE:

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

Signs that have lost significant legibility shall be replaced as soon as possible after notification.

SUPPORT:

Section 2A.8 contains information regarding the retroreflectivity of signs, including the signs that are used in TTC zones.

6F.5 Regulatory Sign Authority

SUPPORT:

Regulatory signs inform road users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent.

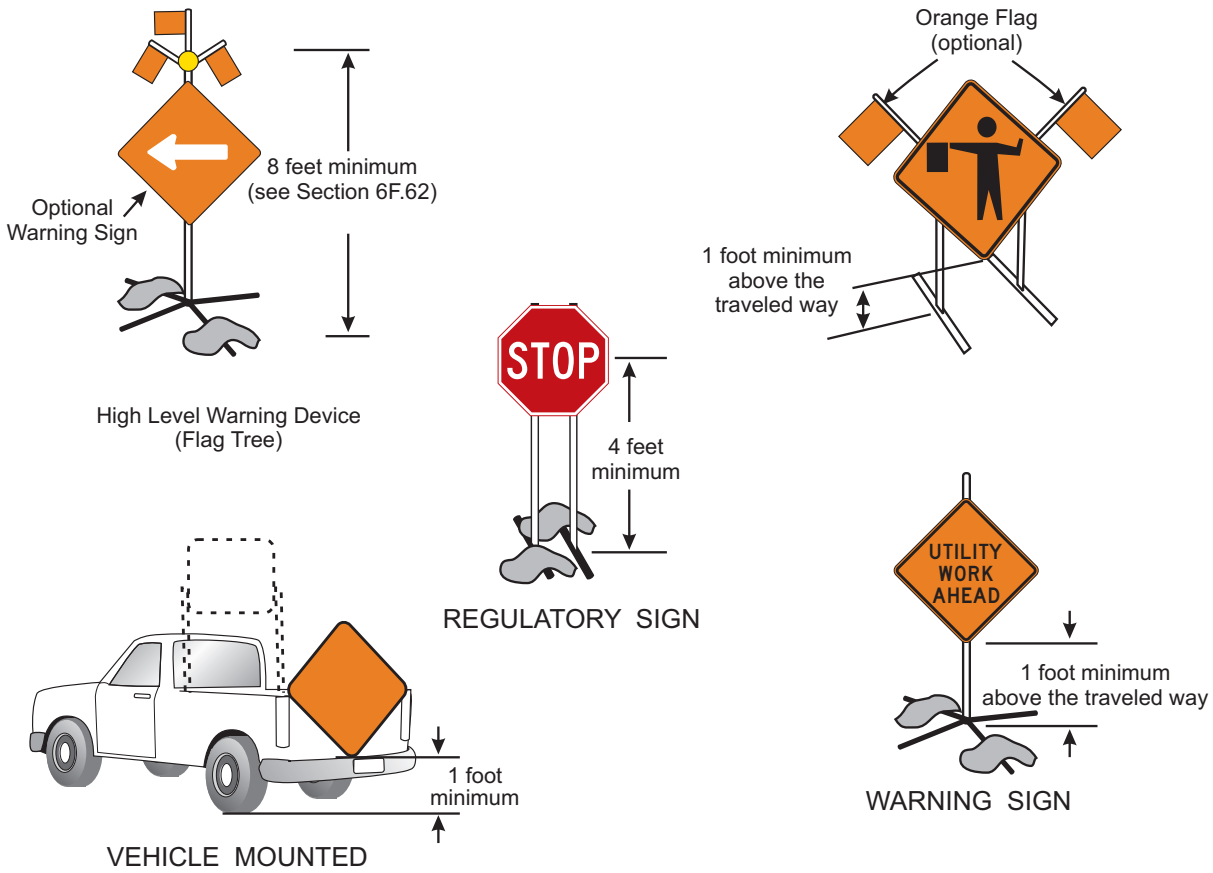
STANDARD:

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

6F.6 Regulatory Sign Design

STANDARD:

TTC regulatory signs shall comply with the Standards for regulatory signs presented in Part 2 and in the MnDOT Standard Signs Manual and the FHWA "Standard Highway Signs and Markings" book (see Section 1A.11).



PORTABLE AND TEMPORARY MOUNTINGS

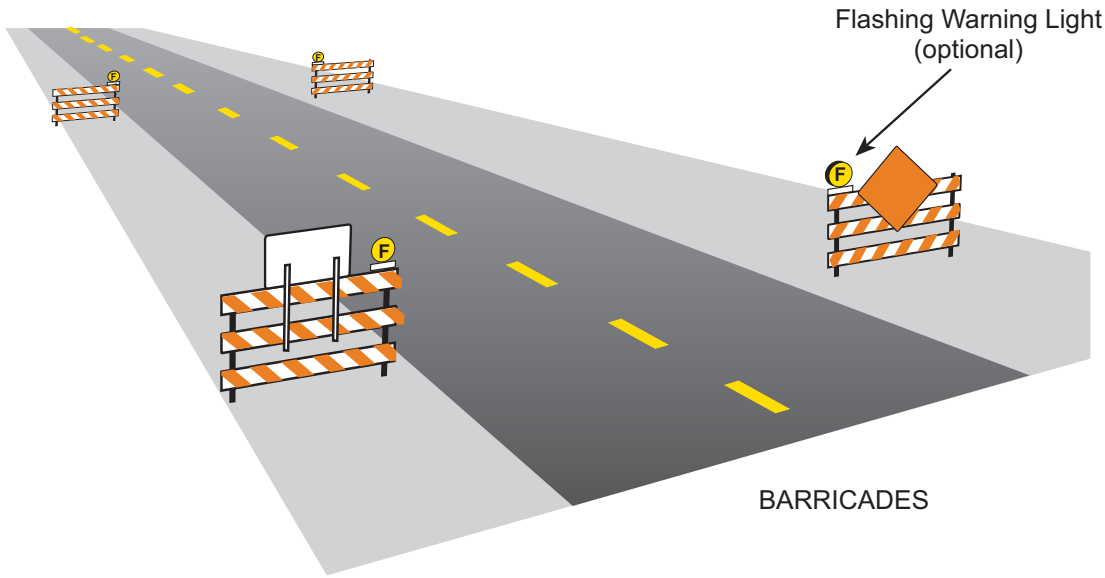


Figure 6F-2 Methods of Mounting Signs Other Than on Posts

SUPPORT:

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

OPTION:

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

6F.7 Regulatory Sign Applications

STANDARD:

If a TTC zone requires regulatory measures different from those existing, the existing permanent regulatory devices shall be removed or covered and superseded by the appropriate temporary regulatory signs. This change shall be made in compliance with applicable ordinances or statutes of the jurisdiction.

6F.8 ROAD (STREET) CLOSED Sign (R11-2)

R11-2

GUIDANCE:

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

OPTION:

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

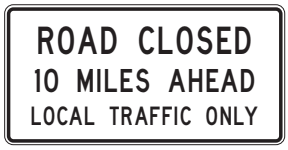
GUIDANCE:

The ROAD (STREET) CLOSED sign should be installed at or near the center of the roadway on or above a Type III barricade that closes the roadway (see Section 6F.68).

STANDARD:

The ROAD (STREET) CLOSED sign shall not be used where road user flow is maintained through the TTC zone with a reduced number of lanes on the existing roadway or where the actual closure is some distance beyond the sign.

6F.9 Local Traffic Only Signs (R11-3a, R11-4)



R11-3a

R11-4

GUIDANCE:

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

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

OPTION:

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

In urban areas, a word message that includes the name of an intersecting street name or well-known destination may be substituted for the words XX MILES AHEAD on the R11-3a sign where applicable.

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

6F.10 Weight Limit Signs (R12-1a, R12-2, R12-5, R12-5 Supplements)

R12-1a

R12-2

R12-5

R12 Supplement Plaques

STANDARD:

A Weight Limit sign, which shows the gross weight or axle weight that is permitted on the roadway or bridge, shall be consistent with State or local regulations and shall not be installed without the approval of the authority having jurisdiction over the highway.

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

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

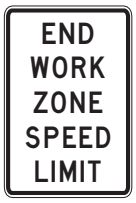
R4-9

OPTION:

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

6F.12 Work Zone and Higher Fines Signs and Plaques

G20-5aP



R2-12

OPTION:

A WORK ZONE (G20-5aP) plaque may be mounted above a Speed Limit sign to emphasize that a reduced speed limit is in effect within a TTC zone. An END WORK ZONE SPEED LIMIT (R2-12) sign may be installed at the downstream end of the reduced speed limit zone.

R2-10

R2-11

GUIDANCE:

A BEGIN HIGHER FINES ZONE (R2-10) sign should be installed at the upstream end of a work zone where increased fines are imposed for traffic violations, and an END HIGHER FINES ZONE (R2-11) sign should be installed at the downstream end of the work zone.

OPTION:

Alternate legends such as BEGIN (or END) DOUBLE FINES ZONE may also be used for the R2-10 and R2-11 signs.

R2-6P

R2-6aP

R2-6bP

A FINES HIGHER, FINES DOUBLE, or $XX FINE plaque (see Section 2B.17) may be mounted below the Speed Limit sign if increased fines are imposed for traffic violations within the TTC zone.

Individual signs and plaques for work zone speed limits and higher fines may be combined into a single sign or may be displayed as an assembly of signs and plaques.

6F.13 PEDESTRIAN CROSSWALK Sign (R9-8)

R9-8

OPTION:

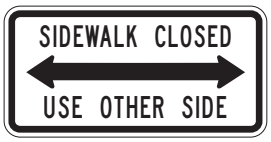
The PEDESTRIAN CROSSWALK (R9-8) sign may be used to indicate where a temporary crosswalk has been established.

STANDARD:

If a temporary crosswalk is established, it shall be accessible to pedestrians with disabilities in accordance with Section 6D.2.

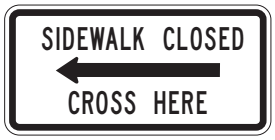
6F.14 SIDEWALK CLOSED Signs (R9-9, R9-10, R9-11, R9-11a)

R9-9



R9-10

R9-11



R9-11a

GUIDANCE:

SIDEWALK CLOSED signs should be used where pedestrian flow is restricted or rerouted by work activities. Bicycle/Pedestrian Detour (M4-9a) signs or Pedestrian Detour (M4-9b) signs should be used where pedestrian flow is rerouted (see Section 6F.59).

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

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

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

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

SUPPORT:

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

6F.15 Special Regulatory Signs

OPTION:

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

GUIDANCE:

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

6F.16 Warning Sign Function, Design, and Application

SUPPORT:

TTC zone warning signs notify road users of specific situations or conditions on or adjacent to a roadway that might not otherwise be apparent.

STANDARD:

TTC warning signs shall comply with the Standards for warning signs presented in Part 2 and in the MnDOT Standard Signs Manual and the FHWA "Standard Highway Signs and Markings" book (see Section 1A.11). Except as provided in the following Option, TTC warning signs shall be diamond-shaped with a black symbol or message and border on an orange background, except for the W10-1 sign which shall have a black legend and border on a yellow background, and except for signs that are required or recommended in Parts 2 or 7 to have fluorescent yellow-green backgrounds.

OPTION:

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

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

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

GUIDANCE:

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

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

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

SUPPORT:

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

OPTION:

Advance warning signs may be used singly or in combination.

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

6F.16.1 Roll-Up Warning Signs

OPTION:

Roll-up warning signs may be used to provide advance warning signing for TTC zones.

STANDARD:

Roll-up warning signs shall have a black legend on a reflectorized orange or reflectorized fluorescent orange background. They may be used for daytime or nighttime only when workers are present to monitor the signs.

The mounting height of roll-up signs shall conform to the standards as shown in Section 6F.3.

GUIDANCE:

A 1 foot minimum height will be allowed for roll-up warning signs, but the signs should be mounted higher in order to improve their visibility.

6F.17 Position of Advance Warning Signs

GUIDANCE:

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

Where multiple advance warning signs are needed on the approach to a TTC zone, the ROAD WORK AHEAD (W20-1) sign should be the first advance warning sign encountered by road users.

OPTION:

Other similar signs such as BRIDGE WORK AHEAD (W20-X9) or SURVEY CREW AHEAD (W21-6a) may be used as a substitute for the ROAD WORK AHEAD (W20-1) sign.

SUPPORT:

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

OPTION:

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

SUPPORT:

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

OPTION:

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

GUIDANCE:

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

6F.18 ROAD (STREET) WORK AHEAD Sign (W20-1)

W20-1

GUIDANCE:

The ROAD (STREET) WORK AHEAD (W20-1) sign, which serves as a general warning of obstructions or restrictions, should be located in advance of the work space or any detour, on the road where the work is taking place, and on all intersecting roadways.

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

STANDARD:

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

6F.19 DETOUR AHEAD Sign (W20-2)

W20-2

GUIDANCE:

The DETOUR AHEAD (W20-2) sign should be used in advance of a road user detour over a different roadway or route.

STANDARD:

The DETOUR sign shall have the legend DETOUR, XX FEET, XX MILES, or AHEAD.

6F.20 ROAD (STREET) CLOSED AHEAD Sign (W20-3)

GUIDANCE:

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

STANDARD:

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

W20-3

W20-3a

6F.20.1 TRAIL CLOSED AHEAD Sign (W20-3a)

GUIDANCE:

The TRAIL CLOSED AHEAD (W20-3a) sign should be used in advance of the point where a recreational trail is closed to all users.

6F.21 ONE LANE ROAD AHEAD Sign (W20-4)

W20-4

STANDARD:

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

GUIDANCE:

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, stop sign or signal control should be used to control alternate traffic flows.

6F.22 Lane(s) Closed Signs (W21-X5, W20-X13)

W21-X5

W20-X13

STANDARD:

Lane closed signs shall be used in advance of that point where one or more through lanes of a multiple-lane roadway are closed.

For a single lane closure, the RIGHT (LEFT) LANE CLOSED (W21-X5) sign shall be used. Where two adjacent lanes are closed, the RIGHT (LEFT) TWO LANES CLOSED (W20-X13) shall be used.

6F.23 CENTER LANE CLOSED Sign (W21-X5c)

STANDARD:

The CENTER LANE CLOSED (W21-X5c) sign shall only be used on roadways where the posted speed limit is 30 MPH or less.

GUIDANCE:

The CENTER LANE CLOSED (W21-X5c) sign should be used in advance of that point where work occupies the center lane(s) and approaching motor vehicle traffic is directed to the right or left of the work zone in the center lane.

W21-X5c

W4-1a

6F.23.1 THRU TRAFFIC MERGE RIGHT (LEFT) Sign (W4-1a)

GUIDANCE:

The THRU TRAFFIC MERGE RIGHT (LEFT) (W4-1a) sign should be used in advance of an intersection where one or more lane closures on the far side of a multi-lane intersection require through motor vehicle traffic on the approach to the intersection to use the right (left) lane to proceed through the intersection.

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

W4-2R

W4-2L

OPTION:

The Lane Reduction (W4-2) symbol sign may be used to warn drivers of the reduction in the number of motor vehicle traffic lanes in the direction of travel on a multi-lane roadway.

6F.24.1 MERGE Sign (W20-X3)

W20-X3

GUIDANCE:

The MERGE sign (W20-X3) with a demountable arrow should be used when closing one or more lanes of a multi-lane roadway.

OPTION:

The MERGE sign (W20-X3) may be used in conjunction with the LANE REDUCTION Sign (W4-2).

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

W13-4P

OPTION:

When work is being done on a ramp, but the ramp remains open, the ON RAMP (W13-4) plaque may be used to supplement the advance ROAD WORK sign.

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

OPTION:

The RAMP NARROWS (W5-4) sign may be used in advance of the point where work on a ramp reduces the normal width of the ramp along a part or all of the ramp.

W5-4

W23-1

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

OPTION:

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

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

E5-2

E5-2a

OPTION:

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

GUIDANCE:

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

6F.29 EXIT ONLY Sign (E5-3)

E5-3

OPTION:

An EXIT ONLY (E5-3) sign may be used to supplement other warning signs where work is being conducted in the vicinity of an exit ramp and where the exit maneuver for vehicular traffic using the ramp is different from the normal condition.

6F.30 NEW TRAFFIC PATTERN AHEAD, TRAFFIC CHANGE AHEAD Signs (W23-2, W3-X5)

W23-2

W3-X5

OPTION:

A NEW TRAFFIC PATTERN AHEAD (W23-2) or TRAFFIC CONTROL CHANGE AHEAD sign (W3-X5) may be used on the approach to an intersection or along a section of roadway to provide advance warning of a change in traffic patterns, such as revised lane usage, roadway geometry, or signal phasing.

GUIDANCE:

To retain its effectiveness, the W23-2 or W3-X5 sign should be displayed for up to 2 weeks, and then it should be covered or removed until it is needed again.

6F.31 Flagger Sign (W20-7)

W20-7

GUIDANCE:

The Flagger (W20-7) symbol sign should be used in advance of any point where a flagger is stationed to control road users.

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OPTION:

A distance legend may be displayed on a supplemental plaque below the Flagger sign. The sign may be used with appropriate legends or in conjunction with other warning signs, such as the BE PREPARED TO STOP (W3-4) sign. The FLAGGER (W20-7a) word message sign with distance legends may be substituted for the Flagger (W20-7) symbol sign.

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STANDARD:

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

6F.32 Two-Way Traffic Sign (W6-3)

W6-3

GUIDANCE:

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

OPTION:

When the lateral space between lanes is restricted, the Two-Way Traffic sign (W6-3) may be replaced with the Opposing Traffic Lane Divider (W6-4).

6F.33 Workers Sign (W21-1)

W21-1

OPTION:

A Workers (W21-1) symbol sign may be used to alert road users of workers in or near the roadway.

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GUIDANCE:

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

OPTION:

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

6F.34 FRESH OIL (TAR) Sign (W21-2)

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GUIDANCE:

The FRESH OIL (TAR) (W21-2) sign should be used to warn road users of the surface treatment.

W21-2

W21-3

6F.35 ROAD MACHINERY AHEAD Sign (W21-3)

OPTION:

The ROAD MACHINERY AHEAD (W21-3) sign may be used to warn of machinery operating in or adjacent to the roadway.

6F.36 Motorized Traffic Signs (W8-6, W11-10)

W8-6

W11-10

OPTION:

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

SUPPORT:

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

6F.37 SHOULDER WORK Signs (W21-5, W21-5a)

W21-5

W21-5a

SUPPORT:

Shoulder Work signs warn of maintenance, reconstruction, or utility operations on the highway shoulder where the roadway is unobstructed.

STANDARD:

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

OPTION:

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

GUIDANCE:

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

6F.38 SURVEY CREW Sign (W21-6a)

GUIDANCE:

The SURVEY CREW AHEAD (W21-6a) sign should be used to warn of surveying crews working in or adjacent to the roadway.

W21-6a

W21-X6”

6F.38.1 CREW WORKING AHEAD Sign (W21-X6)

GUIDANCE:

The CREW WORKING AHEAD sign (W21-X6) should be used for short duration activities being done on or off the roadway for such thing as filming, surveying, tree trimming road inspection, lighting, signal work, utility work, and other activities where a crew is visible to traffic.

OPTION:

The CREW WORKING AHEAD sign (W21-X6) may be used in place of the SURVEY CREW AHEAD sign (W21-6).

6F.39 UTILITY WORD AHEAD Sign (W21-7)

W21-7

OPTION:

The UTILITY WORK (W21-7) sign may be used as an alternate to the ROAD (STREET) WORK (W20-1) sign for utility operations on or adjacent to a highway.

SUPPORT:

Typical examples of where the UTILITY WORK sign is used appear in Chapter 6K (*the Field Manual*), Layouts 6K-3, 6K-9, 6K-13, 6K-22, 6K-28, 6K-40, and 6K-51.

STANDARD:

The UTILITY WORK sign shall carry the legend UTILITY WORK, XX FT, XX MILES, or AHEAD.

6F.40 Signs for Blasting Areas

SUPPORT:

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

STANDARD:

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

6F.41 BLASTING ZONE AHEAD Sign (W22-1)

W22-1

STANDARD:

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

6F.42 TURN OFF 2-WAY RADIO AND CELLULAR PHONE Sign (W22-2)

STANDARD:

The TURN OFF 2-WAY RADIO AND CELLULAR PHONE (W22-2) sign shall follow the BLASTING ZONE AHEAD sign and shall be placed at least 1,000 feet before the beginning of the blasting zone. MN Rev. 1

W22-2

W22-3

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6F.43 END BLASTING ZONE Sign (W22-3)

STANDARD:

The END BLASTING ZONE (W22-3) sign shall be placed a minimum of 1,000 feet past the blasting zone.

OPTION:

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

6F.44 Shoulder Signs

SUPPORT:

The signs in the following sections are to be used as described.

6F.44.1 SHOULDER DROP OFF Sign (W8-9a)

W8-9a

STANDARD:

The SHOULDER DROP-OFF (W8-9a) sign shall be used when a shoulder drop-off, adjacent to the travel lane, exceeds 2 inches in depth and is not protected by portable barriers and the LOW SHOULDER sign (W8-9) is not used.

6F.44.2 LOW SHOULDER Sign (W8-9) HIGH SHOULDER (W21-X9)

W8-9

W21-X9

STANDARD:

The LOW SHOULDER sign (W8-9) and the HIGH SHOULDER sign (W21-X9) shall be used for a shoulder drop-off or rise in accordance with the guidelines shown in Figure 6K-3 on page 6K-xxi.

6F.44.3 NO SHOULDER Sign (W21-X1)

W21-X1

STANDARD:

The NO SHOULDER sign (W21-X1) shall be used for a shoulder drop-off in accordance with the guidelines shown in Figure 6K-5 and 6K-6 on pages 6K-xxii and 6K-xxiii.

6F.44.4 SOFT SHOULDER Sign (W8-4)

OPTION:

The SOFT SHOULDER sign (W8-4) may be used for a shoulder drop-off between 2 and 4 inches in height and the edge has been tapered and compacted at a rate of 6:1 so that a vehicle may safely drive on it.

W8-4

W8-11

6F.45 UNEVEN LANES Sign (W8-11)

STANDARD:

The UNEVEN LANES (W8-11) sign shall be used in accordance with the guidelines shown in Figure 6-3 on page xxi.

GUIDANCE:

The UNEVEN LANES (W8-11) sign should be used during operations that create a difference in elevation between adjacent lanes that are open to travel.

6F.46 STEEL PLATE AHEAD Sign (W8-24)

W8-24

OPTION:

A STEEL PLATE AHEAD (W8-24) sign may be used to warn road users that the presence of a temporary steel plate(s) might make the road surface uneven and might create slippery conditions during wet weather.

6F.47 NO CENTER STRIPE Sign (W8-12a)

W8-12a

STANDARD:

The NO CENTER STRIPE (W8-12a) sign shall be used as detailed in Section 6F.78.

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GUIDANCE:

This sign should also be used at major connection, traffic generators, and/or at appropriate intervals to advise motorists entering the zone.

6F.48 Reverse Curve Signs (W1-4 Series)

W1-4

W1-4b

W1-4c

GUIDANCE:

In order to give road users advance notice of a lane shift, a Reverse Curve (W1-4, W1-4b, or W1-4c) sign (see Figure 6F-4) should be used when a lane (or lanes) is being shifted to the left or right. If the design speed of the curves is 30 mph or less, a Reverse Turn (W1-3) sign should be used.

STANDARD:

If a Reverse Curve (or Turn) sign is used, the direction of the reverse curve (or turn) symbol shall be consistent with the desired vehicle path. Except as provided in the following Option, the number of lanes illustrated on the sign shall be the same as the number of through lanes available to road users.

OPTION:

Where two or more lanes are being shifted, a W1-4 (or W1-3) sign with an ALL LANES (W24-1cP) plaque (see Figure 6F-4) may be used instead of a sign that illustrates the number of lanes.

Where more than three lanes are being shifted, the Reverse Curve (or Turn) sign may be rectangular.

6F.49 Double Reverse Curve Signs (W1-X1, W1-X1b)

W1-X1

W1-X1a

OPTION:

The Double Reverse Curve (W1-X1, W1-X1b) sign may be used where the tangent distance between two reverse curves is less than 600 feet, thus making it difficult for a second Reverse Curve (W1-4 series) sign to be placed between the curves. If the design speed of the curves is 30 mph or less, Double Reverse Turn signs should be used.

STANDARD:

If a Double Reverse Curve (or Turn) sign is used, the direction of the double reverse curve (or turn) symbol shall be consistent with the desired vehicle path. Except as provided in the first paragraph of the following Option, the number of lanes illustrated on the sign shall be the same as the number of through lanes available to road users.

OPTION:

Where two or more lanes are being shifted, a W1-X1 (or Double Reverse Turn sign showing one lane) sign with an ALL LANES (W24-1cP) plaque may be used instead of a sign that illustrates the number of lanes.

Where more than three lanes are being shifted, the Double Reverse Curve (or Turn) sign may be rectangular.

6F.50 Other Warning Signs

OPTION:

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

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

STANDARD:

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

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Figure 6F-4 Other Warning Signs That May be Found in Temporary Traffic Control Zones

6F.50.1 BUMP and DIP Signs (W8-1, W8-2)

W8-1

W8-2

SUPPORT:

The BUMP and DIP signs (W8-1, W8-2) are intended for use to give warning of a sharp rise or depression in the profile of the road that is sufficiently abrupt to create a hazardous condition to cause considerable discomfort to passengers, to cause a shifting of cargo, or to deflect a vehicle from its true course at the normal driving speed for the road.

OPTION:

It may be desirable at some locations to supplement these signs with an Advisory Speed plaque (W13-1).

STANDARD:

The DIP sign (W8-2) shall not be used at a short stretch of depressed alignment that may momentarily hide a vehicle. Such a condition shall be treated as a no-passing zone (see Section 3B-3 to 5).

Only one supplemental plaque shall be permitted beneath each sign.

GUIDANCE:

The use of a flashing beacon or orange flag is discretionary depending on the severity of the bump or dip. When used, they should be mounted on the advance sign assembly.

At less severe or multiple bumps, a BUMP AHEAD (W8-1a) or BUMPS (W8-1b) sign should be placed an adequate distance in advance of the site(s) to ensure that a motorist has sufficient warning before arriving at the location. An appropriate distance plaque, XXX FEET (W20-100p) or NEXT XX MILES (W7-3a) should be placed below the warning sign.

W8-1a

W8-1a

At the site of each severe bump or dip, a "down arrow" should be added to the sign face to identify the exact location of the bump or dip.

When there are multiple bumps of lesser severity or pavement breaks for a distance in excess of one mile, the ROUGH ROAD sign (W8-8) should be used.

W8-8

W7-3aP

OPTION:

The NEXT XX MILES (W7-3aP) may be used below the ROUGH ROAD sign (W8-8).

6F.50.2 BE PREPARED TO STOP Sign (W3-4)

W3-4

OPTION:

The BE PREPARED TO STOP sign (W3-4) may be used in advance of conditions that may require the driver to stop.

SUPPORT:

The BE PREPARED TO STOP sign (W3-4) is usually used in conjunction with the FLAGGER AHEAD sign (W20-7a).

6F.51 Special Warning Signs

OPTION:

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

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

GUIDANCE:

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

6F.52 Advisory Speed Plaque (W13-1P)

W13-1P

OPTION:

In combination with a warning sign, an Advisory Speed (W13-1P) plaque may be used to indicate a recommended safe speed through the TTC zone.

STANDARD:

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

6F.53 Supplemental Distance Plaque (W7-3aP)

W7-3aP

OPTION:

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

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

STANDARD:

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

GUIDANCE:

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

6F.54 Motorcycle Plaque (W8-15P)

W8-15P

OPTION:

A Motorcycle (W8-15P) plaque may be mounted below a LOOSE GRAVEL (W8-7) sign, a GROOVED PAVEMENT (W8-15) sign, a METAL BRIDGE DECK (W8-16) sign, or a STEEL PLATE AHEAD (W8-24) sign if the warning is intended to be directed primarily to motorcyclists.

6F.55 Guide Signs

SUPPORT:

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

GUIDANCE:

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

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

STANDARD:

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

OPTION:

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

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

6F.56 ROAD WORK NEXT XX MILES Sign (G20-1)

G20-1

GUIDANCE:

The ROAD WORK NEXT XX MILES (G20-1) sign should be installed in advance of TTC zones that are more than 2 miles in length.

OPTION:

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

STANDARD:

The distance shown on the ROAD WORK NEXT XX MILES sign shall be stated to the nearest whole mile.

6F.56.1 Closure Notice Sign (G20-X1)

G20-X1

OPTION:

The Closure Notice sign (G20-X1) may be used to advise motorists that road work activities begin at a future date.

GUIDANCE:

When used, the sign should be installed seven calendar days prior to the anticipated closure of the roadway.

STANDARD:

The sign has several possible legends. They include:

- BRIDGE, RAMP, or ROAD CLOSED
- BRIDGE, RAMP, or ROAD DETOURED
- SINGLE LANE BEGINS

6F.57 END ROAD WORK Sign (G20-2)

G20-2

GUIDANCE:

The ROAD WORK NEXT XX MILES (G20-1) sign should be installed in advance of TTC zones that are more than 2 miles in length.

OPTION:

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

6F.58 PILOT CAR FOLLOW ME Sign (G20-4)

G20-4

STANDARD:

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

6F.59 Detour Signs and Markers (M4-8, M4-8a, M4-8b, M4-9, M4-9a, M4-9b, M4-9c, and M4-10)

M4-8 M4-8a M4-8b

M4-9 M4-10

M4-9a M4-9b M4-9c

STANDARD:

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

OPTION:

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

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

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

GUIDANCE:

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

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

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

OPTION:

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

GUIDANCE:

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

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

STANDARD:

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

OPTION:

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

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

6F.60 Portable Changeable Message Signs

SUPPORT:

Portable changeable message signs (PCMS) are TTC devices installed for temporary use with the flexibility to display a variety of messages. In most cases, portable changeable message signs follow the same provisions for design and application as those given for changeable message signs in Chapter 2L. The information in this Section describes situations where the provisions for portable changeable message signs differ from those given in Chapter 2L.

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

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

The primary purpose of portable changeable message signs in TTC zones is to advise the road user of unexpected situations. Portable changeable message signs are particularly useful as they are capable of:

A. Conveying complex messages,

B. Displaying real time information about conditions ahead, and

C. Providing information to assist road users in making decisions prior to the point where actions must be taken.

Some typical applications include the following:

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

GUIDANCE:

The components of a portable changeable message sign should include: a message sign, control systems, a power source, and mounting and transporting equipment. The front face of the sign should be covered with a protective material.

STANDARD:

Portable changeable message signs shall comply with the applicable design and application principles established in Chapter 2A. Portable changeable message signs shall display only traffic operational, regulatory, warning, and guidance information, and shall not be used for advertising messages.

SUPPORT:

Section 2L.2 contains information regarding overly simplistic or vague messages that is also applicable to portable changeable message signs.

STANDARD:

The colors used for legends on portable changeable message signs shall comply with those shown in Table 2A-5.

SUPPORT:

Section 2L.4 contains information regarding the luminance, luminance contrast, and contrast orientation that is also applicable to portable changeable message signs.

STANDARD:

The Portable Changeable Message Sign shall display reliable information. An accurate description of the work or incident location is critical.

GUIDANCE:

Portable changeable message signs should be visible from 1/2 mile under both day and night conditions.

SUPPORT:

Section 2B.13 contains information regarding the design of portable changeable message signs that are used to display speed limits that change based on operational conditions, or are used to display the speed at which approaching drivers are traveling.

GUIDANCE:

A portable changeable message sign should be limited to three lines of eight characters per line or should consist of a full matrix display.

Except as provided in the following Option, the letter height used for portable changeable message sign messages should be a minimum of 18 inches.

OPTION:

For portable changeable message signs mounted on service patrol trucks or other incident response vehicles, a letter height as short as 10 inches may be used. Shorter letter sizes may also be used on a portable changeable message sign used on low speed facilities provided that the message is legible from at least 650 feet.

The portable changeable message sign may vary in size.

GUIDANCE:

Messages on a portable changeable message sign should consist of no more than two phases, and a phase should consist of no more than three lines of text. Each phase should be capable of being understood by itself, regardless of the order in which it is read. Messages should be centered within each line of legend. If more than one portable changeable message sign is simultaneously legible to road users, then only one of the signs should display a sequential message at any given time.

SUPPORT:

Road users have difficulties in reading messages displayed in more than two phases on a typical three-line portable changeable message sign.

STANDARD:

Techniques of message display such as animation, rapid flashing, dissolving, exploding, scrolling, travelling horizontally or vertically across the face of the sign, or other dynamic elements shall not be used.

GUIDANCE:

When a message is divided into two phases, the display time for each phase should be at least 2 seconds, and the sum of the display times for both of the phases should be a maximum of 8 seconds.

Messages should be designed taking into account the following factors:

A. Each phase should convey a single thought.
B. If the message can be displayed in one phase, the top line should present the problem, the center line should present the location or distance ahead, and the bottom line should present the recommended driver action.
C. The message should be as brief as possible.
D. The entire display should be readable twice at the posted speed limit prior to work starting.
E. Any delay message should accurately reflect the traffic delay time.
F. When a message is longer than two phases, additional Portable Changeable Message signs should be used. When multiple portable changeable message signs are needed, they should be placed on the same side of the roadway and they should be separated from each other by a distance of at least 1,000 feet on freeways and expressways, and by a distance of at least 500 feet on other types of highways.
G. The use of abbreviations is discouraged. The entire word should be spelled out whenever space permits.
H. When abbreviations are used, they should be easily understood (see page 6K-xix).

OPTION:

The message sign panel may vary in size.

STANDARD:

Portable Changeable Message Signs shall meet the requirements detailed in Table 6F-2.

There are three types of Portable Changeable Message Signs as described in Table 6F-2.

Requirements	Type A	Type B	Type C
Line(s) of Message	1 Line	2 Lines	3 Lines
Typical Mounting	Vehicle Mounted	Vehicle or Trailer Mounted	Trailer Mounted
Allowed Usage	Emergency and Incident Mgmt.	Advance Warning	Advance Warning & Advance Notice
Legibility Distance Requirements	Legible at 350 feet	Legible at 750 feet	Legible at 900 feet
Minimum Character Height	10 inches	14 inches	18 inches
Maximum No. of Displays	1	2	* 40 mph or less = 3 * 45 mph or more = 2
Message Cycle	Constant	at least 2 seconds per display	at least 2 seconds per display
Minimum Sign Panel Height	5 feet (rural) 7 feet (urban)	5 feet (rural) 7 feet (urban)	5 feet (rural) 7 feet (urban)
Minimum PCMS Spacing	500 feet	1000 feet	1000 feet

* Posted speed limit prior to work starting.

Table 6F-2 Specifications for Portable Changeable Message Sign Use

STANDARD:

When the word messages shown in Tables 1A-1 or 1A-2 need to be abbreviated on a portable changeable message sign, the provisions described in Section 1A.15 shall be followed.

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

The control system shall include a display screen upon which messages can be reviewed before being displayed on the message sign. The control system shall be capable of maintaining memory when power is unavailable.

Portable changeable message signs shall be equipped with a power source and a battery back-up to provide continuous operation when failure of the primary power source occurs.

The mounting of portable changeable message signs on a trailer, a large truck, or a service patrol truck shall be such that the bottom of the message sign shall be a minimum of 7 feet above the roadway in urban areas and 5 feet above the roadway in rural areas when it is in the operating mode.

GUIDANCE:

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

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

Portable changeable message signs should be sited and aligned to provide maximum legibility and to allow time for road users to respond appropriately to the portable changeable message sign message.

Portable Changeable Message Signs should be placed off the shoulder.

STANDARD:

If a Portable Changeable Message sign is placed on the shoulder of the roadway, it shall be placed a minimum of 4 feet from the edge of the traveled lane, and it shall be delineated with a partial shoulder closure taper. If the 4 foot clearance cannot be met, then a full shoulder closure shall be provided.

GUIDANCE:

When portable changeable message signs are not being used to display TTC messages, they should be relocated such that they are outside of the clear zone or shielded behind a traffic barrier and turned away from traffic. If relocation or shielding is not practical, they should be delineated with retroreflective TTC devices.

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

STANDARD:

If a Portable Changeable Message Sign is used as an arrow board, it shall meet all the requirements of an arrow board and shall be used solely as an arrow board.

6F.61 Arrow Boards

STANDARD:

An arrow board shall be a sign with a matrix of elements capable of either flashing or sequential displays. This sign shall provide additional warning and directional information to assist in merging and controlling road users through or around a TTC zone.

GUIDANCE:

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

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

Arrow boards should be placed off the shoulder whenever possible.

STANDARD:

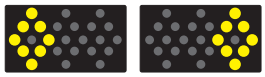
If an arrow board is placed on the shoulder of the roadway, it shall be placed a minimum of 4 feet from the edge of the traveled lane, and it shall be delineated with an appropriate shoulder closure taper.

STANDARD:

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

SUPPORT:

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

Operating Mode	Panel Display *
1. At least one of the following two modes shall be provided:	(Right arrow is shown, left arrow is similar)
Flashing Arrow	**Move/Merge Right**
Sequential Arrow	**Move/Merge Right**
Sequential Chevron	**Move/Merge Right**
2. The following mode shall be provided:	
Flashing Double Arrow	**Move/Merge Right or Left**
3. At least one of the following three modes shall be provided:	
Flashing Four Corners	
Flashing Bar	
Alternating Flashing Diamonds	 **Caution**

* Element layout for Type C panel shown

Panel Type	Minimum Size inches	Minimum Legibility Distance miles	Minimum Number of Elements	Recommended Usage
A	48 x 24	0.5	12	Low speed streets
B	60 x 30	0.75	13	Conventional roadways
C	96 x 48	1.0	15	Freeways and Expressways

Arrow Stick

Arrow Sticks may supplement other TTC devices, but shall not be used in place of arrow boards

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Advance Warning Arrow Board Specifications

Figure 6F-6 Advance Warning Arrow Display Specifications

STANDARD:

Type A, B, and C arrow boards shall have solid rectangular appearances. A Type D arrow board shall conform to the shape of the arrow.

All arrow boards shall be finished in non-reflective black. The arrow board shall be mounted on a vehicle, a trailer, or other suitable support.

GUIDANCE:

The minimum mounting height, measured vertically from the bottom of the board to the roadway below it or to the elevation of the near edge of the roadway, of an arrow board should be 7 feet, except on vehicle-mounted arrow boards, which should be no lower than 3 feet.

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

STANDARD:

Arrow board elements shall be capable of at least a 50 percent dimming from full brilliance. The dimmed mode shall be used for nighttime operation of arrow boards.

GUIDANCE:

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

STANDARD:

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

GUIDANCE:

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

STANDARD:

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

An arrow board shall have the following three mode selections:

A. A Flashing Arrow, or Sequential Arrow, or Sequential Chevron mode;
B. A flashing Double Arrow mode; and
C. A flashing Caution or Alternating Diamond mode.

An arrow board in the arrow or chevron mode shall be used only for stationary or moving lane closures on multi-lane roadways.

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

GUIDANCE:

For a stationary lane closure, the arrow board should be located on the shoulder at the beginning of the merging taper.

Where the shoulder is narrow, the arrow board should be located in the closed lane.

STANDARD:

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

GUIDANCE:

When arrow boards are used to close multiple lanes, if the first arrow board is placed on the shoulder, the second arrow board should be placed in the first closed lane at the upstream end of the second merging taper (see Figure 6H-37). When the first arrow board is placed in the first closed lane, the second arrow board should be placed in the second closed lane at the downstream end of the second merging taper.

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

STANDARD:

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

Arrow boards shall only be used to indicate a lane closure. Arrow boards shall not be used to indicate a lane shift.

OPTION:

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

6F.62 High-Level Warning Devices (Flag Trees)

OPTION:

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

SUPPORT:

A high-level warning device is designed to be seen over the top of typical passenger cars. A typical high-level warning device is shown in Figure 6F-2.

STANDARD:

A high-level warning device shall consist of a minimum of two flags with or without a Type B high-intensity flashing warning light. The distance from the roadway to the bottom of the lens of the light and to the lowest point of the flag material shall be not less than 8 feet. The flag shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color.

OPTION:

An appropriate warning sign may be mounted below the flags.

SUPPORT:

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

6F.63 Channelizing Devices

STANDARD:

Designs of various channelizing devices shall be as shown in Figure 6F-7. All channelizing devices exposed to vehicular traffic shall be crashworthy.

SUPPORT:

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

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

STANDARD:

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

Where channelizing devices are used to channelize pedestrians, there shall be continuous detectable bottom and top surfaces to be detectable to users of long canes. The bottom of the bottom surface shall be no higher than 2 inches above the ground. The top of the top surface shall be no lower than 32 inches above the ground.

OPTION:

A gap not exceeding 2 inches between the bottom rail and the ground surface may be used to facilitate drainage.

GUIDANCE:

Where multiple channelizing devices are aligned to form a continuous pedestrian channelizer, connection points should be smooth to optimize long-cane and hand trailing.

STANDARD:

There are three types of channelizing devices, Type A, B, and C as shown in Figure 6F-7.

The spacing, and the appropriate MN MUTCD section for each channelizing device is shown in Table 6F-2.

GUIDANCE:

The spacing between Type A and B channelizing devices should not exceed a distance in feet equal to 1.0 times the speed limit prior to work starting in mph when used for taper channelization and a distance in feet equal to 2.0 times the speed limit prior to work starting in mph when used for tangent channelization.

When channelizing devices have the potential of leading vehicular traffic out of the intended vehicular traffic space as shown in Layout 6J-4, the channelizing devices should be extended a distance in feet of 2.0 times the speed limit in mph beyond the downstream end of the transition area.

SUPPORT:

The spacing of channelizing devices shown in the TTC layouts are based on the distances contained in Table 6F-3.

OPTION:

Warning lights (see Section 6F.83) may be added to channelizing devices in areas with frequent fog, snow, or severe roadway curvature, or where visual distractions are present.

STANDARD:

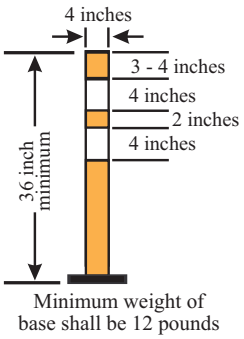
Warning lights shall flash when placed on channelizing devices used alone or in a cluster to warn of a condition. Except for the sequential flashing warning lights discussed in the following Option and Standard paragraphs, warning lights placed on channelizing devices used in a series to channelize road users shall be steady-burn.

OPTION:

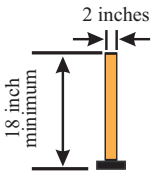
A series of sequential flashing warning lights may be placed on channelizing devices that form a merging taper in order to increase driver detection and recognition of the merging taper.

STANDARD:

When used, the successive flashing of the sequential warning lights shall occur from the upstream end of the merging taper to the downstream end of the merging taper in order to identify the desired vehicle path. Each warning light in the sequence shall be flashed at a rate of not less than 55 nor more than 75 times per minute.

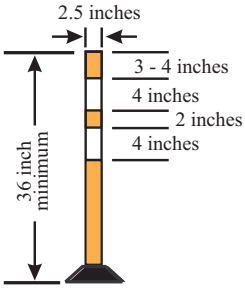


Night and/or Freeway
High Speed Roadway
Speed Limit 45 MPH
or greater

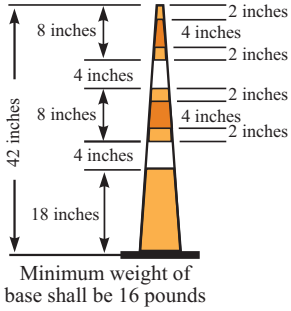


Day and
Low Speed Roadway
Speed Limit 40 MPH
or less

TUBULAR MARKER

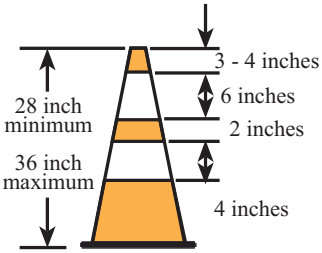


SURFACE MOUNTED DELINEATOR

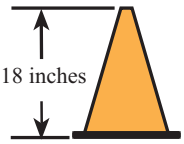


Night and/or Freeway
High Speed Roadway
Speed Limit 45 MPH
or greater

WEIGHTED CHANNELIZER

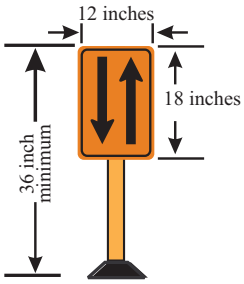


Night and/or Freeway
High Speed Roadway
Speed Limit 45 MPH
or greater



Day and Low Speed
Roadway
Speed Limit 40 MPH
or less

CONES



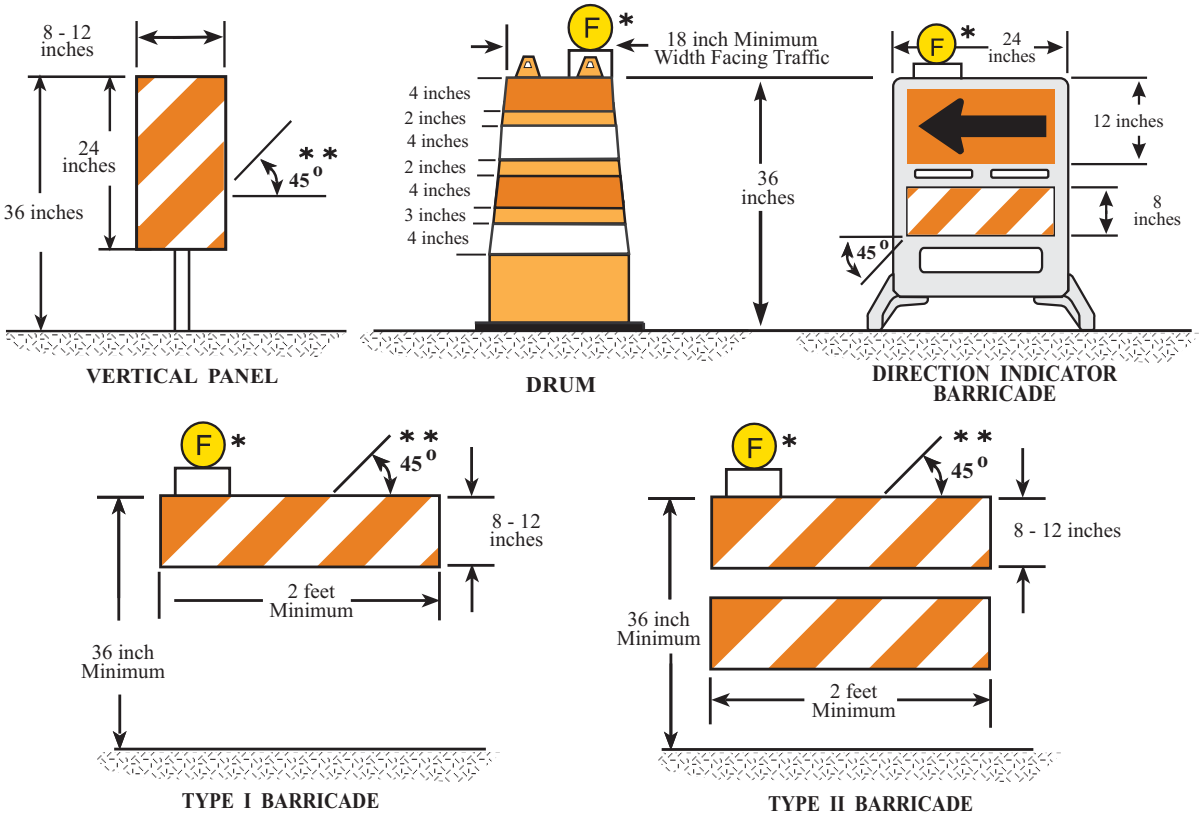
OPPOSING TRAFFIC LANE DIVIDER

Where traffic may approach the channelizing device from either side, the channelizing device should be reflectorized on both sides or two channelizing devices back-to-back to provide visibility.

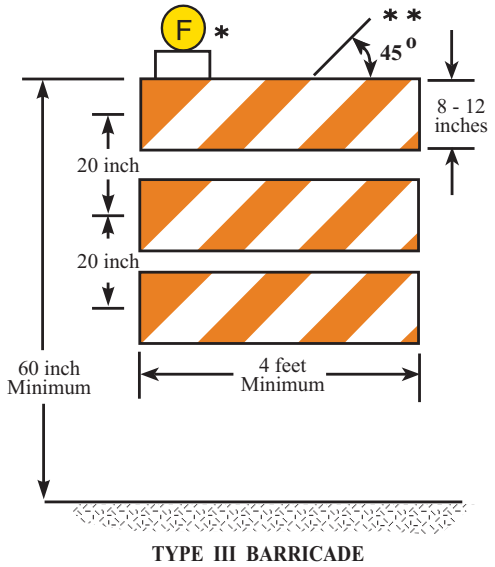
Type A Channelizing Devices

Figure 6F-7 Channelizing Devices

(Sheet 1 of 2)



Type B Channelizing Devices



Type C Channelizing Device

NOTES:

* Warning lights are optional.

** Rail stripe widths shall be 4 inches on barricade rail boards less than 36 inches. Rail stripe widths shall be 6 inches on barricade rail boards wider than 36 inches.

Where traffic may approach the channelizing device from either side, the channelizing device should be reflectorized on both sides or two channelizing devices back-to-back to provide visibility.

Figure 6F-7 Channelizing Devices

(Sheet 2 of 2)

Channelizing Device	Device Type	Maximum Allowed Spacing		Recommended Spacing		MN MUTCD Section for complete information
		Transition Spacing	Tangent Spacing	Transition Spacing	Tangent Spacing	
		feet	feet			
Cone	A	S	2S	G	2G	6F.64
Tubular Marker	A	S	2S	G	2G	6F.65
Surface Mounted Delineator	A	S	2S	G	2G	6F.65.1
Weighted Channelizer	A	S	2S	G	2G	6F.65.2
Drum	B	S	2S	G	2G	6F.67
Vertical Panel	A	S	2S	G	2G	6F.66
Type I Barricade	B	S	2S	G	2G	6F.68
Type II Barricade	B	S	2S	G	2G	6F.68
Type III Barricade	C	N/A	20 S	N/A	20 G	6F.68
Direction Indicator Barricade	B	S	20 S	G	20 G	6F.649
Opposing Traffic Divider	A	S	2S	G	2G	6F.76

Notes:
N/A - Not Applicable
S - Posted speed limit (in mph) prior to work starting
G - Recommended spacing guide number for Field Manual
G = 25 feet for low speed roads (S of 40 mph or less)
G = 50 feet for high speed roads (S of 45 mph or greater)

Table 6F-3 Recommended Spacing of Type A, B, and C Channelizing Devices

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

OPTION:

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

STANDARD:

The letters and numbers of the name and telephone number shall be non-retroreflective and not over 2 inches in height.

GUIDANCE:

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

STANDARD:

Devices that are damaged or have lost a significant amount of their retroreflectivity and effectiveness shall be replaced (see the Quality Standards in Section 6K).

6F.64 Cones

STANDARD:

Cones shall be predominantly orange and shall be made of a material that can be struck without causing damage to the impacting vehicle (see Figure 6F-7). For daytime and low-speed roadways, cones shall be not less than 18 inches in height. When cones are used on freeways and other high-speed highways or at night on all highways, or when more conspicuous guidance is needed, cones shall be a minimum of 28 inches in height.

For nighttime use, cones shall be retroreflectorized or equipped with lighting devices for maximum visibility. Retro-reflectorization of cones that are 28 to 36 inches in height shall be provided by a 6-inch wide white band located 3 to 4 inches from the top of the cone and an additional 4-inch wide white band located approximately 2 inches below the 6-inch band.

Retro-reflectorization of cones that are more than 36 inches in height shall be provided by horizontal, circumferential, alternating orange and white retroreflective stripes that are 4 to 6 inches wide. Each cone shall have a minimum of two orange and two white stripes with the top stripe being orange. Any non-retroreflective spaces between the orange and white stripes shall not exceed 3 inches in width.

Cones shall not be used on unattended work sites.

OPTION:

Traffic cones may be used to mark hazards or close roadways for short term emergency situations.

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

GUIDANCE:

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

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

OPTION:

Cones may be doubled up to increase their weight.

SUPPORT:

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

GUIDANCE:

Ballast should be kept to the minimum amount needed.

6F.65 Tubular Markers

SUPPORT:

Tubular markers are portable devices constructed with weighted bases, or weights such as sandbag rings that can be dropped over the tubes and onto the base to provide added stability.

STANDARD:

Tubular markers shall be tubular, shall be predominantly orange, and shall be made of a material that can be struck without causing damage to the impacting vehicle (see Figure 6F-7). For daytime and low-speed roadways, tubular markers shall not be less than 18 inches high and 2 inches in diameter. When tubular markers are used on freeways and other high-speed highways or at night on all highways, or when more conspicuous guidance is needed, tubular markers shall be a minimum of 36 inches high and 4 inches in diameter.

For nighttime use, tubular markers shall be retroreflectorized or equipped with lighting devices for maximum visibility. Retroreflectorization of 36 inch or larger tubular markers shall be provided by a white band 4 inches wide located 3 to 4 inches from the top of the marker and an additional 4 inch wide white band approximately 2 inches below the 4 inch band.

Tubular markers shall not be used to mark hazards or close roadways.

GUIDANCE:

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

Tubular markers should be stabilized by affixing them to the pavement, by using weighted bases, or weights such as sandbag rings that can be dropped over the tubular markers and onto the base to provide added stability. The weighted base should weigh at least 12 pounds.

OPTION:

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

6F.65.1 Surface Mounted Delineators

OPTION:

Surface mounted delineators are delineation devices that may be used as center lane dividers to separate opposing motor vehicle traffic on a two-lane, two-way operation.

Surface mounted delineators may also be used to provide other traffic delineation.

STANDARD:

Surface mounted delineators shall be predominantly orange, and shall be made of a material that can be struck without causing damage to the impacting vehicle (see Figure 6F-7). Surface mounted delineators shall be attached to the pavement surface to assure they remain inplace. If a non-cylindrical tubular marker is used, it shall be attached to the pavement in a manner to display a minimum 2.5 inch width to all approaching road users.

Surface mounted delineators shall not be less than 36 inches high and 2.5 inches wide facing road users. The delineator shall be retroreflectorized for nighttime visibility with a white band 4 inches wide located 3 to 4 inches from the top of the delineator and an additional 4 inch wide white band approximately 2 inches below the 4 inch band.

6F.65.2 Weighted Channelizers

STANDARD:

Weighted Channelizers used for road user warning or channelization shall be predominantly orange in color and shall be constructed of lightweight, deformable materials (see Figure 6F-7). They shall be a minimum of 42 inches in height having a conical cross section a minimum of 4 inches wide at the top, regardless of orientation, and a minimum cross sectional area of 200 square inches. The weighted base shall be a minimum of 16 pounds.

The markings on weighted channelizers shall be horizontal, circumferential, alternating orange and white retroreflective stripes 4 to 6 inches wide with the top stripe being orange. Any non-retroreflective spaces between the horizontal orange and white stripes shall not exceed 2 inches in width.

OPTION:

Weighted channelizers may have a handle or lifting device, which extends above the 42 inch minimum device height.

GUIDANCE:

Weighted channelizers have less visible area than other devices and should therefore be used only where space is limited or the presence of larger devices will restrict sight.

The spacing of weighted channelizers should not exceed a distance in feet equal to the posted speed limit in mph when used for taper channelization. The spacing of weighted channelizers should not exceed a distance in feet equal to 2.0 times the posted speed limit in mph when used for tangent channelization.

OPTION:

Weighted channelizers may be used effectively to divide opposing lanes of traffic and delineate the edge of pavement drop-offs. Although weighted channelizers are most commonly used to channelize or delineate road user flow, they may also be used alone or in groups to mark specific locations.

6F.66 Vertical Panels

STANDARD:

Vertical panels (see Figure 6F-7) shall have retroreflective striped material that is 8 to 12 inches in width and at least 24 inches in height. They shall have alternating diagonal orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction vehicular traffic is to pass.

Vertical panels used on expressways, freeways, and other high-speed roadways shall have a minimum of 270 square inches retroreflective area facing motor vehicle traffic.

Where the height of the retroreflective material on the vertical panel is 36 inches or more, a stripe width of 6 inches shall be used.

OPTION:

Where the height of the retroreflective material on the vertical panel is less than 36 inches, a stripe width of 4 inches may be used.

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

6F.67 Drums

STANDARD:

Drums used for road user warning or channelization shall be constructed of lightweight, deformable materials (see Figure 6F-7). . They shall be a minimum of 36 inches in height and have at least an 18-inch minimum width regardless of orientation. Metal drums shall not be used. The markings on drums shall be horizontal, circumferential, alternating orange and white retroreflective stripes 4 to 6 inches wide. Each drum shall have a minimum of two orange and two white stripes with the top stripe being orange. Any non-retroreflectorized 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 construction debris or other debris.

SUPPORT:

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

OPTION:

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

GUIDANCE:

Drums should not be weighted with sand, water, or any material to the extent that would make them hazardous to road users or workers when struck. Drums used in regions susceptible to freezing should have drain holes in the bottom so that water will not accumulate and freeze causing a hazard if struck by a road user.

STANDARD:

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

6F.68 Type I, II, or III Barricades

SUPPORT:

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

Barricades are classified as Type I, Type II, or Type III. (see Figure 6F-7)

STANDARD:

Stripes on barricade rails shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Except as noted in the following Option, the stripes shall be 6 inches wide.

OPTION:

When rail lengths are less than 36 inches, 4-inch wide stripes may be used.

STANDARD:

The minimum length for Type I and Type II Barricades shall be 24 inches and the minimum length for Type III Barricades shall be 48 inches. Each barricade rail shall be 8 to 12 inches wide. Barricades used on expressways, freeways and other high-speed roadways shall have a minimum of 270 square inches of retroreflective area facing road users.

GUIDANCE:

Where barricades extend entirely across a roadway, the stripes should slope downward in the direction toward which road users must turn.

Where both right and left turns are provided, the barricade stripes should slope downward in both directions from the center of the barricade or barricades.

Where no turns are intended, the stripes should be positioned to slope downward toward the center of the barricade or barricades.

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

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

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

OPTION:

For Type I Barricades, the support may include other unstriped horizontal panels necessary to provide stability.

GUIDANCE:

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

OPTION:

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

STANDARD:

Ballast shall not be placed on top of any striped rail. Barricades shall not be ballasted by non-deformable objects such as rocks or chunks of concrete. Ballast shall not extend into the accessible passage width of 60 inches.

SUPPORT:

Type I or Type II Barricades are intended for use in situations where road user flow is maintained through the TTC zone.

OPTION:

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

Type I barricades may be used on conventional roads or urban streets.

GUIDANCE:

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

OPTION:

Type III Barricades used at a road closure may be placed completely across a roadway or from curb to curb.

GUIDANCE:

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

SUPPORT:

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

STANDARD:

When a highway is legally closed but access must still be allowed for local traffic, a sign shall be installed with the appropriate legend concerning permissible use by local road users (see Section 6F.9). Adequate visibility of the barricades from both directions shall be provided by;

1. installing retroreflective sheeting on both sides of the barricade boards; or
2. by installing barricade boards back-to-back on the barricade.

OPTION:

Signs may be installed on barricades (see Section 6F.3).

6F.69 Direction Indicator Barricades

STANDARD:

The Direction Indicator Barricade shall consist of a retroreflective One-Direction Large Arrow (W1-6) sign mounted above a diagonal striped, horizontally aligned, retroreflective rail (see Figure 6F-7).

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

OPTION:

The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.

GUIDANCE:

If used, Direction Indicator Barricades should be used in series to direct the driver through the transition and into the intended travel lane.

6F.70 Temporary Traffic Barriers as Channelizing Devices

SUPPORT:

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

STANDARD:

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

Temporary traffic barriers (see Section 6F.85) shall not be used solely to channelize road users, but also to protect the work space. If used to channelize vehicular traffic, the temporary traffic barrier shall be supplemented with delineation, pavement markings, or channelizing devices for improved daytime and nighttime visibility.

GUIDANCE:

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

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

STANDARD:

When it is necessary to use a temporary traffic barrier for a merging taper in low-speed urban areas or for a constricted/ restricted TTC zone, the taper shall be delineated.

GUIDANCE:

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

6F.71 Longitudinal Channelizing Barricades

SUPPORT:

Longitudinal channelizing devices are lightweight, deformable devices that are highly visible, have good target value, and can be connected together.

STANDARD:

If used singly as Type 1, 2, or 3 barricades, longitudinal channelizing devices shall comply with the general size, color, stripe pattern, retroreflectivity, and placement characteristics established for the devices described in this Chapter.

GUIDANCE:

If used to channelize vehicular traffic at night, longitudinal channelizing devices should be supplemented with retroreflective material or delineation for improved nighttime visibility.

OPTION:

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

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

Longitudinal channelizing devices may be used for pedestrian traffic control.

STANDARD:

If used for pedestrian traffic control, longitudinal channelizing devices shall be interlocked to delineate or channelize flow. The interlocking devices shall not have gaps that allow pedestrians to stray from the channelizing path.

GUIDANCE:

Longitudinal channelizing devices have not met the crashworthy requirements for temporary traffic barriers and should not be used to shield obstacles or provide positive protection for pedestrians or workers.

6F.72 Temporary Lane Separators

OPTION:

Temporary lane separators may be used to channelize road users, to divide opposing vehicular traffic lanes, to divide lanes when two or more lanes are open in the same direction, and to provide continuous pedestrian channelization.

STANDARD:

Temporary lane separators shall be crashworthy. Temporary lane separators shall have a maximum height of 4 inches and a maximum width of 1 foot, and shall have sloping sides in order to facilitate crossover by emergency vehicles.

OPTION:

Temporary lane separators may be supplemented with any of the approved channelizing devices contained in this Chapter, such as tubular markers, vertical panels, and opposing traffic lane dividers.

STANDARD:

If appropriate channelizing devices are used to supplement a temporary lane separator, the channelizing devices shall be retroreflectorized to provide nighttime visibility. If channelizing devices are not used, the temporary lane separator shall contain retroreflectorization to enhance its visibility.

GUIDANCE:

A temporary lane separator should be stabilized by affixing it to the pavement in a manner suitable to its design, while allowing the unit to be shifted from place to place within the TTC zone in order to accommodate changing conditions.

STANDARD:

At pedestrian crossing locations, temporary lane separators shall have an opening or be shortened to provide a pathway that is at least 60 inches wide for crossing pedestrians.

6F.73 Other Channelizing Devices

OPTION:

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

GUIDANCE:

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

6F.74 Detectable Edging for Pedestrians

SUPPORT:

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

GUIDANCE:

When it is determined that a facility should be accessible to and detectable by pedestrians with visual disabilities, a continuously detectable edging should be provided throughout the length of the facility such that it can be followed by pedestrians using long canes for guidance. This edging should protrude at least 6 inches above the surface of

the sidewalk or pathway, with the bottom of the edging a maximum of 2 inches above the surface. This edging should be continuous throughout the length of the facility except for gaps at locations where pedestrians or vehicles will be turning or crossing. This edging should consist of a prefabricated or formed-in-place curbing or other continuous device that is placed along the edge of the sidewalk or walkway. This edging should be firmly attached to the ground or to other devices. Adjacent sections of this edging should be interconnected such that the edging is not displaced by pedestrian or vehicular traffic or work operations, and such that it does not constitute a hazard to pedestrians, workers, or other road users.

SUPPORT:

Examples of detectable edging for pedestrians include:

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

GUIDANCE:

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

6F.75 Temporary Raised Islands

STANDARD:

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

OPTION:

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

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

GUIDANCE:

Temporary raised islands should have the basic dimensions of 4 inches high by 12 inches wide and have rounded or chamfered corners.

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

STANDARD:

At pedestrian crossing locations, temporary raised islands shall have an opening or be shortened to provide at least a 60 inch wide pathway for the crossing pedestrian.

6F.76 Opposing Traffic Lane Divider and sign (W6-4)

W6-4

SUPPORT:

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

STANDARD:

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

The Opposing Traffic Lane Divider (W6-4) sign (see Figure 6F-4) shall be an upright, retroreflective orange-colored sign placed on a flexible support and sized at least 12 inches wide by 18 inches high.

6F.77 Pavement Markings

SUPPORT:

Pavement markings are installed or existing markings are maintained or enhanced in TTC zones to provide road users with a clearly defined path for travel through the TTC zone in day, night, and twilight periods under both wet and dry pavement conditions.

GUIDANCE:

The work should be planned and staged to provide for the placement and removal of the pavement markings in a way that minimizes the disruption to traffic flow approaching and through the TTC zone during the placement and removal process.

STANDARD:

Existing pavement markings shall be maintained in all long-term stationary (see Section 6G.2) TTC zones in accordance with Chapters 3A and 3B, except as otherwise provided for temporary pavement markings in Section 6F.78. Pavement markings shall match the alignment of the markings in place at both ends of the TTC zone. Pavement markings shall be placed along the entire length of any paved detour or temporary roadway prior to the detour or roadway being opened to road users.

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

OPTION:

Removable, non-reflective, preformed tape that is approximately the same color as the pavement surface may be used where markings need to be covered temporarily.

6F.78 Interim Pavement Markings

SUPPORT:

Interim pavement markings are those that are allowed to remain in place until the earliest date when it is practical and possible to install pavement markings that meet the Part 3 standards for pavement markings.

GUIDANCE:

Interim pavement markings should not be in place for more than 14 calendar days unless justified by an engineering study.

White lane lines and yellow centerlines, including no passing zones should be installed before opening the roadway to traffic. If it is not possible or practical to install these markings before opening the roadway to traffic the interim markings should be installed at the end of each working day or provided by signing in accordance with the provisions of this section.

GUIDANCE:

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

STANDARD:

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

Except as otherwise provided in this Section, all interim pavement markings for no-passing zones shall comply with the requirements of Chapters 3A and 3B. All interim broken-line pavement markings shall use the same cycle length as permanent markings and shall have line segments that are at least 2 feet long.

GUIDANCE:

All pavement markings and devices used to delineate road user paths should be reviewed during daytime and nighttime periods.

OPTION:

Half-cycle lengths with a minimum of 2-foot stripes may be used on roadways with severe curvature (see Section 3A.6) for broken line center lines in passing zones and for lane lines.

For temporary situations of 14 calendar days or less, for a two- or three-lane road, no-passing zones may be identified by using DO NOT PASS (R4-1), PASS WITH CARE (R4-2), and NO PASSING ZONE (W14-3) signs (see Sections 2B.28, 2B.29, and 2C.45) rather than pavement markings. Also, DO NOT PASS, PASS WITH CARE, and NO PASSING ZONE signs may be used instead of pavement markings on roads with low volumes for longer periods in accordance with the State's or highway agency's policy.

GUIDANCE:

If used, the DO NOT PASS, PASS WITH CARE, and NO PASSING ZONE signs should be placed in accordance with Sections 2B.28, 2B.29, and 2C.45.

If used, the NO CENTER STRIPE sign should be placed in accordance with Section 6F.47.

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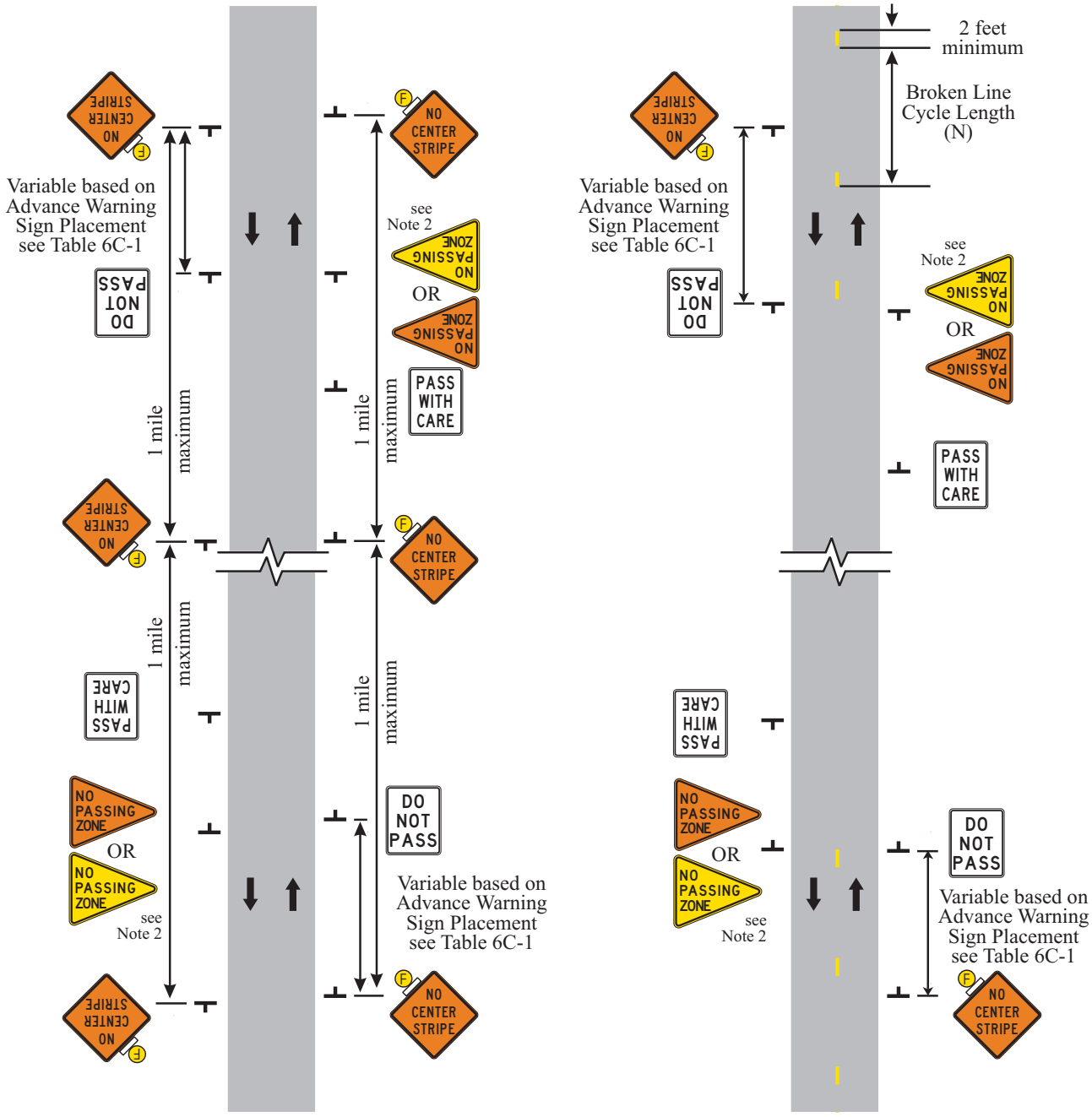
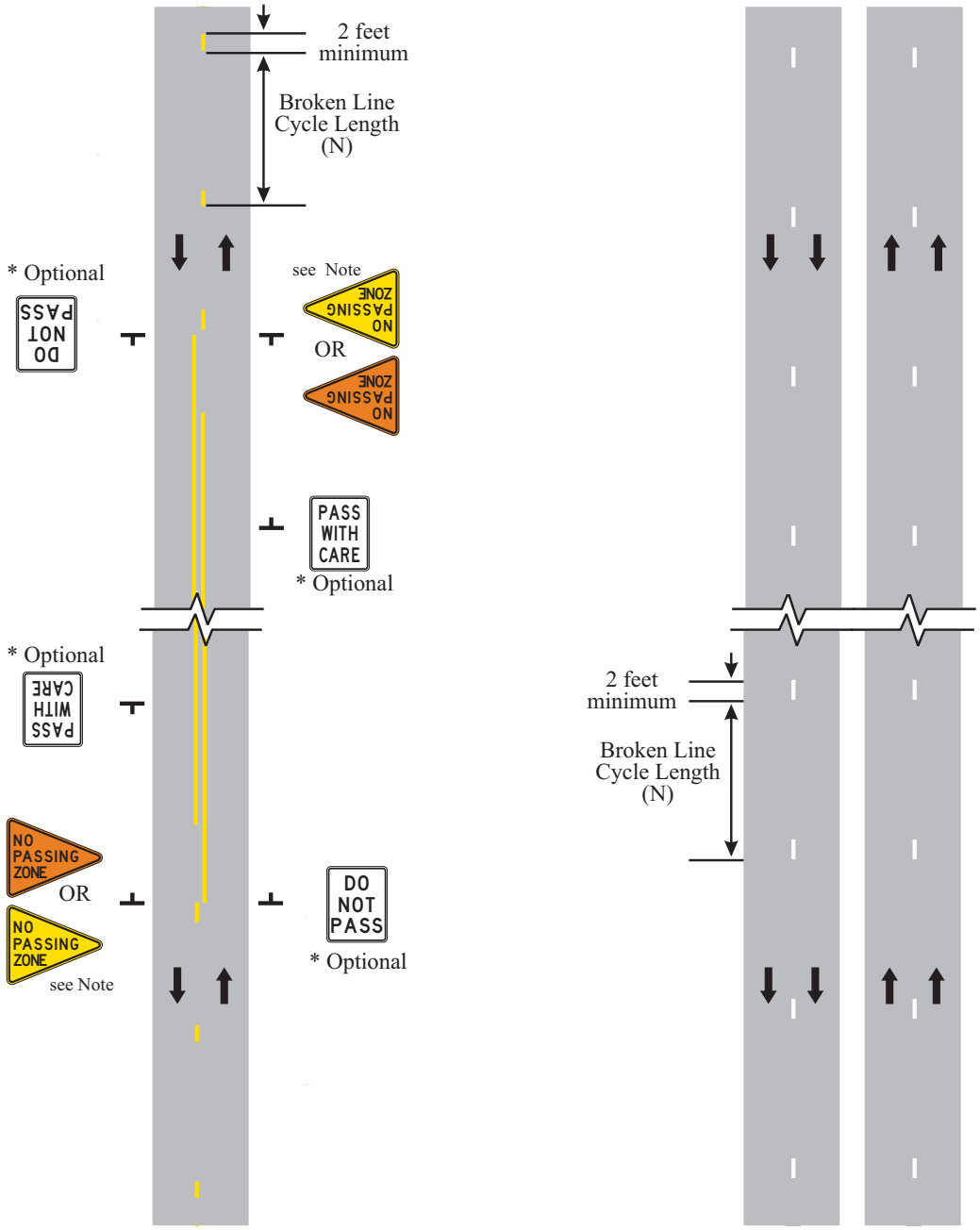


TWO-LANE, TWO-WAY **TWO-LANE, TWO-WAY**

NOTE:

1. Either layout may be used for up to 14 days when the Average daily Traffic is less than 400.
2. Any NO PASSING ZONE sign (W14-3) used in temporary traffic control zone that is applicable in its current location or will remain inplace after completion of the construction project may have a black legend and border on a yellow retroreflectorive background.

Figure 6F-8a Interim Pavement Markings - 3 Days or Less



TWO-LANE, TWO-WAY **MULTI-LANE, DIVIDED**

NOTE:
Any NO PASSING ZONE sign (W14-3), used in a temporary traffic control zone that is applicable in its current location or will remain inplace after completion of the construction project may have a black legend and border on a yellow retroreflectorive background.

Figure 6F-8b Interim Pavement Markings - 14 Days or Less

OPTION:

On low volume roads with an ADT (Average Daily Traffic) of less than 400 vehicles, the signs may be used in lieu of pavement markings for up to 14 calendar days (see Section 5A.1).

STANDARD:

If no passing zone signing is used in lieu of pavement markings the following shall be installed before opening the roadway to traffic:

- If no interim markings are used A NO CENTER STRIPE sign (W8-12a) shall be used for each direction of travel in accordance with Section 6F.47. This sign shall be repeated at major intersections or on one-mile intervals, whichever is greater.
- If interim no passing zone markings are not installed but interim broken markings are installed a NO CENTER STRIPE sign (W8-12a) shall be installed in advance of each no passing zone.
- If not already in place, a DO NOT PASS sign (R4-1) shall be installed on the right side of the road at the beginning of the zone opposite of the NO PASSING ZONE sign (W14-3).
- A PASS WITH CARE sign (R4-2) shall be installed on the right side of the road at the end of the no passing zone.

6F.79 Temporary Raised Pavement Markers

OPTION:

Retroreflective or internally illuminated raised pavement markers, or non-retroreflective raised pavement markers supplemented by retroreflective or internally illuminated markers, may be substituted for markings of other types in TTC zones.

STANDARD:

If used, the color and pattern of the raised pavement markers shall simulate the color and pattern of the markings for which they substitute.

If temporary raised pavement markers are used to substitute for broken line segments, a group of at least three retroreflective markers shall be equally spaced at no greater than N/10 (see Section 3B.14). The value of N for a broken or dotted line shall equal the length of one line segment plus one gap.

If temporary raised pavement markers are used to substitute for solid lines, the markers shall be equally spaced at no greater than N/5, with retroreflective or internally illuminated units at a spacing no greater than N/2. The value of N referenced for solid lines shall equal the N for the broken or dotted lines that might be adjacent to or might extend the solid lines (see Section 3B.11).

OPTION:

Temporary raised pavement markers may be used to substitute for broken line segments by using at least two retroreflective markers placed at each end of a segment of 2 to 5 feet in length, using the same cycle length as permanent markings.

GUIDANCE:

Temporary raised pavement markers used on 2- to 5-foot segments to substitute for broken line segments should not be in place for more than 14 days unless justified by engineering judgment.

Raised pavement markers should be considered for use along surfaced diversions (bypasses) or temporary roadways, and other changed or new travel-lane alignments, because of the need to accentuate changed travel paths and their wet weather capabilities.

OPTION:

Retroreflective or internally illuminated raised pavement markers, or non-retroreflective raised pavement markers supplemented by retroreflective or internally illuminated markers, may also be used in TTC zones to supplement markings as prescribed in Chapters 3A and 3B.

6F.80 Post-Mounted Delineators

STANDARD:

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

GUIDANCE:

Spacing along roadway curves should be as set forth in Section 3F.4 and should be such that several delineators are always visible to the driver.

OPTION:

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

6F.81 Lighting Devices

GUIDANCE:

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

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

OPTION:

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

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

STANDARD:

Although vehicle hazard warning lights are permitted to be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights, they shall not be used instead of high-intensity rotating, flashing, oscillating, or strobe lights.

6F.82 Floodlights

SUPPORT:

Utility, maintenance, or construction activities on highways are frequently conducted during nighttime periods when motor vehicle traffic volumes are lower. Large construction projects are sometimes operated on a double-shift basis requiring night work.

GUIDANCE:

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

STANDARD:

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

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

GUIDANCE:

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

SUPPORT:

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

6F.83 Warning Lights

SUPPORT:

Type A, Type B, Type C, and Type D 360-degree warning lights are portable, powered, yellow, lens-directed, enclosed lights.

STANDARD:

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

When warning lights are used, they shall be mounted on signs or channelizing devices in a manner that, if hit by an errant vehicle, they will not be likely to penetrate the windshield.

GUIDANCE:

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

SUPPORT:

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

OPTION:

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

STANDARD:

Except for the sequential flashing warning lights that are described in Paragraphs 8 and 9, flashing warning lights shall not be used for delineation, as a series of flashers fails to identify the desired vehicle path.

OPTION:

A series of sequential flashing warning lights may be placed on channelizing devices that form a merging taper in order to increase driver detection and recognition of the merging taper.

STANDARD:

If a series of sequential flashing warning lights is used, the successive flashing of the lights shall occur from the upstream end of the merging taper to the downstream end of the merging taper in order to identify the desired vehicle path. Each flashing warning light in the sequence shall be flashed at a rate of not less than 55 or more than 75 times per minute.

Type A Low-Intensity Flashing warning lights, Type C Steady-Burn warning lights, and Type D 360-degree Steady-Burn warning lights shall be maintained so as to be capable of being 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 capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1,000 feet.

Warning lights shall have a minimum mounting height of 30 inches to the bottom of the lens.

SUPPORT:

Type A Low-Intensity Flashing warning lights are used to warn road users during nighttime hours that they are approaching or proceeding in a potentially hazardous area.

OPTION:

Type A warning lights may be mounted on channelizing devices.

SUPPORT:

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

OPTION:

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

Type C Steady-Burn warning lights and Type D 360-degree Steady-Burn warning lights may be used during nighttime hours to delineate the edge of the traveled way.

GUIDANCE:

When used to delineate a curve, Type C and Type D 360-degree warning lights should only be used on devices on the outside of the curve, and not on the inside of the curve.

6F.83.1 Warning Lights on STOP Signs

SUPPORT:

Type A warning lights are portable, powered, red, lens-directed, enclosed lights.

STANDARD:

Warning lights shall be in accordance with the current ITE "Purchase Specification for Flashing and Steady-Burn Warning Lights" except except that they shall be red in color.

Warning lights shall flash when placed on STOP signs.

The warning lights shall be maintained according to the Type A Low-Intensity Flashing warning lights standard (see Section 6F.83).

6F.83.2 Steady-Burn Electric Lamps

SUPPORT:

Steady-Burn electric lamps are a series of low-wattage, yellow, electric lamps, generally hard-wired to a 110-volt external power source.

OPTION:

Steady-Burn electric lamps may be used in place of Type C Steady-Burn warning lights (see Section 6F.78).

6F.83.3 Roadway Lighting

SUPPORT:

On long term projects, the use of roadway lighting may be beneficial. Areas that may benefit from the installation of roadway lighting include high hazard areas, high volume areas, crossovers, diversions (bypasses), areas with sudden alignment changes, curves, intersections and transitions from multi-lane divided roadways to two-lane, two-way roadways.

STANDARD:

When possible, all roadway lighting shall be protected or have breakaway bases.

6F.84 Temporary Traffic Control Signals

STANDARD:

Temporary traffic control signals (see Section 4D.32) used to control road user movements through TTC zones and in other TTC situations shall meet the applicable provisions of Part 4.

SUPPORT:

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

STANDARD:

A temporary traffic control signal that is used to control traffic through a one-lane, two-way section of roadway shall comply with the provisions of Section 4H.2.

GUIDANCE:

Where pedestrian traffic is detoured to a temporary traffic control signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals (see Section 4E.9) are needed for crossing along an alternate route.

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

OPTION:

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

GUIDANCE:

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

SUPPORT:

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

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

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

GUIDANCE:

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

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

If a temporary traffic control signal is located within 1/2 mile of an adjacent traffic control signal, consideration should be given to interconnected operation.

STANDARD:

Temporary traffic control signals shall not be located within 200 feet of a grade crossing unless the temporary traffic control signal is provided with preemption in accordance with Section 4D.27, or unless a uniformed officer or flagger is provided at the crossing to prevent vehicles from stopping within the crossing.

6F.85 Temporary Traffic Barriers

SUPPORT:

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

There are five primary functions of temporary traffic barriers:

A To keep motor vehicle traffic from entering work areas, such as excavations or material storage sites;
B. To separate workers, bicyclists, and pedestrians from motor vehicle traffic;
C. To separate opposing directions of motor vehicle traffic; and
D. To separate motor vehicle traffic, bicyclists, and pedestrians from the work area such as false work for bridges and other exposed objects; and
E. To protect drop-offs of greater than 12 inches on longer term projects when a suitable buffer lane cannot be provided.

OPTION:

Temporary traffic barriers may be used to separate two-way motor vehicle traffic.

GUIDANCE:

Because of the risks to the driver and the risks involved in placement and removal of temporary traffic barriers, the following alternatives to using them should be strongly considered:

A. Buffer lane closures;
B. Nightly backfill of excavations;
C. Temporary tapers;
D. Temporary detours or crossovers;
E. For lower speed projects, additional or closer spacing of channelizing devices in conjunction with extra delineation (TRPM's, pavement markings) and extra warning signs (in advance and within work area).

Because the protective requirements of a TTC situation have priority in determining the need for temporary traffic barriers, their use should be based on an engineering study. The following factors should be considered before using temporary traffic barriers:

A. Speed/volume of traffic;
B. Vertical/horizontal roadway alignment;
C. Severity of hazard/excavation/obstacle;
D. Lateral clearance to hazard;
E. Duration of exposure;
F. Duration of the TTC zone;
G. Hazard presented by barrier itself once inplace;
H. Hazard presented to workers and traffic during barrier placement.

Tables 6F-4a and 6F-4b should be used to determine when temporary traffic barrier in edge drop-off situations.

Lateral Offset * feet	Depth of Drop-off inches
0 - 4	12 - 24
4 - 8	24 - 36
8 - 20	>36

* Lateral offset is measured from the edge of the traffic carrying lane to the edge of the vertical drop-off.

Table 6F-5a Drop-offs to Commonly Justify PCB Non-Construction Speed Limits of 45-55 mph

Lateral Offset * feet	Depth of Drop-off inches
0 - 4	12 - 24
4 - 12	24 - 36
12 - 20	>36

* Lateral offset is measured from the edge of the traffic carrying lane to the edge of the vertical drop-off.

Table 6F-5b Drop-offs to Commonly Justify PCB Non-Construction Speed Limits of 60-70 mph

STANDARD:

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

All temporary traffic barriers shall be crashworthy.

Each type of temporary traffic barrier (steel , water-filled or concrete, etc.) requires a specific basic minimum length to achieve its crashworthy compliance. Refer to the barrier's crash testing results to determine the minimum length for predicted crash deflections. Shorter intermittent segments of temporary traffic barrier shall not be used because they nullify the containment and re-directive capabilities of the temporary traffic barrier, increase the potential for serious injury both to vehicle occupants and pedestrians, and encourage the presence of blunt, leading ends. All upstream leading ends that are present shall be appropriately flared or protected with properly installed and maintained crashworthy cushions. Adjacent temporary traffic barrier segments shall be properly connected in order to provide the overall strength required for the temporary traffic barrier to perform properly.

In order to mitigate the effect of striking the end of a temporary traffic barrier, the end shall be installed in accordance with AASHTO's "Roadside Design Guide" (see Section 1A.11) by flaring until the end is outside the acceptable clear zone or by providing crashworthy end treatments (see Section 6F.76). See Figure 6F-9 for temporary traffic barrier placement and end treatments.

OPTION:

End attenuation may be necessary at both ends of barrier used on a two-lane two-way roadway.

GUIDANCE:

Since the barrier itself is a hazard, the use of it should be toward the overall safety benefit.

Excessive/acute tapers and pronounced turns/corners should be avoided. Tapers should be made as smooth as possible.

Sufficient area should be maintained behind the barrier to allow for deflection. Barriers should not typically be butted up to, or mounted on top of curbs or medians. Placing barriers across a curb section should be avoided.

Temporary traffic barriers should be anchored in any location that does not allow adequate area for deflection.

SUPPORT:

Temporary traffic barriers are designed to deflect when struck by a vehicle. Tapers, transition areas and barrier used outside of horizontal curves will see more deflection because of possibility higher angle hits. Tangent areas will generally see less deflection.

STANDARD:

Different designs of barrier shall not be intermixed on the same run of temporary traffic barrier. Barrier runs of different designs on the same project are acceptable, but the barrier runs shall not be connected.

GUIDANCE:

Separate shorter runs with different barrier design types should be discouraged if a longer run of one type is possible.

STANDARD:

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

OPTION:

Warning lights or steady-burn electric lamps may be mounted on temporary traffic barrier installations. When in transition/taper areas or close to traffic lanes, retroreflective barrier markers or tape may be placed on barriers.

Depending on roadway geometrics, temporary speed reduction may be used in barrier areas.

GUIDANCE:

When serving the additional function of channelizing motor vehicle traffic, temporary traffic barriers should be a light color for increased visibility.

SUPPORT:

Temporary traffic barrier is subjected to considerable abuse. The placement process itself can causes damage to the base and ends. Connection loops can be bent and deformed when being placed. Temporary traffic barrier can also degrade over the long term. Barrier is often in place for long periods and is subject to winter road salt spray and snow plows. Over a period, delamination can result, often to the point of section loss. Also, the repeated process of transport and handling causes a good deal of longitudinal flexure, which can cause cracking.

GUIDANCE:

Barrier sections and connections should be routinely inspected for damage.

SUPPORT:

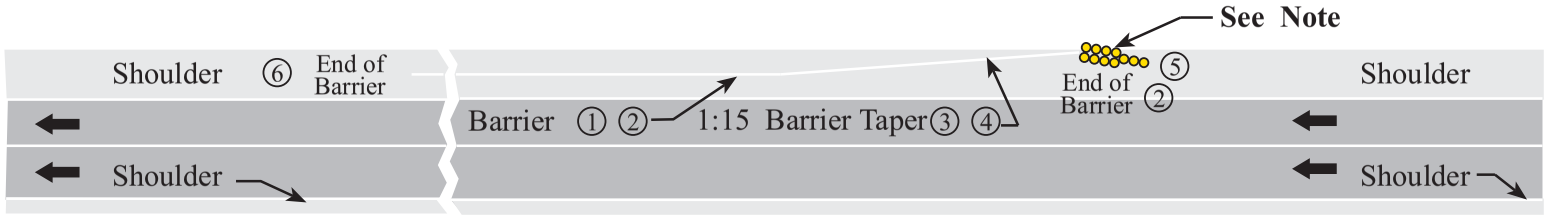
Movable barriers are capable of being repositioned laterally using a transfer vehicle that travels along the barrier. Movable barriers enable short-term closures to be installed and removed on long-term projects. Providing a barrier-protected work space for short-term closures and providing unbalanced flow to accommodate changes in the direction of peak-period traffic flows are two of the advantages of using movable barriers.

Figure 6H-45 shows a temporary reversible lane using movable barriers. The notable feature of the movable barrier is that in both Phase A and Phase B, the lanes used by opposing traffic are separated by a barrier.

Figure 6H-34 shows an exterior lane closure using a temporary traffic barrier. Notes 7 through 9 address the option of using a movable barrier. By using a movable barrier, the barrier can be positioned to close the lane during the off-peak periods and can be relocated to open the lane during peak periods to accommodate peak traffic flows. With one pass of the transfer vehicle, the barrier can be moved out of the lane and onto the shoulder. Furthermore, if so desired, with a second pass of the transfer vehicle, the barrier could be moved to the roadside beyond the shoulder.

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

Portable Concrete Barrier Placement



① It is desirable to maintain full shoulder width whenever possible. If that is not possible, the minimum desirable lateral offsets are based on the following posted speed limits:

70 mph - 12.0 feet
60 mph - 8.0 feet
50 mph - 6.5 feet
40 mph - 5.0 feet

For restricted conditions, lesser offsets may be used. The offsets should be a minimum of 2 feet unless the conditions are extreme. Lateral offsets are measured to the bottom of the barrier. Barrier offset from the edge of the thru lane should not exceed 15 feet.

② Desirable treatments for exposed barrier ends are: a connection to existing barrier; impact attenuator; taper away to the edge of the clear zone; and extending through a plate beam guardrail by removing a panel.

For posted speed limits of 30 mph or less, the tapering away from the traffic is desirable and the use of an impact attenuator is optional.

③ A 1:8 taper may be used when the posted speed limit is 35 mph or less.

A 1:12 taper may be used when the posted speed limit is 45 mph or less.

④ If the barrier is to be extended beyond the shoulder, additional fill will be needed in order to provide a flat (1:10) approach area to the barrier. (see Shoulder Fill detail in Figure 6F-6, Sheet 2 of 2)

⑤ The impact attenuator should be offset a minimum of 2 feet from the edge of the thru lane (see Sand Barrel Offset detail). The impact attenuator should be oriented to accommodate the probable impact angle of an encroaching vehicle. For most roadside conditions, an angle of approximately 10 degrees, as measured between the highway and the impact attenuators longitudinal centerline, is considered appropriate (see Shoulder Fill detail). For Sand Barrel Arrangement, see detail of Figure 6F-6, sheet 2 of 2).

⑥ For Two-Lane, Two-Way traffic, both ends of the barrier should be treated in the same manner as described in ②.

Figure 6F-9 Portable Concrete Barrier Placement and End treatments

(Sheet 1 of 2)

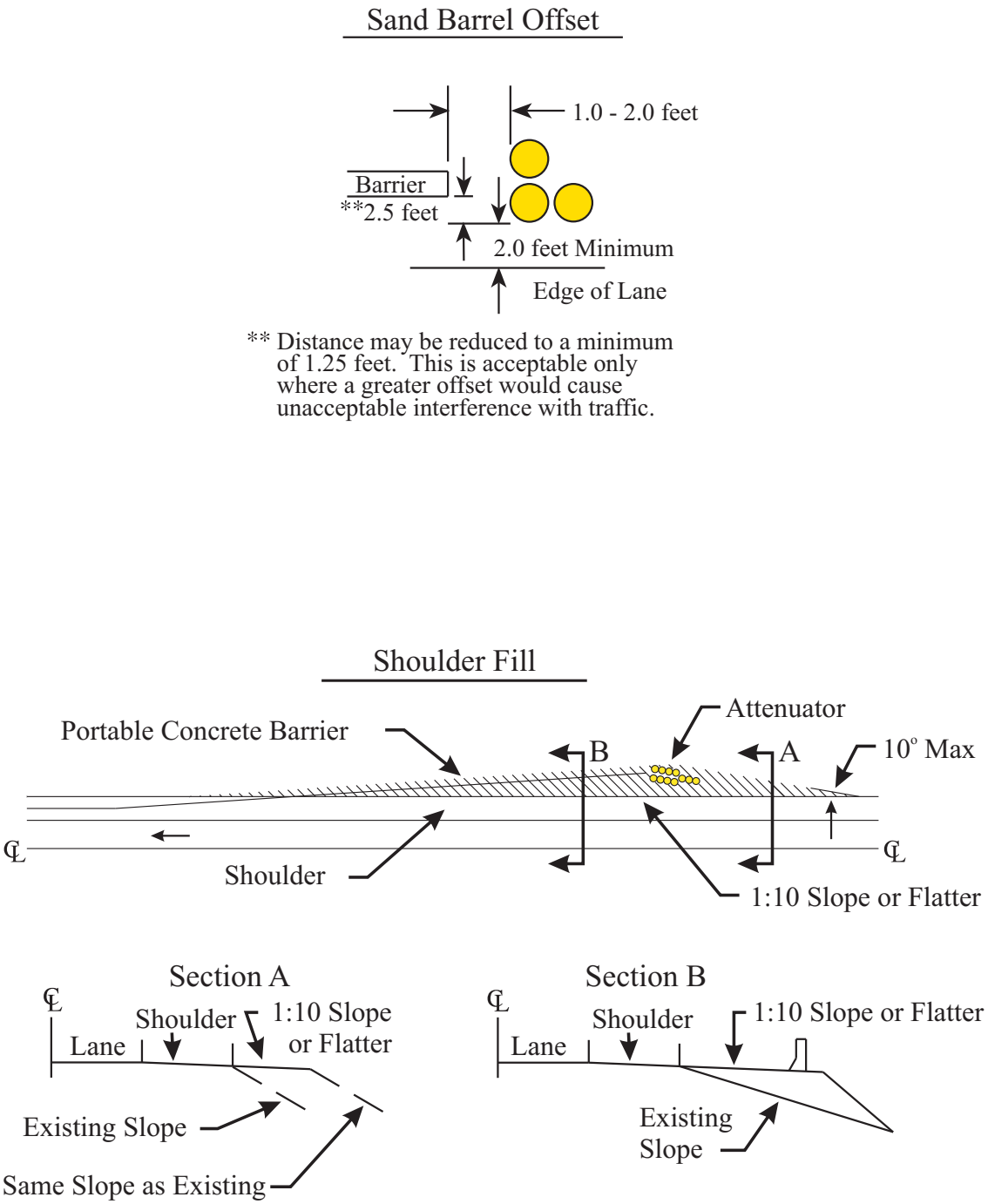


Figure 6F-9 Portable Concrete Barrier Placement and End treatments

(Sheet 2 of 2)

6F.86 Crash Cushions

SUPPORT:

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

STANDARD:

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

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SUPPORT:

Stationary crash cushions are used in the same manner as permanent highway installations to protect drivers from the exposed ends of barriers, fixed objects, and other obstacles. More detailed information on the use of portable barriers and crash cushions can be obtained from Figure 6F-9.

STANDARD:

Stationary crash cushions shall be designed for the specific application intended.

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

SUPPORT:

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

GUIDANCE:

The shadow truck should be positioned in advance of the workers or equipment being protected so that there will be sufficient distance, but not so much so that errant vehicles will travel around the shadow truck and strike the protected workers and/or equipment.(see Chapter Part 6K-Temporary Traffic Control Zone Layouts for the recommended distance charts)

SUPPORT:

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

GUIDANCE:

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

6F.87 Rumble Strips

SUPPORT:

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

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

STANDARD:

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

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

OPTION:

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

GUIDANCE:

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

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

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

Rumble strips should not be placed through pedestrian crossings or within marked bicycle lanes.

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

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

6F.88 Screens

SUPPORT:

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

GUIDANCE:

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

OPTION:

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

GUIDANCE:

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

PART 6. TEMPORARY TRAFFIC CONTROL

Chapter 6G. Type of Temporary Traffic Control Zone Activities

6G.a Introduction

SUPPORT:

The purpose of temporary traffic control is to balance the need for safe and effective work spaces with the need to warn, control, protect, and expedite vehicular and pedestrian traffic. To accomplish this, the respect of the driver must be earned by appropriate and prudent use of traffic control devices. Proper engineering judgment is the key factor in making the temporary traffic control zone both safe and efficient.

GUIDANCE:

Advance planning is necessary for any successful temporary traffic control zone. Before setting up any zone, the appropriate layout and number of devices must be determined. Any major changes from the typical layouts should be documented. For major projects, emergency operation plans should be developed in the event of a total road closure.

OPTION:

Important aspects of the planning stage include consideration of alternate routes and the use of public information.

STANDARD:

It is essential to notify emergency services (i.e. police, fire, etc.) of any road closures and route changes.

SUPPORT:

In this chapter, the factors which affect the selection of the typical temporary traffic control zone layouts are explained. Chapter 6H details the layouts which are found in Chapter 6J, Traffic Control for Long Term Temporary Traffic Control Zones and in Chapter 6K Short Term Temporary Traffic Control Zones (*the Field Manual*).

STANDARD:

For most projects, especially long term projects, it will be necessary to prepare a project specific Traffic Control Plan (TCP). A TCP may range from a reference to Chapter 6K (the Field Manual) to a detailed set of plans and specifications.

GUIDANCE:

In developing any TCP the following items should be considered:

A. Suitable detours
   - Weight, height and width restrictions
   - Capacity
   - Geometrics
   - Maintenance of the detour

B. Access and signage to businesses

C. Conflict with standard routes and accommodations for:
   - School buses
   - Public transit
   - Fire
   - Ambulance
   - Postal Service

D. Restriction of capacity during peak hours

E. Alternate routes and other construction and/or maintenance activities in the area that may affect alternate routes.

F. Restrictions on overweight, overheight and overwidth permits

G. Inplace signing, lighting and signal modifications

H. Trail crossings, pedestrians, bicyclists

I. Utility work

J. Special events, holidays, etc.

K. Local ordinances

6G.1 Typical Applications

SUPPORT:

Each TTC zone is different. Many variables, such as location of work, highway type, geometrics, vertical and horizontal alignment, intersections, interchanges, road user volumes, road vehicle mix (buses, trucks, and cars), and road user speeds affect the needs of each zone. A TTC zone includes the section of roadway between the first advance warning sign through the last traffic control device, where traffic returns to its normal path and conditions. The goal of TTC in work zones is safety with minimum disruption to road users. The key factor in promoting TTC zone safety is proper judgment.

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Typical layouts include a variety of temporary traffic control methods, but do not include a layout for every conceivable work situation.

Well-designed TTC plans for planned special events will likely be developed from a combination of treatments from several of the typical applications.

GUIDANCE:

For any planned special event that will have an impact on the traffic on any street or highway, a TTC plan should be developed in conjunction with and be approved by the agency or agencies that have jurisdiction over the affected roadways.

Typical applications should be altered, when necessary, to fit the conditions of a particular TTC zone. When modifications are made, factors such as traffic volume, speed, sight distance, type of work, etc. should be considered.

OPTION:

The typical layouts illustrated in Chapter 6K (*the Field Manual*) generally represent typical highway agency activities. Other devices may be added to supplement the devices shown in the typical layouts, while others may be deleted. 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 fully effective.

Other devices may be added to supplement the devices shown in the typical applications, while others may be deleted. The sign spacings and taper lengths may be increased to provide additional time or space for driver response. When conditions are less complex than those depicted in the typical applications, fewer devices may be needed.

SUPPORT:

Selecting the most appropriate typical layout and modifications for a TTC zone requires knowledge and understanding of the zone. Although there are many ways of categorizing temporary traffic control zone layouts, roadway type, location of the work, volume, duration of work, and speed have been used to characterize the typical drawings illustrated in Chapter 6K (*the Field Manual*).

6G.2 Work Duration

SUPPORT:

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

STANDARD:

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

A. Long-term TTC zone - any temporary traffic control zone that occupies a location more than 3 days.
B. Intermediate-term/night TTC zone - any TTC zone that occupies a location during hours of darkness or up to 3 days.
C. Short-term TTC zone - any TTC zone that occupies a location for less than twelve (12) hours.
D. Short duration TTC zone - any TTC zone that occupies a location (area) for less than one (1) hour.
E. Mobile TTC zone - any TTC zone that occupies a location (area) for less than fifteen (15) minutes.

6G.2.1 Long-Term Temporary Traffic Control Zone

SUPPORT:

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

STANDARD:

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

GUIDANCE:

Temporary roadways and barriers may be provided, and inappropriate markings should be removed and replaced with temporary markings. Temporary signs should be post-mounted.

STANDARD:

Any conflicting signs shall be covered.

OPTION:

A long-term TTC zone may range in duration from several days to several years.

GUIDANCE:

Traffic control procedures and devices should be chosen to accommodate the varying seasonal, climactic and visibility situations that may arise during the length of the project. Consideration should also be given to devices that are durable and easily maintained.

SUPPORT:

Layouts for long-term TTC zones are not included in Chapter 6K (*the Field Manual*), but examples of long-term applications are shown in Chapter 6J. Normally, a long-term TTC zone will require a project specific Traffic Control Plan (TCP). Implementing a Traffic Control Plan requires advance planning and consultation with the local road authority and Traffic Engineering professionals. Advance notice and good public relations are helpful.

6G.2.2 Intermediate-Term/Night Temporary Traffic Control Zone

SUPPORT:

In intermediate-term/night TTC zones, it might not be feasible or practical to use procedures or devices that would be desirable for long-term 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 pay-back time to economically justify more elaborate temporary traffic control measures.

Night work presents special problems and requires extra-ordinary precautions. Night temporary traffic control zones may be inplace for only a few hours. During this time, traffic volumes may be lighter than during daylight hours. However, additional devices such as warning lights and larger more reflective devices are necessary because drivers are more likely to be impaired and inattentive. Driver impairment may be due to drugs, alcohol, or fatigue.

STANDARD:

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

GUIDANCE:

In addition to floodlighting the flagger stations and the work space, the work vehicles should also be made more visible.

SUPPORT:

Typical characteristics of intermediate-term/night temporary traffic control zones are:

A, Signs mounted on temporary supports,
B. Minimal covering of inplace signs,
C. Additional devices used to override inplace signs, and/or
D. Conflicting pavement markings normally not removed except for multiple lane shifts.

STANDARD:

If multiple lanes are being shifted, then the inplace lane markings shall be removed and temporary markings installed.

6G.2.3 Short-Term Temporary Traffic Control Zones

SUPPORT:

Most maintenance and utility operations fall into the category of short-term TTC zones. The work crew is present to maintain and monitor the TTC zone. Signs are mounted on portable stands and pavement markings are generally not removed.

Within Chapter 6K (*the Field Manual*), several TTC zone layouts when used for a short-term duration have devices which may be either omitted or perhaps substituted with a lower level device depending upon whether the work space will be either attended or occupied. A work space is considered to be attended when the TTC devices are reviewed for knock-downs or other needed adjustments on a hourly basis. A work space is considered to be occupied when workers are present within the work space and TTC devices should continuously be reviewed by workers and adjustments made as needed.

6G.2.4 Short Duration Temporary Traffic Control Zones

SUPPORT:

Quick repair, installation or inspection activities fall into the category of short duration temporary traffic control zones. The work crew will perform a quick operation and leave the area and generally have little or no effect on the traffic.

During short duration work, it often takes longer to set up and remove the traffic control than to perform the work. Workers face hazards in setting up and taking down the temporary traffic control zone. Also, since the work time is short, delays affecting road users are significantly increased when additional devices are installed and removed.

OPTION:

Considering these factors, simplified control procedures may be warranted for short-duration work. A reduction in the number of devices may be offset by the use of other more dominant devices such as rotating lights or strobe lights on work vehicles.

GUIDANCE:

Work that may require a complete closure for a short period of time (15 minutes or less) should be scheduled for non-peak hours. A portable changeable message sign should be considered to warn motorists approaching the closure. Care must be taken to ensure that advance warning signs extend beyond any possible queue. If the closure is done during nighttime hours, uniformed officers should be used for flagging.

6G.2.5 Mobile Temporary Traffic Control Zones

SUPPORT:

Mobile operations are work activities that move along the road. Mobile operations often involve frequent short stops, each as much as 15 minutes long, for activities such as pothole patching, crack sealing or utility operations and are similar to short duration operations. Mobile operations also include work activities in which workers and equipment move along the road without stopping, usually at slow speeds.

As compared to stationary operations, mobile operations are activities that might involve different treatments. Devices having greater mobility might be necessary, such as signs mounted on trucks. Devices that are larger, more imposing, or more visible can be used effectively and economically. The mobility of the TTC zone is important.

Maintaining safe work and road user conditions is a paramount goal in carrying out mobile operations.

During mobile work, it often takes longer to set up and remove the traffic control than to perform the work. Workers face hazards in setting up and taking down the TTC zone. Also, since the work time is short, delays affecting road users are significantly increased when additional devices are installed and removed.

GUIDANCE:

If a mobile operation does not move at least the decision sight distance (See Table 6E-1) every 15 minutes it should be considered a stationary TTC zone and the appropriate stationary layout used. If sight distance is limited or volumes high, a stationary layout should also be considered.

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

OPTION:

Considering these factors, simplified control procedures may be warranted for mobile work. A reduction in the number of devices may be offset by the use of other more dominant devices, as detailed for mobile operations in Chapter 6K (*the Field Manual*), and may include rotating lights or strobe lights on work vehicles and vehicles augmented with signs or arrow panels.

Flaggers may be used for mobile operations that often involve frequent short stops.

STANDARD:

Mobile operations on a high speed travel lane of a multi-lane divided highway shall use arrow boards.

GUIDANCE:

When the mobile operation is continually moving along the road, the traffic should be directed to pass safely. A shadow vehicle or protection vehicle equipped as a sign truck, with an appropriately used arrow board, should follow the work vehicle as detailed in the layouts.

Work and shadow vehicles should be equipped with such devices such as flags, rotating/strobe vehicle lights, truck-mounted attenuators, and appropriate signs. These devices may be required individually or in various combinations, or all of them, as determined necessary.

STANDARD:

Mobile operations shall have appropriate devices on the equipment (that is, high-intensity rotating, flashing, oscillating, or strobe lights, signs, or special lighting), or shall use a separate vehicle with appropriate warning devices.

OPTION:

For mobile operations that move at speeds less than 3 mph, mobile signs or portable stationary signing that is periodically retrieved and repositioned in the advance warning area to keep them near the work space may be used.

6G.3 Location of Work

SUPPORT:

Chapter 6D and Sections 6F.74 and 6G.5 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

The choice of TTC needed for a TTC zone depends upon where the work is located. As a general rule, the closer the work is to road users (including bicyclists and pedestrians), the greater the number of TTC devices that are needed. Procedures are described later in this Chapter for establishing TTC zones in the following locations:

A. Outside the shoulder,
B. On the shoulder with no encroachment,
C. On the shoulder with minor encroachment,
D. Within the median, and
E. Within the traveled way.

STANDARD:

The exact location or locations of the work shall be known prior to selecting the layout.

When the work space is within the traveled way, except for short-duration and mobile operations, advance warning shall provide a general message that work is taking place and shall supply information about highway conditions. TTC devices shall indicate how vehicular traffic can move through the TTC zone.

6G.4 Modifications to Fulfill Special Needs

SUPPORT:

The typical applications in Chapter 6K illustrate commonly encountered situations in which TTC devices are employed.

OPTION:

Other devices may be added to supplement the devices provided in the typical applications, and device spacing may be adjusted to provide additional reaction time. When conditions are less complex than those depicted in the typical applications, fewer devices may be needed.

GUIDANCE:

When conditions are more complex, typical applications should be modified by giving particular attention to the provisions set forth in Chapter 6B and by incorporating appropriate devices and practices from the following list:

A. Additional devices:
   1. Signs
   2. Arrow boards
   3. More channelizing devices at closer spacing (see Section 6F.74 for information regarding detectable edging for pedestrians)
   4. Temporary raised pavement markers
   5. High-level warning devices
   6. Portable changeable message signs
   7. Temporary traffic control signals (including pedestrian signals and accessible pedestrian signals)
   8. Temporary traffic barriers
   9. Crash cushions
   10. Screens
   11. Rumble strips
   12. More delineation
B. Upgrading of devices:
   1. A full complement of standard pavement markings
   2. Brighter and/or wider pavement markings
   3. Larger and/or brighter signs
   4. Channelizing devices with greater conspicuity
   5. Temporary traffic barriers in place of channelizing devices
C. Improved geometrics at detours or crossovers
D. Increased distances:
   1. Longer advance warning area
   2. Longer tapers
E. Lighting:
   1. Temporary roadway lighting
   2. Steady-burn lights used with channelizing devices
   3. Flashing lights for isolated hazards
   4. Illuminated signs
   5. Floodlights
F. Pedestrian routes and temporary facilities
G. Bicycle diversions and temporary facilities

OPTION:

Other devices may be added to supplement the devices indicated in the typical applications, and device spacing may be adjusted to provide additional reaction time. When conditions are less complex than those depicted in the typical applications, fewer devices may be needed.

6G.5 Work Affecting Pedestrian and Bicycle Facilities

SUPPORT:

It is not uncommon, particularly in urban areas, that road work and the associated TTC will affect existing pedestrian or bicycle facilities. It is essential that the needs of all road users, including pedestrians with disabilities, are considered in TTC zones.

In addition to specific provisions identified in Sections 6G.06 through 6G.14, there are a number of provisions that might be applicable for all of the types of activities identified in this Chapter.

GUIDANCE:

Where pedestrian or bicycle usage is high, the typical applications should be modified by giving particular attention to the provisions set forth in Chapter 6D, this Chapter, Section 6F.74, and in other Sections of Part 6 related to accessibility and detectability provisions in TTC zones.

Pedestrians should be separated from the worksite by appropriate devices that maintain the accessibility and detectability for pedestrians with disabilities.

Bicyclists and pedestrians should not be exposed to unprotected excavations, open utility access, overhanging equipment, or other such conditions.

Except for short duration and mobile operations, when a highway shoulder is occupied, a SHOULDER WORK (W21-5) sign should be placed in advance of the activity area. When work is performed on a paved shoulder 8 feet or more in width, channelizing devices should be placed on a taper having a length that conforms to the requirements of a shoulder taper. Signs should be placed such that they do not narrow any existing pedestrian passages to less than 48 inches.

Pedestrian detours should be avoided since pedestrians rarely observe them and the cost of providing accessibility and detectability might outweigh the cost of maintaining a continuous route. Whenever possible, work should be done in a manner that does not create a need to detour pedestrians from existing routes or crossings.

STANDARD:

Where pedestrian routes are closed, alternate pedestrian routes shall be provided.

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

6G.6 Work Outside of the Shoulder

SUPPORT:

When work is being performed off the roadway (beyond the shoulders, but within the right-of-way), little or no TTC might be needed. TTC generally is not needed where work is confined to an area 15 feet or more from the edge of the traveled way. However, TTC is appropriate where distracting situations exist, such as vehicles parked on the shoulder, vehicles accessing the worksite via the highway, and equipment traveling on or crossing the roadway to perform the work operations (for example, mowing). For work beyond the shoulder, see Figure 6K-2.

GUIDANCE:

Where the situations described in the previous Support exist, a single warning sign, such as ROAD WORK AHEAD (W20-1), should be used. If the equipment travels on the roadway, the equipment should be equipped with appropriate flags, high-intensity rotating, flashing, oscillating, or strobe lights, and/or a SLOW MOVING VEHICLE (W21-4) sign.

An advance warning sign should be used when any of the following conditions occur:

A. Work will be performed on the shoulder at certain stages of the activity.
B. Equipment may be moved along or across the highway.
C. Motorists may be distracted by the work activity.

OPTION:

A typical sign for this situation may be ROAD WORK AHEAD.

If work vehicles are on the shoulder, a SHOULDER WORK (W21-5) sign may be used. For mowing operations, the sign MOWING AHEAD (W21-8) may be used.

GUIDANCE:

Where the activity is spread out over a distance of more than 2 miles, the SHOULDER WORK (W21-5) sign should be repeated every 1 mile.

OPTION:

A supplementary plaque with the message NEXT XX MILES (W7-3aP) may be used.

GUIDANCE:

A general warning sign, like Workers sign (W21-1a), should be used if workers and equipment must occasionally move closer to the traveled way.

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. If vehicles are using the shoulder, a ROAD WORK AHEAD (W20-1) or SHOULDER WORK (W21-5) sign is appropriate.

6G.7 Work on the Shoulder with No Encroachment

SUPPORT:

The provisions of this Section apply to short-term through long-term stationary operations.

GUIDANCE:

Parking lanes should be treated the same as shoulders. They should be posted for any restrictions at least 24 hours prior to commencing work.

STANDARD:

If the parking lane is normally open to vehicle travel during the time of day the closure will be in effect, the parking lane shall be considered a traveled lane.

When a highway shoulder is occupied, warning is needed to advise the driver and protect the workers. A single warning sign SHOULDER WORK or ROAD WORK AHEAD shall be used.

When paved shoulders having a width of 8 feet or more are closed, at least one advance warning sign shall be used. In addition, channelizing devices shall be used to close the shoulder in advance to delineate the beginning of the work space and direct motor vehicle traffic to remain within the traveled way.

GUIDANCE:

When paved shoulders having a width of 8 feet or more are closed on freeways and expressways, road users should be warned about potential disabled vehicles that cannot get off the traveled way. An initial general warning sign, such as ROAD WORK AHEAD (W20-1), should be used, followed by a RIGHT or LEFT SHOULDER CLOSED (W21-5a) sign. Where the downstream end of the shoulder closure extends beyond the distance that can be perceived by road users, a supplementary plaque bearing the message NEXT XX FEET (W16-4P) or MILES (W7-3aP) should be placed below the SHOULDER CLOSED (W21-5a) sign. On multi-lane, divided highways, signs advising of shoulder work or the condition of the shoulder should be placed only on the side of the affected shoulder.

When an improved shoulder is closed on a high-speed roadway, it should be treated as a closure of a portion of the road system because road users expect to be able to use it in emergencies. Road users should be given ample advance warning that shoulders are closed for use as refuge areas throughout a specified length of the approaching TTC zone. The sign(s) should read SHOULDER CLOSED (W21-5a) with distances indicated. The work space on the shoulder should be closed off by a taper or channelizing devices with a length of 1/3 L using the formulas in Tables 6C-3 and 6C-4.

When the shoulder is not occupied but work has adversely affected its condition, other warning signs and devices are appropriate. The LOW SHOULDER (W8-9), NO SHOULDER (W21-X1), HIGH SHOULDER (W21-X9) or SOFT SHOULDER (W8-4) sign should be used. See Figures 6K-3, 4, and 5 in the Field Manual for longitudinal drop offs and Sections 6F-44.2 through 6F-44.4. In areas where the speed limit is greater than 30 mph and the condition extends over a distance in excess of one mile, the sign should be repeated at one mile intervals. In areas where the speed limit is 30 mph or less, the sign should be repeated at 1/4 mile increments.

OPTION:

In addition, a supplementary plaque bearing the message NEXT XX MILES (W7-3aP) may be placed below the first such warning sign. Temporary traffic barriers may be needed to inhibit encroachment of errant vehicles into the work space and to protect workers.

GUIDANCE:

Signs advising of shoulder work or the condition of the shoulder should be placed only on the side of the affected shoulder.

STANDARD:

When used for shoulder work, arrow boards shall operate only in the caution mode.

OPTION:

If work is directly adjacent to the travel lane, workers need to be protected. In some instances, this may require the use of portable barriers.

6G.8 Work on the Shoulder with Minor Encroachment

SUPPORT:

Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

GUIDANCE:

When work takes up part of a lane, vehicular traffic volumes, vehicle mix (buses, trucks, cars, and bicycles), speed, and capacity should be analyzed to determine whether the affected lane should be closed. Unless the lane encroachment permits a remaining lane width of 10 feet, the lane should be closed.

Truck off-tracking should be considered when determining whether the minimum lane width of 10 feet is adequate.

Traffic should not be directed onto a lane that is only partially paved.

OPTION:

A lane width of 9 ft may be used for short-term stationary work on intermediate volume, low-speed roadways when motor vehicle traffic does not include longer and wider heavy commercial vehicles.

6G.9 Work Within the Median

SUPPORT:

Chapter 6D and Sections 6F.68 and 6G.5 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

OPTION:

If the work is in a narrow median of a divided highway, traffic control for both directions of travel may be necessary.

GUIDANCE:

If work in the median of a divided highway is within 15 feet from the edge of the traveled way for either direction of travel, TTC should be used through the use of advance warning signs and channelizing devices.

If the work is long term, the use of portable barriers should be considered.

6G.9.1 Detours and Diversions

SUPPORT:

Detour signing is usually designed by the traffic engineer with authority over the closed roadway because it is considered a traffic routing problem. Detour signs are used to direct traffic onto another roadway. At diversions, road users are directed onto a temporary roadway or alignment placed within or adjacent to the right-of-way. Typical applications for detouring or diverting road users on two-lane highways are shown in Layouts 6J-16, 6J-17, and 6J-18. Layout 6J-15 illustrates the controls around an area where a section of roadway has been closed and a diversion has been constructed. Channelizing devices and pavement markings are used to indicate the transition to the temporary roadway.

GUIDANCE:

A diversion (bypass) should be designed the same as a crossover (see Section 6G.16).

OPTION:

A diversion may carry either one direction or both directions of traffic.

GUIDANCE:

When the detour is long, Detour (M4-8, M4-9) signs should be installed periodically and at major intersections to remind and reassure drivers that they are still on a detour.

When a roadway is closed at some point beyond the detour, traffic should be advised as to what location the road is open. If local road users are allowed to use the roadway up to the closure, the ROAD CLOSED AHEAD, LOCAL TRAFFIC ONLY (R11-3a) sign should be used. The portion of the road open to local road users should have adequate signing, marking, and delineation.

Detours should be signed so that traffic will be able to get through the entire detour area and back to the original roadway.

When an entire roadway is closed, as illustrated in Layout 6J-19, a detour should be provided and road users should be warned in advance of the closure, which in this example is a closure 16 km (10 mi) from the intersection.

6G.10 Work Within the Traveled Way of a Two-Lane Highway

SUPPORT:

Chapter 6D and Sections 6F.68 and 6G.5 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

Techniques for one lane, two-way traffic control are described in Section 6C-10.

STANDARD:

When one lane of a two lane road is closed, the remaining lane shall accommodate both lanes of travel. A minimum lane width of 10 feet shall be maintained at all times (see Section 6H-3).

OPTION:

On intermediate volume residential streets, traffic may be self regulating.

Where conditions permit, parking may be prohibited and traffic shifted into the parking lanes.

Flaggers may be used as shown in Layout 6K-8.

STOP/YIELD sign control may be used on intermediate volume roads as shown in Layout 6K-20.

A temporary traffic control signal may be used as shown in Layout 6J-19.

6G.10.1 Work Within the Traveled Way of a Rural Highway

OPTION:

For short term temporary traffic control zones that cover a relatively long segment of roadway (up to 3 miles) but do not meet the requirements for a mobile temporary traffic control zone, flagger signs may be installed at one mile increments.

STANDARD:

A supplementary plaque indicating NEXT X MILES shall be used.

GUIDANCE:

Crossroads should be adequately signed for any driver entering the temporary traffic control zone from the crossroad. For work in intersections, see Section 6G.13.

STANDARD:

The driver expects to enter a turn lane at or near the posted speed limit. Therefore it is necessary to provide adequate advance warning of work in the turn lane.

6G.11 Work Within the Traveled Way of an Urban Street

SUPPORT:

Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

In urban TTC zones, decisions are needed on how to control vehicular traffic, such as how many lanes are required, whether any turns need to be prohibited at intersections, and how to maintain access to business, industrial, and residential areas.

Pedestrian traffic needs separate attention. Chapter 6D contains information regarding pedestrian movements near TTC zones.

STANDARD:

If the TTC zone affects the movement of bicyclists, adequate access to the roadway or shared-use paths shall be provided (see Part 9).

Where transit stops are affected or relocated because of work activity, both pedestrian and vehicular access to the affected or relocated transit stops shall be provided.

GUIDANCE:

If a designated bicycle route is closed because of the work being done, a signed alternate route should be provided. Bicyclists should not be directed onto the path used by pedestrians.

Worksites within the intersection should be protected against inadvertent pedestrian incursion by providing detectable channelizing devices.

SUPPORT:

Utility work takes place both within and outside the roadway to construct and maintain services such as power, gas, light, water, or telecommunications. Operations often involve intersections, since that is where many of the network junctions occur. The work force is usually small, only a few vehicles are involved, and the number and types of TTC devices placed in the TTC zone is usually minimal.

STANDARD:

All TTC devices shall be retroreflective or illuminated if utility work is performed during nighttime hours.

SUPPORT:

TTC zones in urban areas present many problems. Frequent intersections and driveways, parking, congestion, visual clutter and lack of space to install signs make the devices more difficult to install.

OPTION:

Engineering judgment is required to modify the typical layouts for specific situations. These modifications usually include variations in the spacing of devices to provide adequate sight distance for the driver. Modifications may also include the use of high level warning devices in urban areas, in place of or in addition to the work vehicle or Type III barricade.

GUIDANCE:

As discussed under short-duration projects, however, the reduced number of devices in utility work zones should be offset by the use of high-visibility devices, such as high-intensity rotating, flashing, oscillating, or strobe lights on work vehicles or high-level warning devices.

6G.12 Work Within the Traveled Way of a Multi-Lane, Non-Access Controlled Highway

SUPPORT:

Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

Work on multi-lane (two or more lanes of moving motor vehicle traffic in one direction) highways is divided into right-lane closures, left-lane closures, interior-lane closures, multiple-lane closures, and closures on five-lane roadways.

STANDARD:

When a lane is closed on a multi-lane road for other than a mobile operation, a transition area containing a merging taper shall be used.

GUIDANCE:

When justified by an engineering study, temporary traffic barriers (see Section 6F.70) should be used to prevent incursions of errant vehicles into hazardous areas or work space.

If morning and evening peak hour vehicular traffic volumes in the two directions are uneven and the greater volume is on the side where the work is being done in the right-hand lane, consideration should be given to closing the inside lane for opposing vehicular traffic and making the lane available to the side with heavier vehicular traffic.

If the larger vehicular traffic volume changes to the opposite direction at a different time of the day, the TTC should be changed to allow two lanes for opposing vehicular traffic by moving the devices from the opposing lane to the center line. When it is necessary to create a temporary center line that is not consistent with the pavement markings, channelizing devices should be used and closely spaced.

OPTION:

If the work activity can be contained entirely within the left (or inside) lane, it may be appropriate to close only that lane on low speed streets or highways.

When closing a left lane on a multi-lane undivided road, as vehicular traffic flow permits, the two interior lanes may be closed, as shown in Layout 6K-35, to provide drivers and workers additional lateral clearance and to provide access to the work space.

STANDARD:

When only the left lane is closed on undivided roads, channelizing devices shall be placed along the center line as well as along the adjacent lane.

GUIDANCE:

Channelizing devices should be placed along the centerline and outside of the work space to give advance warning to the opposing traffic.

When an interior lane is closed, an adjacent lane should also be considered for closure to provide additional space for vehicles and materials and to facilitate the movement of equipment within the work space.

When multiple lanes in one direction are closed, a capacity analysis should be made to determine the number of lanes needed to accommodate motor vehicle traffic needs. Vehicular traffic should be moved over one lane at a time. As shown in Layout 6K-56, the tapers should be separated by a distance of 2L, with L being determined by the formulas in Table 6C-2.

OPTION:

If operating speeds are 40 mph or less and the space approaching the work area does not permit moving traffic over one lane at a time, a single continuous taper may be used.

STANDARD:

When a directional roadway is closed, inapplicable WRONG WAY signs and markings, and other existing traffic control devices at intersections within the temporary two-lane, two-way operations section shall be covered, removed, or obliterated.

OPTION:

When half the road is closed on an undivided highway, both directions of motor vehicle traffic may be accommodated as shown in Layout 6K-41. When both interior lanes are closed, temporary traffic controls may be used as indicated in Layout 6K-35. When a roadway must be closed on a divided highway, a median crossover may be used (see Section 6G.16).

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 existing traffic volumes and speeds in each direction, is the main factor for determining alternatives.

SUPPORT:

Temporary traffic control for lane closures on five-lane roads is similar to other multi-lane undivided roads. Layouts 6K-25 and 6K-26 can be adapted for use on five-lane roads. Layout 6K-31 can be used on a five-lane road for short duration and mobile operations.

GUIDANCE:

For roadways having either center two-way left turn lanes or exclusive left turn lanes, a transition area should be provided for vehicles entering or exiting the turn lanes.

6G.13 Work Within the Traveled Way at an Intersection

SUPPORT:

Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

The typical layouts for intersections are classified according to the location of the work space with respect to the intersection area (as defined by the extension of the curb or edge lines). The three classifications are near side, far side, and in-the-intersection. Work spaces often extend into more than one portion of the intersection. For example, work in one quadrant often creates a near-side work space on one street and a far-side work space on the cross street. In such instances, an appropriate TTC plan is obtained by combining features shown in two or more of the intersection and pedestrian typical applications.

TTC zones in the vicinity of intersections might block movements and interfere with normal road user flows. Such conflicts frequently occur at more complex signalized intersections having such features as traffic signal heads over particular lanes, lanes allocated to specific movements, multiple signal phases, signal detectors for actuated control, and accessible pedestrian signals and detectors.

GUIDANCE:

The effect of the work upon signal operation should be considered, and temporary corrective actions should be taken, if necessary, such as revising signal phasing and/or timing to provide adequate capacity, maintaining or adjusting signal detectors, and relocating signal heads to provide adequate visibility as described in Part 4.

Prior to working in a signalized intersection, the traffic engineering staff having jurisdiction should be contacted for signal timing modifications.

STANDARD:

When work will occur near an intersection where operational, capacity, or pedestrian accessibility problems are anticipated, the highway agency having jurisdiction shall be contacted.

GUIDANCE:

For work at an intersection, advance warning signs, devices, and markings should be used as appropriate on all roadway approaches to the intersection as appropriate.

When work will occur near non-signalized intersections where operational and capacity problems are anticipated, the highway agency having jurisdiction should be contacted.

For work at an intersection, advance warning signs, devices, and markings should be used on all cross streets, as appropriate. The typical applications depict urban intersections on arterial streets. Where the posted speed limit, the off-peak 85th-percentile speed prior to the work starting, or the anticipated speed exceeds 40 mph, additional warning signs should be used in the advance warning area.

Pedestrian crossings near TTC sites should be separated from the worksite by appropriate barriers that maintain the accessibility and detectability for pedestrians with disabilities.

A. Work Space on the Near Side of Intersections

SUPPORT:

Near side work spaces are simply handled as a midblock lane closure. When a lane is closed on the approach side of an intersection, standard lane closure and taper techniques apply. A 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.

OPTION:

When near-side work spaces are used, A exclusive turn lane may be converted for use as a through traffic lane.

Where space is restricted in advance of near-side work spaces, as with short block spacings, two warning signs may be used in the advance warning area, and a third action-type warning or a regulatory sign (such as a Keep Left sign) may be placed within the transition area.

B. Work Space on the Far Side of Intersections

SUPPORT:

Far-side work spaces require additional treatment because road users typically enter the activity area by straight-through and left or right turning movements.

GUIDANCE:

When a lane through an intersection must be closed on the far side, it should also be closed on the near-side approach to preclude merging movements within the intersection. Merging movements within the intersection should be avoided. Whenever possible, a taper should be provided in the closed lane for turning vehicles.

OPTION:

If there are a significant number of vehicles turning from a near-side lane that is closed on the far side, the near-side lane may be converted to an exclusive turn lane.

C. Work Space Within the Intersection

SUPPORT:

Layout 6K-42 provides guidance on applicable procedures for work performed within the intersection.

OPTION:

If the work is within the intersection, any of the following strategies may be used:

1. A small work space so that road users can move around it;
2. Flaggers or uniformed law enforcement officers to direct road users;
3. Work in stages so the work space is kept to a minimum; and.
4. Road closures or upstream diversions to reduce road user volumes.

GUIDANCE:

Depending on road user conditions, a flagger(s) and/or a uniformed law enforcement officer(s) should be used to control road users.

6G.14 Work Within the Traveled Way of a Freeway or Expressway

SUPPORT:

Due to the physical characteristics of these facilities, unique problems are encountered. Work under high-speed, high-volume motor vehicle traffic on a controlled access highway is complicated by the roadway design and operational features.

The presence of median dividers that establish separate roadways for directional traffic may also prohibit the closure of that roadway or the diverting of traffic to other lanes. Lack of access to and from adjacent roadways prohibits rerouting of traffic away from the activity area 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 a work space that protects workers.

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.

Problems of TTC might occur under the special conditions encountered where vehicular traffic must be moved through or around TTC zones on high-speed, high-volume roadways. Although the general principles outlined in the previous Sections of this Manual are applicable to all types of highways, high-speed, access controlled highways need special attention in order to accommodate vehicular traffic while also protecting road users and workers.

The road user volumes, road vehicle mix (buses, trucks, cars, and bicycles, if permitted), and speed of vehicles on these facilities require that careful TTC procedures be implemented, for example, to induce critical merging maneuvers well in advance of work spaces and in a manner that creates minimum turbulence and delay in the vehicular traffic stream. These situations often require more conspicuous devices than specified for normal rural highway or urban street use. However, the same important basic considerations of uniformity and standardization of general principles apply for all roadways.

Work under high-speed, high-volume vehicular traffic on a controlled access highway is complicated by the roadway design and operational features. The presence of a median that establishes separate roadways for directional vehicular traffic flow might prohibit the closing of one of the roadways or the diverting of vehicular traffic to the other roadway. Lack of access to and from adjacent roadways prohibits rerouting of vehicular traffic away from the work space in many cases. 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.

TTC for a typical lane closure on a divided highway is shown in Layout 6K-52. Temporary traffic controls for short duration and mobile operations on freeways are shown in Layout 6K-45. A typical application for shifting vehicular traffic lanes around a work space is shown in Layout 6K-59. TTC for multiple and interior lane closures on a freeway is shown in Layouts 6K-56 and 6K-57.

GUIDANCE:

The method for closing an interior lane when the open lanes have the capacity to carry vehicular traffic should be as shown in Layout 6K-52 When the capacity of the other lanes is needed, the method shown in Layout 6K-51 should be used.

6G.15 Two-Lane, Two-Way Traffic on One Roadway of a Normally Divided Highway

SUPPORT:

Two-lane, two-way operation on one roadway of a normally divided highway is a typical procedure that requires special consideration in the planning, design, and work phases, because unique operational problems (for example, increasing the risk of head-on crashes) can arise with the two-lane, two-way operation.

STANDARD:

When two-lane, two-way traffic control must be maintained on one roadway of a normally divided highway, opposing vehicular traffic shall be separated with either temporary traffic barriers (concrete safety-shape or approved alternate), channelizing devices, or a temporary raised island throughout the length of the two-way operation. The use of markings and complementary signing, by themselves, shall not be used.

SUPPORT:

Layouts 6J-3, 6J-4, and 6J-5 shows the procedure for two-lane, two-way operation. Treatments for entrance and exit ramps within the two-way roadway segment of this type of work are shown in Figures 6J-7 and 6J-8.

GUIDANCE:

The following items should be considered during the decision-making process:

A. Suitable detours
B. Characteristics of the traffic
C. Intersection closures and/or the perpetuation of turn lanes
D. Maintaining traffic on the shoulder
E. Construction of temporary lanes in the median
F. Construction of emergency pullouts in the two-lane, two-way section
G. Closing only one directional lane
H. Hazards to temporary traffic control zone personnel
I. Shortest contract time
J. Most efficient construction practice and least cost
K. Width or height restrictions
L. Condition of the pavement and the shoulders in the proposed TLTWO section.

STANDARD:

The traffic control plan shall include provisions for separation of opposing traffic whenever two-way traffic must be maintained on one roadway of a normally divided highway. When traffic must be maintained on one roadway of a normally divided highway, opposing traffic shall be separated either with portable barriers, or with channelizing devices throughout the length of the two-way operation.

OPTION:

Striping, raised pavement markers, and signing, either alone or in combination, are used to complement separation devices. Alone or in combination, they do not meet the requirements for traffic separation.

STANDARD:

When the directional roadway is closed, inapplicable WRONG WAY signs and markings, and other existing traffic control devices within the temporary two-lane, two-way operations section, and at intersections shall be covered, removed, or obliterated.

SUPPORT:

In a TLTWO, diverting traffic to the opposing left lane exposes the traffic to unprotected roadside hazards. These hazards may include unprotected bridge piers, bridge rail, and guard rail ends.

STANDARD:

Prior to diverting traffic, these roadside hazards shall be delineated and/or protected per the AASHTO Roadside Design Guide.

The TLTWO shall be used only after careful consideration of other available methods of traffic control.

OPTION:

It may be necessary to laterally shift one or more lanes of traffic.

STANDARD:

If more than one lane is being shifted, even for a short term operation, in-place markings shall be covered or removed and temporary markings shall be installed.

6G.16 Crossovers

GUIDANCE:

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

A. Tapers for lane drops should be separated from the crossovers.
B. Crossovers should be designed for speeds not less than 10 miles per hour below the posted speed prior to work starting. If unusual site conditions require that a lower design speed be used, the signing should reflect an advisory speed determined by engineering judgment or study.
C. A good array of channelizing devices, delineators, and full-length, properly placed pavement markings should be provide drivers with a clearly defined travel path.
D. The design of the crossover should accommodate all roadway traffic including trucks and buses.
E. A clear area should be provided adjacent to the crossover.

SUPPORT:

Temporary traffic barriers and the excessive use of TTC devices cannot compensate for poor geometric and roadway cross-section design of crossovers.

6G.17 Interchanges

GUIDANCE:

Access to interchange ramps on limited-access highways should be maintained even if the work space is in the lane adjacent to the ramps. Access to exit ramps should be clearly marked and delineated with channelizing devices. For long-term projects, conflicting pavement markings should be removed and new ones placed. Early coordination with officials having jurisdiction over the affected cross streets and providing emergency services should occur before ramp closings.

OPTION:

If access is not possible, ramps may be closed by using signs and Type 3 Barricades. As the work space changes, the access area may be changed, as shown in Layout 6K-60. A TTC zone in the exit ramp may be handled as shown in Layout 6K-63.

When a work space interferes with an entrance ramp, a lane may need to be closed on the highway. Work in the entrance ramp may require shifting ramp vehicular traffic. TTC for both operations is shown in Layouts 6K-61 and 6K-62.

GUIDANCE:

Egress to exit ramps should be clearly marked and outlined with channelizing devices.

Advance warning sign spacing is dependent upon the length of the ramp and the exact location of signs is determined in the field. Spacing of the signs should be as long as practicable. A minimum lane width of 10 feet on exit ramps should be maintained.

6G.18 Work in the Vicinity of a Grade Crossing

STANDARD:

When grade crossings exist either within or in the vicinity of a TTC zone, lane restrictions, flagging, or other operations shall not create conditions where vehicles can be queued across the tracks. If the queuing of vehicles across the tracks cannot be avoided, a uniformed law enforcement officer or flagger shall be provided at the crossing to prevent vehicles from stopping on the tracks, even if automatic warning devices are in place.

SUPPORT:

Layout 6J-14 shows work in the vicinity of a highway-rail grade crossing.

GUIDANCE:

Early coordination with the railroad company or light rail transit agency should occur before work starts.

6G.19 Temporary Traffic Control During Nighttime Hours

SUPPORT:

Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

Conducting highway construction and maintenance activities during night hours could provide an advantage when traditional daytime traffic control strategies cannot achieve an acceptable balance between worker and public safety, traffic and community impact, and constructability. The two basic advantages of working at night are reduced traffic congestion and less involvement with business activities. However, the two basic conditions that must normally be met for night work to offer any advantage are reduced traffic volumes and easy set up and removal of the traffic control patterns on a nightly basis.

Shifting work activities to night hours, when traffic volumes are lower and normal business is less active, might offer an advantage in some cases, as long as the necessary work can be completed and the worksite restored to essentially normal operating conditions to carry the higher traffic volume during non-construction hours.

Although working at night might offer advantages, it also includes safety issues. Reduced visibility inherent in night work impacts the performance of both drivers and workers. Because traffic volumes are lower and congestion is minimized, speeds are often higher at night necessitating greater visibility at a time when visibility is reduced. Finally, the incidence of impaired (alcohol or drugs), fatigued, or drowsy drivers might be higher at night.

Working at night also involves other factors, including construction productivity and quality, social impacts, economics, and environmental issues. A decision to perform construction or maintenance activities at night normally involves some consideration of the advantages to be gained compared to the safety and other issues that might be impacted.

GUIDANCE:

Considering the safety issues inherent to night work, consideration should be given to enhancing traffic controls (see Section 6G.4) to provide added visibility and driver guidance, and increased protection for workers.

In addition to the enhancements listed in Section 6G.4, consideration should be given to providing additional lights and retroreflective markings to workers, work vehicles, and equipment.

OPTION:

Where reduced traffic volumes at night make it feasible, the entire roadway may be closed by detouring traffic to alternate facilities, thus removing the traffic risk from the activity area.

GUIDANCE:

Because typical street and highway lighting is rarely adequate to provide sufficient levels of illumination for work tasks, temporary lighting should be provided where workers are active to supply sufficient illumination to reasonably safely perform the work tasks.

Temporary lighting for night work should be designed such that glare does not interfere with driver visibility, or create visibility problems for truck drivers, equipment operators, flaggers, or other workers.

Consideration should be given to stationing uniformed law enforcement officers and lighted patrol cars at night work locations where there is a concern that high speeds or impaired drivers might result in undue risks for workers or other drivers.

STANDARD:

Except in emergencies, temporary lighting shall be provided at all flagger stations.

SUPPORT:

Desired illumination levels vary depending upon the nature of the task involved. An average horizontal luminance of 5 foot candles can be adequate for general activities. An average horizontal luminance of 10 foot candles can be adequate for activities around equipment. Tasks requiring high levels of precision and extreme care can require an average horizontal luminance of 20 foot candles.

6G.20 Installation, Maintenance and Inspection of Temporary Traffic Control

GUIDANCE:

Prior to installing any traffic control device, it should be inspected for condition, reflectorization and standard shape, size, color and message. If the device is not standard or in good condition, it should be replaced immediately. See Section 6K (the Field Manual) for Quality Standards.

Existing signs that do not apply or conflict with temporary traffic control should be removed or covered. If the sign is removed it should be carefully stored for re-installation when the temporary traffic control zone is removed.

SUPPORT:

When covering a sign, care should be taken not to damage the sign face. When placing another hard material over the sign face, plastic spacers need to be inserted to avoid scratching the sign face. Translucent materials and materials that may become damaged by the weather are not acceptable coverings.

Temporary traffic control zone signs that are installed prior to the start of work also need to be covered, rotated or folded to avoid giving the driver an erroneous message.

STANDARD:

When work is not in progress and the hazard no longer exists, devices shall be covered or removed.

Traffic control devices shall be installed in the order that drivers will see them, starting with the sign or device that is furthest from the work space.

OPTION:

If traffic in both directions will be affected, such as work in the center lanes, the devices can be placed in both directions at the same time.

GUIDANCE:

When one direction of traffic will be directed into the opposing lanes of traffic, all traffic controls for the opposing traffic should be installed first.

The devices should be removed as soon as the work is completed and they are no longer needed. Devices should be removed in the opposite order from which they were installed. Devices closest to the work space should be removed first.

SUPPORT:

After the temporary traffic control zone is inplace, it is helpful to inspect the zone by driving through the zone. Driver's actions and reactions should be noted and if any problems are encountered, they should be quickly corrected.

GUIDANCE:

Any major modifications to the Traffic Control Plan or standard layouts and the reasons for the modifications should be documented.

SUPPORT:

During the life of a temporary traffic control zone, maintenance is needed. On short term operations, vehicles may knock over cones which then need to be placed upright. For intermediate term and long term operations, accidents, weather, dirt and vandalism may affect the traffic control devices.

GUIDANCE:

A regular plan for inspection and maintenance should be implemented to ensure that all devices remain functional and in good repair throughout the life of the temporary traffic control zone. If problems are encountered, they should be corrected immediately and documented.

Any hazard (i.e. pothole, washout, damaged guardrail) should be repaired as soon as possible. However, when the hazard cannot be immediately repaired, or is not directly in the traveled way, it should be marked. Hazards should be marked with a reflectorized drum(s) or Type I or Type II barricade(s) with a Type A, low intensity flashing warning light attached.

SUPPORT:

Other problems may be noted during routine inspections which may indicate a problem with the driver's perception of the zone. Skid marks, broken glass and devices continually knocked over may indicate a lack of advance warning or other problem with the temporary traffic control.

GUIDANCE:

The zone should be reviewed during day and night to determine the problem and take appropriate corrective action.

SUPPORT:

The frequency of inspection and maintenance will vary depending on the project size, duration, volume of traffic and complexity of the zone. Good communication and clear lines of responsibility will assist in resolving problems promptly.

PART 6. TEMPORARY TRAFFIC CONTROL

Chapter 6H. Speed Limits in Temporary Traffic Control Zones

6H-1 General

SUPPORT:

There are three different methods of speed limit signing available for speed control in temporary traffic control zones, advisory speeds, temporary speed limits in construction zones, and work zone speed limits. It must be noted that signing alone will not reduce the speed through a temporary traffic control zone. The driver must clearly perceive the need to reduce speed before a reduction in speed can be achieved. The worker should not feel a false sense of security with temporary traffic control zone speed limits inplace. The speed limit in temporary traffic control zones must be used correctly and judiciously to obtain the maximum effectiveness, to earn drivers respect and to gain compliance.

OPTION:

The following types of control may be used in construction or maintenance temporary traffic control zones. In order to achieve maximum benefit, the speed zone must be correctly installed, documented, maintained and removed in a timely manner.

SUPPORT:

The posted speed must be reasonable to the driver.

Just as with any type of temporary traffic control zone signing, leaving speed limit signs inplace when they are clearly not needed causes driver disrespect and encourages non-compliance.

GUIDANCE:

The temporary traffic control speed limit should be carefully documented. This documentation shall include the location of the road, the reference point of the temporary traffic control zone, the date/time installed, direction of travel, the speed installed and the date/time removed.

6H-2 Advisory Speeds

SUPPORT:

The purpose of advisory speeds is to identify safe speeds for specific hazards. Warning signs with advisory speed plaques warn drivers of a particular hazard or a potentially hazardous condition and indicate the safe speed at which to take the hazard. Examples of situations where an advisory speed plaque may be used are bypasses to indicate the curve, low and no shoulder situations, and where there is reduced visibility due to work activities, environmental factors or geometrics.

OPTION:

Advisory speed plaques may be posted any time a hazard is present; an authorization from the Commissioner of Transportation is not necessary.

GUIDANCE:

Traffic engineering personnel should be consulted as to the reasonable speed to be posted.

SUPPORT:

In some situations such as sharp curves, there are recommended maximum speeds established for a certain degree of curve. In situation other than horizontal curves, the proper advisory speed is determined by experience and good engineering judgement.

STANDARD:

When used, the Advisory Speed Plaque (W13-I) shall be installed below the appropriate advance warning sign(s) or below the Worker Ahead sign (W21-1a).

The advisory speed plaque shall be the same color as the warning sign it is installed with and be at least 24 x 24 inches.

Advisory speed plaques shall not be posted alone.

Inplace speed limits shall be reviewed to ensure that the advisory speed is not greater than the regulatory speed.

GUIDANCE:

Once installed, the advisory speed should be tested by driving through the hazard at the posted advisory speed.

Care should be taken when posting an advisory speed plaque that it is not placed near a regulatory speed sign so that the motorist may confuse the two speeds.

6H-3 Temporary Speed Limits in a Construction Zone

SUPPORT:

Temporary speed limits in a construction zone are regulatory speed limits that indicate a full-time regulatory speed through a temporary traffic control zone or a detour. They are established for long term stationary temporary traffic control zones and remain inplace on a twenty four hour basis. These speed limits are used where the physical features of the roadway require lower vehicle speeds. Examples include a detour with poor geometrics or a two-lane, two-way operation on what is normally a four-lane

divided highway. Temporary speed limits are primarily used to provide safety for the motorist. They are not used if the workers are directly adjacent to the travelled thru lane with no protection.

STANDARD:

An order from the Commissioner of Transportation shall be obtained to establish a temporary speed limit on all roads. A traffic engineering investigation shall be performed in order to establish a safe and reasonable speed limit.

GUIDANCE:

The traffic control zone should also be monitored throughout the duration of the project to ensure that the appropriate speed limit is inplace. The date of installation and removal of the signs should be documented on the speed limit authorization form for enforcement purposes.

STANDARD:

The SPEED LIMIT signs (R2-1) used for the temporary speed zone shall have a black legend and border on a white background. They shall be installed at the beginning of the temporary traffic control zone and a second sign installed 750 feet into the zone as a confirmation sign. At the end of the temporary traffic control zone, a SPEED LIMIT sign with the original speed limit for the roadway shall be installed to indicate the end of the zone and the return to normal driving conditions (see Layout 6J-22).

When the temporary speed limit results in a reduction of 15 mph or greater from the previous zone, a Speed Reduction sign (W3-5) shall be installed in advance of the temporary traffic control zone.

6H-4 Work Zone Speed Limits

SUPPORT:

A work zone speed limit is a regulatory speed limit in a temporary traffic control zone to improve worker safety.

STANDARD:

A work zone speed limit shall not be used on a two-lane, two-way roadway or wherever a closed lane separates the traffic from the work space.

These speed limits shall only be used when workers are present and working directly adjacent to the traveled lanes. Work zone speed limits shall be removed or covered during non-working hours.

GUIDANCE:

Typical applications where work zone speed limits should be used include a concrete joint repair project, or a bituminous paving project where workers are adjacent to traffic.

OPTION:

The local road authority may authorize a work zone speed limit within the limitations established in Minnesota Statutes 169.14, subdivision 5d.

SUPPORT:

Statutes provide for a maximum work zone speed limit of 55 mph on divided , four-lane highways and a maximum of 40 mph on other roads. The statute allows for reducing the existing speed limit by as much as 15 mph. However, the work zone speed limit must be always be 20 mph or greater and not exceed the maximum permitted work zone speed limits. As a rule, a 10 mph speed limit reduction will gain the best compliance.

R2-6aP

R2-1

STANDARD:

A work zone speed limit assembly shall consist of a black and white SPEED LIMIT sign (R2-1) with a black and orange FINES DOUBLE sign (R2-6aP) installed above it.

GUIDANCE:

A work zone speed limit assembly should be placed near that portion of the work zone where the workers are actually working. An advance speed limit sign should be placed at least 300 feet in advance of the work area to notify drivers of the reduction in speed.

STANDARD:

As the work activity proceeds downstream thru the work area, the advance speed sign shall be no greater than 2500 feet from the active work area where workers are present. When the workers reach this distance, the sign shall be relocated closer to the active work area.

SUPPORT:

If the work activity is rather stationary, studies have shown that the optimum speed reduction and compliance occurs when the advance speed sign is located approximately 1200 feet in advance of the active work crew.

STANDARD:

All work zone speed limit sign assemblies shall be installed on the edge of the shoulder of the thru lane at a least one foot above the pavement.

All inplace speed limit signing shall be removed, folded or covered while the work zone speed limit is inplace.

OPTION:

Where the work zone speed limit signs are installed and removed each day, the inplace speed limit signs may be covered for the duration of the project if the inplace speed limit is determined by state statute or matches a statutory value. For other speeds limits, the first sign of the inplace speed zone and the inplace speed limit signs at major intersections shall be covered and uncovered daily.

STANDARD:

All work zone speed limit signs shall be covered, folded, or removed when the workers are not present or are not working directly adjacent to traffic.

6H-5 Guidelines for Work Zone Speed Limits

SUPPORT:

Guidelines, proper layouts, and procedures for implementing work zone speed limits in highway work zones may be found in the publication "Work Zone Speed Limit Guidelines." (see Section 1A.11)

The publication is also available on the MnDOT, Traffic Engineering website at:

http://www.dot.state.mn.us/trafficeng/

PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6I. Control of Traffic Through Traffic Incident Management Areas

6I.1 General

SUPPORT:

The National Incident Management System (NIMS) requires the use of the Incident Command System (ICS) at traffic incident management scenes.

A traffic incident is an emergency road user occurrence, a natural disaster, or other unplanned event that affects or impedes the normal flow of traffic.

A traffic incident management area is an area of a highway where temporary traffic controls are installed, as authorized by a public authority or the official having jurisdiction of the roadway, in response to a road user incident, natural disaster, hazardous material spill, or other unplanned incident. It is a type of TTC zone and extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a point where vehicles return to the original lane alignment and are clear of the incident.

Traffic incidents can be divided into three general classes of duration, each of which has unique traffic control characteristics and needs. These classes are:

A. Major-expected duration of more than 2 hours,
B. Intermediate-expected duration of 30 minutes to 2 hours, and
C. Minor-expected duration under 30 minutes.

The primary functions of TTC at a traffic incident management area are to inform road users of the incident and to provide guidance information on the path to follow through the incident area. Alerting road users and establishing a well defined path to guide road users through the incident area will serve to protect the incident responders and those involved in working at the incident scene and will aid in moving road users expeditiously past or around the traffic incident, will reduce the likelihood of secondary traffic crashes, and will preclude unnecessary use of the surrounding local road system. Examples include a stalled vehicle blocking a lane, a traffic crash blocking the traveled way, a hazardous material spill along a highway, and natural disasters such as floods and severe storm damage.

GUIDANCE:

In order to reduce response time for traffic incidents, highway agencies, appropriate public safety agencies (law enforcement, fire and rescue, emergency communications, emergency medical, and other emergency management), and private sector responders (towing and recovery and hazardous materials contractors) should mutually plan for occurrences of traffic incidents along the major and heavily traveled highway and street system.

On-scene responder organizations should train their personnel in TTC practices for accomplishing their tasks in and near traffic and in the requirements for traffic incident management contained in this Manual. On-scene responders should take measures to move the incident off the traveled roadway or to provide for appropriate warning. All on-scene responders and news media personnel should constantly be aware of their visibility to oncoming traffic and wear high-visibility apparel.

Emergency vehicles should be safe-positioned (see definition in Section 1A.13) such that traffic flow through the incident scene is optimized. All emergency vehicles that subsequently arrive should be positioned in a manner that does not interfere with the established temporary traffic flow.

Responders arriving at a traffic incident should estimate the magnitude of the traffic incident, the expected time duration of the traffic incident, and the expected vehicle queue length, and then should set up the appropriate temporary traffic controls for these estimates.

OPTION:

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

W20-X3 W20-X16 W21-X5

SUPPORT:

While some traffic incidents might be anticipated and planned for, emergencies and disasters might pose more severe and unpredictable problems. The ability to quickly install proper temporary traffic controls might greatly reduce the effects of an incident, such as secondary crashes or excessive traffic delays. An essential part of fire, rescue, spill clean-up, highway agency, and enforcement activities is the proper control of road users through the traffic incident management area in order to protect responders, victims, and other personnel at the site. These operations might need corroborating legislative authority for the implementation and enforcement of appropriate road user regulations, parking controls, and speed zoning. It is desirable for these statutes to provide sufficient flexibility in the authority for, and implementation of, TTC to respond to the needs of changing conditions found in traffic incident management areas.

OPTION:

For traffic incidents, particularly those of an emergency nature, TTC devices on hand may be used for the initial response as long as they do not themselves create unnecessary additional hazards.

6I.2 Major Traffic Incidents

SUPPORT:

Major traffic incidents are typically traffic incidents involving hazardous materials, fatal traffic crashes involving numerous vehicles, and other natural or man-made disasters. These traffic incidents typically involve closing all or part of a roadway facility for a period exceeding 2 hours.

GUIDANCE:

If the traffic incident is anticipated to last more than 24 hours, applicable procedures and devices set forth in other Chapters of Part 6 should be used.

SUPPORT:

A road closure can be caused by a traffic incident such as a road user crash that blocks the traveled way. Road users are usually diverted through lane shifts or detoured around the traffic incident and back to the original roadway. A combination of traffic engineering and enforcement preparations is needed to determine the detour route, and to install, maintain or operate, and then to remove the necessary traffic control devices when the detour is terminated. Large trucks are a significant concern in such a detour, especially when detouring them from a controlled-access roadway onto local or arterial streets.

During traffic incidents, large trucks might need to follow a route separate from that of automobiles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous material might need to follow a different route from other vehicles.

Some traffic incidents such as hazardous material spills might require closure of an entire highway. Through road users must have adequate guidance around the traffic incident. Maintaining good public relations is desirable. The cooperation of the news media in publicizing the existence of, and reasons for, traffic incident management areas and their TTC can be of great assistance in keeping road users and the general public well informed.

The establishment, maintenance, and prompt removal of lane diversions can be effectively managed by interagency planning that includes representatives of highway and public safety agencies.

GUIDANCE:

All traffic control devices needed to set up the TTC at a traffic incident should be available so that they can be readily deployed for all major traffic incidents. The TTC should include the proper traffic diversions, tapered lane closures, and upstream warning devices to alert traffic approaching the queue and to encourage early diversion to an appropriate alternative route.

Attention should be paid to the upstream end of the traffic queue such that warning is given to road users approaching the back of the queue.

If manual traffic control is needed, it should be provided by qualified flaggers or uniformed law enforcement officers.

OPTION:

If flaggers are used to provide traffic control for an incident management situation, the flaggers may use appropriate traffic control devices that are readily available or that can be brought to the traffic incident scene on short notice.

GUIDANCE:

When light sticks or flares are used to establish the initial traffic control at incident scenes, channelizing devices (see Section 6F.63) should be installed as soon thereafter as practical.

OPTION:

The light sticks or flares may remain in place if they are being used to supplement the channelizing devices.

GUIDANCE:

The light sticks, flares, and channelizing devices should be removed after the incident is terminated.

6I.3 Intermediate Traffic Incidents

SUPPORT:

Intermediate traffic incidents typically affect travel lanes for a time period of 30 minutes to 2 hours, and usually require traffic control on the scene to divert road users past the blockage. Full roadway closures might be needed for short periods during traffic incident clearance to allow traffic incident responders to accomplish their tasks.

The establishment, maintenance, and prompt removal of lane diversions can be effectively managed by interagency planning that includes representatives of highway and public safety agencies.

GUIDANCE:

All traffic control devices needed to set up the TTC at a traffic incident should be available so that they can be readily deployed for intermediate traffic incidents. The TTC should include the proper traffic diversions, tapered lane closures, and upstream warning devices to alert traffic approaching the queue and to encourage early diversion to an appropriate alternative route.

Attention should be paid to the upstream end of the traffic queue such that warning is given to road users approaching the back of the queue.

If manual traffic control is needed, it should be provided by qualified flaggers or uniformed law enforcement officers.

OPTION:

If flaggers are used to provide traffic control for an incident management situation, the flaggers may use appropriate traffic control devices that are readily available or that can be brought to the traffic incident scene on short notice.

GUIDANCE:

When light sticks or flares are used to establish the initial traffic control at incident scenes, channelizing devices (see Section 6F.63) should be installed as soon thereafter as practical.

OPTION:

The light sticks or flares may remain in place if they are being used to supplement the channelizing devices.

GUIDANCE:

The light sticks, flares, and channelizing devices should be removed after the incident is terminated.

6I.4 Minor Traffic Incidents

SUPPORT:

Minor traffic incidents are typically disabled vehicles and minor crashes that result in lane closures of less than 30 minutes. On-scene responders are typically law enforcement and towing companies, and occasionally highway agency service patrol vehicles.

Diversion of traffic into other lanes is often not needed or is needed only briefly. It is not generally possible or practical to set up a lane closure with traffic control devices for a minor traffic incident. Traffic control is the responsibility of on-scene responders.

GUIDANCE:

When a minor traffic incident blocks a travel lane, it should be removed from that lane to the shoulder as quickly as possible.

6I.5 Use of Emergency-Vehicle Lighting

SUPPORT:

The use of emergency-vehicle lighting (such as high-intensity rotating, flashing, oscillating, or strobe lights) is essential, especially in the initial stages of a traffic incident, for the safety of emergency responders and persons involved in the traffic incident, as well as road users approaching the traffic incident. Emergency-vehicle lighting, however, provides warning only and provides no effective traffic control. The use of too many lights at an incident scene can be distracting and can create confusion for approaching road users, especially at night. Road users approaching the traffic incident from the opposite direction on a divided facility are often distracted by emergency-vehicle lighting and slow their vehicles to look at the traffic incident posing a hazard to themselves and others traveling in their direction.

The use of emergency-vehicle lighting can be reduced if good traffic control has been established at a traffic incident scene. This is especially true for major traffic incidents that might involve a number of emergency vehicles. If good traffic control is established through placement of advanced warning signs and traffic control devices to divert or detour traffic, then public safety agencies can perform their tasks on scene with minimal emergency-vehicle lighting.

GUIDANCE:

Public safety agencies should examine their policies on the use of emergency-vehicle lighting, especially after a traffic incident scene is secured, with the intent of reducing the use of this lighting as much as possible while not endangering those at the scene. Special consideration should be given to reducing or extinguishing forward facing emergency-vehicle lighting, especially on divided roadways, to reduce distractions to oncoming road users.

Because the glare from floodlights or vehicle headlights can impair the nighttime vision of approaching road users, any floodlights or vehicle headlights that are not needed for illumination, or to provide notice to other road users of an incident response vehicle being in an unexpected location, should be turned off at night.

PART 6. TEMPORARY TRAFFIC CONTROL
Chapter 6J. Long Term Temporary Traffic Control Zone Layouts

6J-1 General

SUPPORT:

This section illustrates typical layouts which provide additional guidance for individuals with traffic engineering expertise.

GUIDANCE:

These layouts should be used during the development of detailed traffic control plans. They should only be used under the direction of a traffic engineering professional. They should be combined with the principles and figures contained elsewhere in this manual.

OPTION:

Some of these layouts may be used on short term construction or maintenance projects.

SUPPORT:

The concepts shown in the following layouts are only intended to be guidelines.

Symbols	Meaning
	Flagger or Operator of Automated Flagging Assistance Device
AFAD	Automated Flagging Assistance Device (AFAD)
	Flashing Arrow Board
CHANGEABLE MESSAGE SIGN (PCMS) / RIGHT LANE CLOSED	Portable Changeable Message Sign (PCMS)
E	Portable Equipment - includes testing devices, detection, surveying, etc.
	Portable Traffic Signal
	360-Degree Yellow Flashing Vehicle Light(s)
	Longitudinal Channelizer
	Type III Barricade
ROAD WORK AHEAD	Traffic Control Sign
	Reboundable Sign Support
F	Type A Flashing Warning Light
	Surface mounted delineator
	Channelizing Device.
	A combination of Type A and B channelizing devices
	Direction of Traffic
6	See Note; i.e. See Note 6
	Work Space

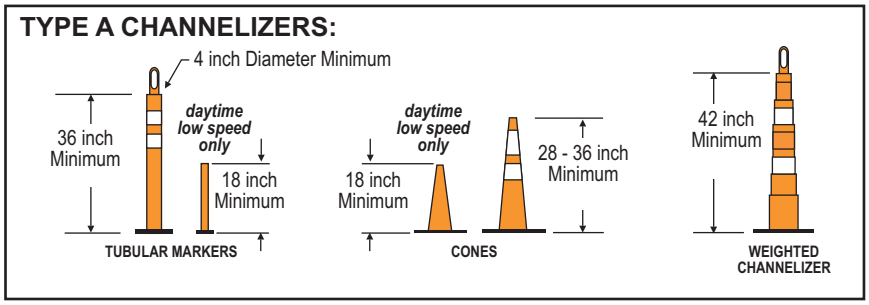
Figure 6J-1 Symbols Used in Typical Layouts

Temporary Traffic Control Distance Charts

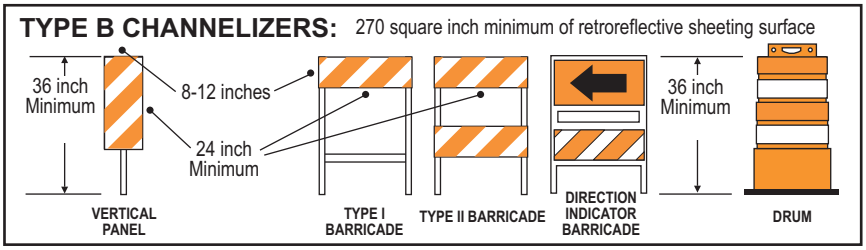
Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Decision Sight Distance (D) feet	Taper Length (*12 ft lane*) (L) feet	Shifting Taper (L/2) feet	Typical Shoulder Taper (L/3) feet
0 - 30	G = 25 ft	250	550	200	100	75
35 - 40		325	700	325	175	125
45 - 50	G = 50 ft	600	900	600	300	200
55		750	1200	700	350	250
60 - 65		1000	1400	800	400	275
70 - 75		1200	1600	900	450	300

Posted Speed Limit Prior to Work Starting (mph)		Buffer Space (B) feet	Shadow Vehicle Following Distance (F) feet	Protection Vehicle Roll-Ahead Buffer Distance (with or without TMA) (R) Moving (15 mph max) feet	Stopped feet
0 - 30	G = 25 ft	85	250 - 550	100	100
35 - 40		170	325 - 700	100	100
45 - 50	G = 50 ft	280	600 - 900	175	125
55		335	750 - 1200	175	125
60 - 65		485	1000 - 1400	225	175
70 - 75		670	1200 - 1600	225	175

Type A channelizing devices are typically used in attended temporary traffic control zones.*

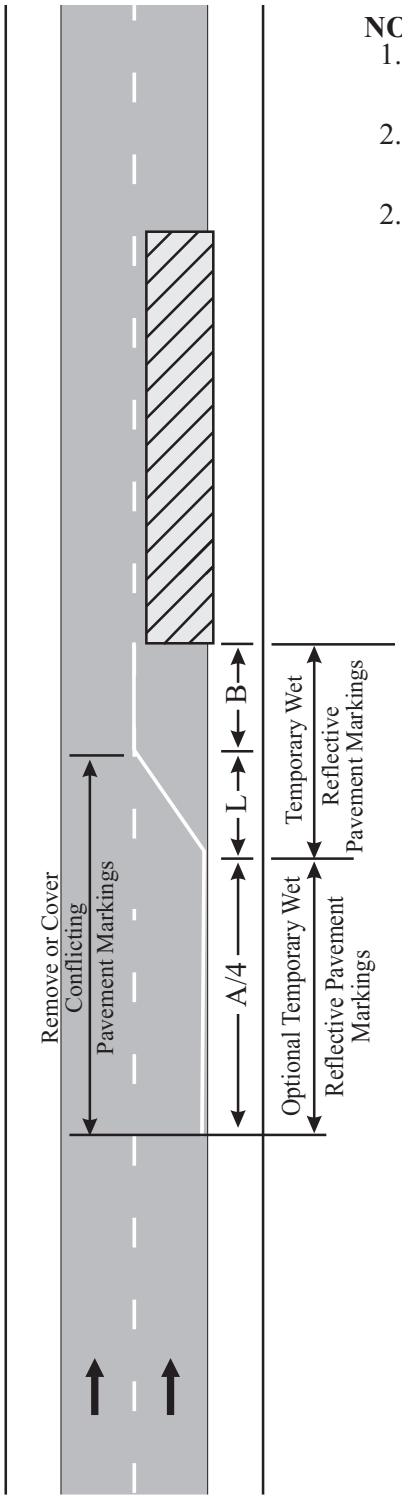


Type B channelizing devices shall be used if the temporary traffic control zone will be installed for more than 12 hours or if it is left unattended over night.*



* See the MN MUTCD, Part 6F for more details on application restrictions.

Figure 6J-2 Temporary Traffic Control Devices and Distance Charts



NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.

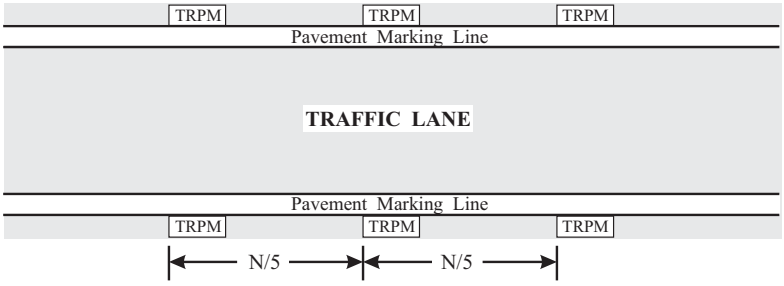
2. Traffic control devices are not shown. Use appropriate lane closure.

2. Install wet reflective edgelines through the transition and alignment change areas including lane closure tapers, sharp curves, exits, shifts onto temporary roadways, etc.

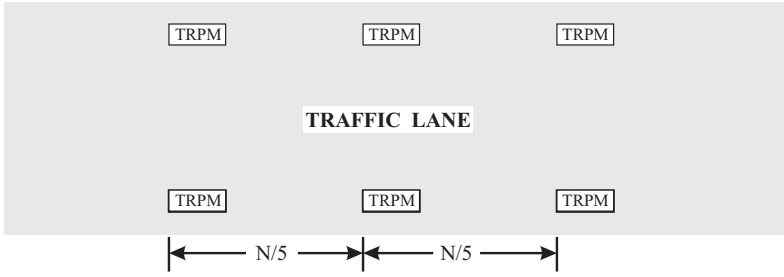
TYPICAL STRIPING AND STRIPE REMOVAL FOR LANE CLOSURE
MULTILANE DIVIDED ROAD

LONG TERM

LAYOUT 6J-1



SUPPLEMENTING A SOLID LINE



SIMULATING A SOLID LINE

SUPPLEMENTING A BROKEN LINE

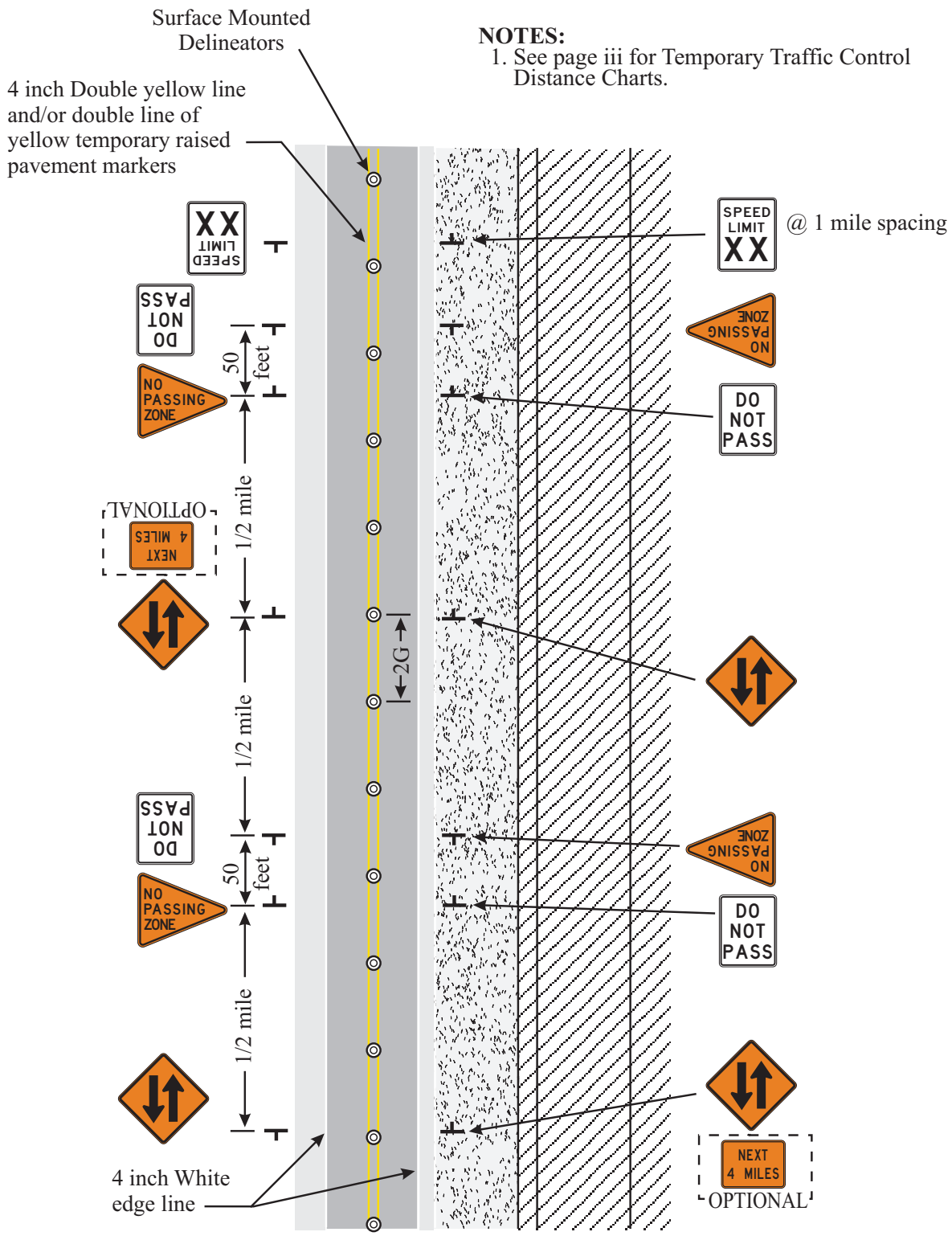
SIMULATING A BROKEN LINE

N = the length of one line segment plus one gap

PLACEMENT AND SPACING OF TEMPORARY RAISED PAVEMENT MARKERS (TRPMs)

LONG TERM

LAYOUT 6J-2

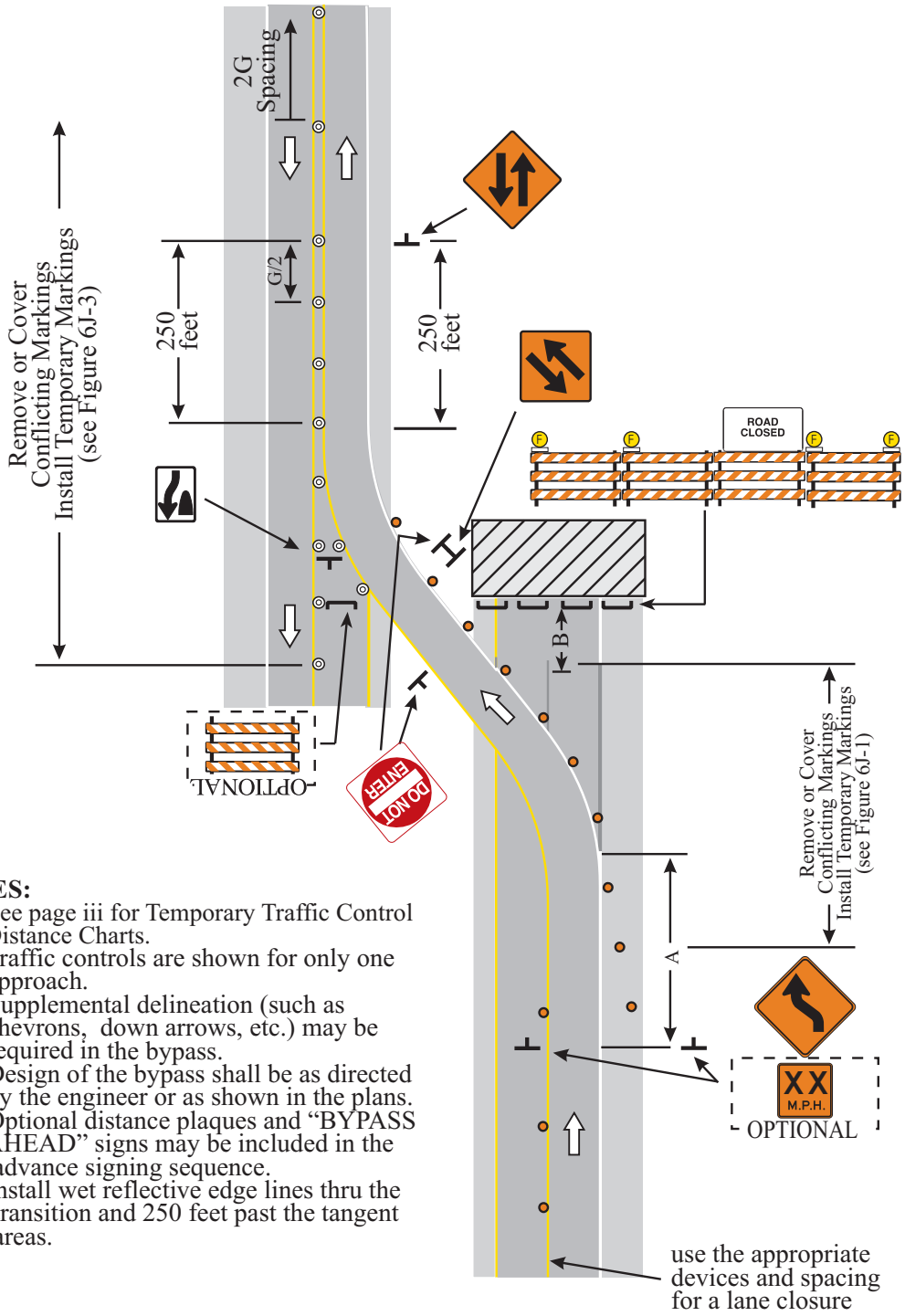


NOTES:
1. See page iii for Temporary Traffic Control Distance Charts.

TYPICAL SECTION FOR TWO-LANE, TWO-WAY OPERATIONS
MULTILANE DIVIDED ROAD

LONG TERM

LAYOUT 6J-3



NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Traffic controls are shown for only one approach.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required in the bypass.
4. Design of the bypass shall be as directed by the engineer or as shown in the plans.
5. Optional distance plaques and "BYPASS AHEAD" signs may be included in the advance signing sequence.
6. Install wet reflective edge lines thru the transition and 250 feet past the tangent areas.

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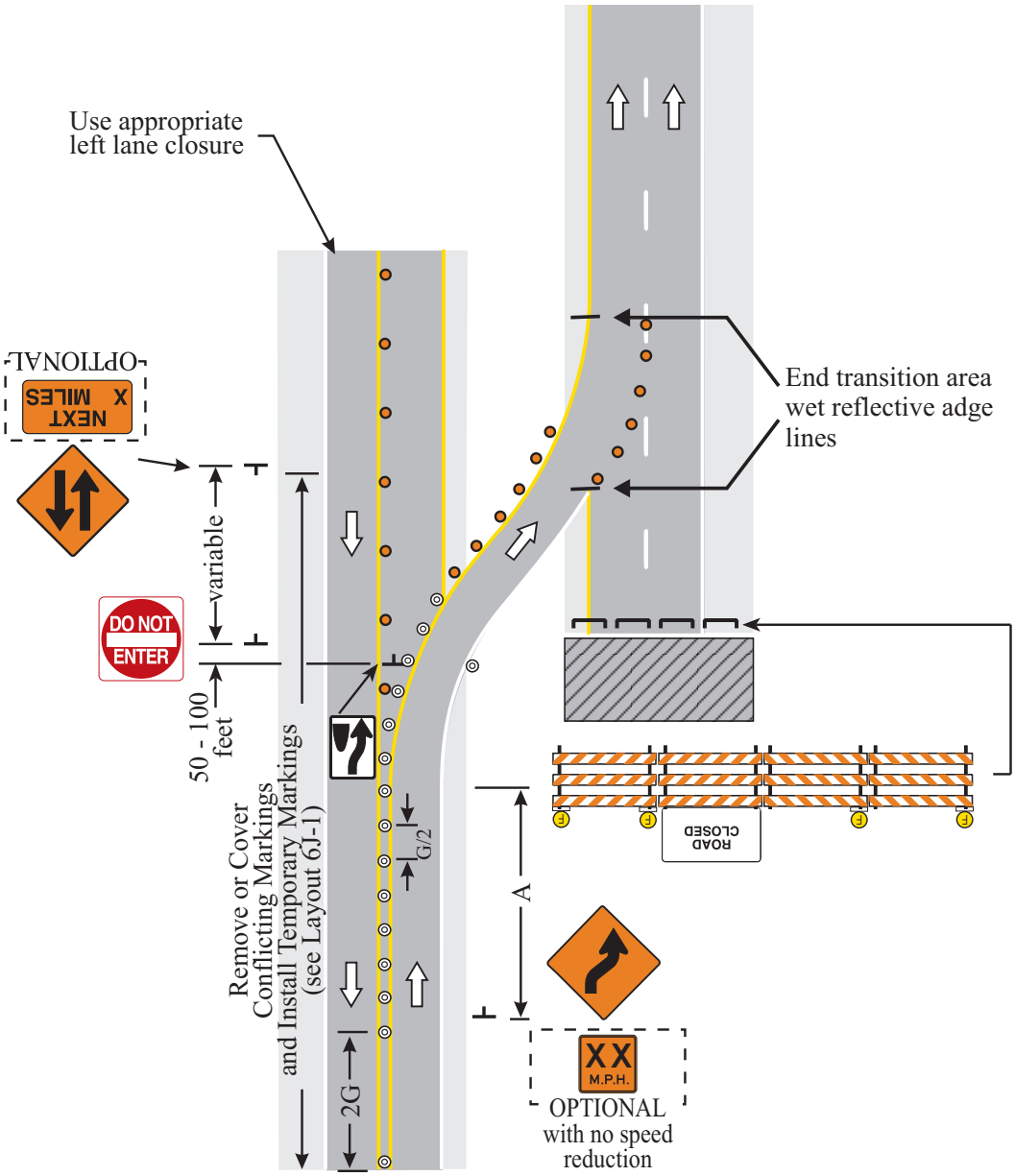
TYPICAL CROSSOVER TO TWO-LANE, TWO-WAY OPERATIONS
MULTILANE DIVIDED ROAD

LONG TERM

LAYOUT 6J-4

NOTES:

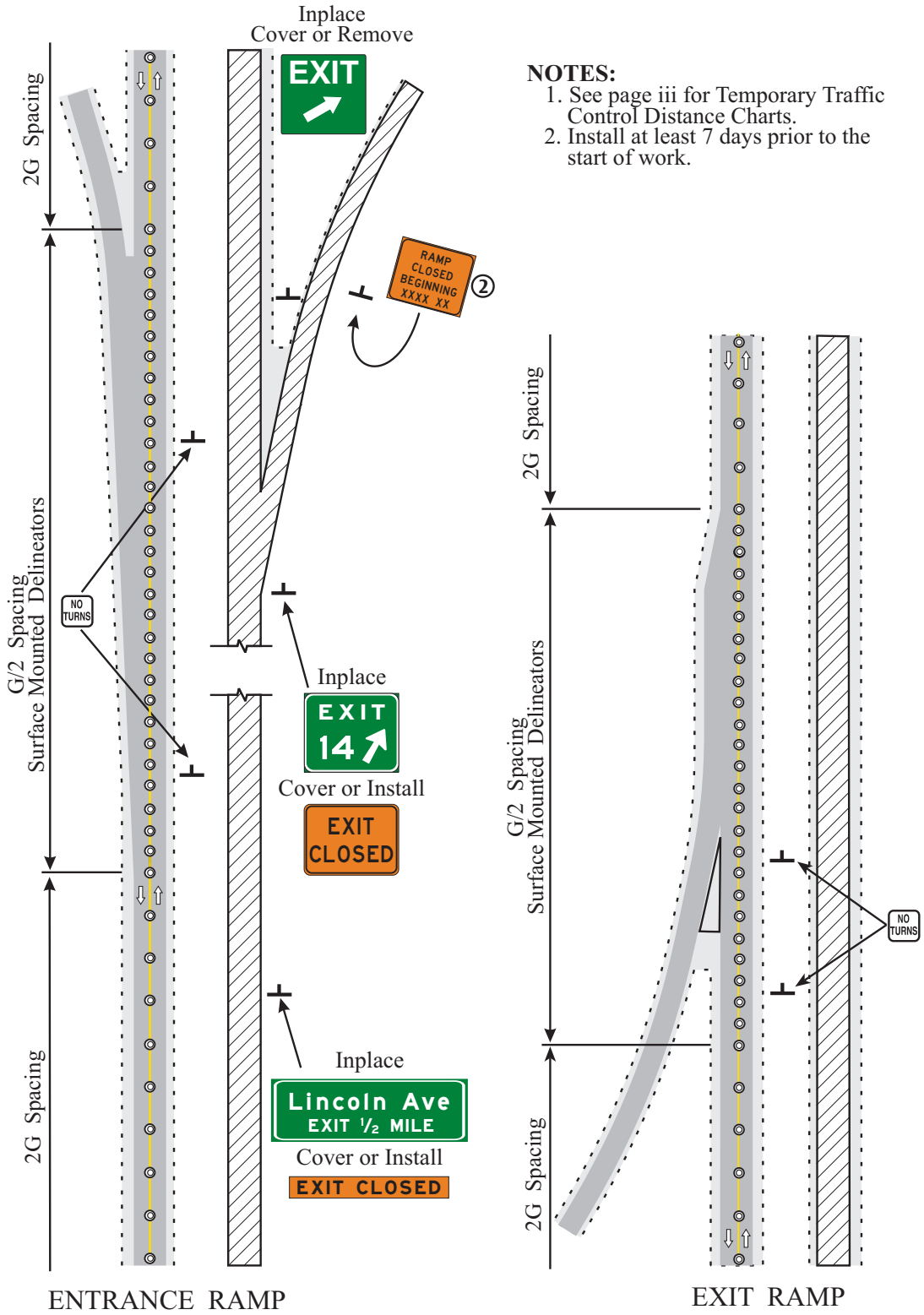
1. See page iii for Temporary Traffic Control Distance Charts.
2. Traffic controls are shown for only one approach.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required in the bypass.
4. Install wet reflective edge lines thru the transition and 250 feet past the tangent areas.



TYPICAL CROSSOVER FROM A TWO-LANE, TWO-WAY OPERATION
MULTILANE DIVIDED ROAD

LONG TERM

LAYOUT 6J-5



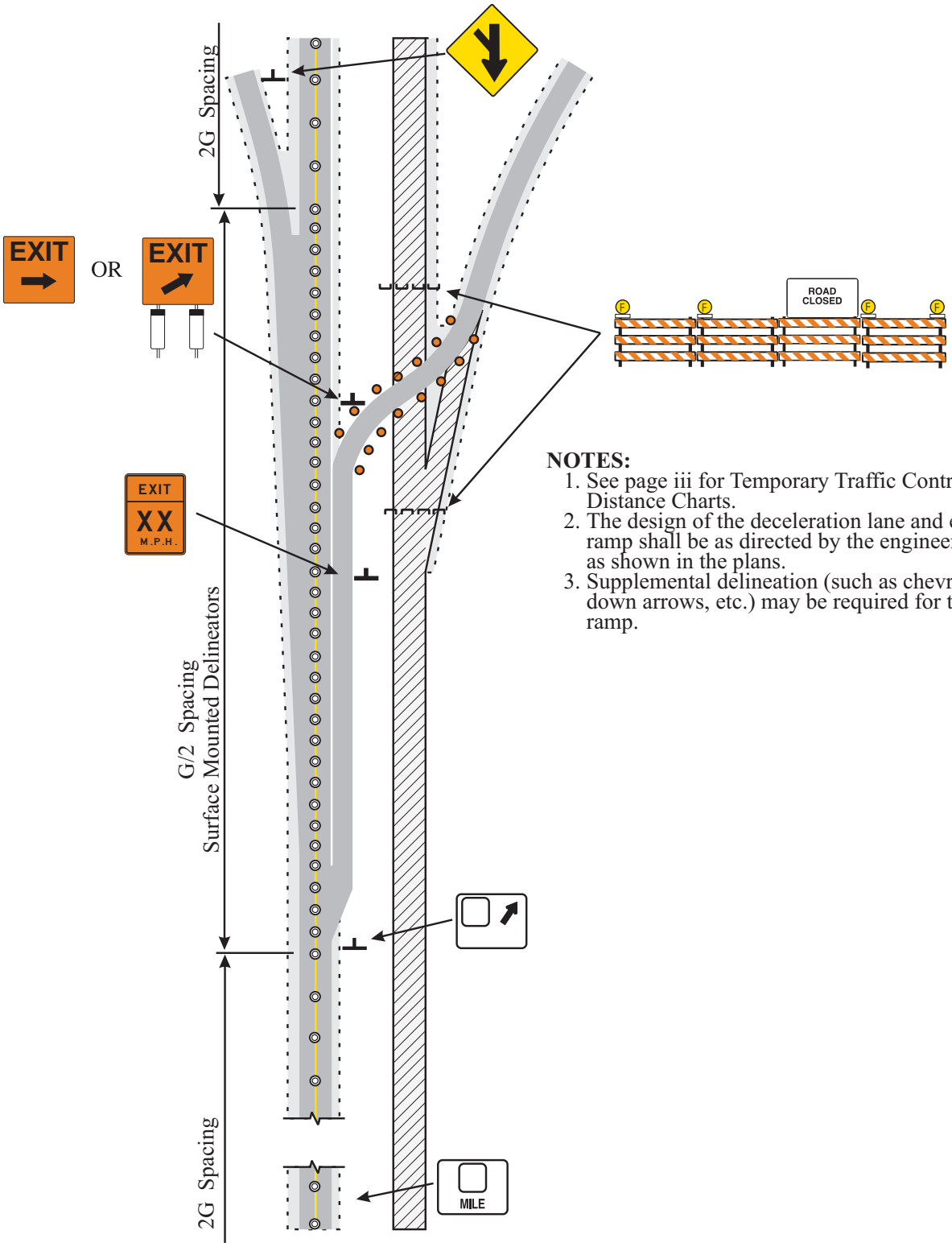
NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Install at least 7 days prior to the start of work.

TWO-LANE, TWO-WAY OPERATIONS AT RAMPS ON OPEN ROADWAY

LONG TERM

LAYOUT 6J-6



NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The design of the deceleration lane and exit ramp shall be as directed by the engineer or as shown in the plans.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required for the ramp.

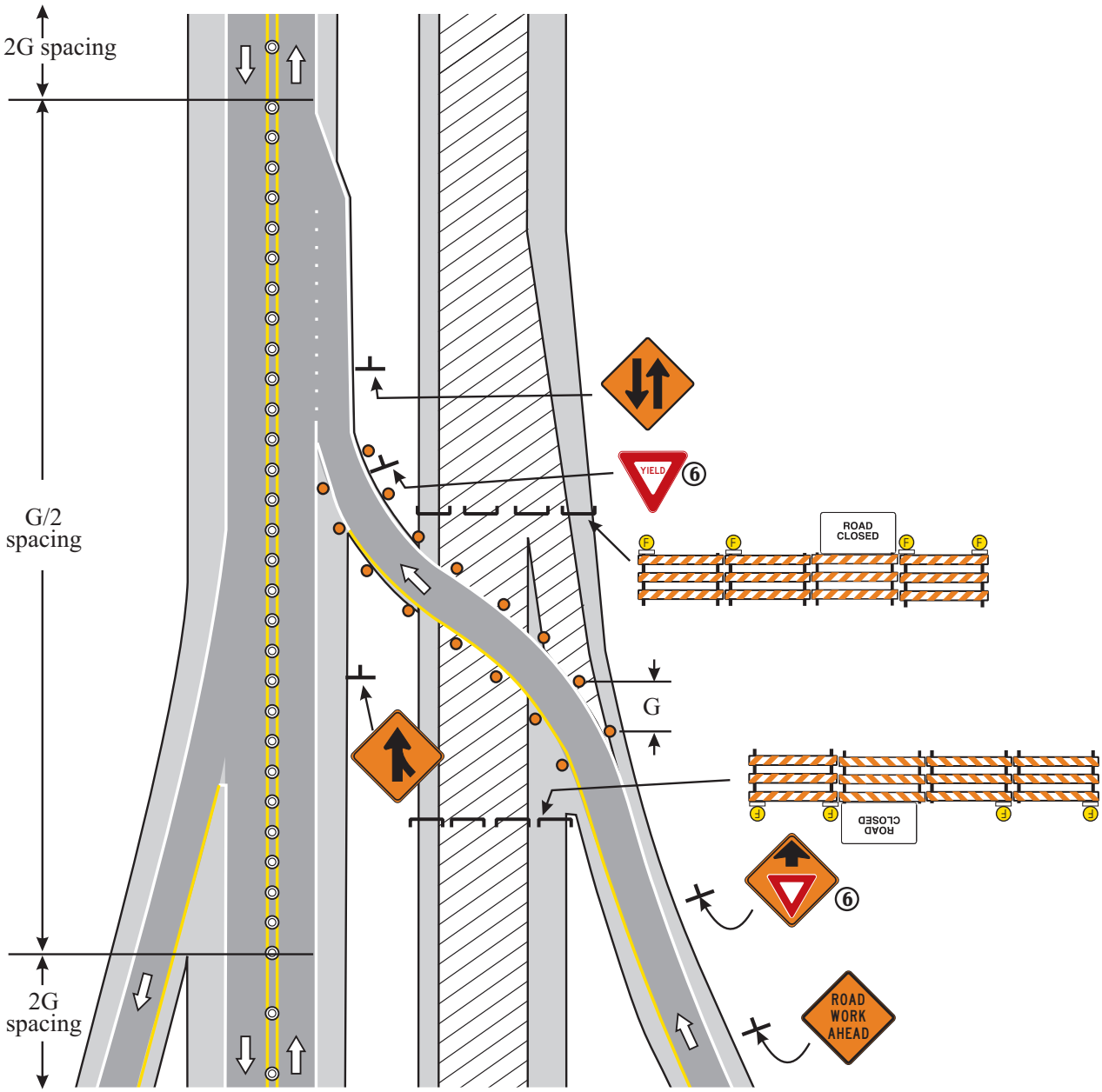
TWO-LANE, TWO-WAY OPERATION
AT EXIT RAMP ACROSS CLOSED ROADWAY

LONG TERM

LAYOUT 6J-7

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The design of the acceleration lane and entrance ramp shall be as directed by the engineer or as shown in the plans.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required for the ramp.
4. The advance warning sign spacing is dependent on the ramp length and the location of inplace signing. The spacing should be as long as is practical.
5. Remove conflicting pavement markings and install temporary markings (see Figure 6J-1).
6. When an adequate acceleration lane is provided, this sign should be omitted.



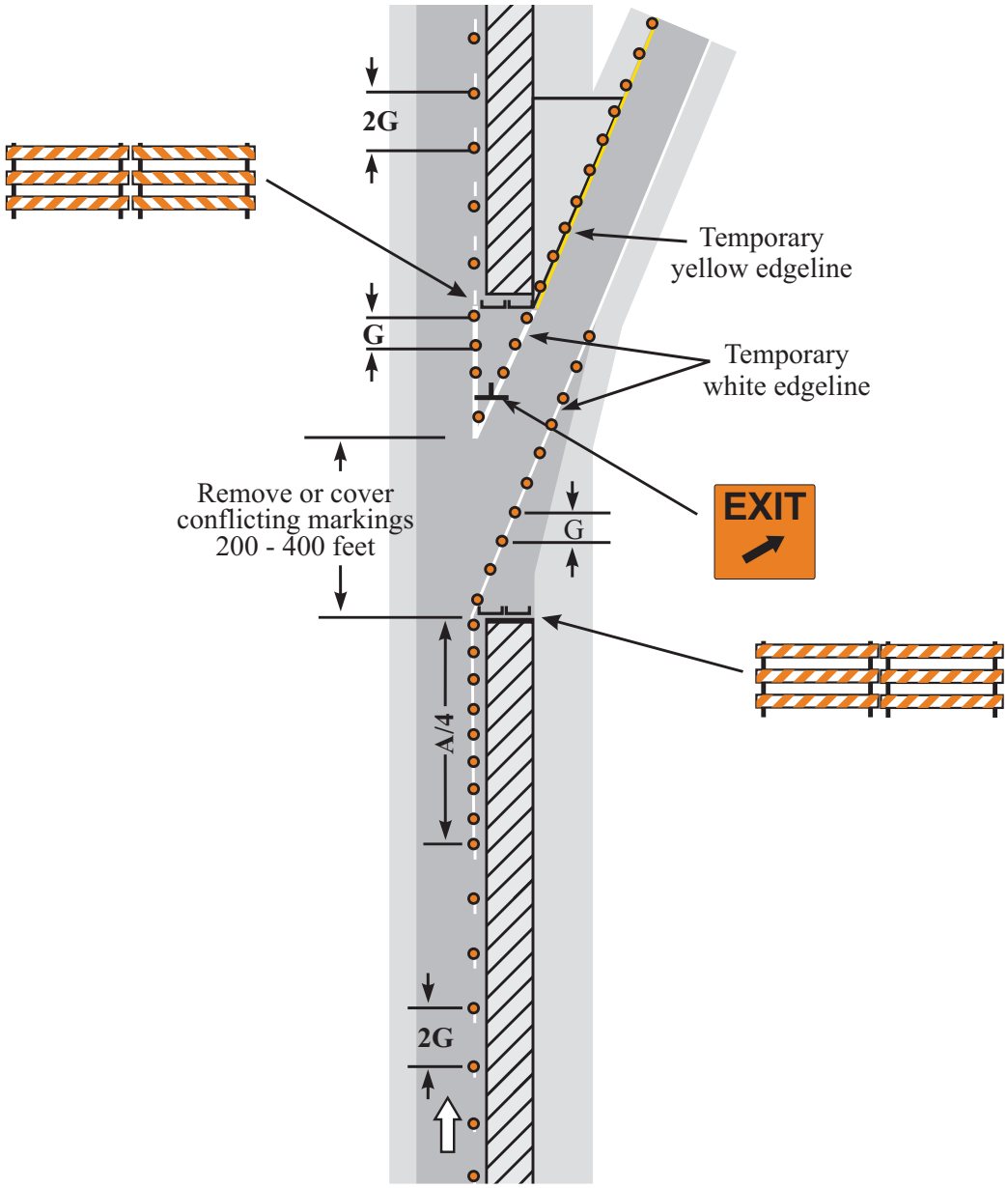
TWO-LANE, TWO-WAY OPERATION AT ENTRANCE RAMP ACROSS CLOSED ROADWAY

LONG TERM

LAYOUT 6J-8

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The design of the deceleration lane and the exit ramp shall be as directed by the engineer or as shown in the plans.
3. The advance warning sign spacing is dependent on the ramp length and the location of inplace signing. The spacing should be as long as is practical.



Use appropriate devices and spacing for lane closure.

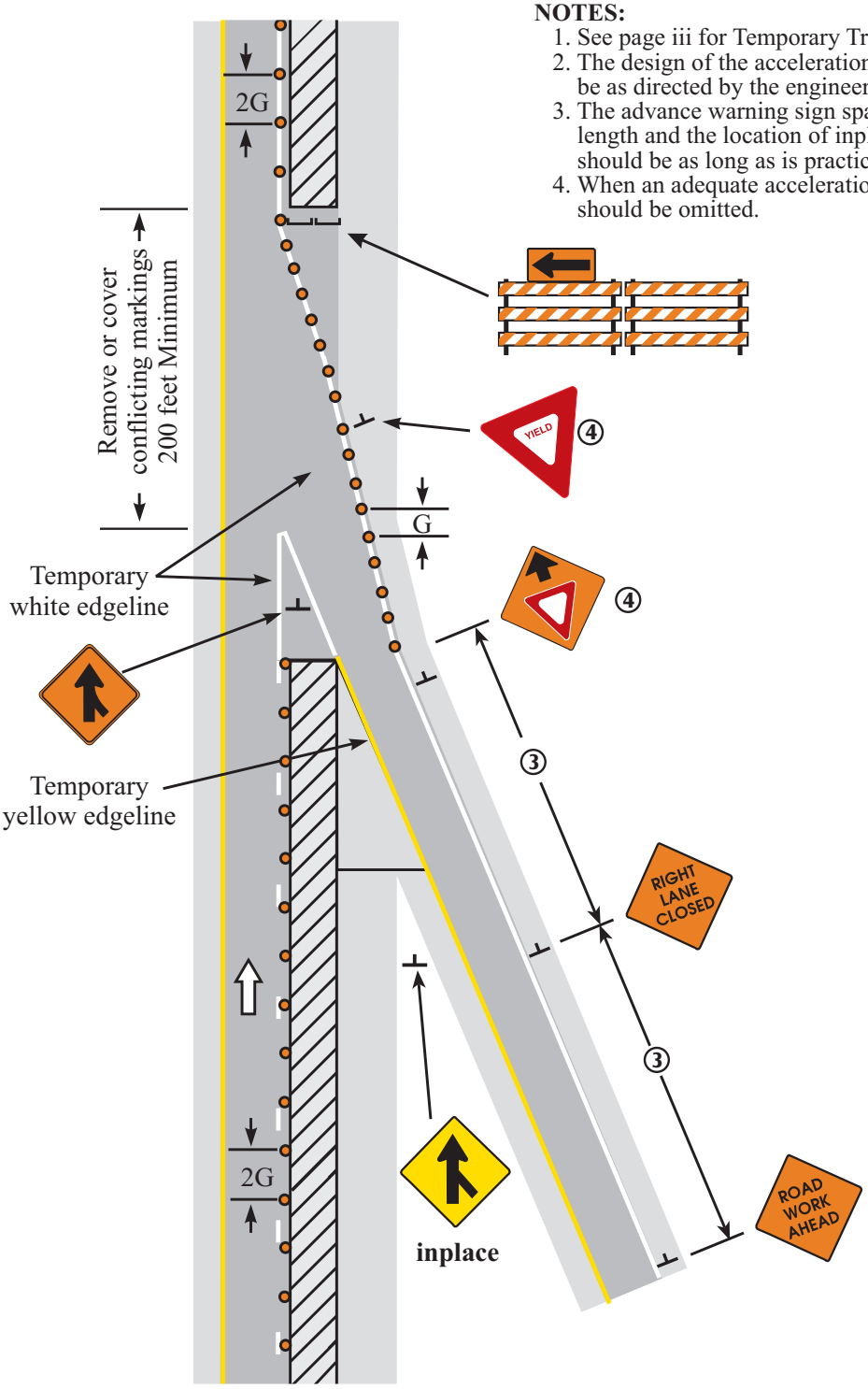
MAINLINE RIGHT LANE CLOSED
EXIT RAMP OPEN

LONG TERM

LAYOUT 6J-9

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The design of the acceleration lane and the entrance ramp shall be as directed by the engineer or as shown in the plans.
3. The advance warning sign spacing is dependent on the ramp length and the location of inplace signing. The spacing should be as long as is practical.
4. When an adequate acceleration lane is provided, this sign should be omitted.

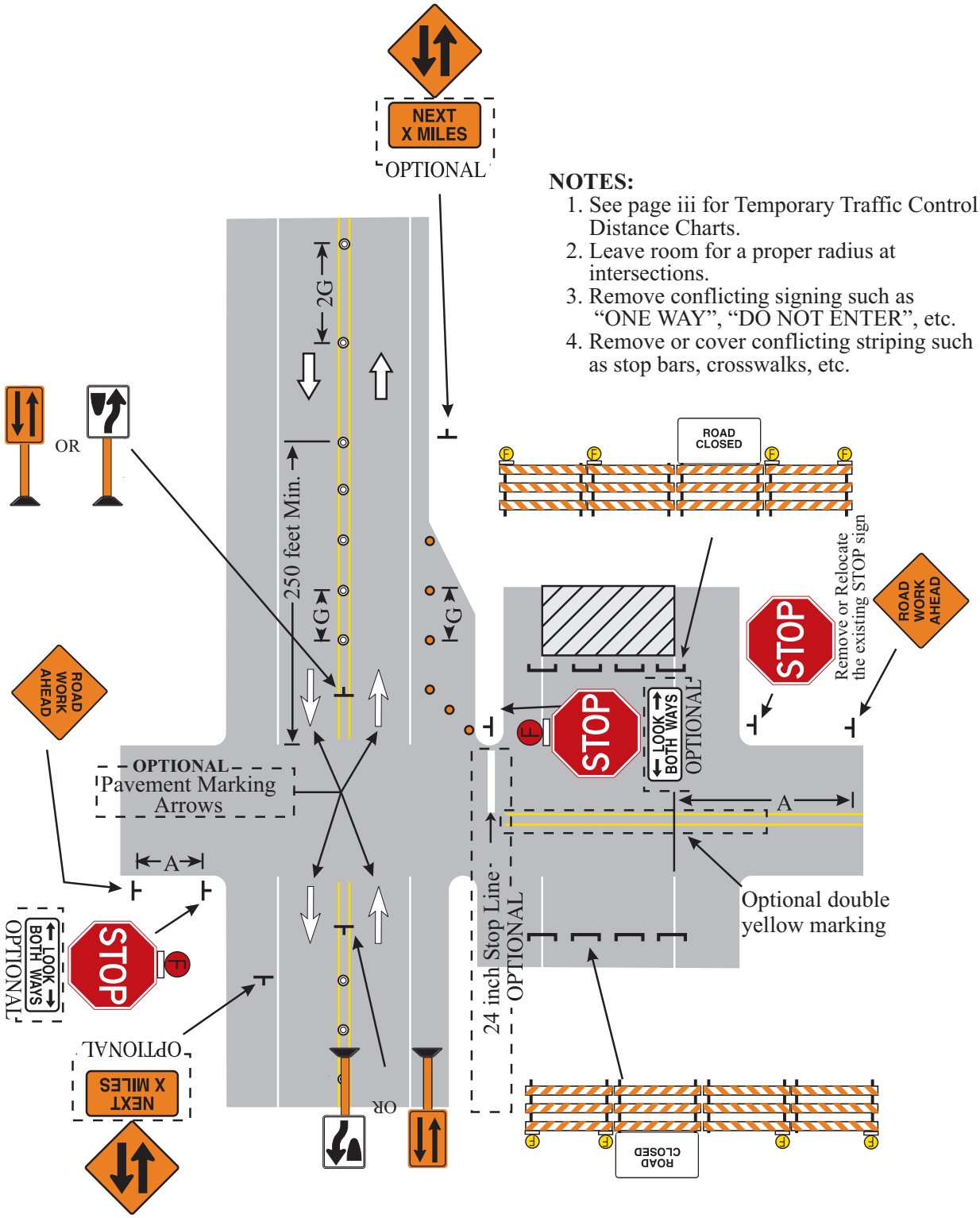


Use the appropriate devices and spacing for a lane closure.

MAINLINE RIGHT LANE CLOSED
ENTRANCE RAMP OPEN

LONG TERM

LAYOUT 6J-10



NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Leave room for a proper radius at intersections.
3. Remove conflicting signing such as "ONE WAY", "DO NOT ENTER", etc.
4. Remove or cover conflicting striping such as stop bars, crosswalks, etc.

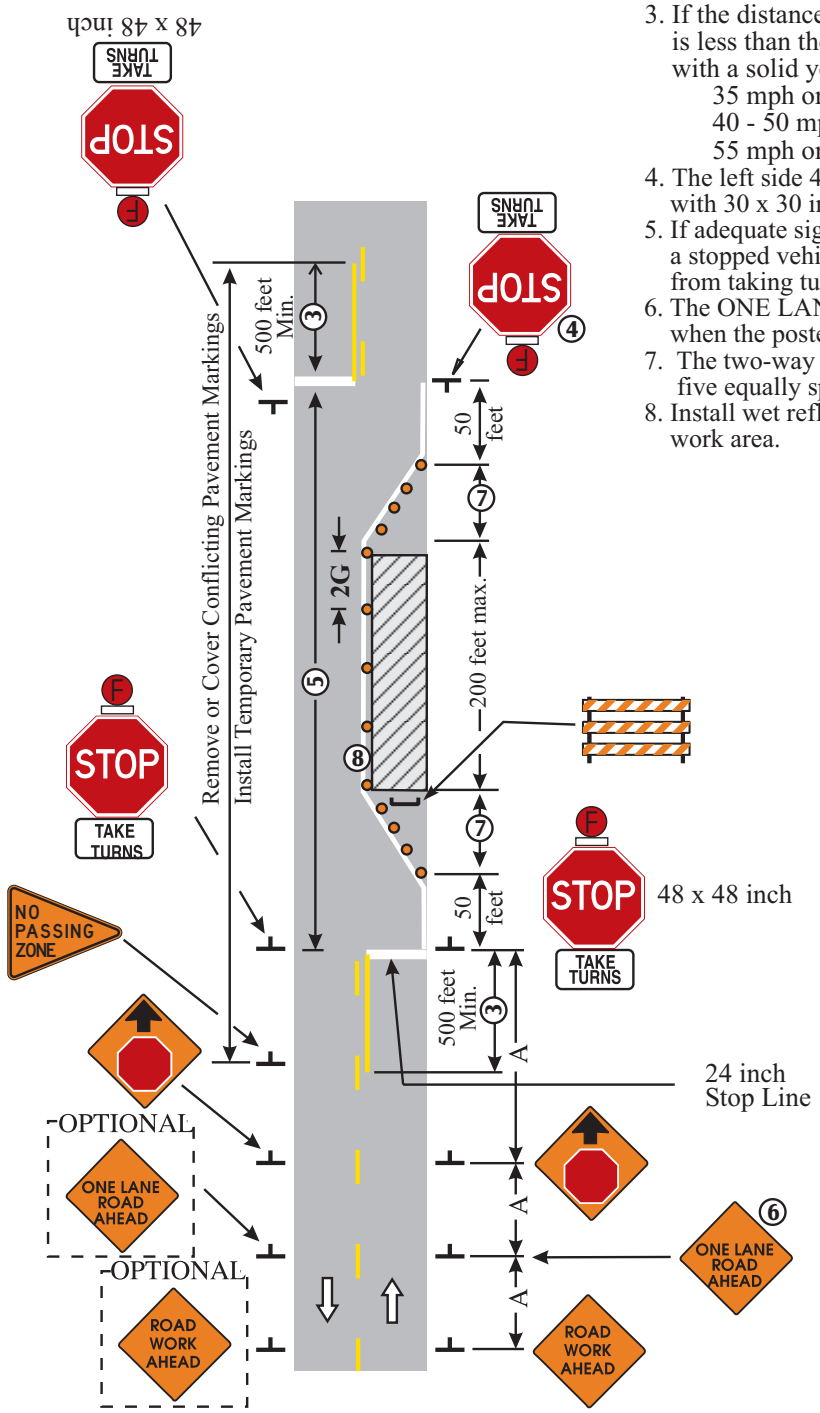
TWO-LANE, TWO-WAY OPERATION THROUGH TYPICAL INTERSECTION

LONG TERM

LAYOUT 6J-11

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Approach signs and marking is the same in both directions.
3. If the distance from an inplace "NO PASSING ZONE" is less than the following, the zones shall be connected with a solid yellow line:
   35 mph or less - 500 feet
   40 - 50 mph - 600 feet
   55 mph or greater - 800 feet
4. The left side 48 x 48 inch STOP signs may be replaced with 30 x 30 inch STOP signs.
5. If adequate sight distance is not available to recognize a stopped vehicle or traffic volume restricts vehicles from taking turns through the open lane, use Layout 6J-13.
6. The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.
7. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.
8. Install wet reflective edgeline through tapers and the work area.



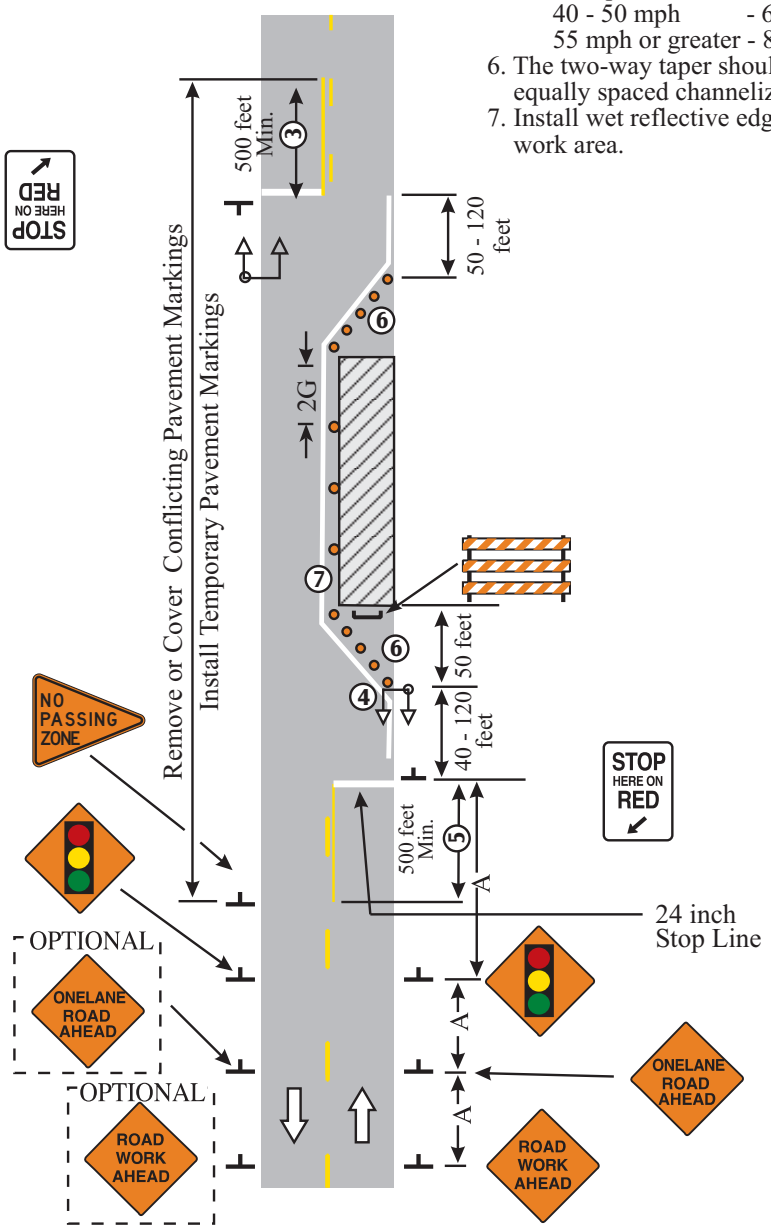
LANE CLOSURE WITH STOP SIGNS
TWO-LANE, TWO-WAY ROAD

LONG TERM

LAYOUT 6J-12

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Approach signing and marking is the same in both directions.
3. Signal timing shall be established by qualified personnel.
4. Two signal heads shall be installed per approach. The first shall be installed on the right shoulder. The second signal head may be installed on either the left shoulder or mounted over head on the same structure as the first signal head.
5. If the distance from an inplace "NO PASSING ZONE" is less than the following, the zones shall be connected with a solid yellow line:
   - 35 mph or less - 500 feet
   - 40 - 50 mph - 600 feet
   - 55 mph or greater - 800 feet
6. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.
7. Install wet reflective edgeline through tapers and the work area.



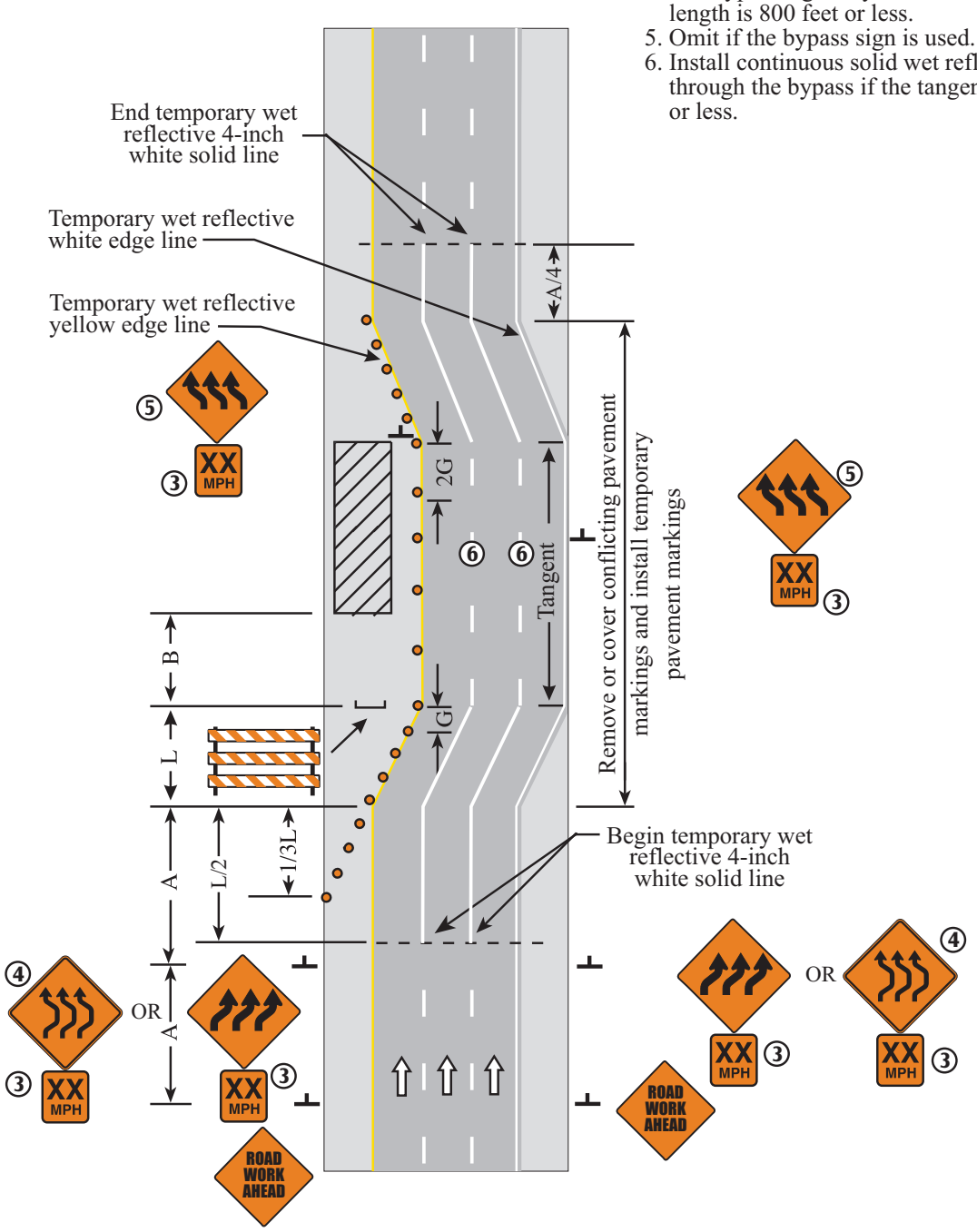
LANE CLOSURE WITH SIGNALS
TWO-LANE, TWO-WAY ROAD

LONG TERM

LAYOUT 6J-13

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The minimum lane width shall be 10 feet.
3. The curve advisory speed will be determined by the Road Authority at the time of installation.
4. The bypass sign may be used when the tangent length is 800 feet or less.
5. Omit if the bypass sign is used.
6. Install continuous solid wet reflective lane lines through the bypass if the tangent is 800 feet or less.



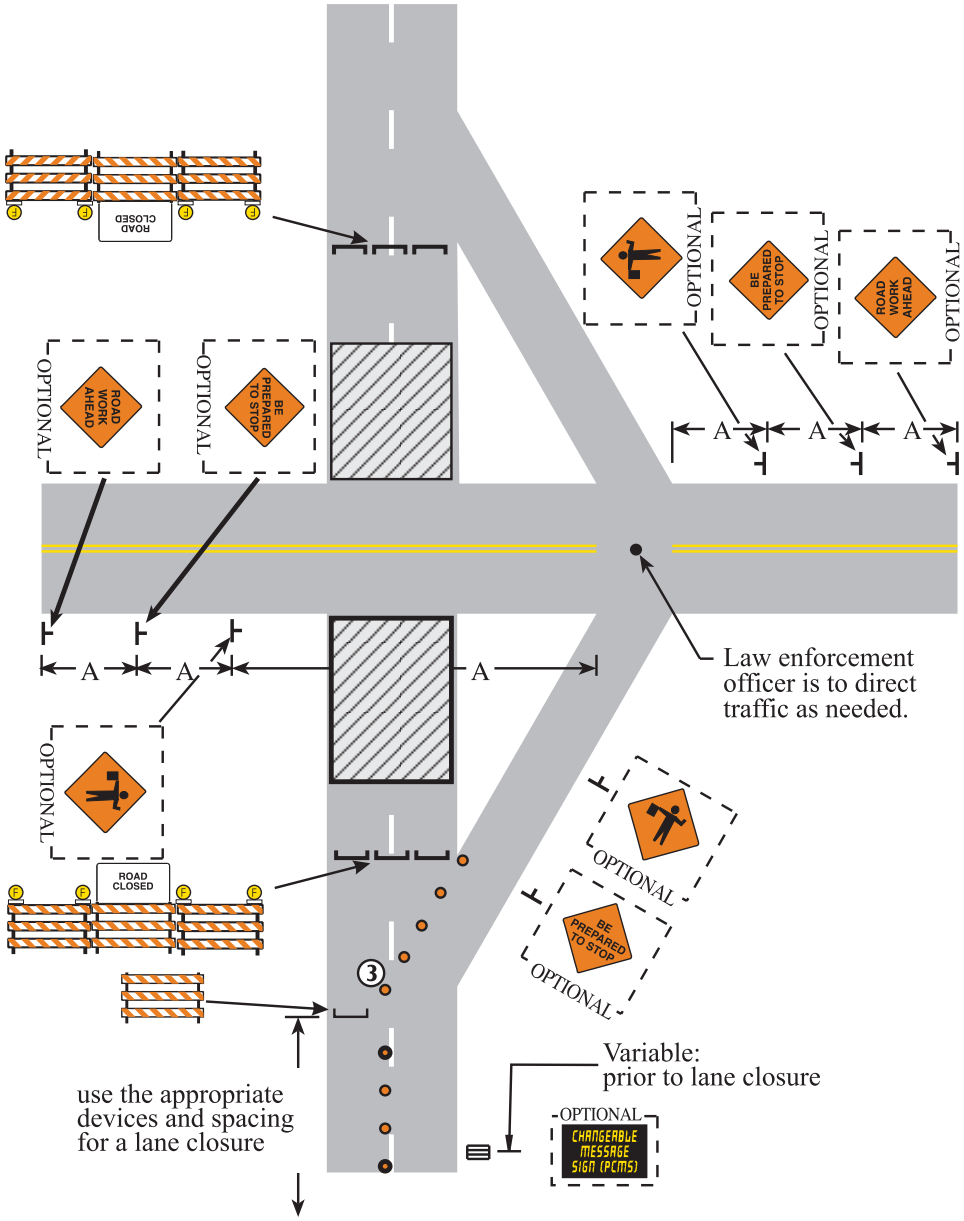
MULTIPLE LANE SHIFT
MULTILANE DIVIDED ROAD

LONG TERM

LAYOUT 6J-14

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The closed road volume should be below 800-1000 vehicles per hour.
3. Supplemental delineation such as chevrons, down arrows, etc. may be required in the bypass.



ROAD CLOSURE AT INTERCHANGE

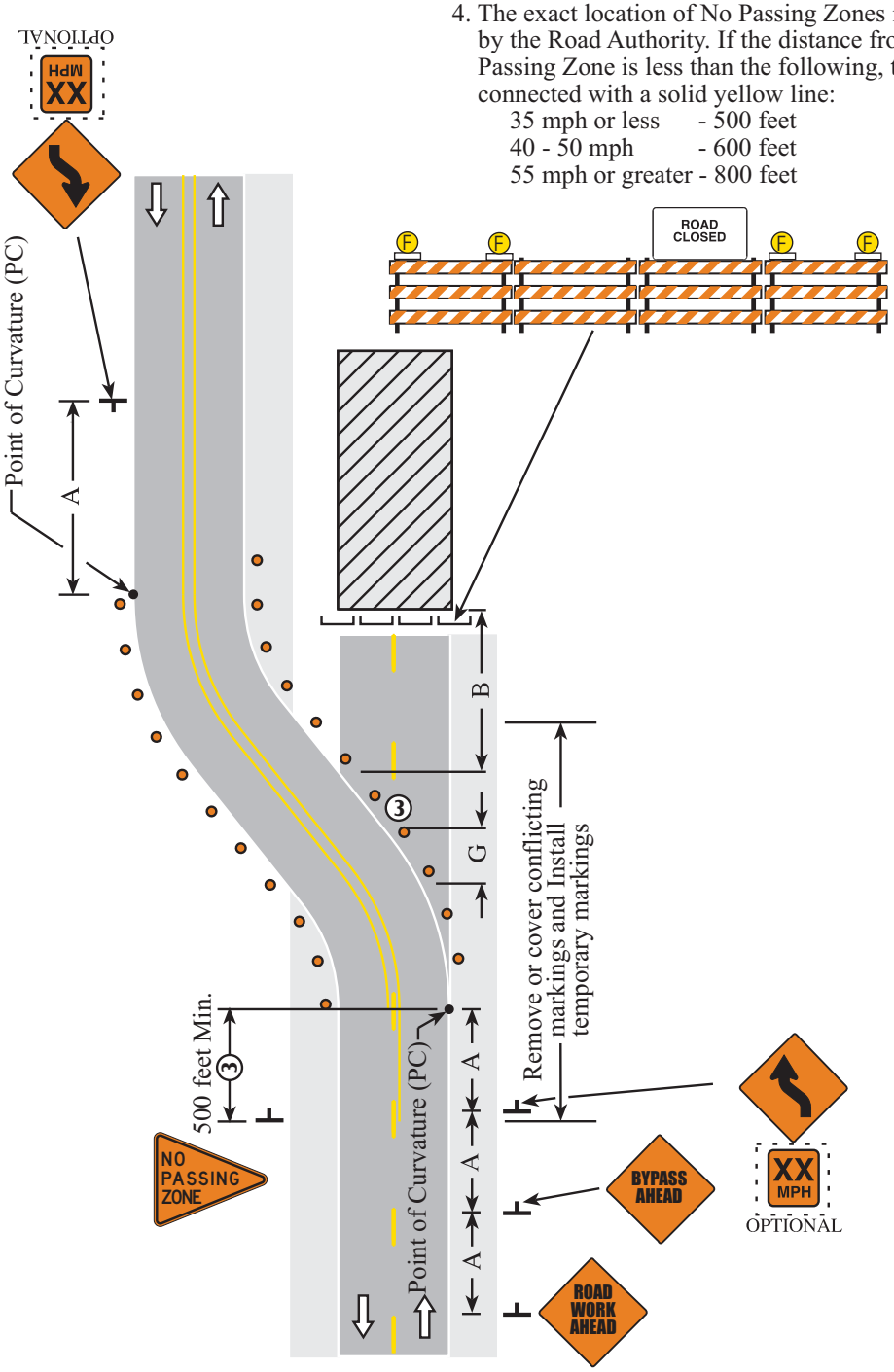
SHORT TERM
LONG TERM

LAYOUT 6J-15

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Typical traffic control is shown for one approach only.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required on the bypass.
4. The exact location of No Passing Zones is to be determined by the Road Authority. If the distance from an inplace No Passing Zone is less than the following, the zones shall be connected with a solid yellow line:

35 mph or less	- 500 feet
40 - 50 mph	- 600 feet
55 mph or greater	- 800 feet



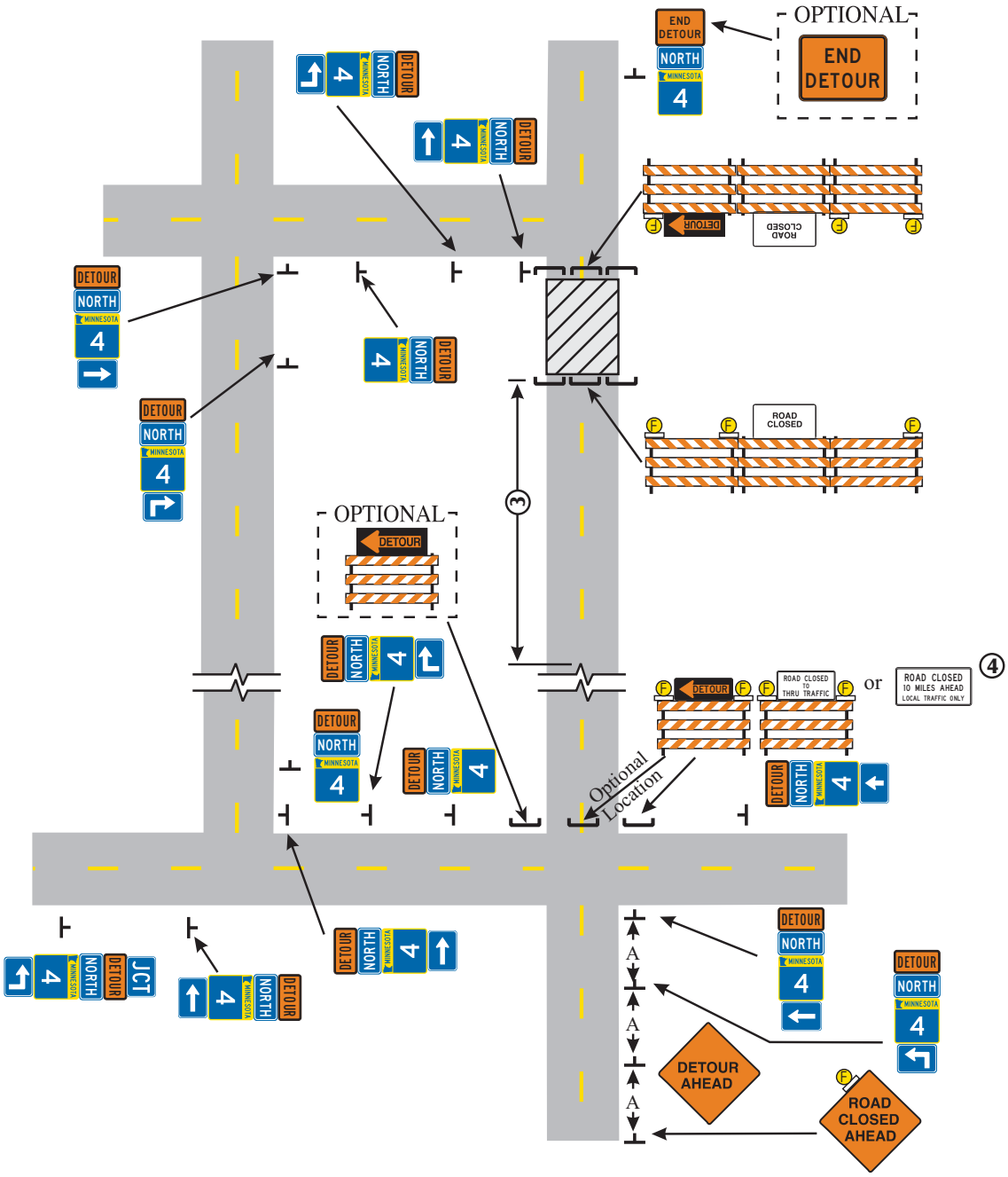
ROAD CLOSURE WITH DIVERSION (BYPASS)
TWO-LANE, TWO-WAY ROAD

LONG TERM

LAYOUT 6J-16

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Detour signing is shown for one direction only. The other direction shall be similar.
3. See Long Term Layout 6J-20 for devices and spacing.
4. Use this sign when it is 2 mile or greater to the road closure.



MN Rev. 2

MN Rev. 2

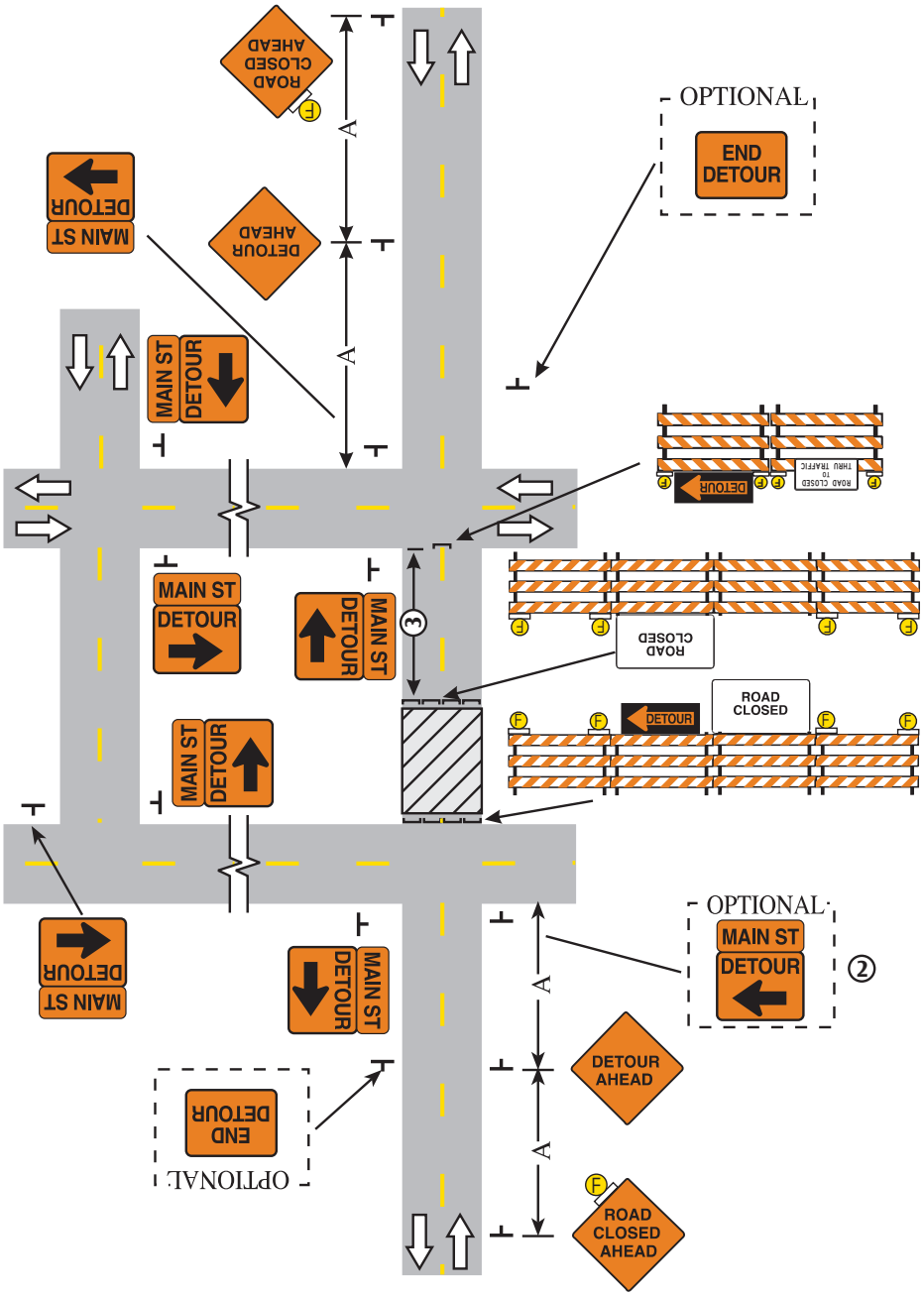
ROAD CLOSURE WITH DETOUR

LONG TERM

LAYOUT 6J-17

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. A M4-9 Detour Sign with an advance turn arrow may be used in advance of a turn. On multi-lane streets, such signs should be used.
3. See Long Term Layout 6J-20 for devices and spacing.



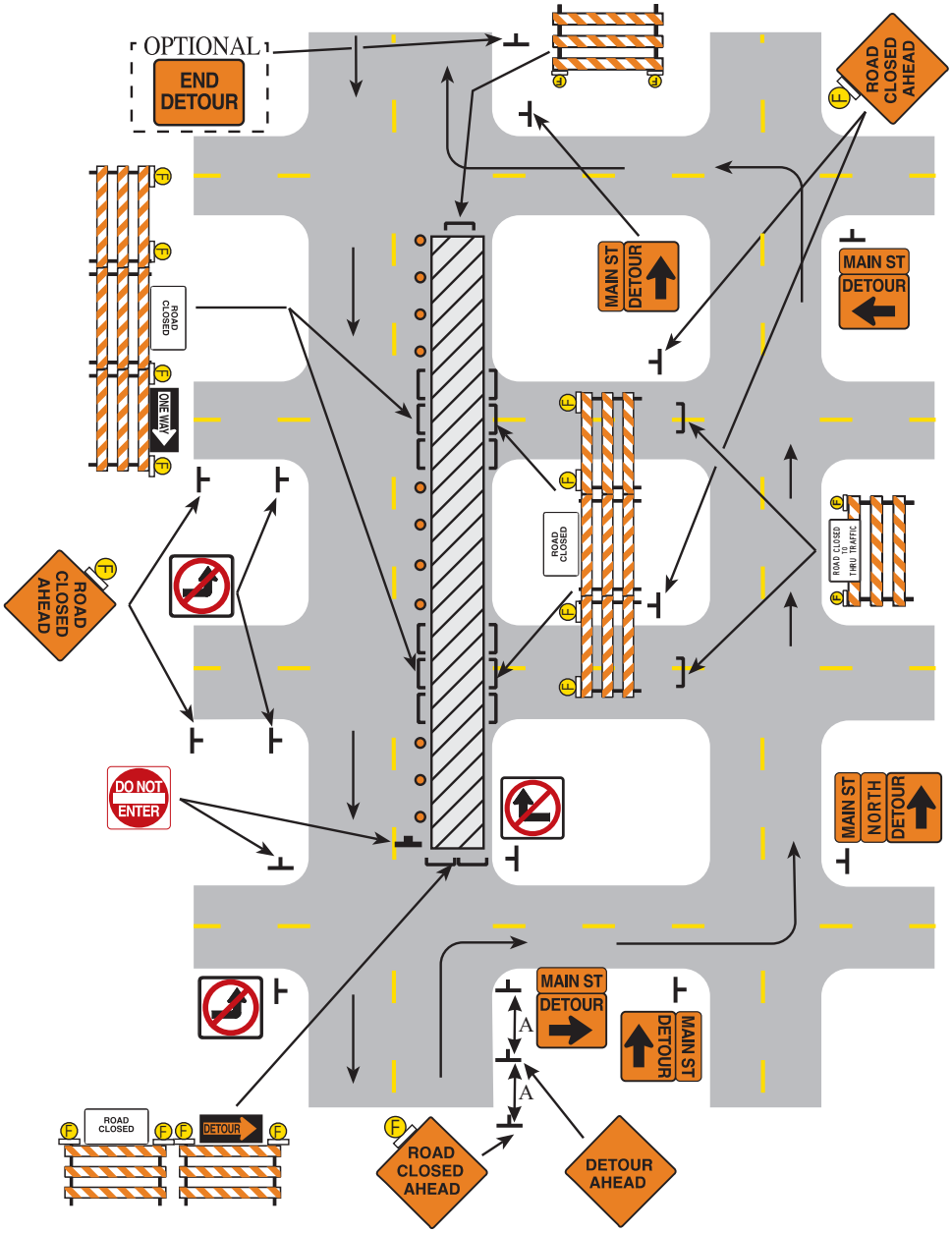
DETOUR FOR CLOSED STREET

LONG TERM

LAYOUT 6J-18

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Additional "DO NOT ENTER" signs may be desirable at intersections with intervening streets.
3. For sidewalk and crosswalk closures, see Layouts 6K-29 and 6K-30.
4. Additional side street signs may be required.



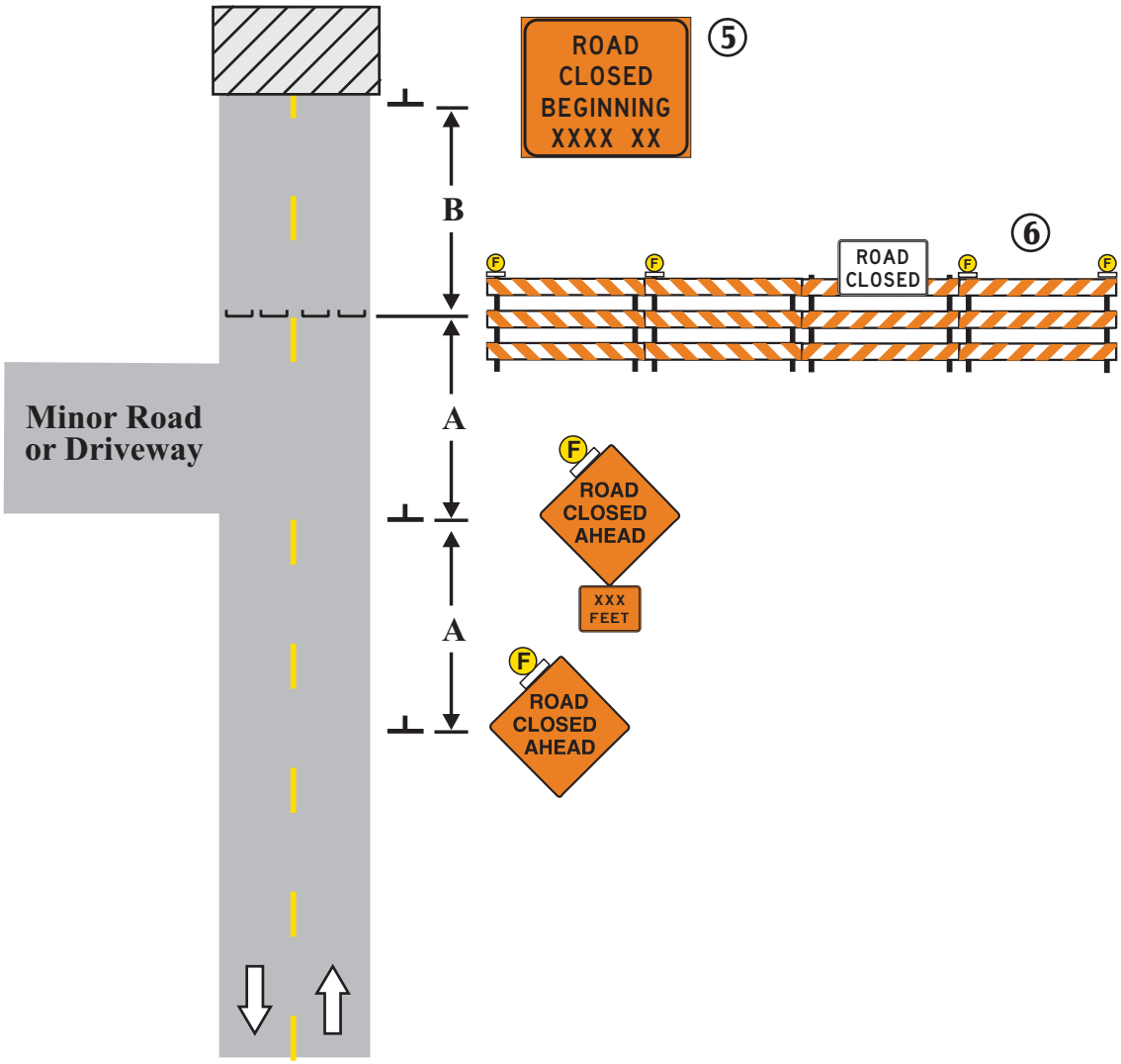
DETOUR FOR ONE TRAVEL DIRECTION

LONG TERM

LAYOUT 6J-19

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. All devices are shown for one direction. Devices for the other direction should be similar.
3. The Road Authority will determine if a detour is required and specify the detour route.
4. Flashers are not required on signs and on Type III barricades for a daylight only closure.
5. Advance warning signs should be used seven days in advance of the closure.
6. Install at the last driveway or intersection beyond which there is no public access.



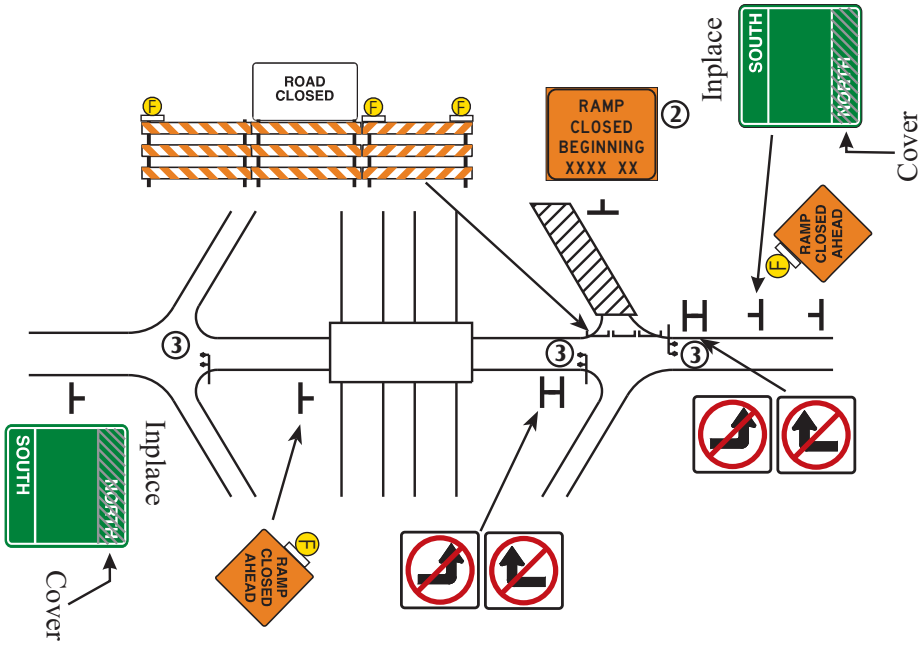
TYPICAL SIGNING FOR ROAD CLOSURE

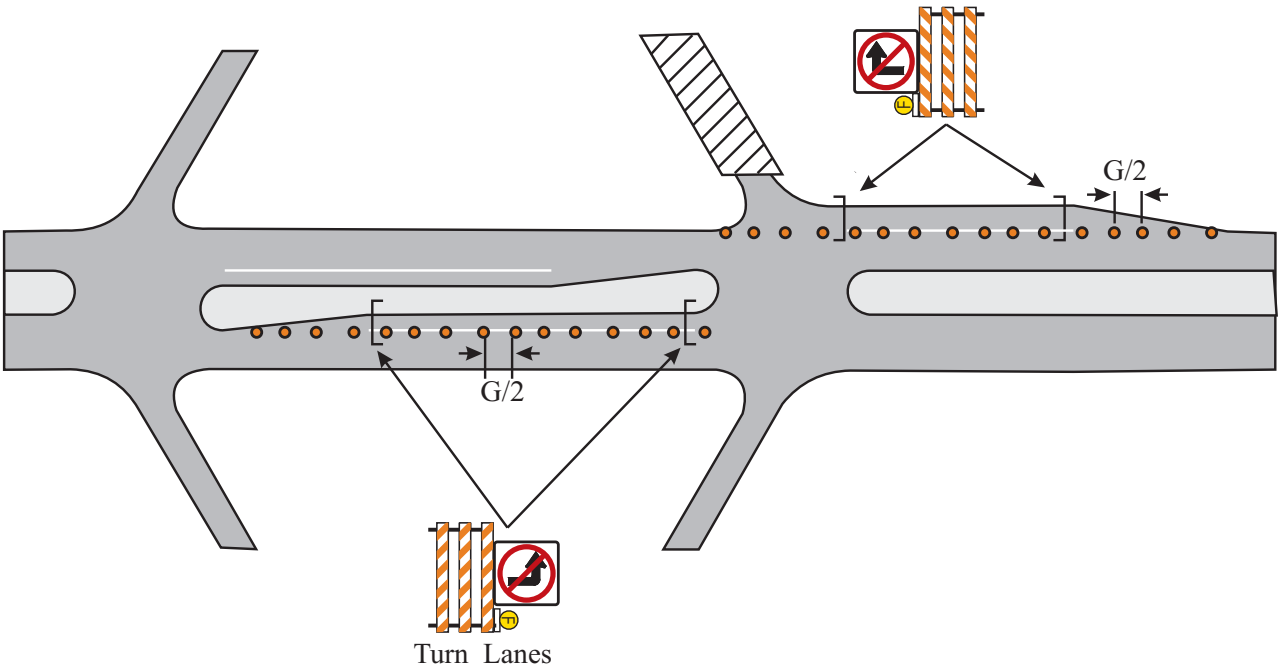
LONG TERM

LAYOUT 6J-20

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Advance warning signs should be used seven days in advance of the closure.
3. Cover all directional signing for the closed ramp.

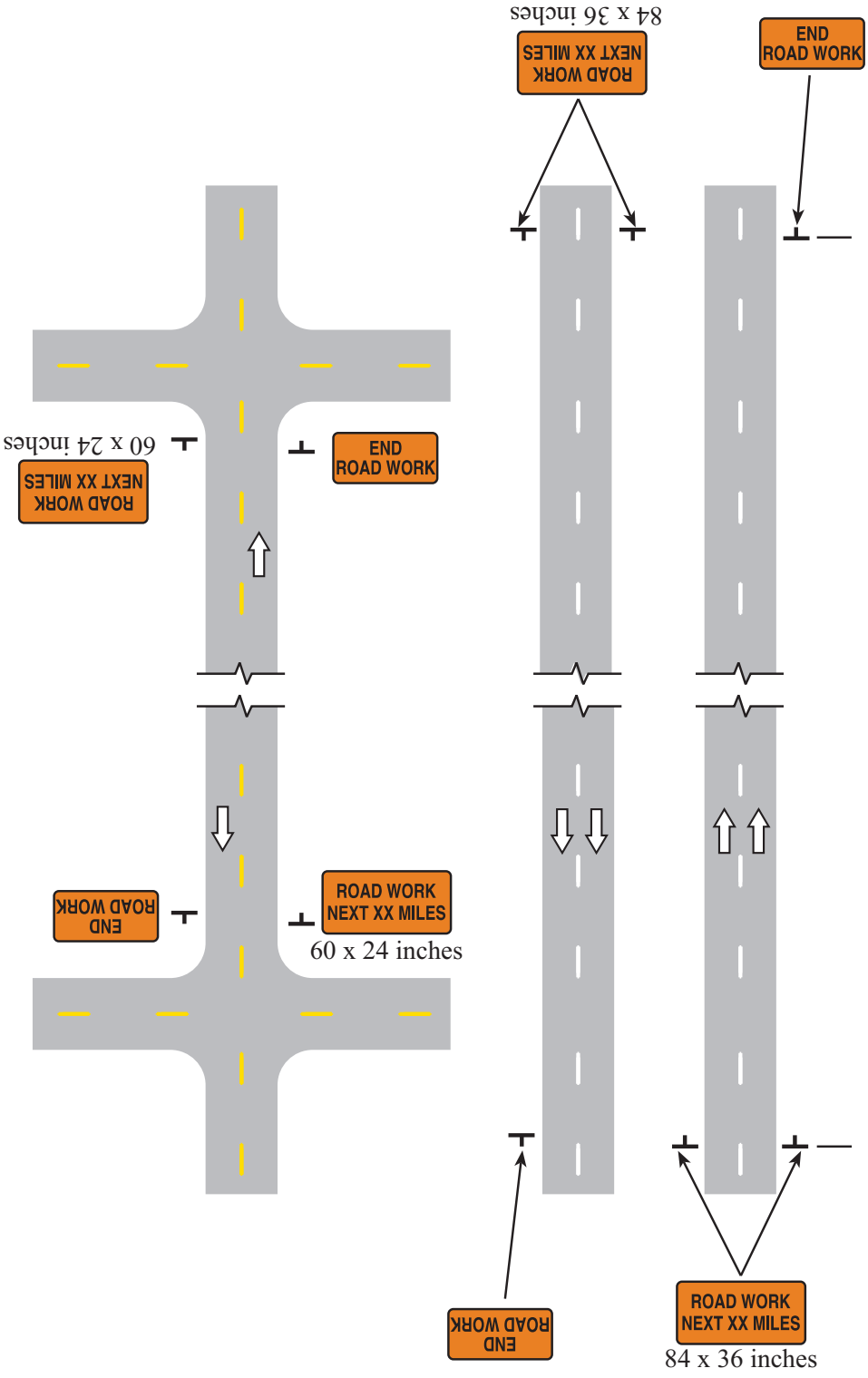




ENTRANCE RAMP CLOSURES

LONG TERM

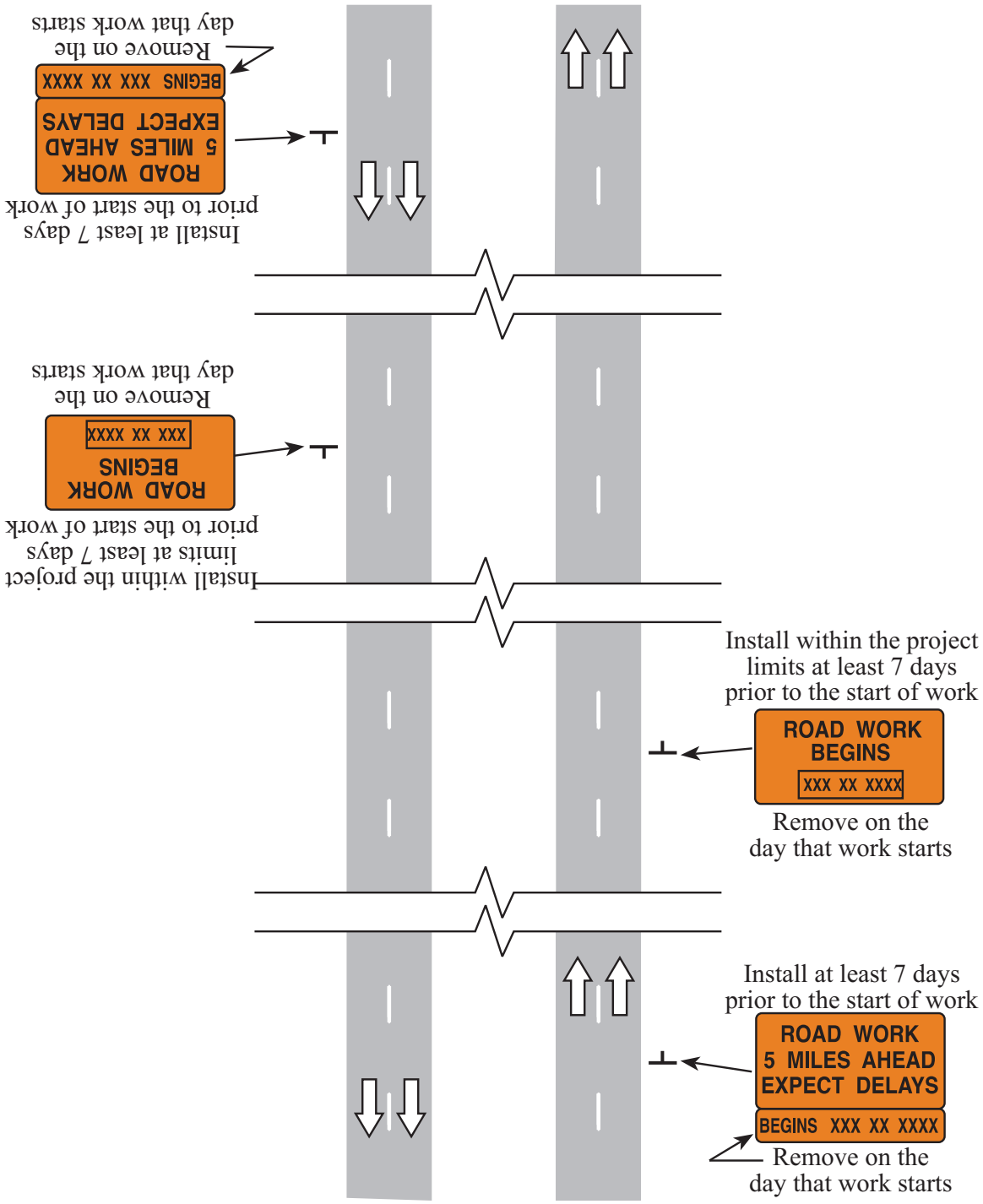
LAYOUT 6J-21



TYPICAL TERMINI SIGNING

LONG TERM

LAYOUT 6J-22



TYPICAL ADVANCE SIGNING

LONG TERM

LAYOUT 6J-23

NOTES:

1. When crosswalks, sidewalks or other pedestrian facilities are blocked, closed or relocated, temporary facilities shall include accessibility features consistent with the features present in the existing pedestrian facility.

2. The examples show only key typical dimensions. Refer to the MnDOT "Temporary Pedestrian Access Route" (TPAR) website (http://www.dot.state.mn.us/trafficeng/workzone/tpar.html) for standards, guidance and options when blocking, closing, or relocating pedestrian facilities.

3. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.

4. An approved audible message device or tactile message should be provided for sight-impaired pedestrians. When used, a message device should provide a complete physical description of the temporary pedestrian detour including duration, length of (and/or distance to) the by-pass, any restrictions or hazards and project information as listed in note 5 below. The number and location of devices should be determined for each project prior to starting work. Devices may be placed prior to sidewalk work to warn regular users of the planned work.

5. Typical sign message for a temporary pedestrian detour should include information such as the duration of the walkway restrictions (beginning and/or end dates) and a project contact number for 24/7 questions or reporting hazards.

6. The International Symbol of Accessibility should be displayed when any walkway through a work zone has been determined to be TPAR compliant. The Symbol of Accessibility shall not be displayed if persons with disabilities should not use the primary temporary pedestrian detour. The reason for the non-compliance should be posted and an alternate route should be posted when the primary temporary pedestrian detour is non-complaint to TPAR standards.

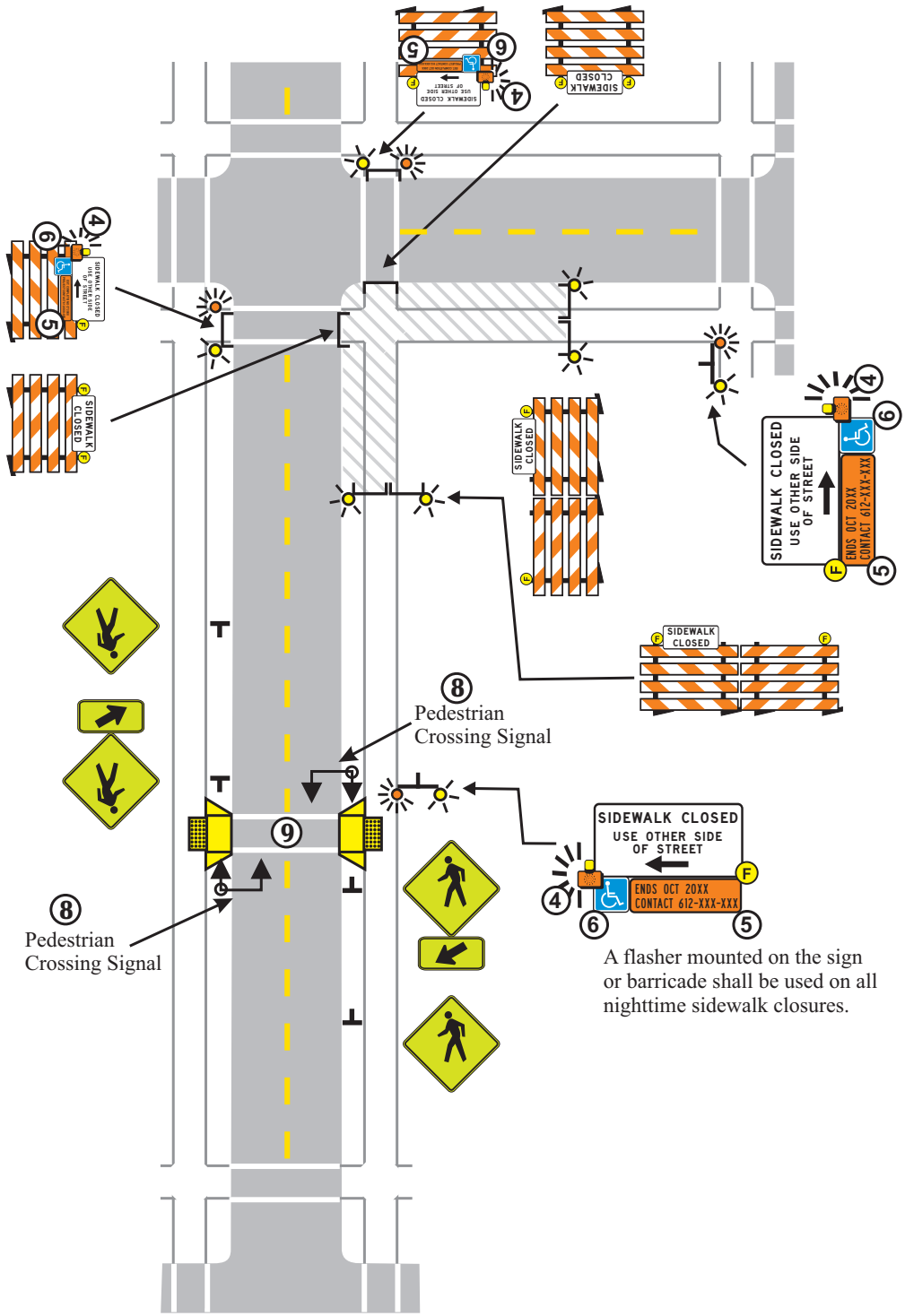
7. Conditions that are beyond recommended standards should be documented. A walkway is non-compliant if it is missing key ADA elements such as curb ramp(s), truncated domes, and detectable edging. Other restrictions or hazards may include insufficient width or pinch-point widths, traffic conflicts, steep grades, non-continuous railings, tripping hazards, or uneven/rough/soft surface conditions, etc.

8. Pedestrian traffic signal displays controlling closed crosswalks shall be covered. Temporary pedestrian signals should be considered when creating a new crossing location.

9. Curb marking shall be prohibited for a minimum of 30 feet in advance of the mid-block pedestrian crossing. Crosswalk marking shall be installed and conflicting marking removed or covered. Curb ramps with detectable warnings shall be provided to transition from the sidewalk to the crosswalk.

CROSSWALK CLOSURES AND PEDESTRIAN DETOURS

LONG TERM LAYOUT 6J-24a



CROSSWALK CLOSURES AND PEDESTRIAN DETOURS

LONG TERM

LAYOUT 6J-24b

NOTES:

1. When crosswalks, sidewalks or other pedestrian facilities are blocked, closed or relocated, temporary facilities shall include accessibility features consistent with the features present in the existing pedestrian facility.

2. The examples show only key typical dimensions. Refer to the Mn/DOT "Temporary Pedestrian Access Route" (TPAR) website (**http://www.dot.state.mn.us/trafficeng/workzone/tpar.html**) for standards, guidance and options when blocking, closing, or relocating pedestrian facilities.

3. Where high speeds and/or high traffic volumes are anticipated, barrier should be used to separate the temporary pedestrian walkway from vehicular traffic. When used, barriers shall be installed as detailed in the MN MUTCD Part 6F.

4. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.

5. When both sides of a temporary pedestrian bypass require channelizing devices, then the devices should be a similar type (railing system, barricade, or fencing system), excluding when TTC barrier (such as concrete barrier) is used to protect pedestrians from an open traffic lane.

6. An approved audible message device or tactile message should be provided for sight-impaired pedestrians. When used, a message device should provide a complete physical description of the temporary pedestrian by-pass including duration, length of (and/or distance to) the bypass, any restrictions or hazards and project information as listed in note 7 below. The message device(s) may also describe an alternate route. The number and location of devices should be determined for each project prior to starting work. Devices may be placed prior to sidewalk work to warn regular users of the planned work.

7. Typical sign message for a temporary pedestrian bypass should include information such as the duration of the walkway restrictions (beginning and/or end dates) and a project contact number for 24/7 questions or reporting hazards.

8. The International Symbol of Accessibility should be displayed when any walkway through a work zone has been determined to be TPAR compliant. The Symbol of Accessibility shall not be displayed if persons with disabilities should not enter the temporary pedestrian by-pass. An alternate route should be posted when the temporary pedestrian bypass is non-complaint to TPAR standards.

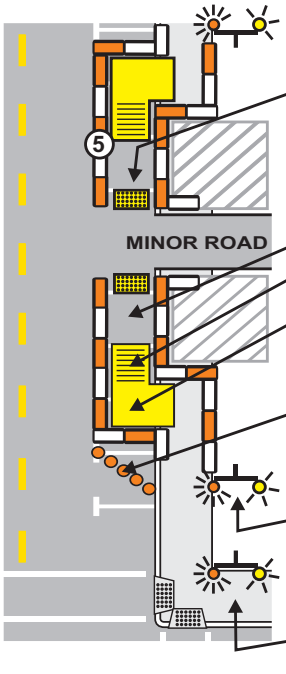
9. Conditions that are beyond recommended standards should be documented. A walkway is non-compliant if it is missing key ADA elements such as curb ramp(s), truncated domes, and detectable edging. Other restrictions or hazards may include insufficient width or pinch-point widths, traffic conflicts, steep grades, non-continuous railings, tripping hazards, or uneven/rough/soft surface conditions, etc.

10. When a sidewalk is closed but workers are present who will provide assistance or directions to pedestrians, then the devices as shown are not required.

SIDEWALK BYPASS

LONG TERM LAYOUT 6J-25a

LOW-SPEED ROADWAY



Temporary truncated domes, optional based upon usage of cross-street

Temporary pedestrian access route width 48 inch minimum and 60 inch preferred or wider

Temporary curb ramp providing 12:1 (8%) slope or flatter and non-slip treatment added

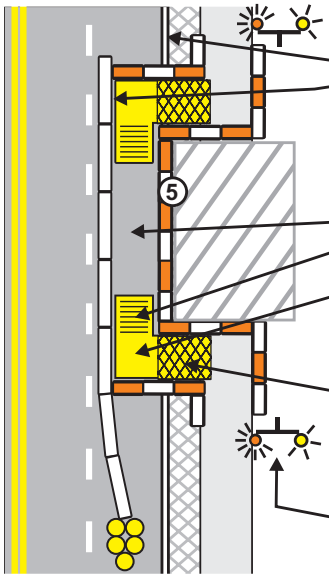
Ramp landing area providing 48 x 48 inch minimum area and 2% or flatter cross-slope

5 device taper 25 feet long (1 stall), recommended when the closed area was used as ab intermittent traffic lane or bypass lane.

Additional audible message devices may be needed for route information

A flasher is optional on a bypass route

HIGH-SPEED ROADWAY or LOW-SPEED MULTI-LANE



Curb & gutter or other transition between roadway and sidewalk

TTC barrier with taper and attenuation (length as required)

Temporary pedestrian access route width 48inch minimum and 60 inch preferred or wider

Temporary curb ramp providing 12:1 (8%) slope or flatter and non-slip treatment added

Ramp landing area providing a 48 x 48 inch minimum area and 2% or flatter cross-slope

Temporary walkway surface covering rough, soft or uneven ground or hazards

A flasher is optional on a bypass route

SIDEWALK BYPASS

LONG TERM

LAYOUT 6J-25b