



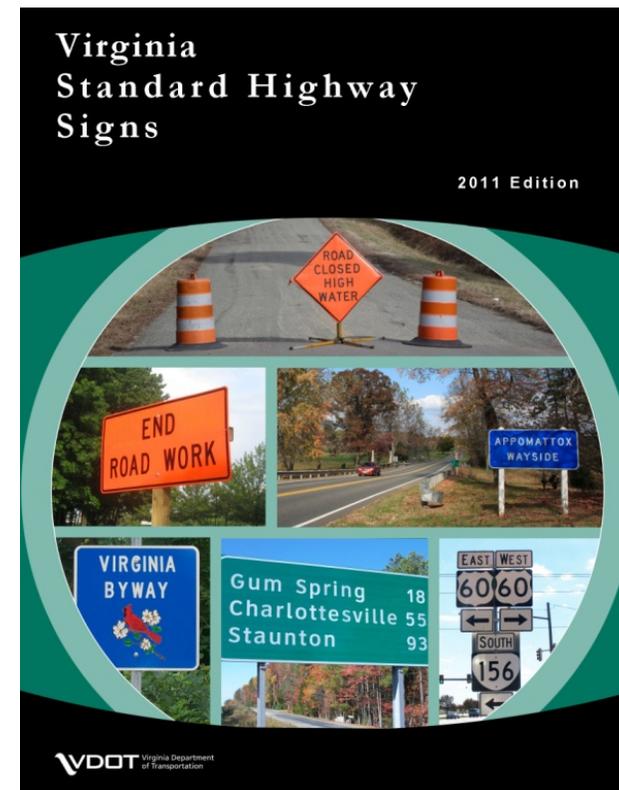
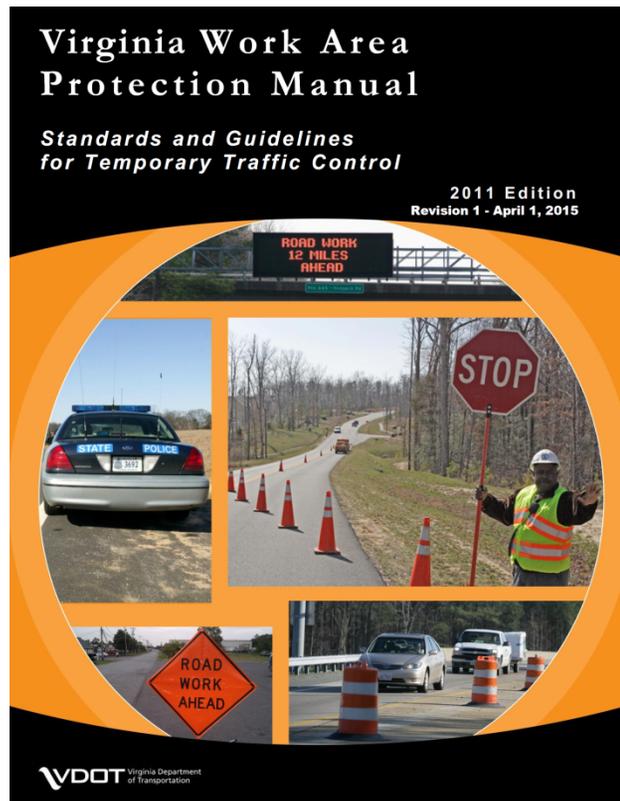
REVISION 1
2011 VIRGINIA WORK AREA
PROTECTION MANUAL

**Effective April 1, 2015 for State Forces &
Effective starting on the July 2015 Advertisement**

VA Supplements to the MUTCD

Revisions to VDOT developed Supplements:

- **VA Work Area Protection Manual**
 Effective for daily operations – April 1, 2015
 Effective for projects advertised for bid – July 1, 2015
- **VA Standard Highway Signs book (living document)**



2011 VA WAPM Revision Documentation

“Technical Changes in Revision 1 of the 2011 Virginia Work Area Protection Manual”

- Lists all revisions in the manual by:
 - Chapter
 - Section
 - Paragraph/Figure/Table
 - Sign Designation

- Provides specific information:
 - What was revised
 - Why it was revised, as applicable

CHAPTER	SECTION NUMBER	SECTION TITLE	NEW TABLE/FIGURE /PARAGRAPH NUMBER	TABLE / FIGURE TITLE	REVISION TOPIC	SIGN CODE	REVISION DESCRIPTION
6E	6E.02	High-Visibility Safety Apparel	Paragraph 04		Safety Apparel Head Protection		Deleted Paragraph 04: “Beginning July 1, 2012, all workers, including emergency responders, media, towing and recovery personnel and others within the right-of-way who are either exposed to traffic or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets Performance Class 3 requirements of the ANSI/ISEA 107–2010 publication entitled “American National Standard for High-Visibility Safety Apparel and Headwear” (see Section 1A.11 of the Virginia Supplement to the 2009 MUTCD), or equivalent revisions, and labeled as meeting the ANSI 107-2010 standard performance for Class 3 risk exposure, except as provided in Paragraph 7”. Replaced “Until” with “Since”; added “full length” and “overalls” to sentence. Added “Shorts shall not be worn.” to new Paragraph 04. Renumbered remaining paragraphs.
			Paragraph 05				Added the Support statement: “ Class E trousers are defined as full length waistband trousers or overalls that meet all minimum requirements of the ANSI/ISEA 107-2010 publication.” Renumbered the remaining paragraphs.
			Paragraph 06		Safety Apparel		Added the Standard statement: “All apparel shall be securely fastened such that the greater conspicuity provided by the fluorescent colors, retroreflectivity and pattern of the high-visibility apparel is visible for 360° around the wearer.” Renumbered the remaining paragraphs.
			Paragraph 07				Added “Section 6D.03(09)”.
			Paragraph 09		Safety Apparel Head Protection		Added “Headwear meeting ANSI 107/ISEA 107-2010 standards may be worn but is not required.”

Changes/Revisions Identified by:

- New date at the top of the page (April 2015)
- Content;
 - Gray Shading
 - Superscript 1 following the revision
 - Revised TTC Figures designated by superscript 1
- Footnote at the bottom of the page noting the revision number and date

33. Portable Temporary Rumble Strip (PTRS) — is a transverse rumble strip that consists of intermittent, narrow, transverse areas of rough-textured, slightly raised or depressed surface that extend across the travel lane to alert drivers to unusual vehicular traffic conditions. The PTRS can be quickly installed or removed.¹

34. Portable Traffic Signal—a temporary traffic control signal that is designed so that it can be easily transported and reused at different locations.

35. Post-Mounted Sign—a sign that is placed to the side of the roadway such that no portion of the sign or its support is directly above the roadway or shoulder.

Revision 1
2011 Work Area Protection Manual

Chapter 6A
General

Revision 1

2011 Work Area Protection Manual

Section 6A.03

Definitions of Words and Phrases in This Manual

24. Limited Access Highway revised

33. Portable Temporary Rumble Strip (PTRS)

- Alerts driver
- Transverse rumble strip
- Extends across the travel lane
- Installed & removed quickly

Section 6A.04

Meanings of Acronyms and Abbreviations...

26. PTRS Portable Temporary Rumble Strip

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2011 Work Area Protection Manual

Chapter 6B
Fundamental Principles

A number in parentheses represents the revised
Section's paragraph.

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Section 6B.01

Fundamental Principles of TTC

(15) When flagging operation is suspended:



W20-7

The flagger symbol sign shall be removed or covered.

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Chapter 6C
Temporary Traffic Control
Elements

A number in parentheses represents the revised Section's paragraph.

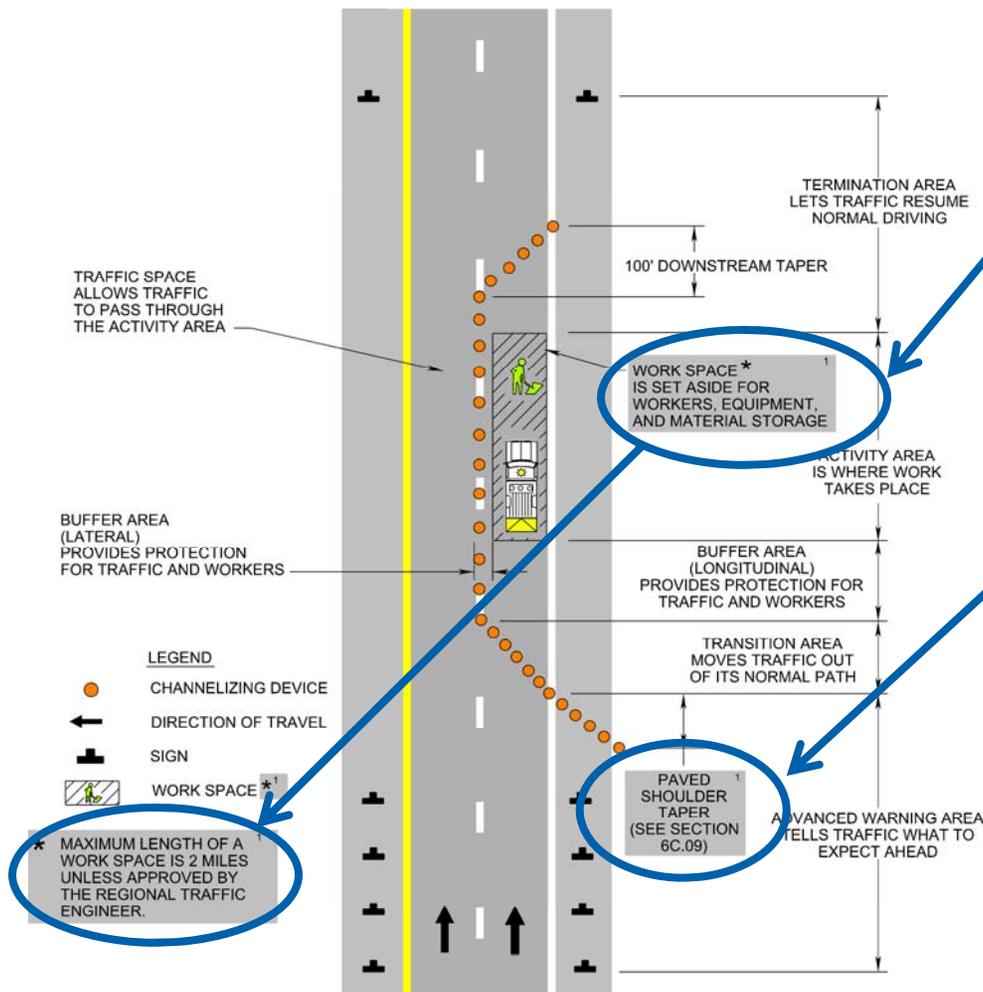
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Figure 6C-1, Component Parts of TTC Zone

Added:

- 2 mile is the Max. length of a work space unless approved by the RTE
- Paved shoulder taper reference 6C.09(11).



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Table 6C-1 & Table 6H-5, Recommended Spacing of Advance Warning Signs

Road Type	Spacing (Feet)
Urban street with 25 mph or less posted speed	100 – 200
Urban street with 30 to 40 mph posted speed	250 – 350
* All Other Roadways with 45 mph or less posted speed	350 – 500
All Other Roadways with greater than 45 mph posted speed	500 – 800
Limited Access highways	1300 – 1500

Changed title to “Recommended Spacing of Advance Warning Signs”

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Table 6C-2, Length of the Longitudinal Buffer Space

Table 6E-1, Longitudinal Buffer Space¹ (title change)

Table 6H-3, Longitudinal Buffer Space¹ (title change)

Posted Speed Limit (mph)	Distance (Feet)
≤ 20	115 – 120
25	155 – 165 ¹
30	200 – 210
35	250 – 260
40	305 – 325 ¹
45	360 – 380
50	425 – 445
55	500 – 530 ¹
60	570 – 600 ¹
65	645 – 675
70	730 – 760
75	820 – 850

Changed distances:

25 mph 155 – 165¹

40 mph 305 – 325¹

55 mph 500 – 530¹

60 mph 570 – 600¹

**Buffer Space lengths
changed in
TIMC-1 to TIMC-4**

Section 6C.06 Buffer Space

(05) These distances should be increased for downgrades and other geometric conditions that affect stopping distance.¹

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Section 6C.08 Termination Area

(02) *The END ROAD WORK sign should be used to inform road users they can resume normal operations.*



G20-2 (V)

(04) **END WORK ZONE SPEED LIMIT** sign is used on un-posted secondary roads, otherwise the **SPEED LIMIT** sign is used. When part of a project speed is reduced, the original speed limit shall be posted 500' \pm past the work area.



R2-12



R2-1

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Table 6C-4, Taper Chart Table 6H-2, Taper Chart

Posted Speed Limit (mph)	Taper Length (L)				Remarks
	Width of Offset (Feet)				
	9	10	11	12	
≤ 25	95	105	115	125	L= S ² W/60
30	135	150	165	180	"
35	185	205	225	245	"
40	240	270 ¹	295 ¹	320	"
45	405	450	495	540	L=SW
50	450	500	550	600	"
55	495	550	605	660	"
60	540	600	660	720	"
65	585	650	715	780	"
70<	630	700	770	840	"

Limited Access highway merging taper length (L) shall be 1000 feet regardless of the posted speed and SW=L is desired for the shifting taper length with ½L being the minimum.

Changed 40 MPH
length
270 – 295

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Chapter 6C

Section 6C.09 Tapers:

- (11) Paved shoulder having a width of 8 feet or more, a shoulder taper shall be used in advance of the merging taper

Channelizing devices match those used in the merging taper



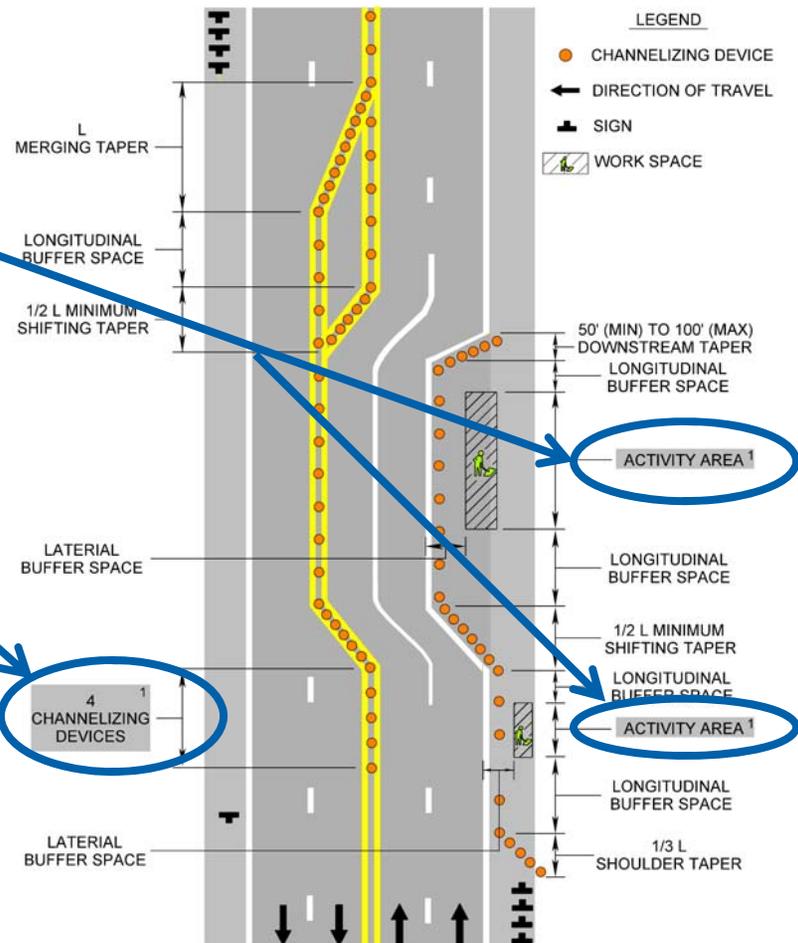
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Figure 6C-2, Example of Types of Tapers

Changed:

- **Work space to Activity Area**
- **Channelizing device spacing to match roadway spacing**



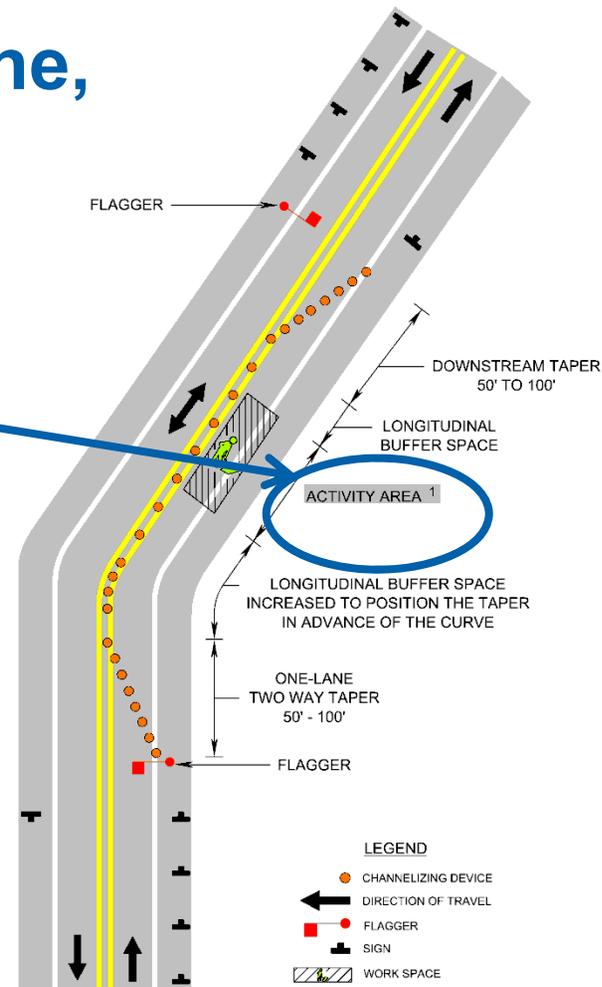
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Figure 6C-3,
Example of a One-Lane,
Two-Way Taper

Changed:

- Work space to Activity Area



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Chapter 6D
Pedestrian and Worker
Safety

A number in parentheses represents the revised Section's paragraph.

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Section 6D.03 Worker Safety Consideration

(05) & (06)

Defines Class E trousers:

Full length waistband trousers or overalls that meet minimum requirements of Performance Class 3 risk requirements of ANSI/ISEA 107-2010

Shorts shall not be worn at any time.

(07) ANSI/ISEA 107/2010 headwear may be worn

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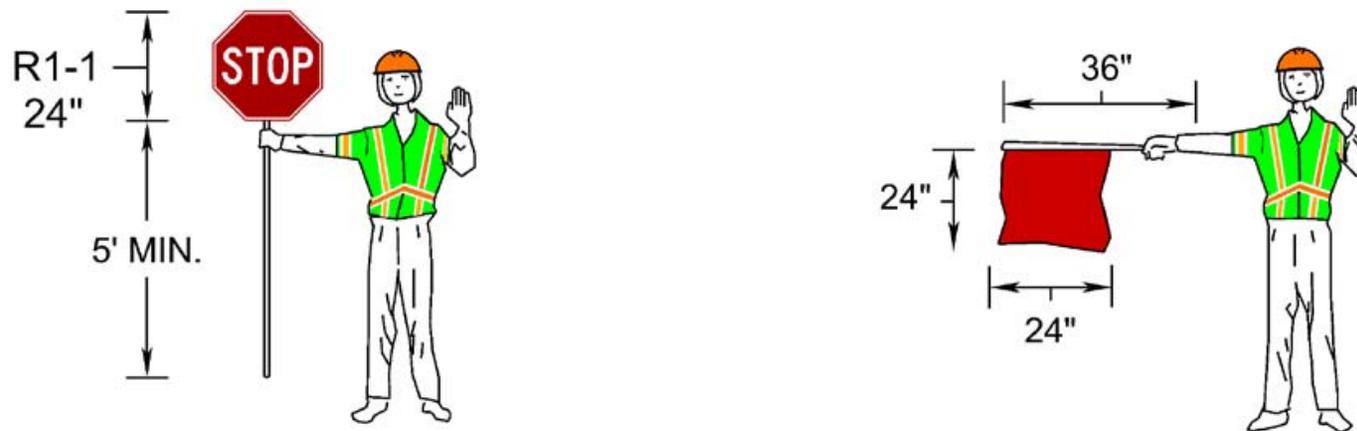
Section 6D.03 Worker Safety Consideration

- (09) Uniform law enforcement personnel high-visibility safety apparel shall meet Performance Class 2 or 3 requirements of ANSI/ISEA 107/2010 when exposed to traffic
- (11) High-visibility safety apparel shall:
- be securely fastened
 - be visible for 360° around the wearer
 - provide conspicuity of fluorescent colors, retroreflectivity and pattern

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Chapter 6E Flagger Control

A number in parentheses represents the revised Section's paragraph.



TO STOP TRAFFIC

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Section 6E.01 Qualifications for a Flagger

(03) Recertification for Flaggers

- 2 years VDOT Flagger Certification
- 4 years Flagger Certification with:
 - VDOT Basic Work Zone Traffic Control Training
 - VDOT Intermediate Work Zone Traffic Control Training
- ATSSA's classroom Flagger Certification Program

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Section 6E.02 High Visibility Apparel

(04) Flaggers:

- Required to wear ANSI 107/ISEA 107-2010 Performance Class 3
- Nighttime flaggers apparel includes full length Type E trousers or overalls
- Shorts shall not be worn

(05) Defines Class E trousers as full length waistband trousers or overalls that meet minimum requirements of ANSI/ISEA 107-2010

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Section 6E.02 High Visibility Apparel

- (06) Apparel shall be securely fasten apparel so retroreflectivity is visible 360 around wearer.**
- (07) Uniformed law enforcement personnel shall wear ANSI/ISEA 107-2010 Performance Class 2 or 3 to:**
 - Direct traffic, investigate crashes, handle lane closures, obstructed roadways and disasters**
- (09) ANSI/ISEA 107-2010 headwear may be worn.**

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Section 6E.03 Hand Signaling Devices:

(10) Flag:

- 24 x 24 inches square

Flag Staff:

- 1 to 1 ³/₄ inches in diameter staff

(12) Nighttime both side of the flag shall be retroreflectorized orange/red in color



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Section 6E.04, Automated Flagger Assistances Devices:

- (13) - Described Method 1 as Stop/Slow AFAD
 - Described Method 2 as Red/Yellow Lens AFAD
- (14) Two AFADs shall be used to control one-lane two-way traffic
- (15) When one flagger operates both AFADs, the flagger shall have an unobstructed view of approaching traffic in both directions

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Figure 6E-1, Example of the Use of Stop/Slow AFAD
 Figure 6E-2, Example of the Use of Red/Yellow Lens AFAD

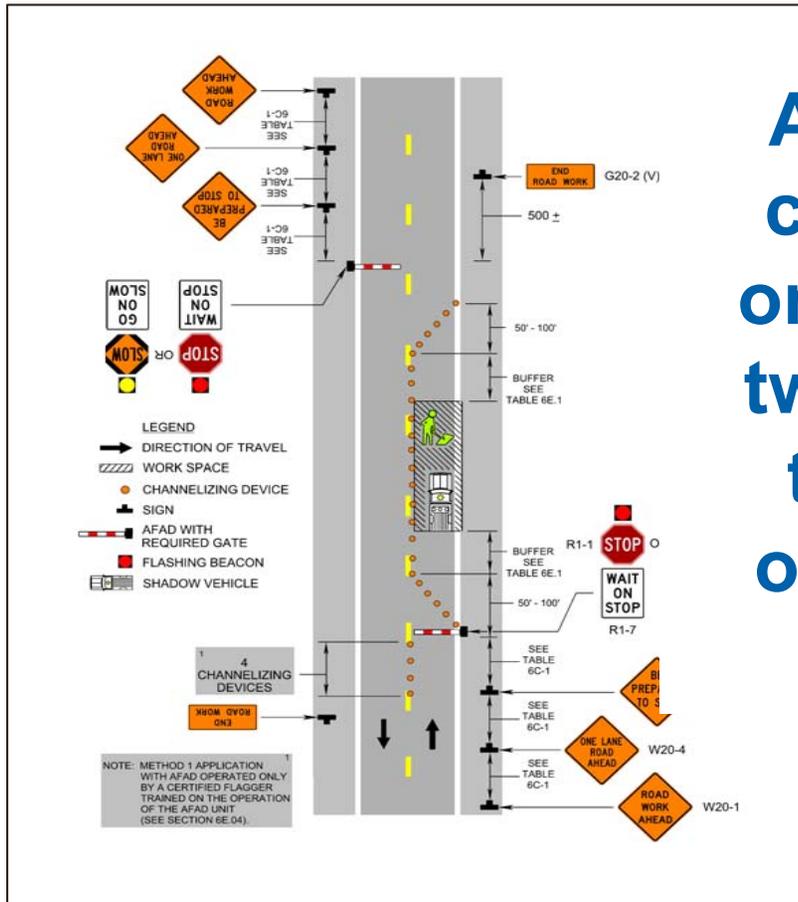


Figure 6E-1

AFADs
control
one-lane
two-way
traffic
on both
ends

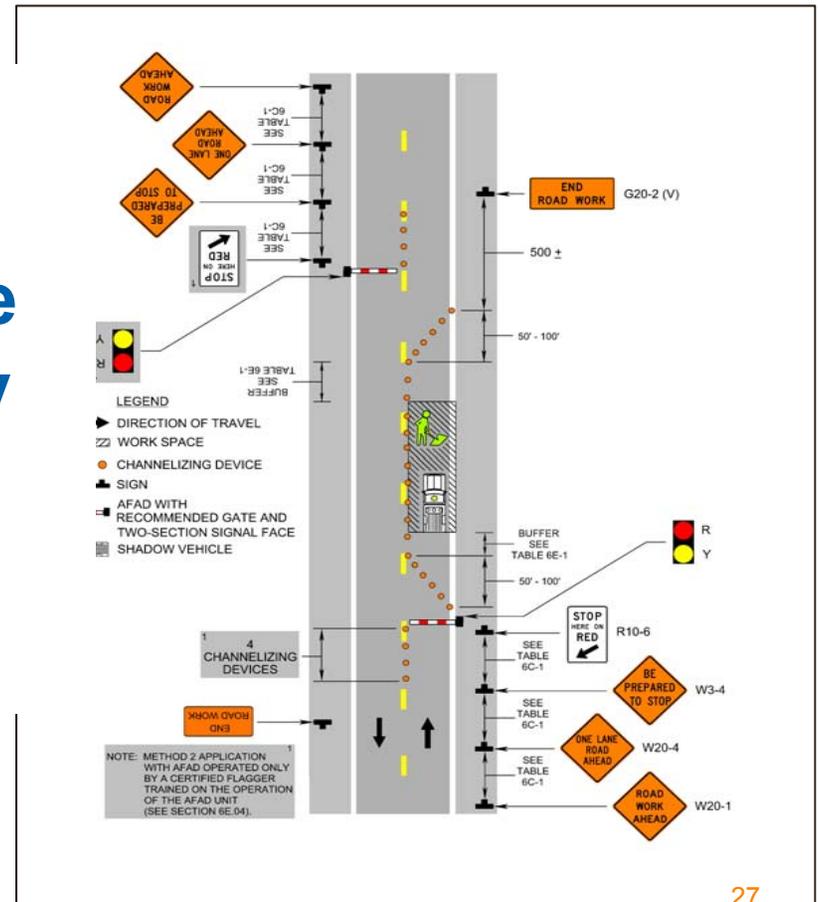


Figure 6E-2

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Figure 6E-4, Flagger Requirements (Sheet 2 of 2)

Virginia Department of Transportation

Methods of Flagging Traffic

Where to stand

1. Flagging stations shall be preceded by proper advance warning signs. Signs shall be removed when the flagger is no longer at their station. At night, flagging stations shall be illuminated with a minimum of horizontal luminance of 5-foot candles (50 lux).
2. Stand where you can see and be seen by approaching traffic. Clear sight distance from the graphic flagger sign to the flagger station should be 350' to 500' where the posted speed limit is 45 m.p.h. or 500' to 800' where the posted speed limit is greater than 45 m.p.h. (Less spacing may be necessary in areas where conditions warrant).
3. Stand facing traffic either on the edge of the shoulder of the road or near the edge of pavement.
4. Flagger stations should be located such that an errant vehicle has additional space to stop without entering the work area. The distance from the flagger station to the work area should be:

Posted Speed	≤20	25	30	35	40	45	50	55	60
Distance (Feet)	115 - 120	155 - 165	200 - 210	250 - 260	305 - 325	360 - 375	425 - 440	500 - 530	570 - 600

How to release traffic

1. Before releasing traffic the flagger will return to the normal flagging location. Keep your paddle on STOP or flag extended until you are safely on the shoulder of the roadway.
2. (a) With a Paddle--Stand facing traffic. Hold the SLOW sign paddle in a stationary position with the paddle facing the road user. With your free arm signal the drivers to proceed into the open lane.
(b) With a Flag--Stand parallel to roadway facing the road users. drop the flag to your side and with you free hand motion traffic to proceed to the open lane.
(c) Where traffic is stopped temporarily in one lane, release traffic by turning the paddle a quarter turn so that the word "STOP" faces you and is parallel to the roadway. With your free arm signal the drivers to proceed into the open lane.

How to alert and slow traffic but not stop it

1. Stand facing traffic.
2. (a) With a Paddle - Hold the SLOW sign paddle in a stationary position with the arm extended horizontally away from the body. For added emphasis, the flagger may raise and lower the free hand with the palm down.
(b) With a Flag - Stand parallel to traffic movement. The flagger should raise the flag from the ground to the shoulder and slowly motion up and down with the free palm down.

Never wave a paddle or flag

1. Signals must be clear and direct.
2. Use hand signals with devices. Don't make drivers guess what they

Posted Speed	≤ 20	25	30	35	40	45	50	55	60
Distance (Feet)	115 - 120	155 - 165	200 - 210	250 - 260	305 - 325	360 - 375	425 - 440	500 - 530	570 - 600

Matches Table 6E-1:
Longitudinal Buffer Space

1

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Section 6E.08, Flagger Station

- (01) When the Flagger operation is suspended:
- The Flagger (W20-1) symbol sign shall be removed or covered from road user

**No longer allowed to be turned
sign from traffic**

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Chapter 6F
Temporary Traffic Control
Devices

A number in parentheses represents the revised Section's paragraph.

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Section 6F.02, General Characteristics of Signs

- (22) Post-mounted rigid sign material changed to allow aluminum 0.080 inch thickness

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Table 6F-1, Temporary Traffic Control Zone Sign and Plaque Sizes

New Regulatory Signs:

- **Proceed When Way Is Clear (R1-V1)**
- **Work Zone \$500 Max. Fine For Exceeding Speed Limit When Flashing (R2-V1)**
- **Begin Right Turn Lane w/ Arrow (R3-20L, R3-20R)**
- **Turning Vehicles Yield to Pedestrians (R10-15)**

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Table 6F-1, TTC Zone Sign and Plaque Sizes

New Warning Signs:

- **Crash Area Keep Clear (WO-V1)**
- **Grooved Pavement Ahead (W20-V14)**
- **Median Crossover Closed Ahead (W20-V15)**
- **Median Crossover Closed (W20-V16)**
- **Rumble Strips Ahead (W20-V26)**
- **Emergency Work Ahead (W20-V27)**
- **Road Patching Ahead (W21-V18)**
- **Road Patching Next X Miles (W21-V19)**

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Table 6F-1, TTC Zone Sign and Plaque Sizes

New Vehicle Mounted Sign:

- Work Vehicle Frequent Turns (G20-V1a)

New Turn Lane Open/Closed Signs:

- Turn Lane Open (E5-V3L, EV-3R)
- Turn Lane Closed (E5-V4L, EV-4R)

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Table 6F-1, TTC Zone Sign and Plaque Sizes

Additional Guide Signs:

- Interstate Route Shields
- U. S. Route Markers
- VA Primary Route Markers
- VA Circular Secondary Route Markers
- Cardinal Directional Auxiliary
- Directional Arrows Auxiliary
 - Detour Route Shield Assemblies (Long-term)
 - WZ – Orange Arrows
 - Incident Management – Pink Arrows

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Section 6F.03, Sign Placement & Figure 6F-1

- Post may extend 2' above sign
- (08) (10) Height to bottom of
 - Plaque 7' max – 6' min
 - Sign 8' max – 7' min
- Adjusted measurements for 6x6 breakaway holes as related to ground line
- Verify post installation in STANDARDS/Plans

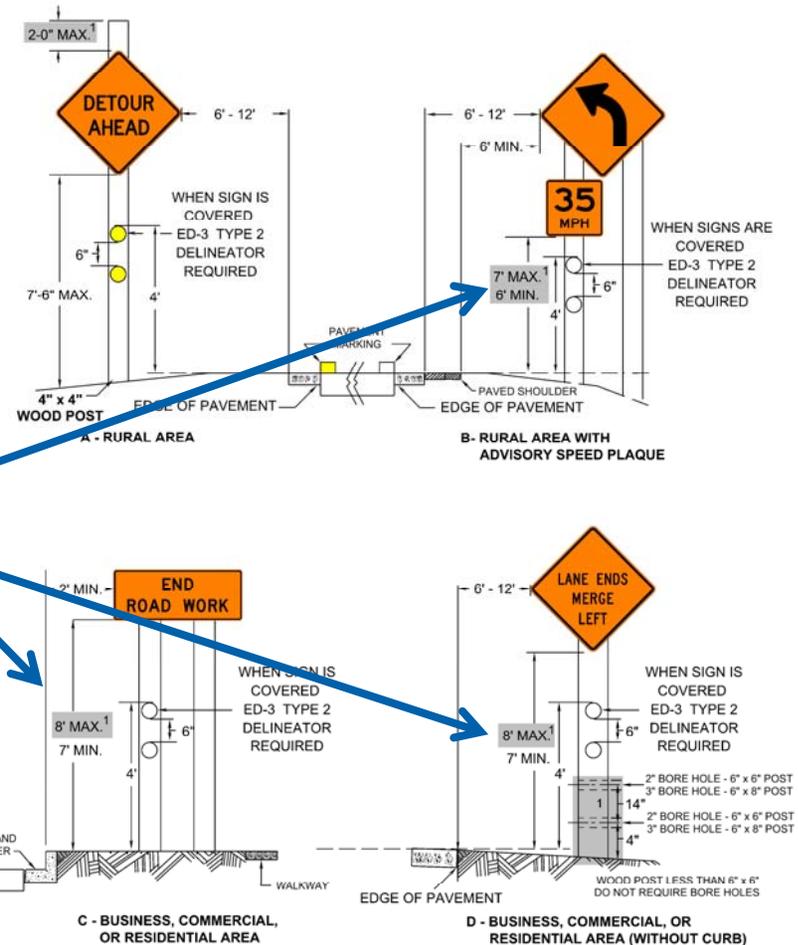


Fig. 6F-1 Height and Lateral Location of Signs – Typical Post-Mounted Installations

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Section 6F.03, Sign Placement

Portable sign supports:

(20) Legs fully extended for stability or add weight

(26) Portable support weight:

- 25 pound sand bag per leg or
- 2 drum collars center of sign stand
- Cones weights no longer allowed



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Section 6F.04, Sign Maintenance

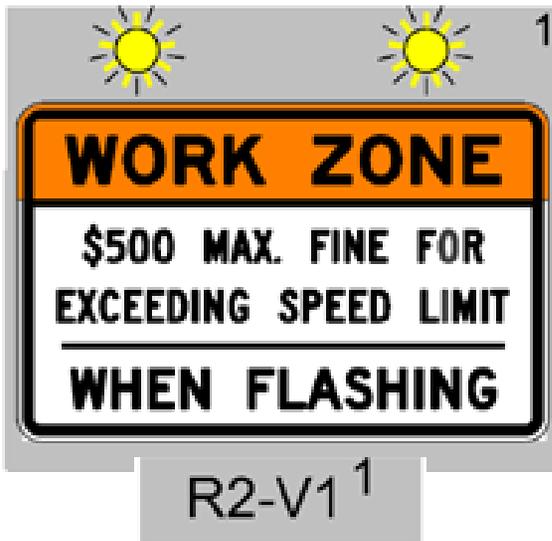
(03) When used, plywood shall only be attached to ground-mounted TTC sign



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Section 6F.13 & Figure 6F-2 Work Zone \$500 Max. Fine For Exceeding Speed Limit When Flashing Sign (R2-V1)

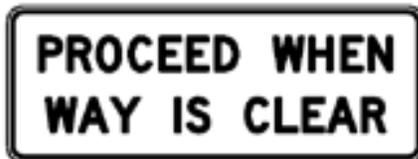


- (01) Code of VA amended
- (02) New sign shown has been required since July 1, 2012
- (03) (06)
Ty B flashing light shall be activated remotely when workers are present

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Section 6F.17 Special Regulatory Signs



R1-V1¹

- (04) An engineering study should determine the use of the **PROCEED WHEN WAY IS CLEAR** sign when a stop or yield condition is used to control traffic on a two-lane roadway (TTC-25).

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R10-15

Section 6F.17, Special Regulatory Signs

← (09) **Turning Vehicles Yield To Pedestrian sign reminds turning motorists to yield to pedestrians**

Section 6F.18, Warning Signs Function, Design, Application

(14) **Advance warning signs shall be installed on entrance ramps if they are not visible to ramp users**

2011 Work Area Protection Manual

Section 6F.21, Emergency Work Ahead

W20-V27¹

- (16) Used when unexpected or natural event must be dealt with urgently; not part of daily operation or planned work
- (13) Should be first sign in Temporary Incident Management Control Zone
- (14) May be used in lieu of ROAD WORK AHEAD
- (15) Supporting warning signs may be florescent orange with black legend & border

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Section 6F.26 (05) Median Crossover
Closed Ahead & Median Crossover Closed

- Shall be used in advance of the point where the median crossover is closed
- A NO LEFT TURN (R3-2) sign shall be used in conjunction with the MEDIAN CROSSOVER signs
- Median Crossover Closed installed at the beginning of the turn lane taper or 200' to 300' in advance of the of a crossover without turn lane.

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Section 6F.26



Section 6F.28

Required as of July 1, 2014

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Section 6F.35, Exit Open & Exit Closed signs



E5-2



E5-2a

- (04) For better visibility the minimum mounting height shall be **7 feet** from the pavement surface to the bottom of the sign

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Section 6F.38, Flagger Sign, XX Feet Plaque



W20-7

(02) When flagging operation is suspended the Flagger symbol sign shall be removed or covered

1000 FEET

W16-VP3 for 36" sign - 48 x 12

W16-VP3 for 48" sign - 60 x 18

Required, July 1, 2014¹

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Section 6F.40,... Trucks Entering Highway sign

(05) The Truck Entering Highway sign shall be used for Logging operations .

LOG TRUCKS ENTERING HIGHWAY sign shall not be use.



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Section 6F.41

- (02) **GROOVED PAVEMENT (W20-V14) sign may be alternative to the ROUGH ROAD sign.**
- (03) **A MOTORCYCLE (W8-15P) plaque may supplement a post mounted ROUGH ROAD or GROOVED PAVEMENT sign.**



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Section 6F.44



Section 6F.50



Section 6F.53

Required as of July 1, 2014

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Section 6F.50



W8-V5

Required, July 1, 2014¹

Section 6F.53



W8-12 (2009 MUTCD)

Required, July 1, 2014¹

Section 6F.58



W13-1 24" x 24" on 36" x 36" signs

W13-1 30" x 30" on 48" x 48" signs

Required, July 1, 2014¹

Section 6F.59



W16-VP1 for 36" sign - 48 x 12

W16-VP1 for 48" sign - 60 x 18

Required, July 1, 2014¹

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Section 6F.58



Section 6F.59

Required as of July 1, 2014

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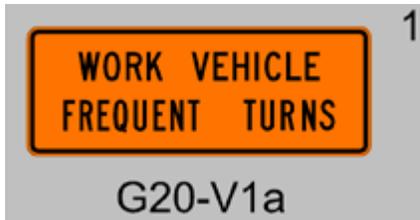
2011 Work Area Protection Manual Section 6F.64 Work Vehicle Frequent Turns sign



↑
G20-V1

Optional Until
June 30, 2017

OR



(04) Required as
of July 1, 2017

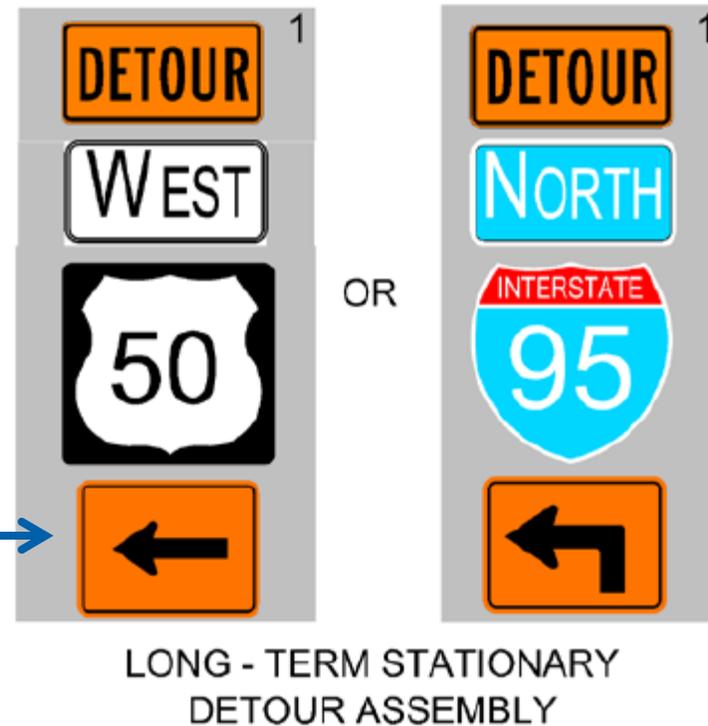
- (01) Mounted on rear of a vehicle hauling/delivering material
- (02) May be displayed at all times or covered or removed when not in use
- (05) Not required when the tailgate has been removed or lowered for work operations
- (05) Not required on vehicles which can enter or exit the work zone at higher speeds
- (03) Work Vehicle Do Not Enter is not required on 1-way, 2-lane operation

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Figure 6F.5... Detour Signs for TTC

Orange directional arrow auxiliary will be required on long-term detours to improve visibility and help identify work zone detour.



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Section 6F.68, Portable Changeable Message Boards

(33) PCMS other non-crashworthy trailer mounted devices

- Intelligent Transportation Systems (ITS)
- Highway Advisory Radio
- Speed Trailers
- CB Wizards
- ITS cameras
- Portable Traffic Control Signals
- AFAD units
- Light towers, etc.

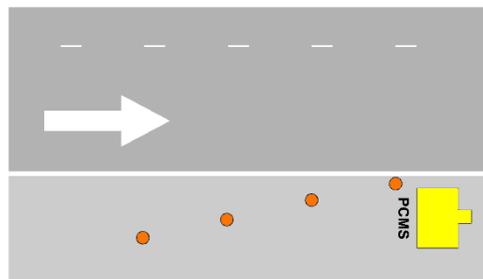
Delineate with 4-drum taper at all times

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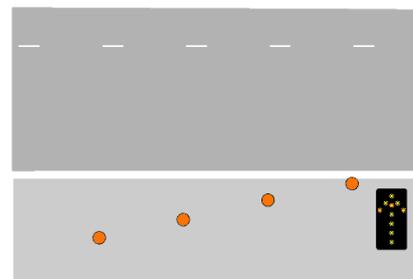
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Section 6F.69, Arrow Boards & Figure 6F-6

- Minimum 4 channelizing device taper delineates the arrow board at all times
- Shoulder taper required if placed on paved shoulders with a width of 8 feet or more
- Delineation/channelizing devices match those used in merging taper



FOUR (4) DRUMS FORM A TAPER
IN ADVANCE OF THE PCMS OR OTHER
UNMANNED TRAILER MOUNTED DEVICES¹
0- 35 MPH SPACING AT 20'
36 MPH & ABOVE SPACING AT 40'



FOUR (4) CHANNELIZING DEVICES¹
(MATCHING ROADWAY TAPER)
FORM A TAPER IN ADVANCE OF
THE ELECTRONIC ARROW BOARD
0- 35 MPH SPACING AT 20'
36 MPH & ABOVE SPACING AT 40'

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Section 6F.73, Tubular Marker:

- (01) Constructed of lightweight, formable material.
- (02) Retroreflective sheeting, ASTM Type III Reboundable,¹ 4- to 6-inch wide alternating orange and white strips

247 Specification

- Required on projects advertised July 1, 2012.
- Advertised prior to July 1, 2012 may be used until July 1, 2016.
- Regardless of dates all shall comply by July 1, 2016.

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Section 6F.75, Drum:

- (01) **Retroreflective sheeting, ASTM Type III Reboundable, 6-inch wide alternating orange and white strips.**
- **Required on projects advertised July 1, 2012.**
 - **Advertised prior to July 1, 2012 may be used until July 1, 2016.**
 - **Regardless of dates all shall comply by July 1, 2016.**
- (02) **Retroreflectivity sheeting should be grouped together.**

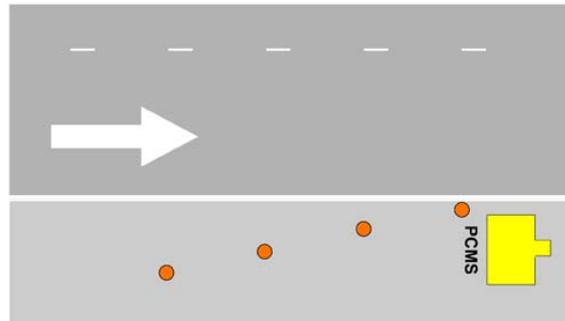
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Section 6F.75, Drum:

- (09) A four drum taper shall be used to delineate PCMS or other unmanned trailer mounted devices.

**Fig.
6F-6**



FOUR (4) DRUMS FORM A TAPER
IN ADVANCE OF THE PCMS OR OTHER
UNMANNED TRAILER MOUNTED DEVICES¹
0- 35 MPH SPACING AT 20'
36 MPH & ABOVE SPACING AT 40'

- (10) Drums may be left on the shoulder but must not prohibit the use of the shoulder.

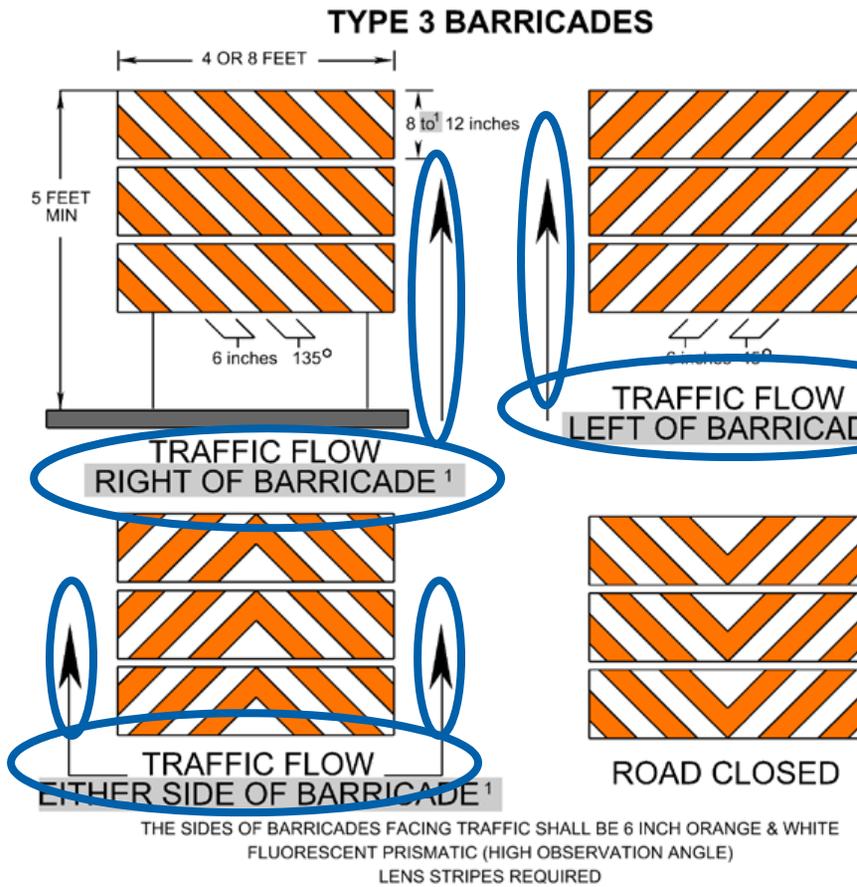
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Section 6F.76, Type 3 Barricades & Figure 6F-8

Type 3 Barricades: (04) Rail width

approximately 8 to 12 inches.



(17) Shall be used to close work access - entrances openings

(18) A person shall be assigned to ensure proper closure at the end of the work day

(21) Signs mounted on Ty. 3 barricade should not cover more than the top rail.

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Section 6F.83 Temporary Raised Islands

(07) Added reference for flex post delineators

- See Figure 6 in Appendix A of this manual or IIM-LD-93 for specific details on Temporary Asphalt Medians

Section 6F.86 Temporary Markings

(05) Flexible temporary pavement markers (FTPMs)¹ for up to ten consecutive days as directed by the Engineer

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Section 6F.90 Floodlights

(06) Added anti-glare shields to eliminate glare



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Section 6F.92 Vehicle Warning Lights

(02) Deleted strobe lights

(02 – 1.) ... Sealed beams shall have a flash rate of 75 to 135 flashes per minute.

(06) **Both day and night, vehicle warning lights should be used on work vehicles entering and exiting a work zone and visible from 360 degrees.**

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Section 6F.94 Temporary Traffic Barrier

- (06) Shall be crashworthy and selected from VDOT's Approved Products list**

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Section 6F.95 Crash Cushion

(04) CRASH AREA KEEP CLEAR sign shall be installed when a non-redirective crash cushion (impact attenuator) is directed by the plan assembly.



W0-V1¹

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Section 6F.95 Crash Cushion

Truck Mounted Attenuator (TMA) shall:

- (06) - only be used to protect a fixed object for incident management operation.
 - remain in place for no more than 24 hours after the initial scene response.
- (07) have a rear panel with 6 to 8 inches wide black and fluorescent yellow (Orange still allowed) strips.
- (08) be installed as tested per NCHRP350/Mash Test Level 3 criteria

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Section 6F.95 Crash Cushion

- (18) Additional shadow vehicle(s) may be used to protect workers in separate locations throughout the work area.**
- (20) - Channelizing devices and signs shall not be store on a shadow vehicle with a TMA.**
 - All other material and/or equipment on the shadow vehicle TMA shall be properly secured to prevent spillage if struck by an errant vehicle.**

Section 6F.96 Rumble Strips**Portable Temporary Rumble Strips (PTRS)**

- (03) Transverse rumble strip
Installed/removed quickly**
- (06) Interlocking or hinged segments**
- (07) - With stand 80,000 lbs.
- No more than 6 inches parallel
incidental movement during 8 hour
use
- 3 rumble strips equals an array**

Section 6F.96 Rumble Strips & Figure TTC-23

- (15) • **Approval must be granted by the Engineer**
- **Used in one-lane, two-way flagging operations.**
 - **PTRS should extend across the travel lane but not encroach into the opposing lane.**
 - **Only one array of PTRS should be used in the advance warning area.**

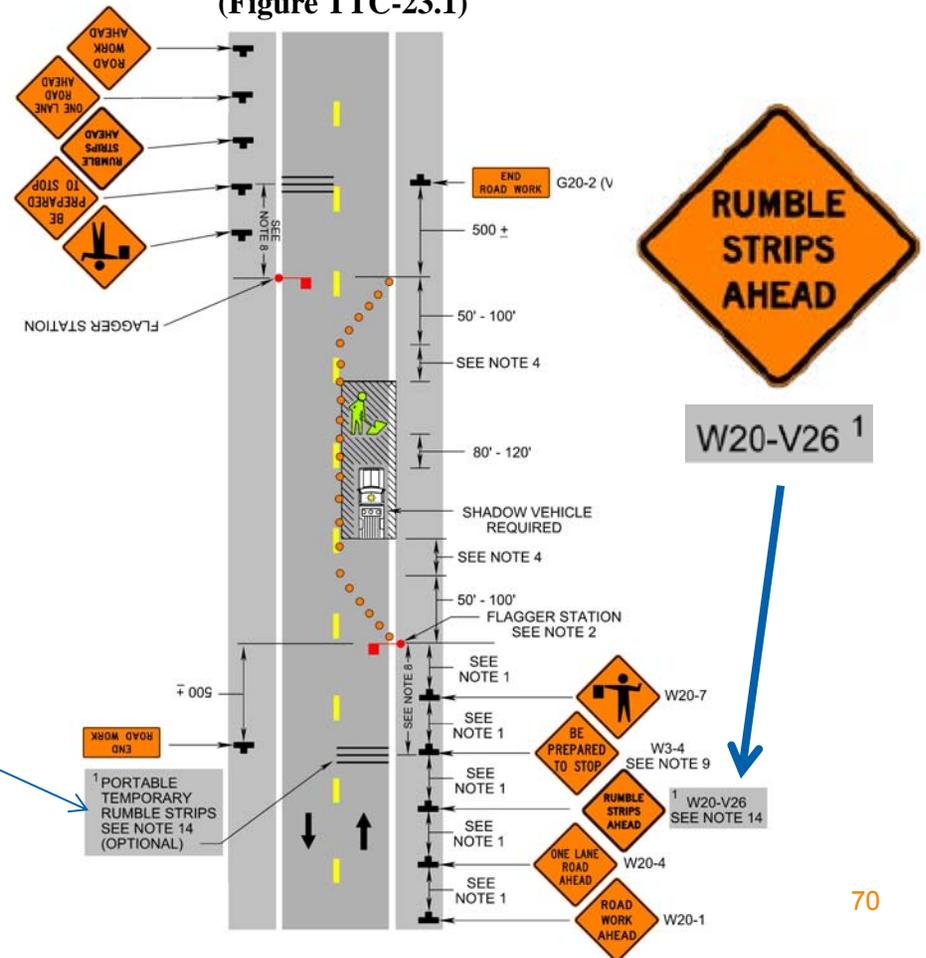
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Section 6F.96 Rumble Strips & Figure TTC-23

(16) PTRS should be installed/removed with the advance warning signs for the work operation.

(07) PTRS Spacing
center to center
 0 – 35 mph 5 feet
 36 – 55 mph 8 feet

Lane Closure on a Two-Lane Roadway Using Flaggers
(Figure TTC-23.1)



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Chapter 6F

Section 6G.02 Work Duration

- (02 E.) Mobile is work that moves intermittently (1 to 15 minutes) or continuously.**
- (11) Removed reference to strobe light for vehicle mounted lights and throughout Chapter 6G.**

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Section 6G.10 Work Within the Traveled Way of a Two-Lane Highway

Support:

- (06) When a work zone on a two-lane highway transitions to a multi-lane highway the temporary traffic control continues as a two-lane highway. Lane closure signs and arrow boards typically used for temporary traffic control on multi-lane highways are not needed.

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Chapter 6F

Section 6G.24

Slow Roll Temporary Traffic Control Operation

- (02) Shall be approve by Regional Traffic Engineer or their designee.**
- (07) A control vehicle can be a contractor's, public agency's or VSP's**

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Section 6G.25 Installing/Removing Temporary Traffic Control - **On a two-lane roadway:**

- (02) **Non-stationary flagging operation using:**
- **Temporary Traffic Control (TTC) Spotter(s)**
 - (06) **Highly visible at all times**
 - (06) **Position after Road Work Ahead sign**
 - **Shadow Vehicle and**
 - **Work Operations Vehicle**
 - (03) **May act as a shadow vehicle when one is not available.**

Revision 1

2011 Work Area Protection Manual

Section 6G.25 Installing/Removing Temporary Traffic Control - **On a two-lane roadway:**

(02) Non-stationary flagging operation using:

- **Temporary Traffic Control (TTC) Spotter**
 - (04) Uses red or red-orange flag
 - (05) May use STOP/SLOW paddle
 - (07) Two TTC spotters should be used when the work operations vehicle acts as a shadow vehicle.
 - One controls traffic
 - other watches and alerts workers and stops traffic when necessary

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Section 6G.25 Installing/Removing Temporary Traffic Control - **On a multi-lane roadway:**

(08) Begins and ends as a modified mobile operation (for an example see TTC.62) uses:

- **Shadow vehicles shall be equipped with an arrow board & vehicle warning lights**
- **A shadow vehicle closes the shoulder.**
- **A shadow vehicle closes the lane.**
- **Work Operations vehicle equipped with vehicle warning lights**

(11) TMA required when shadow vehicle encroaches partially or fully in the travel lane when speed limit is 45 or greater.

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Section 6G.25 Installing/Removing Temporary Traffic Control - **On a multi-lane roadway:**

- (09) A work operations vehicle may be equipped with a TMA but must be protected by a shadow vehicle with a TMA.
- (10) - TTC devices shall not be stored, installed or removed from a shadow vehicle equipped with or without a TMA
 - TTC devices shall be installed or removed from a work operation vehicle.

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Section 6G.25 Installing/Removing Temporary Traffic Control - **On a multi-lane roadway:**

(17) A shadow vehicle with a TMA will not be required for operations that can be performed quickly with no further use of the TMA vehicle is needed such as:

- **Work beyond the shoulder (TTC-1)**
- **Litter removal or mowing (non-Limited Access) off of the travelway and shoulder**
- **Surveying operations (TTC-49)**
- **Logging operations (TTC-63)**

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Section 6G.26, Temporary Traffic Control During Nighttime Hours

- (10) **NIGHT WORK AHEAD** on the PCMS may be used to supplement the advance warning signs for a night work zone.

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Section 6G.27 Work Area Ingress/Egress Considerations

- (05) Work area ingress/egress spacing should be:**
- **One every 0.5 to 0.75 mile if activity area length is up to 2.0 miles.**
 - **One every mile if activity area length is greater than 2.0 miles.**

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Section 6G.27 Work Area Ingress/Egress Considerations

- (06) Minimum length of the ingress/egress should be 1320 feet with the desirable width of 15 feet width.**
- (08) Minimum width ingress/egress may be reduced to 12 feet if right-of-way constraints exist.**

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Section 6G.27 Work Area Ingress/Egress Considerations

- (09) Type 3 barricades shall be used to close or partially close a work access opening or construction entrance.
- (10) A vehicle-mounted sign shall be placed on the rear of trucks hauling/delivering material to the work space (see Section 6F.64).

▪

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Chapter 6H
Temporary Traffic Control
Devices

A number represent TTC note.

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Section 6H.01 Typical Applications

- (11) Prior to the installation of an approved lane closure, notification as defined in the contract/permit shall be made to the Regional Transportation Operations Center advising of the closure and the estimated duration time for the lane closure. As soon as practical, the Regional TOC shall be notified when the lane closure has been removed.**

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Table 6H-2 and Table 6C-4 Taper Chart

Posted Speed Limit (mph)	Taper Length (L)				Remarks
	Width of Offset (Feet)				
	9	10	11	12	
≤ 25	95	105	115	125	L= S ² W/60
30	135	150	165	180	"
35	185	205	225	245	"
40	240	270 ¹	295 ¹	320	"
45	405	450	495	540	L=SW
50	450	500	550	600	"
55	495	550	605	660	"
60	540	600	660	720	"
65	585	650	715	780	"
70<	630	700	770	840	"

Limited Access highway merging taper length (L) shall be 1000 feet regardless of the posted speed and SW=L is desired for the shifting taper length with ½L being the minimum.

Changed 40 MPH
length
270 – 295

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Table 6H-3, Longitudinal Buffer Space
Table 6C-2, Length of the Longitudinal Buffer Space
Table 6E-1, Longitudinal Buffer Space

Posted Speed Limit (mph)	Distance (Feet)
≤ 20	115 – 120
25	155 – 165 ¹
30	200 – 210
35	250 – 260
40	305 – 325 ¹
45	360 – 380
50	425 – 445
55	500 – 530 ¹
60	570 – 600 ¹
65	645 – 675
70	730 – 760
75	820 – 850

Changed distance

25 mph	155 – 165¹
40 mph	305 – 325¹
55 mph	500 – 530¹
60 mph	570 – 600¹

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Table 6H-5 and Table 6C-1, Recommended Spacing of Advance Warning Signs

Road Type	Spacing (Feet)
Urban street with 25 mph or less posted speed	100 – 200
Urban street with 30 to 40 mph posted speed	250 – 350
* All Other Roadways with 45 mph or less posted speed	350 – 500
All Other Roadways with greater than 45 mph posted speed	500 – 800
Limited Access highways	1300 – 1500

Changed title to “Recommended Spacing of Advance Warning Signs”

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Chapter 6H

Figure 6H-1

	ARROW BOARD		CHANGEABLE MESSAGE SIGN SUPPORT OR TRAILER
	ARROW BOARD ON TRAILER		ARROW BOARD ON VEHICLE
	CHANNELIZING DEVICE		TEMPORARY TRAFFIC BARRIER
	ACTIVE TRAFFIC SIGNAL		LONGITUDINAL CHANNELIZING DEVICE
	INACTIVE TRAFFIC SIGNAL		TYPE 3 BARRICADE
	TRAFFIC OR PEDESTRIAN SIGNAL		SIGN
	FLAGGER		HIGH-LEVEL WARNING DEVICE (FLAG TREE)
	1 WAY PAVEMENT MARKER		2 WAY PAVEMENT MARKER
	WORK VEHICLE		TRACTOR
	TRUCK MOUNTED ATTENUATOR		SLOW MOVING VEHICLE EMBLEM
	LAW ENFORCEMENT VEHICLE		WARNING LIGHT
	WORK SPACE		MILLED PAVEMENT
	RUMBLE STRIPS		DIRECTION OF TRAFFIC
	IMPACT ATTENUATOR		AUTOMATED FLAGGER ASSISTANCE DEVICE



TEMPORARY TRAFFIC BARRIER

**Changed
CONCRETE to
TRAFFIC**

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Eliminated STROBE light as a vehicle warning light in:

Figure	Note Number(s)	Figure	Note Number(s)
TTC-1	Notes 4 & 5	TTC-3	Notes 3 & 4
TTC-4	Notes 4 & 5	TTC-5	Notes 5 & 6
TTC-9	Note 1	TTC-10	Note 1
TTC-11	Notes 1 & 2	TTC-12	Notes 1 & 2
TTC-13	Note 1	TTC-14	Note 1
TTC-15	Note 2	TTC-16	Notes 8 & 9
TTC-17	Notes 8 & 9	TTC-18	Notes 8 & 9
TTC-19	Notes 8 & 9	TTC-20	Note 6
TTC-21	Note 6	TTC-22	Note 7

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Eliminated STROBE light as a vehicle warning light in:

Figure	Note Number(s)	Figure	Note Number(s)
TTC-23	Note 7	TTC-24	Note 10
TTC-26	Notes 4 & 6	TTC-27	Notes 4 & 6
TTC-28	Notes 4 & 5	TTC-31	Notes 7 & 8
TTC-32	Notes 3 & 5	TTC-33	Notes 8 & 9
TTC-37	Note 7	TTC-38	Note 4
TTC-39	Note 8	TTC-40	Note 9
TTC-41	Note 7	TTC-42	Note 6
TTC-49	Notes 3 & 4	TTC-56	Notes 10 & 11
TTC-61	Notes 1 & 4	TTC-62	Note 1

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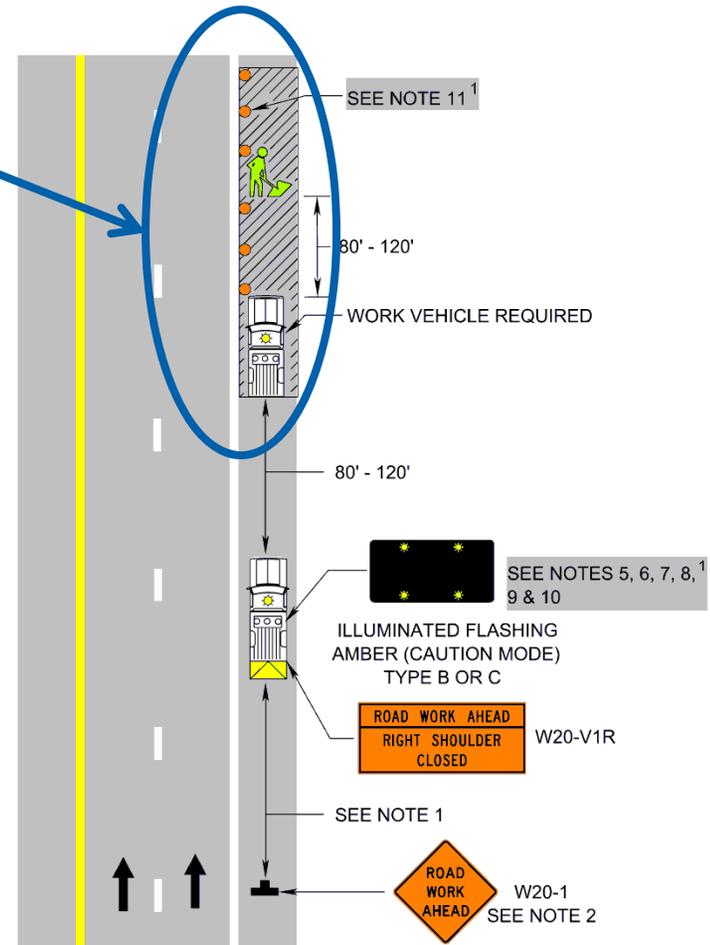
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Mobile or Short Duration Shoulder Operation

TTC-3.1

8. A TMA shall be used on Limited Access highways and multi-lane roadway where the posted speed limit is 45 or greater and the work operation last more than 60 minutes.
9. Vehicle warning lights may be used when the work operation is off the shoulder 1 – 15 minutes.
10. A sign should supplement the vehicle warning lights when the work is off the shoulder for 15-60 minutes.

11. Channelizing devices at a reduced spacing may be used to delineate the work area. They would start at the front of the shadow vehicle & extend through the work area.



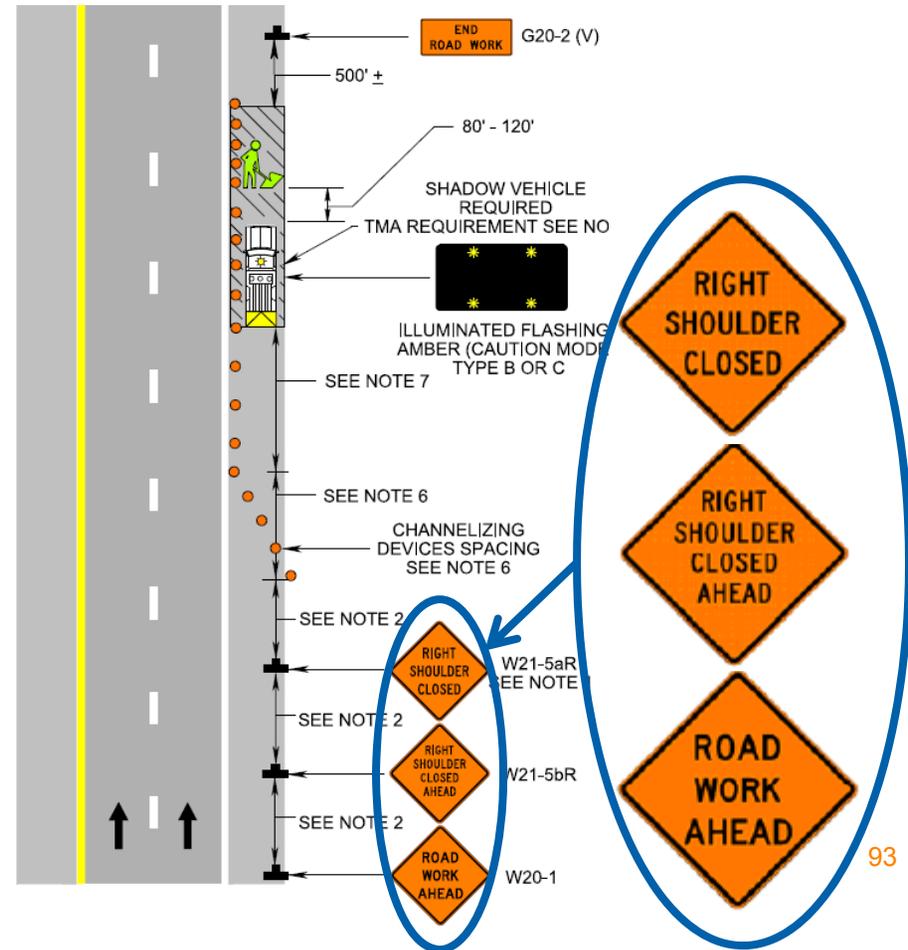
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Stationary Operation on a Shoulder

TTC-4.1

**1. Divided highway:
For work operations less than 3 days, sign assemblies only required on the side of the shoulder closure.**



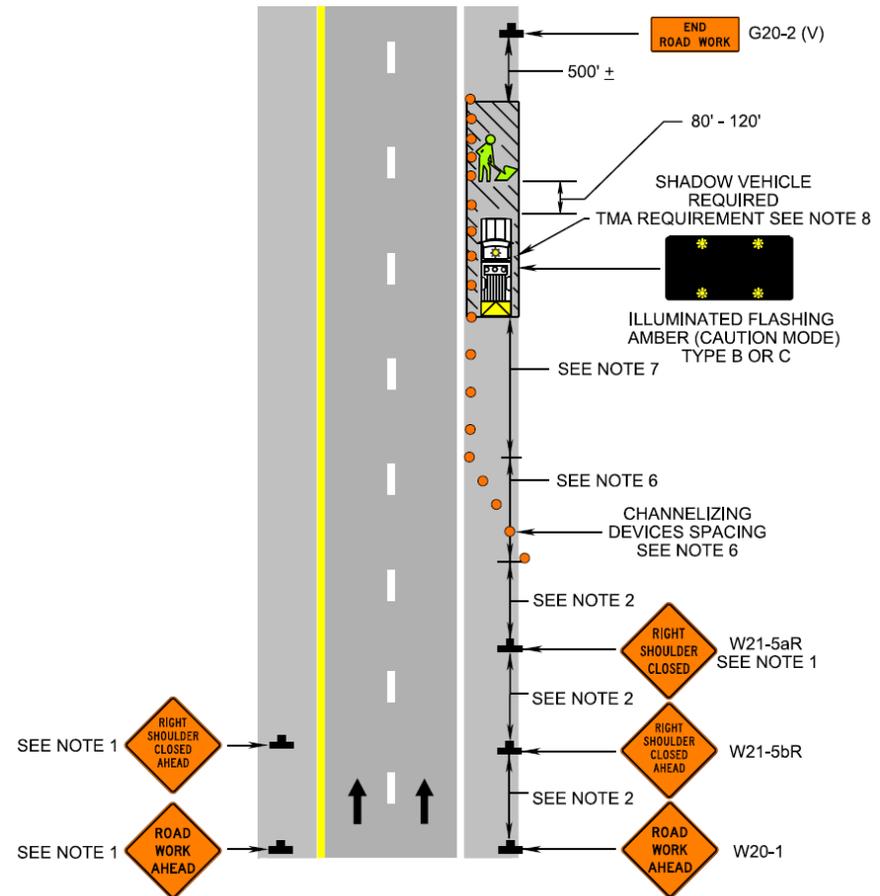
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Shoulder Operation with Minor Encroachment

TTC-5.1

**1. Divided highway:
Long-term
stationary work
left and right sign
assemblies
required when
median is wider
than 8'.**



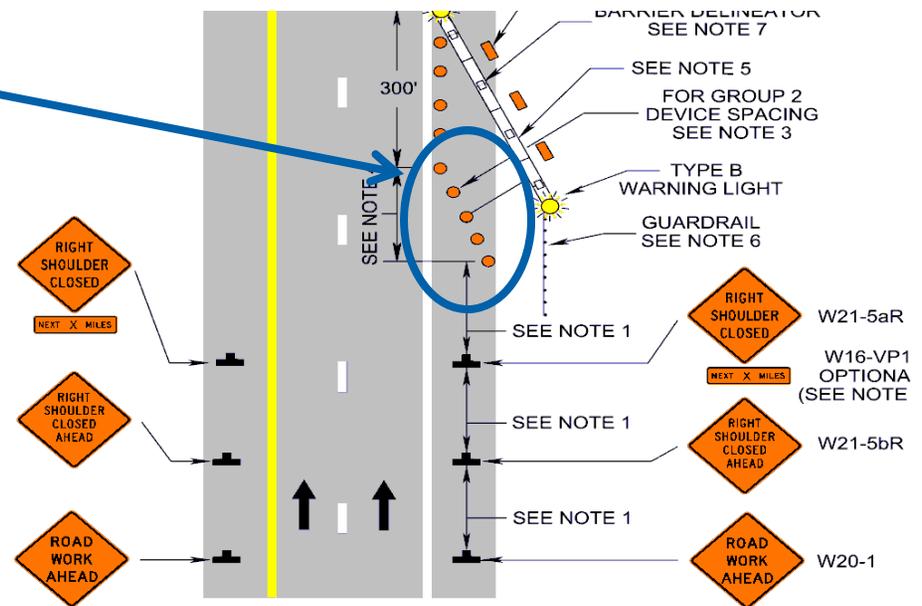
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Shoulder Closure with Barrier Operation

TTC-6.1

4. Shoulder Taper for Limited Access highway shall be 360 feet otherwise 1/3L on all other roadways.



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Mowing Operation with Encroachment on Non-Limited Access Roadways - TTC-9.1

9. Weed eating and push mowing should be performed using the mowing series of warning signs.
11. If only litter pick up operation is performed then the LITTER PICK UP signs shall be used.
12. If warning signs for mowing and litter pick up operations cannot be seen by ramp traffic, then warning signs shall be installed on the ramp.

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Mowing Operation with Encroachment on Non-Limited Access Roadways - TTC-9.1

10. Litter pick up may be preformed with the mowing series of warning signs during mowing operations.
13. If only litter pick up operations are performed then the LITTER PICK UP signs shall be used.
14. A shadow vehicle with a TMA may be used behind the slow moving vehicle to protect motorists and the operator.

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Non-Licensed Vehicle Operation with Encroachment on Limited Access Highways - TTC-10.1

15. If only litter pick up operation is performed then the LITTER PICK UP signs shall be used.
16. If warning signs for mowing and litter pick up operations cannot be seen by ramp traffic, then warning signs shall be installed on the ramp.

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Non-Licensed Vehicle Operation with Encroachment on Limited Access Highways - TTC-10.1

13. Weed eating and push mowing should be preformed using the mowing series of warning signs.
14. Litter pick up may be preformed with the mowing series of warning signs during mowing operations.
17. If only litter pick up operations are performed then the LITTER PICK UP signs shall be used.

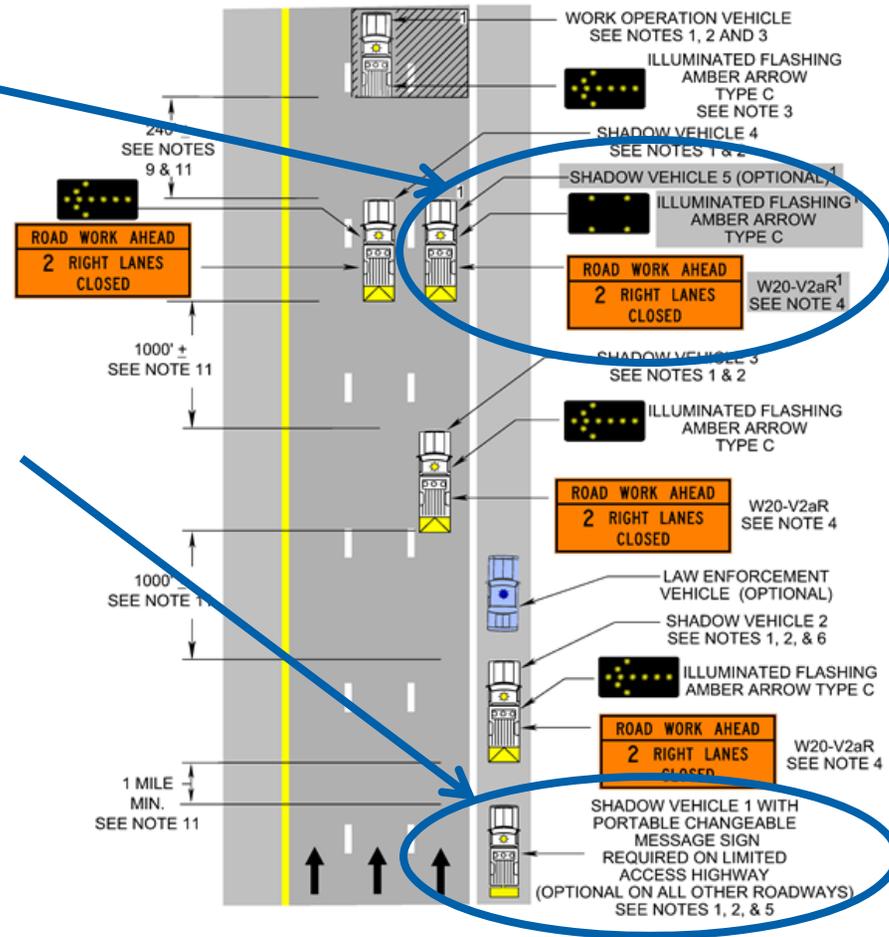
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Moving/Mobile Operations on Limited Access Highways (Multiple Lane Closure) - TTC-12.1

- In Figure added optional Shadow Vehicle 5

- Non Limited Access Highways Shadow Vehicle 1 shall have the option to use a PCMS or Arrow Board

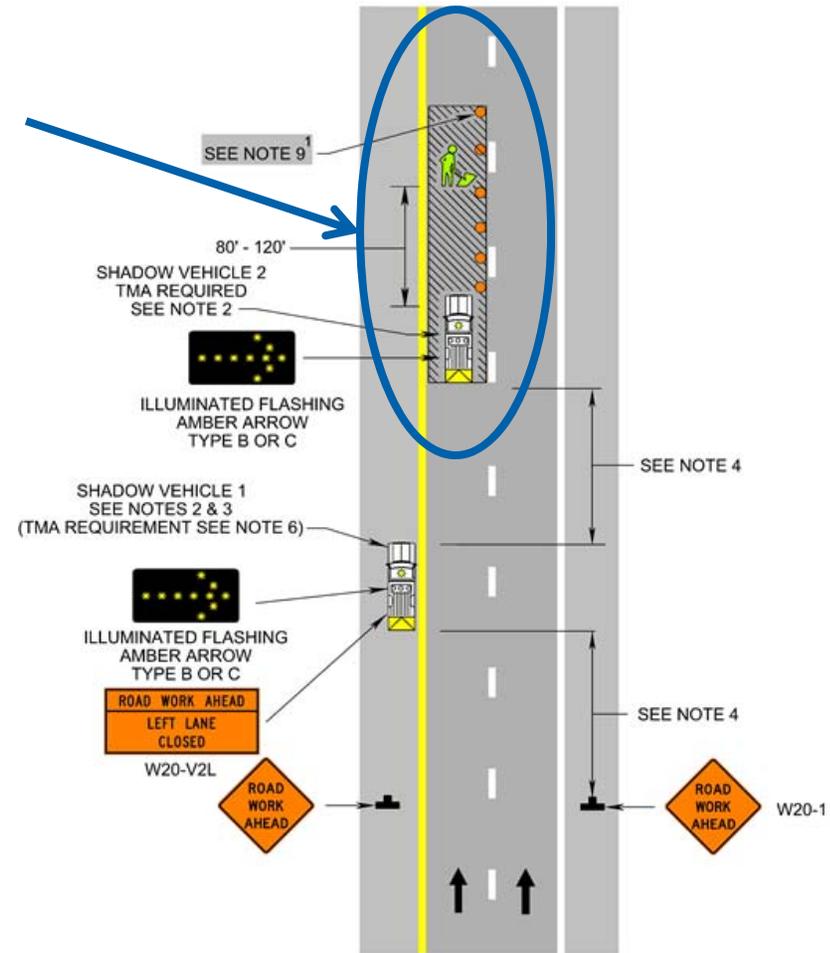


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Short Duration Operation on a Multi-Lane Roadway - TTC-15.1

9. Channelizing devices at a reduced spacing may be used to delineate the work area. They would start at the front of the shadow vehicle & extend through the work area.



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TTC-19.1, TTC-22.1 & TTC-32.1

TTC-19.1 & TTC-22.1
5. Corrected
Lane Width (Feet)

TTC-32.1
4. Corrected
Lane Width (Feet)

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11 ¹	12
25	95	105	115	125
30	135	150	165	180
35	185	205	225	245
40	240	270	295	320
45	405	450	495	540
50	450	500	550	600
55	495	550	605	660
60	540	600	660	720
65	585	650	715	780
70	630	700	770	840
Minimum taper lengths for Limited Access highways shall be 1000 feet.				
Shoulder Taper = $\frac{1}{3}$ L Minimum				

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Lane Closure Operation with Temporary Traffic Barrier - TTC-20.1

- Title changed Temporary Traffic Barrier
8. Change slope rate to Flare Rate in text and table.

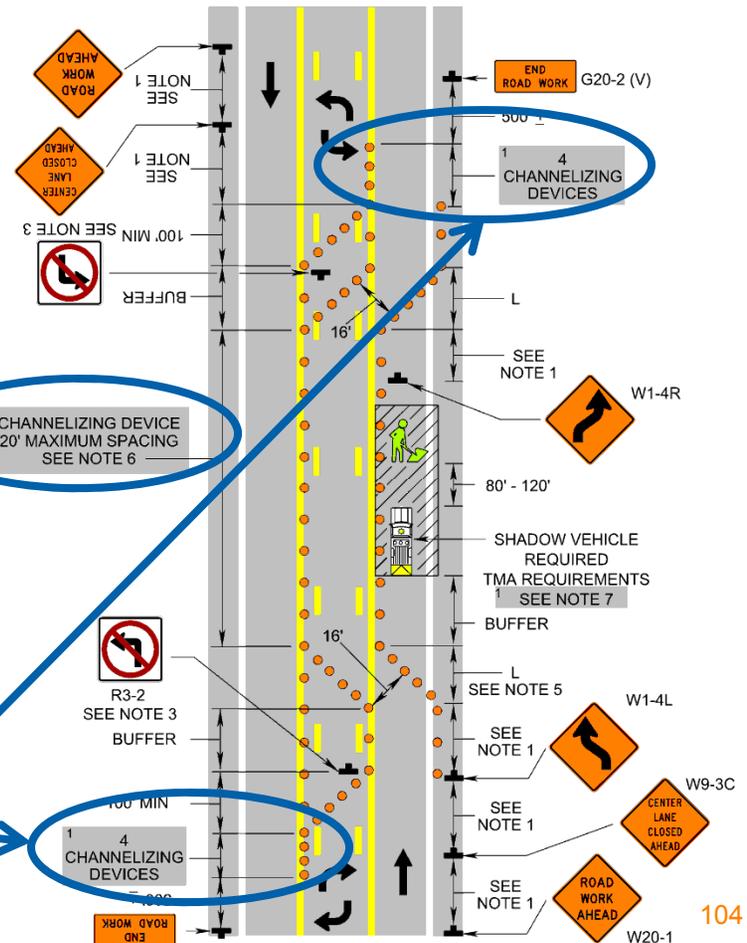
Speed Limit (mph)	Flare Rate ¹	Speed Limit (mph)	Flare Rate ¹	Speed Limit (mph)	Flare Rate ¹
70	22:1	55	17:1	40	13:1
65	20:1	50	16:1	35	11:1
60	19:1	45	14:1	≤30	10:1

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Right Lane Closure Operation on a Three-Lane Roadway - TTC-22.1

- 6. Channelizing device spacing shall be a maximum of 20' on center in the buffer & activity area.
- 10. Four channelizing devices should be used to beyond the downstream end of the transition area as depicted to provide additional guidance for motorists.



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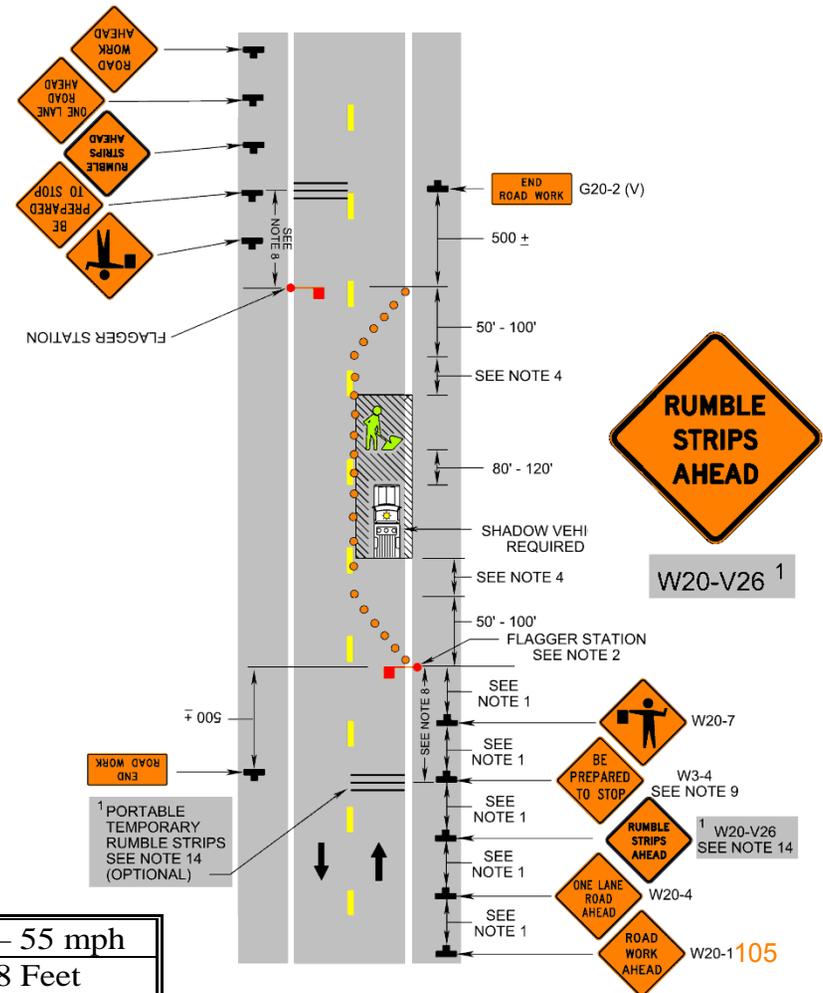
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Lane Closure on a Two-Lane Roadway Using Flaggers - TTC-23.1

14. Portable Temporary Rumble Strips (PTRS) when used:

- Must be approved by the Engineer
- Installed in conjunction with BE PREPARED TO STOP sign.
- RUMBLE STRIP AHEAD sign required.
- PTRS Spacing:

Posted Speed	0 – 35 mph	36 – 55 mph
PTRS Spacing (Center to Center)	5 Feet	8 Feet

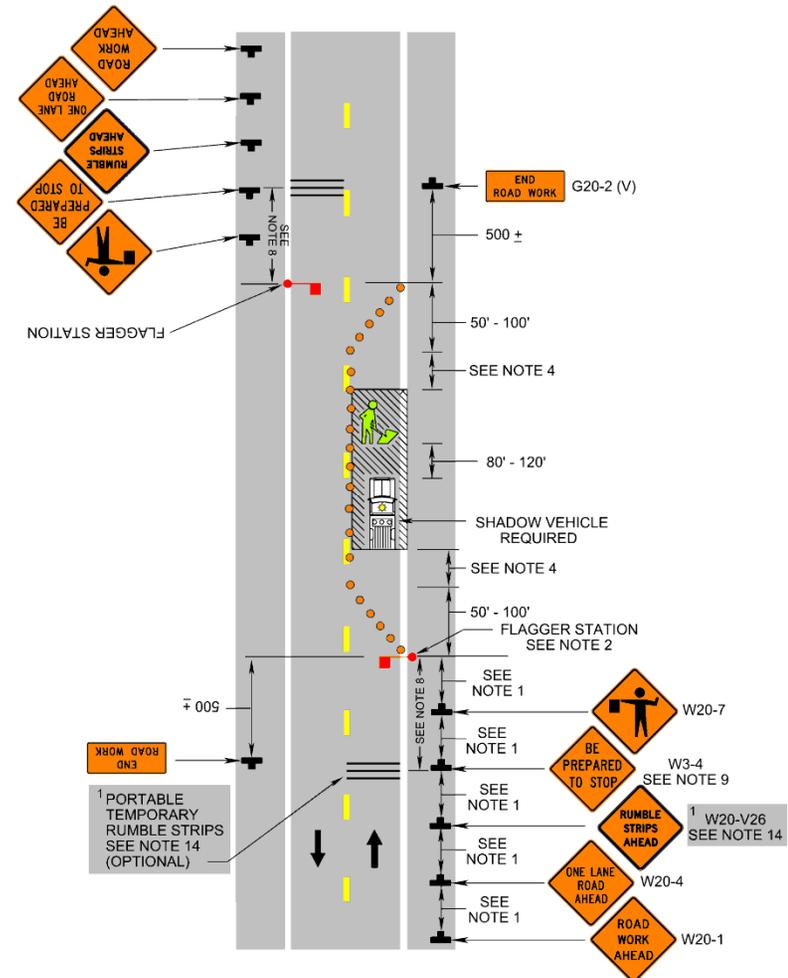


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Lane Closure on a Two-Lane Roadway Using Flaggers - TTC-23.1

9. Portable temporary rumble strips (PTRS) should be adjusted when the queue of traffic reaches the **BE PREPARED TO STOP** sign.

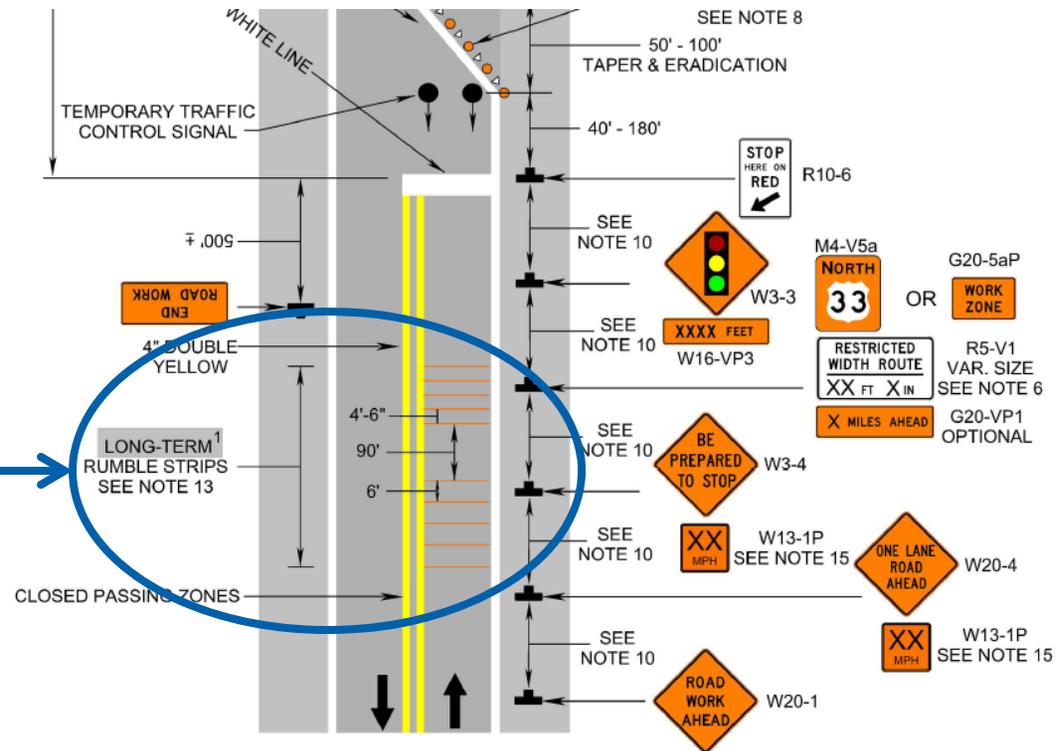


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Lane Closure Operation on a Two-Lane Roadway Using Traffic Control Signals - TTC-25.1

13. Long-term¹ rumble strips may be used to enhance the work zone.



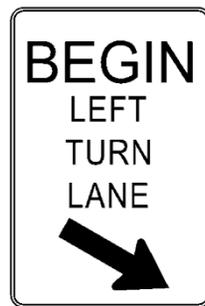
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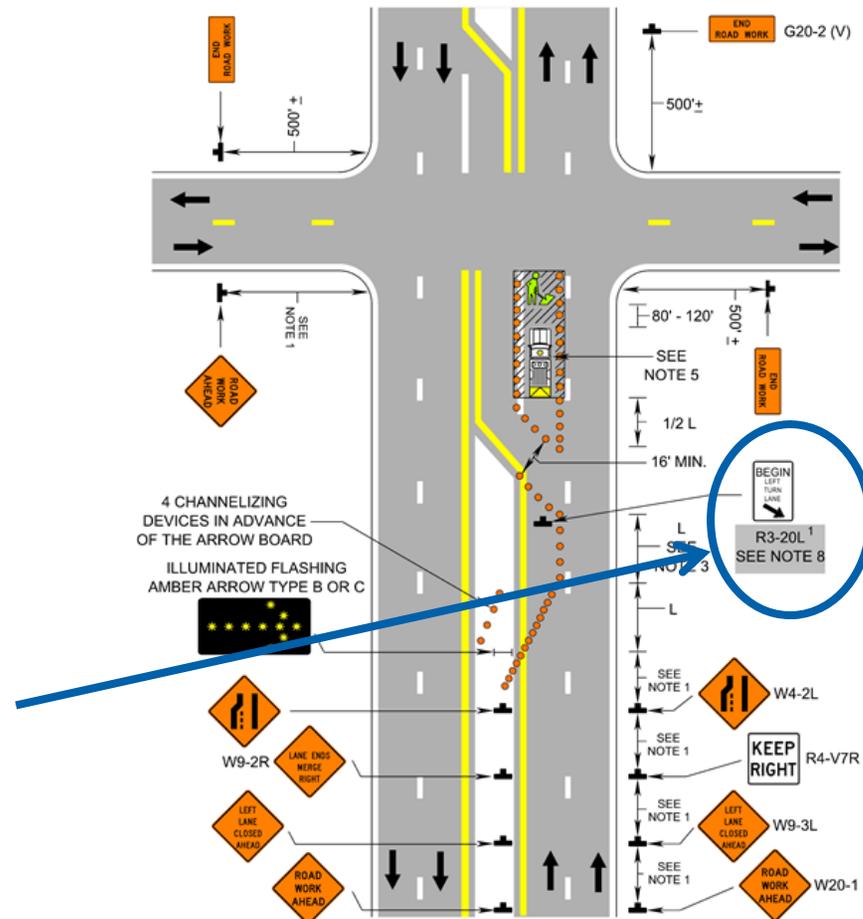
Lane Closure Operation – Near Side of an Intersection - TTC-26.1

8. If the left turn lane is closed a **NO LEFT TURN (Symbol) (R3-2)** shall be used.

New sign required



R3-20L



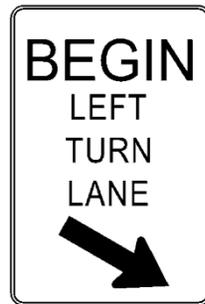
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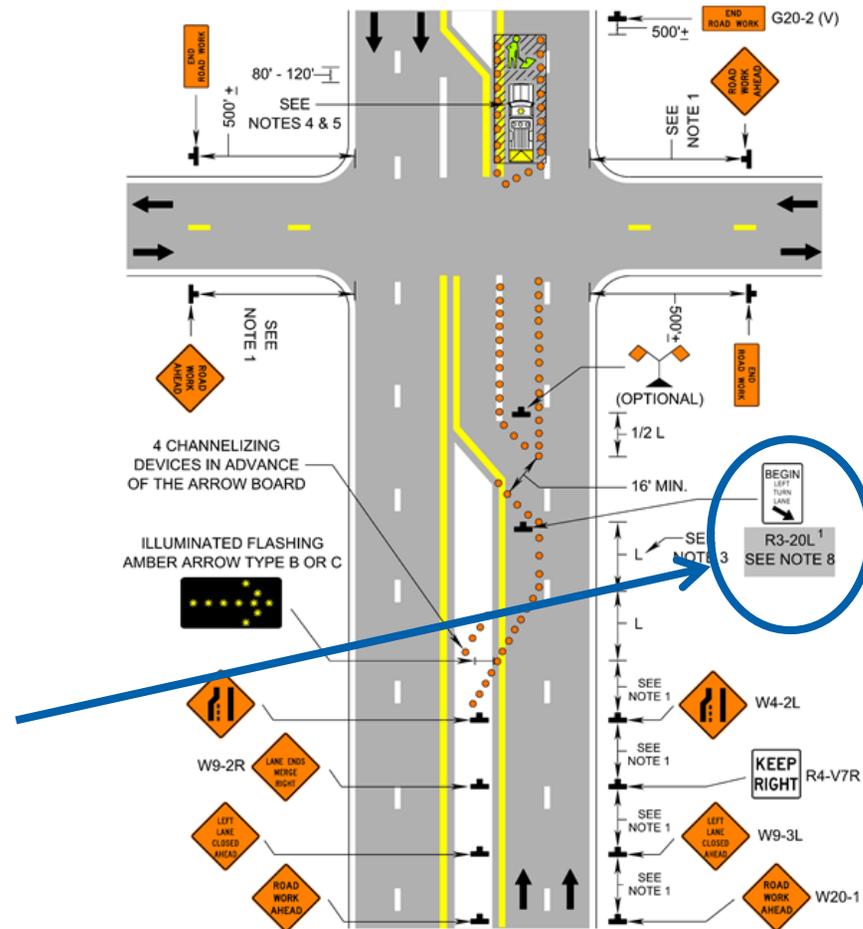
Lane Closure Operation - Far Side of an Intersection - TTC-27.1

8. If the left turn lane is closed a **NO LEFT TURN (Symbol) (R3-2)** shall be used.

New sign required



R3-20L



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Turn Lane Closure Operation

TTC-29.1

7. Changed buffer space lengths:

Posted Speed Limit (mph)	Distance (Feet) ¹
≤20	115 – 120
25	155 – 165
30	200 – 210
35	250 – 260
40	305 – 325
45	360 – 380
50	425 – 445
55	500 – 530
60	570 – 600
65	645 – 675
70	730 – 760

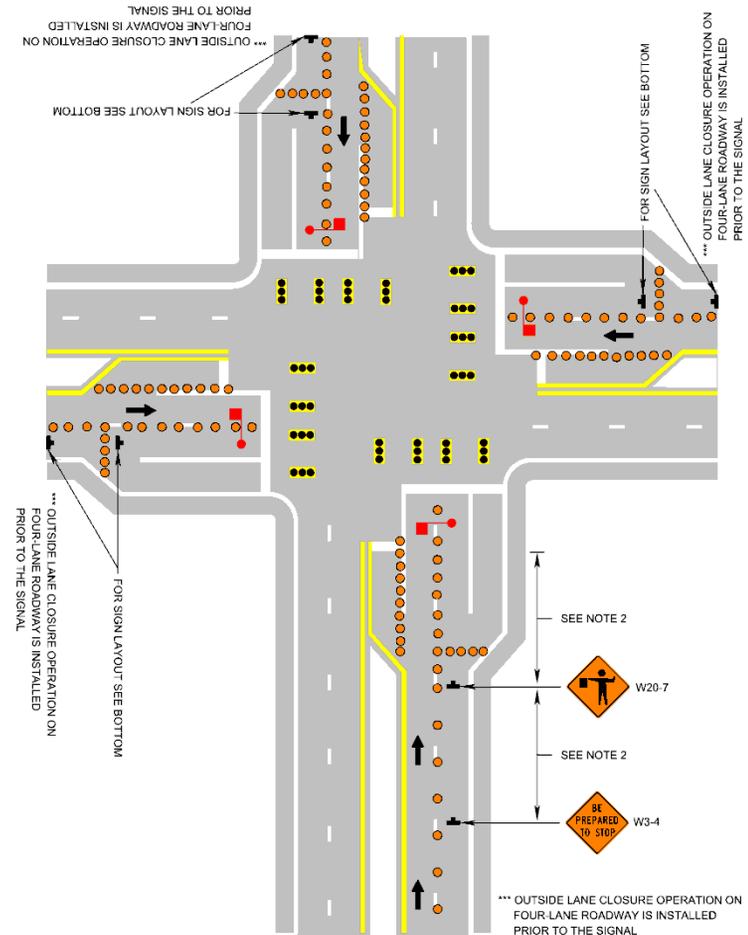
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Flagging Operation at a Signalized Intersection - TTC-30.1

**Notes 3 & 4 –
When FLAGGERS
control a signalized
intersection.**

- Turn lanes are closed.
- Lane closures are installed on a multi-lane roadways.

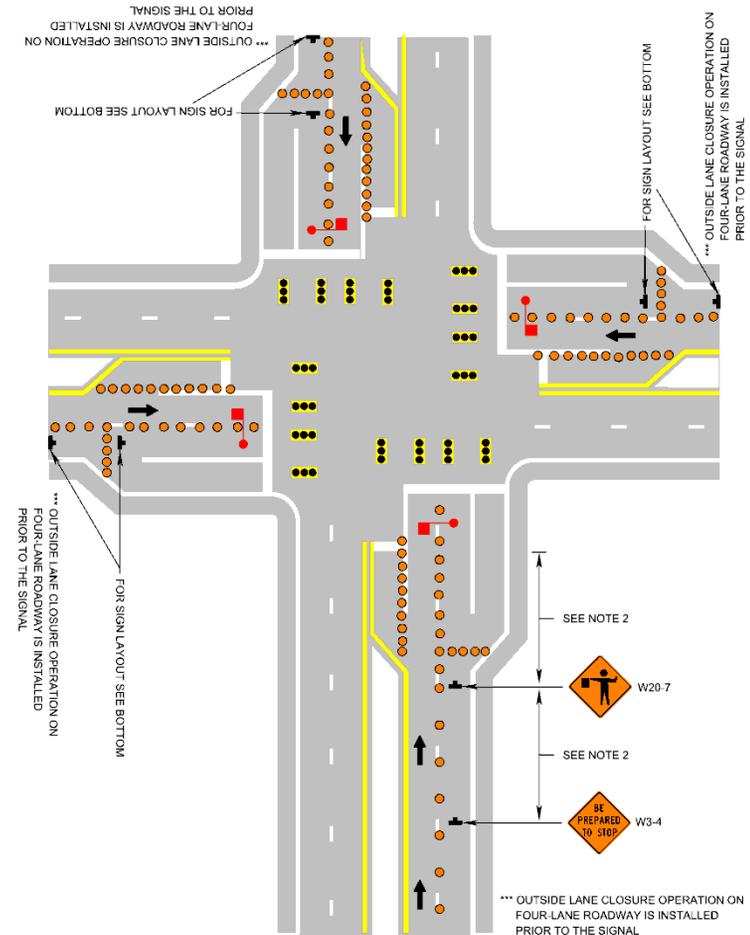


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Flagging Operation at a Signalized Intersection - TTC-30.1

- Notes 12 & 13:**
When a Law Enforcement Officer directs traffic:
- The signal may be on the flash mode
 - The travel and turn lanes may remain open at the discretion of the Law Enforcement Officer.



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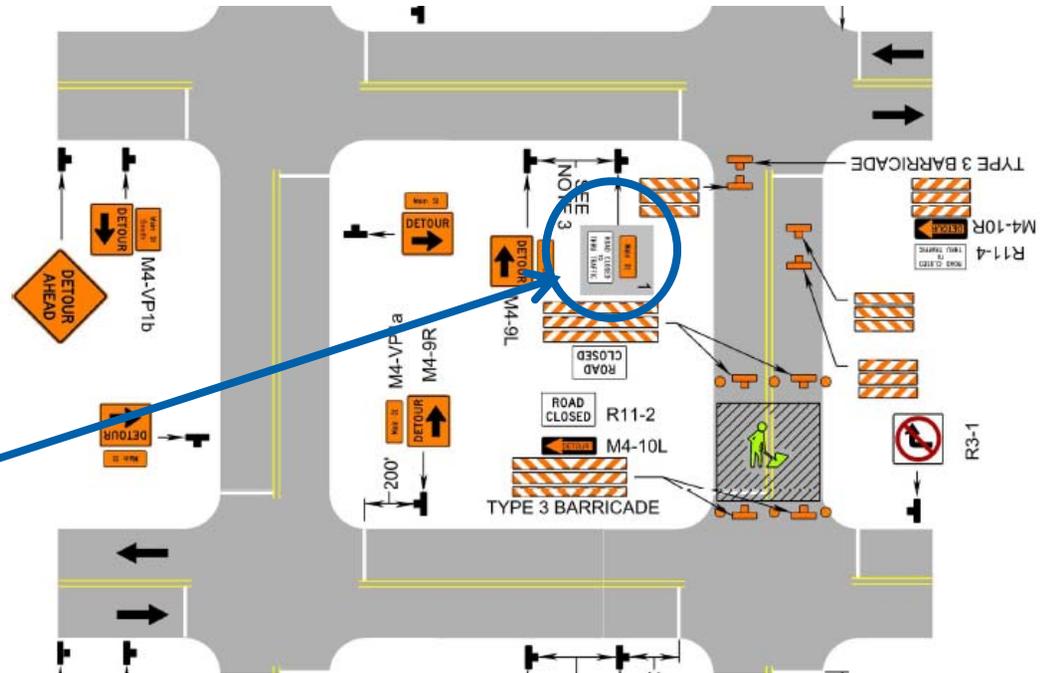
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Street Closure Operation with Detour - TTC-34.1

Changed NO
RIGHT TURN to

Main St

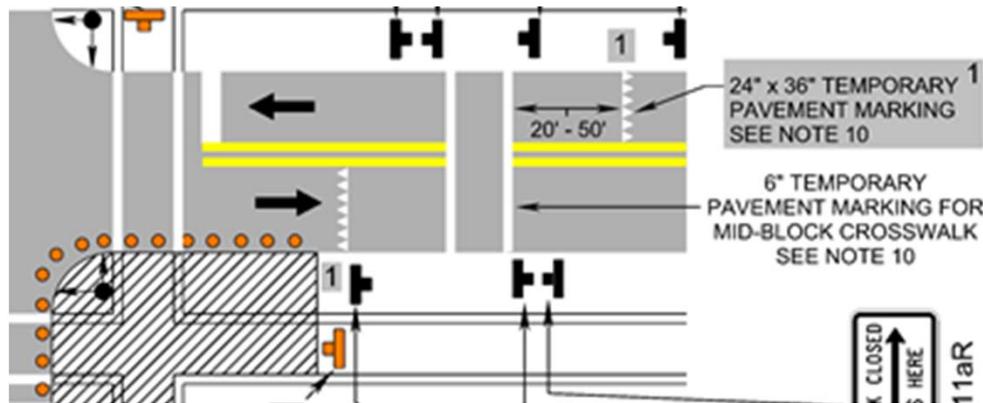
ROAD CLOSED
TO
THRU TRAFFIC



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Crosswalk Closure and Pedestrian Detour Operation - TTC-36.1



10. Motorists shall yield to pedestrians
 - 24" x 36" yield lines required

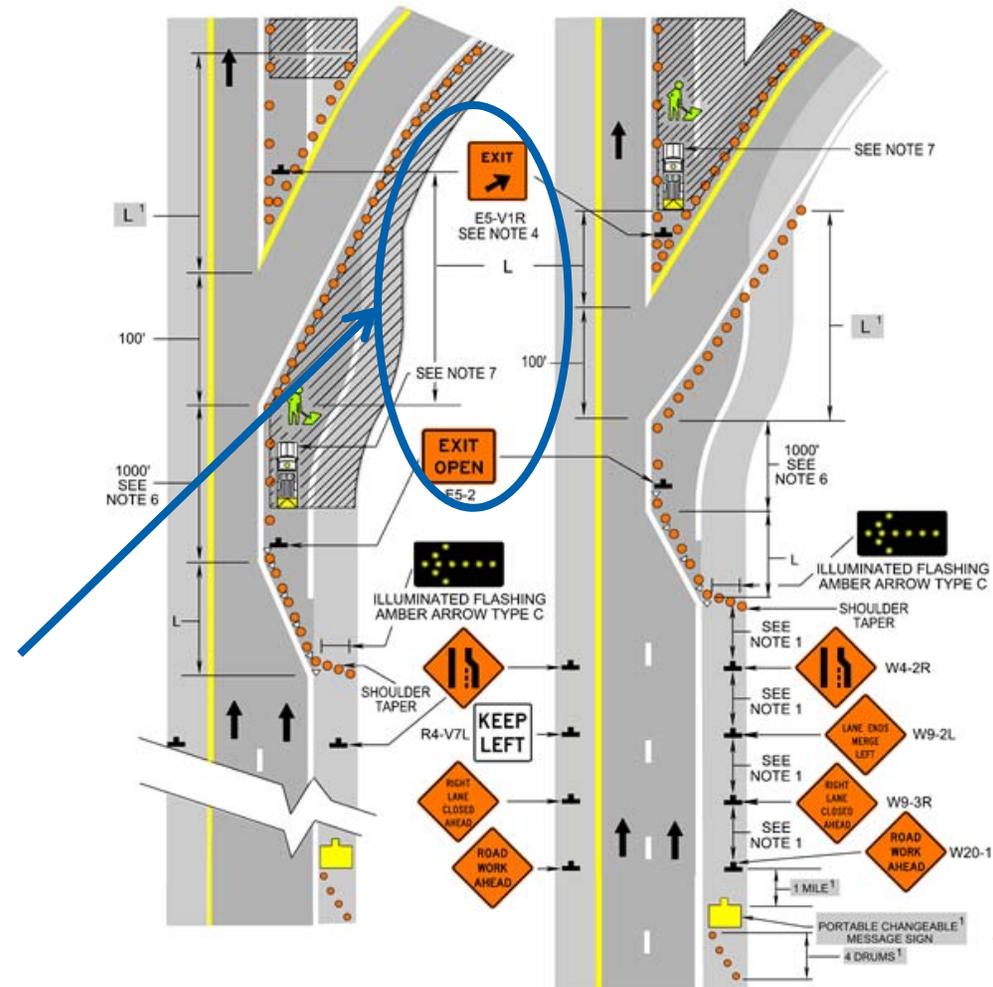
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Work Operation in the Vicinity of an Exit Ramp -TTC-37.1



4. EXIT OPEN, EXIT w/ ARROW, EXIT Closed signs shall be a min of 7' from pavement surface to bottom of the sign



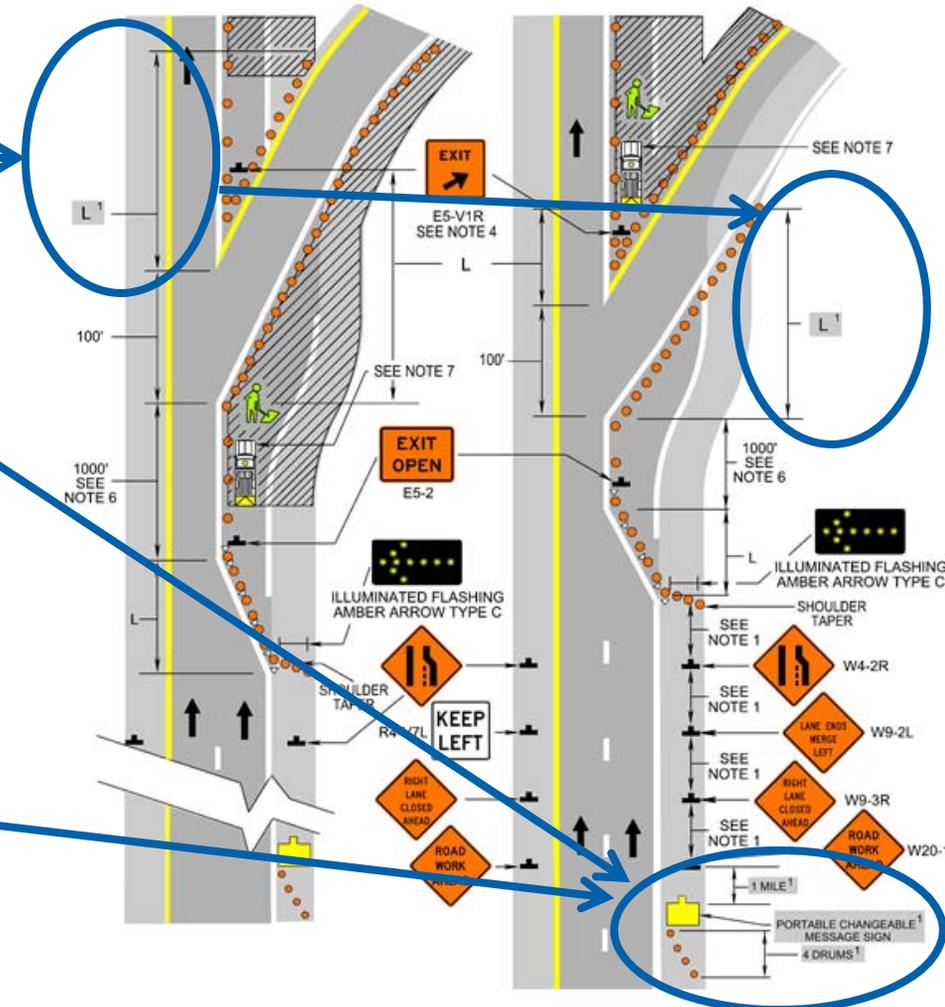
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Work Operation in the Vicinity of an Exit Ramp -TTC-37.1

Figure:

- **Adjusted “L”**
- **Added “1 MILE” distance in advance of warning signs**
- **Added PCMS & 4 drum taper**



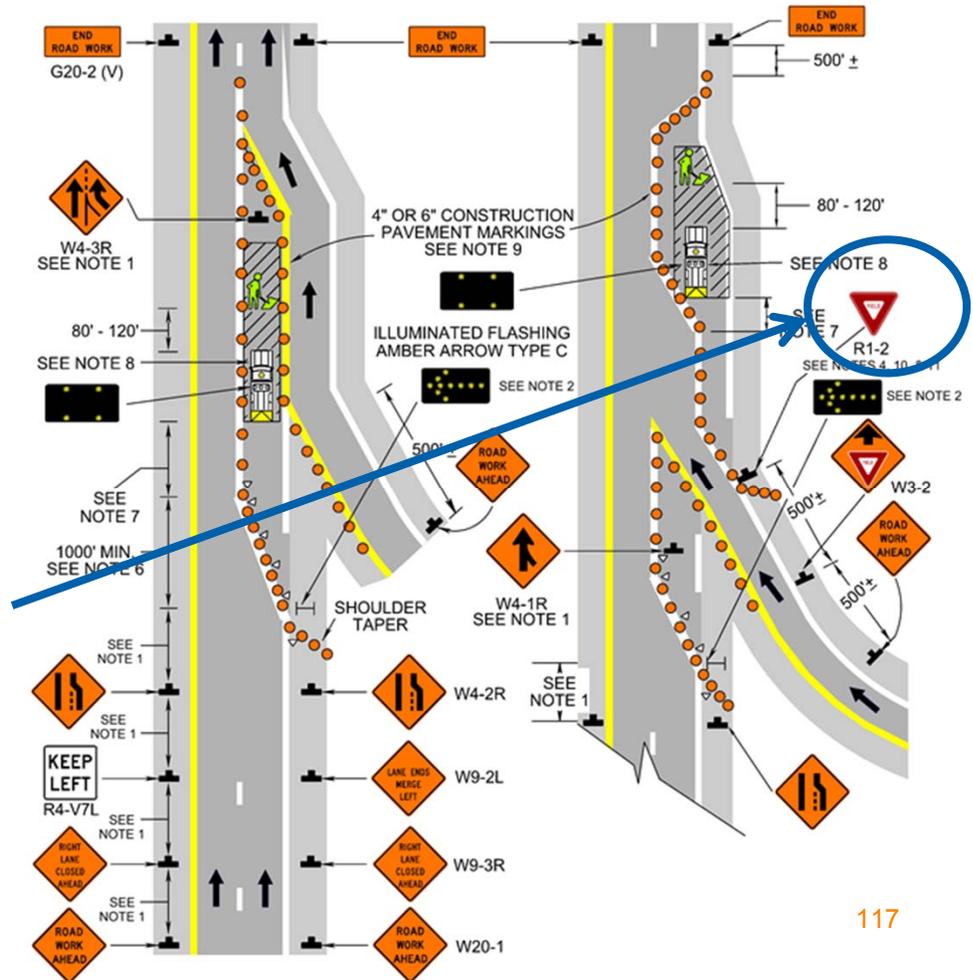
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Work Operation in the Vicinity of an Entrance Ramp - TTC-39.1



4. STOP and YIELD signs shall be mounted a minimum of 7 feet from the pavement surface to the bottom of the sign.



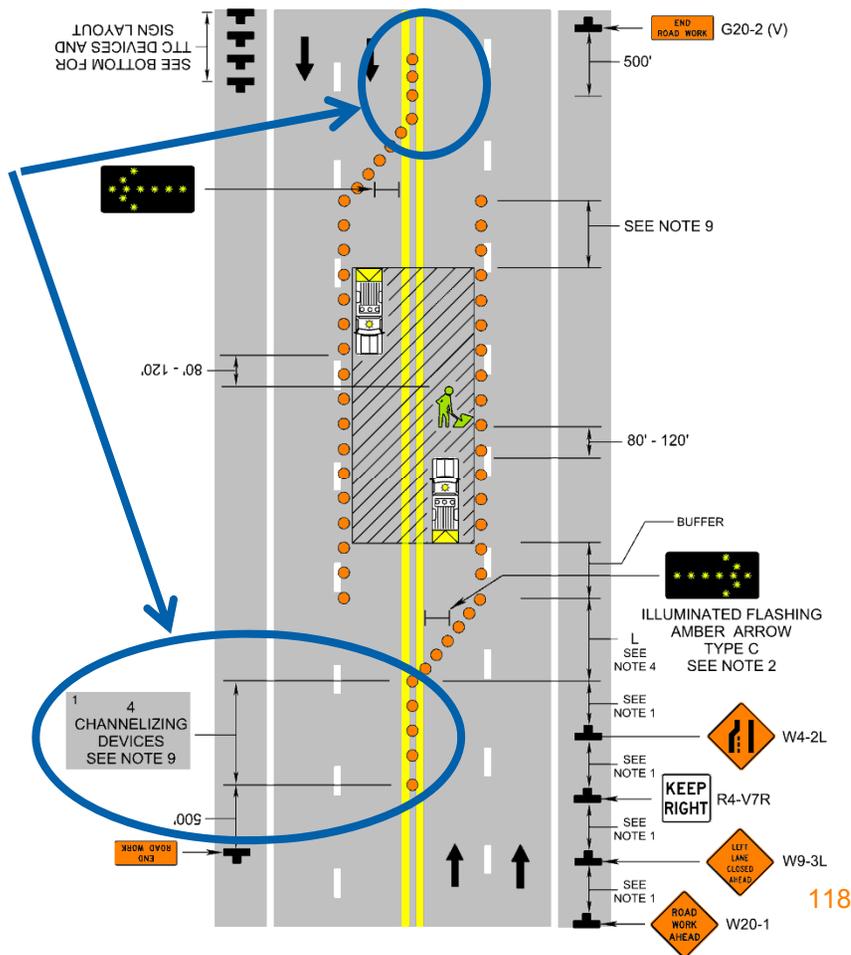
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Interior Lane Closure Operation on a Multi-Lane Roadway - TTC-42.1

9. Four channelizing devices should be used to beyond the downstream end of the transition area.

10. NO LEFT TURN should be use when high volume turning movement exists.



Revision 1

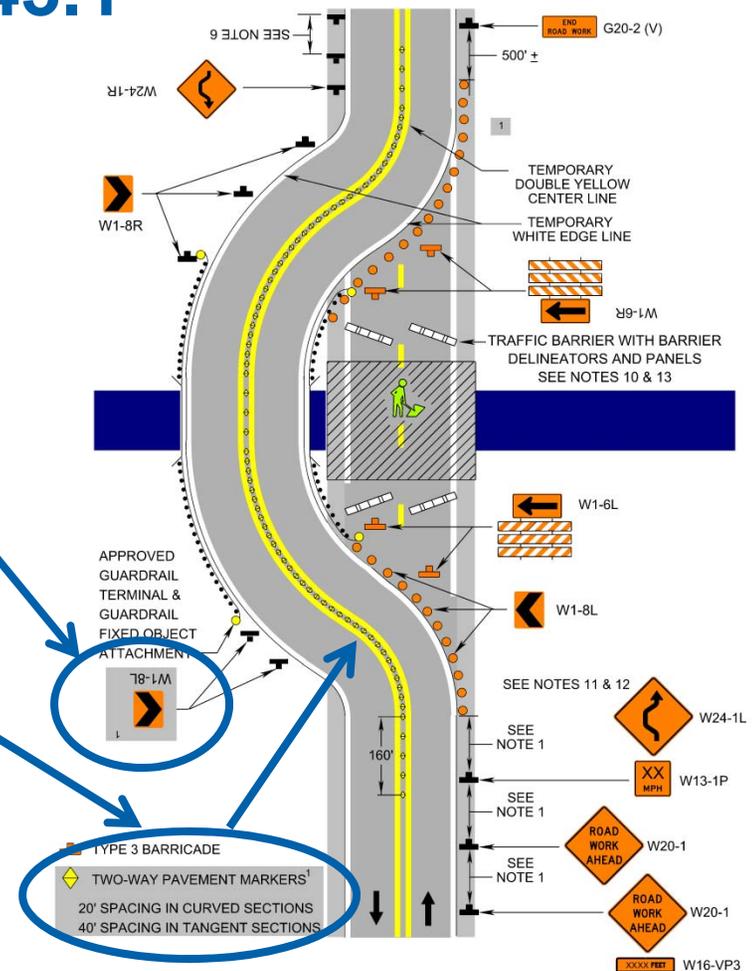
2011 Work Area Protection Manual

Road Closure Operation with a Diversion

TTC-43.1

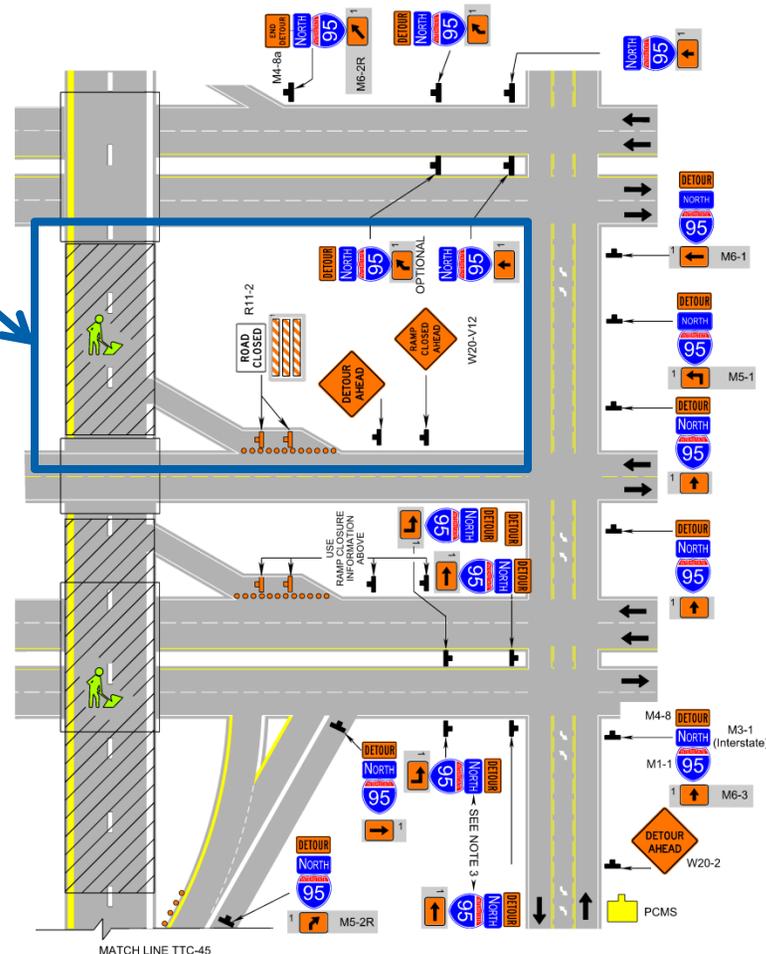
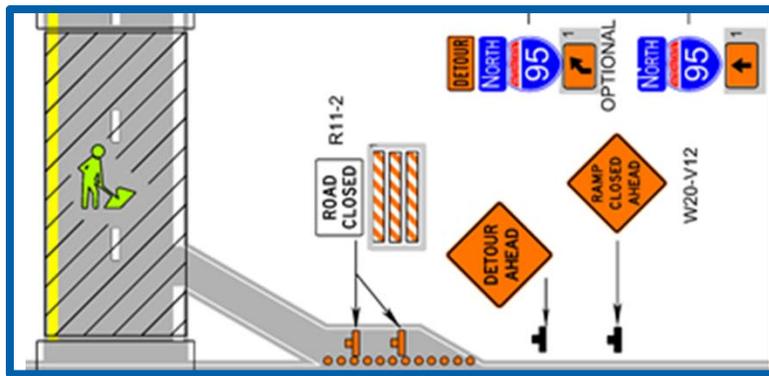
In figure:

- Added Chevrons
- Added two-way pavement markers throughout diversion



Revision 1

2011 Work Area Protection Manual *Limited Access Highway Closure Operation with a Long Term Detour - TTC-47.1*

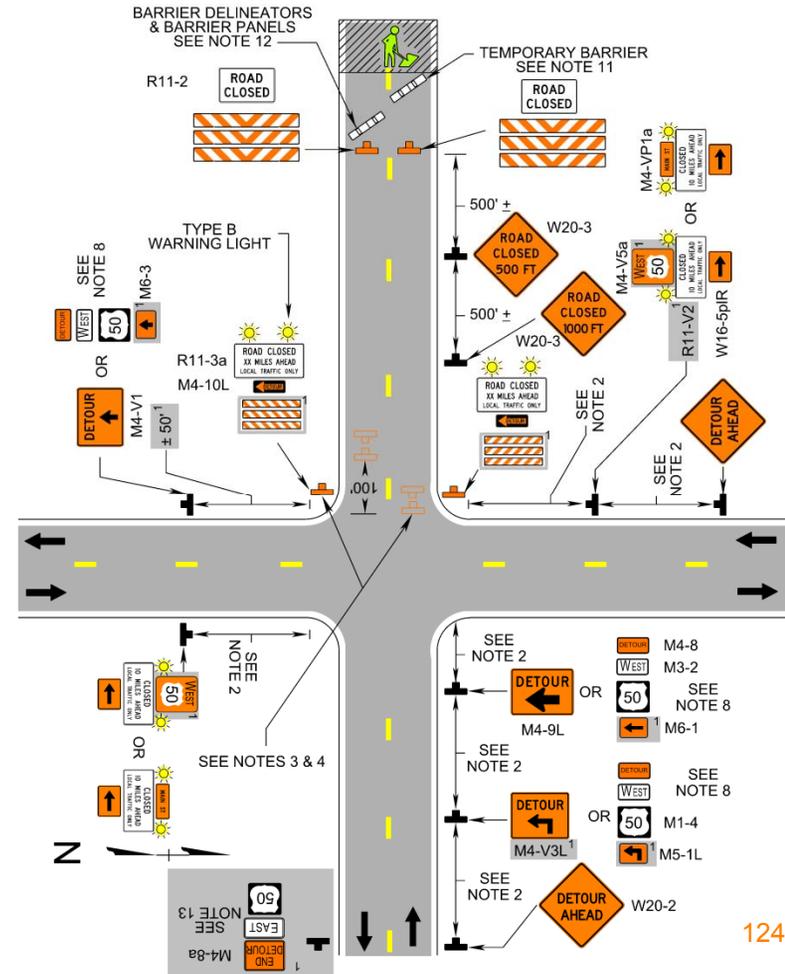


- Changed stripes of Ty. 3 Barricade
- All directional arrows shall be fluorescent orange

Revision 1

2011 Work Area Protection Manual Road Closure Operation with a Detour TTC-48.1

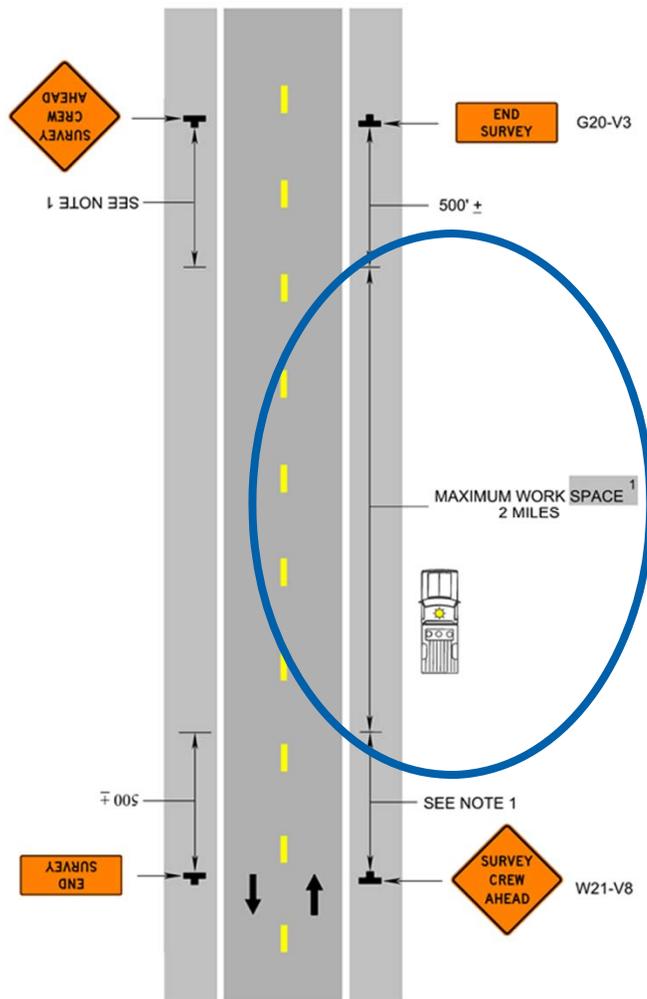
- Changed stripes of Ty. 3 Barricade
- All directional arrows shall be fluorescent orange
- Changed sign designations
- Add confirmation detour or route shield assembly and distance from intersection.



Revision 1

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Surveying Operation - TTC-49.1



- Change work area to work space
- Defines maximum work space as 2 miles

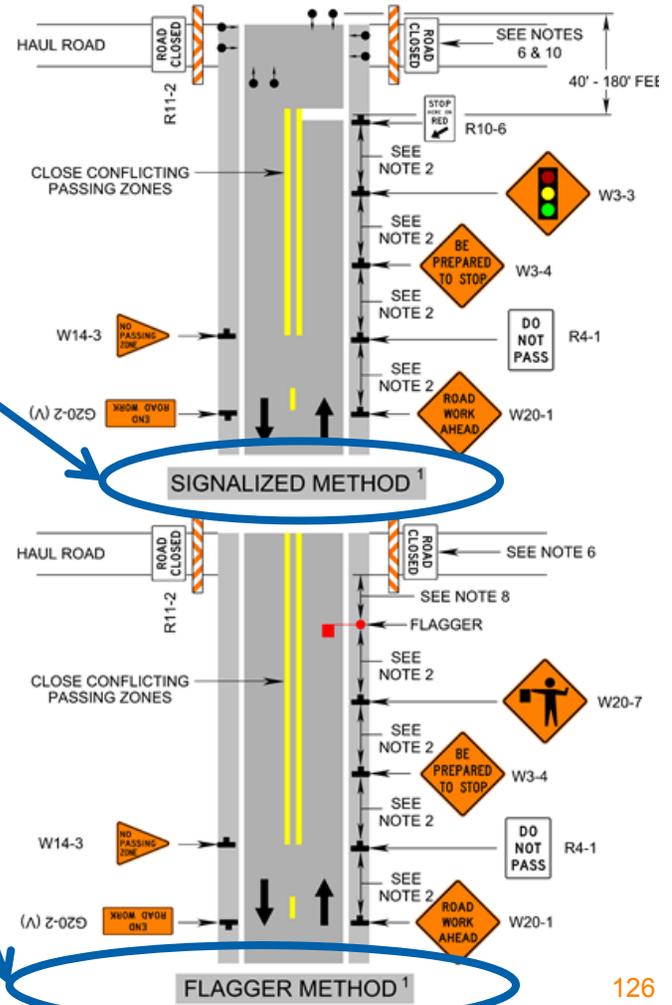
Revision 1

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Haul Road Crossing Operation - TTC-51.1

Added titles to Figure:

- **SIGNALIZED METHOD**
- **FLAGGER METHOD**



Revision 1

2011 Work Area Protection Manual *Signing for Speed Limit and Fine Signs in Work Zones - TTC-52.1*

1. A Traffic Engineering (TE) investigation shall be performed and evaluated to reduce the speed limit per TE-350 Memo.
5. When the **WORK ZONE \$500 MAX FOR EXCEEDING SPEED LIMIT WHEN FLASHING** sign is used Type B warning lights shall be installed above the sign and shall be controlled remotely and activated when workers are present in the work zone.

Revision 1

2011 Work Area Protection Manual *Signing for Speed Limit and Fine Signs in Work Zones - TTC-52.1*

5. When the **WORK ZONE \$500 MAX FOR EXCEEDING SPEED LIMIT WHEN FLASHING** is used the **WORK ZONE** *plaque shall be installed above the SPEED LIMIT sign and the FINES HIGHER plaque below.*

Revision 1

2011 Work Area Protection Manual *Signing for Speed Limit and Fine Signs in Work Zones - TTC-52.1*

10. Speed Limits may be reduced for short-term (less than 72 hours) operations
 - If the speed limit is reduced portable sign supports may be used for the Reduced Speed Limit Ahead graphic and the SPEED LIMIT signs

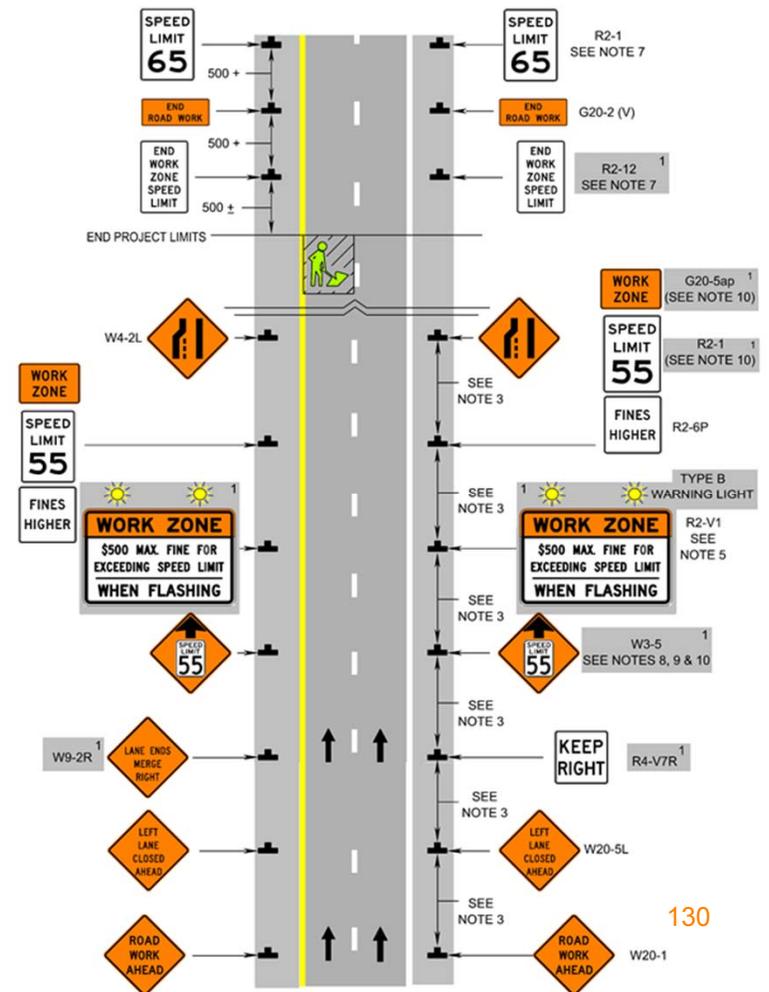
Revision 1

2011 Work Area Protection Manual *Signing for Speed Limit and Fine Signs in Work Zones - TTC-52.1*

7. END WORK ZONE SPEED LIMIT only required on road without a posted speed limit

In figure:

- Added or deleted reference notes for sign
- Change WORK ZONE MAX FINE sign and added Ty. B Warning Lights



Revision 1

2011 Work Area Protection Manual *Eradication of Pavement Markings in a Work Zone - TTC-55.1*

4. In lane shift areas pavement markings and markers shall be removed when:
 - not behind temporary traffic barrier
 - within 6' of the new edge line
8. Addition pavement markings & pavement markers should be removed based on roadway geometrics & specific site conditions so traffic is guided safely in case TTC devices become displaced.

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*End of Day Signing for Partial Paving Operations
on a Multi-Lane Roadway - TTC-57.1 &
End of Day Signing for Full Paving Operations
on a Multi-Lane Roadway - TTC-58.1*

7. Portable sign supports shall be supported by a sand bag weighing approximately 25-pounds on each leg or two (2) drum collar weights positioned on the center of the sign stand for:



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*End of Day Signing for Paving Operations
on a Two-Lane Roadway - TTC-59.1*

4. & 6.:

Portable sign supports shall be supported by a sand bag weighing approximately 25-pounds on each leg or two (2) drum collar weights positioned on the center of the sign stand for:



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End of Day Signing for Paving Operations on a Two-Lane Roadway - TTC-59.1

9. Other devices may be need to control traffic through work area.
10. **LOW SHOULDER** sign may be used where there is an elevation difference of less than 2 inches between the shoulder and travel lane.

Revision 1

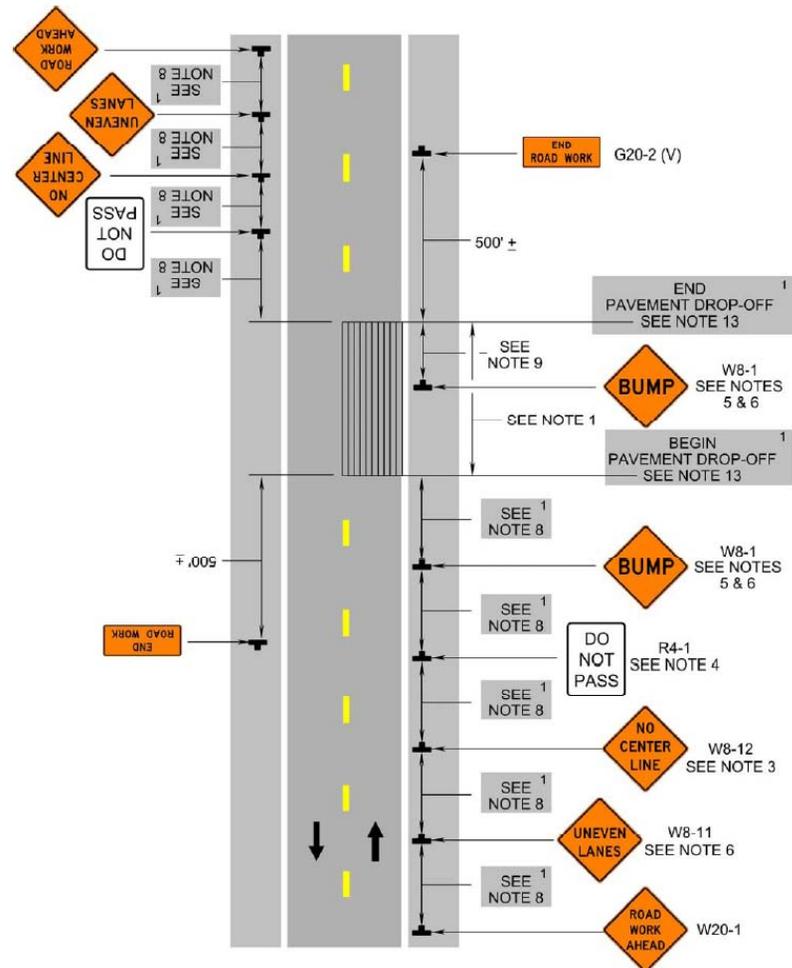
2011 Work Area Protection Manual

End of Day Signing for Paving Operations on a Two-Lane Roadway - TTC-59.1

8. Added sign spacing distances.

In Figure changed note references for:

- **Begin & end pavement drop-off**
- **Sign spacing**



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2011 Work Area Protection Manual
Logging Operations - TTC-63.1

4. **Logging operations Truck Entering Highway shall be used.**

LOG TRUCKS ENTERING HIGHWAY sign shall not be use.



Revision 1

2011 Work Area Protection Manual NEW - End of Day Signing for Surface Treatment, Slurry Seal and Latex Emulsion Treatment Operations - TTC-64.0

Standard:

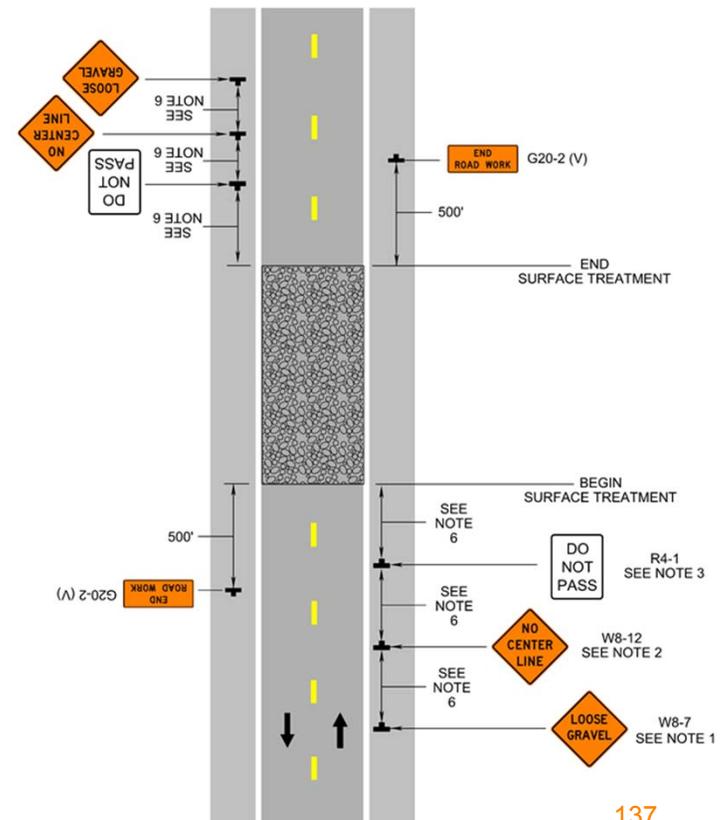
1. LOOSE GRAVEL (W8-7) signs shall be installed on surface treated roadways and shall be removed when the roadway has been swept or loose gravels have been removed from the roadway.
2. NO CENTER LINE (W8-12) signs shall be installed whenever the centerline has been obliterated or until permanent pavement markings have been installed. The sign shall be installed in both directions when the centerline is not present. In addition, NO CENTER LINE signs shall be installed every mile if the unmarked area is less than 3 miles, or every 2 miles if the unmarked area is longer than 4 miles.
3. A DO NOT PASS (R401) sign shall be used when the centerline has been obliterated or until permanent pavement markings have been installed. The DO NOT PASS sign shall be installed after the NO CENTER LINE sign and their sign stand shall be supported with a sand bag weighting approximately 25-pounds on each leg or two (2) drum collar weights positioned on the center of the sign stand. Thereafter, the DO NOT PASS sign installed every mile if the unmarked area is less than 3 miles, or every 2 miles if the unmarked area is longer than 4 miles.
4. Signs shall be post-mounted at locations after 72 consecutive hours of non-work activities.
5. If temporary construction or permanent pavement markings cannot be installed in accordance with Road and Bridge Specification 704, then yellow flexible temporary pavement markers (FTPMS) spaced at 20-foot centers for two-way traffic shall be placed along the centerline for lane division. No edge markers will be required.

Guidance:

6. Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, 500'-800' where the posted speed limit is greater than 45 mph.

Option

7. Only traffic control signing for surface treatment/slurry/latex emulsion treatment operations is shown. Other traffic control devices may be used for the control of traffic through the work area.
8. The advanced warning signs shown may also be used on multi-lane roadways, replacing the NO CENTER LINE signs with UNMARKED PAVEMENT AHEAD (W8-V4) signs and adding a ROAD WORK AHEAD (W20-1) sign as the first advanced warning sign.



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2011 Work Area Protection Manual

NEW - Short Duration Road Patching Operation on a Low Volume Two-Lane Roadway -TTC-65.0

Guidance:

1. Sign spacing distance should be 350'-500' where the posted speed limit 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.

Standard:

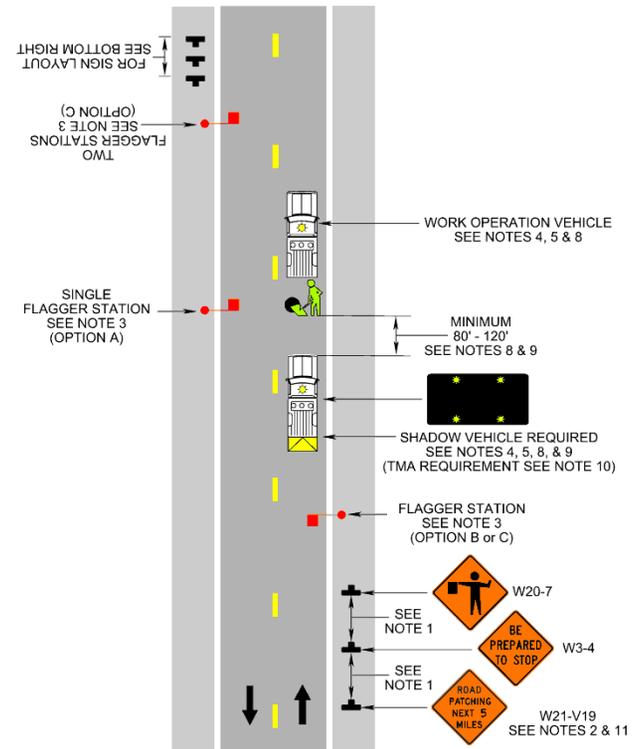
2. A ROAD PATCHING NEXT 5 MILES (W21-V19) sign, a BE PREPARED TO STOP (W3-4) sign and a Flagger (W20-7) symbol sign shall be installed at the intersection of each end of the route being patched. See Figure TTC-67 for guidance on the requirements for intersections within the limits of the operation.
3. Flagging Station Options:
 - A. A single flagger can be used when adequate sight distance is available from both travel directions;
 - B. When adequate sight distance is not available to utilize a single flagger, traffic shall be stopped in the direction of the work vehicles until work is completed.
 - C. When adequate sight distance is not available to use a single flagger to control two-way traffic, two flaggers shall be used to control the two-way traffic until the work is complete.
4. Each vehicle involved in the moving/mobile operation shall be equipped with at least one high-intensity amber rotating, oscillating, or flashing light. Vehicle hazard warning signals shall not be used instead of rotating lights or flashing lights, but as a supplement.
5. If using a Type B (60" x 30") or Type C (96" x 48") arrow board on the shadow vehicle, it shall operate in the four corner caution mode.

Guidance:

6. When using a CMS to replace the arrow board it should display the Type B caution mode.
7. Care should be exercised when establishing the flagger station to insure maximum possible sight distance based on the posted speed limit and at least equal to or greater than the values in Table 6H-3.
8. Where practical and when needed, the work and shadow vehicles should pull over periodically to allow motor vehicle traffic to pass.
9. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance from the work vehicle/operation and proceed at the same speed. The shadow vehicle should slow down or stop if necessary in advance of vertical or horizontal curves that restrict sight distance.
10. A truck-mounted attenuator should be used on the shadow vehicle.

Option:

11. A ROAD PATCHING NEXT 2 MILES (W21-V19) sign or ROAD PATCHING AHEAD (W21-V18) sign may be used to meet field condition.
12. The distance between the work and shadow vehicles may vary according to speed, terrain, curing time and other factors.
13. A PCMS may be used in advance of the work operation to supplement the static advance warning signs.
14. The vehicle mounted arrow board may be replaced with a vehicle-mounted CMS with a minimum character height of 10".



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NEW - Slow Roll Operation on a Multi-Lane Roadway - TTC-66.0

Standard:

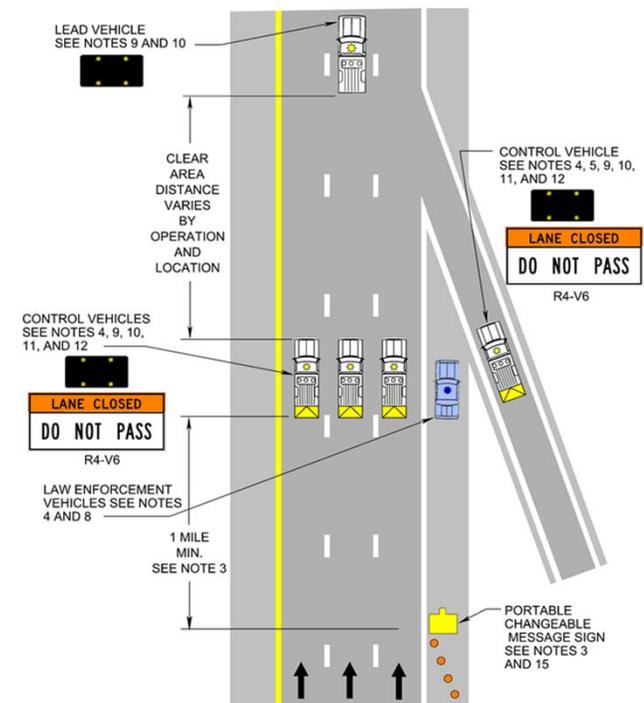
1. Slow Roll operation shall be submitted to and approved by the Regional Traffic Engineer or their designee prior to use and shall be performed according to Section 6G.24.
2. Slow Roll operation shall include the use of the Virginia State Police (VSP) or other law enforcement personnel unless an exception is granted by the Regional Traffic Engineer.
3. A portable changeable message sign (PCMS) or, if available, an overhead changeable message sign (CMS) shall be used a minimum of 1 mile in advance of the beginning of the Slow Roll operation with the following messages: **ROAD WORK AHEAD; BE PREPARED TO STOP.**
4. A control vehicle (contractor or state) shall occupy each travel lane of the route affected by the Slow Roll operation. All entrance ramps within the Slow Roll operation shall be temporarily closed. A drive through of the route shall be performed prior to beginning the Slow Roll operation to ensure there are no parked vehicles along the roadway which could enter the travel lane during the Slow Roll operation.

Option

5. Once the Slow Roll operation has passed a closed entrance ramp, the ramp may be reopened.

Standard:

6. Prior to utilizing Slow Roll operation, a coordination meeting shall be held with all entities involved in the operation to discuss each person's role.
7. The starting point for the Slow Roll operation shall be in a tangent section (both horizontal and vertical) of the approach roadway with adequate sight distance.
8. Law enforcement vehicles in the Slow Roll operation shall display full emergency lights.
9. Each slow roll control vehicle shall be equipped with at least one high-intensity amber rotating, oscillating, or flashing light. Vehicle hazard warning signals shall not be used instead of rotating lights or flashing lights, but as a supplement.
10. Each slow roll control vehicle shall be equipped with a Type C (96" x 48") arrow board on the shadow vehicle, it shall operate in the four corner caution mode.
11. Each slow roll control vehicle controlling traffic shall be equipped with a truck-mounted attenuator.
12. Upon a sufficient gap in traffic, each slow roll vehicle will pull out and occupy a travel lane with their warning lights and hazard lights operating and will travel at a minimum of 10 miles per hour. A lead vehicle shall follow the last motorist vehicle traveling in advance of the slow roll operation vehicles to notify the work crew when the roadway is closed and free of approaching motorist.
13. The lead vehicle in the Slow Roll operation shall have radio/telephone communication with the work crew. Once the need for the road closure is complete, the work crew shall notify the lead vehicle in the slow roll operation, who in turn will notify the other work vehicles. The slow roll vehicles shall gain speed and pull over to the right side of the roadway; starting from the vehicle occupying the left lanes first (the VSP should continue with the flow of traffic).
14. If the Slow Roll operation vehicles reach the work site before receiving notification that the operation has been completed, they shall slow down and/or stop until signaled that the roadway is safe to release traffic.
15. Once the Slow Roll operation is complete and free flow travel conditions have been re-established, the PCMS or overhead CMS messages shall be modified to remove the BE PREPARED TO STOP message.



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NEW - Lane Closure Operation through an Unsignalized Intersection - TTC-67.0)

Guidance:

1. Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, 500'-800' where the posted speed limit is greater than 45 mph.

Standard:

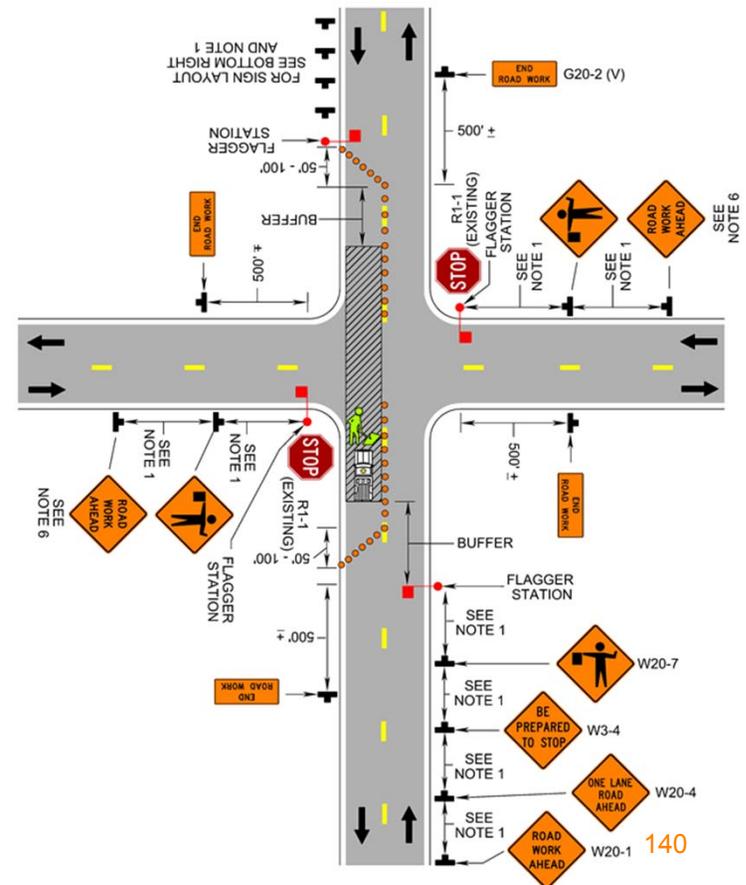
2. Channelizing device spacing shall be on 20' centers or less 100 feet in advance of the intersection.

Guidance:

3. If room permits, a shadow vehicle with at least one rotating amber light or high intensity amber strobe light should be parked 80'-120' in advance of the first work crew.
4. If the posted speed limit is 45 mph or greater, the shadow vehicle should have a truck-mounted attenuator.
5. If the work space extends across a crosswalk, the crosswalk should be closed using the information and devices shown in Figure TTC-36.

Option

6. At the stop condition intersecting roadway, additional flagger sign may be used (BE PREPARED TO STOP (W3-4)) between the ROAD WORK AHEAD and the flagger station in the proper sequence, as directed by the Regional Traffic Engineer.



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CHAPTER 6I
CONTROL OF TRAFFIC
THROUGH
TRAFFIC INCIDENT
MANAGEMENT AREAS

A number represent TTC note.

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Chapter 6I

5. Change Buffer Space Table in:

- **TIMC-1.1**
- **TIMC-2.1**
- **TIMC-3.1**
- **TIMC-4.1**

Posted Speed Limit (mph)	Distance (Feet)
≤ 20	115 - 120
25	155 - 165 ¹
30	200 - 210
35	250 - 260
40	305 - 325 ¹
45	360 - 380
50	425 - 445
55	500 - 530 ¹
60	570 - 600 ¹
65	645 - 675
70	730 - 760
Vehicles and equipment shall not park in the buffer space.	

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Incident Blocking a Lane on a Two-Lane Roadway
TIMC-7.1

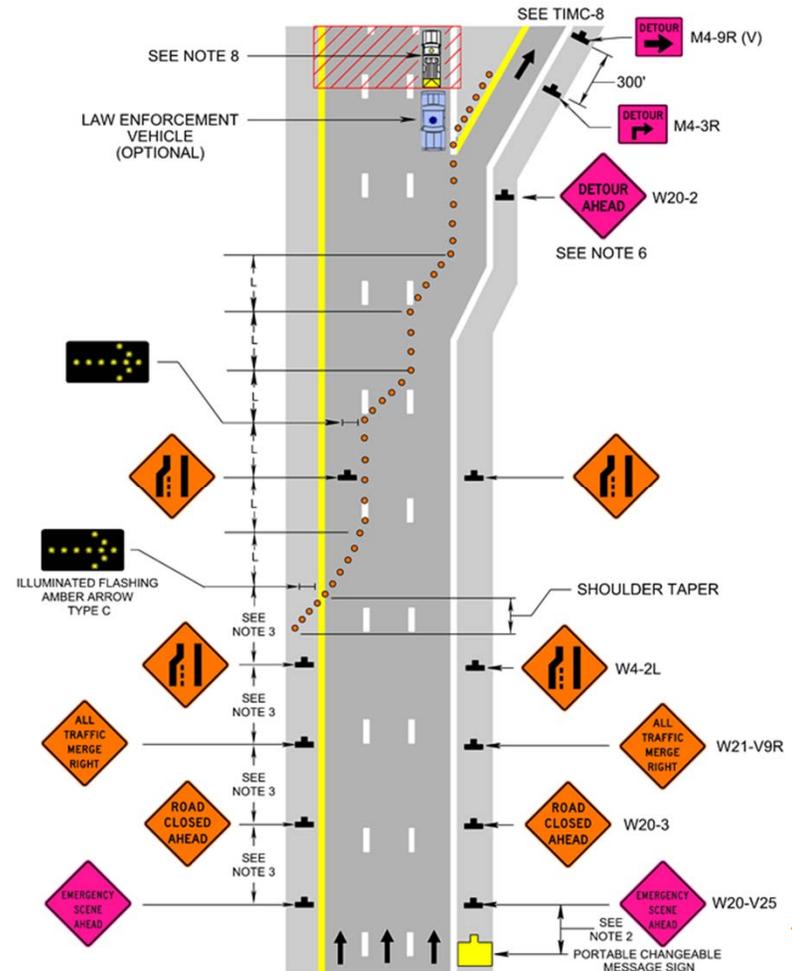
- 9. Eliminated STROBE light as a vehicle warning light**

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Incident Closing a Highway TIMC-7.1

6. Added:

- see Figures TTC-46 or TTC-47.
- Detour with a Route Assembly sign.



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APPENDIX A

**GUIDELINES FOR THE USE
OF BARRIER/CHANNELIZING
DEVICES IN WORK ZONES**

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Appendix A

1. Channelizing Device/Barrier Selection Process

Page A-5:

- 2. Change Figure 3b, ROR Frequency Factor Chart for All Other Highways to “Figure 3a, ROR Frequency Factor Chart for Limited Access Highways”**

Figure 3a added note under title:

“Data presented is for 2 way ADT. When applying this chart to divided roadways, reduce ADT by one-half before entering chart.”

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Appendix A

1. Channelizing Device/Barrier Selection Process

Page A-6:

- **Changed Figure 4 to “Table 1”**
- **Figure 3b added note under title:
“Data presented is for 2 way ADT. When applying this chart to divided roadways, reduce ADT by one-half before entering chart.”**

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Appendix A

3. BARRIER DESIGN CONSIDERATIONS

Page A-14

ADDED:

Temporary Longitudinal Steel Barriers¹

Acceptance based on the following NCHRP 350/Mash08 Test Criteria

Dynamic deflection is based on:

¾ Ton pick-up truck at 45 mph and 25° impact angle (TL-2).

¾ Ton pick-up truck at 62 mph and 25° impact angle (TL-3).

For additional information on longitudinal steel barriers, length of need and impact attenuator application, please refer to IIM-LD-93, Construction Work Zone/ Safety Guidelines and Pay Items for Construction Work Zone:

<http://www.extranet.vdot.state.va.us/locdes/electronic%20pubs/iim/IIM93.pdf>

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Appendix A

3. Barrier Design Considerations

Page A-14 - Added Table 3,

Acceptable Longitudinal Steel Barriers

FHWA Code	Manufacturer	Device Description	Test Level	Dynamic Deflection	Anchorage
B134	Energy Absorption Systems, Inc.	Vulcan Barrier	TL-3	13'- 2"	302' Lg. (a)
B134	Energy Absorption Systems, Inc.	Vulcan Barrier with Anchoring System VAS	TL-3	6'- 11"	(b)
B-131	Highway Care, Inc.	Barrier Guard 800	TL-3	4'- 11"	(c)
B-158	Highway Care, Inc.	Barrier Guard 800 MDS	TL-3	0'- 3"	(d)
B-176A	Hill & Smith, Inc.	Zone Guard Standard	TL-3	6'- 4"	(e)
B-176A	Hill & Smith, Inc.	Zone Guard Minimum Deflection	TL-3	1'- 4"	(f)

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Appendix A

3. Barrier Design Considerations

Page A-15 - Added (references to Table 3)

- a – Freestanding barrier with no anchorage and is defined as the additional length of barrier needed, upstream and downstream of the work zone, to ensure the system does not exceed the maximum dynamic deflection noted in the adjacent column.
- b – System was anchored using a QuadGuard CZ[®]. This system is acceptable for uni-directional (run-on only) conditions. Refer to FHWA acceptance letter B-131 for additional guidance for this application.
- c – System was anchored each end with four anchors. System must be terminated outside of clear zone or shielded with a crashworthy device.
- d – System was anchored each end with four anchors. Each barrier of the system was also anchored every 20 feet with either joint anchors or intermediate anchors. System must be terminated outside of clear zone or shielded with a crashworthy device.
- e – System was anchored with four anchors at each end. System must be terminated outside of clear zone or shielded with a crashworthy device.
- f – System was anchored with four anchors at each end. The system was also anchored every 33'- 4" along the barrier. System must be terminated outside of clear zone or shielded with a crashworthy device.

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Appendix A

3. Barrier Design Considerations

Page A-15 - Added Table 4,

Acceptable Longitudinal Channelizing Devices

FHWA Code	Manufacturer	Device Description	Test Level	Dynamic Deflection	Anchorage
B111	Creative Building Products	Water Filled Plastic Barrier.	TL-2	10'- 4"	16' - 6" Lg. Segments (96')
B101	Rhino Safety Barrier LLC	Water-Filled Plastic Barrier.	TL-2	13'- 2"	59'
B-97	Yodock Wall Company, Inc.	Yodock Model 2001M/2001 Plastic Barriers w/ steel tubes.	TL-2 TL-3	12' 14'	46'
B-48	Energy Absorption Systems, Inc.	Triton water-filled temporary barrier.	TL-3	19'- 0" 22'- 8"	97' - 6" 65'
B-34 B-30	Armorcast Products Co.	Guardian Safety Barrier System	TL-3 TL-2	11'- 2" 6'- 6"	(a)

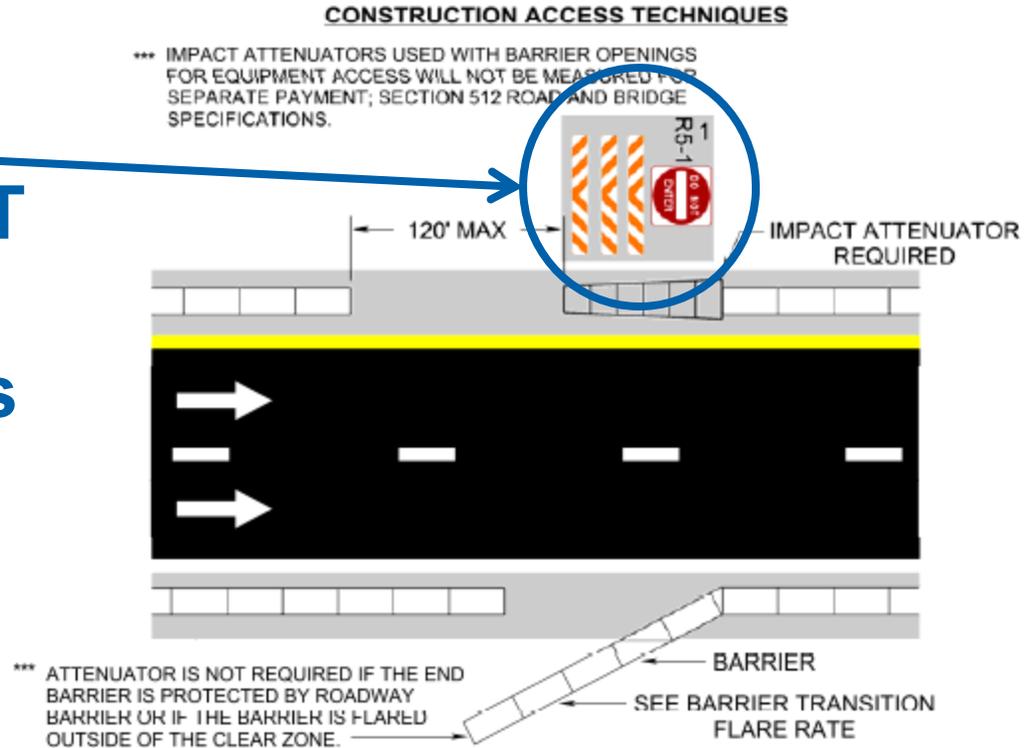
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Appendix A

Figure 5, Construction Access Technique and Introduced Barrier

Added Ty. 3 Barricade & DO NOT ENTER sign at construction access & work entrances



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2011 Work Area Protection Manual

APPENDIX D
PORTABLE CHANGEABLE
MESSAGE SIGN (PCMS)
DISPLAYS

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2011 Work Area Protection Manual

Appendix D

Page D-1

- **The revision to Appendix D provides uniformity across the Commonwealth by standardizing PCMS messages for temporary traffic control applications as shown in Chapter 6H.**
- **Three phase may be displayed on a PCMS but the use of 2 PCMSs is preferred. The Engineer will provide guidance.**

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Appendix D

Page D-1

- **The revision to Appendix D provides uniformity across the Commonwealth by standardizing PCMS messages for temporary traffic control applications as shown in Chapter 6H.**
- **Three phase may be displayed on a PCMS but the use of 2 PCMSs is preferred. The Engineer will provide guidance.**

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Appendix D

Page D-1

PCMS use on long-term projects:

- should be used to advise motorists of the initial change in traffic pattern.
- should only display the initial message should for 2 weeks to retain its effectiveness.
- may display daily standardized messages based on the TTC application that affect the mainline traffic.
- non-standardized messages should be approved by the Regional Traffic Operations Manager, authority of a public agency or official having jurisdiction.

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Appendix D

Page D-2, Alternate Route Messages

PCMS should only be used:

- where the CMS operator has current and continuously updated knowledge of the traffic conditions on the alternative route.
- where the alternate route will result in a significant savings in time for the detoured motorists.

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Appendix D

Page D-2, Traffic Detour Messages

- PCMS messages should be used when a complete road closure is required.
- A detour is warranted when positive guidance is provide to motorist by:
 - a properly marked detour or guide signs to the major destination, or
 - law enforcement or traffic control personnel control and guide traffic at critical locations.

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Appendix D

Pages D-3 to D-6

Table D-1, PCMS Message for TTC Applications

TTC Number	PHASE 1	PHASE 2	PHASE 3 or Additional PCMS may be used
Example	Line 1 / Line 2 / Line 3	Line 1 / Line 2 / Line 3	Line 1 / Line 2 / Line 3
TTC-1	RIGHT / SHOULDER / WORK		
TTC-2	FLAGGER / AHEAD	PREPARE / TO / STOP	
TTC-3	SLOW / MOVING / WORK	RIGHT / SHOULDER / CLOSED	
TTC-4	RIGHT / SHOULDER / CLOSED		
TTC-5	RIGHT / SHOULDER / CLOSED	RIGHT / LANE / NARROWS	
TTC-6	RIGHT / SHOULDER / CLOSED		
	*RIGHT / SHOULDER / CLOSED	TRUCKS / USE / RT LANE	
TTC-7	LANE(S) / SHIFT / RIGHT	RIGHT / SHOULDER / CLOSED	
	*LANE(S) / SHIFT / RIGHT	TRUCKS / USE / RT LANE	

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Appendix D

Page D-6

Display of Future Roadwork:

- may be displayed
- shall be replaced by current information
- should not be given more than six (6) days prior to roadwork
- should display the days of the week
- may display be a that requires calendar dates under special situation

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Appendix D

Page D-7

Table D-2, Portable Changeable Messages for Advance Closures or Road Work

?? ST / CLOSED / 7/1-8/31
RT 50 / CLOSED / MON-FRI
EXIT 123 / CLOSED / JUL14-18
RD WORK / CLOSED / MON-FRI

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Appendix D

Page D-7

Table D-3, Unacceptable Portable Changeable Messages

BEAWARE, BEWARE
BE ALERT (any form or combination of BE ALERT messages)
CARE (any form or combination of CARE messages)
USE CARE
CAUTION (any form or combination of CAUTION messages)
USE CAUTION
NOTICE (messages)
WARNING, WARN (any form or combination of WARN messages)

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Appendix D

Pages D-8 to D-9,

**Table D-4, Abbreviations That Shall be
Used Only on PCMS Signs**

Work Message	Standard Abbreviation	Prompt Word That Should Precede the Abbreviation	Prompt Word That Should Follow the Abbreviation
Access	ACCS	—	Road
Ahead	AHD	Fog	—
Blocked	BLKD	Lane	—
Bridge	BR*	(Name)	—
Cannot	CANT	—	—
Center	CNTR	—	LANE
Chemical	CHEM	—	SPILL
Condition	COND	Traffic	—
Congestion	CONG	Traffic	—

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Appendix D

Page D-10

Table D-5, Acceptable Abbreviations

- **Word abbreviations shown shall be used when necessary.**
- **Abbreviations should either precedes or follow prompt word shown.**

Word Message	Standard Abbreviation		Word Message	Standard Abbreviation
Afternoon / Evening	PM		Maximum	MAX
Alternate	ALT		Mile(s)	MI
AM Radio	AM		Miles Per Hour	MPH
Avenue	AVE, AV		Minimum	MIN
Bicycle	BIKE		Minute(s)	MIN
Boulevard	BLVD		Monday	MON
Bridge	BR*		Morning / Late Night	AM

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Appendix D

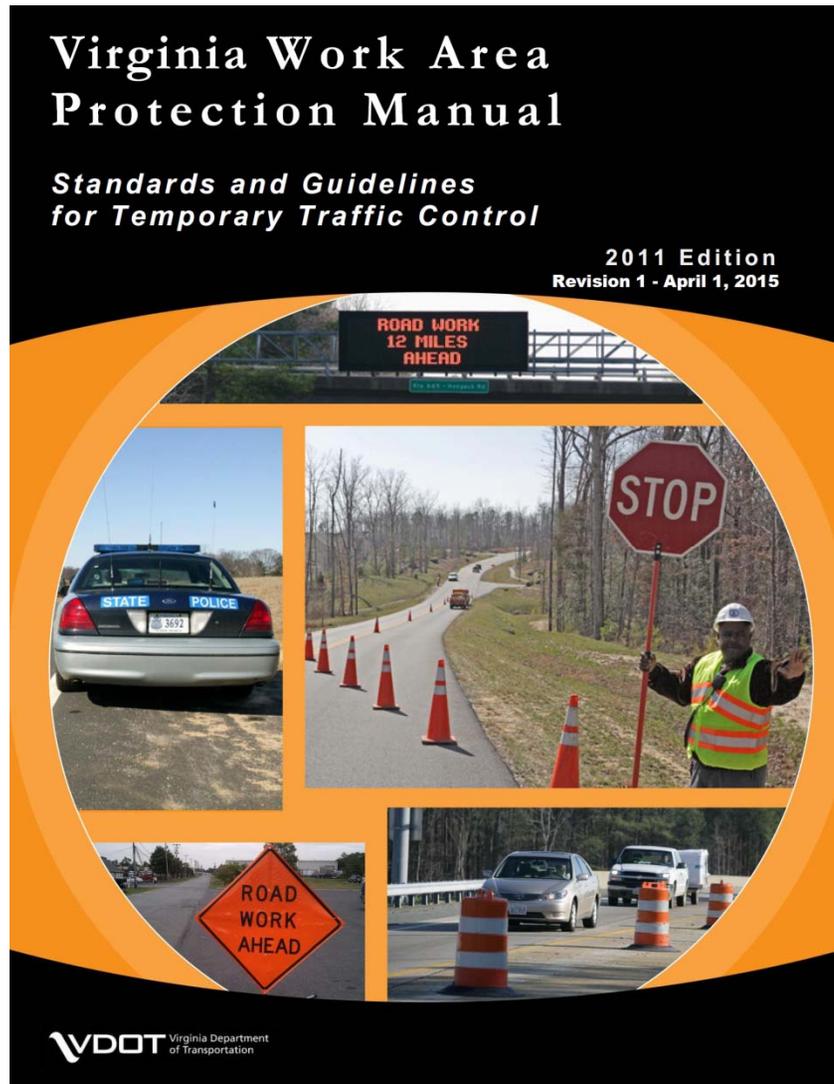
Page D-11

Table D-6, Unacceptable Abbreviations

Abbreviations that shall not be used because of their potential to be misinterpreted by road users.

Abbreviation	Intended Work	Common Misinterpretation
ACC	Accident	Access (Road)
CLRS	Clears	Colors
DLY	Delay	Daily
FDR	Feeder	Federal
L	Left	Lane (Merge)
LT	Light (Traffic)	Left
PARK	Parking	Park
POLL	Pollution (Index)	Poll
RED	Reduce	Red
STAD	Stadium	Standard
WRNG	Warning	Wrong

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- Effective April 1, 2015 for State Forces
- Effective starting on the July 2015 Advertisement