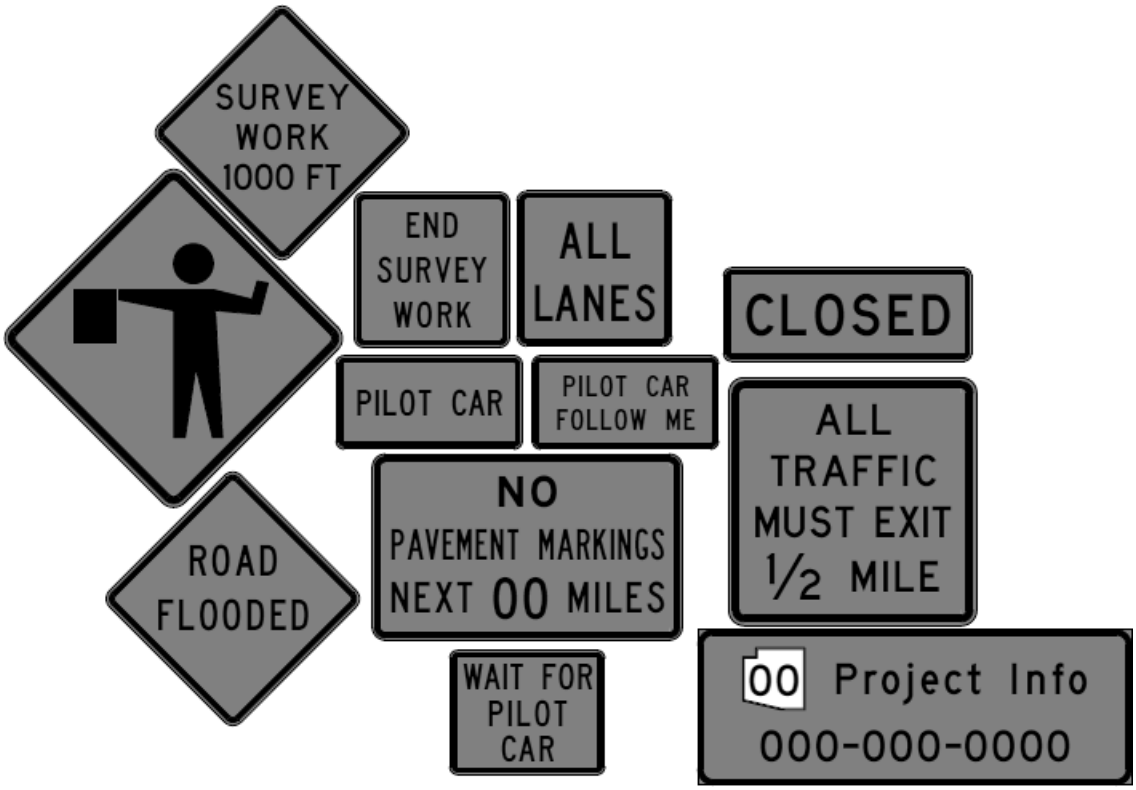
Arizona Department of Transportation

Temporary Traffic Control Design Guidelines



Traffic Engineering Group

September 2019

ADOT

Contents

Appendix

List of Abbreviations

AASHTO.....American Association of State Highway and Transportation Officials

ADA .....Americans with Disabilities Act

ADOT ..... Arizona Department of Transportation

MASH ..... Manual for Assessing Safety Hardware

MOAS .....Manual of Approved Signs

mph.....Miles Per Hour

MUTCD..... Manual on Uniform Traffic Control Devices

NCHRP 350 ..... National Cooperative Highway Research Program Report 350

PROWAG .....Pedestrian Right of Way Accessibility Guidelines

RDG ..... Roadside Design Guide

SA .....Supplemental Application

TA .....Typical Application

TCB .....Temporary Concrete Barrier

TMP..... Transportation Management Plan

TTC ..... Temporary Traffic Control

Glossary

Existing Speed Limit

The maximum or minimum speed applicable to a section of highway as established by law or regulation prior to the implementation of traffic control.

TTC Zone

An area of a highway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel.

Introduction

This document is intended to provide guidelines relating to the design of temporary traffic control for state highway construction, maintenance related operations, utility operations, and incident management operations. The guidelines should be used with the Manual on Uniform Traffic Control Devices (Current Edition with Arizona Supplement) (MUTCD), Arizona Department of Transportation (ADOT) Standard Specifications, and ADOT Stored Specifications. This is not a standalone document. Work activities including roadway construction, maintenance operations, utility work, and incident management operations are often unique and require a site-specific plan for each situation encountered. While the MUTCD provides the foundation and the basis for the application and use of traffic control devices, this design guide is intended to provide additional guidance to designers, field construction and maintenance personnel, and contractors in establishing and implementing safe, efficient, well-conceived traffic control plans. This design guide should be used as an extension of the MUTCD in the day to day implementation of the MUTCD standards. It is the intent of this document to provide additional information which is applicable specifically to the practices, policies, and procedures currently being implemented on the Arizona State Highway System.

If for any reason information presented in this document can be interpreted as conflicting with the MUTCD, the contents of the MUTCD shall take precedence and shall govern the design or application of the standard. The Typical Applications (TA) contained in the MUTCD, in general, apply to most construction and maintenance projects. Additional Supplemental Application (SA) figures are provided herein for those applications which are encountered frequently for work on State highways and are not adequately addressed in the MUTCD. If there are any conflicts, please contact the ADOT Traffic Standards Section.

Fundamental Principles

Temporary Traffic Control (TTC) should be based on the design speed of the facility prior to construction, whenever possible. When this is not feasible, the off-peak 85th percentile speed or existing speed limit should govern the design. When a detour is required to carry traffic around a construction zone, the detour shall be designed in accordance with ADOT standards for construction, speed zoning, signing, and pavement markings to establish a temporary facility which provides a design comparable to the existing facility.

Depending on the nature and duration of the traffic control needs, a traffic operations analysis or traffic modeling may be appropriate to identify operational changes to accommodate existing vehicular, bicycle, and pedestrian traffic. Aspects to consider include roadway capacity, peak hour requirements, traffic signals, routing of pedestrians and bicycles, routing of trucks, and emergency vehicle access.

The District Engineers or their authorized representatives are empowered, and shall have the authority, to determine when construction or maintenance activities have progressed to a point where roadway

conditions warrant a reduction of speed through all or part of the construction or maintenance project. The necessary speed reduction will be established and documented by the TTC designer, in the interest of public safety and for the protection of workers and equipment through the use of standard speed limit signs placed or caused to be placed by ADOT. If a speed limit reduction is justified, a maximum reduction of 10 mph is appropriate in most cases. Any reduction in speed limit greater than 10 mph shall be approved by the District Engineers, Regional Traffic Engineers, or their authorized representatives.

All conflicting regulatory signs, route designation signs, and warning signs shall be taken down or completely covered. The method used to cover signs shall not damage the reflective side of the sign.

Speed Limits Within Work Zones

From Section 6C.01 of the MUTCD:

> Reduced speed limits should be used only in the specific portion of the TTC zone where conditions or restrictive features are present. However, frequent changes in the speed limit should be avoided. A TTC plan should be designed so that vehicles can travel through the TTC zone with a speed limit reduction of no more than 10 mph.
>
> A reduction of more than 10 mph in the speed limit should be used only when required by restrictive features in the TTC zone. Where restrictive features justify a speed reduction of more than 10 mph, additional driver notification should be provided. The speed limit should be stepped down in advance of the location requiring the lowest speed, and additional TTC warning devices should be used.
>
> Reduced speed zoning (lowering the regulatory speed limit) should be avoided as much as practical because drivers will reduce their speeds only if they clearly perceive a need to do so.
>
> 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 10 mph cause smaller changes in speed variance and lessen the potential for increased crashes. A reduction in the regulatory speed limit of only up to 10 mph from the normal speed limit has been shown to be more effective.

When a speed reduction greater than 10 mph is considered appropriate, the transition to the lower speed limit should be made in steps of not more than 10 mph. When conditions no longer require a reduced speed limit, the signs for the speed reduction shall be removed. Documentation for reducing the speed limit through the TTC zone shall be maintained. The speed reduction documentation may consist of a traffic operations analysis, a written justification, or other documents and will be maintained in the project file.

Prior to the installation of any reduction in the posted speed limit, a SPEED REDUCED AHEAD (W3-5aAZ) or symbolic Reduced Speed Limit Ahead (W3-5) sign shall be installed. If the posted speed limit is reduced, a regulatory speed limit sign indicating the existing speed limit should be placed approximately 500 feet beyond the end of the TTC zone unless there is existing speed limit signing in place within 1,000 feet of the end of the work zones.

All temporary speed limit signing should be sized according to the table below. If field conditions do not allow the sizes shown in the table, a smaller size may be used, but should not be smaller than the existing speed limit signs.

Existing Speed Limit Sign Size	**Minimum Temporary Speed Limit Sign Size**
24 inches x 30 inches	36 inches x 48 inches
30 inches x 36 inches	36 inches x 48 inches
36 inches x 48 inches	48 inches x 60 inches
48 inches x 60 inches	48 inches x 60 inches

Within the reduced speed zone, temporary speed limit signs shall be placed at every major intersecting street or following every ramp entrance point that is open to traffic. The temporary speed limit signs should also be placed approximately every 2 miles if the distance between the major intersecting streets or ramp entrance points is greater than 2 miles.

Standard enhancement to traffic control signing should include flashing warning lights and flags to sign assemblies. Flashing warning lights should be used whenever the traffic control signs are in place overnight, during the early morning hours, or in the late evening hours. An exception is the END ROAD WORK THANK YOU (G20-2AZ) sign, which does not require lights or flags. Flags also may be omitted from signs where the flags would be in the path of vehicular, bicycle, or pedestrian traffic.

TTC zones shall maintain adequate pedestrian and bicycle routes if pedestrians and bicyclists are present prior to work activities. When a pedestrian access route is disrupted by work activities, a 4-foot minimum traversable (with a maximum cross slope of 2.00%) route shall be maintained. This route should be on the same side of the street, to the maximum extent feasible. The pedestrian access route shall meet the American with Disabilities Act (ADA) Standards or Pedestrian Right of Way Accessibility Guidelines (PROWAG).

Some projects will likely result in significant impacts to the traveling public. On these projects it will be necessary for project personnel to identify, assess, and document these impacts. Impacts include, but are not limited to:

- Travel delay
- Queue lengths
- Emergency vehicle access
- School bus access
- Business and residential access points
- Pedestrian access
- Public transit

A Transportation Management Plan (TMP) is required on some projects as determined by the project team. The full TMP consists of the TTC plan, a traffic operations component, a public information component, and an Emergency Vehicle Access Plan (EVAP). More information is contained in the ADOT Work Zone Safety and Mobility Implementation Guidelines.

Components of Temporary Traffic Control

Advance Warning Area

Advance warning signs shall be placed in advance of the transition area which precedes the activity area. On divided highways, the advance warning signs shall be located on the right shoulder and, where space is available, on the left shoulder of the roadway. On roadways with raised medians where space is sufficient, left side signs may be placed on the raised median. On undivided roadways with a two-way left turn lane, signs may be placed in the two-way left turn lane.

Tapers

When determining the length of taper, the speed in the formula is the design speed, the off-peak 85th percentile speed, or the existing speed limit. The reduced speed limit within the TTC zone should not be used as the basis to calculate the length of the taper or the spacing of devices.

One-Lane, Two-Way Traffic Control

In addition to the TA for the flagger method of traffic control, the designer should be aware of the potential to employ a pilot car to augment the flaggers in accordance with Figure SA-3. WAIT FOR PILOT CAR (G20-4b) signs shall be placed on minor side streets, whereas flaggers shall be placed on major collectors and arterials where routes cannot be closed.

The flagger stations and pilot car turn around area should be located in places that have adequate stopping sight distance. In rolling or mountainous terrain, the flagger station and pilot car turn around

areas should be located at the top or bottom of the grade wherever possible and where sight distance is available. A brake check area should be established in advance of the flagger station at the top of a significant grade. Figure SA-4 represents the brake check traffic control requirement. An advance flagger may be positioned in advance of any station where a flagging station will be stopping traffic. Stations where flaggers would be stopping traffic at night shall be illuminated by existing street lighting or portable light towers.

Temporary Traffic Control Elements

Crash Test Requirements for Temporary Traffic Control Devices

Temporary work zone devices manufactured after December 31, 2019, shall be successfully tested to the 2016 edition of the Manual for Assessing Safety Hardware (MASH). Devices manufactured on or before December 31, 2019, and successfully tested to National Cooperative Highway Research Report 350 (NCHRP 350) or the 2009 edition of MASH, may continue to be used throughout their normal service lives.

Signs

All traffic control signs shall conform to the design and size of the respective series listed in the ADOT Manual of Approved Signs (MOAS) or Part 6 of the MUTCD.

The placement of signs should conform to MUTCD Section 6F.03 - Sign Placement.

When signs are used for long-term stationary work, they should be placed on posts.

Smart Work Zone Systems

The use of smart work zones may be considered by designers when choosing which type of temporary traffic control to use. A smart work zone system consists of different types of technology to provide information to operators and/or road users. These systems may provide information about queue lengths, travel times, speeds, delays, or other operational information.

Channelizing Devices

Channelizing devices include cones, vertical panels, Type 1 barricades, Type 2 barricades, Type 3 barricades, drums, and tubular markers. The retroreflective areas of channelizing devices shall meet the requirements of the MUTCD. Designers should consult with Regional Traffic and/or Districts to determine preferences on the choices of channelizing devices.

Spacing of channelizing devices should, at a minimum, comply with the guidelines set forth in the MUTCD.

Typical ADOT practice for roadways with a posted speed of 40 mph or greater is to space channelizing devices at 40 feet on tapers and 80 feet on tangents. For roadways with a posted speed less than 40 mph, the spacing should not exceed distance in feet equal to the speed limit in mph when used for tapers and a distance equal to 2 times the speed limit in mph for tangents. The spacing of the devices in departure tapers as well as One-Lane, Two-Way Traffic Control operations should be 20 feet.

Cones

Cones shall have a minimum height of 28 inches. For nighttime use, cones shall have retroreflective banding, in accordance with the requirements of the MUTCD, for maximum visibility. Cones are strongly discouraged for use in tapers at night and in tapers on freeways.

Vertical Panels

Vertical panels are an alternative to Type 2 barricades.

Vertical panels may be used as an alternative to Type 2 barricades, primarily where lateral space is a consideration.

In some cases, the legs of Type 2 barricades may damage newly placed pavements. In those cases vertical panels with rubber bases may be considered as an alternative.

Type 1 Barricades

Type 1 barricades may be used on conventional roads or urban streets.

Type 2 Barricades

Type 2 barricades should be used on freeways and expressways or other high speed roadways.

Type 3 Barricades

Type 3 barricades are listed as a channelizing device by the MUTCD but ADOT typically does not use them as channeling devices. Type 3 barricades are used to close a roadway.

The ROAD CLOSED or ROAD CLOSED TO THRU TRAFFIC signs may be mounted to a Type 3 barricade. The ROAD CLOSED TO THRU TRAFFIC is usually used on one barricade to allow local traffic to pass. When completely closing roadways or ramps, there will be a sufficient number of Type 3 barricades to prevent vehicles from travelling beyond the barricades.

Drums

The major consideration for the use of drums is they are wider and more highly visible than other channelizing devices. Drums should not be used in locations where space is limited.

Drums are channelizing devices that have no diagonals.

Tubular Markers

Tubular markers are discouraged because they typically require intensive maintenance.

Tubular markers should only be placed when approved by the District Engineer, the Regional Traffic Engineer, or their authorized representative.

Temporary Concrete Barrier (TCB)

Set-ups of TCB shall be designed in accordance with length of need and offset formulas found in ADOT Roadside Design Guide 305-8. There should be a minimum 2-foot lateral offset between the edge of the travelled way and the traffic side of the TCB. There should be a minimum of 2 feet of lateral clear space between the work zone side of the TCB and the work area/drop off or hazard that is being shielded. Where possible, designers should consider providing more than 2 foot lateral offsets. If the clear space between the work zone side of the TCB and the work area or hazard is less than 2 feet, the TCB should be pinned or anchored to a road surface that will be replaced or resurfaced. Designers should consider construction phasing so TCBs are pinned to surfaces that will be replaced or resurfaced.

The TCB shall have BM-1 (white) or, on the left side of a one-way roadway, BM-2 (yellow) barrier markers placed on the tops or sides of the TCB at 20-foot spacing.

When needed, glare screens can be used on TCBs. Glare screens must be paddle-type. Expanded mesh glare screens are no longer used.

For setups off the roadway, earthen material or aggregate base shall be placed at a 10:1 or flatter slope under the TCB and between the TCB and the roadway.

Existing speed limits are a consideration in the design of TCB flare rates. TCB is considered flared when it is not parallel to the edge of the traveled way. The flare rate is the angle of the TCB relative to the parallel portion of TCB. The flare rate should be no steeper than 8:1. Flare rates between 8:1 and 20:1 are shown in Table 5-9 of the AASHTO Roadside Design Guide. The AASHTO Roadside Design Guide notes that flare rates that are more parallel to the edge of the traveled way lead to longer tapers and may lead to more frequent impacts, while steeper flare rates may lead to more severe crashes.

Flare rates steeper than 8:1 may be considered for use in urban areas and/or where existing speeds are lower 45 mph. Flare rates may also be steeper than 8:1 where there are side friction or access concerns.

The effect of striking the ends of barriers should be mitigated by the use of an impact attenuator rated for the design speed or abutting the end against or into the side of an embankment. The end of the barrier need not be protected if the end is located outside the clear zone.

Other Barriers

Temporary Steel Barrier (TSB)

TSB is an alternative to temporary concrete barrier. TSBs are lighter per unit length than TCBs, but have much higher dynamic deflections when not pinned. When used, they shall be in accordance with the manufacturer's recommendations.

Water-Filled Barrier

Water-filled barriers may be used on low-speed roadways with constraints. When used, they shall be in accordance with the manufacturer's recommendations.

Pedestrian Barrier

Pedestrian barriers are designed to channelize pedestrians around a work area. These barriers do not provide positive protection from errant vehicles. Pedestrian access routes that use pedestrian barriers shall follow ADA requirements.

Temporary Pavement Markings

Temporary pavement markings may be used to delineate the traveled way in conjunction with long-term work and for resurfacing projects. Temporary pavement markings include paint and preformed tape. Some examples where temporary pavement markings are provided include:

- Temporary roadway detour
- Lane closures
- Lane shifts
- On interim pavement surfaces
- Seasonal shutdowns

As a minimum, center lines, lane lines, no passing zones, channelized areas, special markings such as railroad crossings, and stop bars should be installed. Painted pavement markings installed on the final surface course in the permanent location are permanent, not temporary, pavement markings.

The temporary pavement markings section of Part 6 of the MUTCD and Section 701 of the ADOT Standard Specifications shall apply. In general, pavement stripes to be installed for up to a two-week period should be at least 4 inches wide and shall consist of 4 foot stripes over 40 foot intervals (2 foot stripes over 20 foot intervals for situations involving severe curvature) for center lines and lane lines. Other temporary pavement markings may consist of temporary pavement arrows, pavement legends, and crosswalk lines and stop bars at least 12 inches wide. If the interim period would be longer than two weeks before any additional work would be done on the roadway, for example seasonal shutdowns, center lines, lane lines, and edge lines corresponding to the existing lengths and all other temporary

pavement markings shall be placed. In addition, gore striping should be placed on freeways. For projects for which the temporary pavement markings will remain constant for a long period of time, the temporary pavement markings shall be applied at the full lengths. For setups in place over 2-3 months, an additional application(s) of temporary pavement markings may need to be applied.

Temporary Pavement Markers

On work involving a chip seal, chip seal markers shall be used to delineate the center lines and lane lines. The contractor should apply permanent pavement marking material within 7 calendar days of the chip seal placement. Chip seal markers shall not be placed on milled surfaces. Chip seal markers may be used with other bituminous treatments which require loose surface materials to be applied. In those situations, temporary painted markings would be removed with the loose surface materials.

Retroreflective pavement markers (RPM) may be used to supplement temporary striping for long-term setups.

Temporary Delineators

Temporary delineators are infrequently used, but where they are used, they are typically used alongside temporary pavements where they can be placed off of the pavement. The spacing of temporary delineators shall comply with the MUTCD.

Changeable Message Signs

Each changeable message sign message shall be limited to a maximum of two separate phases with a maximum of three lines per phase and a maximum of eight characters per line. Changeable message signs are not crashworthy devices. Changeable message signs should be placed behind guardrail or concrete barrier. Where this is not possible, Type 2 barricades should be used to alert drivers to changeable message signs.

Existing dynamic message signs (DMS) may be used as a temporary changeable message sign. DMS have the advantage to allow more than 8 characters per line. DMS have the disadvantage of having its message preempted in the case of an emergency.

Designers should coordinate potential messages with the appropriate district personnel. Acceptable abbreviations for messages are identified in Table 1A-2 of the MUTCD and the Portable Changeable Message Sign Handbook.

Field personnel should base the size of a changeable message sign for the specific location according to Section 701 of the ADOT Specifications and the MUTCD.

Designers should field-verify the locations of changeable message signs before identifying sites for them.

Temporary Impact Attenuators

Temporary impact attenuators include stationary attenuators, such as sand barrel arrays and in-line attenuators, and portable attenuators, such as truck mounted attenuators (TMAs).

Stationary temporary impact attenuators are intended to shield blunt end hazards such as the end of a TCB run or a fixed hazard within the clear zone. Factors involved with the selection of the impact attenuators include, but are not limited to:

- Manufacturer's specifications
- Site conditions
    - Existing speed or prevailing speed of the roadway
    - Width of the hazard
    - Configuration of the hazard
    - Offset from the edge of the pavement

Temporary impact attenuators shall be maintained on a regular basis. They shall not be used to retain slopes. Appropriate delineation shall be affixed to the temporary impact attenuators.

The surface underneath a sand barrel array and between the array and the edge of the roadway shall be 10:1 or flatter.

Temporary In-Line Attenuators (In-Line Energy Absorbing Terminals)

A temporary in-line attenuator is one type of attenuation device, typically positioned at one or more ends of a temporary concrete barrier (TCB) installation for temporary traffic control setups. In-line attenuators, which are approximately the same widths as TCB, are frequently used instead of temporary sand barrel crash cushions, primarily where there are lateral constraints so that sand barrel crash cushions are impractical. However, unlike the sand barrel crash cushions, in-line attenuators must align with the adjoining section of TCB to be effective. In-line attenuators should be oriented to align with oncoming traffic. These devices must meet the requirements of MASH Test Level 3 or NCHRP 350 Test Level 3.

Truck Mounted Attenuators

If used, a truck mounted attenuator (TMA) shall be placed in advance of the work area within the TTC zone. TMAs used on roadways with posted speeds over 45 mph shall meet NCHRP 350 or MASH Test Level 3 or above. The traffic control setup shall incorporate an appropriate roll-ahead distance in accordance with the manufacturer's specifications. The roll-ahead distance is defined as the distance the TMA host vehicle travels forward if hit.

The designer should coordinate with the ADOT District before calling for TMAs. TMAs should be considered carefully before included on traffic control plans. The following are some types of work where TMAs may be used:

- Shoulder work
- Setup and take down of temporary traffic control
- Lane closures
- Mobile operations

Temporary Traffic Signals (Portable)

Temporary traffic signals replace existing traffic signals at existing intersections or are used instead of flaggers on two-lane, two-way roadways for which there will temporarily be alternating one-way flows of traffic over relatively long durations. These durations make it financially impractical to use flaggers, especially when the need for alternating traffic flows is on a 24-hour-a-day basis for many days. However, there is no guarantee drivers will comply with the indications of the temporary traffic signals. Temporary traffic signals should be positioned so approaching traffic has sufficient sight distance to the signal and the last vehicle in the queue.

There is an advantage and a disadvantage to motorists at the stopping points being able to see one another. The advantage is the drivers would be able to proceed if there is a power outage or if the signal malfunctions. The disadvantage is drivers may proceed on a red indication if they do not see a vehicle coming toward them or waiting at the other signal location.

Typically, the construction speed limit is reduced to no greater than 35 mph at locations where there are temporary traffic signals on a two-lane, two-way roadway.

Each setup with temporary traffic signals requires one trailer per direction of traffic. For example, when there are alternating flows on a two-lane, two-way roadway, two trailers will typically be necessary. Typically, each trailer has two signal heads, one on the pole arising from the trailer and one overhead on a mast arm connected to that pole. For two-lane, two-way roadways with alternating flows, each trailer should be situated in a protected area behind barrier – typically guardrail or temporary concrete barrier – or behind an attenuation device(s). The trailers should be positioned so the temporary stop bars can be placed per Part 4 of the MUTCD. It is also important to consider the locations of the one-lane, two-way traffic tapers when locating the trailers and stop bars.

Occasionally, a traffic control setup may require more than two trailers with the temporary traffic signals. This could be due to the temporary signal control needing to apply to one or more approaches to the roadway between the locations of the primary two trailers. Where possible, it is highly desirable to avoid the need for more than the primary two trailers. Each additional approach requiring temporary signalization typically increases delay times due to an additional all-red phase. These delays can be

minimized by providing detection instead of calling for "fixed time" for the temporary traffic signals. It may also be possible to close or to re-route temporarily an approach to avoid the need for that approach to be signalized.

Since a long-term traffic control setup needs to have a relatively fixed alignment to use temporary traffic signals, frequently temporary concrete barrier (TCB) may be necessary to ensure vehicles follow that fixed alignment. When it is necessary for vehicles to deviate from that alignment, such as when a traffic control setup is being changed, flaggers are typically used to override the traffic signals temporarily.

Warning Lights

Warning Lights on Temporary Traffic Control Devices			
Type	Description	Application	Usage
Type A	Low Intensity Flashing *Typically used for most applications*	1. On advance warning signs 2. Devices to warn of a potential hazard 3. Detour signs	Night
Type B	High Intensity Flashing *Only used on certain signs or other devices for special situations*	1. On advance warning signs 2. Devices to warn of a potential hazard 3. Detour signs Engineering judgment must be used for considering Type B lights.	Day and Night
Type C	Steady-Burn	1. Lane guidance a. Merging tapers b. Shifting tapers c. Tangent sections 2. Delineation of traveled way	Night
Type D	360 Degree Steady-Burn *Only used rarely for special situations*	Used where the devices, on specific applications, may need to be viewed from multiple directions. Engineering judgment must be used for considering Type D lights.	Night

The following guidance will be followed if lights are included:

Type A flashing warning lights shall be placed on each end of each Type 3 barricade whenever the Type 3 barricade will remain in place overnight or whenever the barricade is set before sunrise or traffic control activities extend after sunset. Type A or Type B flashing warning lights shall be placed on devices that precede or are located in a potentially hazardous area.

Type B warning lights may be considered for locations for which Type A flashing warning lights are not sufficient such as:

- A location(s) which may experience diminished visibility for reasons other than darkness, such as periodic dust storms or fog.
- A work zone with a particular sign(s) of relative importance – especially for an unexpected condition such as a significant decrease in the operating speed and/or a significant change in the roadway alignment, especially where site conditions may not permit the regular complement of signs to be positioned.

Optionally, Type C warning lights may be added to channelizing devices in areas with frequent fog, snow, or severe roadway curvature, or where visual distractions are present. The maximum spacing for warning lights should be identical to the channelizing device spacing requirements. When used to delineate a curve, Type C warning lights should only be used on devices on the outside of the curve, and not on the inside of the curve. When used on channelizing devices, Type C steady-burn lights shall be placed on every vertical panel, Type 1 and Type 2 barricade, and drum during the same periods, except when they precede or are located in a potentially hazardous area.

Type D warning lights may be considered for locations such as:

- The edges of the traveled way at an intersection with atypical returns – primarily with curving or skewed roadway approaches or other atypical alignments.
- A taper – particularly a lane closure taper – where the roadway alignment containing the taper curves sharply.

Where possible, designers should design traffic control plans to avoid the situations identified for Type D warning lights.

Types of Temporary Traffic Control Zone Activities

Duration of Work

Work duration is a significant factor in the selection of a supplemental or typical application. There are five categories of work durations according to Section 6G.02 of the MUTCD.

1. Long-term stationary – work that occupies a location for more than 3 days.
2. Intermediate-term stationary – work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.
3. Short-term stationary – daytime work that occupies a location for more than 1 hour within a single daylight period.
4. Short duration – work that occupies a location up to 1 hour.

5. Mobile – work that moves intermittently or continuously, for example, operations that involve pothole patching.

Elevation Differences

When construction requires there to be a drop-off between adjoining lanes or between the paved roadway and the unpaved shoulder, it is typical to provide elevation difference signs. Where temporary concrete barrier is placed alongside the drop-off, elevation difference warning signs are not used.

Elevation difference signs are not used where the pavement will be milled and replaced because ADOT Specifications prohibit trench conditions being left at the end of working shifts.

Elevation Difference Signs

Warning signs for differences in elevation should be provided under the following conditions:

(a) LOW SHOULDER (W8-9) sign – The LOW SHOULDER sign should only be used when the drop-off between edge of pavement and shoulder is less than 2 inches.

(b) Shoulder Drop-Off (W8-17) sign – The shoulder drop-off sign should be used when the drop-off between the travel lane and the shoulder is 2 inches or more. Furthermore, a fillet of earthen material or aggregate base material shall be placed adjacent to the drop-off. The fillet shall be at least 2 feet wide followed by a slope of 3:1 for the protection of run-off-the-road vehicles.

(c) UNEVEN LANES (W8-11) sign – The UNEVEN LANES sign should be used to identify a difference in elevation between travel lanes of 2 inches or more. These signs should be placed after every significant access point or no more than every ½ mile to warn traffic of the uneven edge between lanes.

Supplemental Applications

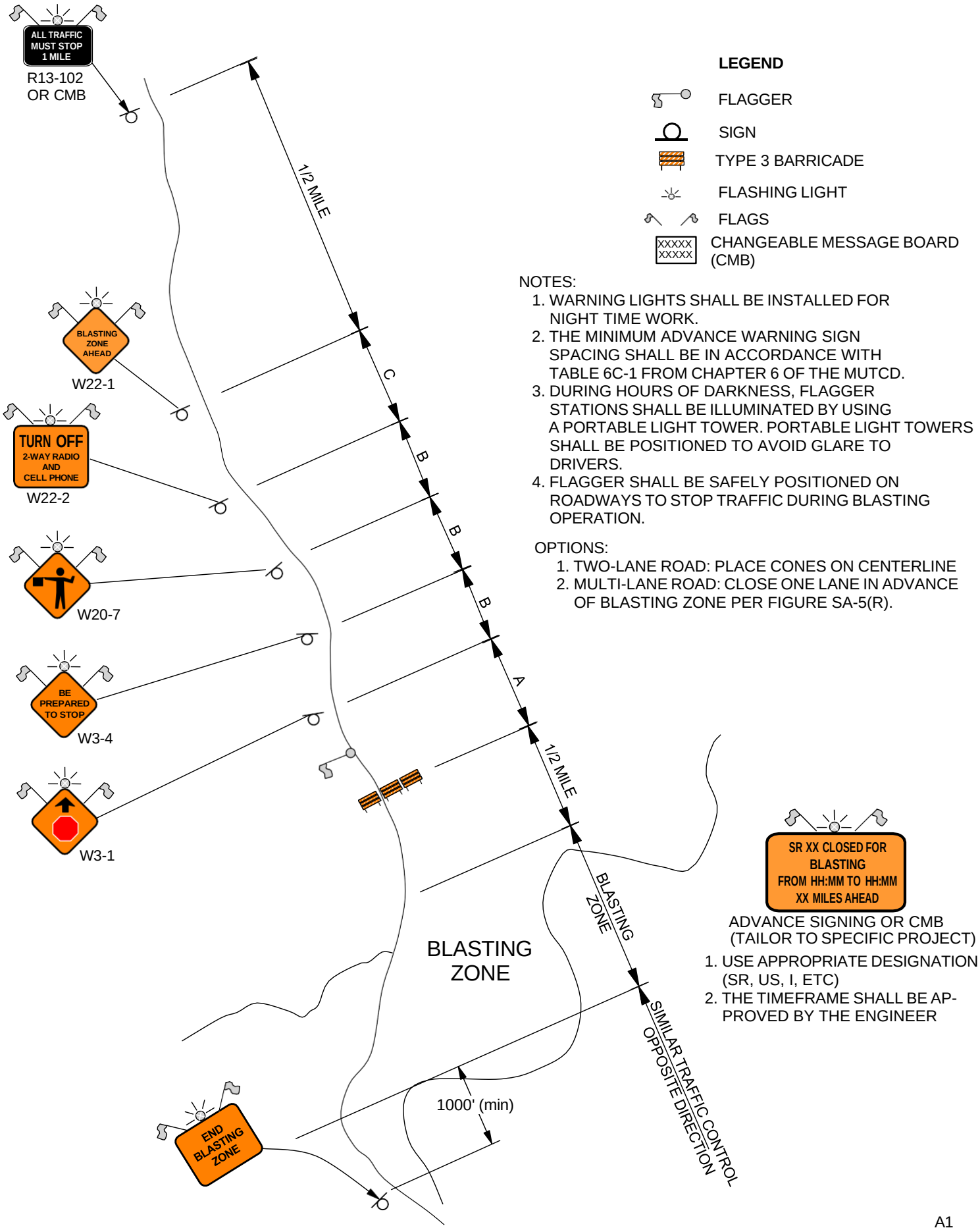
In addition to the typical applications (TA) found in Part 6 of the MUTCD, this document contains additional typical applications, Figures SA-1 through SA-19, that may be used for temporary traffic control, if applicable.

There will be situations where the traffic control does not generally conform to any of the SA or TA applications. In those cases, the designer will be required to provide a site-specific traffic control plan to address those situations. Designers shall assess the nature of the work to determine which traffic control plan is appropriate.

Supplemental Application Number	Supplemental Application Description
SA-1	Blasting Zone
SA-2	Mandatory Road Closure at Intersection of Multi-Lane Roadway
SA-3	One Lane Closure of a Two-Way Roadway Utilizing a Pilot Car
SA-4	Brake Check Area (Two-Lane, Two-Way)
SA-5L	Lane and a Half Closure (Left Lane) Divided Highway
SA-5R	Lane and a Half Closure (Right Lane) Divided Highway
SA-6	Diversion of Left Through Lane onto Left Turn Lane
SA-7	Right Lane Closure with Lane Shifts Using Left Turn Lane
SA-8	Intersection with Right Turn Lane - Right Lane Closure – Near Side
SA-9	Full Closure, Multi-Lane Divided Highway
SA-10	Exit Ramp Closure Advanced Notification and Actual Closure
SA-11	Median Crossover for Construction Vehicles (Divided Highway)
SA-12	Traffic Control Signing: Fines are Double in the Work-Zone Area Where Workers are Present
SA-13	Shoulder Closure for Changeable Message Board (Mainline Adjacent to On-Ramp)
SA-14	Shoulder Closure for Changeable Message Board (Ramp)
SA-15	Shoulder Closure for Changeable Message Board (Mainline)
SA-16	Shoulder Closure for Changeable Message Board (Median)
SA-17	Shoulder Closure for Changeable Message Board (Mainline Adjacent to Off-Ramp)
SA-18	Mobile Striping Operation – Divided Highway
SA-19	Mobile Striping Operation – Non-Divided Highway
SA-20	Mobile Striping Operation – Ramp

Appendix A

FIGURE SA-1.
BLASTING ZONE



LEGEND

- FLAGGER
- SIGN
- TYPE 3 BARRICADE
- FLASHING LIGHT
- FLAGS
- XXXXX / XXXXX — CHANGEABLE MESSAGE BOARD (CMB)

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
3. DURING HOURS OF DARKNESS, FLAGGER STATIONS SHALL BE ILLUMINATED BY USING A PORTABLE LIGHT TOWER. PORTABLE LIGHT TOWERS SHALL BE POSITIONED TO AVOID GLARE TO DRIVERS.
4. FLAGGER SHALL BE SAFELY POSITIONED ON ROADWAYS TO STOP TRAFFIC DURING BLASTING OPERATION.

OPTIONS:

1. TWO-LANE ROAD: PLACE CONES ON CENTERLINE
2. MULTI-LANE ROAD: CLOSE ONE LANE IN ADVANCE OF BLASTING ZONE PER FIGURE SA-5(R).

ADVANCE SIGNING OR CMB
(TAILOR TO SPECIFIC PROJECT)

1. USE APPROPRIATE DESIGNATION (SR, US, I, ETC)
2. THE TIMEFRAME SHALL BE APPROVED BY THE ENGINEER

FIGURE SA-2.
ROAD CLOSURE FAR SIDE OF THE AT INTERSECTION OF MULTI-LANE ROADWAY

LEGEND
- FLAGS
- CHANNELIZING DEVICE
- FLASHING LIGHT
- DIRECTION OF TRAVEL
- XXXXX XXXXX CHANGEABLE MESSAGE BOARD (CMB)
- TYPE 3 BARRICADE
- SIGN

NOTES:
1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. ENGINEER MAY ALLOW CONTRACTOR TO OMIT FLAGS DUE TO LATERAL CONSTRAINTS.
3. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
4. PROVIDE CMB OR STATIC SIGNS INDICATING STREET CLOSURE AHEAD.
5. SIGN TO BE PLACED ONLY IF THERE IS DETOUR SIGNING THAT IS IN PLACE.
6. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

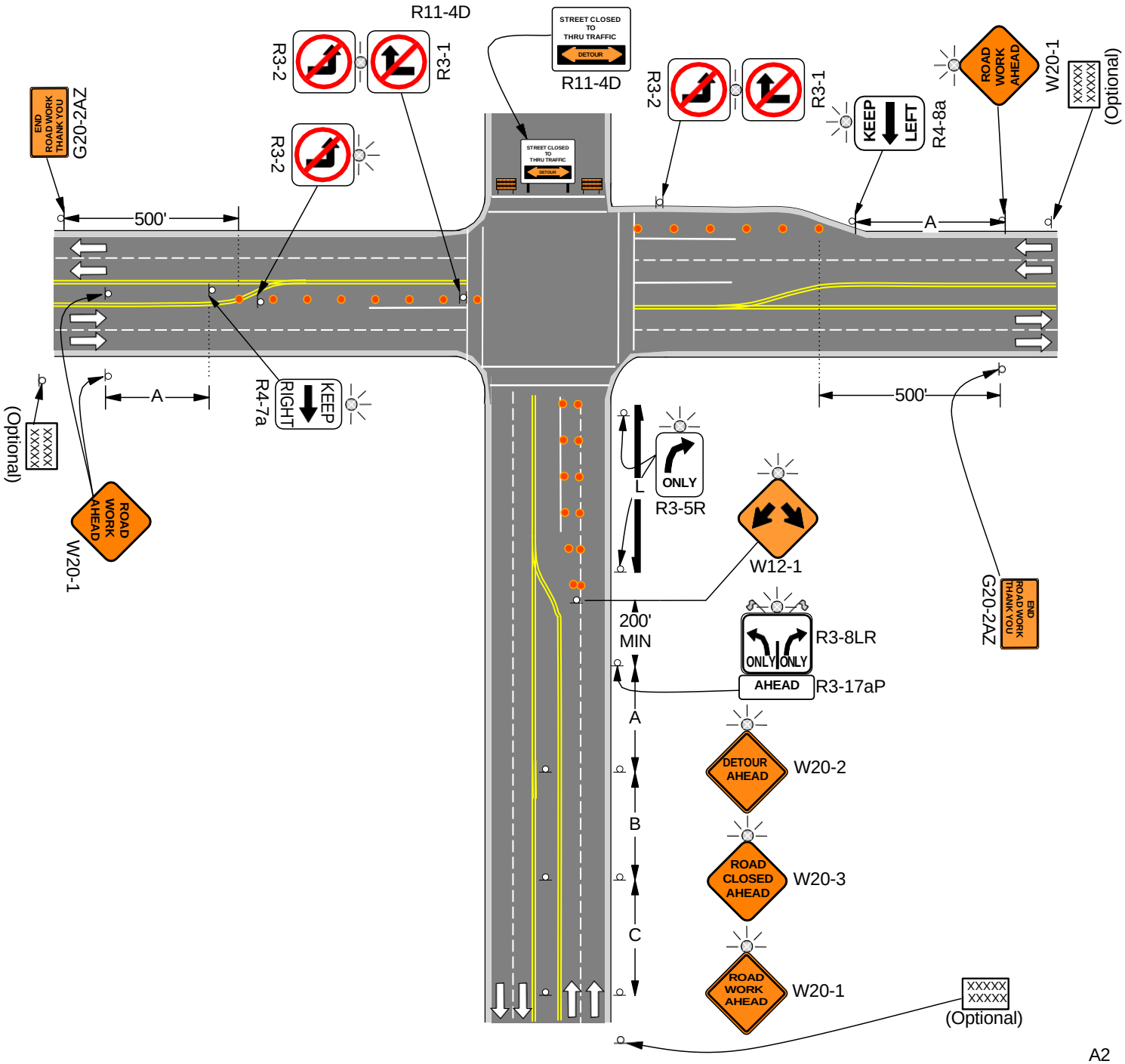
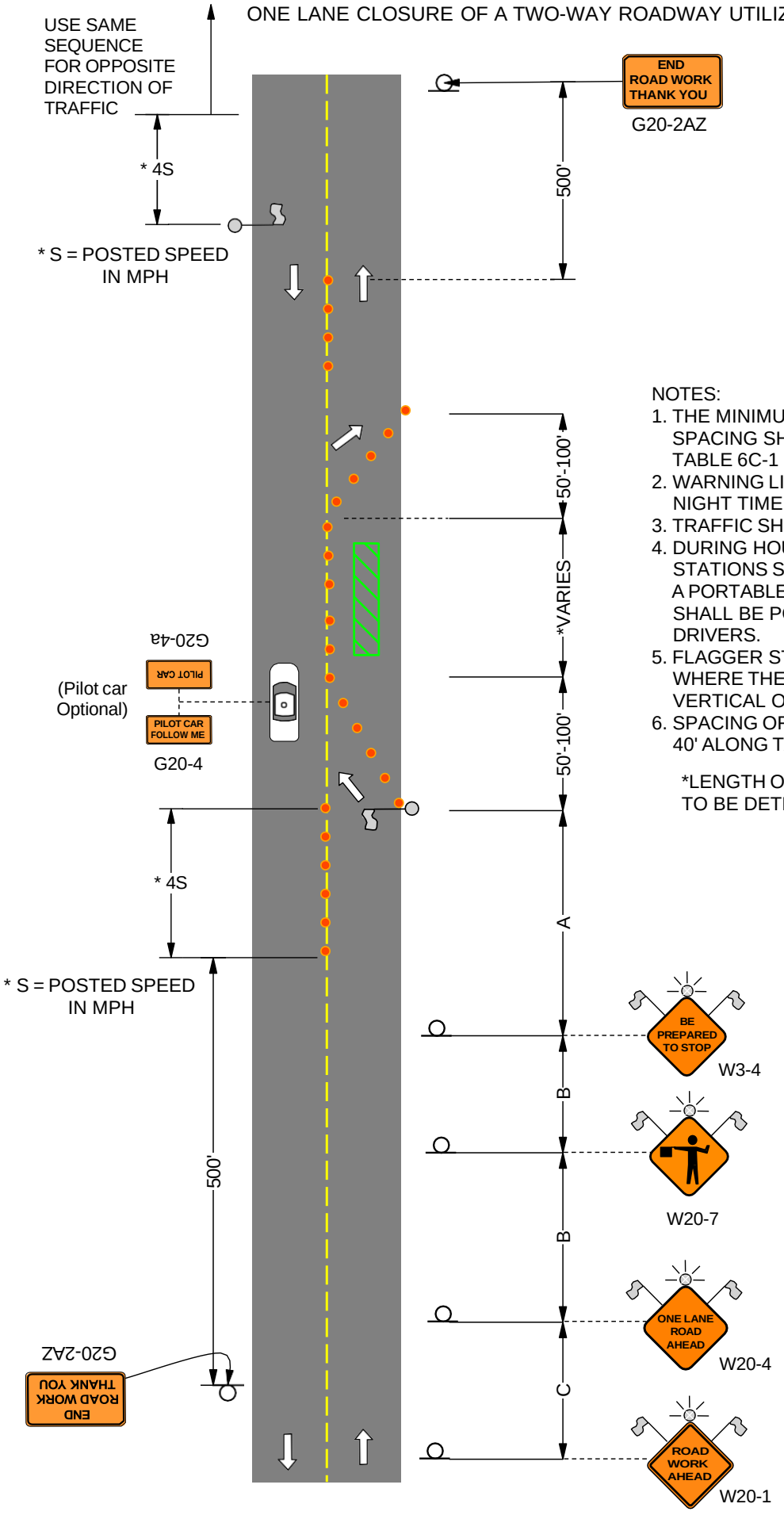


FIGURE SA-3.
ONE LANE CLOSURE OF A TWO-WAY ROADWAY UTILIZING PILOT CAR



LEGEND

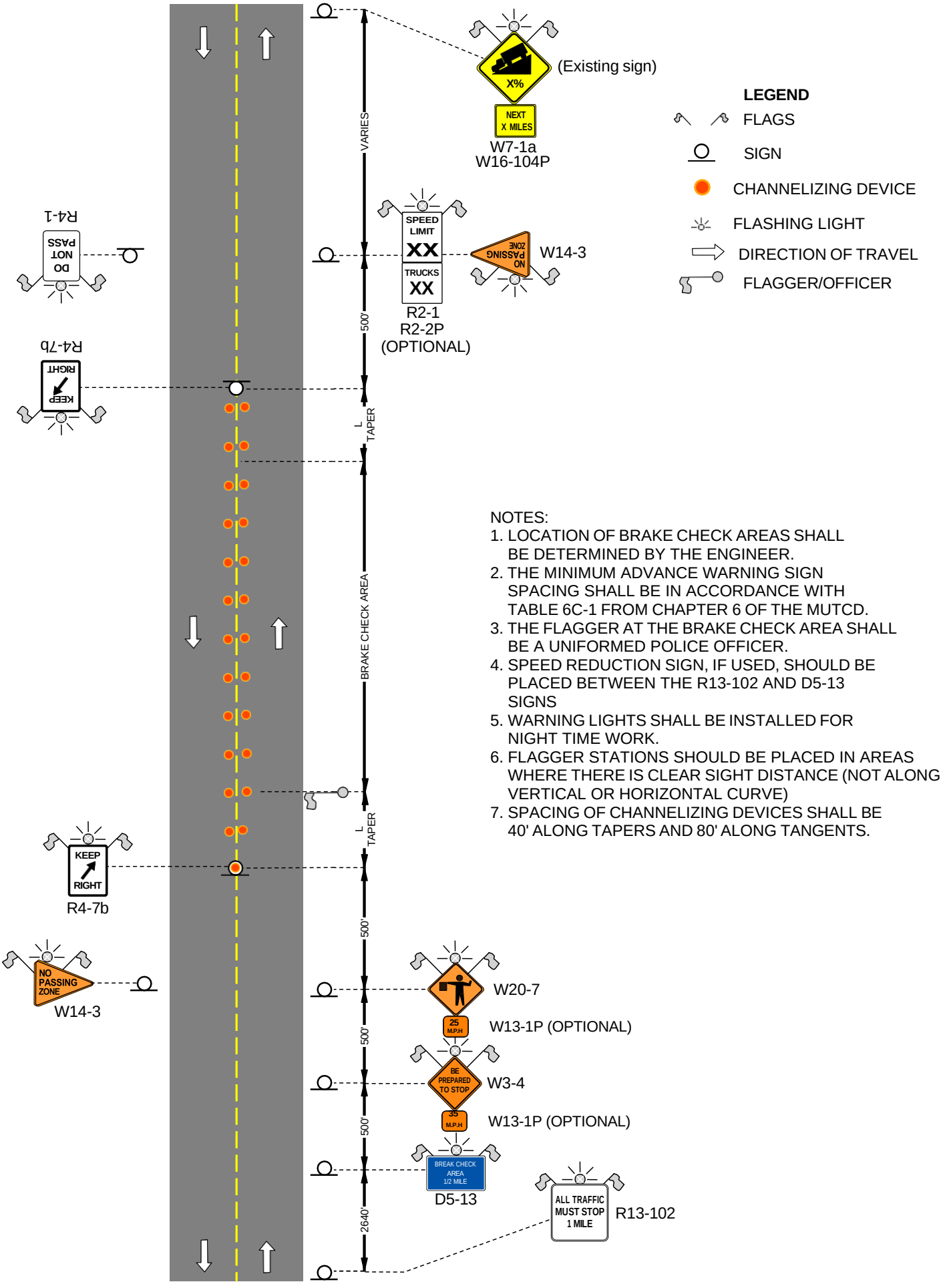
- FLAGS
- CHANNELIZING DEVICE
- FLASHING LIGHT
- FLAGGER
- SIGN
- DIRECTION OF TRAVEL
- WORK ZONE

NOTES:

1. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
2. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
3. TRAFFIC SHOULD NOT BE HELD MORE THAN 15 MIN.
4. DURING HOURS OF DARKNESS, FLAGGER STATIONS SHALL BE ILLUMINATED BY USING A PORTABLE LIGHT. PORTABLE LIGHT TOWERS SHALL BE POSITIONSED TO AVOID GLARE TO DRIVERS.
5. FLAGGER STATIONS SHOULD BE PLACED IN AREAS WHERE THERE IS CLEAR SIGHT DISTANCE (NOT ALONG VERTICAL OR HORIZONTAL CURVE)
6. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

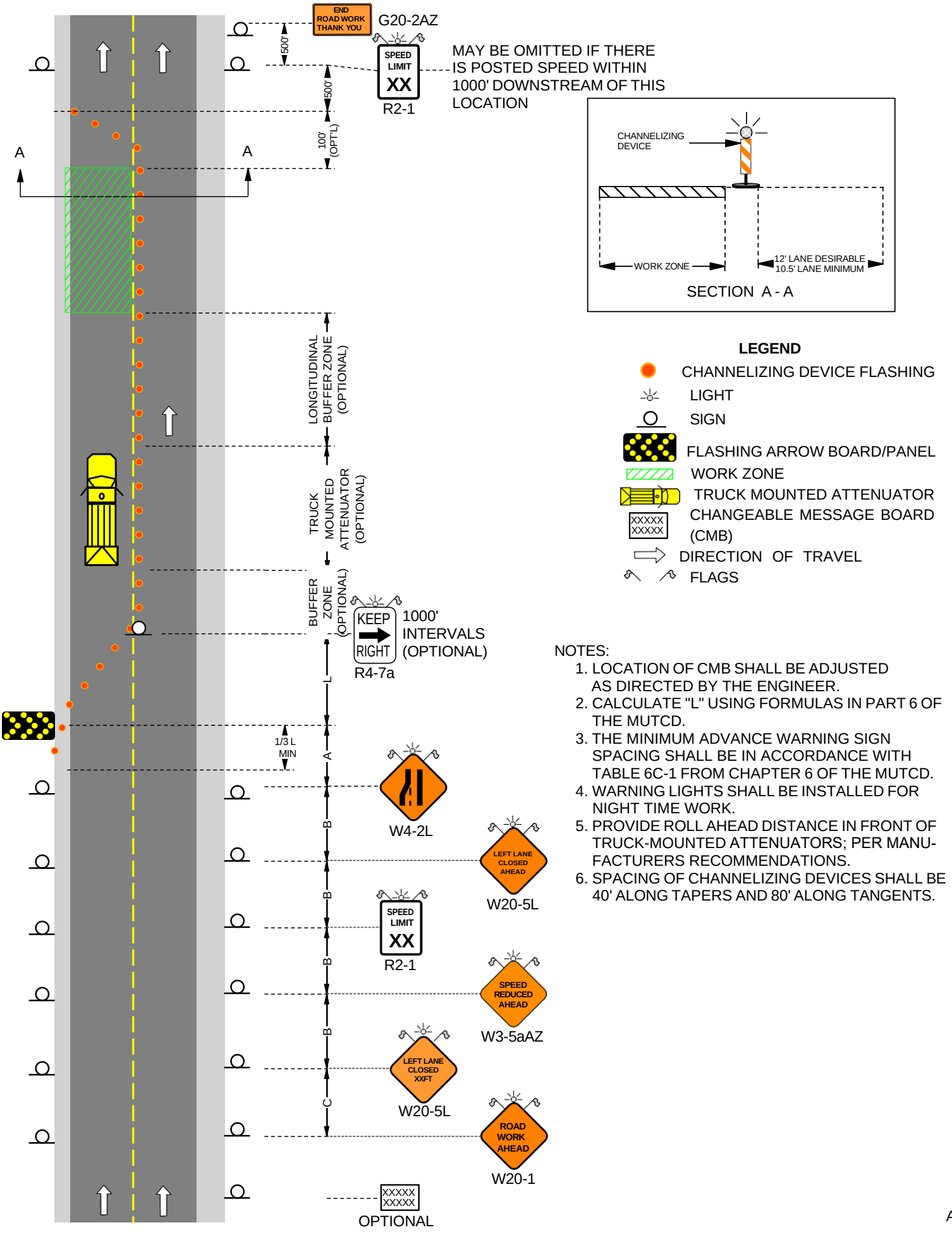
*LENGTH OF WORKZONE VARIES BY WORK ACTIVITY, TO BE DETERMINED BY THE ENGINEER.

FIGURE SA-4.
BRAKE CHECK AREA (TWO-LANE, TWO-WAY)



NOTES:
1. LOCATION OF BRAKE CHECK AREAS SHALL BE DETERMINED BY THE ENGINEER.
2. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
3. THE FLAGGER AT THE BRAKE CHECK AREA SHALL BE A UNIFORMED POLICE OFFICER.
4. SPEED REDUCTION SIGN, IF USED, SHOULD BE PLACED BETWEEN THE R13-102 AND D5-13 SIGNS
5. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
6. FLAGGER STATIONS SHOULD BE PLACED IN AREAS WHERE THERE IS CLEAR SIGHT DISTANCE (NOT ALONG VERTICAL OR HORIZONTAL CURVE)
7. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

FIGURE SA-5(L).
LANE CLOSURE (RIGHT LANE) DIVIDED HIGHWAY

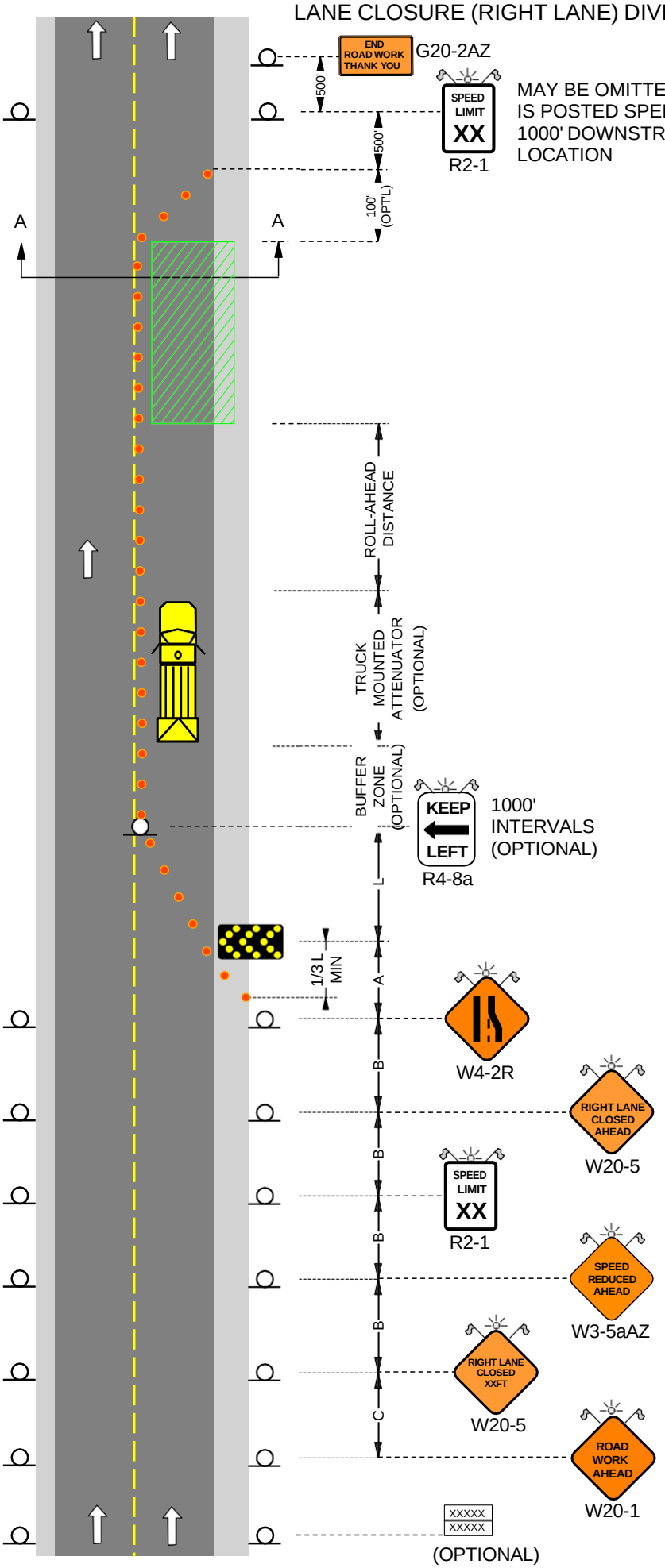


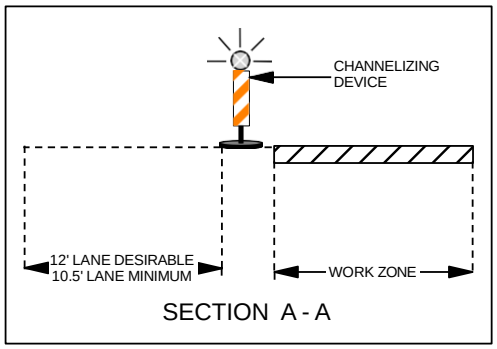
NOTES:

1. LOCATION OF CMB SHALL BE ADJUSTED AS DIRECTED BY THE ENGINEER.
2. CALCULATE "L" USING FORMULAS IN PART 6 OF THE MUTCD.
3. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
4. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
5. PROVIDE ROLL AHEAD DISTANCE IN FRONT OF TRUCK-MOUNTED ATTENUATORS; PER MANUFACTURERS RECOMMENDATIONS.
6. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

FIGURE SA-5(R).

LANE CLOSURE (RIGHT LANE) DIVIDED HIGHWAY





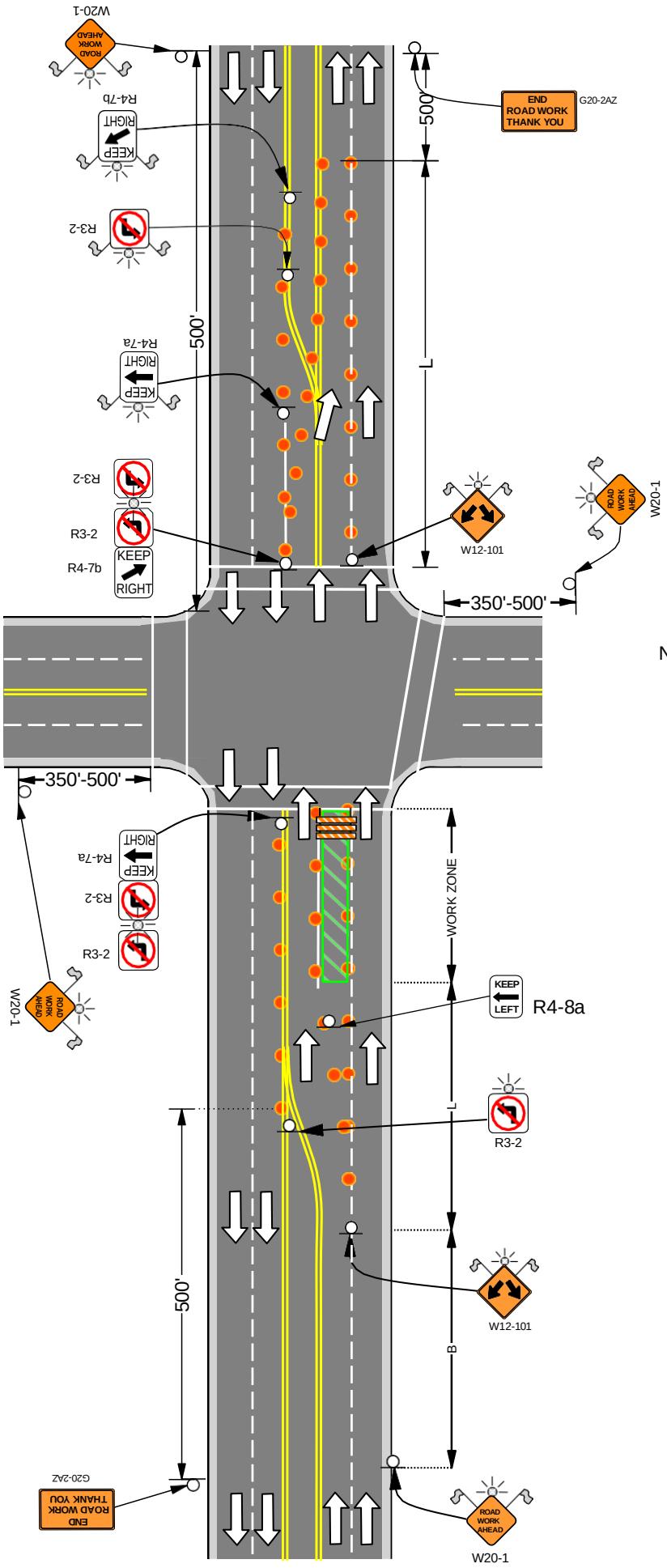
LEGEND

- CHANNELIZING DEVICE FLASHING LIGHT
- SIGN
- FLASHING ARROW BOARD/PANEL
- WORK ZONE
- TRUCK MOUNTED ATTENUATOR
- CHANGEABLE MESSAGE BOARD (CMB)
- DIRECTION OF TRAVEL
- FLAGS

NOTES:

1. LOCATION OF CMB SHALL BE ADJUSTED AS DIRECTED BY THE ENGINEER.
2. CALCULATE "L" USING FORMULAS IN PART 6 OF THE MUTCD.
3. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
4. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
5. PROVIDE ROLL AHEAD DISTANCE IN FRONT OF TRUCK-MOUNTED ATTENUATORS; PER MANUFACTURERS RECOMMENDATIONS.
6. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

FIGURE SA-6.
DIVERSION OF LEFT THROUGH LANE INTO LEFT TURN LANE



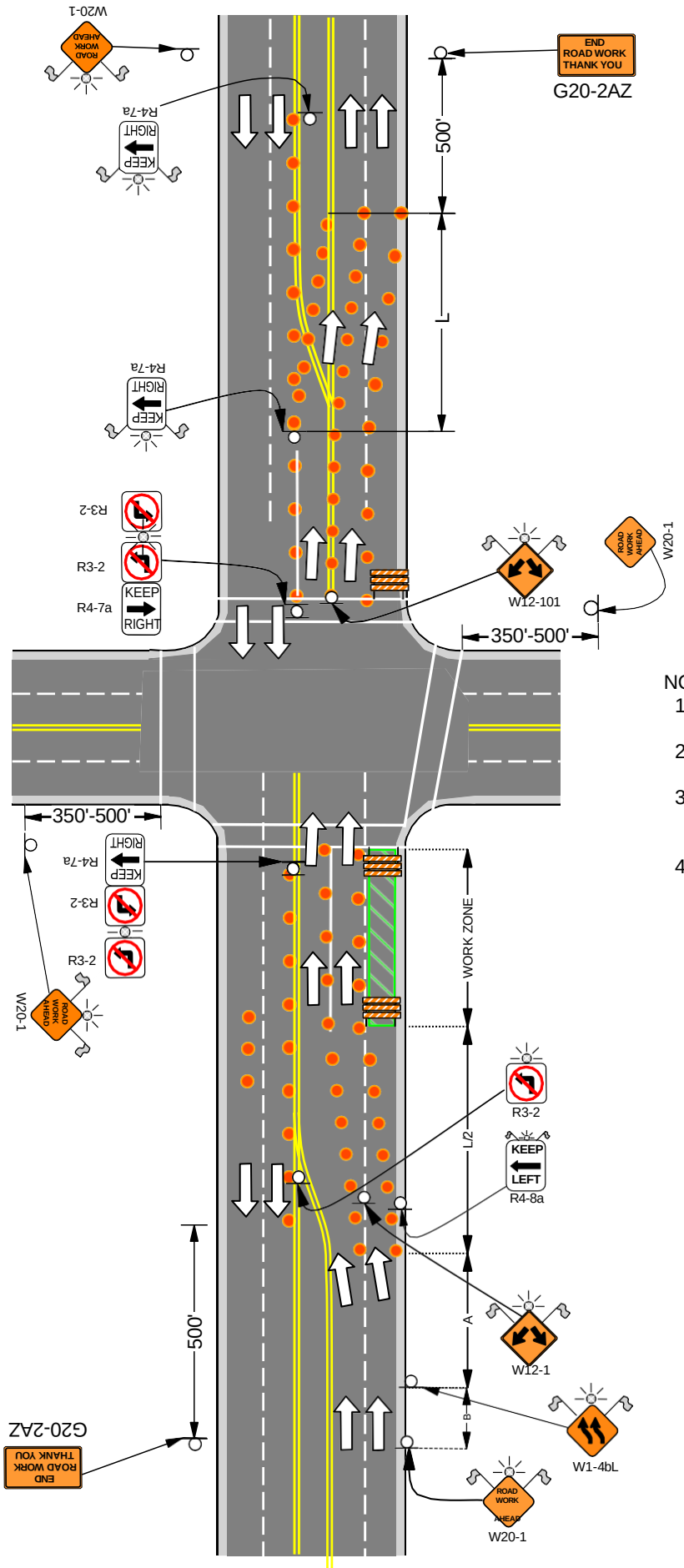
LEGEND

- CHANNELIZING DEVICE
- FLASHING LIGHT
- SIGN
- WORK ZONE
- DIRECTION OF TRAVEL
- FLAGS
- TYPE 3 BARRICADE

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED.
2. ENGINEER MAY ALLOW CONTRACTOR TO OMIT FLAGS DUE TO LATERAL CONSTRAINTS.
3. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
4. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

FIGURE SA-7.
RIGHT LANE CLOSURE WITH LANE SHIFTS USING LEFT TURN LANE



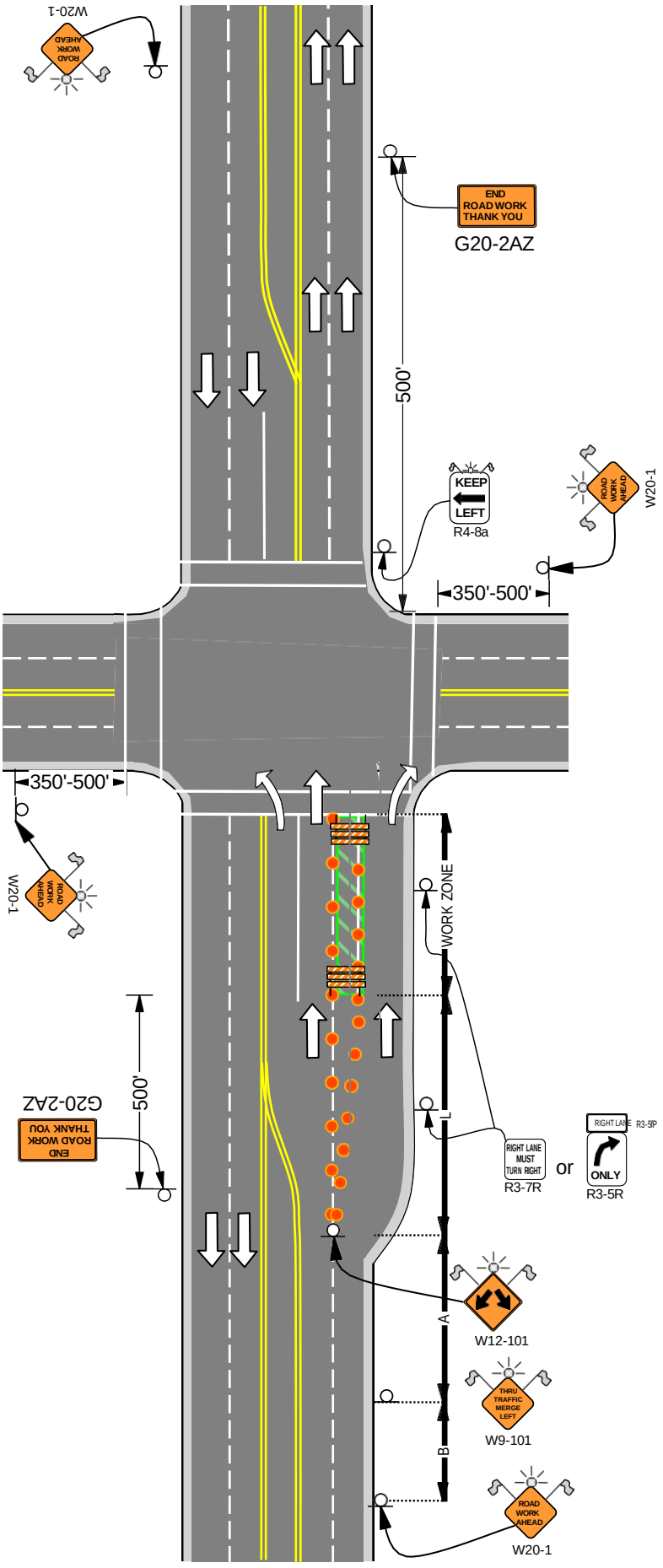
LEGEND

- CHANNELIZING DEVICE
- FLASHING LIGHT
- SIGN
- WORK ZONE
- DIRECTION OF TRAVEL
- FLAGS
- TYPE 3 BARRICADE

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. ENGINEER MAY ALLOW CONTRACTOR TO OMIT FLAGS DUE TO LATERAL CONSTRAINTS.
3. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
4. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

FIGURE SA-8.
INTERSECTION WITH RIGHT LANE CLOSURE - NEAR SIDE



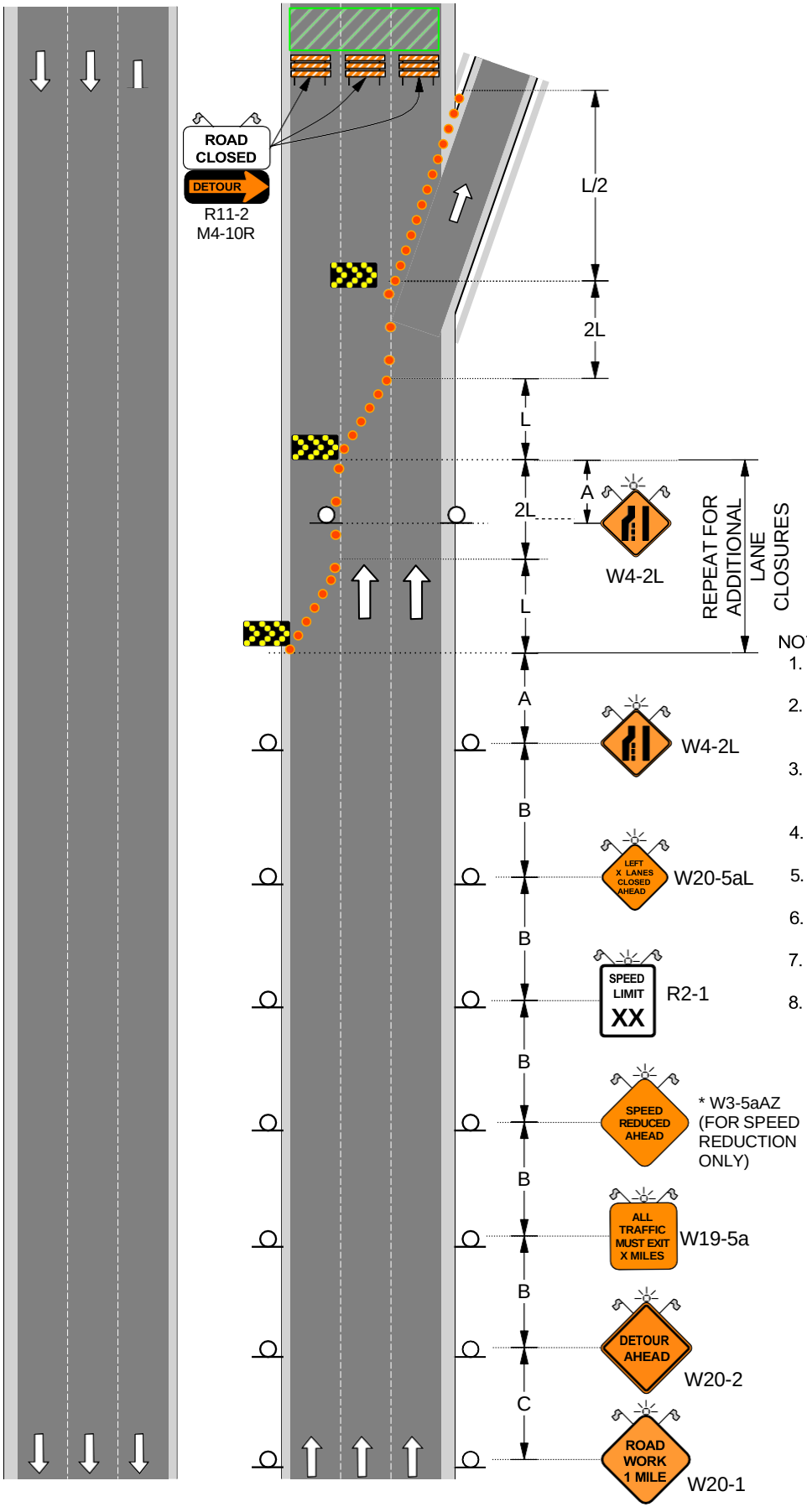
LEGEND

- CHANNELIZING DEVICE
- FLASHING LIGHT
- SIGN
- WORK ZONE
- DIRECTION OF TRAVEL
- FLAGS
- TYPE 3 BARRICADE

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. ENGINEER MAY ALLOW CONTRACTOR TO OMIT FLAGS DUE TO LATERAL CONSTRAINTS.
3. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
4. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

FIGURE SA-9.
FULL CLOSURE, MULTI-LANE DIVIDED HIGHWAY



LEGEND

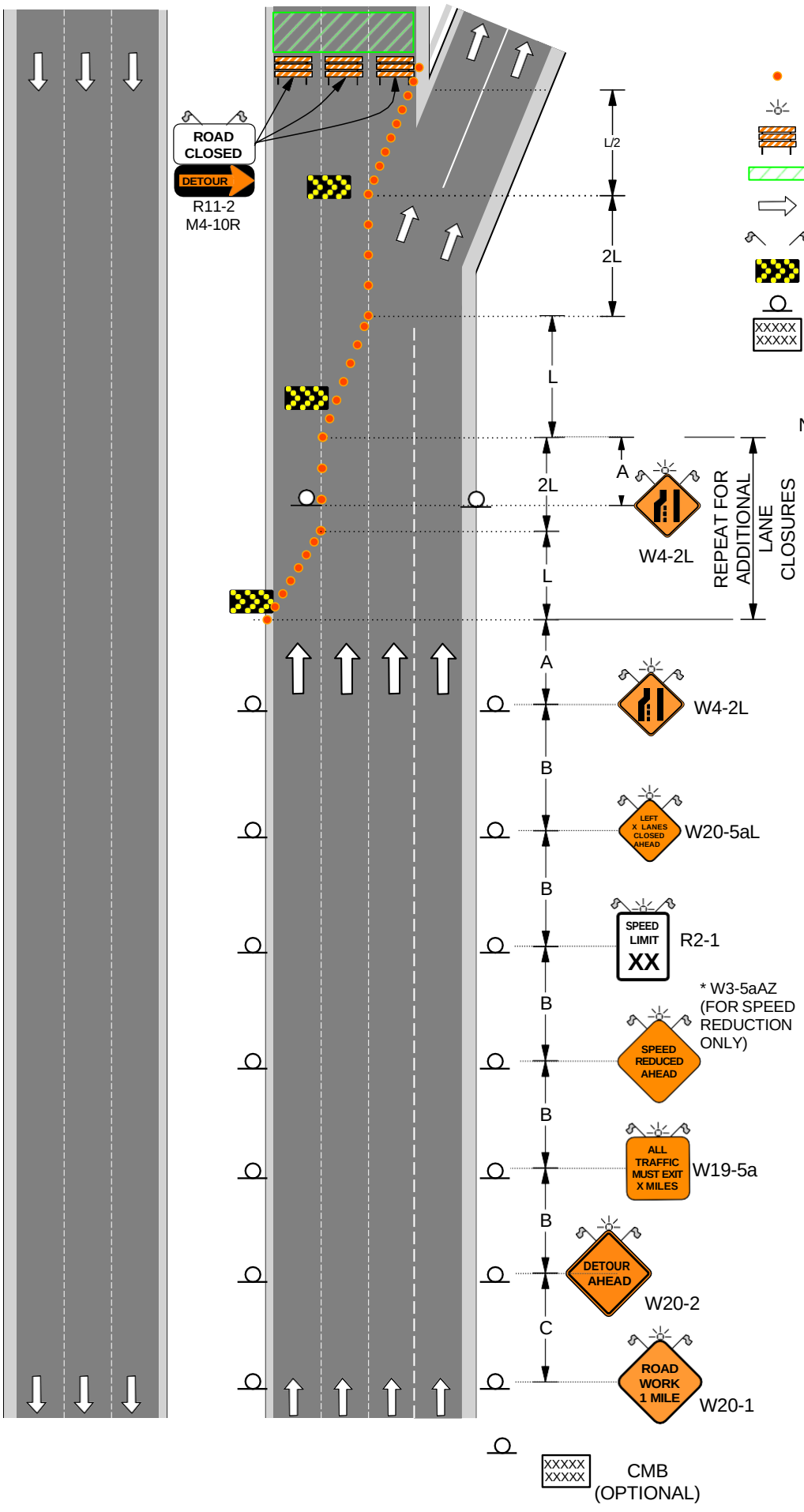
- CHANNELIZING DEVICE
- FLASHING LIGHT (SEE NOTE)
- TYPE 3 BARRACADE
- WORK ZONE
- DIRECTION OF TRAVEL
- FLAGS
- ARROW BOARD
- SIGN
- CHANGEABLE MESSAGE BOARD (CMB)

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT WORK ONLY.
2. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
3. PRECEDING ON-RAMP OF TIs SPACED AT 1 MILE (CLOSELY-SPACED) SHALL BE CLOSED DURING THIS CLOSURE.
4. DETOUR PLAN MAY BE NECESSARY IN CON-JUNCTION WITH THIS PLAN SA-9.
5. LOCATION OF CMB SHALL BE ADJUSTED AS DIRECTED BY THE ENGINEEER.
6. ADDITIONAL SPEED REDUCTIONS MAY BE NE-CESSARY.
7. DETOUR PLAN MAY BE NECESSARY IN CONJUNC-TION WITH SA-9.
8. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

CMB (OPTIONAL)

FIGURE SA-9B.
FULL CLOSURE, MULTI-LANE DIVIDED HIGHWAY DUAL EXIT



LEGEND

- CHANNELIZING DEVICE
- FLASHING LIGHT (SEE NOTE)
- TYPE 3 BARRACADE
- WORK ZONE
- DIRECTION OF TRAVEL
- FLAGS
- ARROW BOARD
- SIGN
- CHANGEABLE MESSAGE BOARD (CMB)

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT WORK ONLY.
2. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
3. THE PRECEDING ON-RAMPS OF TIs SPACED AT 1 MILE SHALL BE CLOSED DURING THIS CLOSURE.
4. DETOUR PLAN SHALL BE NECESSARY IN CONJUNCTION WITH THIS PLAN SA-9.
5. LOCATION OF CMB SHALL BE ADJUSTED AS DIRECTED BY THE ENGINEER.
6. ADDITIONAL SPEED REDUCTIONS MAY BE NECESSARY.
7. DETOUR PLAN MAY BE NECESSARY IN CONJUNCTION WITH SA-9.
8. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

FIGURE SA-10.
EXIT RAMP CLOSURE

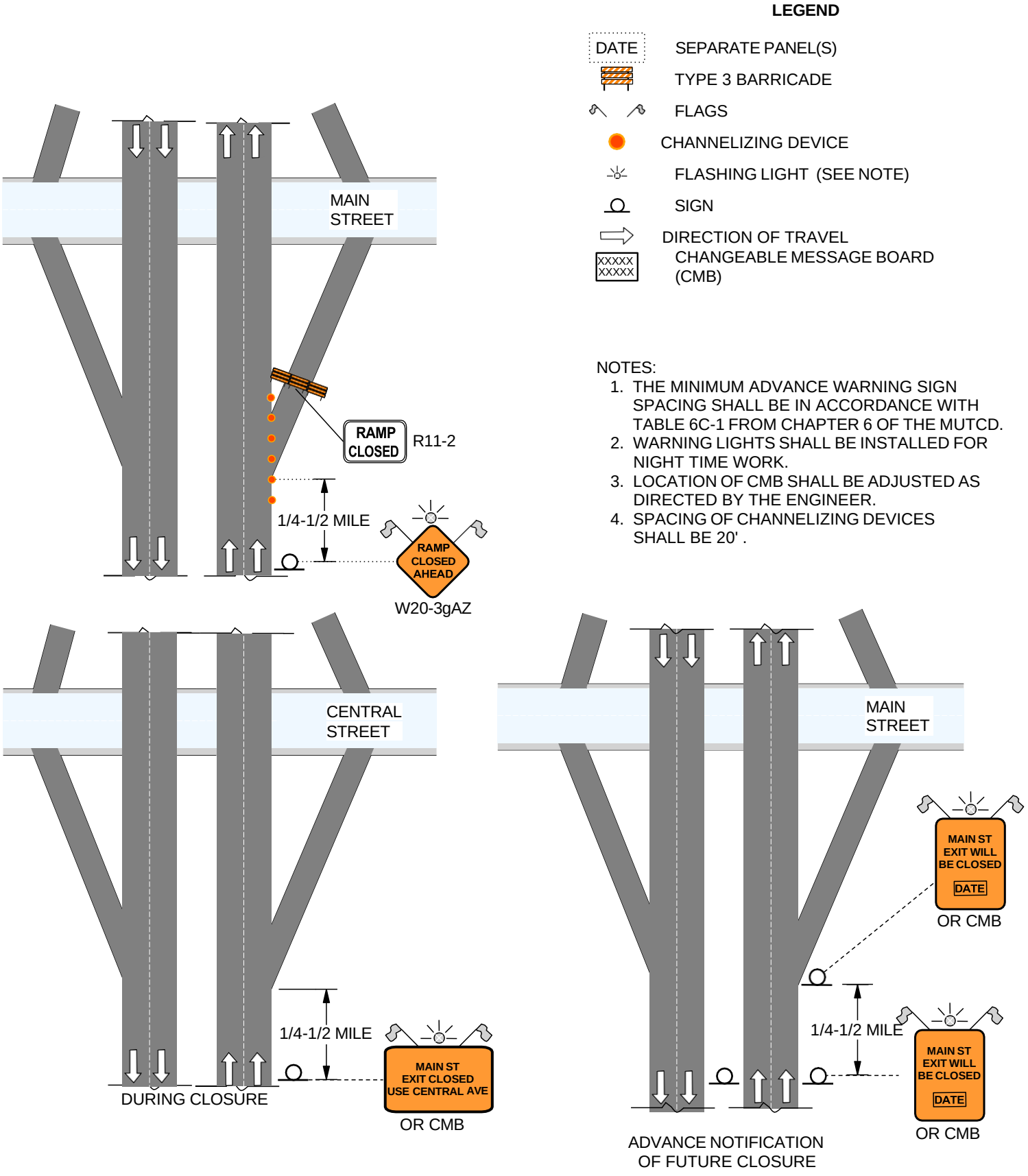
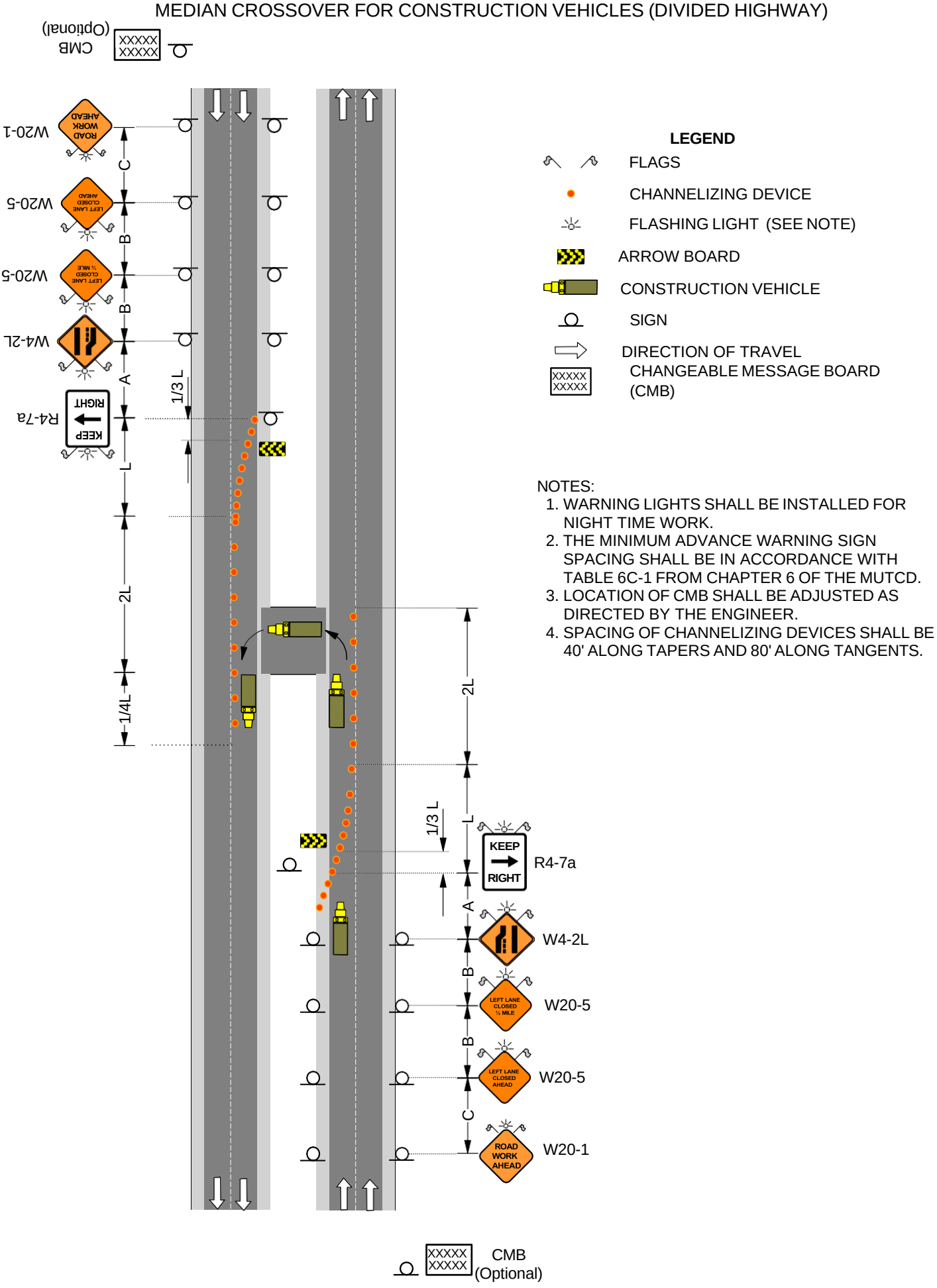


FIGURE SA-11.
MEDIAN CROSSOVER FOR CONSTRUCTION VEHICLES (DIVIDED HIGHWAY)



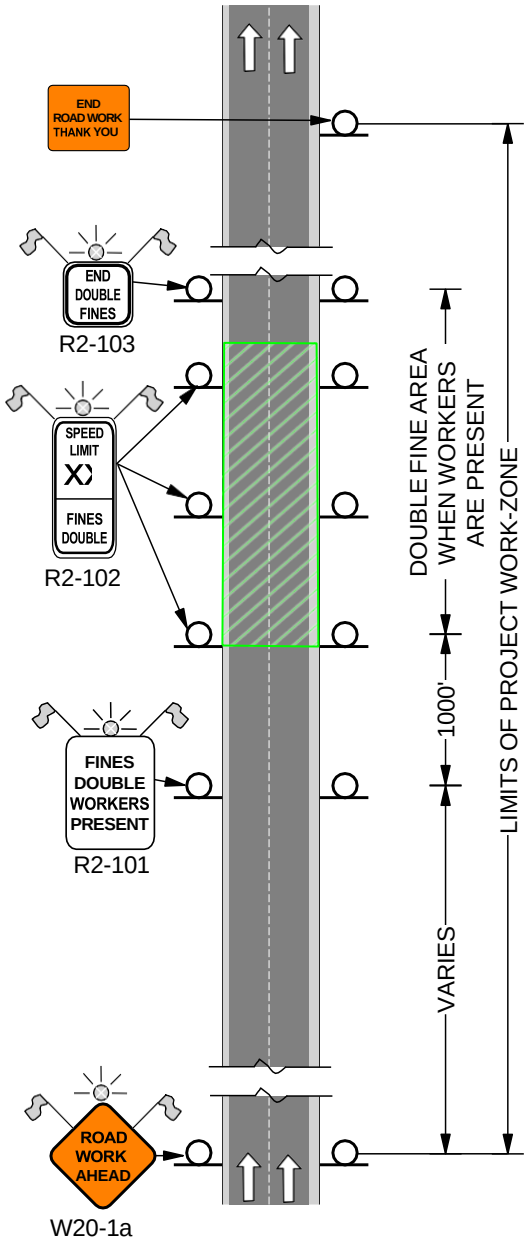
LEGEND

- FLAGS
- CHANNELIZING DEVICE
- FLASHING LIGHT (SEE NOTE)
- ARROW BOARD
- CONSTRUCTION VEHICLE
- SIGN
- DIRECTION OF TRAVEL
- CHANGEABLE MESSAGE BOARD (CMB)

NOTES:
1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
3. LOCATION OF CMB SHALL BE ADJUSTED AS DIRECTED BY THE ENGINEER.
4. SPACING OF CHANNELIZING DEVICES SHALL BE 40' ALONG TAPERS AND 80' ALONG TANGENTS.

CMB (Optional)

FIGURE SA-12.
TRAFFIC CONTROL SIGNING:
FINES ARE DOUBLE IN THE WORK ZONE WHERE WORKERS ARE PRESENT.
ADDENDUM TO ADOT MUTCD CHAPTER 6 SUPPLEMENT



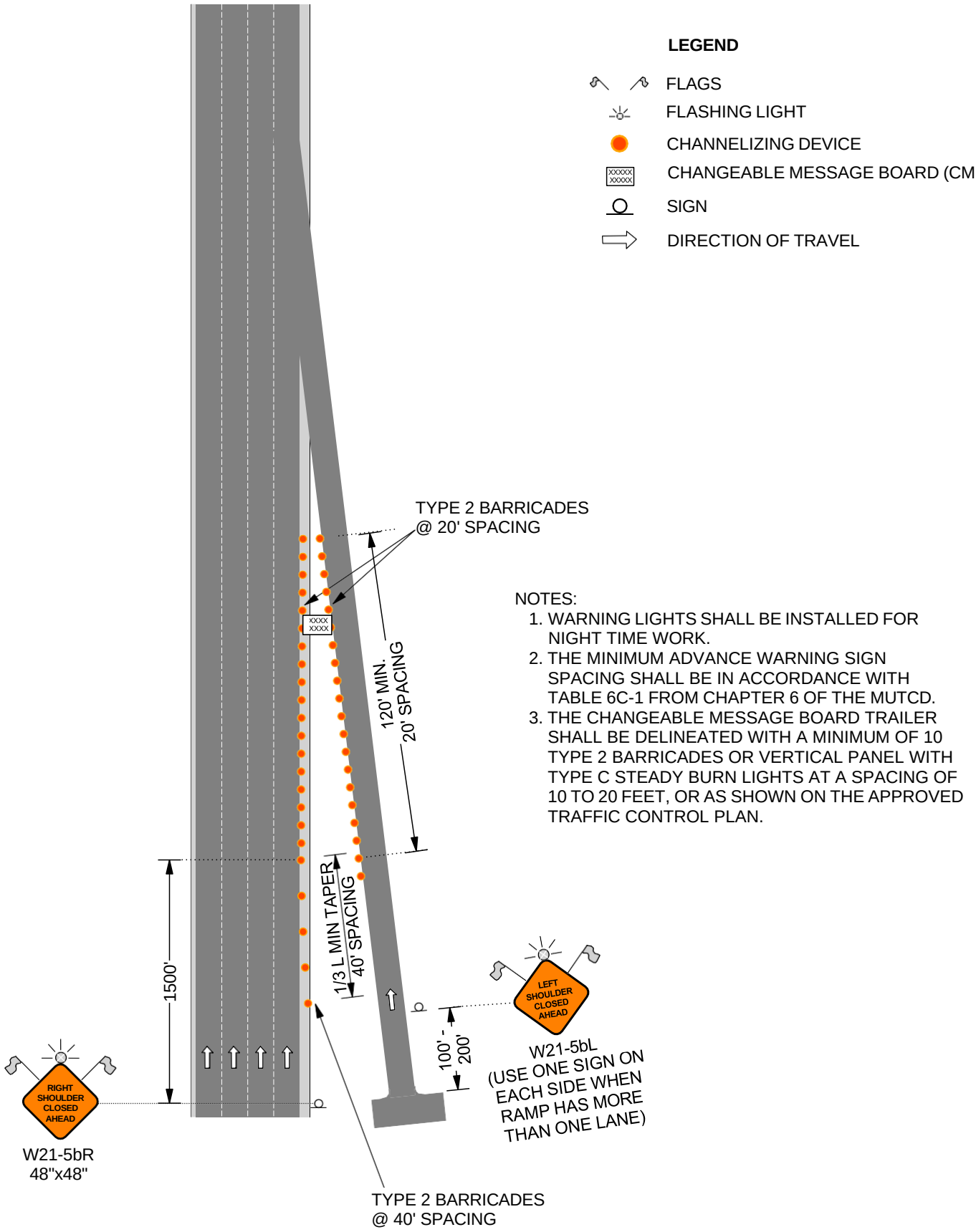
LEGEND

- FLAGS
- FLASHING LIGHT (SEE NOTE)
- SIGN
- DIRECTION OF TRAVEL
- WORK ZONE

NOTES:

1. THESE SIGNS SHALL BE PLACED ONLY WHEN WORKERS ARE PRESENT IN THE DOUBLE FINE AREA, AND SHALL BE REMOVED IMMEDIATELY WHEN WORKERS ARE NOT PRESENT IN THE DOUBLE FINE AREA. EXISTING SPEED LIMIT SIGNS IN DOUBLE FINE AREA SHALL BE COVERED WHEN THESE SIGNS ARE VISIBLE.
2. MORE THAN ONE DOUBLE FINE AREA COULD EXIST IN THE PROJECT WORK-ZONE LIMITS.
3. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
4. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
5. SPACING BETWEEN R2-102 SHALL BE AT LEAST 2500 FT.
6. THIS FIGURE DOES NOT APPLY FOR WORKERS WHEN THEY ARE BEHIND TEMPORARY CONCRETE BARRIER.

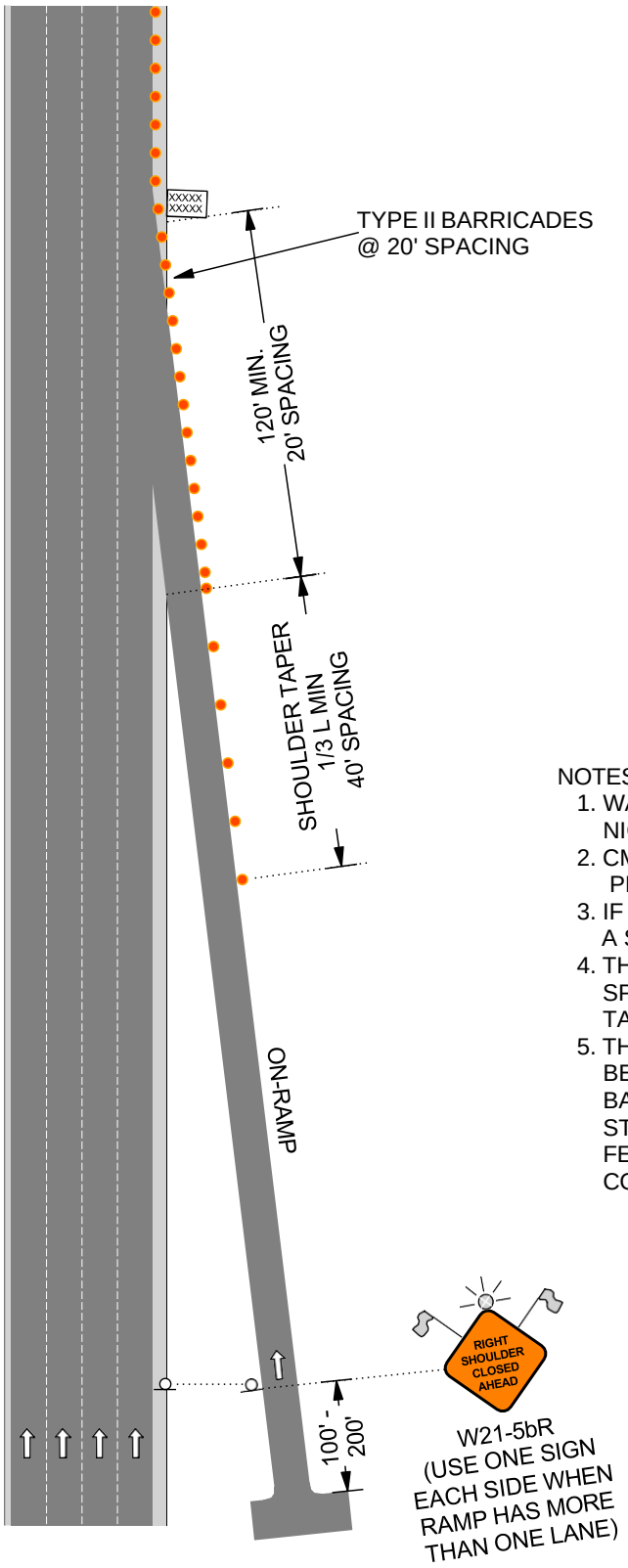
FIGURE SA-13.
SHOULDER CLOSURE FOR CHANGEABLE MESSAGE BOARD



NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
3. THE CHANGEABLE MESSAGE BOARD TRAILER SHALL BE DELINEATED WITH A MINIMUM OF 10 TYPE 2 BARRICADES OR VERTICAL PANEL WITH TYPE C STEADY BURN LIGHTS AT A SPACING OF 10 TO 20 FEET, OR AS SHOWN ON THE APPROVED TRAFFIC CONTROL PLAN.

FIGURE SA-14.
SHOULDER CLOSURE FOR CHANGEABLE MESSAGE BOARD



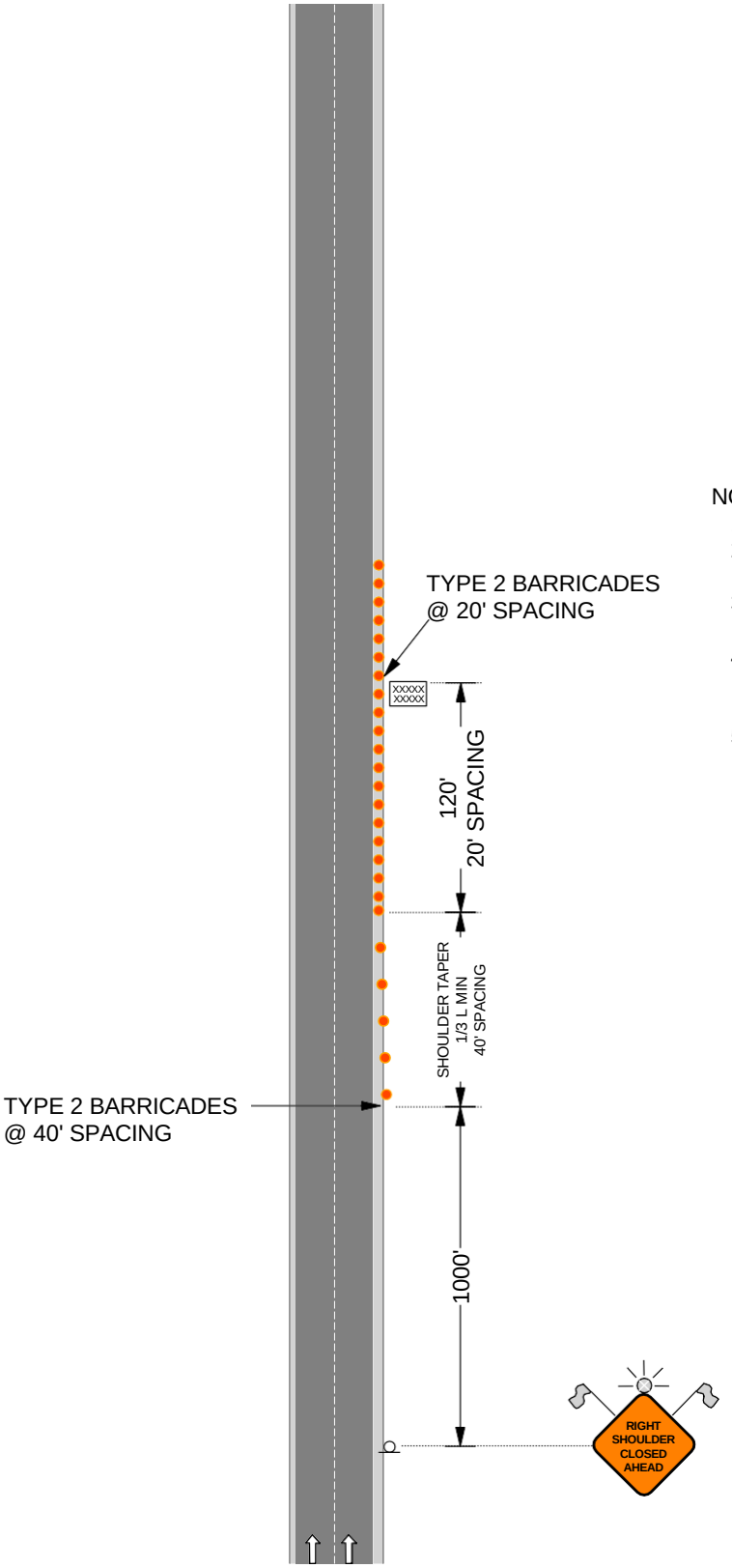
LEGEND

- FLAGS
- FLASHING LIGHT
- CHANNELIZING DEVICE
- CHANGEABLE MESSAGE BOARD (CMB)
- SIGN
- DIRECTION OF TRAVEL

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. CMB SHOULD BE PLACED BEHIND POSITIVE PROTECTION WHENEVER POSSIBLE.
3. IF CMB IS PLACED ON DEVELOPED SHOULDERS A SHOULDER CLOSURE IS REQUIRED.
4. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
5. THE CHANGEABLE MESSAGE BOARD TRAILER SHALL BE DELINEATED WITH A MINIMUM OF 10 TYPE 2 BARRICADES OR VERTICAL PANEL WITH TYPE C STEADY BURN LIGHTS AT A SPACING OF 10 TO 20 FEET, OR AS SHOWN ON THE APPROVED TRAFFIC CONTROL PLAN.

FIGURE SA-15.
SHOULDER CLOSURE FOR CHANGEABLE MESSAGE BOARD



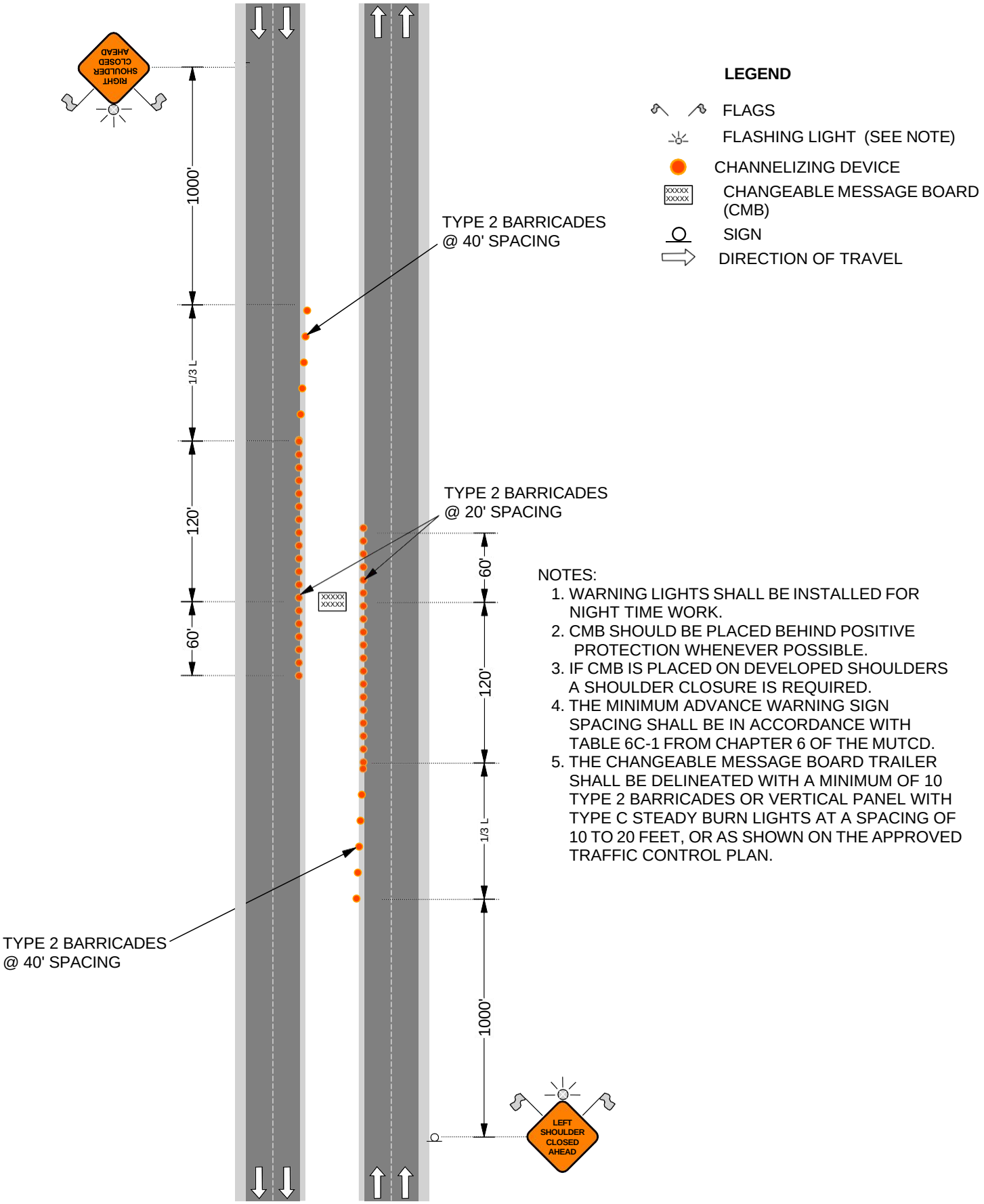
LEGEND

- FLAGS
- FLASHING LIGHT (SEE NOTE)
- CHANNELIZING DEVICE
- CHANGEABLE MESSAGE BOARD (CMB)
- SIGN
- DIRECTION OF TRAVEL

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED.
2. CMB SHOULD BE PLACED BEHIND THE GUARD-RAIL WHENEVER POSSIBLE (4-6' BUFFER).
3. IF CMB IS PLACED ON DEVELOPED SHOULDERS A SHOULDER CLOSURE IS REQUIRED.
4. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
5. THE CHANGEABLE MESSAGE BOARD TRAILER SHALL BE DELINEATED WITH A MINIMUM OF 10 TYPE 2 BARRICADES OR VERTICAL PANEL WITH TYPE C STEADY BURN LIGHTS AT A SPACING OF 10 TO 20 FEET, OR AS SHOWN ON THE APPROVED TRAFFIC CONTROL PLAN.

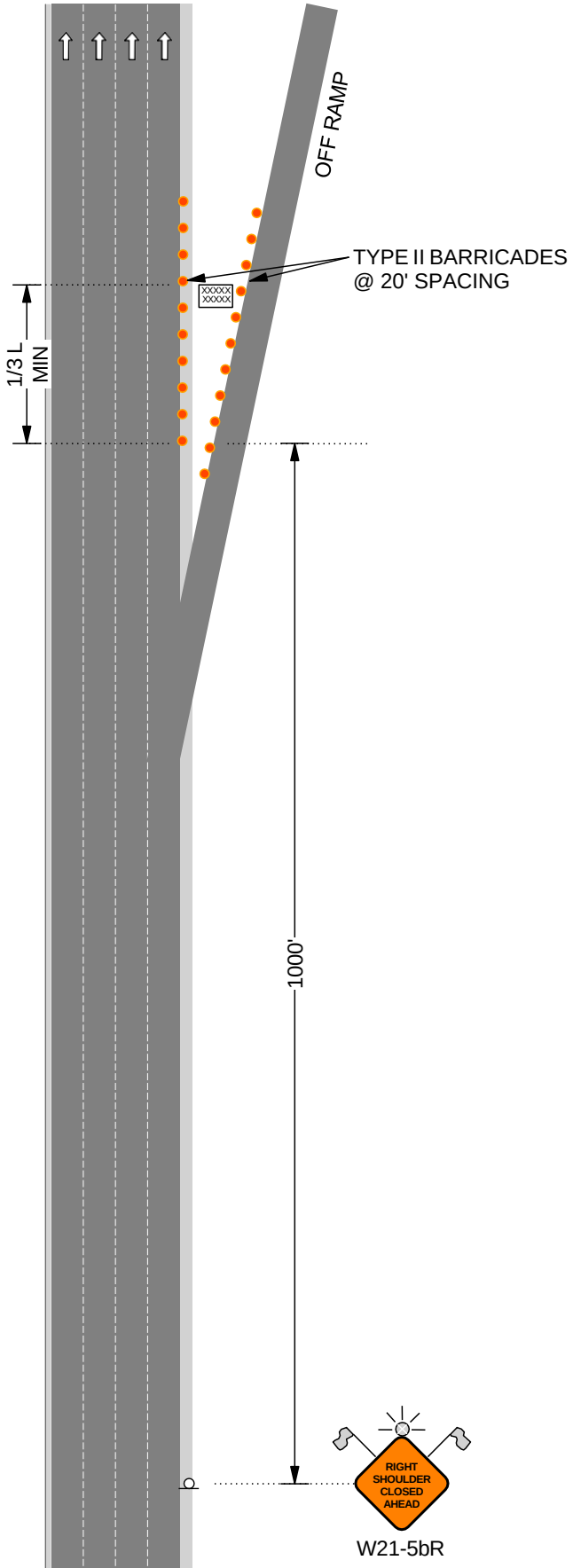
FIGURE SA-16.
MEDIAN CLOSURE FOR CHANGEABLE MESSAGE BOARD



NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. CMB SHOULD BE PLACED BEHIND POSITIVE PROTECTION WHENEVER POSSIBLE.
3. IF CMB IS PLACED ON DEVELOPED SHOULDERS A SHOULDER CLOSURE IS REQUIRED.
4. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
5. THE CHANGEABLE MESSAGE BOARD TRAILER SHALL BE DELINEATED WITH A MINIMUM OF 10 TYPE 2 BARRICADES OR VERTICAL PANEL WITH TYPE C STEADY BURN LIGHTS AT A SPACING OF 10 TO 20 FEET, OR AS SHOWN ON THE APPROVED TRAFFIC CONTROL PLAN.

FIGURE SA-17.
SHOULDER CLOSURE FOR CHANGEABLE MESSAGE BOARD



LEGEND

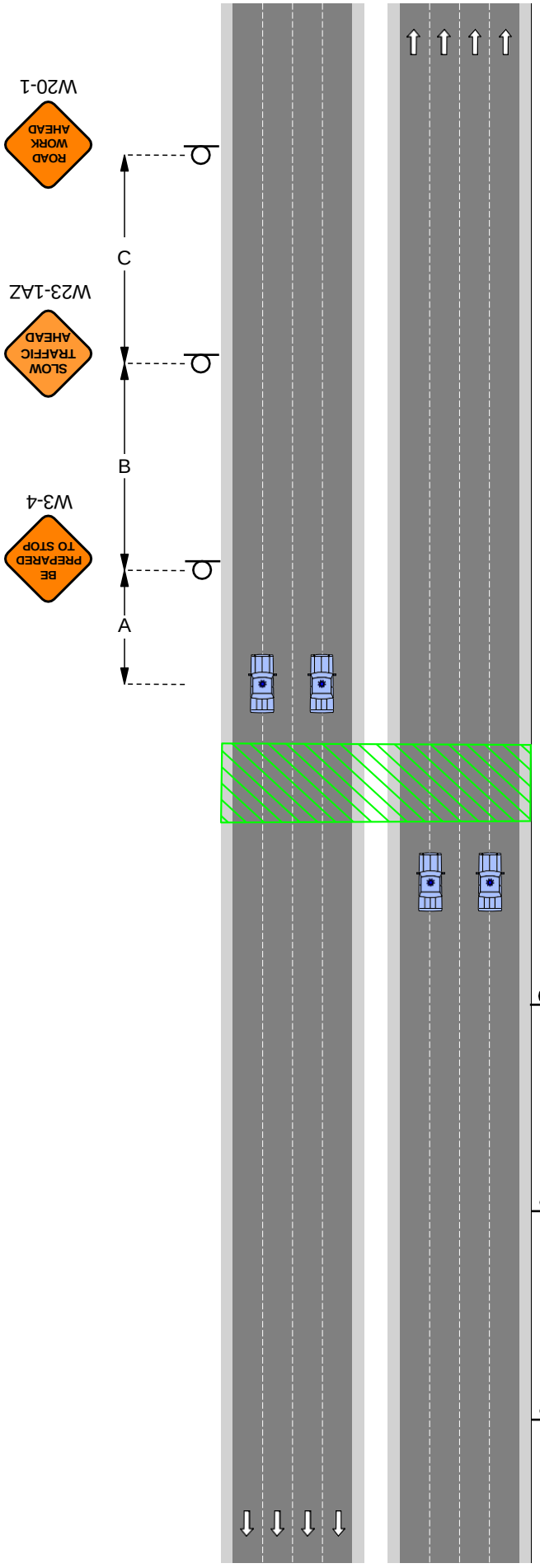
- FLAGS
- FLASHING LIGHT (SEE NOTE)
- CHANNELIZING DEVICE
- CHANGEABLE MESSAGE BOARD (CMB)
- SIGN
- DIRECTION OF TRAVEL

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. CMB SHOULD BE PLACED BEHIND POSITIVE PROTECTION WHENEVER POSSIBLE.
3. IF CMB IS PLACED ON DEVELOPED SHOULDERS A SHOULDER CLOSURE IS REQUIRED.
4. THE MINIMUM ADVANCE WARNING SIGN SPACING SHALL BE IN ACCORDANCE WITH TABLE 6C-1 FROM CHAPTER 6 OF THE MUTCD.
5. THE CHANGEABLE MESSAGE BOARD (CMB) TRAILER SHALL BE DELINEATED WITH A MINIMUM OF 10 TYPE 2 BARRICADES OR VERTICAL PANEL WITH TYPE C STEADY BURN LIGHTS AT A SPACING OF 10 TO 20 FEET, OR AS SHOWN ON THE APPROVED TRAFFIC CONTROL PLAN.
6. CMB SHALL BE PLACED AT LEAST 500' FROM GORE SIGN.

FIGURE SA-18A

ROLLING CLOSURE; MULTI-LANE DIVIDED HIGHWAY



LEGEND

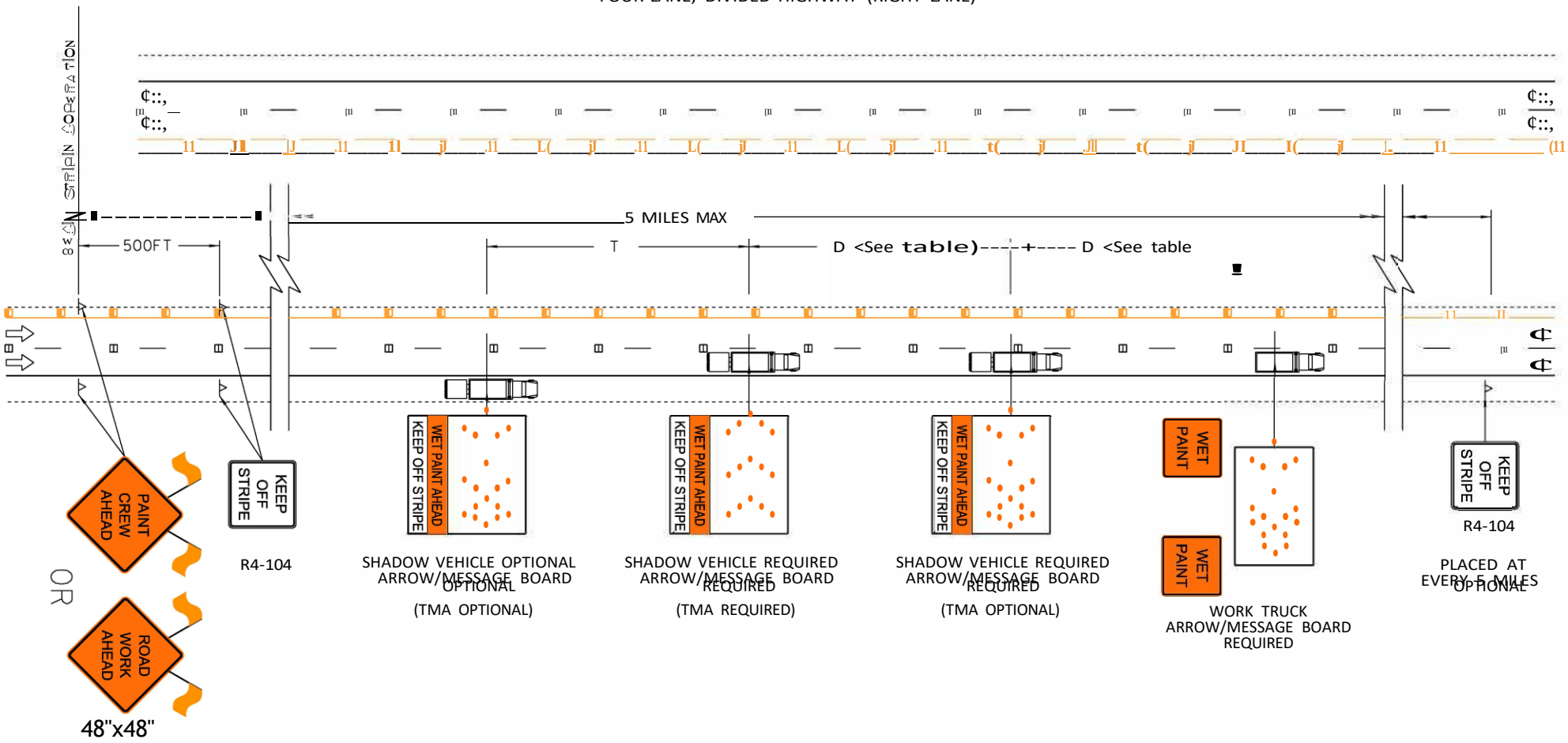
- LAW ENFORCEMENT VEHICLE
- SIGN
- DIRECTION OF TRAVEL
- WORK ZONE

NOTES:

1. WARNING LIGHTS SHALL BE INSTALLED FOR NIGHT TIME WORK.
2. ENGINEER MAY ALLOW CONTRACTOR TO OMIT FLAGS DUE TO LATERAL CONSTRAINTS.
3. FOR DISTANCE BETWEEN SIGNS, REFER TO PART 6 OF THE MUTCD; TABLE 6C-1.
4. ONE LAW ENFORCEMENT VEHICLE FOR TWO LANES TRAFFIC.
5. ALL SIGNS SHALL BE ON BOTH SIDES OF THE ROAD WHERE SPACE IS AVAILABLE.
6. THIS OPERATION SHALL NOT EXCEED MORE THAN 10 MINUTES AT A TIME.

FIGURE SA-18B

WORK ZONE TRAFFIC CONTROL FOR MOBILE OPERATION
PLACEMENT OF RAPID-DRY PAVEMENT MARKING
FOUR-LANE, DIVIDED HIGHWAY (RIGHT LANE)



TMA: TRUCK MOUNTED ATTENUATOR

NOTES:

1. Advance warning vehicle shall not encroach on to the travel lane. If shoulder are becomes too narrow for a vehicle to be completely on the shoulder, the vehicle shall stay on the shoulder area until operator can safely drive around narrow shoulder to new set up point.
2. Unless otherwise noted; TMA is optional but recommended in roadway with posted speed limit exceeding 45 MPH.

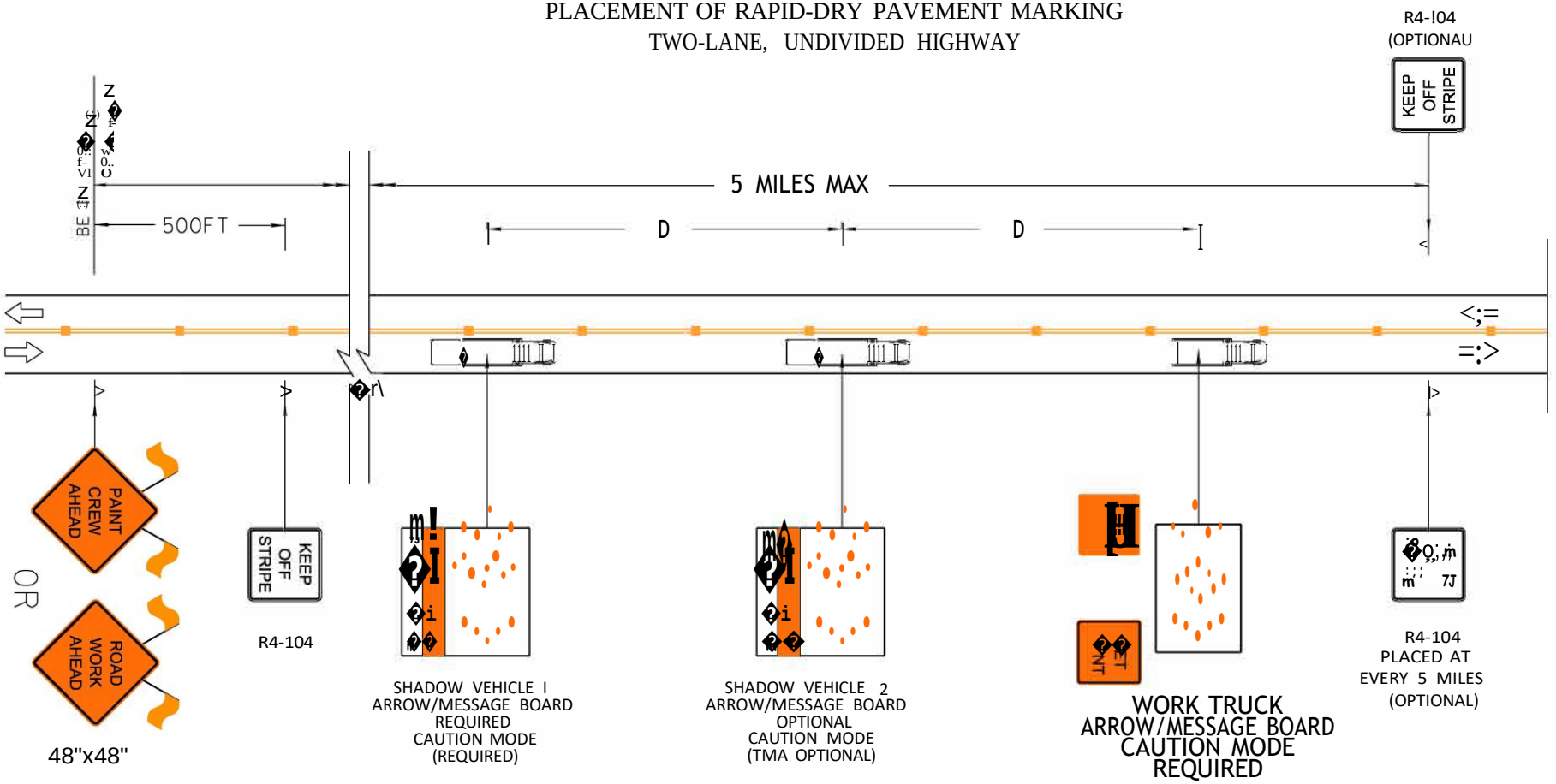
VEHICLE SPACING (D)		
POSTED SPEED LIMIT <MPH)	fc45	is45
D (FT) MINIMUM	250*	500*

* DISTANCE SHOULD BE ADJUSTED AS DICTATED BY FIELD CONDITIONS AND STRIPING MATERIAL TO DRY

T = 12 x Speed Limit (MPH)

FIGURE SA-19A

WORK ZONE TRAFFIC CONTROL FOR MOBILE OPERATION
PLACEMENT OF RAPID-DRY PAVEMENT MARKING
TWO-LANE, UNDIVIDED HIGHWAY



TMA: TRUCK MOUNTED ATTENUATOR

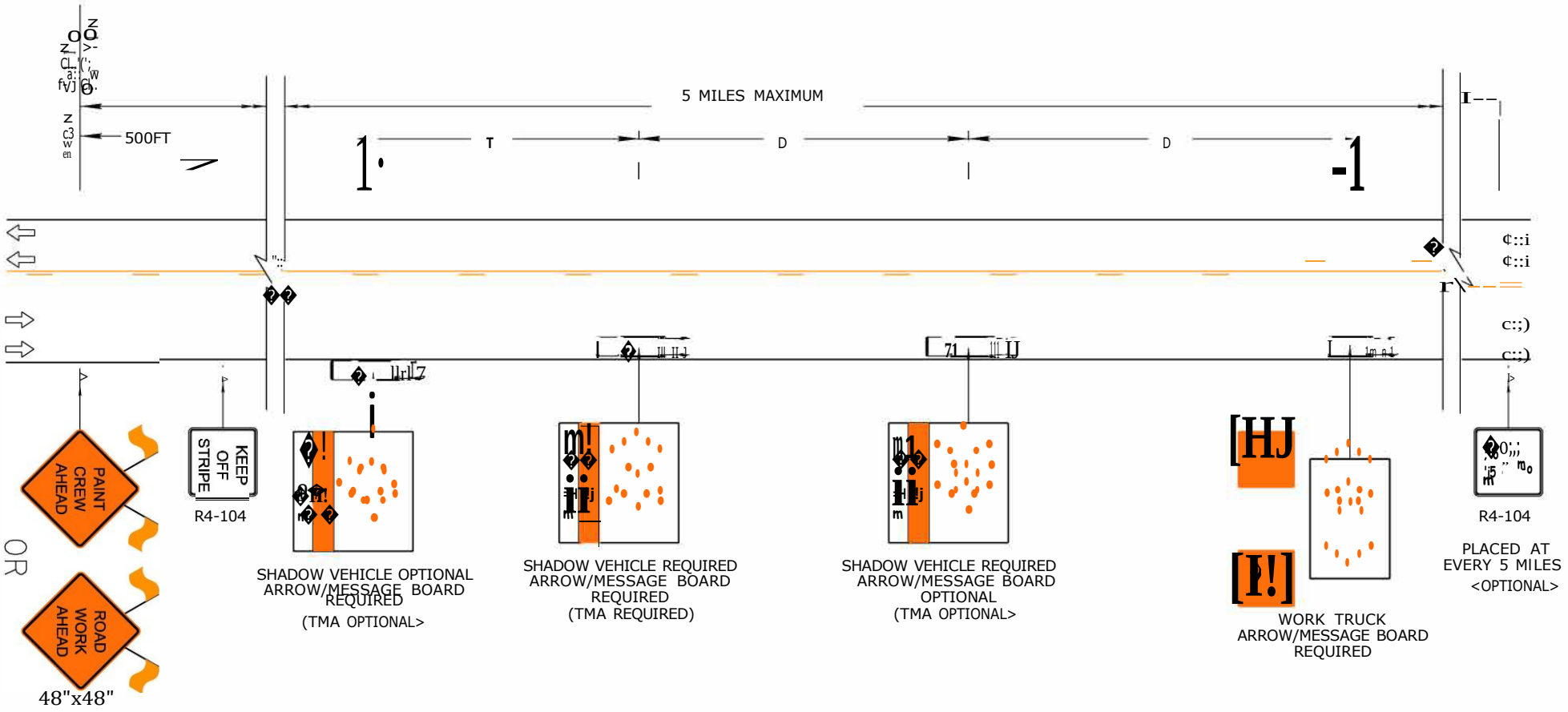
WORK TRUCK
ARROW/MESSAGE BOARD
CAUTION MODE ONLY

VEHICLE SPACING (Dl		
POSTED SPEED LIMIT (MPH)		*
D (FT) MINIMUM	250*	500*

DISTANCE SHOULD BE ADJUSTED AS DICTATED BY FIELD CONDITIONS AND STRIPING MATERIAL TO DRY

FIGURE SA-19B

WORK ZONE TRAFFIC CONTROL FOR MOBILE OPERATION
PLACEMENT OF RAPID-DRY PAVEMENT MARKING
FIVE-LANE, UNDIVIDED HIGHWAY (RIGHT LANE)



TMA: TRUCK MOUNTED ATTENUATOR

NOTES:

1. Advance warning vehicle shall not encroach on to the travel lane. If shoulder is too narrow for a vehicle to be completely on the shoulder, the vehicle shall stay on the shoulder area until operator can safely drive around narrow shoulder to new set up point.

2. Unless otherwise noted; TMA is optional but recommended in roadway with posted speed limit exceeding 45 MPH.

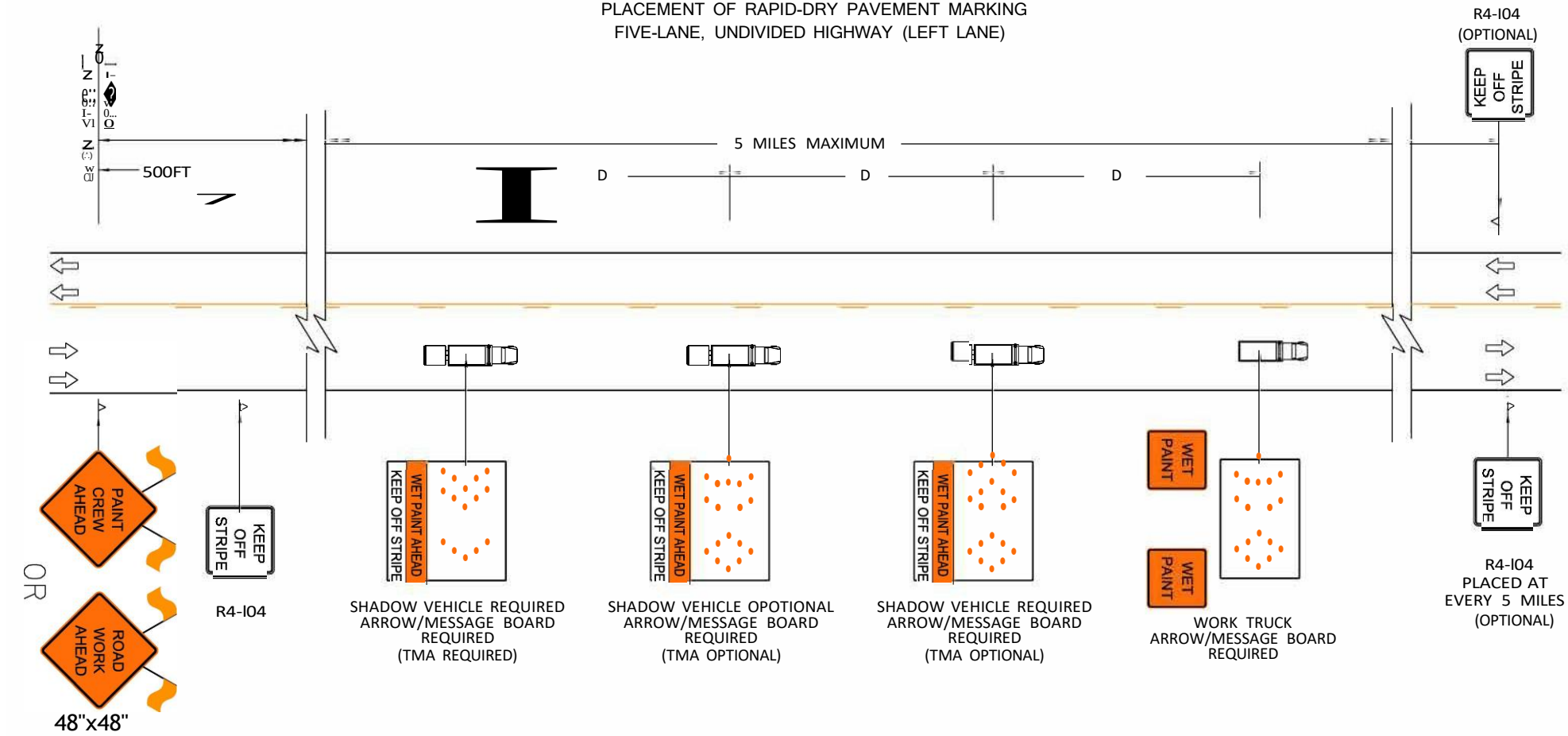
VEHICLE SPACING (D)		
POSTED SPEED LIMIT (MPH)	45	55
D <FT> MINIMUM	250*	540*

* DISTANCE SHOULD BE ADJUSTED AS DICTATED BY FIELD CONDITIONS AND STRIPING MATERIAL TO DRY

T = 12 x Speed Limit (MPH)

FIGURE SA-19C

WORK ZONE TRAFFIC CONTROL FOR MOBILE OPERATION
PLACEMENT OF RAPID-DRY PAVEMENT MARKING
FIVE-LANE, UNDIVIDED HIGHWAY (LEFT LANE)



TMA: TRUCK MOUNTED ATTENUATOR

NOTES:

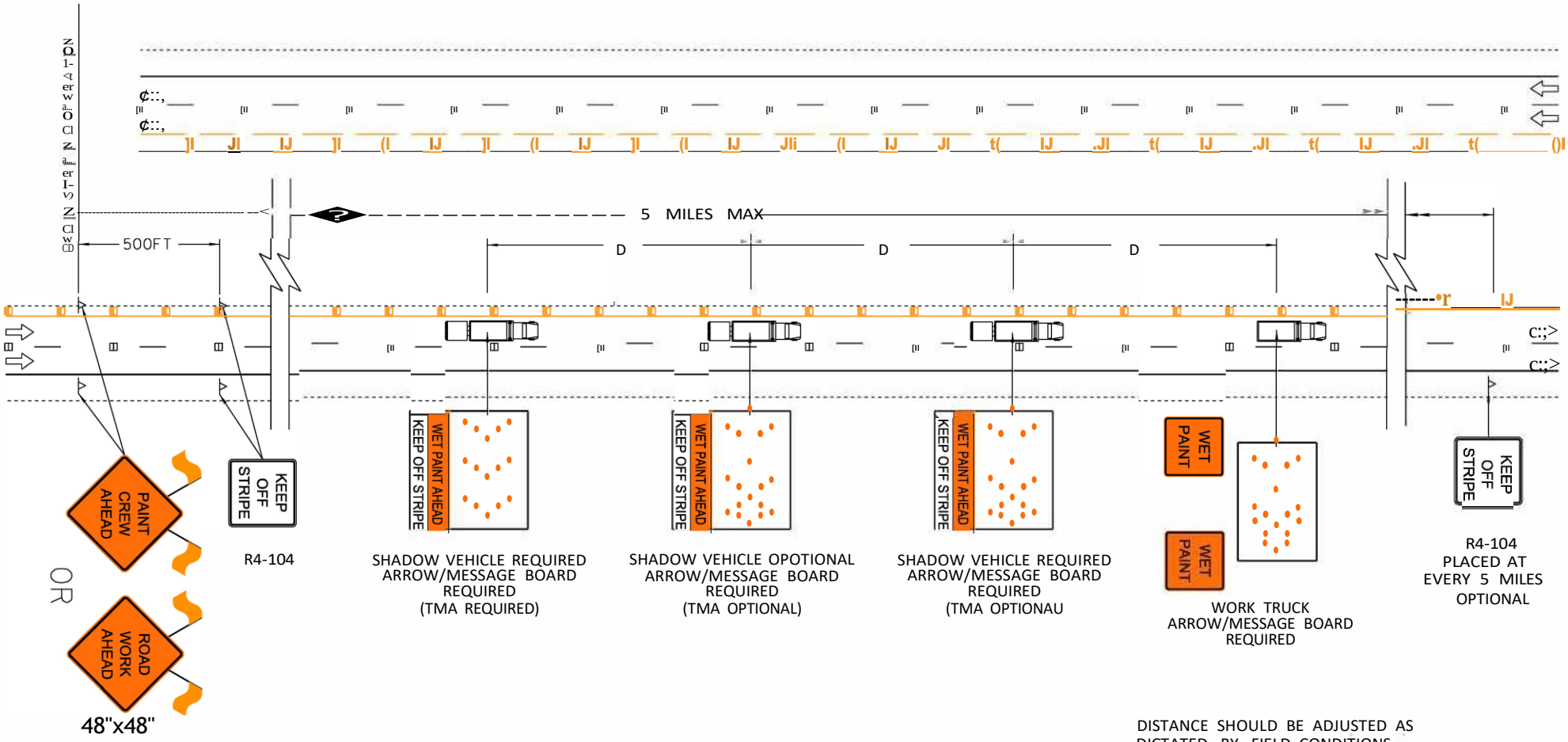
1. TMA is optional but recommended in roadway with posted speed limit exceeding 45 MPH.
2. shadow vehicles is optional in roadways with posted speed limit below 45 MPH.

VEHICLE SPACING (D)	
POSTED SPEED LIMIT (MPH)	45
D (FT) MINIMUM	250* 540*

* DISTANCE SHOULD BE ADJUSTED AS DICTATED BY FIELD CONDITIONS AND STRIPING MATERIAL TO DRY

FIGURE SA-19D

WORK ZONE TRAFFIC CONTROL FOR MOBILE OPERATION
PLACEMENT OF RAPID-DRY PAVEMENT MARKING
FOUR-LANE, DIVIDED HIGHWAY (LEFT LANE)



DISTANCE SHOULD BE ADJUSTED AS DICTATED BY FIELD CONDITIONS AND STRIPING MATERIAL TO DRY

TMA: TRUCK MOUNTED ATTENUATOR

NOTE:

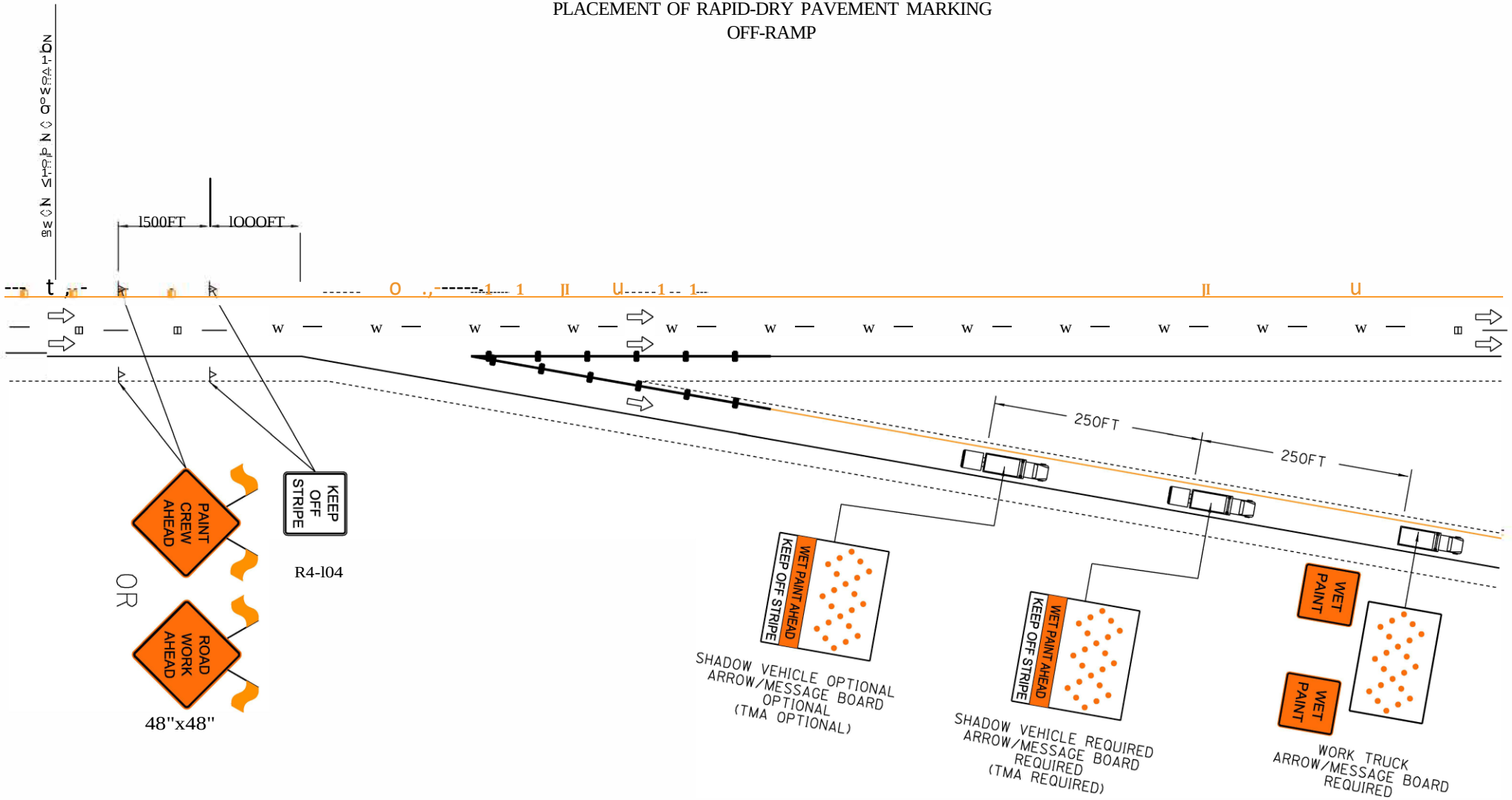
Unless otherwise noted; TMA is optional but recommended in roadway with posted speed limit exceeding 45 MPH.

VEHICLE SPACING (D)	
POSTED SPEED LIMIT (MPH)	t:s45
D (FT) MINIMUM	I zso*I soo*

*

FIGURE SA-20A

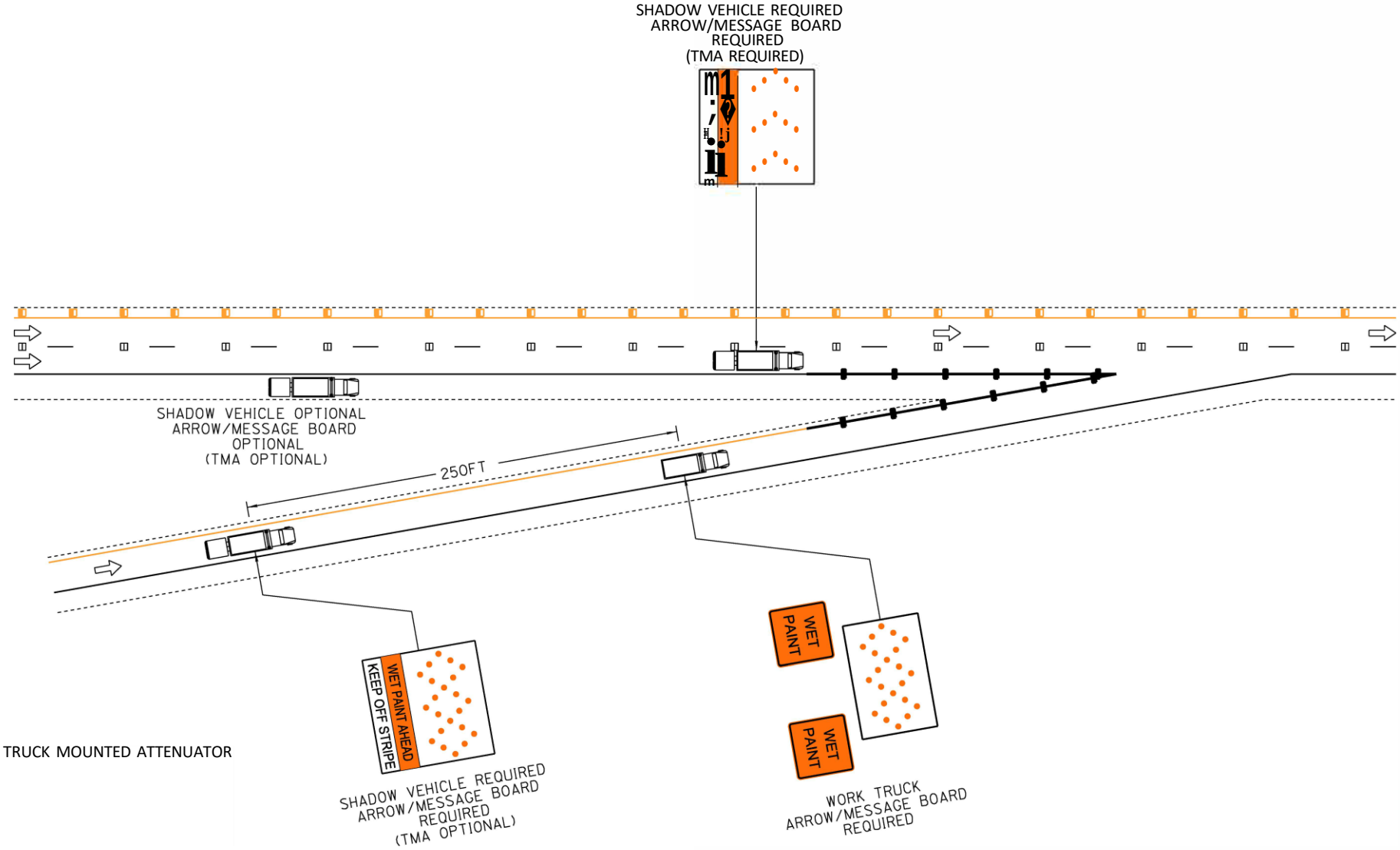
WORK ZONE TRAFFIC CONTROL FOR MOBILE OPERATION
PLACEMENT OF RAPID-DRY PAVEMENT MARKING
OFF-RAMP



TMA: TRUCK MOUNTED ATTENUATOR

FIGURE SA-20B

WORK ZONE TRAFFIC CONTROL FOR MOBILE OPERATION
PLACEMENT OF RAPID-DRY PAVEMENT MARKING
ON-RAMP



TMA: TRUCK MOUNTED ATTENUATOR

FOR Future Use