CHAPTER 6H. TYPICAL APPLICATIONS

Section 6H.01 Typical Applications

Support:

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

Standard:

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

Support:

03 Chapter 6G contains discussions of typical TTC activities. Chapter 6H presents typical applications for a variety of situations commonly encountered. While not every situation is addressed, the information illustrated can generally be adapted to a broad range of conditions. In many instances, an appropriate TTC plan is achieved by combining features from various typical applications. For example, work at an intersection might present a near-side work zone for one street and a far-side work zone for the other street. These treatments are found in two different typical applications, while a third typical application shows how to handle pedestrian crosswalk closures. For convenience in using the typical application diagrams, Tables 6C-4, 6C-2, 6F-2, and 6C-1 are reproduced in this Chapter as Tables 6H-2, 6H-3, 6H-4, and 6H-5, respectively.

04 Procedures for establishing TTC zones vary with such conditions as road configuration, location of the work, work activity, duration of work, road user volumes, road vehicle mix (buses, trucks, cars, motorcycles, and bicycles), and road user speeds. Examples are presented in this Chapter showing how to apply principles and standards. Applying these guidelines to actual situations and adjusting to field conditions requires judgment. In general, the procedures illustrated represent minimum solutions for the situations depicted.

Option:

05 Other devices may be added to supplement the devices and device spacing may be adjusted to provide additional reaction time or delineation. Fewer devices may be used based on field conditions.

Support:

06 Figures and tables found throughout this Manual and Part 6 of the 2009 MUTCD provide information for the development of TTC plans. Table 6H-2 is used for the determination of taper lengths, Table 6H-3 for buffer lengths and flagger placement.

07 Table 6H-1 is an index of the 63 Typical Traffic Control (TTC) figures. Typical traffic control figures are shown on the right page with notes on the facing page to the left. The legend for the symbols used in the TTC figures is provided in Figure 6H-1. In many of the typical applications, sign spacing and other dimensions are indicated in the notes to the left of the figure.

08 Most of the typical applications show TTC devices for only one direction.

09 The following TTC applications illustrate mobile, short duration, short-term and intermediate-term stationary work activities utilizing portable (self-erecting) sign stands placed on the shoulder.

Standard:

10 **For long-term stationary work activities or as directed by the engineer, post-mounted signs placed outside of the shoulder per Figure 6F-1 shall be used[1].**

11 **Prior to the installation of an approved lane closure on all Limited Access Highways or Primary routes, notification as defined in the contract/permit, shall be made to the Regional Transportation Operations Center (TOC) 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.[1]**

1: Revision 1 – 4/1/2015

Table 6H-1, Index to Typical Temporary Traffic Control Figures and Notes

Type of Operation	Figure Number	Page Numbers
Work Outside the Shoulder		
Work Beyond the Shoulder Operation	TTC-1.1	6H-8, 6H-9
Blasting Zone Operation	TTC-2.0	6H-10, 6H-11
Work On the Shoulder		
Mobile or Short Duration Shoulder Operation	TTC-3.1	6H-12, 6H-13
Stationary Operation on a Shoulder	TTC-4.1	6H-14, 6H-15
Shoulder Operation with Minor Encroachment	TTC-5.1	6H-16, 6H-17
Shoulder Closure with Barrier Operation	TTC-6.1	6H-18, 6H-19
Shoulder Closure with Barrier and Lane Shift Operation	TTC-7.0	6H-20, 6H-21
Pull-Off Areas on Limited Access Highways	TTC-8.0	6H-22, 6H-23
Mowing Operation with Encroachment on Non-Limited Access Roadways	TTC-9.1	6H-24, 6H-25
Non-Licensed Vehicle Operation with Encroachment on Limited Access Highways	TTC-10.1	6H-26, 6H-27
Work Within the Travelway		
Moving/Mobile Operations on Limited Access Highways (Single Lane Closure)	TTC-11.1	6H-28, 6H-29
Moving/Mobile Operations on Limited Access Highways (Multiple Lane Closure)	TTC-12.1	6H-30, 6H-31
Moving/Mobile Operations on a Multi-Lane Roadway	TTC-13.1	6H-32, 6H-33
Moving/Mobile Operations on a Two-Lane Roadway	TTC-14.1	6H-34, 6H-35
Short Duration Operation on a Multi-Lane Roadway	TTC-15.1	6H-36, 6H-37
Outside Lane Closure Operation on a Four-Lane Roadway	TTC-16.1	6H-38, 6H-39
Inside Lane Closure Operation on a Four-Lane Roadway	TTC-17.1	6H-40, 6H-41
Multi-Lane Closure Operation	TTC-18.1	6H-42, 6H-43
Lane Closure Operation with Lane Weave	TTC-19.1	6H-44, 6H-45
Lane Closure Operation with Tenporary Traffic Barrier	TTC-20.1	6H-46, 6H-47
Center Turn Lane Closure Operation	TTC-21.1	6H-48, 6H-49
Right Lane Closure Operation on a Three-Lane Roadway	TTC-22.1	6H-50, 6H-51

Table 6H-1, Index to Typical Temporary Traffic Control Figures and Notes

Type of Operation	Figure Number	Page Numbers
Lane Closure on a Two-Lane Roadway Using Flaggers	TTC-23.1	6H-52, 6H-53
Non-Stationary Operation on a Two-Lane Roadway Using Flaggers	TTC-24.1	6H-54, 6H-55
Lane Closure Operation on a Two-Lane Roadway Using Traffic Control Signals	TTC-25.1	6H-56, 6H-57
Work Within the Travelway at an Intersection and Sidewalks		
Lane Closure Operation – Near Side of an Intersection	TTC-26.1	6H-58, 6H-59
Lane Closure Operation – Far Side of an Intersection	TTC-27.1	6H-60, 6H-61
Lane Closure Operation in an Intersection	TTC-28.1	6H-62, 6H-63
Turn Lane Closure Operation	TTC-29.1	6H-64, 6H-65
Flagging Operation at a Signalized Intersection	TTC-30.1	6H-66, 6H-67
Flagging Operation on a Single Lane Roundabout	TTC-31.1	6H-68, 6H-69
Inside Lane Closure Operation on a Multi-Lane Roundabout	TTC-32.1	6H-70, 6H-71
Outside Lane Closure Operation on a Multi-Lane Roundabout	TTC-33.1	6H-72, 6H-73
Street Closure Operation with Detour	TTC-34.1	6H-74, 6H-75
Sidewalk Closure and Bypass Sidewalk Operation	TTC-35.0	6H-76, 6H-77
Crosswalk Closure and Pedestrian Detour Operation	TTC-36.1	6H-78, 6H-79
Work Within the Travelway of Multi-Lane Highways		
Work Operation in the Vicinity of an Exit Ramp	TTC-37.1	6H-80, 6H-81
Partial Exit Ramp Closure Operation	TTC-38.1	6H-82, 5H-83
Work Operation in the Vicinity of an Entrance Ramp	TTC-39.1	6H-84, 6H-85
Multi-Lane Shift Operation	TTC-40.1	6H-86, 6H-87
Half Road Closure Operation on a Multi-Lane Roadway	TTC-41.1	6H-88, 6H-89
Interior Lane Closure Operation on a Multi-Lane Roadway	TTC-42.1	6H-90, 6H-91
Road Closure Operation with a Diversion	TTC-43.1	6H-92, 6H-93
Median Cross-Over Operation on a Multi-Lane Roadway	TTC-44.1	6H-94, 6H-95
Total Limited Access Highway Closure Operation	TTC-45.1	6H-96, 6H-97

Table 6H-1, Index to Typical Temporary Traffic Control Figures and Notes

Type of Operation	Figure Number	Page Numbers
Limited Access Highway Closure Operation with a Short Term Detour	TTC-46.1	6H-98, 6H-99
Limited Access Highway Closure Operation with a Long Term Detour	TTC-47.1	6H-100, 6H-101
Road Closure Operation with a Detour	TTC-48.1	6H-102, 6H-103
Specialty Operations Within or Near the Travelway		
Surveying Operation	TTC-49.1	6H-104, 6H-105
Disruption Operation on a Multi-Lane Roadway	TTC-50.0	6H-106, 6H-107
Haul Road Crossing Operation	TTC-51.1	6H-108, 6H-109
Signing for Speed Limit and Fine Signs in Work Zones	TTC-52.1	6H-110, 6H-111
Signing for Project Limits	TTC-53.0	6H-112, 6H113
Motorist Survey Operation on a Two-Lane Roadway	TTC-54.0	6H-114, 6H-115
Eradication of Pavement Markings in a Work Zone	TTC-55.1	6H-116, 6H-117
Work in the Vicinity of a Highway-Rail Crossing	TTC-56.1	6H-118, 6H-119
End of Day Signing for Partial Paving Operations on a Multi-Lane Roadway	TTC-57.0	6H-120, 6H-121
End of Day Signing for Full Paving Operations on a Multi-Lane Roadway	TTC-58.0	6H-122, 6H-123
End of Day Signing for Paving Operations on a Two-Lane Roadway	TTC-59.1	6H-124, 6H-125
Temporary Pavement Marking and Marker Guidelines	TTC-60.0	6H-126, 6H-127
Pre-Storm Treatment Operation	TTC-61.1	6H-128, 6H-129
Litter Pick-Up on Limited Access Highways	TTC-62.1	6H-130, 6H-131
Logging Operations	TTC-63.1	6H-132, 6H-133
End of Day Signing for Surface Treatment, Slurry Seal and Latex Emulsion Treatment Operations[1]	TTC-64.0[1]	6H-134, 6H-135[1]
Short Duration Patching Operation on a Low Volume Two-Lane Roadway[1]	TTC-65.0[1]	6H-136, 6H-137[1]
Slow Roll Operation on a Multi-Lane Roadway[1]	TTC-66.0[1]	6H-138, 6H-139[1]
Lane Closure Operation Through an Unsignalized Intersection[1]	TTC-67.0[1]	6H-140, 6H-141[1]

1: Revision 1 – 4/1/2015

Table 6H-2, Taper Length (L)

Posted Speed Limit (mph)	Width of Offset (Feet)				Remarks
	9	10	11	12	
≤ 25	95	105	115	125	$L= S^2W/60$
30	135	150	165	180	"
35	185	205	225	245	"
40	240	270	295	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. SW=L is desired for the shifting taper length with ½L being the minimum.					

Table 6H-3, Length of the Longitudinal Buffer Space[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

1: Revision 1 – 4/1/2015

Table 6H-4, Channelizing Device Spacing

Location	Posted Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Spot Construction Access *	80'	120'

* For easier access by construction vehicles into the work area, spacing of devices may be increased to this distance, but shall not exceed one access per 0.25 mile unless approved by the engineer and documented.

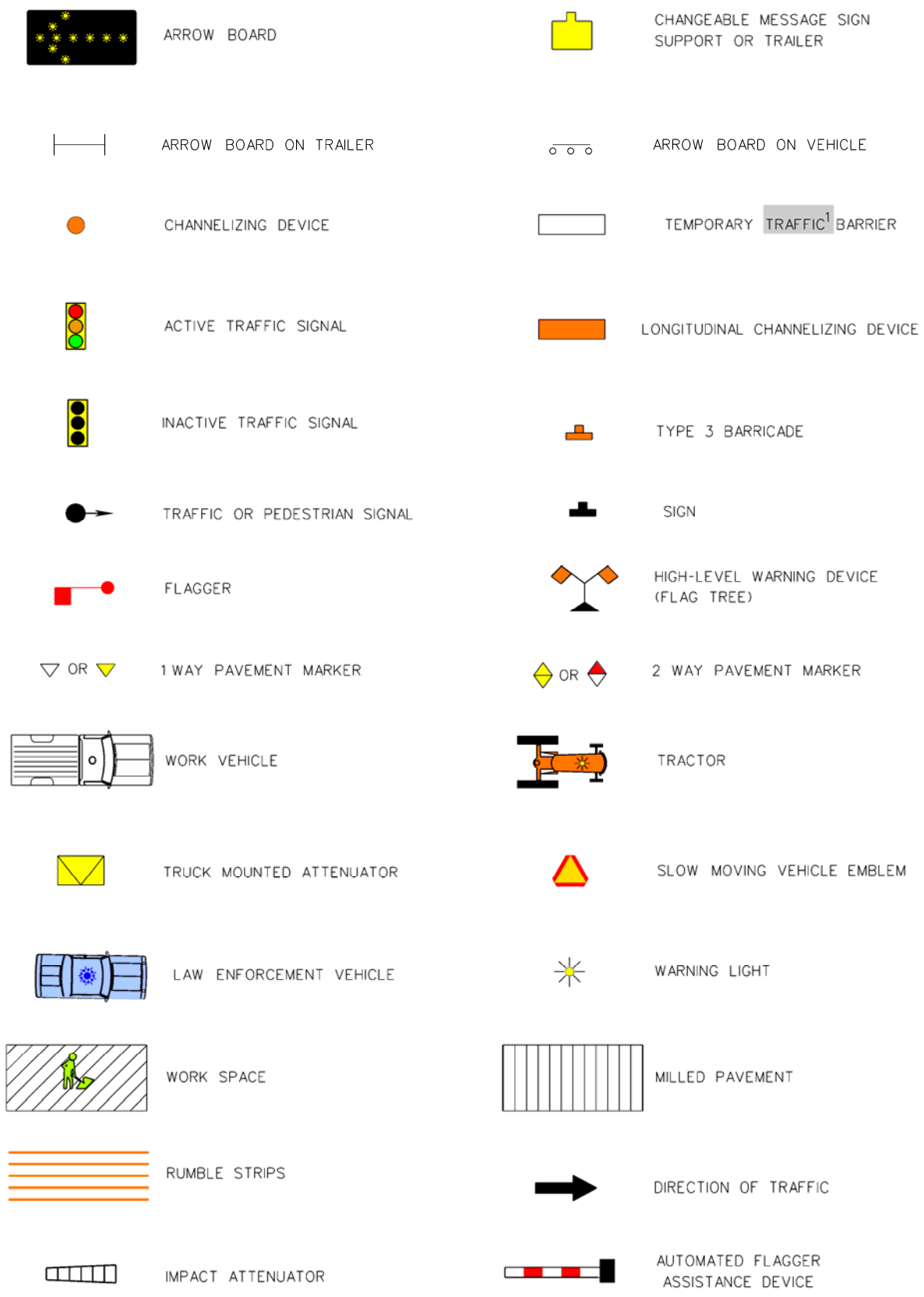
Table 6H-5, Recommended Spacing of Advance Warning Signs[1]

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

* Urban streets with greater than 40 mph posted speed limits fall into this category.

Note: For urban conditions, it is generally better to place all advanced warning signs within a one block area versus spreading out the signs over several blocks, however, motorist must have time to recognize and react to each warning sign see Section 6G.11.

Figure 6H-1, Symbols Used In Typical Temporary Traffic Control Figures Application



1: Revision 1 – 4/1/2015

Typical Traffic Control

Work Beyond the Shoulder Operation

(Figure TTC-1.1)

NOTES

Guidance:

1. *The minimum distance between the sign and work vehicle should be 1300'-1500' on Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limited is 45 mph or less.*

Option:

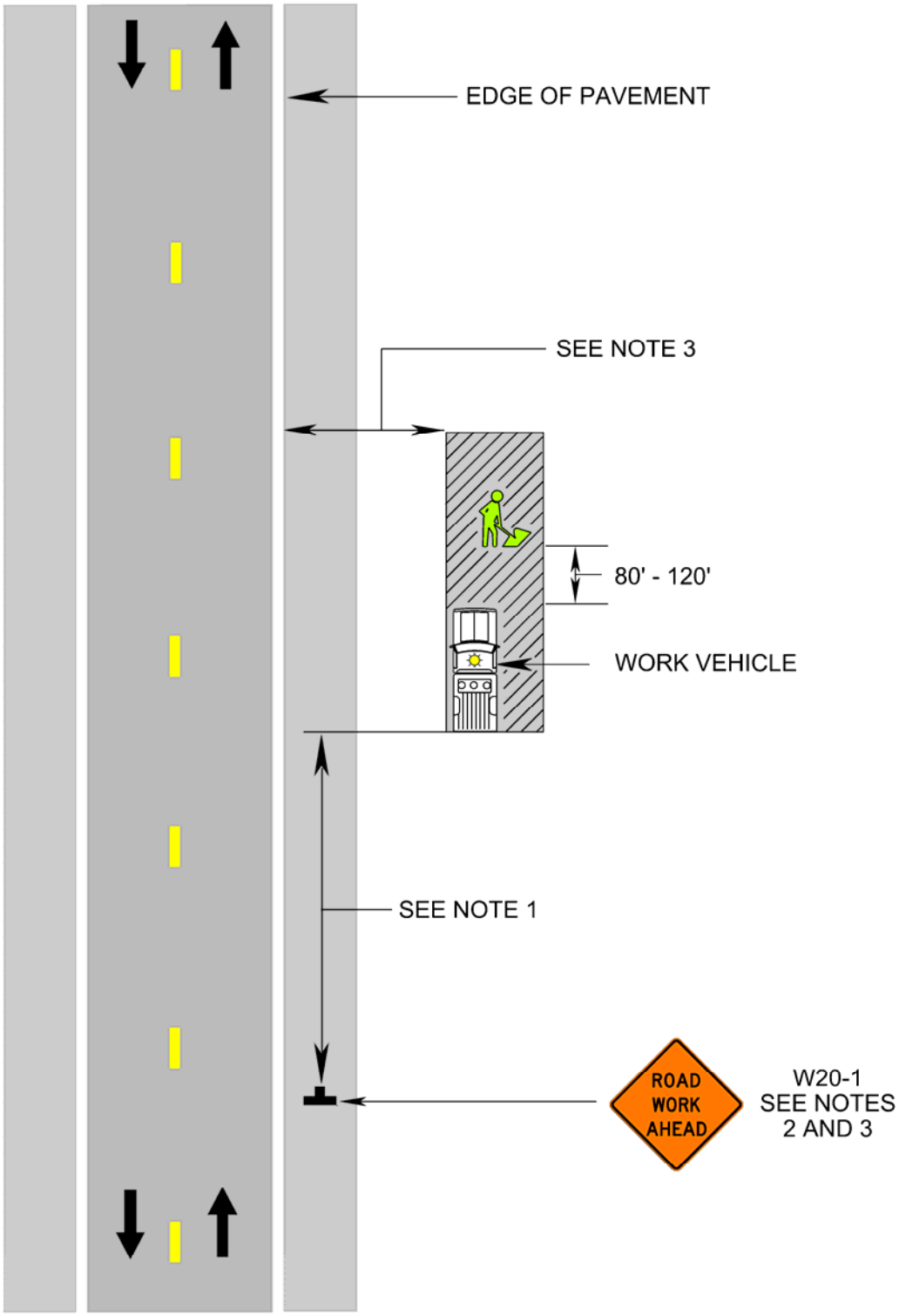
2. The ROAD WORK AHEAD (W20-1) sign may be replaced with other appropriate signs such as the SHOULDER WORK (W21-5) sign. The SHOULDER WORK sign may be used for work adjacent to the shoulder.
3. The ROAD WORK AHEAD sign may be omitted where the work space is behind a barrier, more than 4 feet behind vertical curb (Standard CG-2 and CG-6) on urban roadways, or outside of the clear zone for all other roadways. For clear zone values see Page A-4 of Appendix A.
4. For short-term, short duration or mobile operations[1], all signs and channelizing devices may be eliminated if a vehicle with activated high-intensity amber rotating, flashing, or[1] oscillating lights is used.

Standard:

5. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or oscillating lights.**
6. **If the work space is in the median of a divided highway, an advance warning sign shall also be placed on the left side of the directional roadway.**

1: Revision 1 – 4/1/2015

Work Beyond the Shoulder Operation
(Figure TTC-1.1)



Typical Traffic Control
Blasting Zone Operation
(Figure TTC-2.0)
NOTES

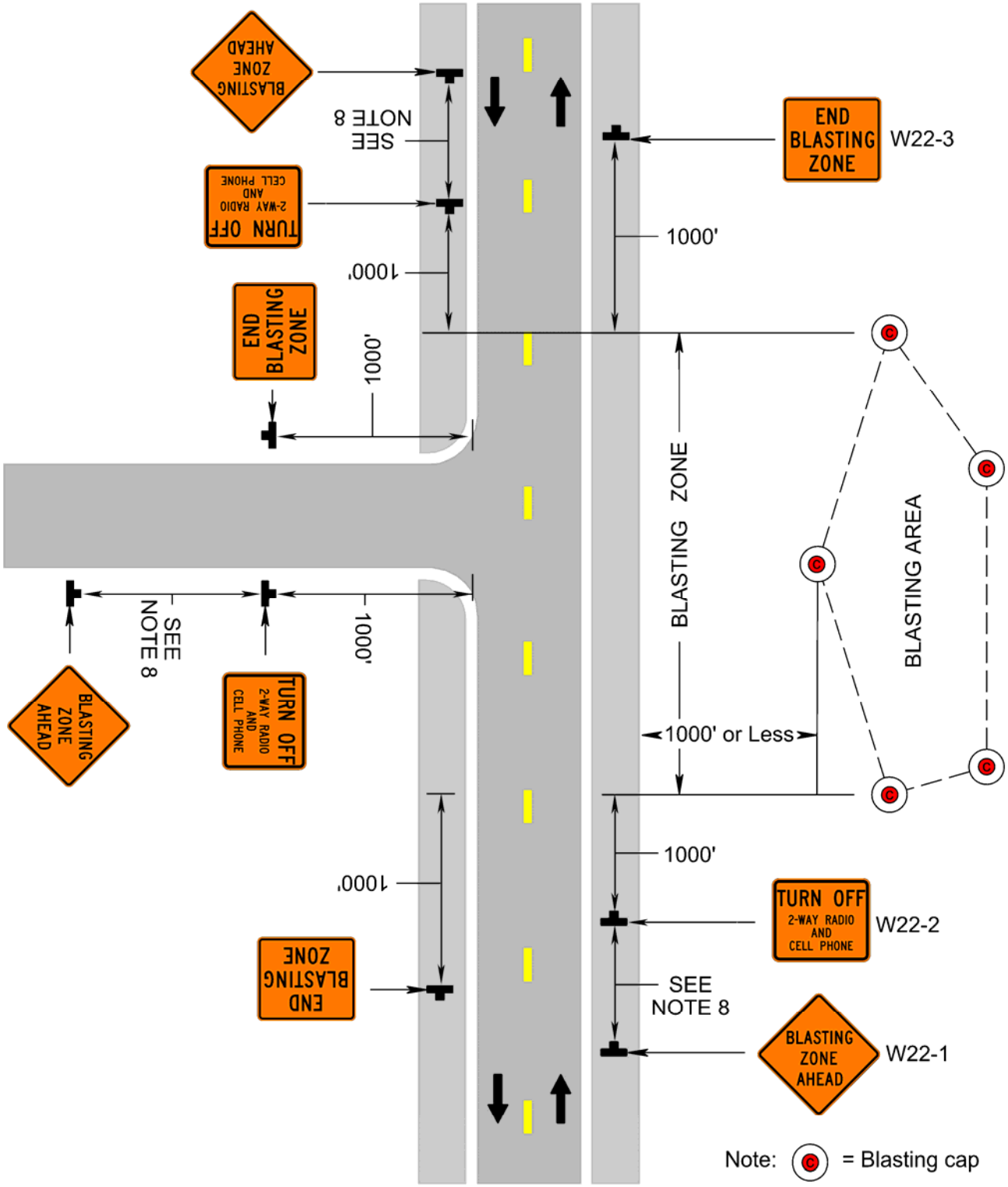
Standard:

1. **Whenever blasting caps are used within 1000 feet of a roadway, the signing shown shall be used.**
2. **Sign spacing distance shall be a minimum of 1000 feet from the blasting area.**
3. **The signs shall be covered or removed when there are no explosives in the area or the area is otherwise secure.**
4. **Whenever a side road intersects the roadway between the BLASTING ZONE AHEAD (W22-1) sign and the END BLASTING ZONE (W22-3) sign, or a side road is within 1000 feet of any blasting cap, similar signing, as on the mainline, shall be installed on the side road.**
5. **Prior to blasting, the blaster in charge shall determine whether road users in the blasting zone will be endangered by the blasting operation. If there is danger, road users shall not be permitted to pass through the blasting zone during blasting operations.**
6. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Guidance:

7. *On a divided highway, the signs should be mounted on both sides of the directional roadways.*
8. *Spacing between signs should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Blasting Zone Operation
(Figure TTC-2.0)



Typical Traffic Control

Mobile or Short Duration Shoulder Operation

(Figure TTC-3.1)

NOTES

Guidance:

1. *In those situations where multiple work locations within a limited distance make it practical to place stationary signs, the distance between the advance warning sign and the work should not exceed 5 miles.*
2. *The ROAD WORK NEXT 2 MILES (W21-V2) sign should be used instead of the ROAD WORK AHEAD (W20-1) sign if the work locations occur over a distance of more than 2 miles.*

Option:

3. Stationary warning signs may be omitted for short duration or mobile operations if the work vehicle displays high-intensity rotating, flashing, or[1] oscillating lights.

Standard:

4. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**
5. **If an arrow board is used for an operation on the shoulder, the caution mode shall be used.**
6. **Vehicle-mounted signs shall be mounted in a manner such that they are not obscured by equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned from view when work is not in progress.**
7. **If multiple work crews are active at various locations throughout the 2 mile work zone, a shadow vehicle shall be used for each work crew.**
8. **A truck-mounted attenuator (TMA) shall be used on the shadow vehicle on Limited Access highways and multi-lane roadways with posted speed limit equal to or greater than 45 mph for operations with a duration greater than 60 minutes.[1]**

Option:

9. When the work operation is off the shoulder with a work duration of 1-15 minutes vehicle warning lights may be used on a work vehicle parked on the shoulder.[1]

Guidance:

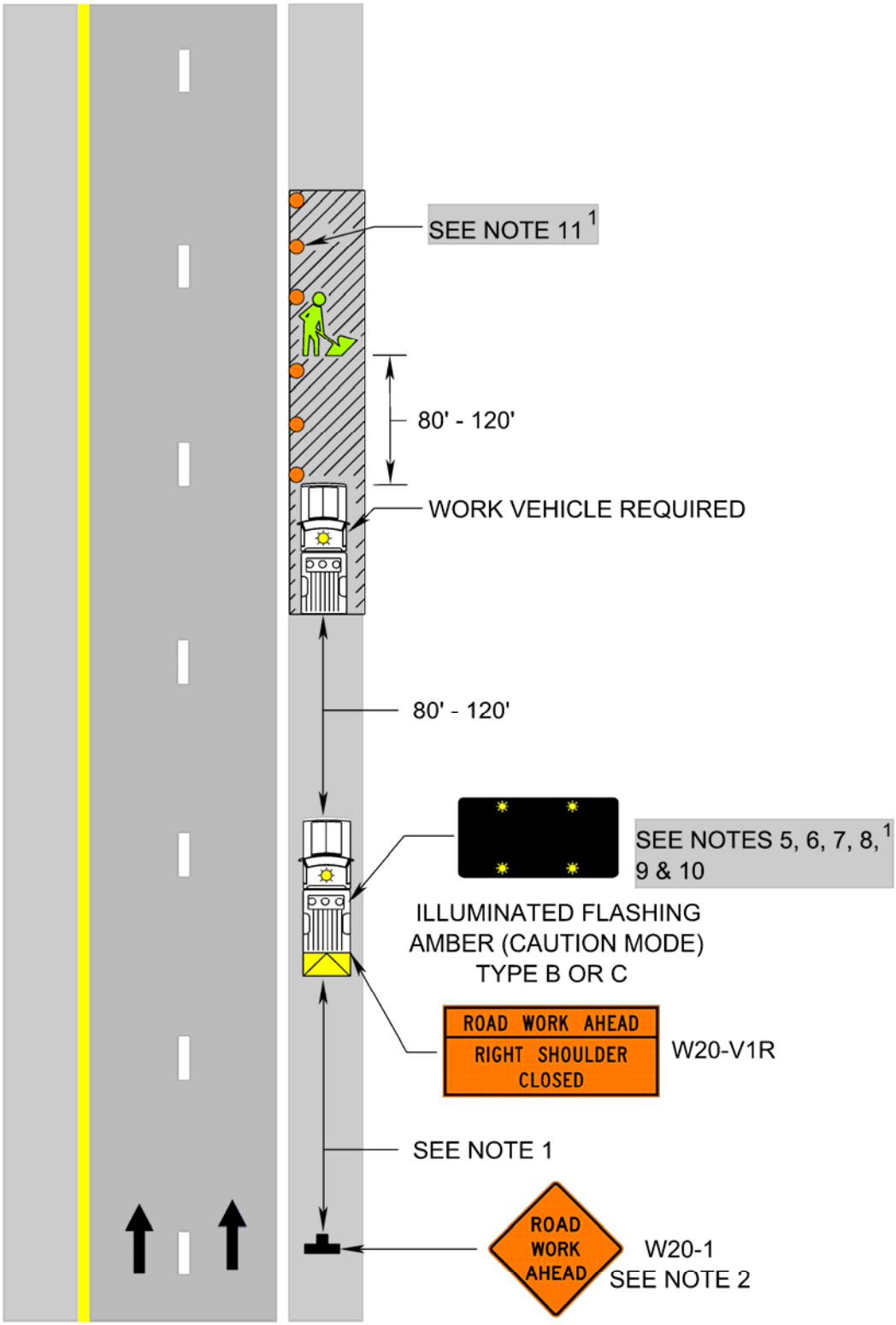
10. *When the work operation is off the shoulder with a work duration of 15-60 minutes, vehicle warning lights and a truck mounted sign (W20-V3, W20-V6, W20-V1, etc.) or a sign on a portable sign support should be placed behind the work operations vehicle.*[1]

Option:

11. The work area may be delineate by installing channelizing devices. The channelizing devices would start at the front of the shadow vehicle and extend through the work area. The spacing between channelizing devices may be reduced in the travelway to prevent motorists from entering the work area.[1]

1: Revision 1 – 4/1/2015

Mobile or Short Duration Shoulder Operation
(Figure TTC-3.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control
Stationary Operation on a Shoulder
(Figure TTC-4.1)
NOTES

Standard

1. **For long-term stationary work (more than 3 days) on divided highways having a median wider than 8', sign assemblies on both sides of the roadway shall be required as shown (ROAD WORK AHEAD (W20-1), RIGHT SHOULDER CLOSED AHEAD (W21-5bR), RIGHT SHOULDER CLOSED (W21-5aR)[1]), even though only one shoulder is being closed. For operations less than 3 days in duration, sign assemblies will only be required on the side where the shoulder is being closed and a RIGHT SHOULDER CLOSED (W21-5aR)[1] sign shall be added to that side.**

Guidance

2. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Option:

3. The SHOULDER WORK (W21-5) sign on an intersecting roadway may be omitted where drivers emerging from that roadway will encounter another advance warning sign prior to this activity area.
4. For short duration operations of 60 minutes or less, all signs and channelizing devices may be eliminated if a vehicle with activated high-intensity amber rotating, flashing, or[1] oscillating lights is used.

Standard:

5. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating, lights.**
6. **Taper length (L) and channelizing device spacing shall be at the following:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

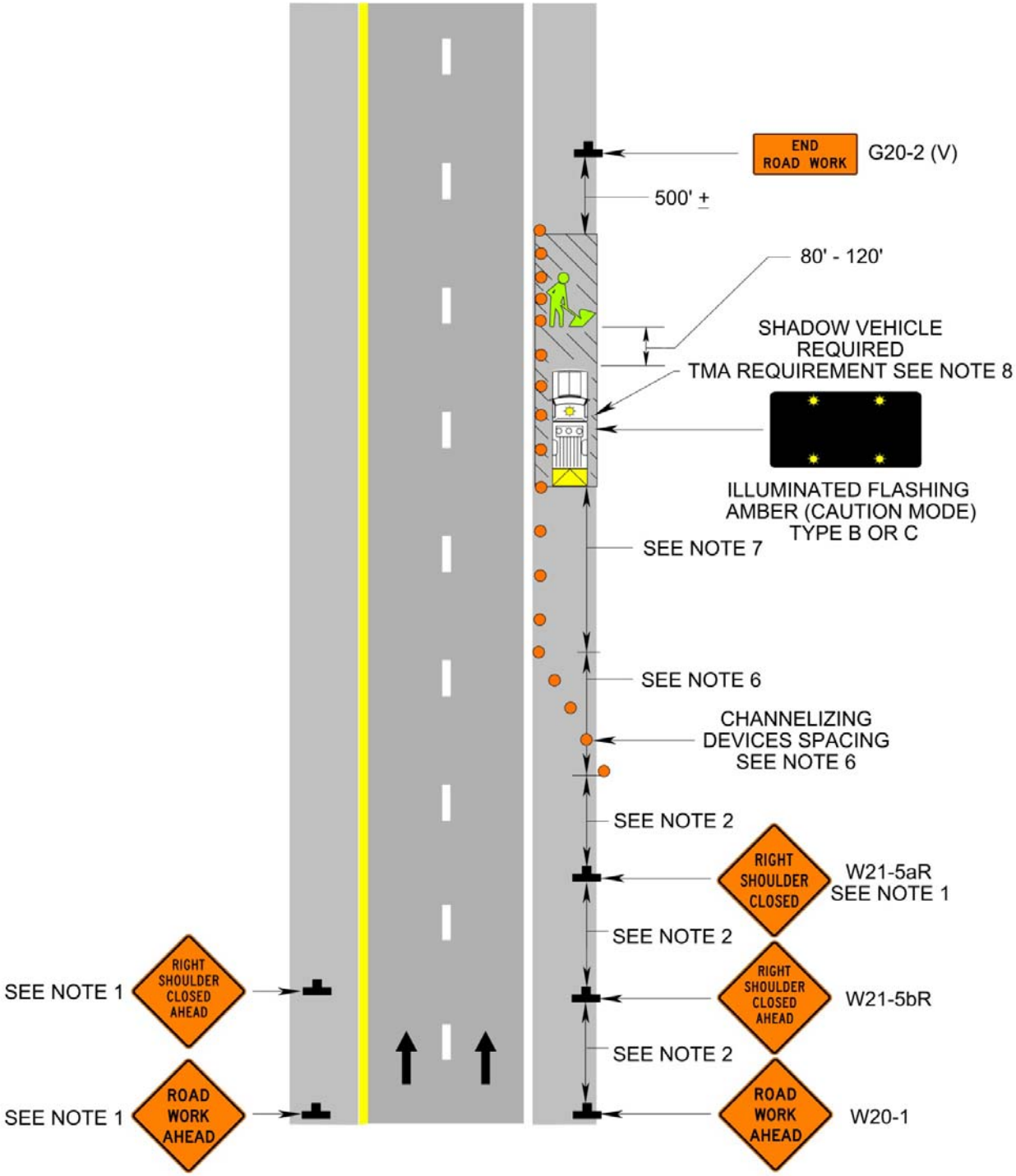
Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

7. **The buffer space length shall be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
8. **A truck-mounted attenuator (TMA) shall be used on the shadow vehicle on Limited Access highways and multi-lane roadways with posted speed limit equal to or greater than 45 mph for operations with a duration greater than 60 minutes.**
9. **When a side road intersects the highway within the temporary traffic control zone, additional traffic control devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Stationary Operation on a Shoulder
(Figure TTC-4.1)



Typical Traffic Control

Shoulder Operation with Minor Encroachment

(Figure TTC-5.1)

NOTES

Standard

1. **For required sign assemblies for multi-lane roadways see Note 1, TTC-4.[1]**

Guidance

2. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
3. *When work takes up part of a lane on a high volume roadway; vehicular traffic volumes, vehicle mix, speed and capacity should be analyzed to determine whether the affected lane should be closed. Unless the lane encroachment analysis permits a remaining lane width of 10 feet, the lane should be closed. If the closure operation is on a Limited Access highway, the minimum lane width is 11 feet.*

Option:

4. The ROAD WORK AHEAD (W20-1) sign on an intersecting roadway may be omitted where drivers emerging from that roadway will encounter another advance warning sign prior to this activity area.

Standard:

5. **A shadow vehicle with either an arrow board operating in the caution mode, or at least one high-intensity amber rotating, flashing, or[1] oscillating light shall be parked 80' - 120' in advance of the first work crew.**
6. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**
7. **Taper length (L) and channelizing device spacing shall be at the following:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

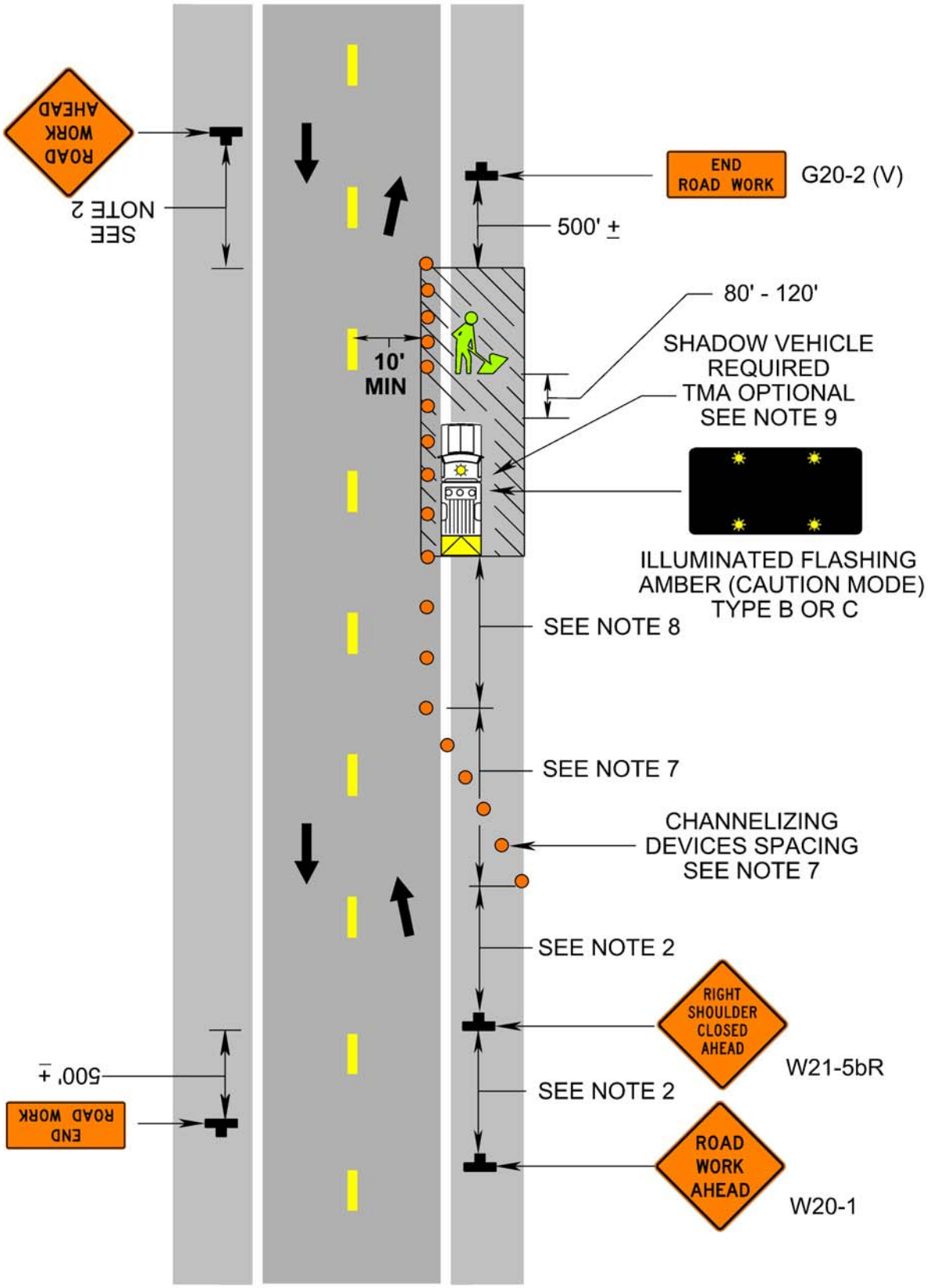
Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

8. **The buffer space length shall be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
9. **A truck-mounted attenuator (TMA) shall be used on Limited Access highways and multi-lane roadways with posted speed limit equal to or greater than 45 mph.**
10. **When a side road intersects the highway within the temporary traffic control zone, additional traffic control devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Shoulder Operation with Minor Encroachment
(Figure TTC-5.1)



Typical Traffic Control
Shoulder Closure with Barrier Operation
(Figure TTC-6.1)
NOTES

Guidance:

1. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Standard:

2. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **Group 2 channelizing device spacing shall be at the following:**

Location	Posted Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'

4. **The minimum length for a shoulder taper shall be 360'[1] on Limited Access highways, and ⅓ L for all other roadways (see Note 7 of TTC-5 for values of L).**
5. **Barrier transition slope ratio shall be as follows:**

Speed Limit (mph)	Slope Ratio	Speed Limit (mph)	Slope Ratio	Speed Limit (mph)	Slope Ratio
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

When the barrier transition slope is on a horizontal alignment, the total offset shall be prorated around the curve in lieu of a straight-line slope.

6. **End treatment of a barrier in order of preference:**
   a. **Where guardrail exists, attach to barrier with appropriate fixed object attachment.**
   b. **Where cut slope exists, bury barrier into cut slope and provide for drainage as needed.**
   c. **Extend end of barrier until it is beyond the established clear zone (see Figure 2 on Page A-4 in Appendix A for clear zone values).**
   d. **When barrier end is inside the established clear zone, attenuator service Type I or Type II shall be used. Contact L&D Standards/Special Design Section for approved attenuators.**
7. **Barrier panels 8 inches in width and 12 inches in height shall be placed on top of the concrete barrier and spaced 80' on centers along the parallel or tangent sections and 40' on centers along the transition or taper sections. Reflectorized surface shall be fluorescent orange prismatic lens sheeting. The light at the beginning of the barrier run and at the breakpoint where the barrier becomes parallel to the roadway shall be a Type B flashing light. Barrier delineators shall be installed along the traffic side of the concrete barriers in-between and at the same spacing as the barrier panels approximately 24 inches up from the roadway surface.**

Option:

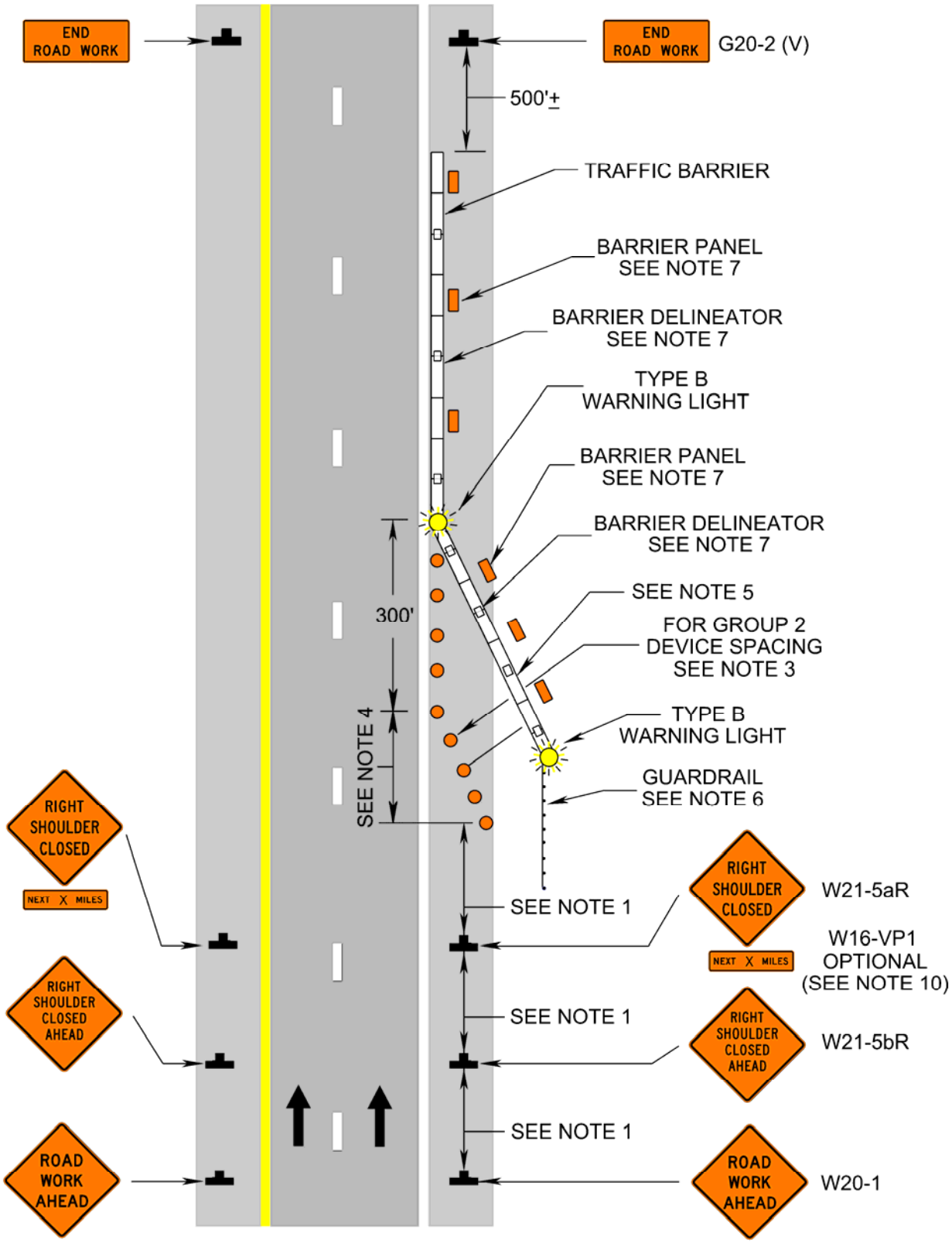
8. The barrier shown in this typical application is an example of one method that may be used to close a shoulder of a long-term project.
9. The RIGHT SHOULDER CLOSED (W21-5aR) sign may be eliminated from all roadways except Limited Access highways.

Guidance:

10. *If drivers cannot see a pull-off area beyond the closed shoulder, information regarding the length of the shoulder closure shall be provided in feet or miles, as appropriate.*
11. *An emergency pull-off area should be provided per Section 6G.18 and Temporary Traffic Control Figure TTC-8.*

1: Revision 1 – 4/1/2015

Shoulder Closure with Barrier Operation
(Figure TTC-6.1)



Typical Traffic Control

Shoulder Closure with Barrier and Lane Shift Operation

(Figure TTC-7.0)

NOTES

Guidance:

1. *The lane shift should be used when the work space extends into either the right or left lane of a divided highway and it is not practical, for capacity reasons, to reduce the number of available lanes.*
2. *When a lane shift is accomplished by using: (1) geometry that meets the design speed at which the permanent highway was designed, (2) full normal cross-section (full lane width and full shoulders), and (3) complete pavement markings, then the Reverse Curve signs are not required.*
3. *Sign spacing distance should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Standard:

4. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
5. **Length of pavement marking transition (L) is equal to posted speed (S) times the width of transition (W) (Example: 55 mph x 2' = 110').**
6. **Channelizing device spacing shall be at the following:**

Location	Posted Speed Limit (mph)	
	0 – 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'

7. **For end treatment of the barrier in order of preference see Note 6 of TTC-6.**
8. **Barrier panels 8 inches in width and 12 inches in height shall be placed on top of the concrete barrier and spaced 80' on centers along the parallel or tangent sections and 40' on centers along the transition or taper sections. Reflectorized surface shall be fluorescent orange prismatic lens sheeting. The light at the beginning of the barrier run and at the breakpoint where the barrier becomes parallel to the roadway shall be a Type B flashing light. Barrier delineators shall be installed along the traffic side of the concrete barrier in-between and at the same spacing as the barrier panels approximately 24 inches up from the roadway surface.**
9. **Unless approved by the Regional Traffic Engineer, the minimum width of the travel lanes shall be 11 feet.**
10. **For long-term work zones existing conflicting pavement markings and markers shall be removed and temporary pavement markings and markers shall be installed per TTC-60.**

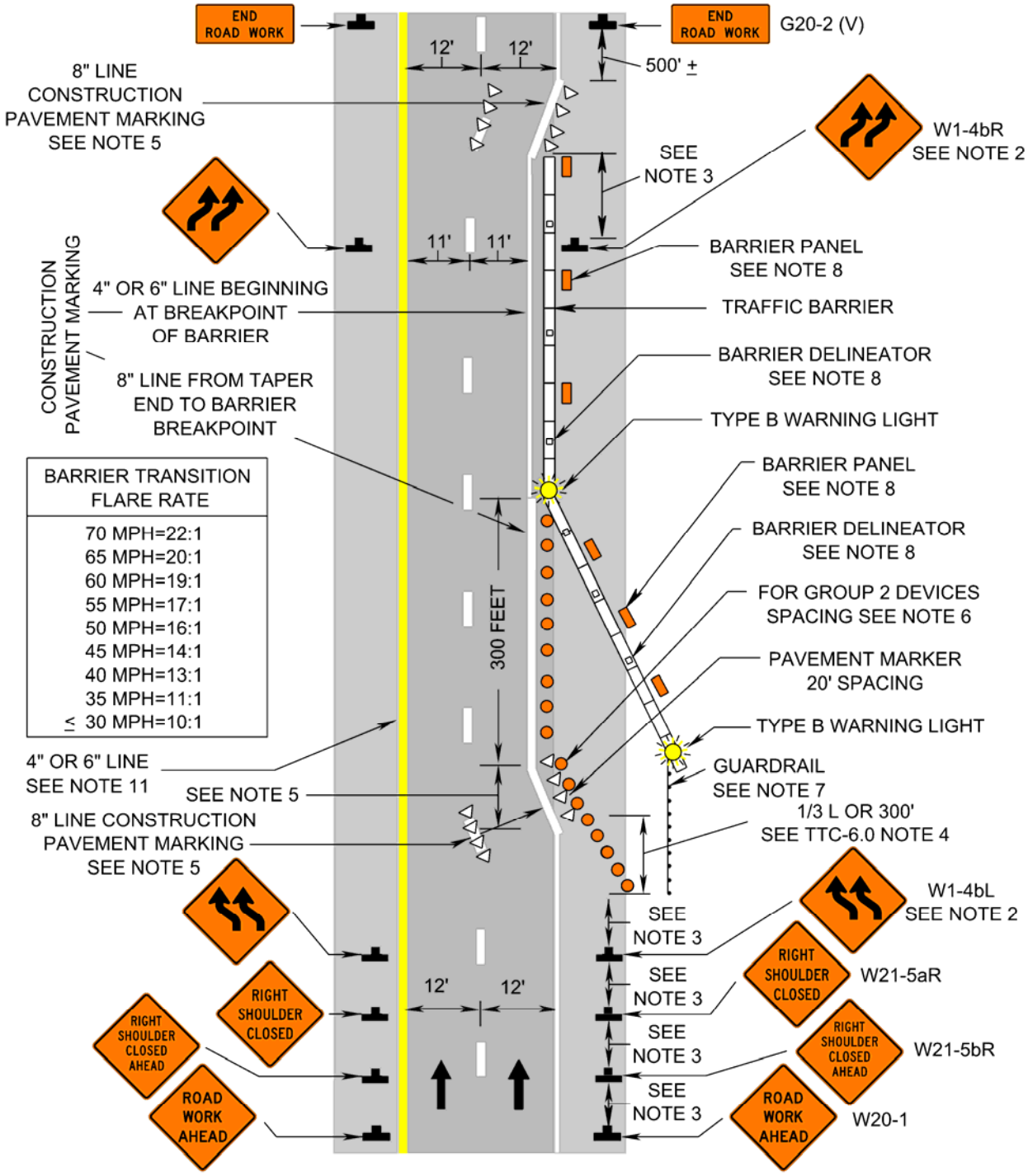
Option:

11. Temporary pavement may be needed to maintain traffic with 11' minimum width lanes.

Guidance:

12. *Eradication of existing pavement markings should be as shown in Typical Traffic Control Figure TTC-55.*
13. *If drivers cannot see a pull-off area beyond the closed shoulder, information regarding the length of the shoulder closure should be provided in feet or miles, as appropriate.*
14. *An emergency pull-off area should be provided per Section 6G.18 and Temporary Traffic Control Figure TTC-8.*

Shoulder Closure with Barrier and Lane Shift Operation
(Figure TTC-7.0)



Typical Traffic Control

Pull-Off Areas on Limited Access Highways

(Figure TTC-8.0)

NOTES

Guidance:

1. *Work zone pull-off areas should be provided in work zones along Limited Access highways where one or both shoulders are closed due to construction.*

Option:

2. Work zone pull-off areas may be considered in work zones for other roadways where one or both shoulders are closed due to construction.

Guidance:

3. *The spacing of pull-off areas should be as follows:*
   - *For projects with activity areas up to 2.0 miles in length, one every 0.5 to 0.75 mile.*
   - *For projects with activity areas greater than 2.0 miles in length, one every mile.*
4. *Pull-off areas should be a minimum of 1320 feet long. The width of pull-off areas should be a desirable distance of 15 feet.*

Option:

5. The width of the work zone pull-off areas may be reduced to a minimum of 12 feet on roadways with Right-of-Way constraints.

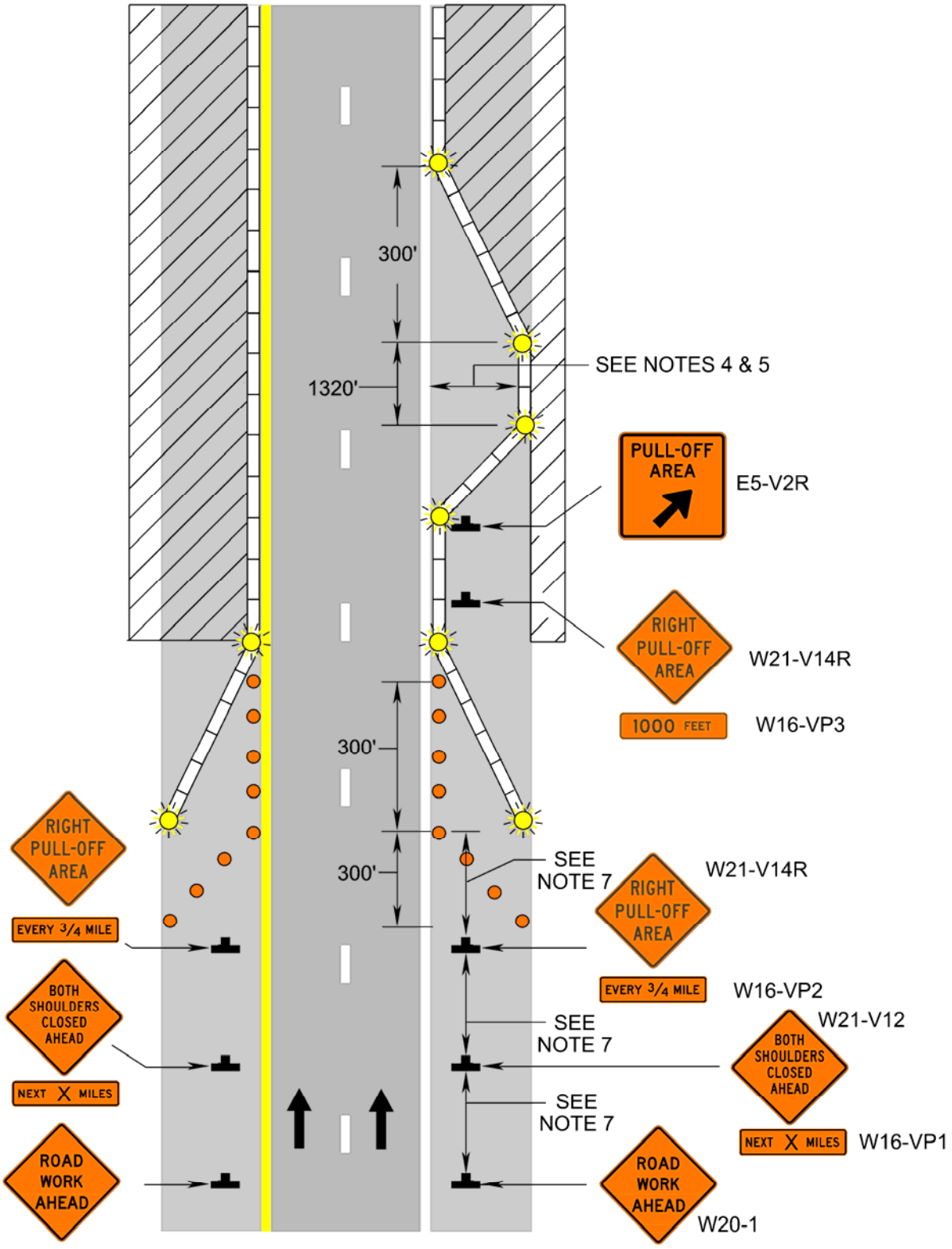
Guidance:

6. *Advance warning signs placed after the ROAD WORK AHEAD sign, should be installed as follows:*
   a. *A NEXT XX MILES (W16-VP1) supplemental plaque should be provided with the first SHOULDER CLOSED AHEAD (W21-5b or W21-V12) sign in the sequence.*
   b. *The third sign in the sequence should be either:*
      - *A NO PULL-OFF AREA (W21-V15) sign with NEXT XX MILES (W16-VP1) supplemental plaque, if there are no pull off areas throughout the work area, or*
      - *A LEFT (RIGHT) PULL-OFF AREA (W21-V13, W21-V14L, or W21-14R) sign with EVERY X MILE (W16-VP2) supplemental plaque, if pull-off areas are provided.*
   c. *A LEFT (RIGHT) PULL-OFF AREA warning sign with a 1000 FEET (W16-VP3) supplemental plaque should be placed in advanced of each pull-off area to give distance information to a driver as to the location of the emergency pull-off area. Additional options for the supplemental plaque below PULL-OFF AREA (W21-V13, W21-V14L, orW21-14R) sign that could be considered for these locations include a distance message appropriate for the design speed of the roadway (for example 500 FT or 1000 FT), NEXT EXIT, EXIT XX, NEXT LEFT or NEXT RIGHT (see Section 6F.43).*
   d. *A Pull-Off Area Entrance (E5-V2) sign should be placed immediately prior to the pull-off area to help a driver navigate to it safely.*
   e. *A PULL-OFF AREA (W21-V13) sign /NEXT EXIT (W16-VP4) plaque signing should be provided within 0.5 mile of a limited access interchange exit if the exit is clearly signed and the interchange facilities provide adequate places for refuge (see Section 6F-43 for additional guidance).*
7. *Sign spacing should be 1300'-1500' for Limited Access highways.*

Standard:

8. **Minimum lane closure taper length on all Limited Access highways, regardless of posted speed, shall be 1000 feet. Minimum shoulder taper length of Limited Access highways shall be 300 feet.**
9. **Barrier panels 8 inches in width and 12 inches in height shall be placed on top of the concrete barrier and spaced 80' on centers along the parallel or tangent sections and 40' on centers along the transition or taper sections. Reflectorized surface shall be fluorescent orange prismatic lens sheeting. The light at the beginning of the barrier run and at the breakpoint where the barrier becomes parallel to the roadway shall be a Type B flashing light. Barrier delineators shall be installed along the traffic side of the concrete barrier in-between and at the same spacing as the barrier panels approximately 24 inches up from the roadway surface.**

Pull-Off Areas on Limited Access Highways
(Figure TTC-8.0)



Typical Traffic Control

Mowing Operation with Encroachment on Non-Limited Access Roadways

(Figure TTC-9.1)

NOTES

Standard:

1. **Each vehicle involved in the operation shall be equipped with at least one rotating amber light or high intensity amber flashing[1] or oscillating light, visible from 360°.**
2. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **Connecting roads entering into the work area shall be signed as shown.**
4. **All vehicles traveling at speeds below 25 mph shall display a slow moving vehicle emblem per OHSA regulation 1910.145(d)(10).**

Guidance:

5. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
6. *No more than 2 complete setups (2 miles each) should be exposed to motorist at any one time.*
7. *To prevent multiple lane changing by motorists and constriction of traffic flow, mowing operations should be limited to one side of the roadway at a time, or separated by a minimum of 1000 feet between right and left side operations.*
8. *For high volume, high speed multi-lane highways, if the mower encroaches into the roadway for extended periods of time, or prevents vehicles from passing, TTC-13[1], Short Duration Operation on a Multi-Lane Roadway should be considered.*
9. *All mowing operations, including but not limited to weed eating and push mowing, should be performed using the mowing series of warning signs.*[1]

Option:

10. Litter pick up operations may be performed using the mowing series of warning signs (MOWING NEXT 2 MILES and WATCH FOR SLOW MOVING VEHICLES) during mowing operations.[1]

Standard:

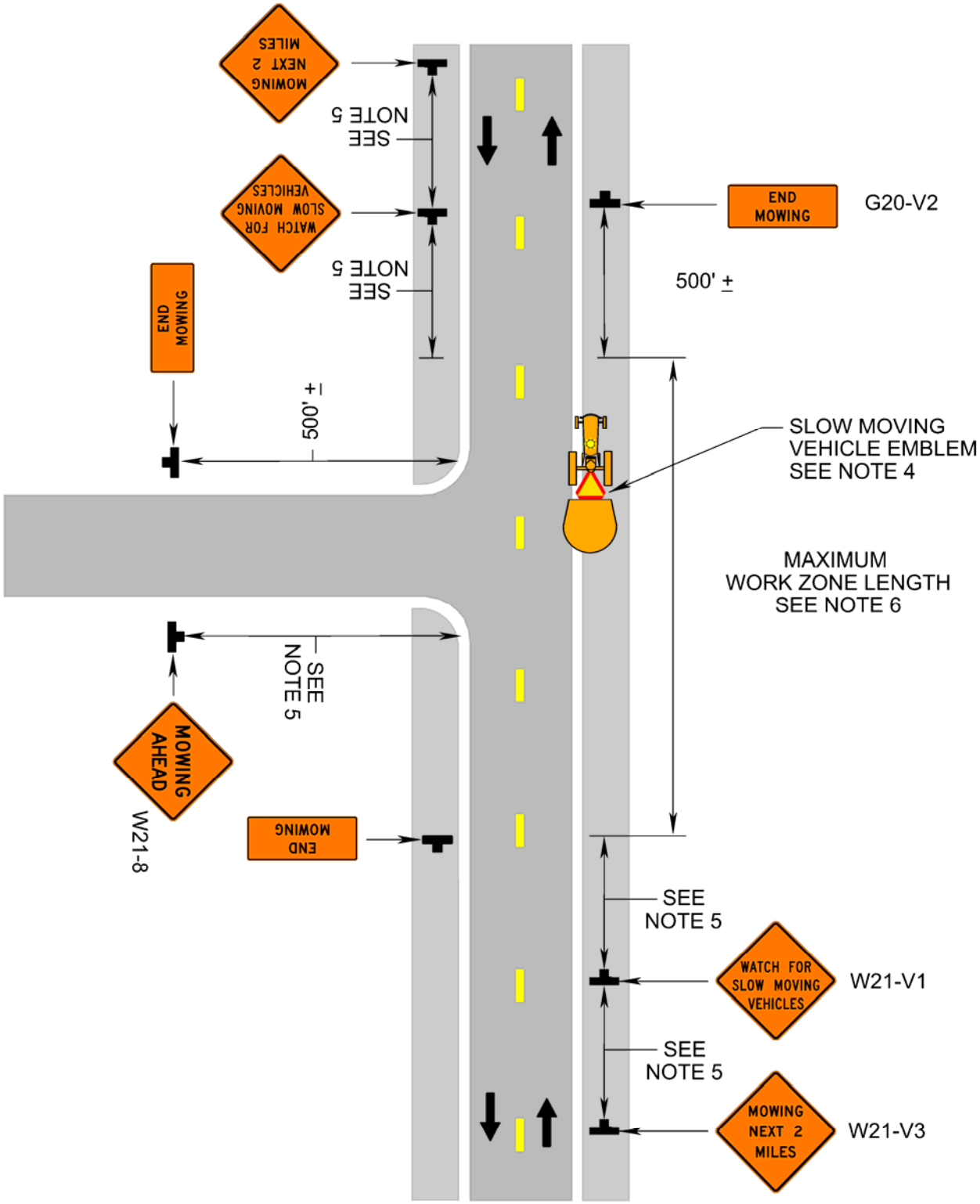
11. **If only litter pick up operation is being performed, then the appropriate LITTER PICK UP signs shall be used.**[1]
12. **If the warning signs mowing and litter pick up operations cannot be seen by ramp traffic then they shall be signed to warn motorists of the operation being performed.**[1]

Option:

13. The warning signs for mowing and litter pick up may be placed where they are visible to both mainline and ramp traffic.[1]
14. A shadow vehicle with a TMA may be placed 80' to 120' behind the slow moving vehicle to protect the motorists and the slow moving vehicle's operator.[1]

1: Revision 1 – 4/1/2015

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



Typical Traffic Control

Non-Licensed Vehicle Operation with Encroachment on Limited Access Highways

(Figure TTC-10.1)

NOTES

Standard:

1. **Each vehicle involved in the operation shall be equipped with at least one rotating amber light or high intensity amber flashing[1] or oscillating light, visible from 360°.**
2. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **Entrance ramps within the work area shall be signed as shown.**
4. **All vehicles traveling at speeds below 25 mph shall display a slow moving vehicle emblem per OHSA regulation 1910.145(d)(10).**

Guidance:

5. *Sign spacing distance should be 1300'-1500' for Limited Access highways.*
6. *No more than 2 complete setups (2 miles each) should be exposed to motorist at any one time.*
7. *To prevent multiple lane changing by motorists and constriction of traffic flow, mowing operations should be limited to one side of the roadway at a time, or separated by a minimum of 1000 feet between right and left side operations.*

Option:

8. If the work operations vehicle is a motorized piece of equipment, such as a motor grader, grade-all, etc., the illuminated flashing arrow may be deleted.
9. The vehicle static warning sign and arrow board may be replaced with a vehicle-mounted CMS with a minimum character height of 10". The arrow display using a CMS may be a Type B. Arrow direction and lane designation may change as needed.
10. The Shadow Vehicle 2 may be eliminated if the operation does not encroach in the travel lane.

Standard:

11. **If Shadow Vehicle 1 cannot run completely on the shoulder out of the travel lane and would be partially in the travel lane, it shall be equipped with a truck-mounted attenuator.**

Guidance:

12. *When using a CMS to replace the static sign and arrow board, each word message phase should be followed by the Type B arrow display.*
13. *All mowing operations, including but not limited to weed eating and push mowing, should be performed using the mowing series of warning signs.*[1]

Option:

14. Litter pick up operations may be performed using the mowing series of warning signs (MOWING NEXT 2 MILES and WATCH FOR SLOW MOVING VEHICLES) during mowing operations.[1]

Standard:

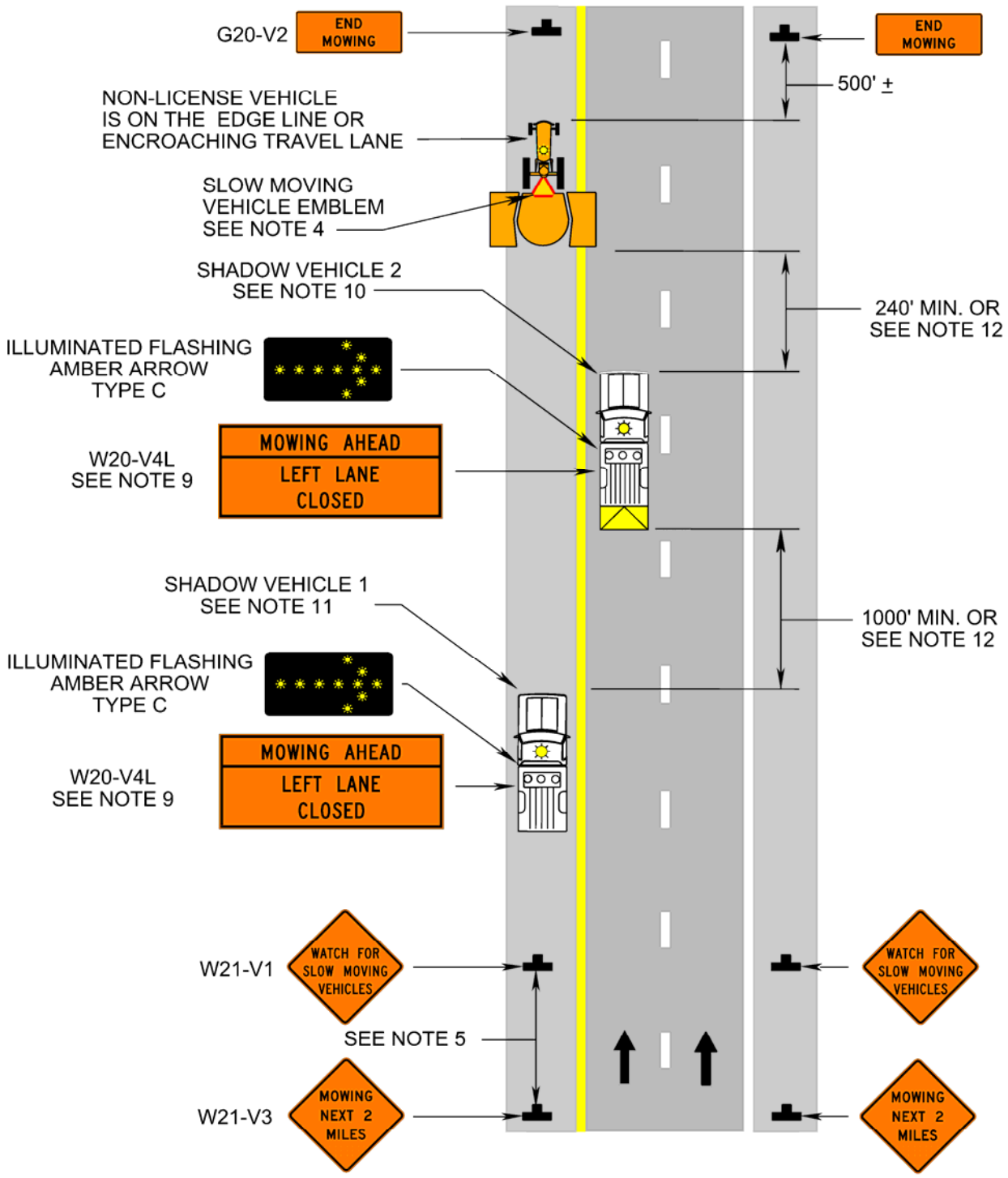
15. **If only litter pick up operation is being performed, then the appropriate LITTER PICK UP signs shall be used.**[1]
16. **If the warning signs mowing and litter pick up operations cannot be seen by ramp traffic then they shall be signed to warn motorists of the operation being performed.**[1]

Option:

17. The warning signs for mowing and litter pick up may be placed where they are visible to both mainline and ramp traffic.[1]

1: Revision 1 – 4/1/2015

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



Typical Traffic Control

Moving/Mobile Operations on Limited Access Highways (Single Lane Closure)

(Figure TTC-11.1)

NOTES

Standard:

1. **Each vehicle involved in the moving/mobile operation shall be equipped with at least one high-intensity amber rotating, flashing or[1] oscillating light. Illuminated flashing arrows on the advance warning vehicles shall be Type C (96" x 48"), and on the work operations vehicle a Type B (60" x 30") or Type C.**
2. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**

Option:

3. If the work operations vehicle is a motorized piece of equipment, such as a motor grader, grade-all, etc., the illuminated flashing arrow may be deleted.
4. The static warning sign and arrow board may be replaced with a vehicle-mounted CMS with a minimum character height of 10". The arrow display using a CMS may be a Type B. Arrow direction and lane designation may change as needed.

Standard:

5. **Shadow Vehicle 1 shall travel along the paved shoulder with either a flashing arrow, or a portable changeable message sign with 18" high characters advising of the operation ahead (LINE PAINTING AHEAD), and lane closure information (RIGHT LANE CLOSED, MERGE LEFT). Shadow Vehicle 2, with a truck-mounted attenuator (TMA), shall either straddle the edgeline, partially on the shoulder and partially in the lane, or travel fully in the travel lane. Shadow Vehicle 3, with a TMA, shall be in the travel lane.**
6. **If Shadow Vehicle 1 cannot run completely on the shoulder out of the travel lane and would be partially in the travel lane, it shall be equipped with either a truck-mounted attenuator or follow option in Note 7.**

Option:

7. When Shadow Vehicle 1 cannot run completely on the shoulder, it may be replaced with a PCMS with the messages in Note 5 displayed, or with a static warning sign with the appropriate message (LINE PAINTING NEXT 2 MILES (W21-V4)). For inside lane closure operations, the Shadow Vehicle 1 may be positioned on the right shoulder without arrow designation.

Standard:

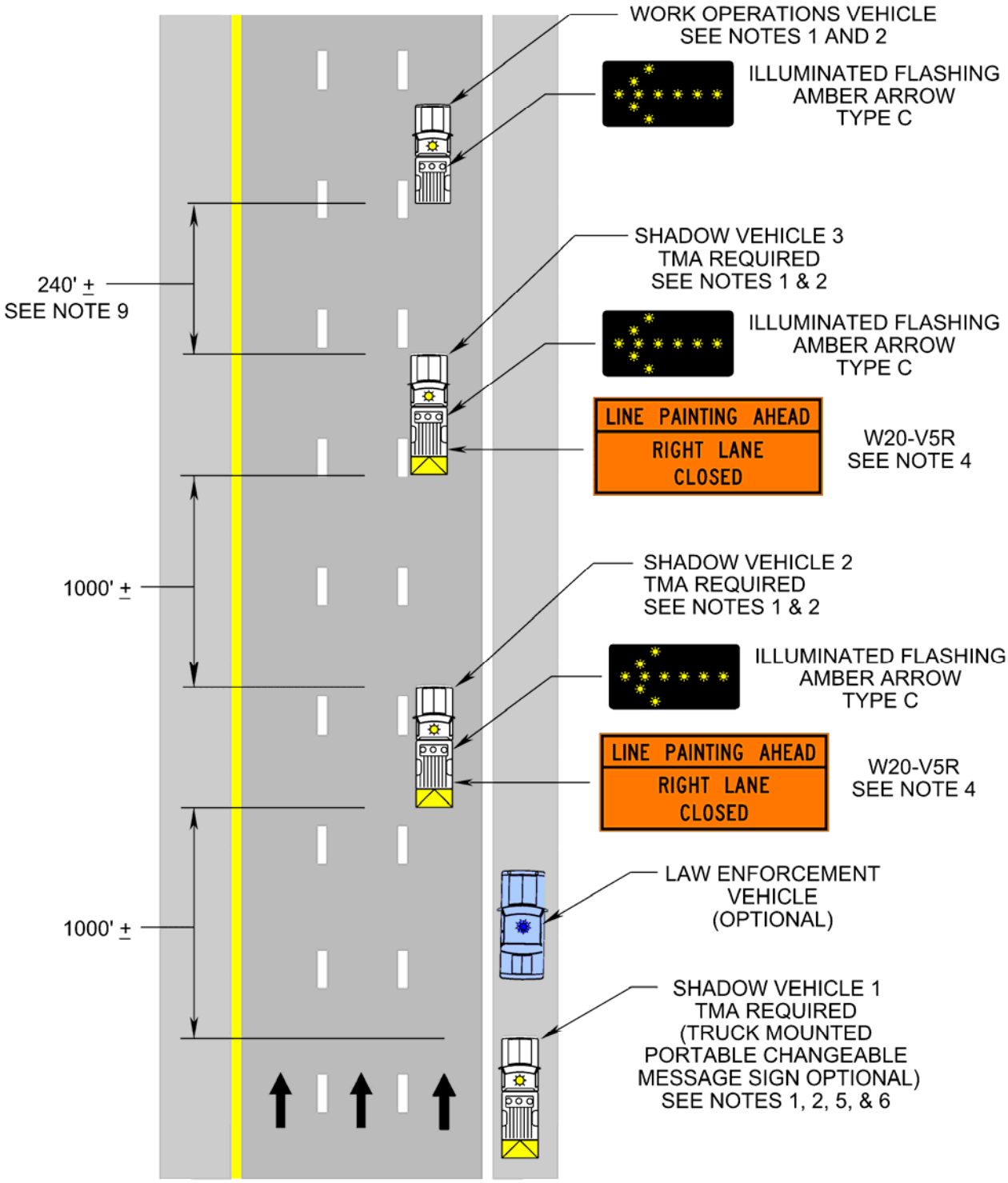
8. **Each vehicle involved in the moving operation shall have radio communication between vehicles.**
9. **When the work operations vehicle is stationary, Shadow Vehicle 3 following the operations vehicle shall be in a position 80'-120' in advance of the work operations vehicle to provide protection. When the work operations vehicle is moving, the Shadow Vehicle 3 following the operations vehicle shall follow at a distance of 240'± .**

Guidance:

10. *Spacing between vehicles may vary, depending on the speed, sight distance, and type of operation. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance and proceed at the same speed as the work operation vehicle. The shadow vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.*
11. *When using a CMS to replace the static sign and arrow board, each word message phase should be followed by the Type B arrow display.*

1: Revision 1 – 4/1/2015

Moving/Mobile Operations on Limited Access Highways (Single Lane Closure)
(Figure TTC-11.1)



Typical Traffic Control

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

(Figure TTC-12.1)

NOTES

Standard:

1. **Each vehicle involved in the moving/mobile operation shall be equipped with at least one high-intensity amber rotating, flashing, or[1] oscillating light. Illuminated flashing arrows on the advance warning vehicles shall be Type C (96" x 48"), and on the work operations vehicle a Type B (60" x 30") or Type C.**
2. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**

Option:

3. If the work operations vehicle is a motorized piece of equipment, such as a motor grader, grade-all, etc., the illuminated flashing arrow may be deleted.
4. The static warning sign and arrow board may be replaced with a vehicle-mounted CMS with a minimum character height of 10". The arrow display using a CMS may be a Type B. Arrow direction and lane designation may change as needed.

Standard:

5. **Shadow Vehicle 1 shall travel along the paved shoulder with a portable changeable message sign with 18" high characters advising of the operation ahead (LINE PAINTING AHEAD), and lane closure information (RIGHT LANE CLOSED, MERGE LEFT). Shadow Vehicle 2, with a truck-mounted attenuator (TMA), shall either straddle the edgeline, partially on the shoulder and partially in the lane, or travel fully in the travel lane. For non-limited access highways, Shadow Vehicle 1 shall have the option of using a Type C arrow board in place of the PCMS.[1]**
6. **If Shadow Vehicle 2 cannot run completely on the shoulder out of the travel lane and would be partially in the travel lane, it shall be equipped with either a truck-mounted attenuator or follow option in Note 7.**

Option:

7. When Shadow Vehicle 2 cannot run completely on the shoulder, it may be replaced with a PCMS with the messages in Note 5 displayed, or with a static warning sign with the appropriate message (LINE PAINTING NEXT 2 MILES (W21-V4)). For inside lane closure operations, the Shadow Vehicle 2 may be positioned on the right shoulder without arrow designation.

Standard:

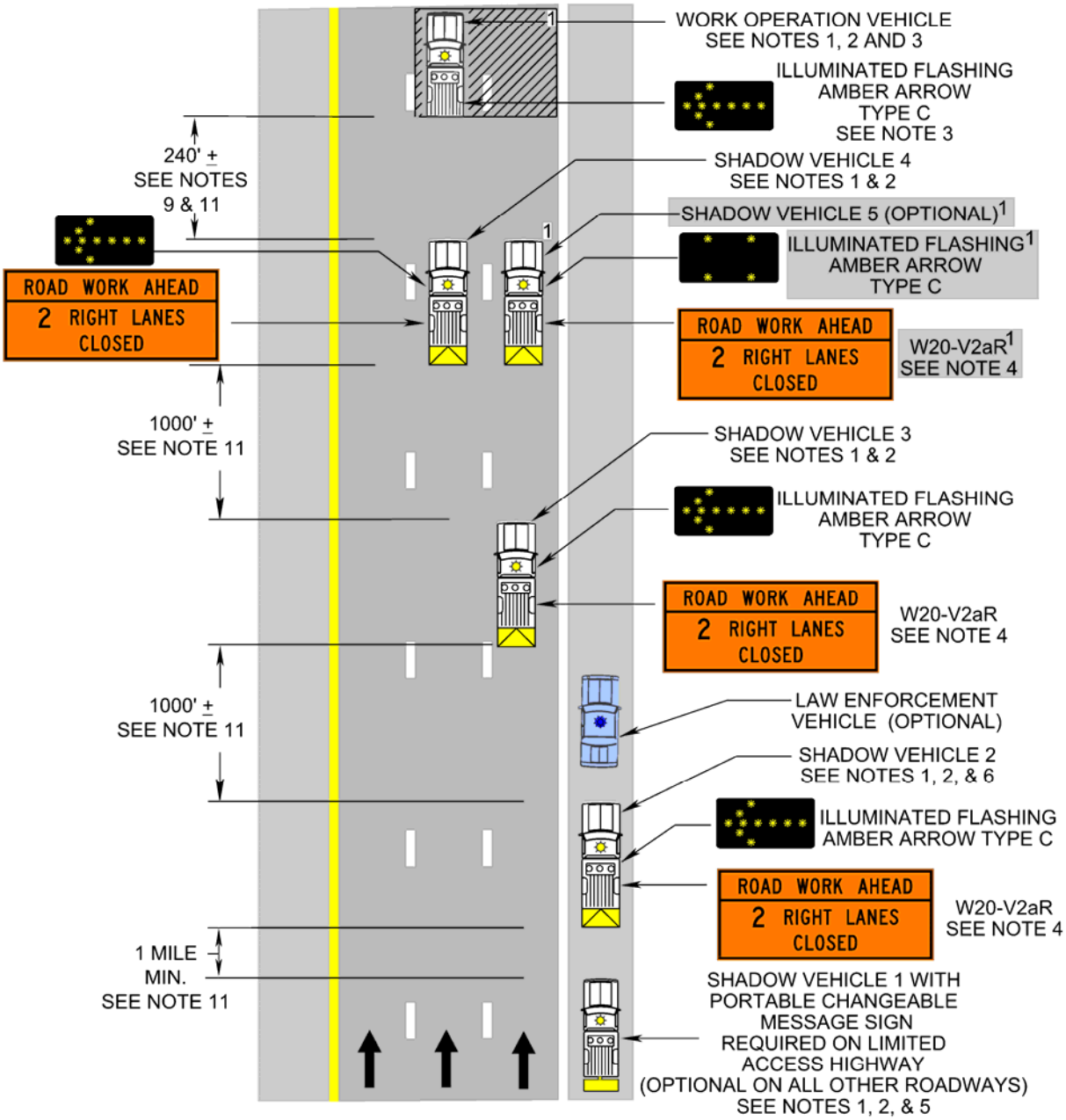
8. **Shadow Vehicles 3 and 4, with a TMA, shall be in their respective travel lane.**
9. **When the work operations vehicle is stationary, Shadow Vehicle 4 following the operations vehicle shall be in a position 80'-120' in advance of the work operations vehicle to provide protection. When the work operations vehicle is moving, the Shadow Vehicle 4 following the operations vehicle shall follow at a distance of 240'±.**
10. **Each vehicle involved in the moving operation shall have radio communication between vehicles.**

Guidance:

11. *Spacing between vehicles may vary, depending on the speed, sight distance, and type of operation. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance and proceed at the same speed as the work operation vehicle. The shadow vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.*
12. *When using a CMS to replace the static sign and arrow board, each word message phase should be followed by the Type B arrow display.*
13. *Section 6G-02 should be referenced for information on vehicle spacing for application on other classification of roadways.*

1: Revision 1 – 4/1/2015

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



1: Revision 1 – 4/1/2015

Typical Traffic Control

Moving/Mobile Operations on a Multi-Lane Roadway

(Figure TTC-13.1)

NOTES

Standard:

1. **Each vehicle involved in the moving/mobile operation shall be equipped with at least one high-intensity amber rotating, flashing[1], or oscillating light. Illuminated flashing arrows on the shadow vehicles and work operations vehicle shall be a Type B (60" x 30") or Type C (96" x 48"). Vehicle hazard warning signals shall not be used instead of rotating, flashing, or oscillating[1] lights, but as a supplement**.

Option:

2. If the work operations vehicle is a motorized piece of equipment, such as a motor grader, grade-all, etc., the illuminated flashing arrow will not be required.
3. The static warning sign and arrow board may be replaced with a vehicle-mounted CMS with a minimum character height of 10".
4. Arrow direction and designation may change as needed.

Guidance:

5. *Spacing between vehicles may vary, depending on the speed, sight distance, and type of moving operation. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance and proceed at the same speed as the work operation vehicle. The shadow vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.*
6. *Actual conditions could dictate more traffic control device needs in the operation. On high speed, high volume roads, a shadow vehicle on the shoulder with an arrow board and sign should be used. Also, in certain situations, appropriate stationary signing (SPRAYING NEXT 5 MILES (W21-V5)) could be used to further enhance safety.*

Standard:

7. **If Shadow Vehicle 1 cannot run completely on the shoulder and is partially in the travel lane, it shall be equipped with a truck-mounted attenuator (TMA).**
8. **When the work operations vehicle is stationary, Shadow Vehicle 2 following the work operations vehicle shall be in a position 80'-120' in advance of the work operations vehicle to provide protection. When the work operations vehicle is moving, Shadow Vehicle 2 following the work operations vehicle shall follow at a distance of 240'±.**

Option:

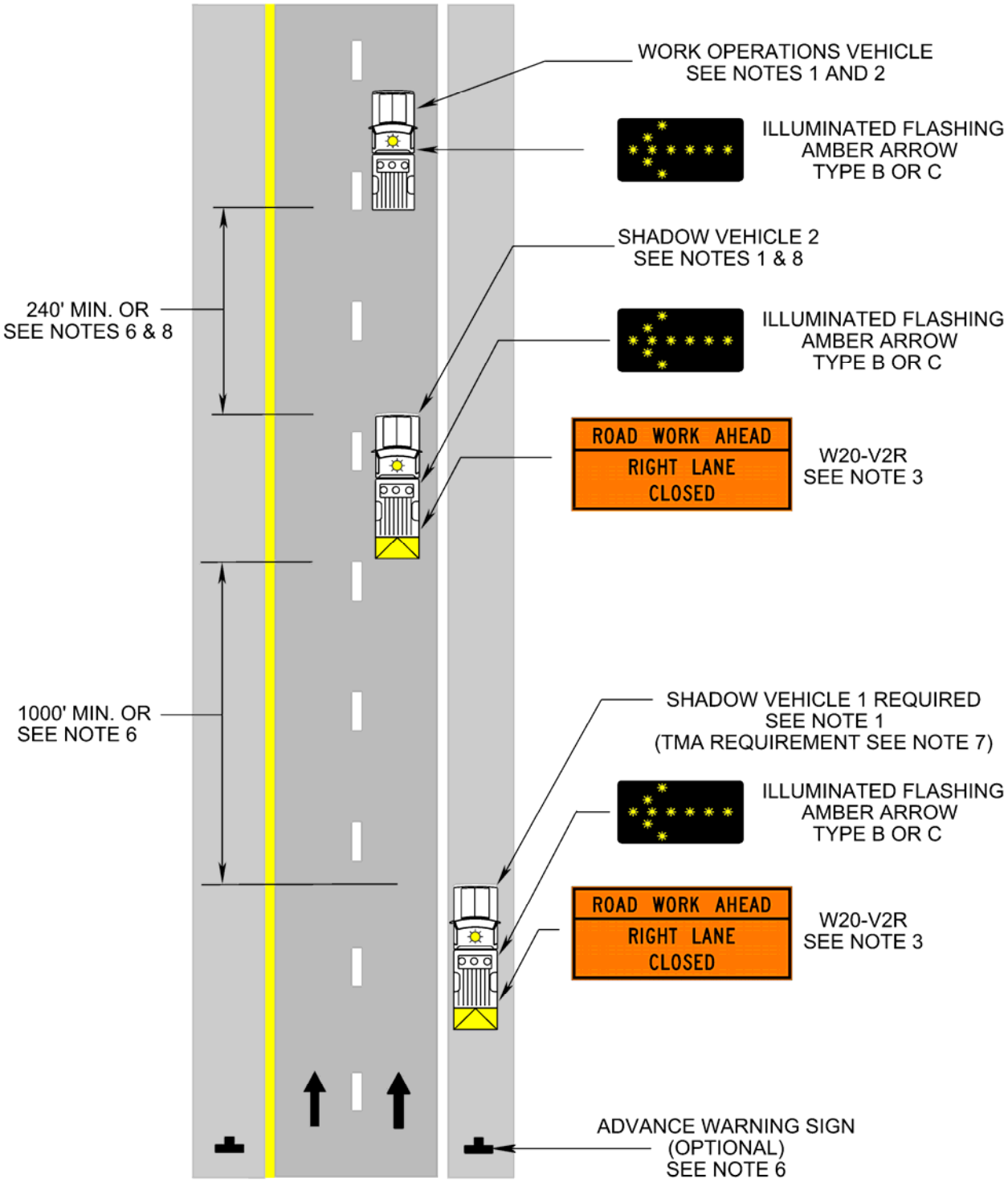
9. For inside lane closure operations, Shadow Vehicle 1 may be positioned on the right shoulder without arrow designation but displaying the caution mode.
10. When the operation is completely off the travelway, only one shadow vehicle will be required. A truck-mounted attenuator will not be required. The second line of the sign message shall be changed to “Right Shoulder” and the arrows shall be changed to the four corner caution mode.

Guidance:

11. *When using a CMS to replace the static sign and arrow board, each word message phase should be followed by the Type B arrow display.*

1: Revision 1 – 4/1/2015

Moving/Mobile Operations on a Multi-Lane Roadway
(Figure TTC-13.1)



Typical Traffic Control

Moving/Mobile Operations on a Two-Lane Roadway

(Figure TTC-14.1)

NOTES

Standard:

1. **Each vehicle involved in the moving/mobile operation shall be equipped with at least one high-intensity amber rotating, flashing, or[1] oscillating light. Illuminated flashing arrows on the advance warning vehicles and work operations vehicle shall be a Type B (60" x 30") or Type C (96" x 48"). Vehicle hazard warning signals shall not be used instead of rotating, flashing or oscillating[1] lights, but as a supplement**.
2. **Vehicle-mounted signs shall be mounted with the bottom of the sign at a minimum height of 48 inches above the pavement and mounted in a manner such that equipment or supplies do not obscure them. Sign legends shall be covered or turned from view when work is not in progress.**
3. **If using an arrow board on the shadow vehicle, it shall operate in the four corner caution mode.**

Guidance:

4. *Where practical and when needed, the work and shadow vehicles should pull over periodically to allow motor vehicle traffic to pass.*
5. *Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.*
6. *A truck-mounted attenuator should be used on the shadow vehicle.*

Option:

7. The distance between the work and shadow vehicles may vary according to speed, terrain, paint drying time, and other factors.

Guidance:

8. *If the work and shadow vehicles cannot pull over to allow motor vehicle traffic to pass frequently, a DO NOT PASS (R4-V6) sign should be placed on the rear of the shadow vehicle blocking the lane.*

Option:

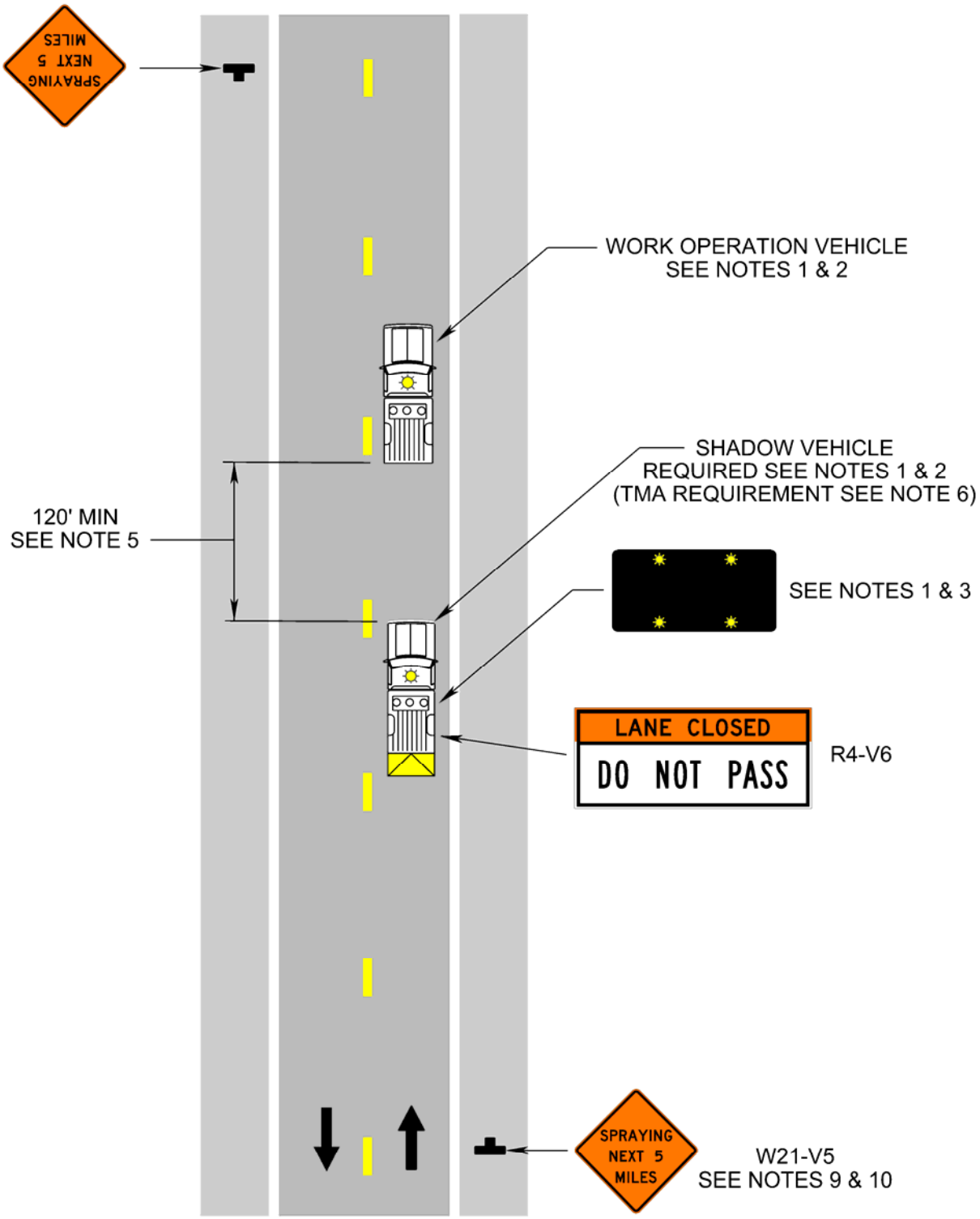
9. Signs may be fabricated to permit change of the message in the field to identify the type of moving operation (LINE PAINTING NEXT 5 MILES (W21-V4)). The maximum distance between the sign and protection vehicle is 5 miles.
10. Stationary signing may be eliminated on low volume (less than 500 vehicles per day), low speed (30 mph or less) roadways.
11. The static warning sign and caution mode arrow board may be replaced with a vehicle-mounted CMS with a minimum character height of 10".

Guidance:

12. *When using a CMS to replace the static sign and arrow board, each word message phase should be followed by the Type B arrow display.*

1: Revision 1 – 4/1/2015

Moving/Mobile Operation on a Two-Lane Roadway
(Figure TTC-14.1)



Typical Traffic Control

Short Duration Operation on a Multi-Lane Roadway

(Figure TTC-15.1)

NOTES

Standard:

1. **This typical traffic control layout shall be used only during non-peak travel periods with the approval of the Regional Traffic Engineer. This typical traffic control layout shall not be used for Limited Access highways or two-lane roadways.**
2. **Each vehicle involved in the operation shall have either an arrow board operating in the caution mode, or at least one high-intensity amber rotating, flashing or[1] oscillating light. Vehicle hazard warning signals shall not be used instead of rotating, flashing, or oscillating[1] lights, but as a supplement**.
3. **Vehicle-mounted signs shall be mounted with the bottom of the sign at a minimum height of 48 inches above the pavement.**

Guidance:

4. *The minimum distance between the sign/shadow vehicle and the truck-mounted attenuator (TMA) vehicle should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Option:

5. The static warning sign and arrow board may be replaced with a vehicle-mounted CMS with a minimum character height of 10".

Standard:

6. **If Shadow Vehicle 1 occupies any part of the travel lane, it shall be equipped with a TMA. A truck-mounted attenuator (TMA) shall be used on Shadow Vehicle 2 in the travelway regardless of the posted speed limit.**

Guidance:

7. *When using a CMS to replace the arrow board, each word message phase should be followed by the Type B arrow display.*

Support:

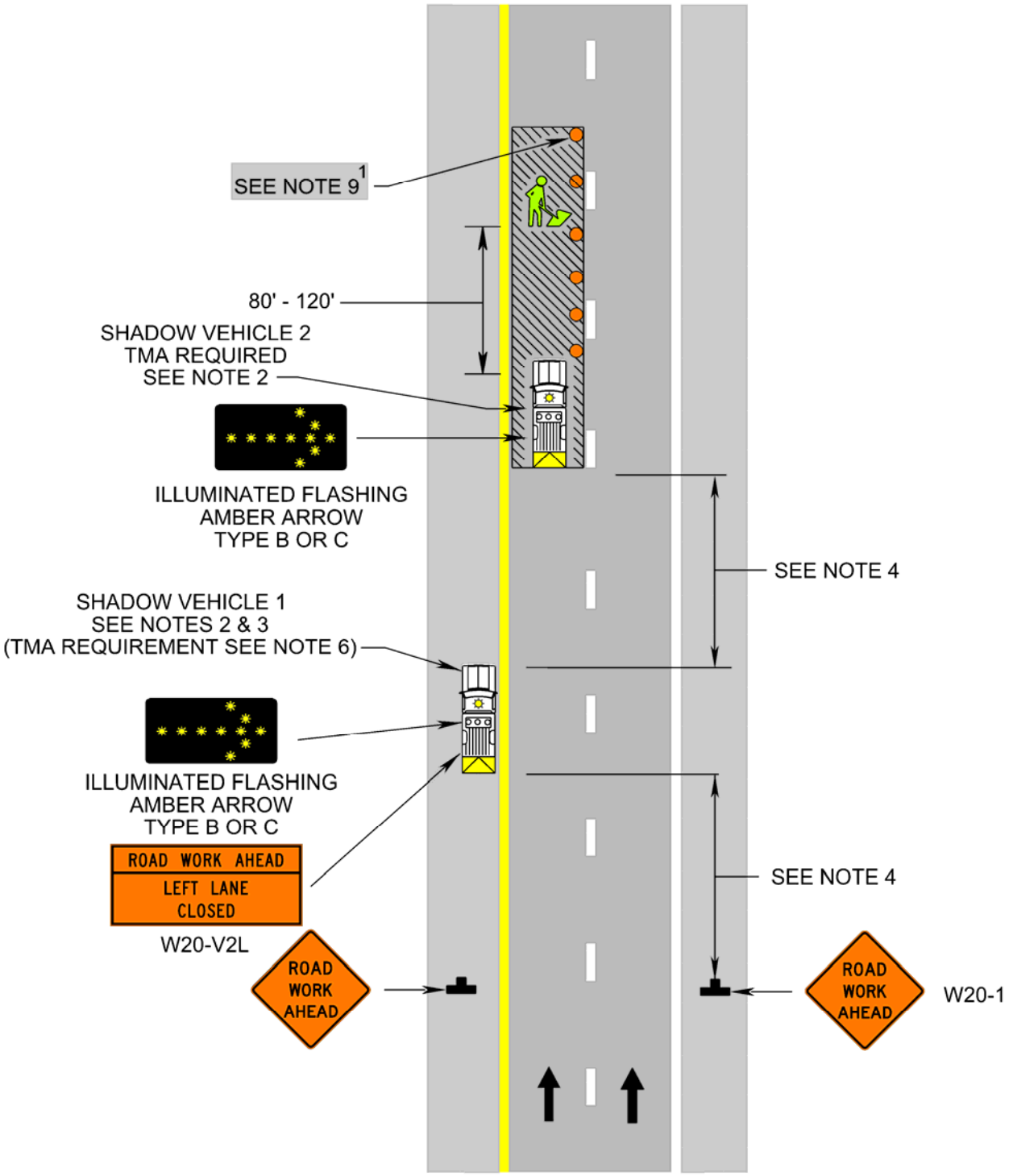
8. A short duration operation is defined as an operation that requires 16 minutes to 60 minutes to perform in the immediate area. (The immediate area is defined as a 1000' ± linear distance.)

Option:

9. The work area may be delineate by installing channelizing devices. The channelizing devices would start at the front of the shadow vehicle and extend through the work area. The spacing between channelizing devices may be reduced in the travelway to prevent motorists from entering the work area.[1]

1: Revision 1 – 4/1/2015

Short Duration Operation on a Multi-Lane Roadway
(Figure TTC-15.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Outside Lane Closure Operation on a Four-Lane Roadway

(Figure TTC-16.1)

NOTES

Standard:

1. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Guidance:

2. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
3. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*
4. *All vehicles, equipment, workers, and their activities should be restricted to one side of the pavement.*

Standard:

5. **Taper Length (L) and Channelizing Device Spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

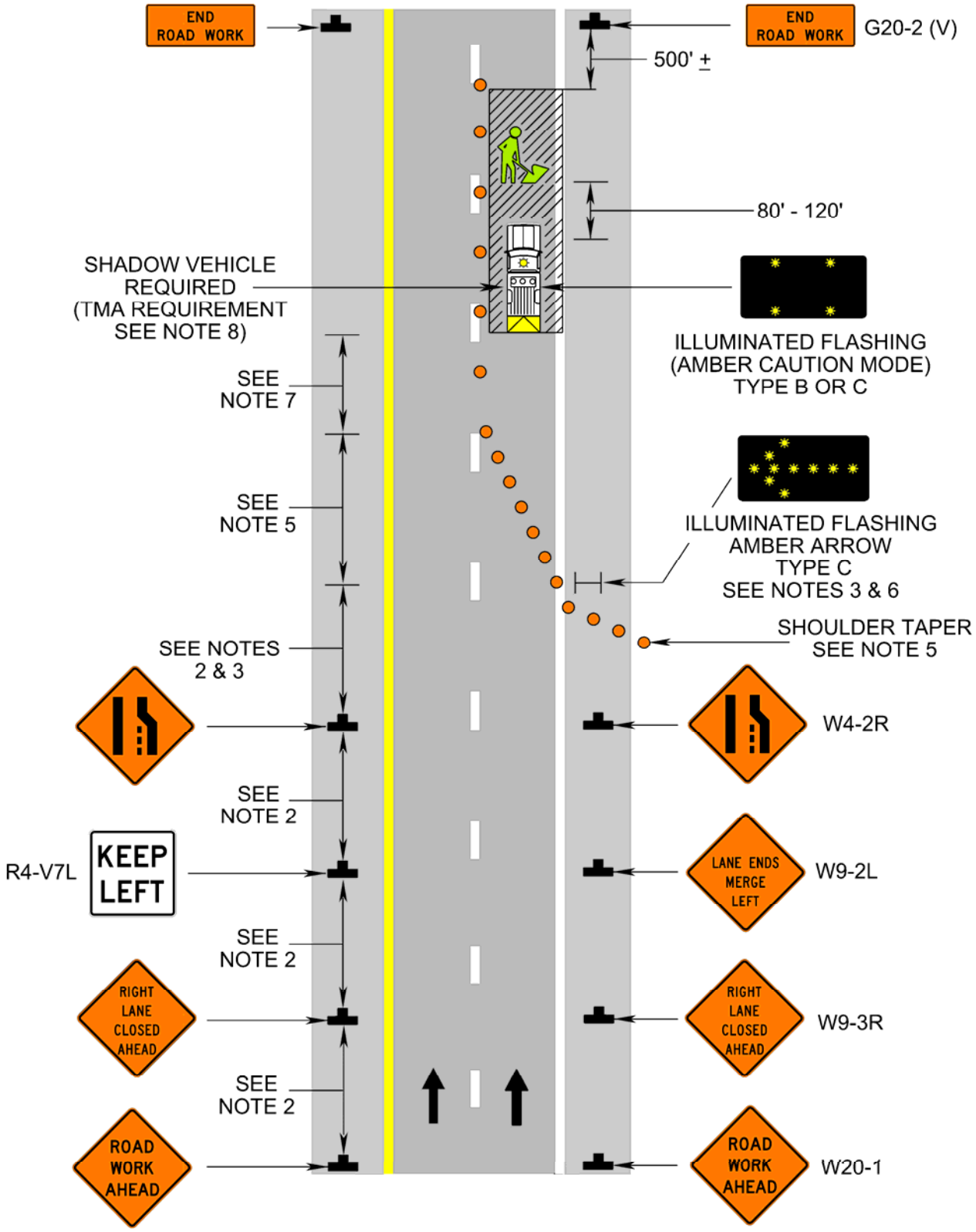
Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

6. **An arrow board shall be used when a lane is closed. When more than one lane is closed, a separate arrow board shall be used for each closed lane (see Figure TTC-18).**
7. **The buffer space length shall be shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
8. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one high intensity amber rotating, flashing, or[1] oscillating light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
9. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights but can be used to supplement the amber rotating, flashing, or[1] oscillating lights.**
10. **When a side road intersects the highway within the TTC zone, additional TTC devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Outside Lane Closure Operation on a Four-Lane Roadway
(Figure TTC-16.1)



Typical Traffic Control

Inside Lane Closure Operation on a Four-Lane Roadway

(Figure TTC-17.1)

NOTES

Standard:

1. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Guidance:

2. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
3. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*
4. *All vehicles, equipment, workers, and their activities should be restricted to one side of the pavement.*

Standard:

5. **Taper length (L) and channelizing device spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

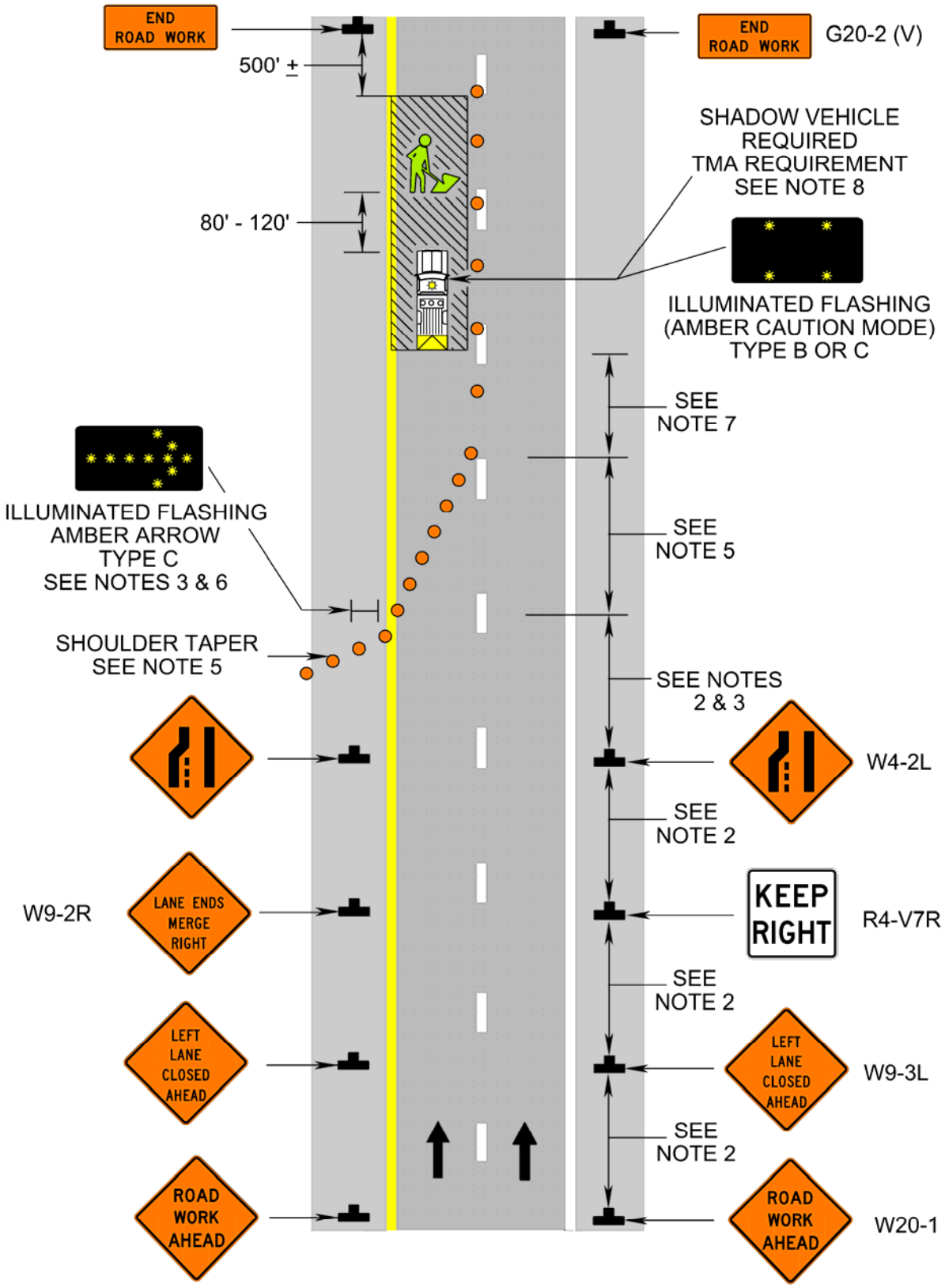
Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

6. **An arrow board shall be used when a lane is closed. When more than one lane is closed, a separate arrow board shall be used for each closed lane (see Figure TTC-18).**
7. **The buffer space length shall be shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
8. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one high intensity amber rotating, flashing, or[1] oscillating light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
9. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or oscillating lights but can be used to supplement the amber rotating, flashing, or[1] oscillating lights.**
10. **When a side road intersects the highway within the TTC zone, additional TTC devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Inside Lane Closure Operation on a Four-Lane Roadway
(Figure TTC-17.1)



Typical Traffic Control
Multi-Lane Closure Operation
(Figure TTC-18.1)
NOTES

Standard:

1. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Guidance:

2. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
3. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*
4. *All vehicles, equipment, workers, and their activities should be restricted to one side of the pavement.*

Standard:

5. **Taper length (L) and channelizing device spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

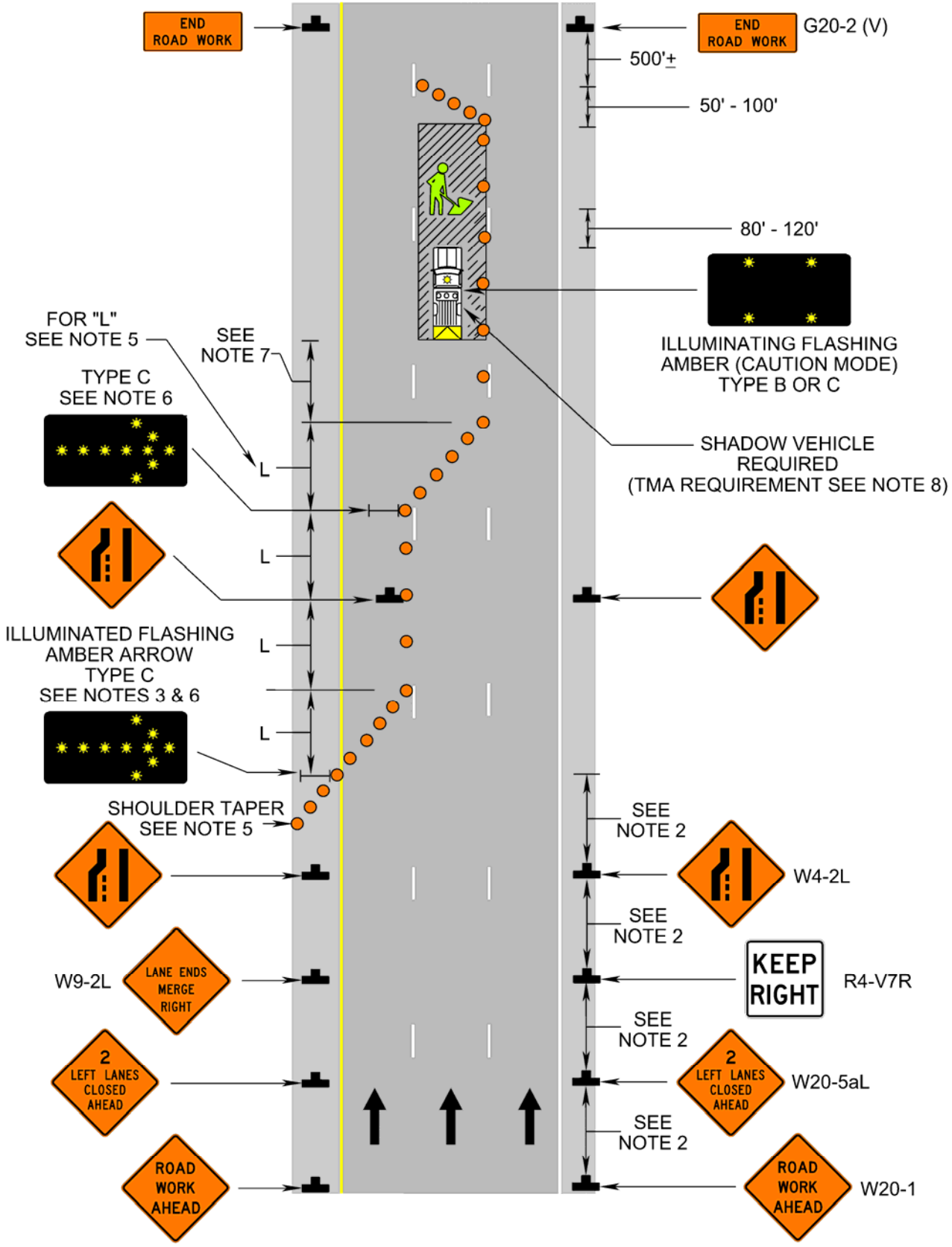
Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

6. **An arrow board shall be used when a lane is closed. When more than one lane is closed, a separate arrow board shall be used for each closed lane.**
7. **The buffer space length shall be shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
8. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one high intensity amber rotating, flashing, or[1] oscillating light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
9. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**
10. **When a side road intersects the highway within the TTC zone, additional TTC devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Multi-Lane Closure Operation
(Figure TTC-18.1)



Typical Traffic Control

Lane Closure Operation with Lane Weave

(Figure TTC-19.1)

NOTES

Standard:

1. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Guidance:

2. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
3. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*
4. *All vehicles, equipment, workers, and their activities should be restricted to one side of the pavement.*

Standard:

5. **Taper length (L) and channelizing device spacing shall be:**

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 = ⅓ L Minimum				

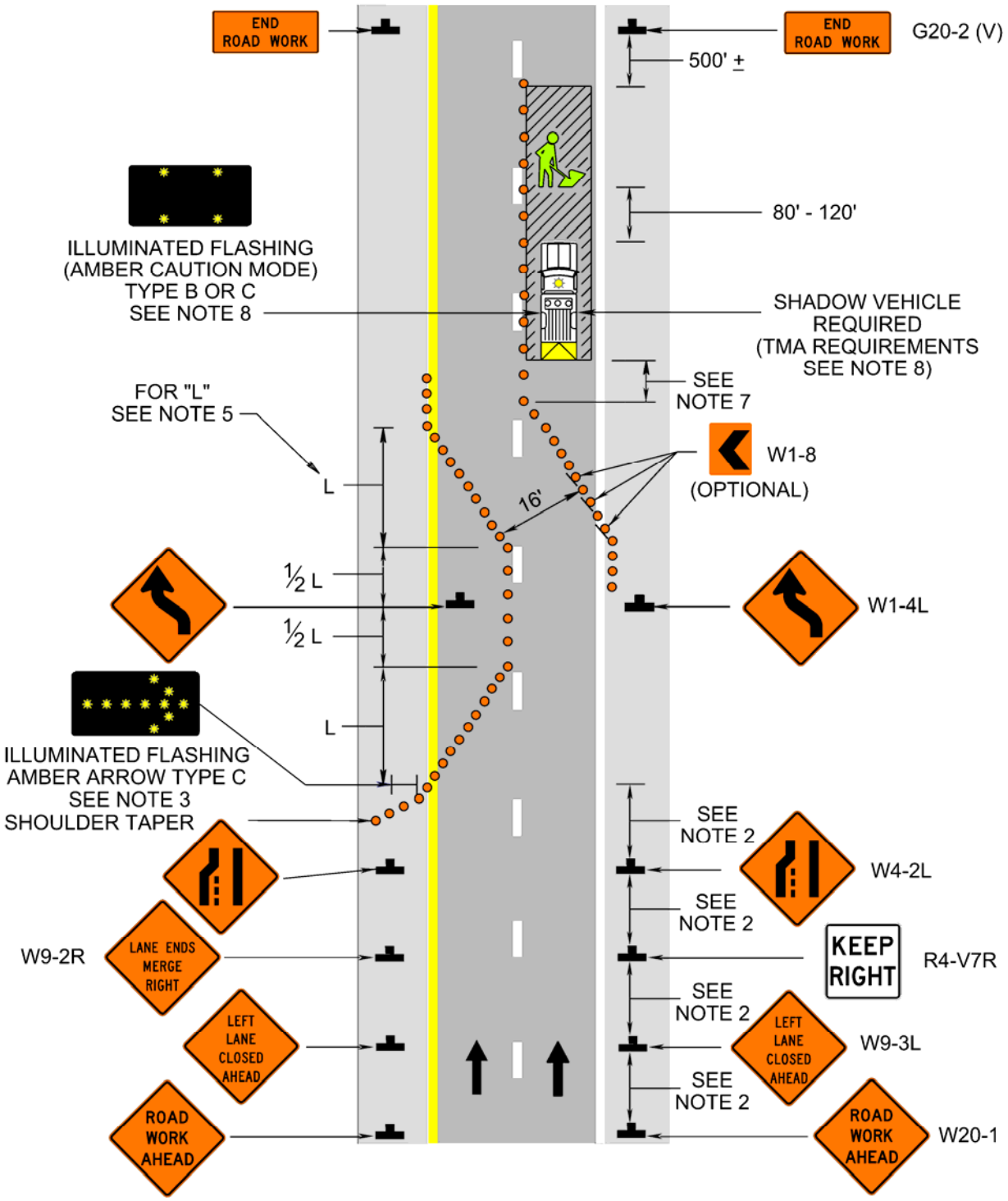
Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

6. **An arrow board shall be used when a lane is closed. When more than one lane is closed, a separate arrow board shall be used lane.**
7. **The buffer space length shall be shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
8. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one high intensity amber rotating, flashing, or[1] oscillating light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
9. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**
10. **When a side road intersects the highway within the TTC zone, additional TTC devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Lane Closure Operation with Lane Weave
(Figure TTC-19.1)



Typical Traffic Control
Lane Closure Operation with Temporary Traffic Barrier [1]
(Figure TTC-20.1)
NOTES

Guidance:

1. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
2. *SHOULDER CLOSED (W21-5a) signs should be used on Limited-Access Highways where there is no opportunity for disabled vehicles to pull off the roadway (see Figure TTC-6).*
3. *If drivers cannot see a pull-off area beyond the closed shoulder, information regarding the length of the shoulder closure should be provided in feet or miles, as appropriate.*
4. *An emergency pull-off area should be provided per Section 6G.18 and Temporary Traffic Control Figure TTC-8.*

Standard:

5. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
6. **Group 2 channelizing device spacing shall be at the following:**

Location	Posted Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'

7. **Length of pavement marking transition (L) is equal to Posted Speed (S) times the Width of Transition (W) (Example: 55 mph x 12'=660'), 1000' minimum for Limited Access highways.**
8. **Barrier transition flare rate[1] shall be as follows:**

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

When the barrier transition flare[1] is on a horizontal alignment, the total offset shall be prorated around the curve in lieu of a straight-line flare.

9. **End treatment of a barrier in order of preference:**
   a. **Where guardrail exists, attach to barrier with appropriate fixed object attachment.**
   b. **Where cut slope exists, bury barrier into cut slope and provide for drainage as needed.**
   c. **Extend end of barrier until it is beyond the established clear zone (see Figure 2 on Page A-4 of Appendix A for clear zone values).**
   d. **When barrier end is inside the established clear zone, attenuator service Type I or Type II shall be used. Refer to L&D special design drawings.**
10. **Barrier panels 8 inches in width and 12 inches in height shall be placed on top of the concrete barrier and spaced 80' on centers along the parallel or tangent sections and 40' on centers along the transition or taper sections. Reflectorized surface shall be fluorescent orange prismatic lens sheeting. The light at the beginning of the barrier run and at the breakpoint where the barrier becomes parallel to the roadway shall be a Type B flashing light. Barrier delineators shall be installed along the traffic side of the concrete barrier in-between and at the same spacing as the barrier panels approximately 24 inches up from the roadway surface.**

Guidance:

11. *Eradication of existing pavement markings should be as shown in Figure TTC-55.*

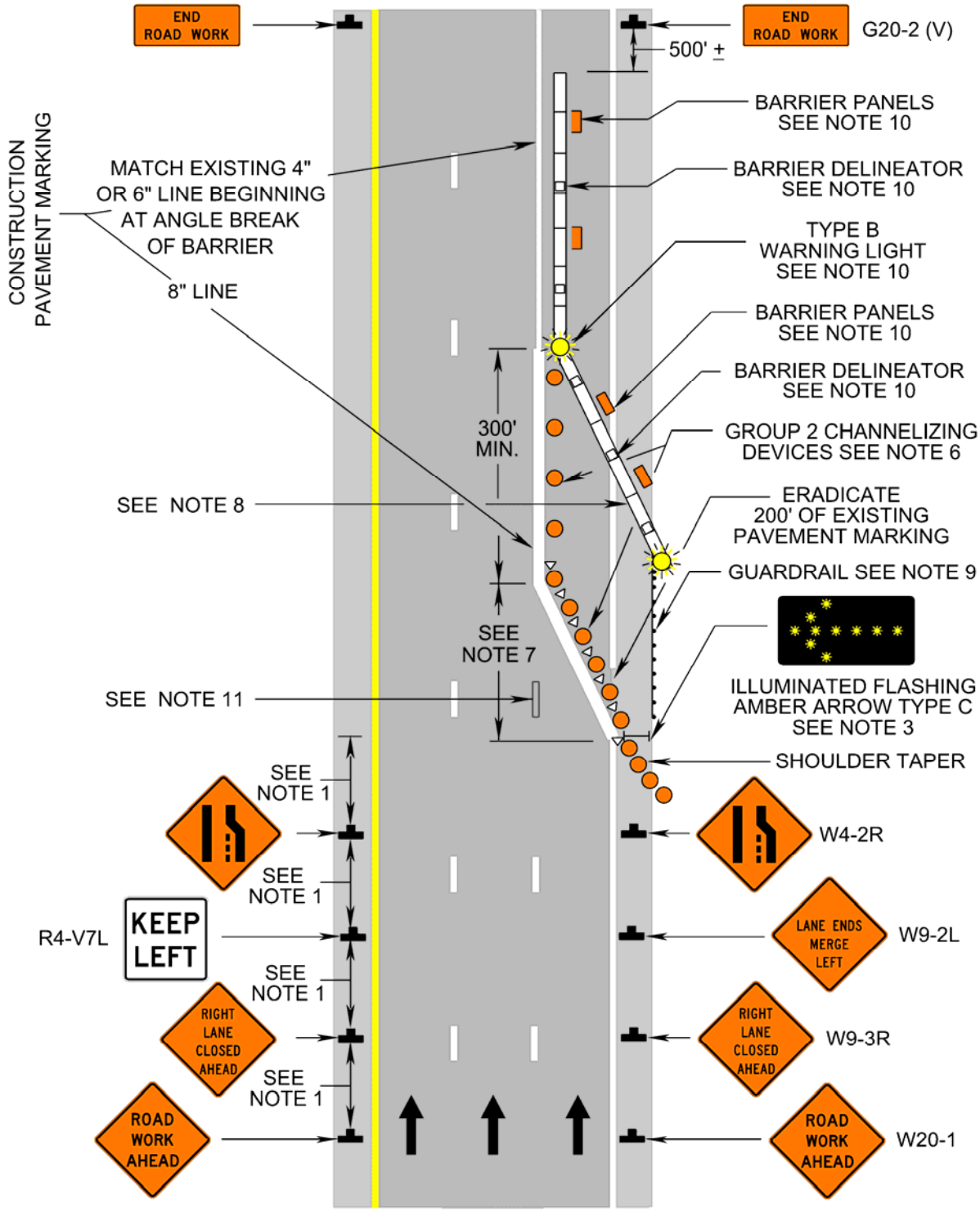
Option:

12. The barrier shown in this typical application is an example of one method that may be used to close a shoulder on a long-term project.

1: Revision 1 – 4/1/2015

Lane Closure Operation with Temporary Traffic Barrier [1]

(Figure TTC-20.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Center Turn Lane Closure Operation

(Figure TTC-21.1)

NOTES

Guidance:

1. *The distance between signs and beginning of channelizing device transition should be a minimum of 500' and a maximum of 800'.*
2. *The buffer space length should be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.*
3. *For locations with a high volume of left turning movements, the graphic NO LEFT TURN (R3-2) signs should be used within the closed lane.*

Option:

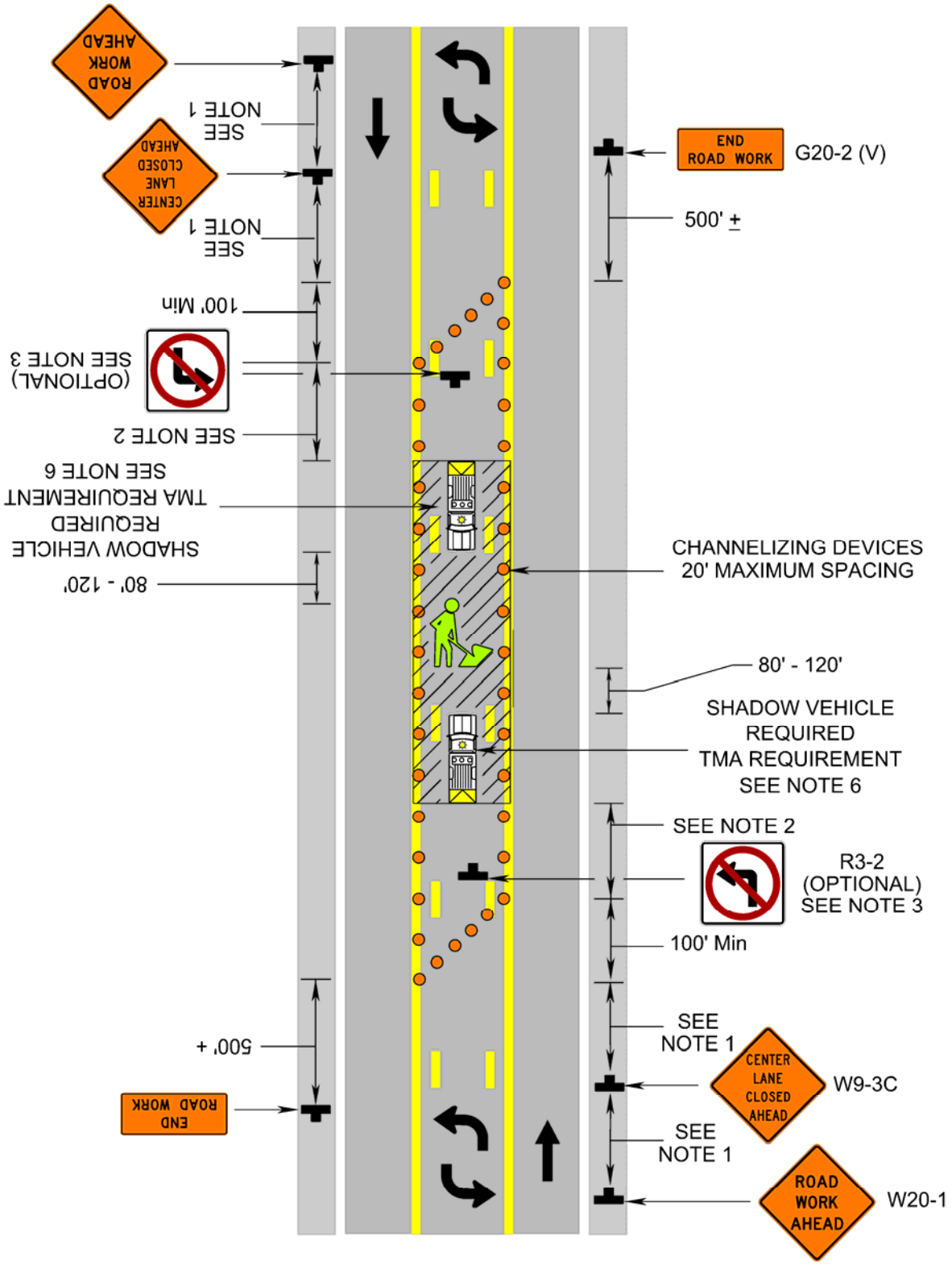
4. Where Right-of-Way or geometric conditions prevent use of 48" x 48" signs, 36" x 36" signs may be used.

Standard:

5. **To prevent vehicles from entering into the work zone, channelizing device spacing shall be a maximum of 20' on center.**
6. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one rotating amber light or high intensity amber flashing or oscillating[1] light shall be parked 80'-120' in advance of the work crew in both directions of travel. If multiple lanes are present (four or more lanes, excluding the center turn lane) and the posted speed limit is 45 mph or greater, the vehicles shall be equipped with a truck-mounted attenuator (TMA).**
7. **When a side road intersects the highway within the temporary traffic control zone, additional traffic control devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Center Turn Lane Closure Operation
(Figure TTC-21.1)



Typical Traffic Control
Right Lane Closure Operation on a Three-Lane Roadway
(Figure TTC-22.1)
NOTES

Guidance:

1. *The distance between signs and beginning of channelizing device transition should be a minimum of 500' and a maximum of 800'.*
2. *The buffer space length should be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.*
3. *For locations with a high volume of left turning movements, the graphic NO LEFT TURN (R3-2) signs should be used within the closed lane.*

Option:

4. Where Right-of-Way or geometric conditions prevent use of 48" x 48" signs, 36" x 36" signs may be used.

Standard:

5. **Taper length (L) and channelizing device spacing shall be :**

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 = ⅓ L Minimum				

Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

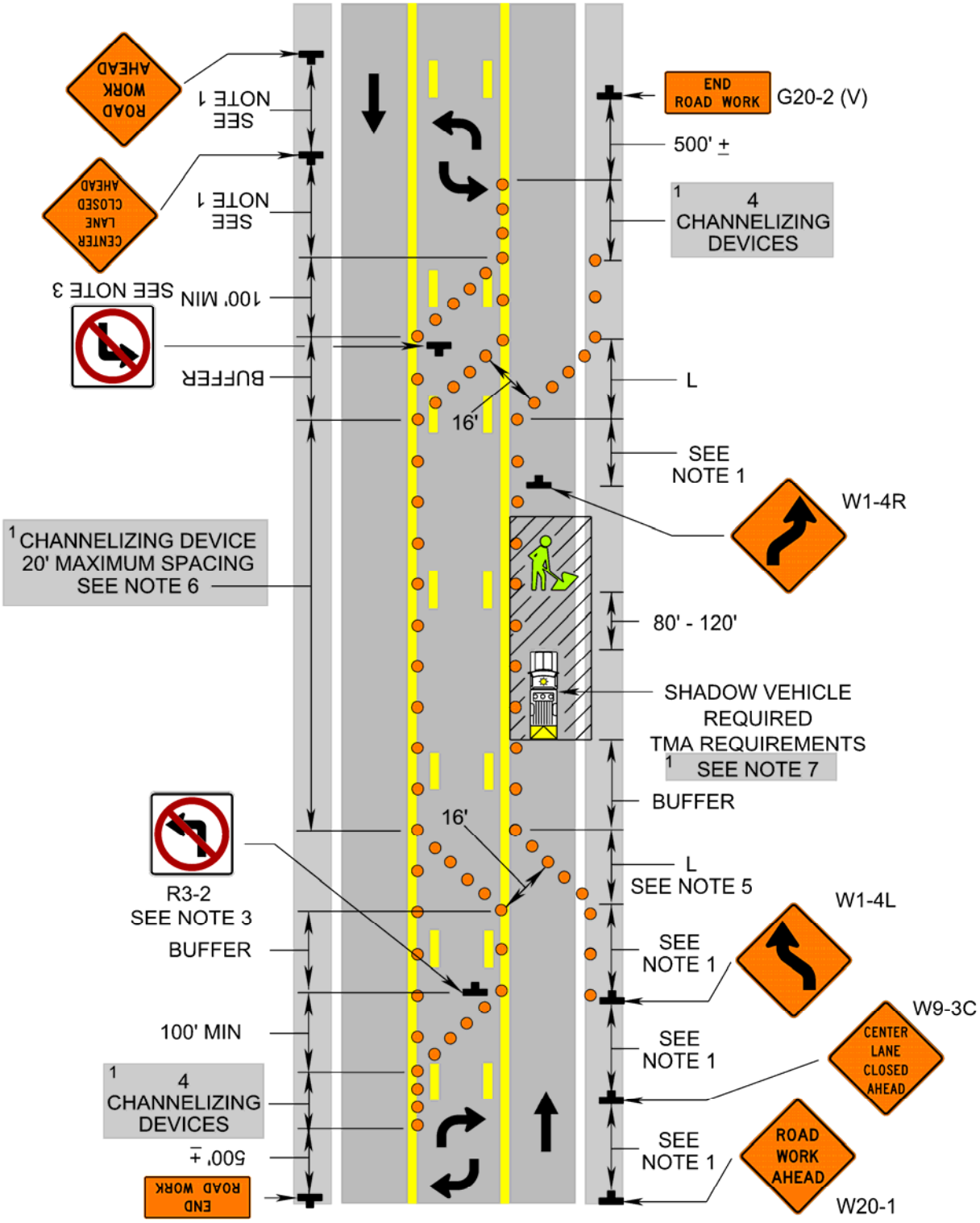
6. **To prevent vehicles from entering into the buffer and activity areas[1], channelizing device spacing shall be a maximum of 20' on center.**
7. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one rotating amber light or high intensity amber flashing or oscillating[1] light shall be parked 80'-120' in advance of the work crew in both directions of travel. If multiple lanes are present (four or more lanes, excluding the center turn lane) and the posted speed limit is 45 mph or greater, the vehicles shall be equipped with a truck-mounted attenuator (TMA).**
8. **When a side road intersects the highway within the temporary traffic control zone, additional traffic control devices shall be placed as needed.**
9. **For long-term work zones existing conflicting pavement markings and markers shall be removed and temporary pavement markings and markers shall be installed per Figure TTC-60.**

Guidance:

10. *When channelizing devices have the potential of leading vehicular traffic out of the intended traffic space, the channelizing devices should be extended a distance with 4 additional channelizing devices beyond the downstream end of the transition area as depicted.*[1]

1: Revision 1 – 4/1/2015

Right Lane Closure Operation on a Three-Lane Roadway
(Figure TTC-22.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Lane Closure on a Two-Lane Roadway Using Flaggers

(Figure TTC-23.1)

NOTES

Guidance:

1. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
2. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the flagger station and transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. Generally speaking, motorists should have a clear line of sight from the graphic flagger symbol sign to the flagger.*

Option:

3. Where Right-of-Way or geometric conditions prevent the use of 48" x 48" signs, 36" x 36" signs may be used.

Standard:

4. **Flagging stations shall be located far enough in advance of the work space to permit approaching traffic to reduce speed and/or stop before passing the work space and allow sufficient distance for departing traffic in the left lane to return to the right lane before reaching opposing traffic (see Table 6H-3 on Page 6H-5).**
5. **All flaggers shall be state certified and have their certification card in their possession when performing flagging duties (see Section 6E.01, Qualifications for Flaggers).**
6. **Cone spacing shall be based on the posted speed and the values in Table 6H-4 on Page 6H-6.**[1]
7. **A shadow vehicle with at least one high intensity amber rotating, flashing, or**[1] **oscillating light shall be parked 80'-120' in advance of the first work crew.**

Option:

8. A supplemental flagger may be required in this area to give advance warning of the operation ahead by slowing approaching traffic prior to reaching the flagger station or queued traffic.

Guidance:

9. *If the queue of traffic reaches the BE PREPARED TO STOP (W3-4) sign then the signs, and if used the portable temporary rumble strips (PTRS)*[1]*, should be readjusted at greater distances.*
10. *When a highway-rail crossing exists within or upstream of the transition area and it is anticipated that queues resulting from the lane closure might extend through the highway-rail grade crossing, the temporary traffic control zone should be extended so that the transition area precedes the highway-rail crossing (see Figure TTC-56 for additional information on highway-rail crossings).*

Standard:

11. **At night, flagger stations shall be illuminated, except in emergencies (see Section 6E.08).**

Option:

12. Cones may be eliminated when using a pilot vehicle operation or when the total roadway width is 20 feet or less.
13. For low-volume situations with short work zones on straight roadways where the flagger is visible to road users approaching from both directions, a single flagger, positioned to be visible to road users approaching from both directions, may be used (see Chapter 6E).

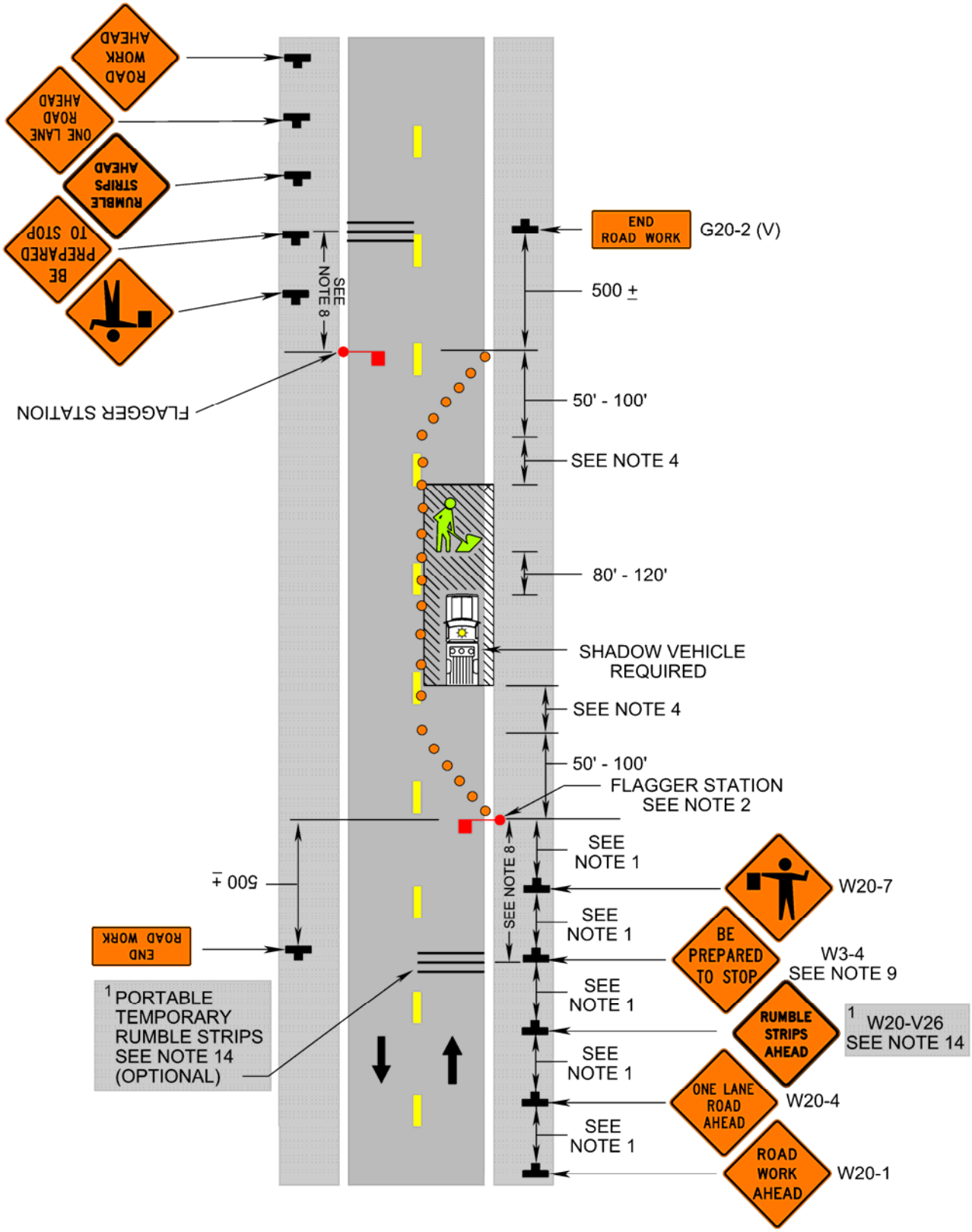
Standard:[1]

14. **When approved for use, three portable temporary rumble (PTRS) strips shall be installed across the entire travel lane adjacent to the BE PREPARED TO STOP (W3-4) sign. The portable temporary rumble strips shall be monitored and adjusted as necessary during the work shift to ensure proper placement on the roadway. When the PTRS are installed, the RUMBLE STRIPS AHEAD (W20-V26) sign shall also be utilized.**

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

1: Revision 1 – 4/1/2015

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



1: Revision 1 – 4/1/2015

Typical Traffic Control

Non-Stationary Operation on a Two-Lane Roadway Using Flaggers

(Figure TTC-24.1)

NOTES

Guidance:

1. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
2. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the flagger station and transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. Generally speaking, motorists should have a clear line of sight from the graphic flagger symbol sign to the flagger.*

Option:

3. Where Right-of-Way or geometric conditions prevent the use of 48" x 48" signs, 36" x 36" signs may be used.

Standard:

4. **Flagging stations shall be located far enough in advance of the work space to permit approaching traffic to reduce speed and/or stop before passing the work space and allow sufficient distance for departing traffic in the left lane to return to the right lane before reaching opposing traffic (see Table 6H-3 on Page 6H-5).**
5. **The Flagger (W20-7) symbol sign shall stay within ½ mile of each flagger.**

Guidance:

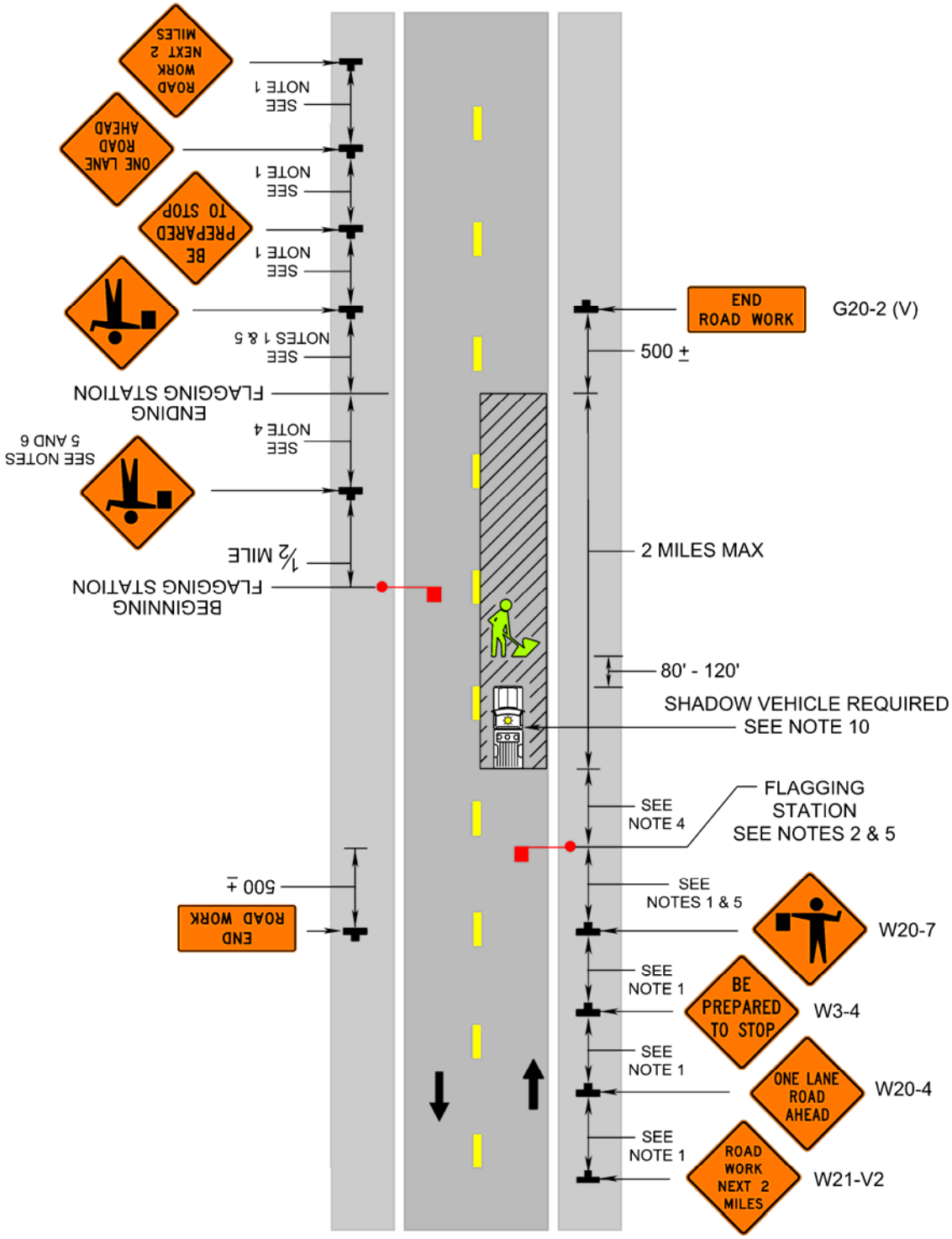
6. *Additional Flagger symbol signs should be placed at ½ mile intervals and either erected by the approaching flagger, or taken down as the operation proceeds past this point.*
7. *When a highway-rail crossing exists within or upstream of the transition area and it is anticipated that queues resulting from the lane closure might extend through the highway-rail grade crossing, the temporary traffic control zone should be extended so that the transition area precedes the highway-rail crossing (see Figure TTC-56 for additional information on highway-rail crossings).*
8. *If the queue of traffic reaches the BE PREPARED TO STOP (W3-4) sign, then the advance warning signs should be readjusted at greater distances.*

Standard:

9. **All flaggers shall be state certified and have their certification card in their possession when performing flagging duties (see Section 6E.01, Qualifications for Flaggers).**
10. **A shadow vehicle with at least one amber rotating, flashing or[1] oscillating lights shall be parked 80'-120' in advance of the first work crew.**
11. **The maximum length of the work area shall be two miles.**

1: Revision 1 – 4/1/2015

Non-Stationary Operation on a Two-Lane Roadway Using Flaggers
(Figure TTC-24.1)



Typical Traffic Control

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

(Figure TTC-25.1)

NOTES

Standard:

1. **TTC signals shall be planned, installed and operated in accordance with the provisions of Part 4 of the 2009 MUTCD, the Road and Bridge Specifications, and the Road and Bridge Standards.**
2. **TTC signal timing shall be established by the appropriate approving agency. Duration of red clearance intervals shall be adequate to clear the one-lane section of conflicting vehicles.**
3. **When the TTC signal is changed to the flashing mode, either manually or automatically, red signal indications shall be flashed to both approaches.**
4. **Stop lines shall be installed with TTC signals for intermediate and long-term closures. Existing conflicting pavement markings and raised pavement marker reflectors between the activity area and the stop lines shall be removed. After the TTC signal is removed, the stop lines and other temporary pavement markings shall be removed and the permanent pavement markings restored.**
5. **Safeguards shall be incorporated to avoid the possibility of conflicting signal indications at each end of the TTC zone.**
6. **A RESTRICTED WIDTH ROUTE (R5-V1) sign shall be installed on roadways where construction/maintenance activities exist with physical barriers on both sides of a single lane and the clear distance is less than 14 feet. The signs shall also be installed in advance of the last alternate route.**
7. **The Regional Traffic Engineer shall determine speed reductions.**
8. **An engineering study shall be conducted to determine if intersection(s) and entrance(s) within the work zone need signalization and the use of positive barrier versus channelizing devices shall be determined. Group 2 channelizing device spacing shall be at the following:**

Location	Posted Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

9. **The buffer space length shall be shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**

Guidance:

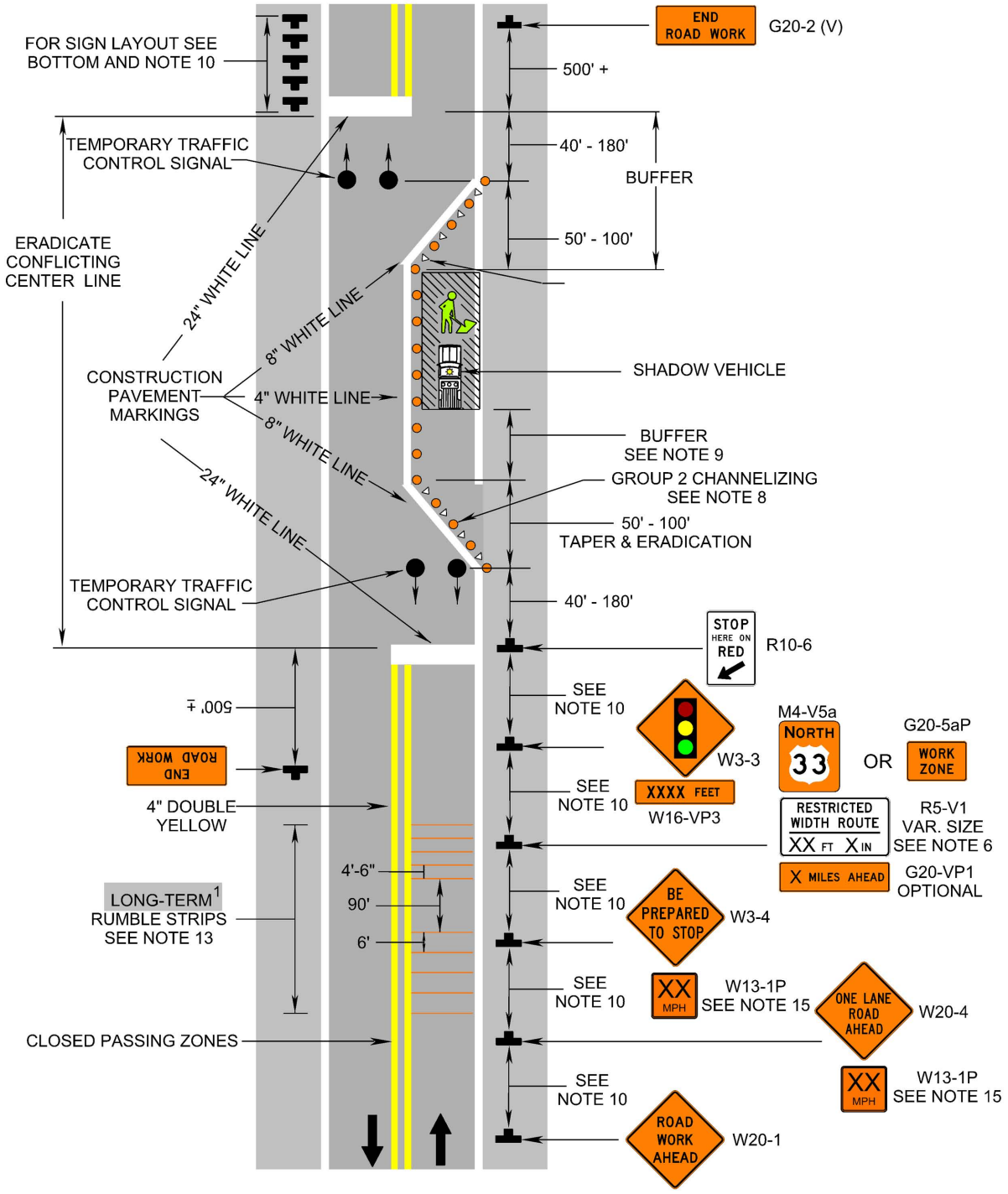
10. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph. Refer to Table 6C-1, Spacing of Advance Warning Signs for urban sign spacing. Adjustments in the location of the advance warning signs should be made as needed to accommodate the horizontal or vertical alignment of the roadway.*
11. *Where no-passing lines are not already in place, they should be added.*
12. *Additional RESTRICTED WIDTH ROUTE (R5-V1) signs should be installed on the approaches of the alternate route to alert traffic intending to turn onto the restricted route.*

Option:

13. Long-term[1] rumble strips may be used to enhance the work zone.
14. Flashing warning lights may be used on advance warning signs.
15. Advisory Speed (W13-1P) plaques may be added to the ONE LANE ROAD AHEAD (W20-4) and BE PREPARED TO STOP (W3-4) signs as directed by the Regional Traffic Engineer.
16. Temporary Signals may be replaced with either a STOP (R1-1) condition or YIELD (R1-2) condition based on an engineering study and approval of the Regional Traffic Engineer.

1: Revision 1 – 4/1/2015

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



1: Revision 1 – 4/1/2015

Typical Traffic Control

Lane Closure Operation – Near Side of an Intersection

(Figure TTC-26.1)

NOTES

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. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **Taper length (L) and channelizing device spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

On three or more lane roadways, the merging tapers shall be installed as shown in TTC-18.

Guidance:

4. *If room permits, a shadow vehicle with at least one rotating, oscillating, or amber strobe light should be parked 80'-120' in advance of the first work crew.*

Standard:

5. **If the posted speed limit is 45 mph or greater, the shadow vehicle shall have a truck-mounted attenuator.**
6. **For emergency situations (any non-planned operation) of 30 minutes or less duration, two rotating amber lights or two high intensity amber flashing or oscillating[1] lights mounted on the vehicle and visible for 360° shall be required in addition to the channelizing devices shown around the vehicle. Also, vehicle hazard warning signals shall be used.**

Guidance:

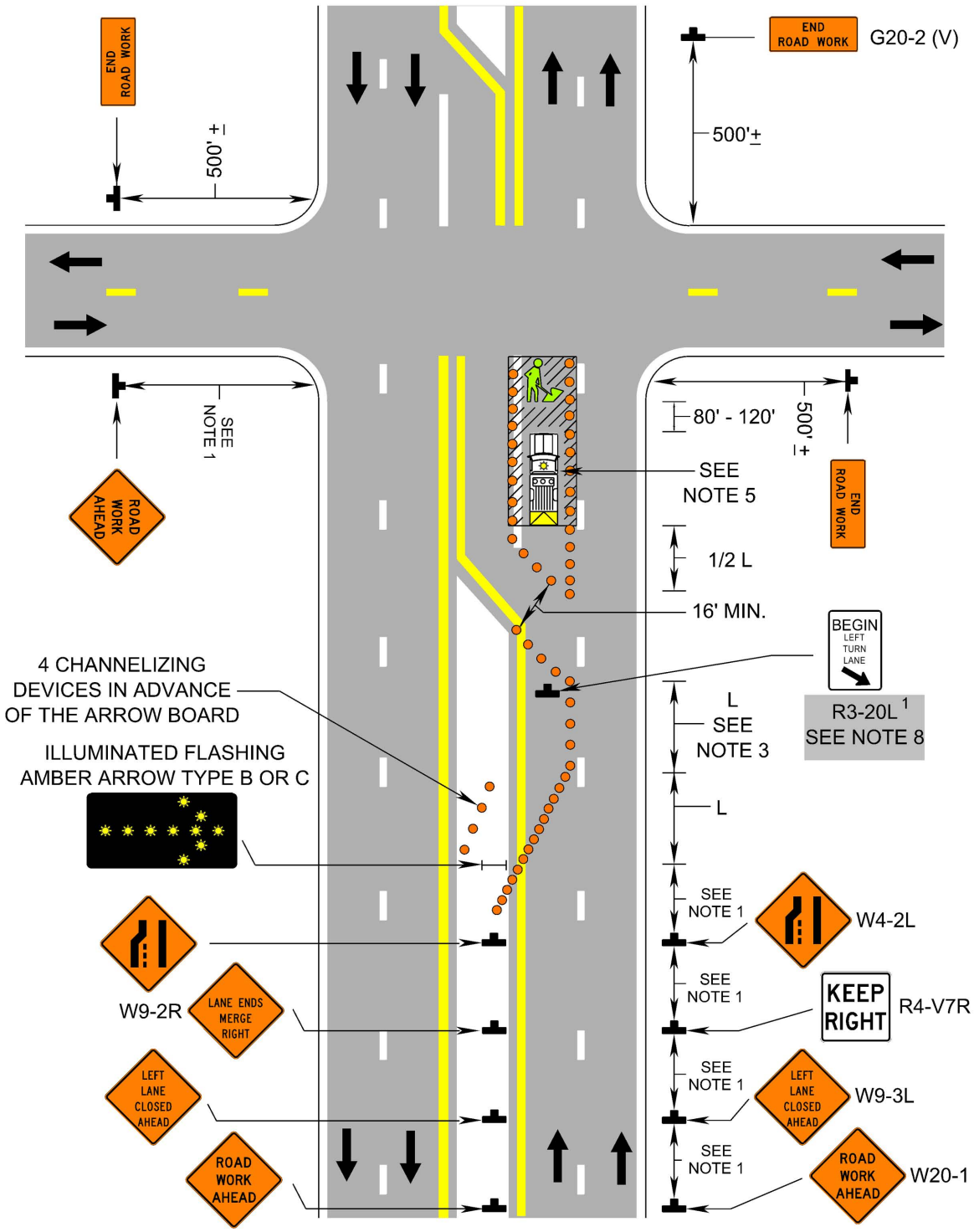
7. *If the work space extends across a crosswalk, the crosswalk should be closed using the information and devices shown in Figure TTC-36.*

Standard:

8. **If the left turn lane is closed a NO LEFT TURN (Symbol) (R3-2) shall be used.[1]**

1: Revision 1 – 4/1/2015

Lane Closure Operation - Near Side of an Intersection
(Figure TTC-26.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Lane Closure Operation – Far Side of an Intersection

(Figure TTC-27.1)

NOTES

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. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **Taper length (L) and channelizing device spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

Guidance:

4. *If room permits, a shadow vehicle with at least one amber[1] rotating, oscillating, or high intensity flashing[1] light should be parked 80'-120' in advance of the first work crew.*

Standard:

5. **If the posted speed limit is 45 mph or greater, the shadow vehicle shall have a truck-mounted attenuator.**
6. **For emergency situations (any non-planned operation) of 30 minutes or less duration, two rotating amber lights or high intensity amber flashing or oscillating[1] lights mounted on the vehicle and visible for 360° shall be required in addition to the channelizing devices shown around the vehicle. Also, vehicle hazard warning signals shall be used.**

Guidance:

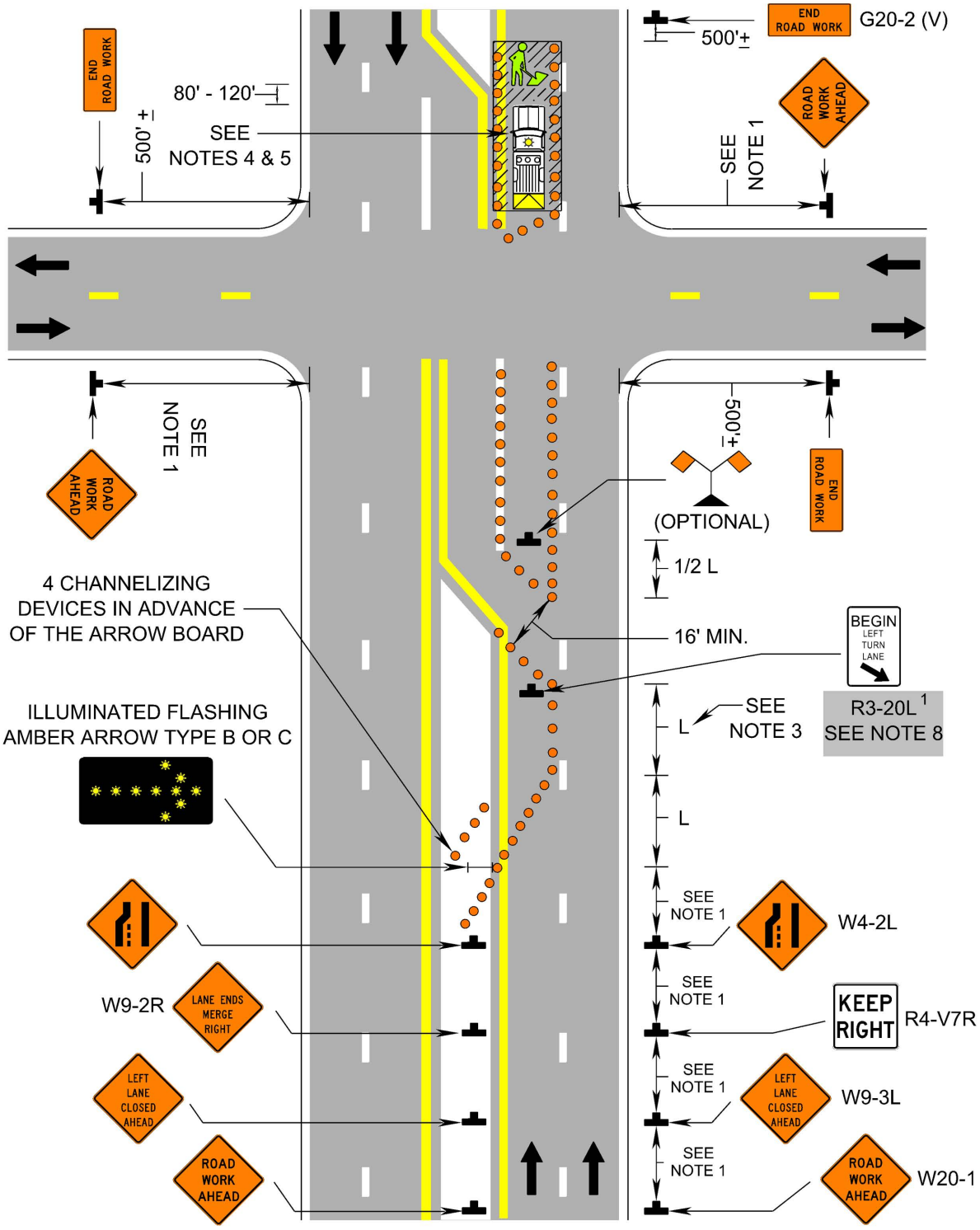
7. *If the work space extends across a crosswalk, the crosswalk should be closed using the information and devices shown in Figure TTC-36.*

Standard:

8. **If the left turn lane is closed a NO LEFT TURN (Symbol) (R3-2) shall be used.[1]**

1: Revision 1 – 4/1/2015

Lane Closure Operation - Far Side of an Intersection
(Figure TTC-27.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Lane Closure Operation in an Intersection

(Figure TTC-28.1)

NOTES

Guidance:

1. *The control of traffic through the intersection in order of preference should be:*
   a. *Obtain the services of law enforcement personnel.*
   b. *Detour the effective routes to other roads and streets as approved and directed by the Regional Traffic Engineer.*
   c. *Place a state certified flagger on each leg of the intersection controlling a single lane of traffic.*

   Appropriate signing as shown should be used for law enforcement and flagging operations. For detour signs see Figure TTC-34.
2. *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:

3. **Channelizing device spacing shall be on 20' centers or less.**

Guidance:

4. *If room permits, a shadow vehicle with at least one rotating amber light or high intensity amber flashing or oscilllating[1] light should be parked 80'-120' in advance of the first work crew.*

Standard:

5. **For emergency situations (any non-planned operation) of 30 minutes or less duration, two rotating amber lights or high intensity amber flashing or oscillating[1] lights mounted on the vehicle and visible for 360° shall be required in addition to the channelizing devices shown around the vehicle. Also, vehicle hazard warning signals shall be used.**

Guidance:

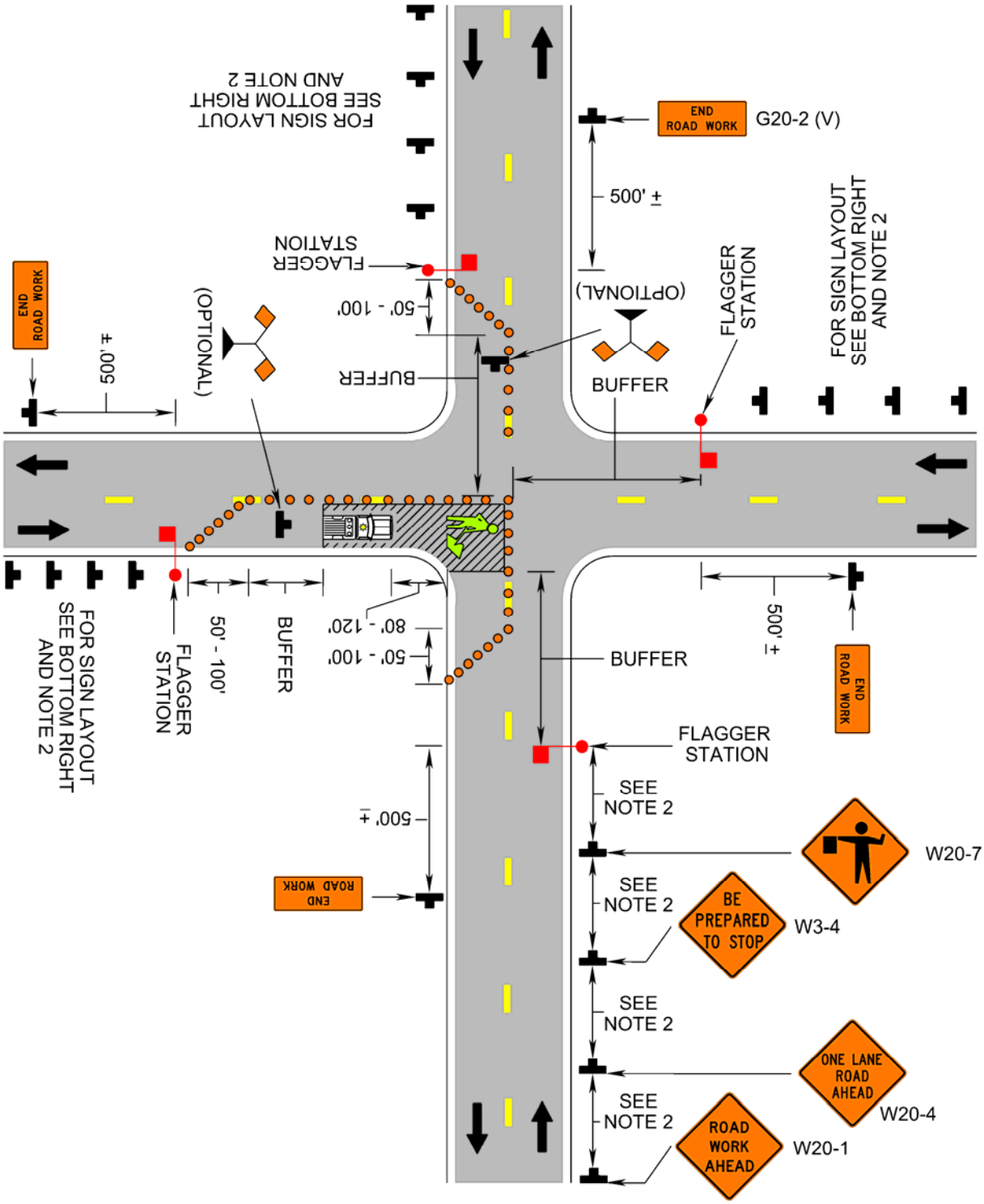
6. *If the work space extends across a crosswalk, the crosswalk should be closed using the information and devices shown in Figure TTC-36.*

Support:

7. Turns can be prohibited as required by vehicular traffic conditions. Unless the streets are wide, it might be physically impossible to make certain turns, especially for large vehicles.

1: Revision 1 – 4/1/2015

Lane Closure Operation in an Intersection
(Figure TTC-28.1)



Typical Traffic Control
Turn Lane Closure Operation
(Figure TTC-29.1)
NOTES

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. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **To prevent accidental intrusion into the work area, channelizing device spacing shall not exceed 20' on centers.**

Option:

4. This layout may be used for either right or left turn lane closures.
5. For a high volume of turning movements, additional traffic control devices, such as signs (graphic NO LEFT TURN (R3-2) or LEFT LANE MUST TURN LEFT (R3-7L)), channelizing devices and vehicles may be used

Standard:

6. **Taper Length (L) shall be:**

Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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
Shoulder Taper = ⅓ L Minimum				

7. **Buffer Space Length shall be:**

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

Guidance:

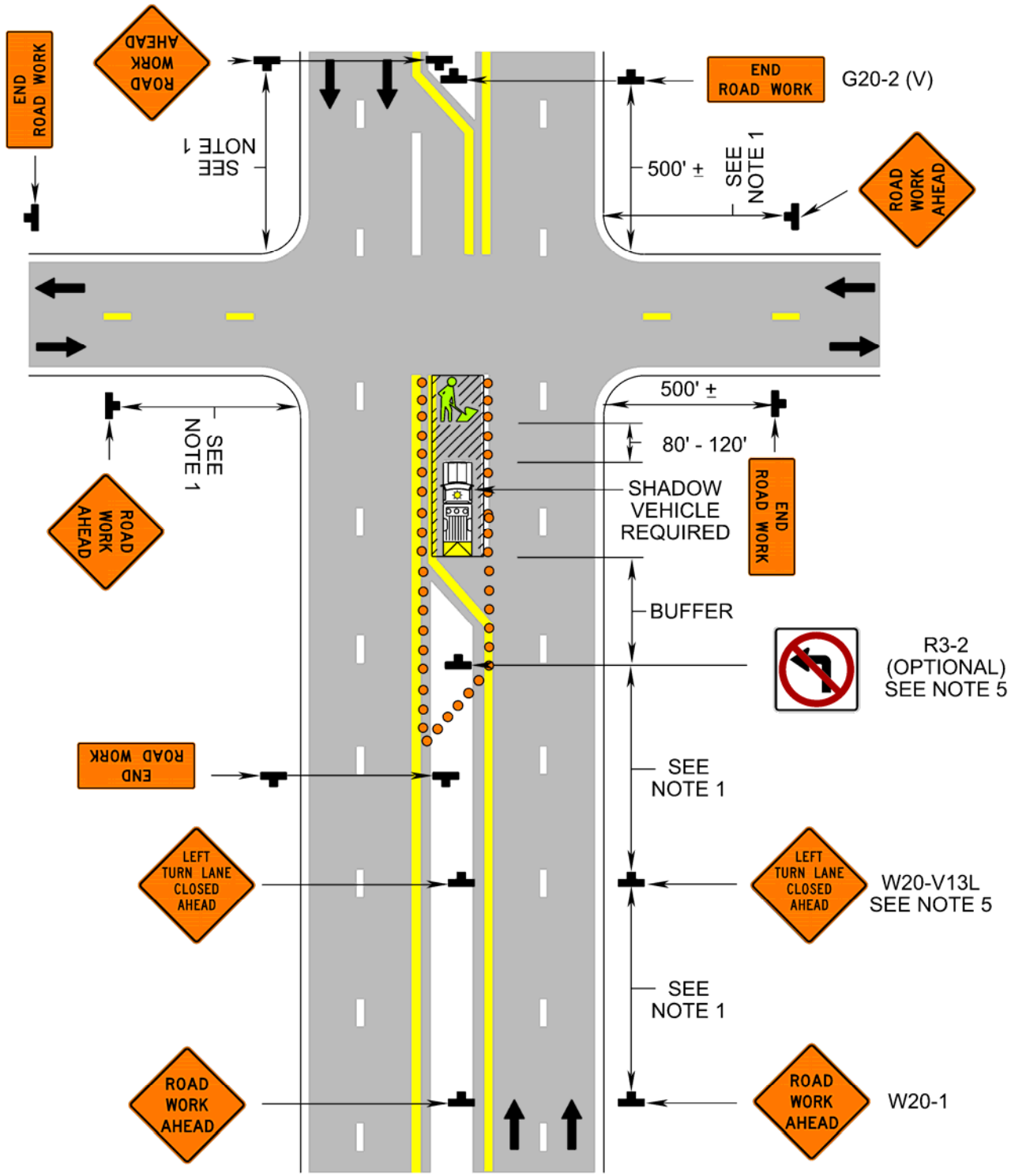
8. *If the work space extends across a crosswalk, the crosswalk should be closed using the information and devices shown in Figure TTC-36.*

Support:

9. Turns can be prohibited as required by vehicular traffic conditions. Unless the streets are wide, it might be physically impossible to make certain turns, especially for large vehicles.

1: Revision 1 – 4/1/2015

Turn Lane Closure Operation
(Figure TTC-29.1)



Typical Traffic Control

Flagging Operation at a Signalized Intersection

(Figure TTC-30.1)

NOTES

Guidance:

1. *The control of traffic through the intersection in order of preference should be:*
   a. *Obtain the services of law enforcement personnel.*
   b. *Divert the effective routes to other roads and streets as approved and directed by the Regional Traffic Engineer.*
   c. *Place a state certified flagger on each leg of the intersection with the approved signing as shown.*
2. *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. For urban streets sign spacing distance should be 225'-275' where the posted speed limit is 30 to 35 mph, and 100' -200' where the posted speed is 25 mph or less .*

Standard:

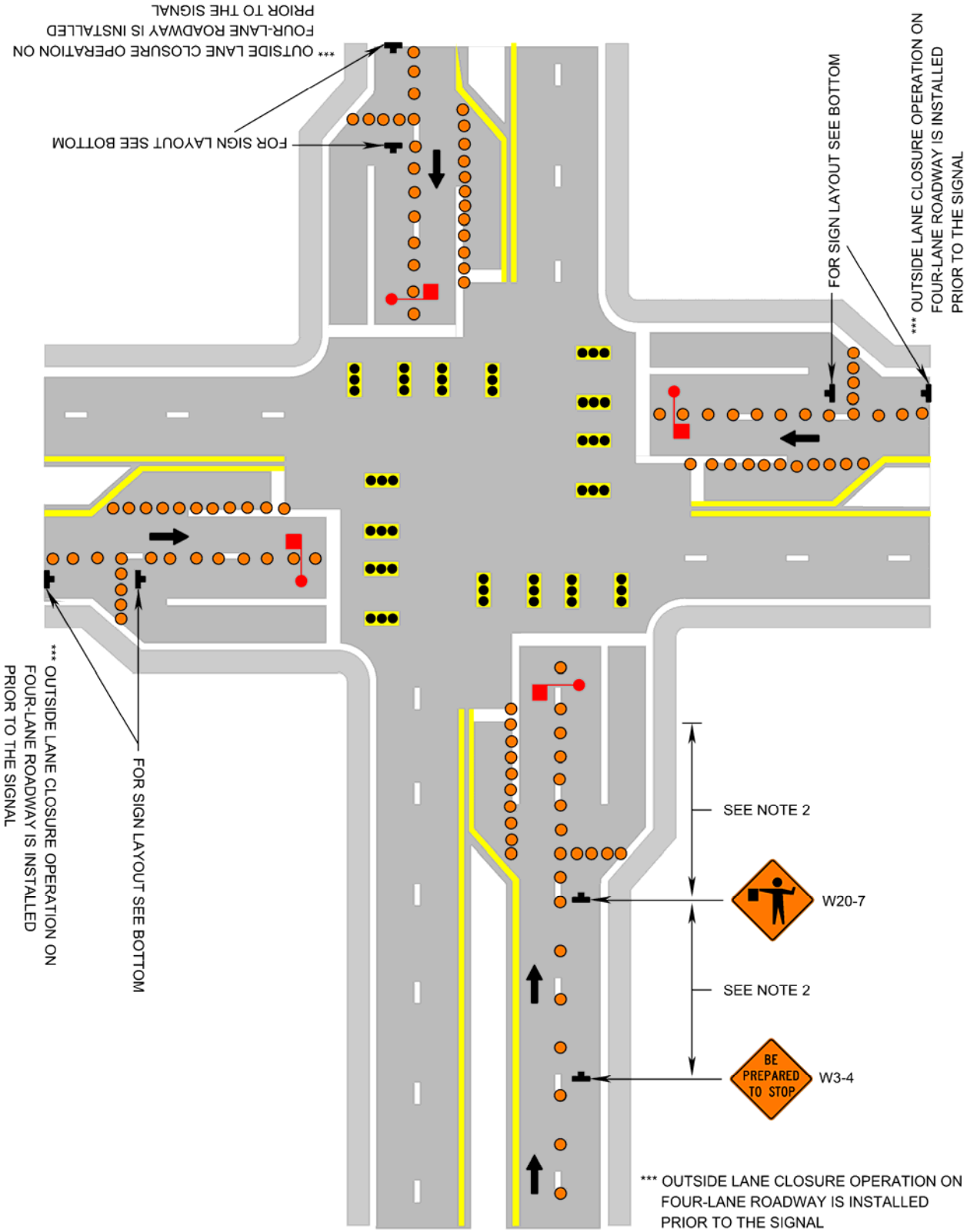
3. **For flagging operations,[1] a stationary lane closure shall be installed in advance of the signalized intersection for all approaches with two or more lanes for through traffic.**
4. **For flagging operations,[1] all turn lanes at the intersection shall be closed.**
5. **Electrical power supply to signals shall be turned off while flaggers are controlling traffic through the intersection.**
6. **To prevent accidental intrusion into the flagger station, cone spacing shall not exceed 10' on centers from the graphic flagger sign to the flagger station. Cones shall be installed in the closed lane, perpendicular to traffic, prior to the flagging station.**
7. **A lead flagger shall be assigned to control all flagger operations. One flagger shall be stationed to control each approach of the intersection. Flaggers shall alternate right-of-way to traffic such that traffic moves through the intersection one approach at a time.**
8. **Flagger stations shall be illuminated during planned night time work operations with a minimum of horizontal luminance of 5-foot candles (50 lux) (see Section 6E.08).**
9. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Option:

10. RIGHT TURN LANE CLOSED AHEAD (W20-V13R) and/or LEFT TURN LANE CLOSED AHEAD (W20-V13L) sign(s) may be used when closing the turn lanes.
11. For a high volume of turning movements, additional traffic control devices, such as signs (graphic NO LEFT TURN (R3-2), NO RIGHT TURN (R3-1), RIGHT TURN LANE CLOSED AHEAD (W20-V13R) and/or LEFT TURN LANE CLOSED AHEAD (W20-V13L)), cones and vehicles may be used.
12. Traffic signals may be on the flash mode when traffic through the intersection when controlled by a law enforcement officer.[1]
13. Travel and turn lanes may remain open if a law enforcement officer is controlling traffic through the intersection.[1]

1: Revision 1 – 4/1/2015

Flagging Operation at a Signalized Intersection
(Figure TTC-30.1)



Typical Traffic Control
Flagging Operation on a Single Lane Roundabout
(Figure TTC-31.1)
NOTES

Support:

1. Each roundabout is unique and the traffic control must be developed to meet the specific conditions of the location and the work operation. A detour could possibly better serve traffic movement and must be consider as an alternative to the flagger operation. This traffic control layout can be used on a traffic circle.

Standard:

2. **Flaggers shall control traffic flow on all approaches of the one-lane roundabout.**
3. **All flaggers shall be state certified and have their certification card in their possession when performing flagging duties. A lead flagger shall be designated and radio communication shall be used by the flaggers.**
4. **Only one quadrant of traffic shall be released at a time.**
5. **Channelizing device spacing shall be as shown in Note 4 in TTC 32.0.**
6. **At night, flagger stations shall be illuminated, except in emergencies. Street lights and vehicle headlights shall not be used to illuminate the flagger station.**
7. **A shadow vehicle with at least one amber[1] high intensity rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew.**
8. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**
9. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

Guidance:

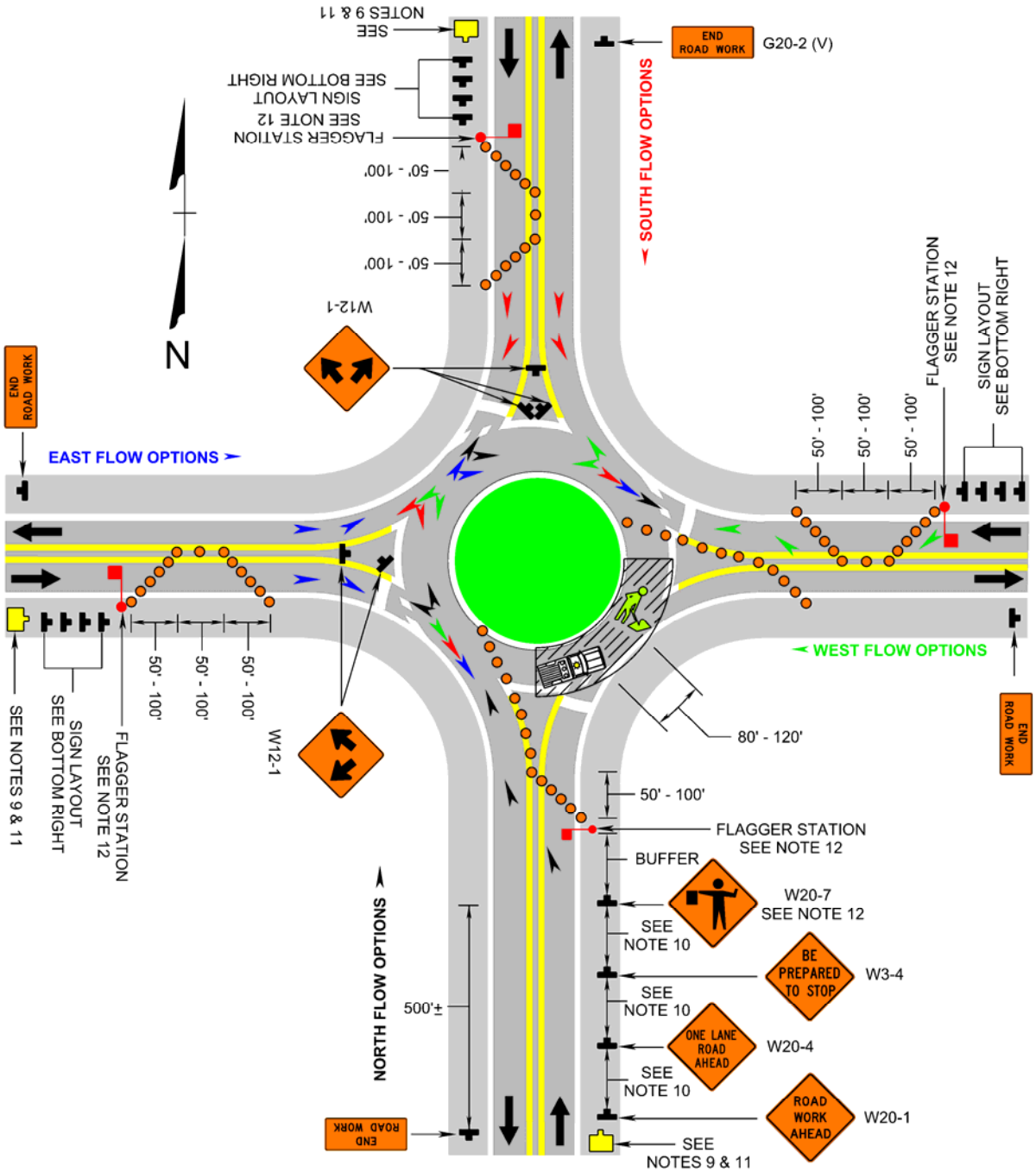
10. *Sign spacing distance should be 350'- 500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
11. *A PCMS should be considered as part of the traffic control plan to provide clear guidance to motorist on all approaches of the roundabout.*
12. *Care should be exercised when establishing the limits of the work zone to ensure maximum possible sight distance to the flagger station, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. Generally speaking, motorists should have a clear line of sight from the graphic flagger symbol sign to the flagger.*
13. *When designing the traffic control and installing the channelizing devices for work activities at roundabouts, accommodations for the turning radius of tractor trailer vehicles and other large vehicles should be considered and the work zone designed accordingly.*

Option:

14. Periodic adjustments to the channelizing devices may be allowed in an active work zone to accommodate the turning movements of tractor trailer vehicles and other large vehicles.
15. A supplemental flagger may be used in the roundabout island to help direct traffic and may be required on the approaches in advance warning of the flagging operation to slow traffic prior to reaching the flagger station or queued traffic.
16. A guide sign with road names may be used in lieu of the Double Arrow (W12-1) sign.
17. On the approaches where traffic flow will be split, two pilot vehicles may be used to guide traffic through the roundabout.
18. Flagging operations may not be necessary when working on the shoulders or in the island of the roundabout. Necessary signage under other typical application must be followed.

1: Revision 1 – 4/1/2015

Flagging Operation on a Single Lane Roundabout
(Figure TTC-31.1)



Typical Traffic Control

Inside Lane Closure Operation on a Multi-Lane Roundabout

(Figure TTC-32.1)

NOTES

Support:

1. Each roundabout is unique and the traffic control must be developed to meet the specific conditions of the location and the work operation. A detour could possibly better serve traffic movement and must be consider as an alternative to the flagger operation. This traffic control layout can be used on a traffic circle.

Standard:

2. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one amber[1] high intensity rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
4. **Taper length (L) and channelizing device spacing shall be:**

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
Shoulder Taper = ⅓ L Minimum				

Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Roundabout Spacing	20'	

5. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**

Guidance:

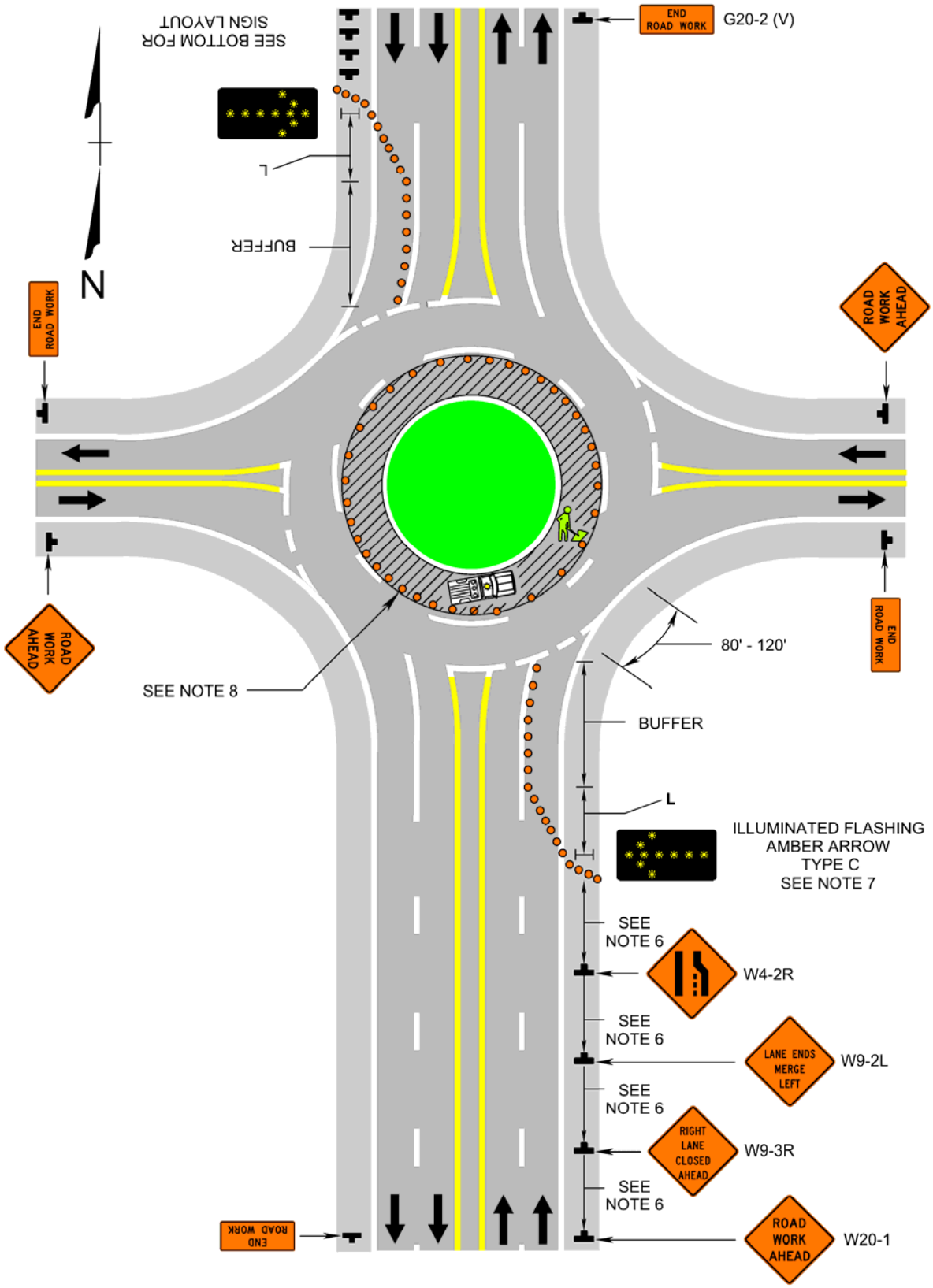
6. *Sign spacing distance should be 350'- 500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
7. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. Generally speaking, motorists should have a clear line of sight from the graphic flagger symbol sign to the flagger.*
8. *When designing the traffic control and installing the channelizing devices for work activities at roundabouts, accommodations for the turning radius of tractor trailer vehicles and other large vehicles should be considered and the work zone designed accordingly.*

Option:

9. Periodic adjustments to the channelizing devices may be allowed in an active work zone to accommodate the turning movements of tractor trailer vehicles and other large vehicles.

1: Revision 1 – 4/1/2015

Inside Lane Closure Operation on a Multi-Lane Roundabout
(Figure TTC-32.1)



Typical Traffic Control
Outside Lane Closure Operation on a Multi-Lane Roundabout
(Figure TTC-33.1)
NOTES

Support:

1. Each roundabout is unique and the traffic control must be developed to meet the specific conditions of the location and the work operation. A detour could possibly better serve traffic movement and must be consider as an alternative to the flagger operation. This traffic control layout can be used on a traffic circle.

Standard:

2. **Multi-lane approaches to the roundabout shall be reduced to one lane and a flagger shall control traffic flow on each approach of the roundabout.**
3. **All flaggers shall be state certified and have their certification card in their possession when performing flagging duties. A lead flagger shall be designated and radio communication shall be used by the flaggers.**
4. **Only one quadrant of traffic shall be released at a time.**
5. **Taper length (L) and channelizing device spacing shall be as shown in Note 4 in TTC 32.0.**
6. **At night, flagger stations shall be illuminated, except in emergencies. Street lights and vehicle headlights shall not be used to illuminate the flagger station.**
7. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
8. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one amber high intensity rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
9. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights. Vehicle hazard warning signals can be used to supplement high-intensity amber rotating, flashing, or[1] oscillating lights.**
10. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

Guidance:

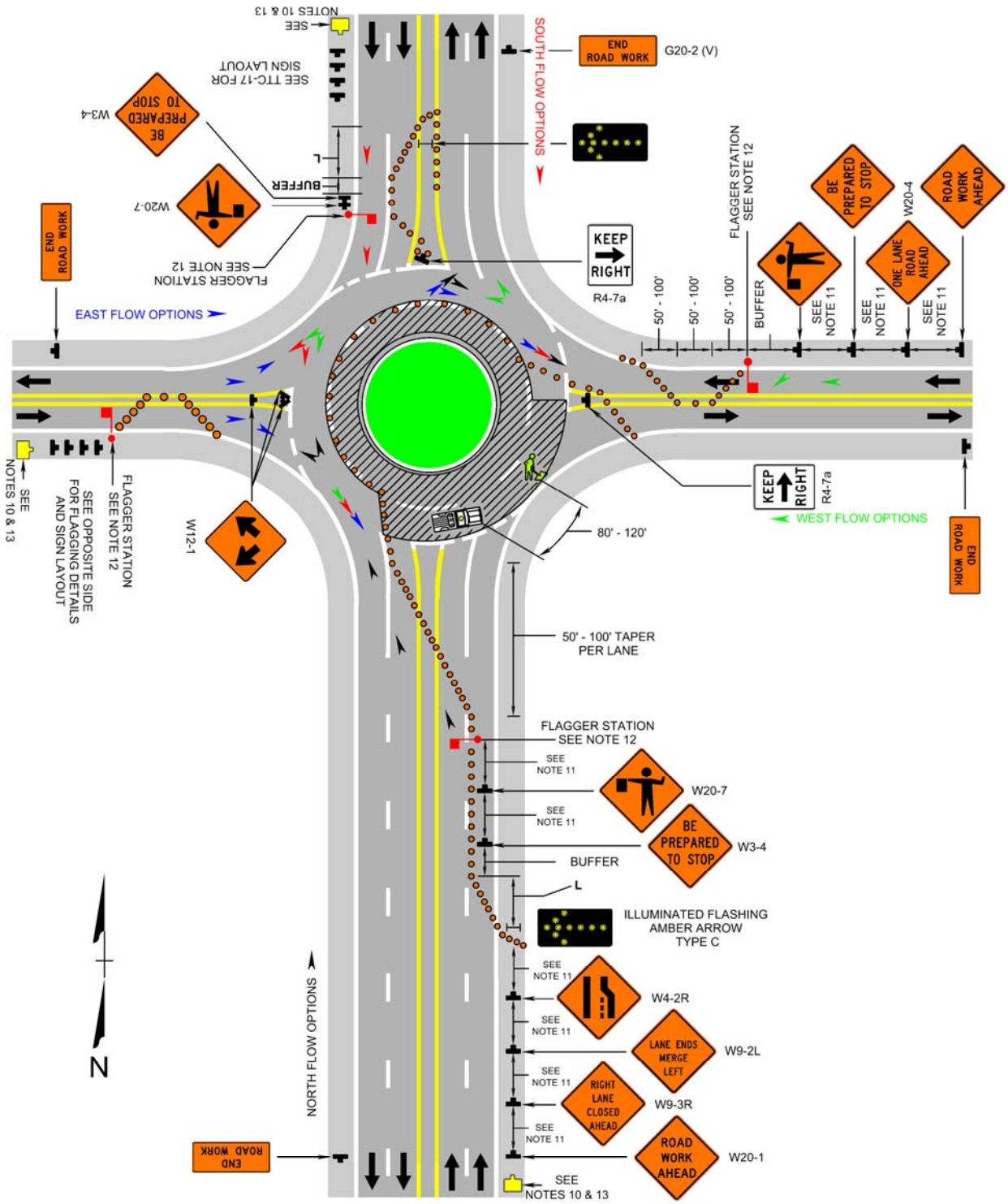
11. *Sign spacing distance should be 350'- 500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
12. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance to the flagger station, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. Generally speaking, motorists should have a clear line of sight from the graphic flagger symbol sign to the flagger.*
13. *A PCMS should be used as part of the traffic control plan to provide clear guidance to motorist on all approaches of the roundabout that must reverse traffic flow.*
14. *When designing the traffic control and installing the channelizing devices for work activities at roundabouts, accommodations for the turning radius of tractor trailer vehicles and other large vehicles should be considered and the work zone designed accordingly.*

Option

15. Periodic adjustments to the channelizing devices may be allowed in an active work zone to accommodate the turning movements of tractor trailer vehicles and other large vehicles.
16. A supplemental flagger may be used in the roundabout island to help direct traffic and may be required on the approaches in advance warning of the flagging operation to slow traffic prior to reaching the flagger station or queued traffic.
17. A guide sign with road names may be used in lieu of the Double Arrow (W12-1) sign.
18. On the approaches where traffic flow will be split, two pilot vehicles may be used to guide traffic through the roundabout.

1: Revision 1 – 4/1/2015

Outside Lane Closure Operation on a Multi-Lane Roundabout
(Figure TTC-33.1)



Typical Traffic Control

Street Closure Operation with Detour

(Figure TTC-34.1)

NOTES

Guidance:

1. *This plan should be used for streets without posted route numbers.*
2. *On multi-lane streets, Detour signs with an Advance Turn Arrow should be used in advance of a turn.*
3. *Sign spacing distance should be 225'-275' where the posted speed limit is 30 to 35 mph, and 100'-200' where the posted speed is 25 mph or less.*
4. *If the road is opened for a significant distance beyond the intersection and/or there are significant origin/destination points beyond the intersection, the ROAD CLOSED (R11-2) and Detour Arrow (M4-10) signs on Type 3 Barricades should be located at the corners of intersecting closed roadway or the traveled way.*

Option:

5. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
6. Flashing warning lights may be used on Type 3 Barricades.
7. Detour signs may be located on the far side of intersections. A Detour sign with an advance arrow may be used in advance of a turn.
8. A Street Name (M4-VP1a) plaque may be mounted with the Detour sign. The Street Name plaque may be either white on green or black on orange.

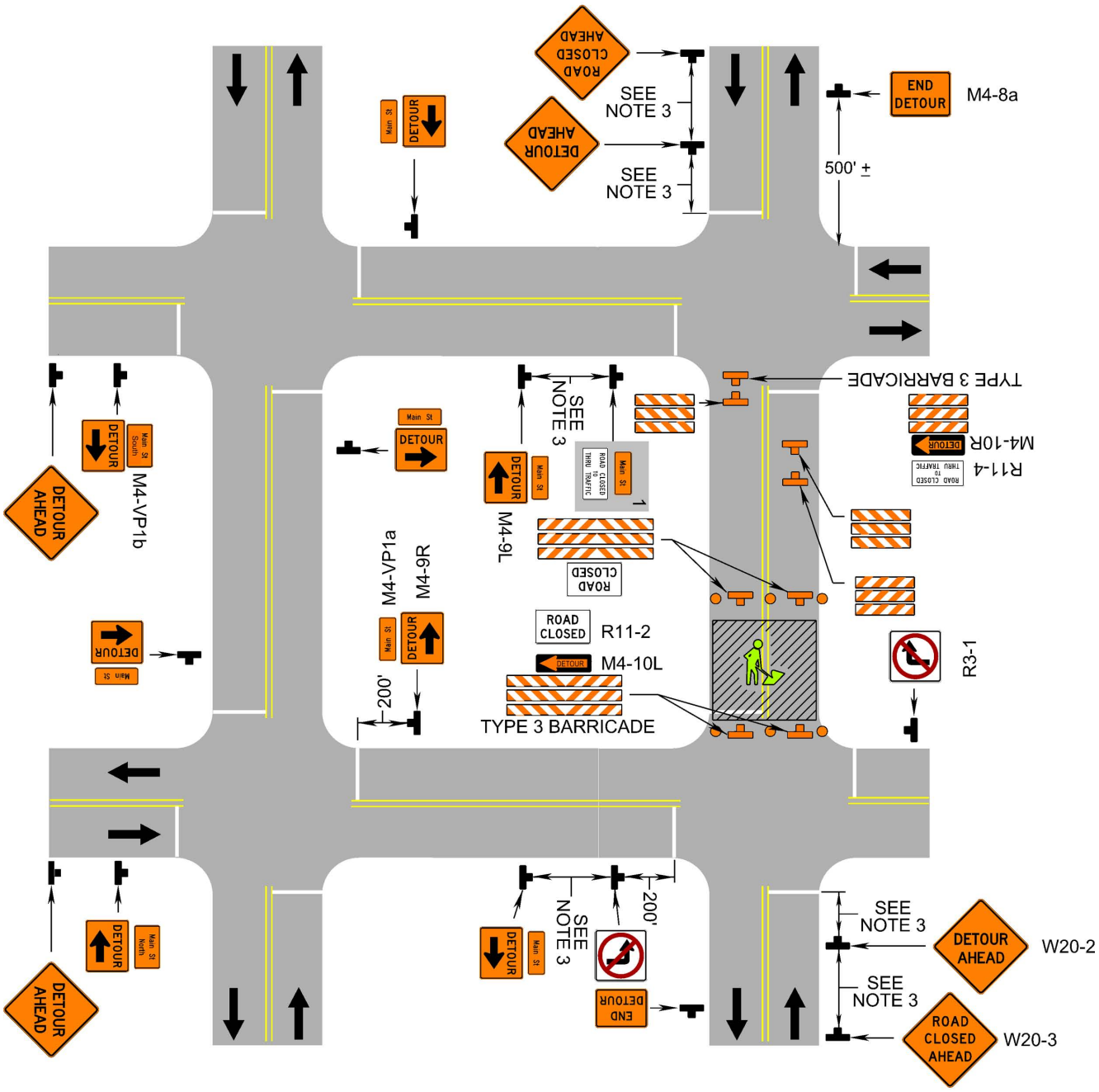
Standard:

9. **When used, the Street Name plaque shall be placed above the Detour sign.**

Support:

10. See Chapter 6I for additional information on incident management traffic control.

Street Closure Operation with Detour
(Figure TTC-34.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Sidewalk Closure and Bypass Sidewalk Operation

(Figure TTC-35.0)

NOTES

Standard:

1. **When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.**

Guidance:

2. *Where high speeds are anticipated, a temporary traffic barrier and, if necessary, a crash cushion should be used to separate the temporary sidewalks from vehicular traffic.*
3. *Audible information devices should be considered where midblock closings and changed crosswalk areas cause inadequate communication to be provided to pedestrians who have visual disabilities.*
4. *Temporary markings should be considered for operations exceeding three days in duration.*

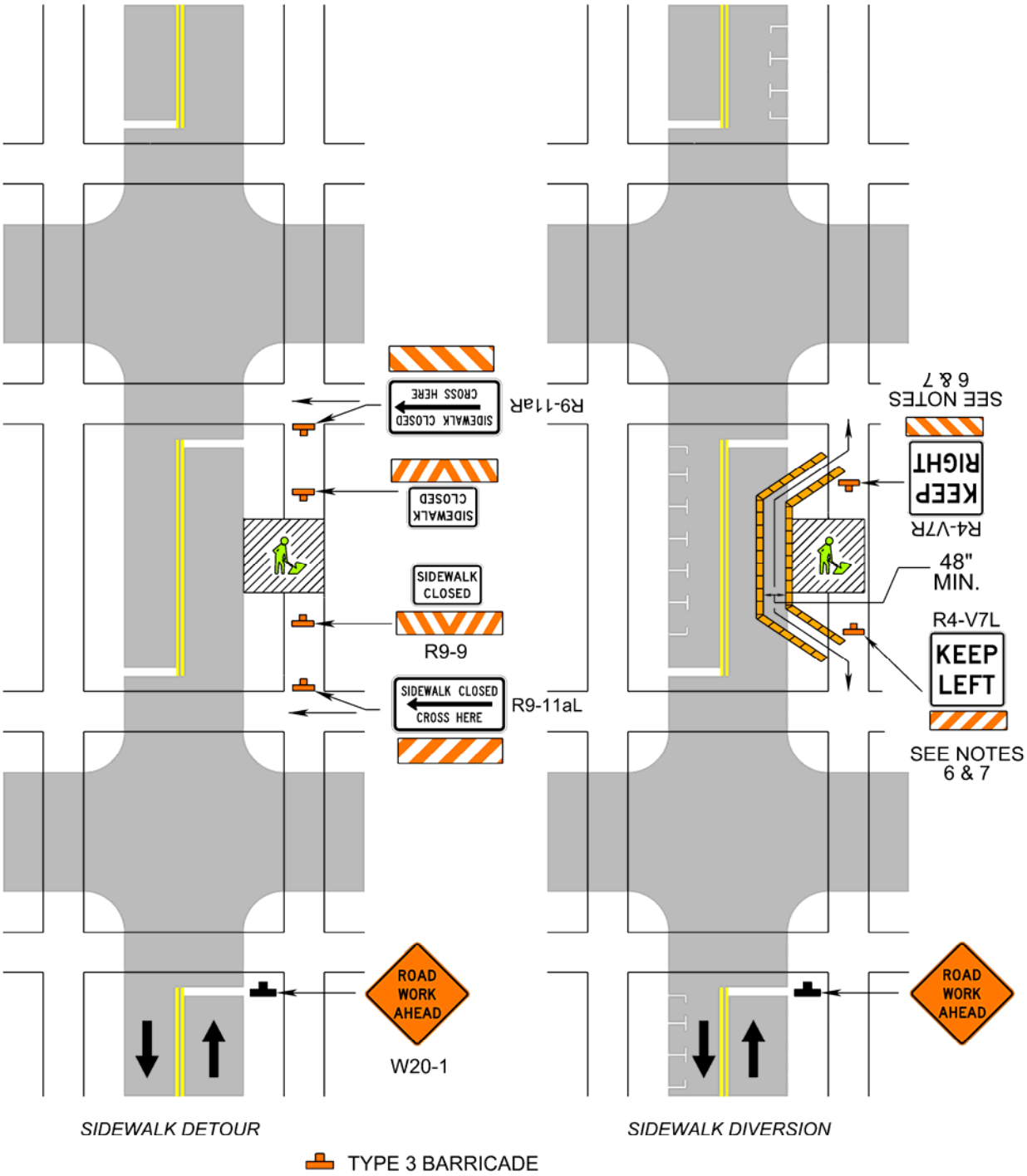
Option:

5. Only the TTC devices related to pedestrians are shown. Other devices, such as lane closure signing or ROAD NARROWS (W5-1) signs, may be used to control vehicular traffic.
6. For nighttime closures, Type A Flashing warning lights may be used on barricades that support signs and close sidewalks.
7. Signs, such as KEEP RIGHT (R4-V7R) and KEEP LEFT (R4-V7L), may be placed along a temporary sidewalk to guide or direct pedestrians.

Standard:

8. **All sidewalk closures shall be closed with Type 3 Barricades.**

Sidewalk Closure and Bypass Sidewalk Operation
(Figure TTC-35.0)



Typical Traffic Control

Crosswalk Closure and Pedestrian Detour Operation

(Figure TTC-36.1)

NOTES

Standard:

1. **When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.**
2. **Curb parking shall be prohibited for at least 50 feet in advance of the midblock crosswalk.**

Guidance:

3. *Audible information devices should be considered where midblock closings and changed crosswalk areas cause inadequate communication to be provided to pedestrians who have visual disabilities.*
4. *Pedestrian traffic signal displays controlling closed crosswalks should be covered or deactivated.*
5. *Temporary markings should be considered for operations exceeding three days in duration.*

Option:

6. Only the TTC devices related to pedestrians are shown. Other devices, such as lane closure signing or ROAD NARROWS (W5-1) signs, may be used to control vehicular traffic.
7. For nighttime closures, Type A Flashing warning lights may be used on barricades supporting signs and closing sidewalks.
8. In order to maintain the systematic use of the fluorescent yellow-green background for pedestrian, bicycle, and school warning signs in a jurisdiction, the fluorescent yellow-green background for pedestrian, bicycle, and school warning signs may be used in TTC zones.

Standard:

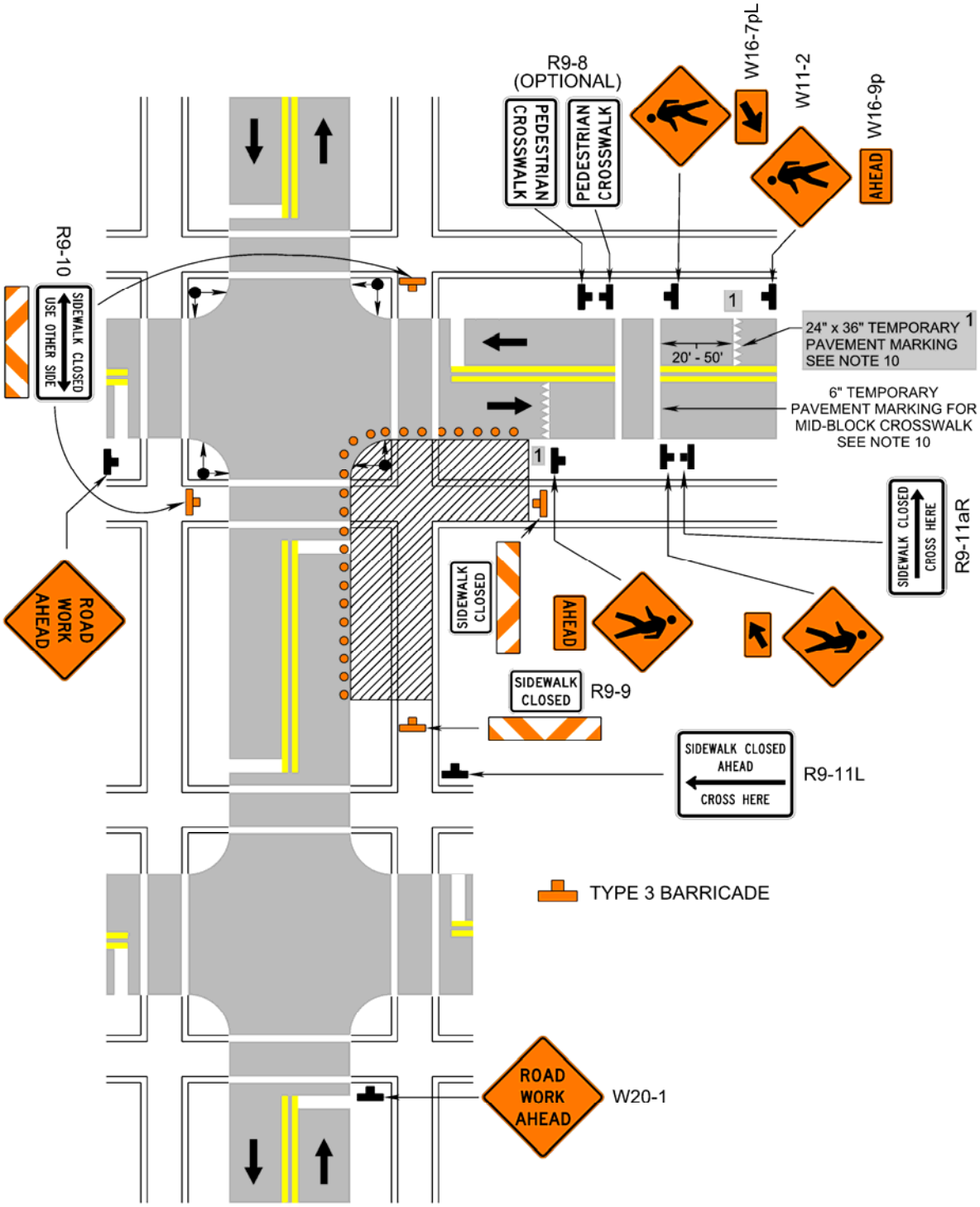
9. **All sidewalk closures shall be closed with Type 3 Barricades.**

Support:

10. Refer to Sections 3B-16 through 3B-18 of the 2009 MUTCD and the Virginia Supplement to the MUTCD[1] for crosswalk[1] lines, yield lines and other related TTC devices that may be used to control vehicular traffic at midblock crosswalks.

1: Revision 1 – 4/1/2015

Crosswalk Closure and Pedestrian Detour Operation
(Figure TTC-36.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Work Operation in the Vicinity of an Exit Ramp

(Figure TTC-37.1)

NOTES

Guidance:

1. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
2. *When flaggers are used, care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the flagger station and transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. Generally speaking, motorists should have a clear line of sight from the graphic flagger symbol sign to the flagger.*

Standard:

3. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
4. **A temporary EXIT (E5-V1) sign shall be located in the temporary gore. For better visibility, the EXIT, EXIT OPEN (E5-2) and EXIT CLOSED (E5-2a) signs[1] shall be mounted a minimum of 7 feet from the pavement surface to the bottom of the sign.**
5. **Taper length (L) and channelizing device spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

6. **The minimum distance between the end of the taper and the beginning of the off ramp shall be 1000'.**
7. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or equipped with at least one high intensity amber[1] rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**

Guidance:

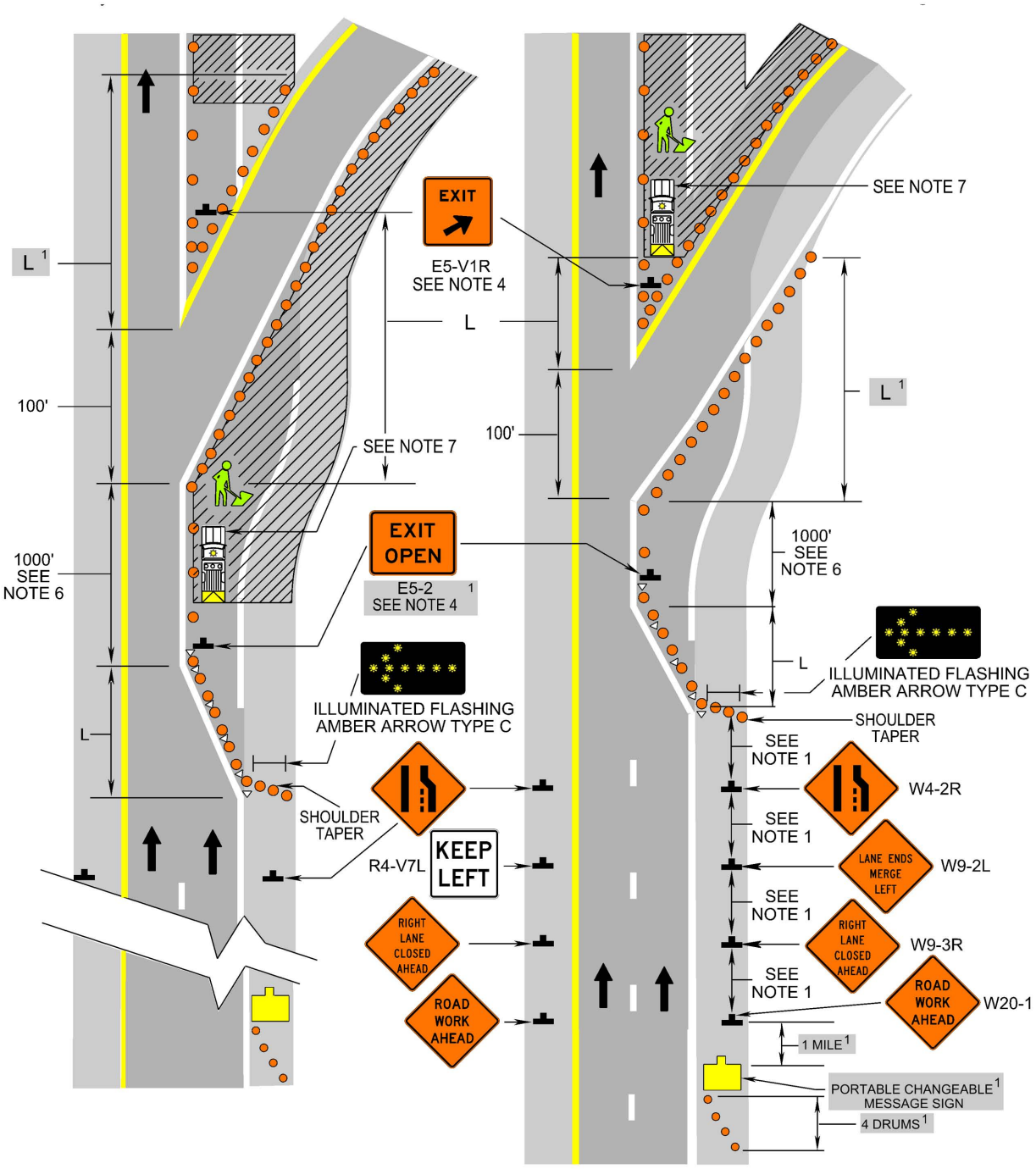
8. *The guide signs should indicate that the ramp is open, and where the temporary ramp is located. However, if the ramp is closed, guide signs should indicate that the ramp is closed.*
9. *When the exit ramp is closed, a black on orange EXIT CLOSED (E5-2a) sign should be placed diagonally across the interchange/intersection guide signs.*
10. *An END ROAD WORK (G20-2 (V)) sign should be placed 500' past the temporary traffic control devices on the off ramp.*

Option:

11. The temporary EXIT sign placed in the temporary gore may be either black on orange or white on green.
12. An alternative procedure that may be used is to channelize exiting vehicular traffic onto the right-hand shoulder and close the lane as necessary.

1: Revision 1 – 4/1/2015

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



1: Revision 1 – 4/1/2015

Typical Traffic Control

Partial Exit Ramp Closure Operation

(Figure TTC-38.1)

NOTES

Guidance:

1. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Standard:

2. **To prevent accidental intrusion into the work area, channelizing device spacing shall not exceed 20' on centers.**
3. **Cone Taper Length (L) is equal to the Posted Speed Limit (S) times the Width of actual ramp closure (W). (Example: 55 mph x 6' = 330')**
4. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or equipped with at least one high intensity amber[1] rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
5. **If an advisory speed limit sign is used, the Regional Traffic Engineer shall determine the advisory speed limit.**

Guidance:

6. *A minimum 200' buffer space should be provided, when possible.*

Standard:

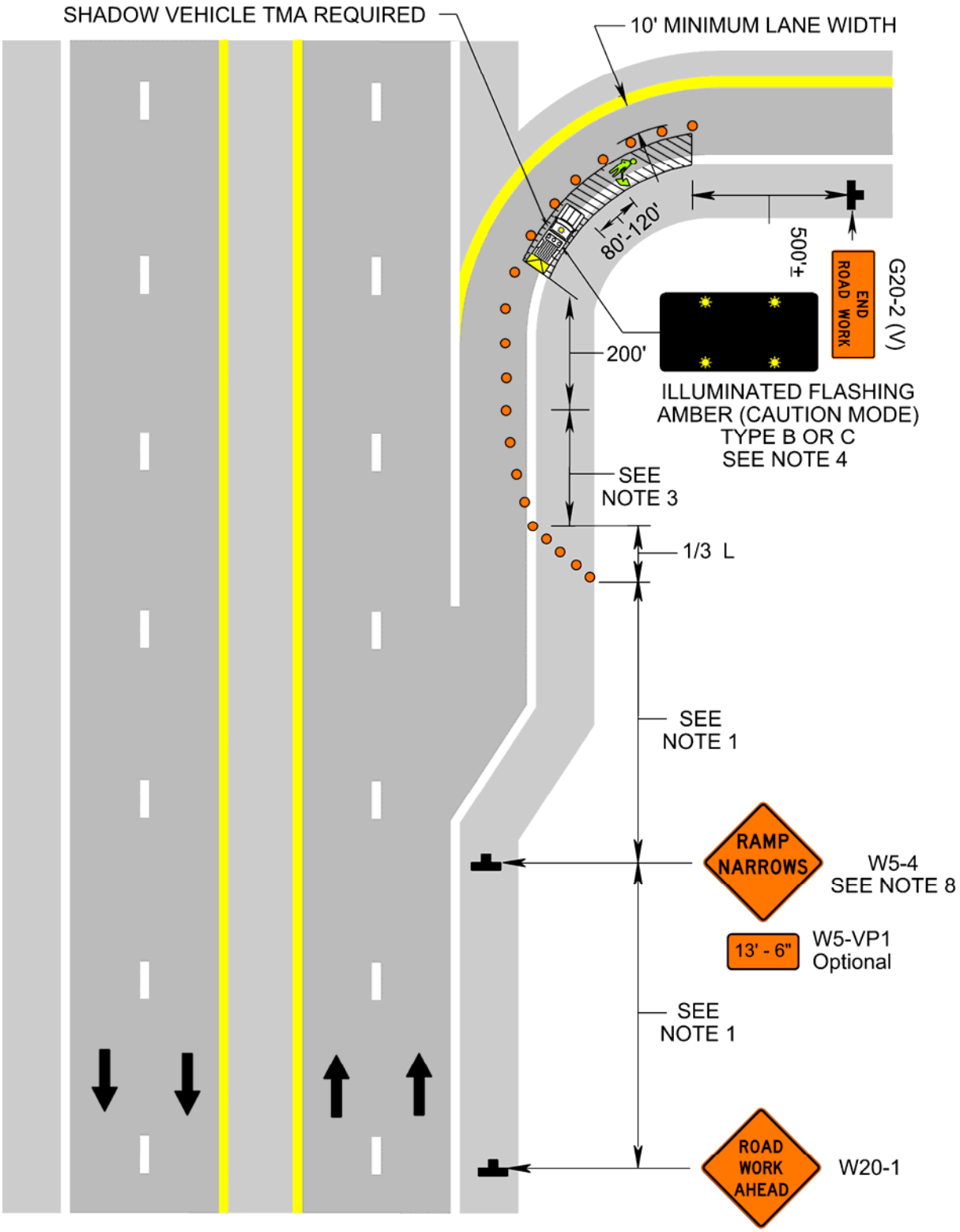
7. **Truck off-tracking shall be considered when determining whether the 10 foot minimum lane width is adequate.**
8. **For long term stationary work (occupying a location for longer than three consecutive days) when the distance between the edgeline and the channelizing devices is less than 14 feet, a RAMP NARROWS (W5-4) sign shall be used, along with a LANE WIDTH (W5-VP1) plaque displaying the width from edgeline to the channelizing devices in feet and inches rounded down to the nearest foot or half foot increment.**
9. **Due to blanket permits for over width loads, whenever a travel direction is reduced to less than 14 feet in width from edgeline to the face of channelizing devices, a 96" by 48" black on white sign displaying the message RESTRICTED WIDTH ROUTE, XX FT.- YY INCHES (R5-V1) with WORK ZONE (G20-5aP or G20-5aP (V)) plaque shall be installed 1000 feet ± prior to the last exit from the approached side of the restricted work zone route.**

Guidance:

10. *A traffic engineering study should determine if there is a need for a wide load detour and additional TTC.*

1: Revision 1 – 4/1/2015

Partial Exit Ramp Closure Operation
(Figure TTC-38.1)



Typical Traffic Control

Work Operation in the Vicinity of an Entrance Ramp

(Figure TTC-39.1)

NOTES

Guidance:

1. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
2. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3.*
3. *An acceleration lane of sufficient length should be provided whenever possible as shown on the left diagram.*

Standard:

4. **For the information shown on the diagram on the right-hand side of the typical application, where inadequate acceleration distance exists for the temporary entrance, the YIELD (R1-2) sign shall be replaced with STOP (R-1-1) signs (one on each side of the approach). For better visibility, the STOP and YIELD signs shall be mounted a minimum of 7 feet from the pavement surface to the bottom of the sign.[1]**
5. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
6. **For taper lengths and channelizing device spacing, Note 5 of TTC-37 shall be used. The minimum length of a lane closure taper on a Limited Access highway shall be 1000'.**
7. **The buffer space length shall be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
8. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or equipped with at least one high intensity amber rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
9. **For long-term work zones existing conflicting pavement markings and markers shall be removed and temporary pavement markings and markers shall be installed per Figure TTC-60.**

Guidance:

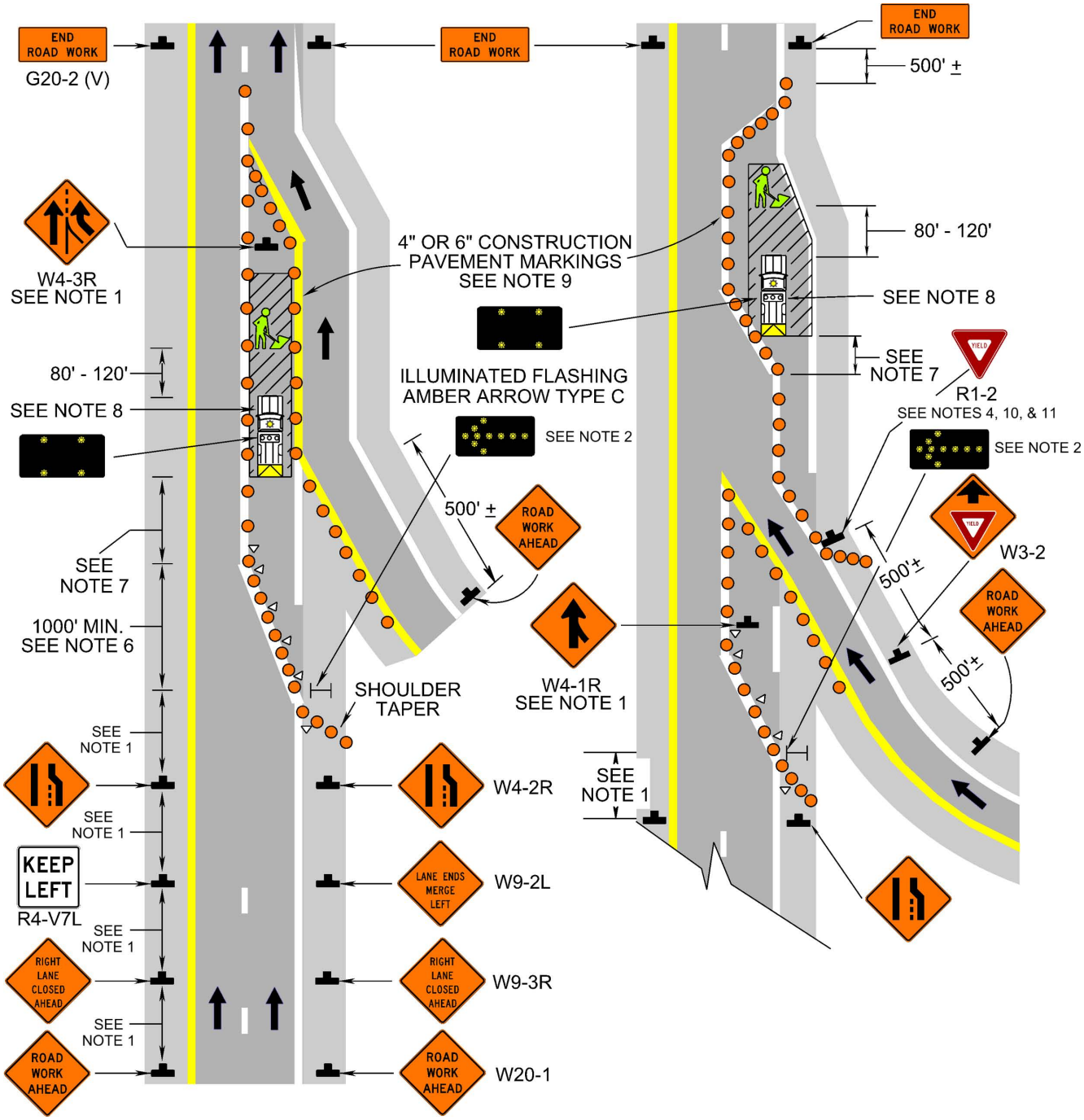
10. *When used, the YIELD or STOP sign should be located so that ramp vehicular traffic has adequate sight distance of oncoming mainline vehicular traffic to select an acceptable gap in the mainline vehicular traffic flow, but should not be located so far forward that motorists will be encouraged to stop in the path of the mainline traffic. Also, a longer acceleration lane should be provided beyond the sign to reduce the gap size needed. If insufficient gaps are available, consideration should be given to closing the ramp.*
11. *Where STOP signs are used, a temporary stop line should be placed across the ramp at the desired stop location.*
12. *The mainline merging taper with the arrow board at its starting point should be located sufficiently in advance so that the arrow board does not confuse the drivers on the entrance ramp, and so that the mainline merging vehicular traffic from the lane closure has the opportunity to stabilize before encountering the vehicular traffic merging from the ramp.*
13. *If the ramp curves sharply to the right, warning signs with advisory speeds located in advance of the entrance terminal should be placed in pairs (one on each side of the ramp).*

Option:

14. Where the acceleration distance is significantly reduced, a NO MERGE AREA (W4-5P) supplemental plaque may be placed below the Yield Ahead (W3-2) sign.
15. A Type B high-intensity flashing warning light with a red lens may be placed above the STOP sign.
16. When operations are 3 days or less in duration, lanes may be delineated by channelizing devices in lieu of temporary markings.

1: Revision 1 – 4/1/2015

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



Typical Traffic Control
Multi-Lane Shift Operation
(Figure TTC-40.1)
NOTES

Guidance:

1. *The lane shift should be used when the work area extends into either the right or left lane of a divided highway and it is not practical, for capacity reasons, to reduce the number of available lanes.*
2. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
3. *If the STAY IN LANE (R4-9) sign is used, then solid 4 inch wide minimum white lines should be used.*

Standard:

4. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
5. **Shoulder and shifting taper lengths shall be as shown in Table 6C-3 on Page 6C-7.**
6. **Taper Length (L) shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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
Shoulder Taper = ⅓ L Minimum				

For all Limited Access highways, the desired shifting transition length is 1000', but lesser values not to be less than ½ L, may be used.

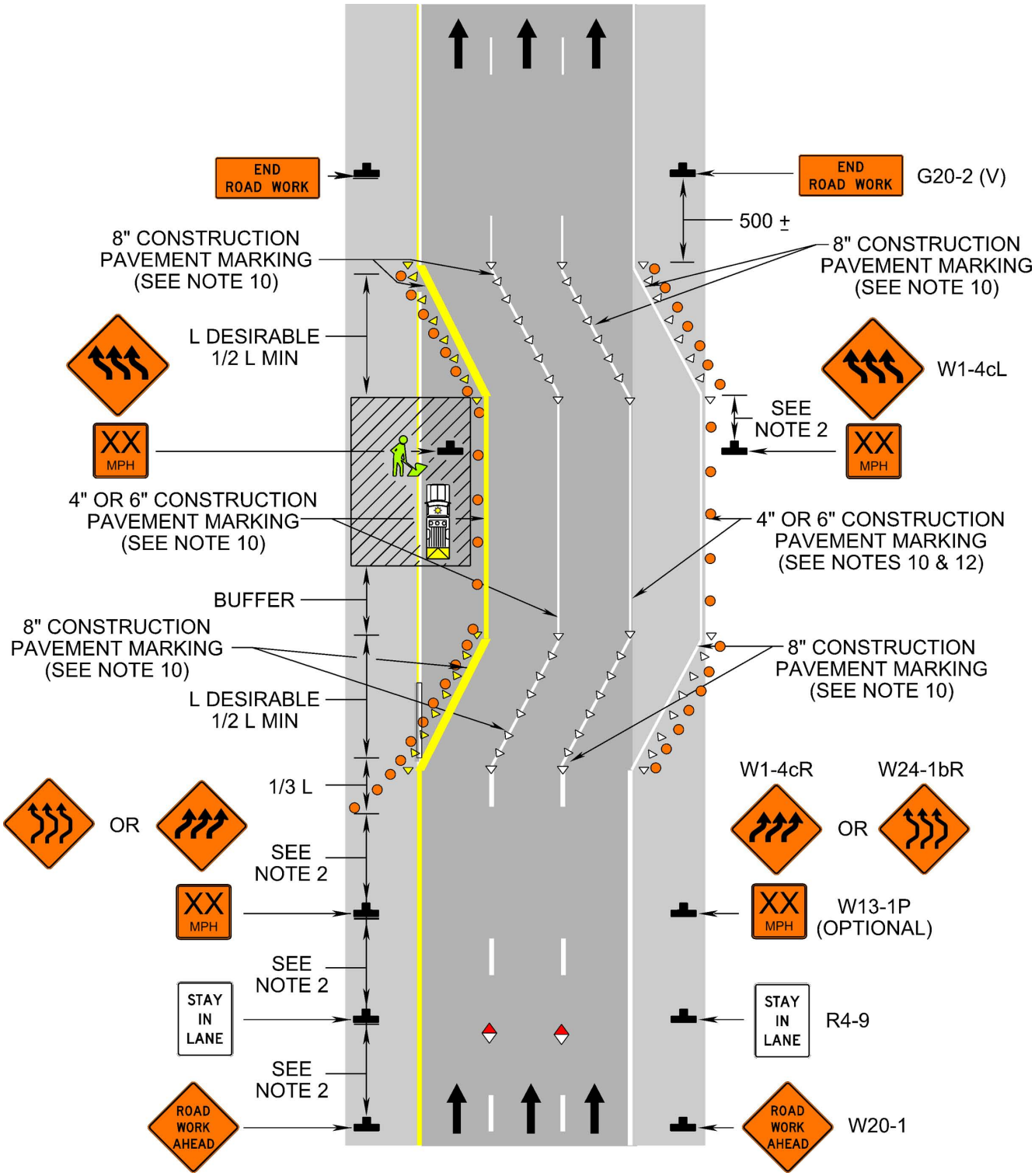
7. **The minimum width of the shoulder lane shall be 11'.**
8. **The buffer space length shall be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
9. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one high intensity amber rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
10. **For long-term work zones existing conflicting pavement markings and markers shall be removed and temporary pavement markings and markers shall be installed per Figure TTC-60.**

Option:

11. For short-term stationary work (less than 3 days duration), lanes may be delineated by channelizing devices or removable pavement markings instead of temporary pavement markings.
12. Temporary pavement markers, on a 40' center to center spacing, may be added to the tangent section between lane shifts as directed by the engineer.

1: Revision 1 – 4/1/2015

Multi-Lane Shift Operation
(Figure TTC-40.1)



Typical Traffic Control

Half Road Closure Operation on a Multi-Lane Roadway

(Figure TTC-41.1)

NOTES

Guidance:

1. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
2. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*

Standard:

3. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
4. **Taper length (L) and channelizing device spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

Channelizing Device Spacing		
Location	Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

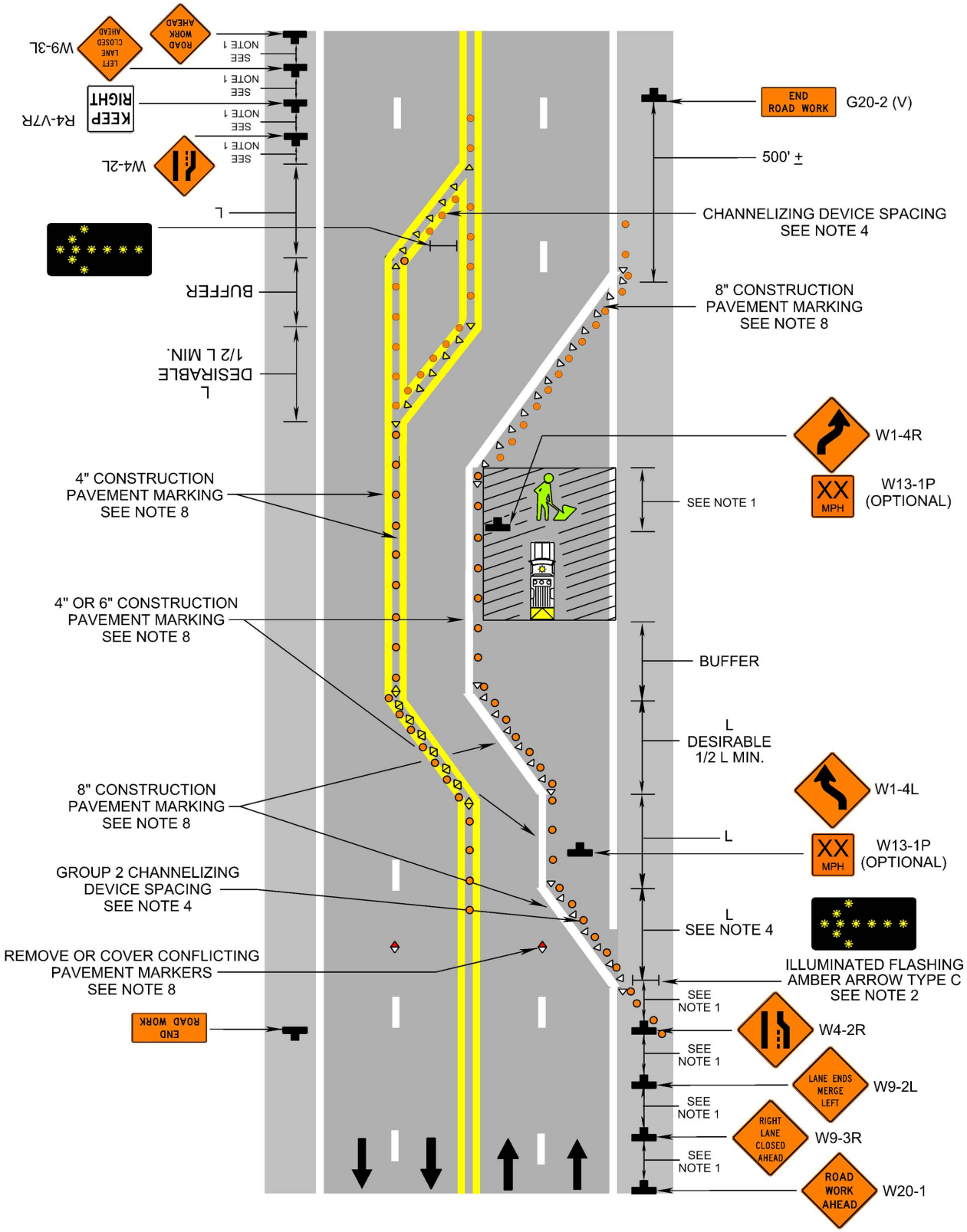
5. **On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.**
6. **The buffer space length shall be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
7. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one high intensity amber rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
8. **Existing conflicting pavement markings and markers shall be removed and temporary pavement markings and markers shall be installed per Figure TTC-60.**

Option:

9. For short-term stationary work (less than 3 days duration), lanes may be delineated by channelizing devices or removable pavement markings instead of temporary pavement markings.
10. Temporary pavement markers, on a 40' center to center spacing, may be added to the tangent section between lane shifts as directed by the engineer.

1: Revision 1 – 4/1/2015

Half Road Closure Operation on a Multi-Lane Roadway
(Figure TTC-41.1)



Typical Traffic Control

Interior Lane Closure Operation on a Multi-Lane Roadway

(Figure TTC-42.1)

NOTES

Guidance:

1. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
2. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*

Standard:

3. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
4. **Taper Length (L) and Channelizing Device Spacing shall be:**

Taper Length (L)				
Speed Limit (mph)	Lane Width (Feet)			
	9	10	11	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 = ⅓ L Minimum				

Channelizing Device Spacing		
Location	Posted Speed (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.

5. **The buffer space length shall be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.**
6. **A shadow vehicle with either a Type B or C arrow board operating in the caution mode, or at least one high intensity amber rotating, oscillating, or flashing[1] light shall be parked 80'-120' in advance of the first work crew. When the posted speed limit is 45 mph or greater, a truck-mounted attenuator shall be used.**
7. **For long-term work zones existing conflicting pavement markings and markers shall be removed and temporary pavement markings and markers shall be installed per Figure TTC-60.**

Option:

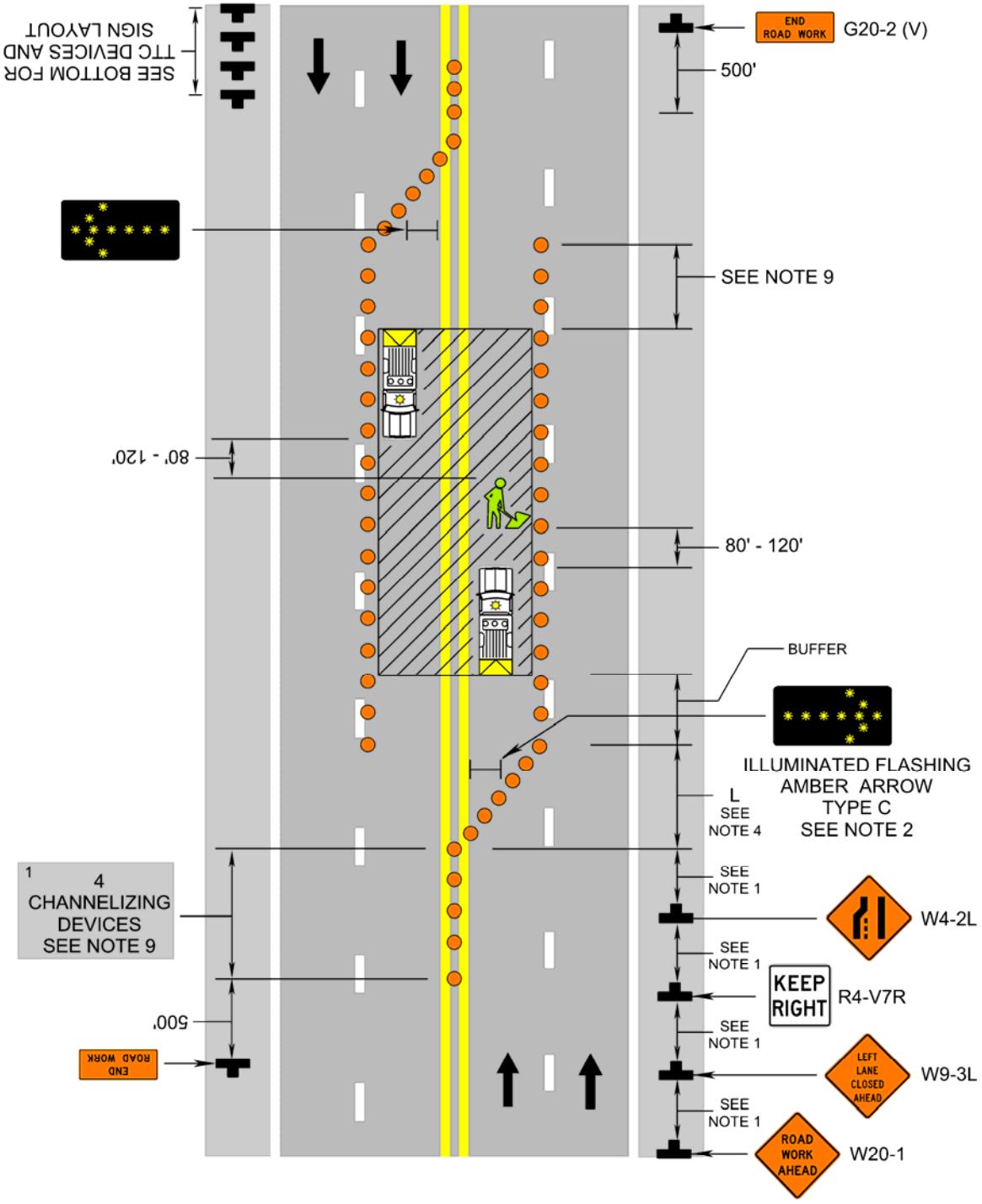
8. For short-term stationary work (less than 3 days duration), lanes may be delineated by channelizing devices or removable pavement markings instead of temporary pavement markings.

Guidance:

9. *When channelizing devices have the potential of leading vehicular traffic out of the intended traffic space, the channelizing devices should be extended a distance with 4 additional channelizing devices[1] beyond the downstream end of the transition area as depicted.*
10. *For locations with a high volume of left turning movements, the graphic NO LEFT TURN (R3-2) signs should be used.[1]*

1: Revision 1 – 4/1/2015

Interior Lane Closure Operation on a Multi-Lane Roadway
(Figure TTC-42.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Road Closure Operation with a Diversion

(Figure TTC-43.1)

NOTES

Guidance:

1. *Sign spacing distance should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
2. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the lane shift, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3.*

Option

3. Temporary traffic barriers, temporary asphalt median or temporary tubular markers may be used to separate opposing vehicular traffic based on guidance in Appendix A.

Guidance:

4. *The alignment should be designed as a reverse curve.*
5. *The curved alignment should meet the design criteria contained in the AASHTO "Policy on the Geometric Design of Highways and Streets" (see Section 1A.11) and current Virginia Road and Bridge Standard GS-10.*

Standard:

6. **Devices similar to those depicted shall be placed for the opposite direction of traffic.**
7. **Appropriate impact attenuators or terminal end treatments shall be used to protect the end of longitudinal barriers if the barrier is terminated within the clear zone.**
8. **Channelizing device spacing shall be:**

Location	Posted Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

9. **Pavement markings and markers no longer applicable to the traffic pattern of the roadway shall be removed or obliterated before any new traffic patterns are open to traffic (see Figure TTC-60).**

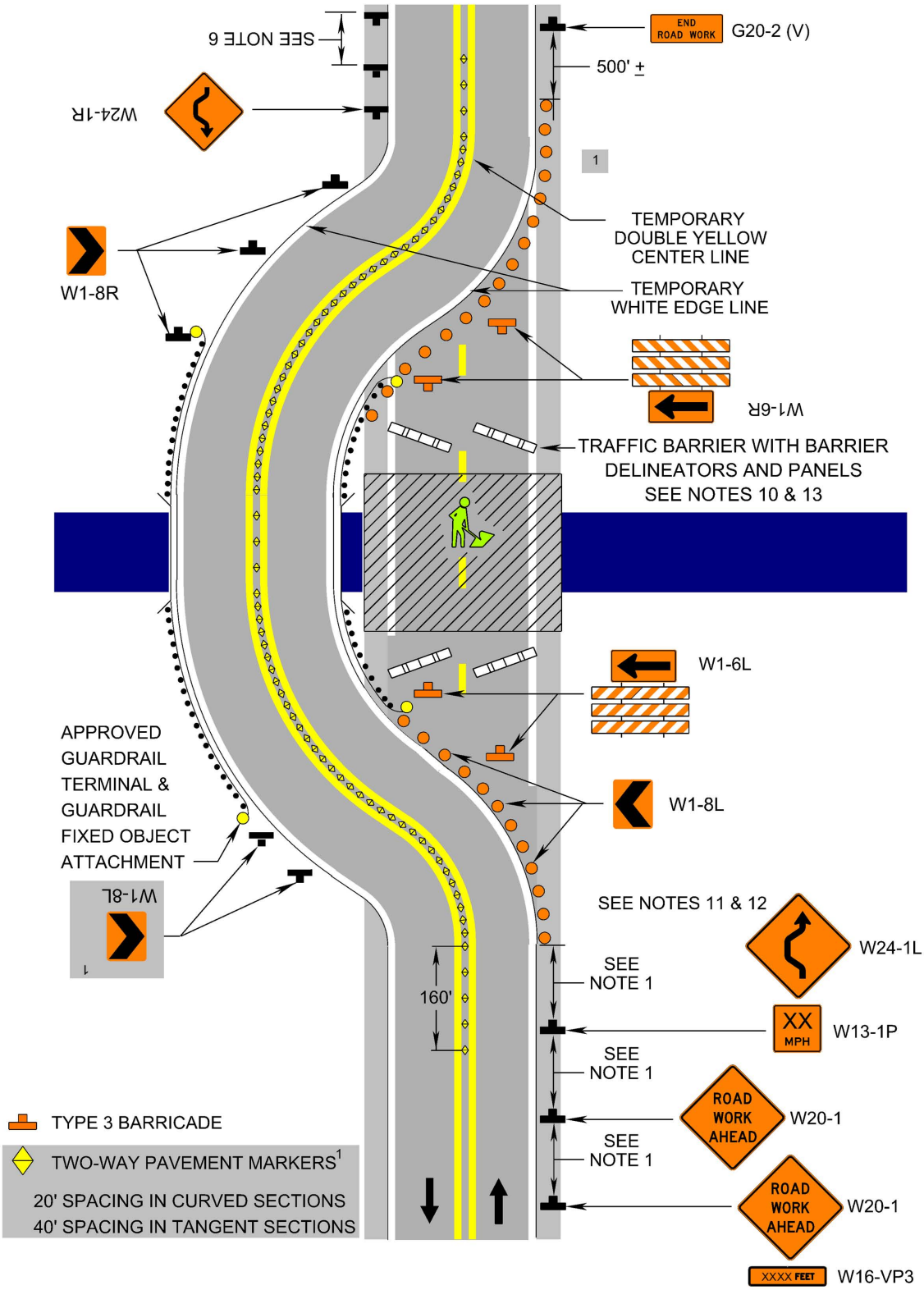
Guidance:

10. *Temporary barrier should be placed at a 45° angle to the travelway a sufficient distance beyond the Type 3 Barricade but before the work space while providing equipment access to the work space.*
11. *If the tangent distance along the temporary diversion is more than 600 feet, a Reverse Curve (W1-4 series) sign, left first, should be used instead of the Double Reverse Curve (W24-1) sign, and a second Reverse Curve sign, right first, should be placed in advance of the second reverse curve back to the original alignment.*
12. *When tangent section of the diversion is more than 600 feet, and the diversion has sharp curves with recommended speeds of 30 mph or less, Reverse Turn (W1-3) signs, should be used.*

Standard:

13. **Barrier panels 8 inches in width and 12 inches in height shall be placed on top of the temporary concrete barrier, perpendicular to traffic, and spaced 20' on centers along the taper sections. Reflectorized surface shall be fluorescent orange prismatic lens sheeting. Barrier delineators shall be installed along the traffic side of the concrete barrier in-between and at the same spacing as the barrier panels approximately 24 inches up from the roadway surface.**

Road Closure Operation with a Diversion
(Figure TTC-43.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Median Cross-Over Operation on a Multi-Lane Roadway

(Figure TTC-44.1)

NOTES

Guidance:

1. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
2. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*

Standard:

3. **Temporary traffic barriers, temporary asphalt median or temporary tubular markers shall be used to separate opposing vehicular traffic based on guidance in Appendix A.**
4. **An arrow board shall not be used to shift a lane of traffic.**

Option:

5. When a temporary traffic barrier is used to separate opposing vehicular traffic, the Two-Way Traffic (W6-3), DO NOT PASS (R4-1), KEEP RIGHT (R4-V7), and DO NOT ENTER (R5-1) signs may be eliminated.

Guidance:

6. *The alignment of the crossover should be designed as a reverse curve.*
7. *When the crossover follows a curved alignment, the design criteria contained in the AASHTO "Policy on the Geometric Design of Highways and Streets" (see Section 1A.11) and current Virginia Road and Bridge Standard GS-10 should be used.*
8. *When channelizing devices are used in lieu of traffic barriers and have the potential of leading vehicular traffic out of the intended traffic space, the channelizing devices should be extended a distance with 4 additional channelizing devices*[1] *beyond the downstream end of the transition area.*
9. *Where temporary asphalt medians or tubular markers are used, the Two-Way Traffic (W6-3) signs should be repeated every 1 mile.*

Option:

10. NEXT XX MILES (W16-VP1) Supplemental Distance plaques may be used with the Two-Way Traffic signs, where XX is the distance to the downstream end of the two-way section.

Support:

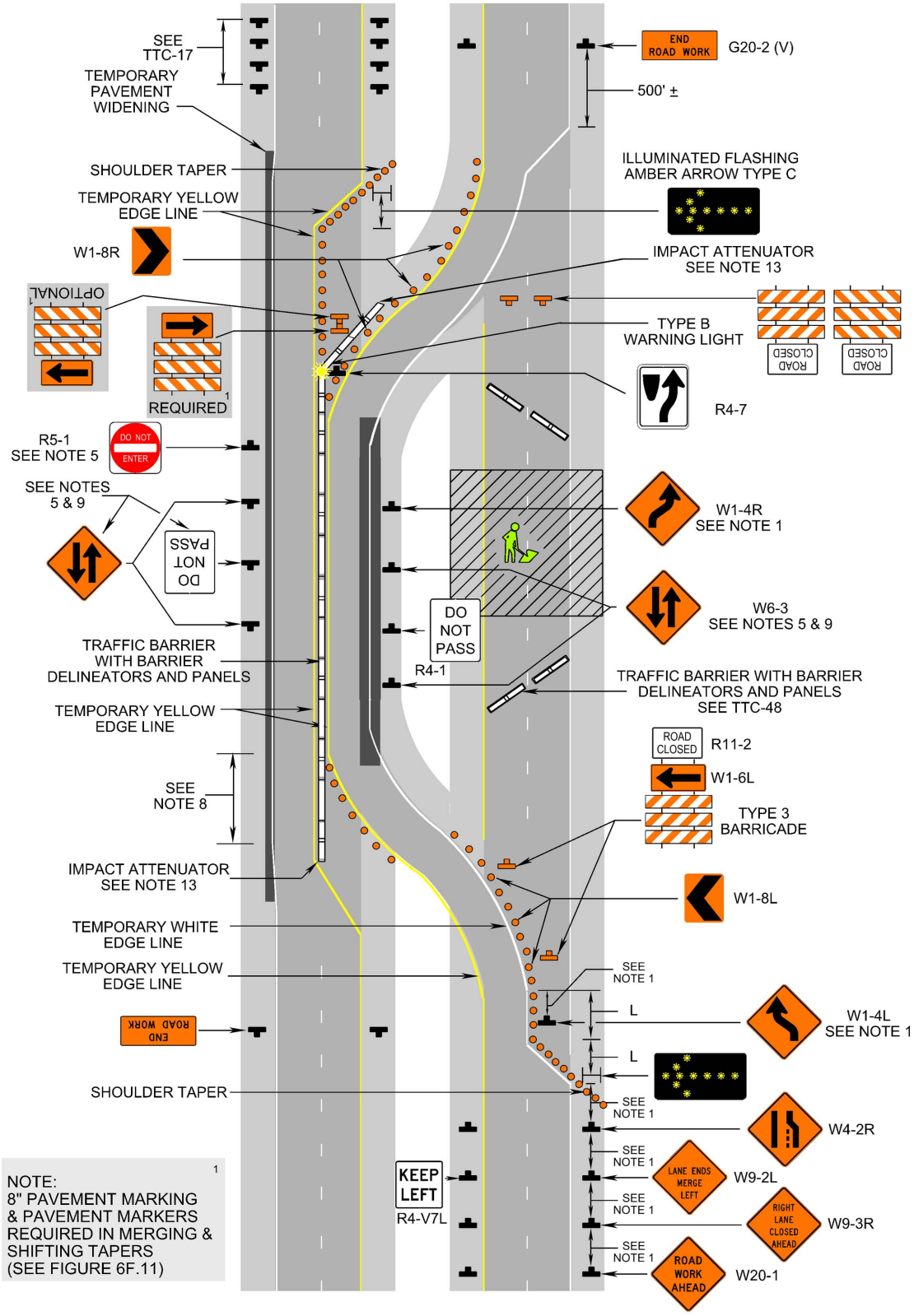
11. When the distance is sufficiently short that road users entering the section can see the downstream end of the section, they are less likely to forget that there is opposing vehicular traffic.

Standard:

12. **The sign legends for the four pairs of signs approaching the lane closure for the non-crossover direction of travel are not shown. They are similar to the series shown for the crossover direction, except that the left lane is closed.**
13. **Impact attenuators shall be used to protect traffic barrier if the barrier is terminated within the clear zone.**
14. **Taper lengths shall be per Table 6C-3 on Page 6C-7; channelizing device spacing shall be per Table 6H-4 on Page 6H-6.**
15. **Existing conflicting pavement markings and markers shall be removed and temporary pavement markings and markers shall be installed per Figure TTC-60.**

1: Revision 1 – 4/1/2015

Median Cross-Over Operation on a Multi-Lane Roadway
(Figure TTC-44.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Total Limited Access Highway Closure Operation

(Figure TTC-45.1)

NOTES

Support:

1. Conditions in this TTC represent planned work activities. See Chapter 6I for additional information on incident management traffic control.

Guidance:

2. *A Portable Changeable Message Sign (PCMS) should be placed a minimum of one mile in advance of the exit proceeding the beginning of the first lane closure activity or queued traffic advising of the road closure ahead. An additional PCMS should be placed one mile in advance of the stationary signing advising ROAD WORK AHEAD, ALL LANES EXIT RIGHT.*
3. *Sign spacing distance should be 1300'-1500' for Limited Access highways.*

Standard:

4. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
5. **Channelizing device spacing shall be a maximum of 40' in transitions, and 80' along the travelway. Transitions shall be a minimum of 1000' in length.**

Guidance:

6. *When detour signing has been installed along the detour route (see Figures TTC-46 or TTC-47), a DETOUR with directional arrow or Detour with a Route Assembly sign should be placed halfway up the ramp or loop. Additionally, a third message should be added to the one mile Portable Changeable Message Sign advising "DETOUR AHEAD."*

Option:

7. Other sign layouts for "Total Limited Access Highway Closure" may be substituted as directed by the Regional Traffic Engineer.

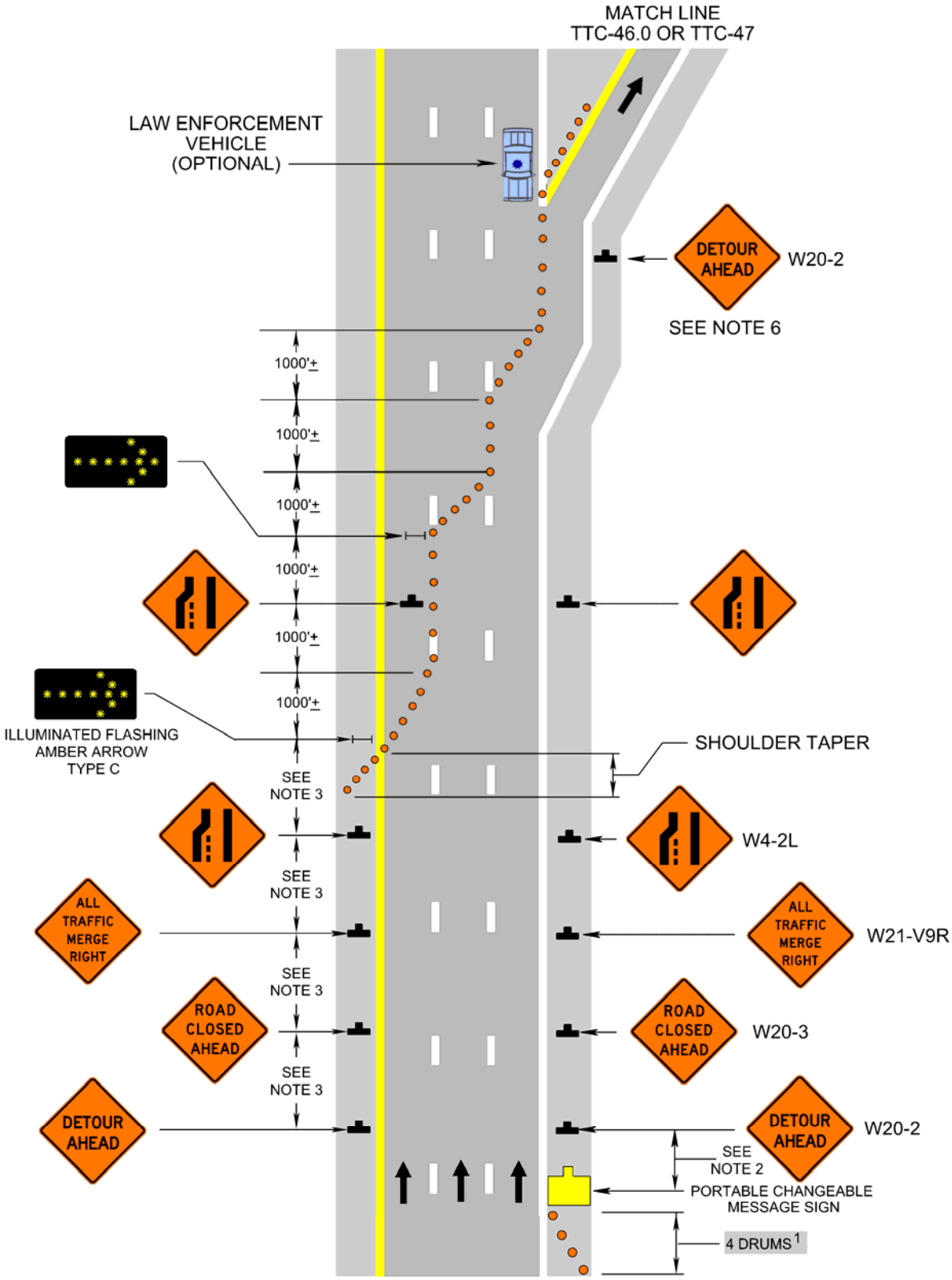
Standard:

8. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

Guidance:

9. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*

Total Limited Access Highway Closure Operation
(Figure TTC-45.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Limited Access Highway Closure Operation with a Short Term Detour

(Figure TTC-46.1)

NOTES

Guidance:

1. *Regulatory traffic control devices should be modified as needed for the duration of the detour.*
2. *Figure TTC-46 illustrates a general layout of detour signs. Additional detour signs should be erected at all connecting roadways.*
3. *Detour signs with an Advanced Turn Arrow (M4-V3) should have a spacing distance of 300' minimum in advance of the intersection. The Detour signs with the Point of Turn Arrow (M4-9) should be placed at the intersection.*
4. *When closing a ramp, the channelizing device spacing should be a maximum of 10'.*

Option:

5. Other sign layouts may be substituted as directed by the Regional Traffic Engineer.
6. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.

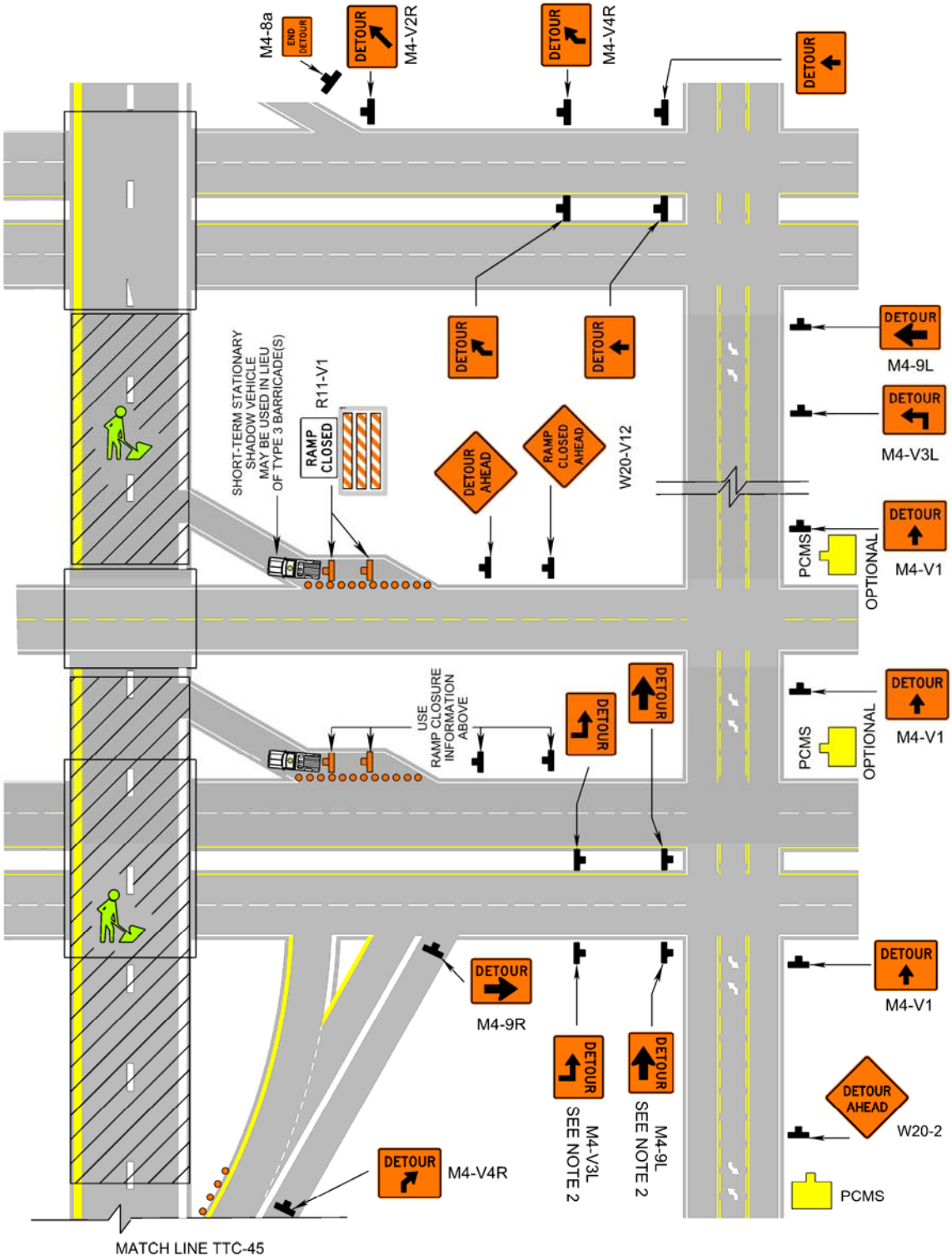
Standard:

7. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
8. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

Support:

9. Short-term stationary operation is daytime work that occupies a location for more than 1 hour within a single daylight period.
10. See Chapter 6I for additional information on incident management traffic control.

Limited Access Highway Closure Operation with a Short Term Detour
(Figure TTC-46.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Limited Access Highway Closure Operation with a Long Term Detour

(Figure TTC-47.1)

NOTES

Guidance:

1. *Regulatory traffic control devices should be modified as needed for the duration of the detour.*
2. *Figure TTC-47 illustrates a general layout of detour signs. Additional detour signs should be erected at all connecting roadways.*
3. *The detour sign assemblies with the Advanced Turn Arrow (M5-1) sign should have a spacing distance of 300' minimum in advance of the intersection. The detour sign assemblies with the Point of Turn arrow (M6-3 and M6-1) signs should be placed at the intersection.*
4. *When closing a ramp, the channelizing device spacing should be a maximum of 10'.*

Option:

5. Other sign layouts may be substituted as directed by the Regional Traffic Engineer.
6. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
7. Cardinal direction plaques may be used with route signs.

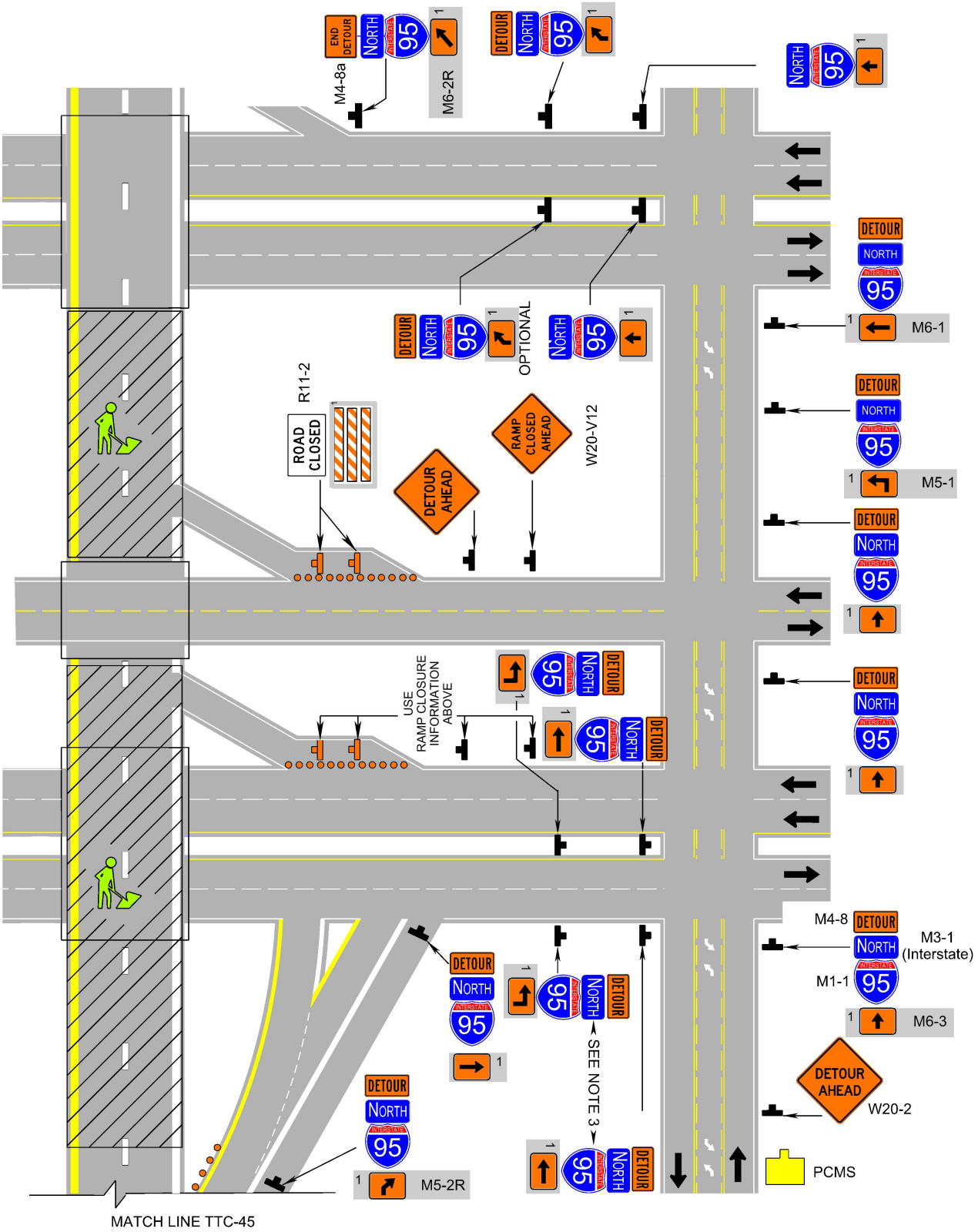
Standard:

8. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
9. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

Support:

10. Long-term stationary operation is work that occupies a location more than 3 days.
11. See Chapter 6I for additional information on incident management traffic control.

Limited Access Highway Closure Operation with a Long Term Detour (Figure TTC-47.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Road Closure Operation with a Detour

(Figure TTC-48.1)

NOTES

Guidance:

1. *Regulatory traffic control devices should be modified as needed for the duration of the detour.*
2. *Sign spacing distance should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less. The directional sign should be placed at the intersection.*
3. *If the road is opened for some distance beyond the intersection and/or there are significant origin/destination points beyond the intersection, the ROAD CLOSED LOCAL TRAFFIC ONLY (R11-3a) and DETOUR (M4-10) signs on Type 3 Barricades should be located at the corners of intersecting closed roadway or the traveled way.*

Option:

4. If the road is open for some distance beyond the intersection the Route Sign Directional assembly may be placed in the travelway as shown to augment or replace the one shown on the corners.
5. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
6. Cardinal direction plaques may be used with route signs.

Standard:

7. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
8. **For short-term duration work the M4-9 or M4-V4 series of signs shall be used. For long-term duration work the route shield assembly shall be used with the detour sign.**

Option:

9. Long-term detours may be signed with a street name (M4-VP1a or M4-Vp1b) plaque above the DETOUR (M4-9 or M4-V4 series) sign (see Figure TTC-34).

Support:

10. See Chapter 6I for additional information on incident management traffic control.

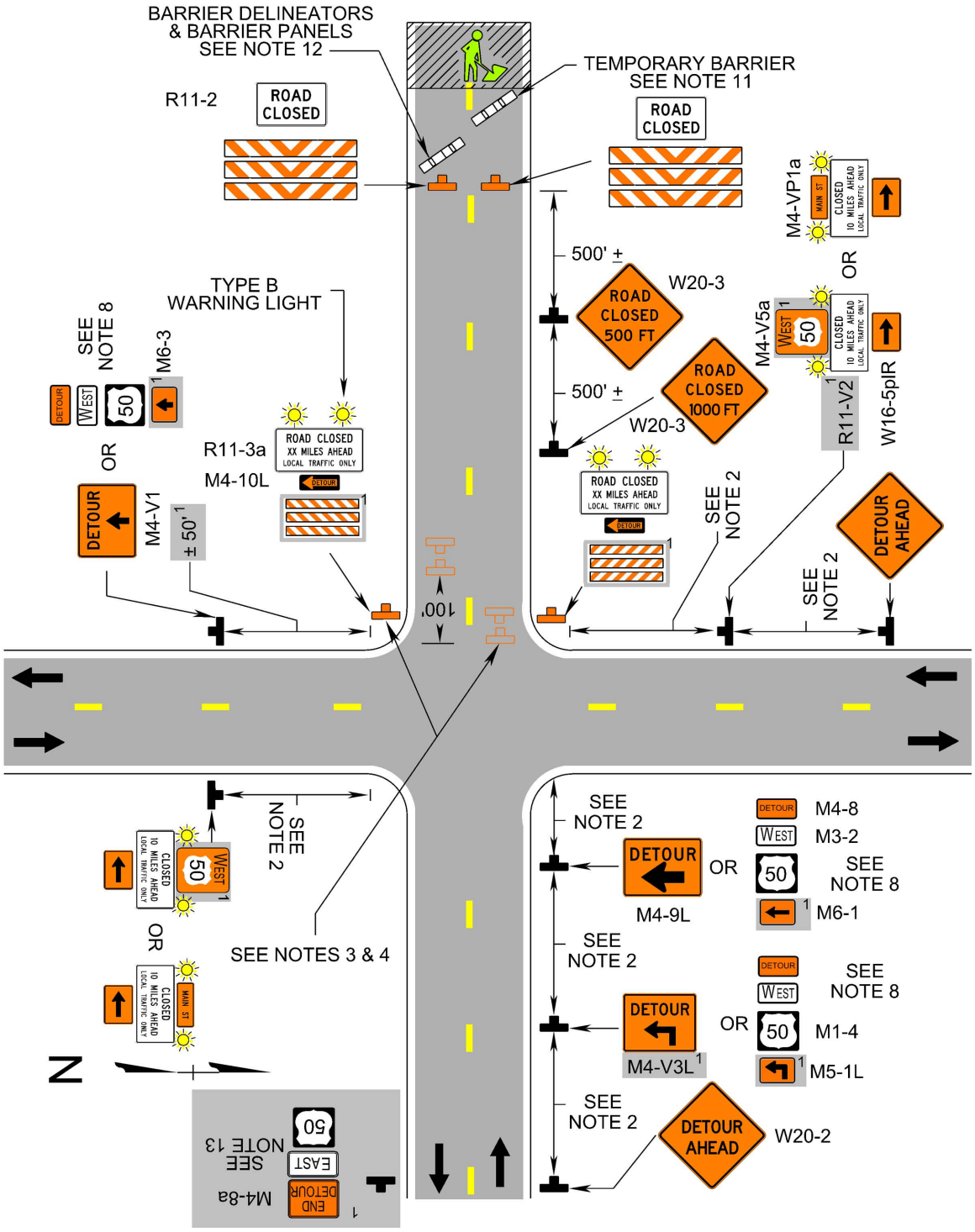
Guidance:

11. *Temporary barrier should be placed at a 45° angle to the travelway a sufficient distance beyond the Type 3 Barricade but before the work space while providing equipment access to the work space.*

Standard:

12. **Barrier panels 8 inches in width and 12 inches in height shall be placed on top of the temporary concrete barrier, perpendicular to traffic, and spaced 20' on centers along the taper sections. Reflectorized surface shall be fluorescent orange prismatic lens sheeting. Barrier delineators shall be installed along the traffic side of the concrete barrier in-between and at the same spacing as the barrier panels approximately 24 inches up from the roadway surface.**
13. **An END DETOUR (M4-8a) sign shall be used with a Cardinal Route shiel and a Cardinal Directional sign to terminate the detour route.**

Road Closure Operation with a Detour
(Figure TTC-48.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control
Surveying Operation
(Figure TTC-49.1)
NOTES

OFF TRAVELWAY -

Guidance:

1. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Standard:

2. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
3. **Each vehicle involved in the surveying operation shall be equipped with at least one high intensity amber rotating, flashing[1], or oscillating light.**
4. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights but can be used as a supplement.**
5. **Maximum length of the work zone shall be two miles.**

Option:

6. Where Right-of-Way and/or geometric conditions do not allow the use of 48" x 48" signs, 36" x 36" signs may be used.

Standard:

7. **All workers shall wear high visibility clothing per Chapter 6D (see Section 6D.03).**

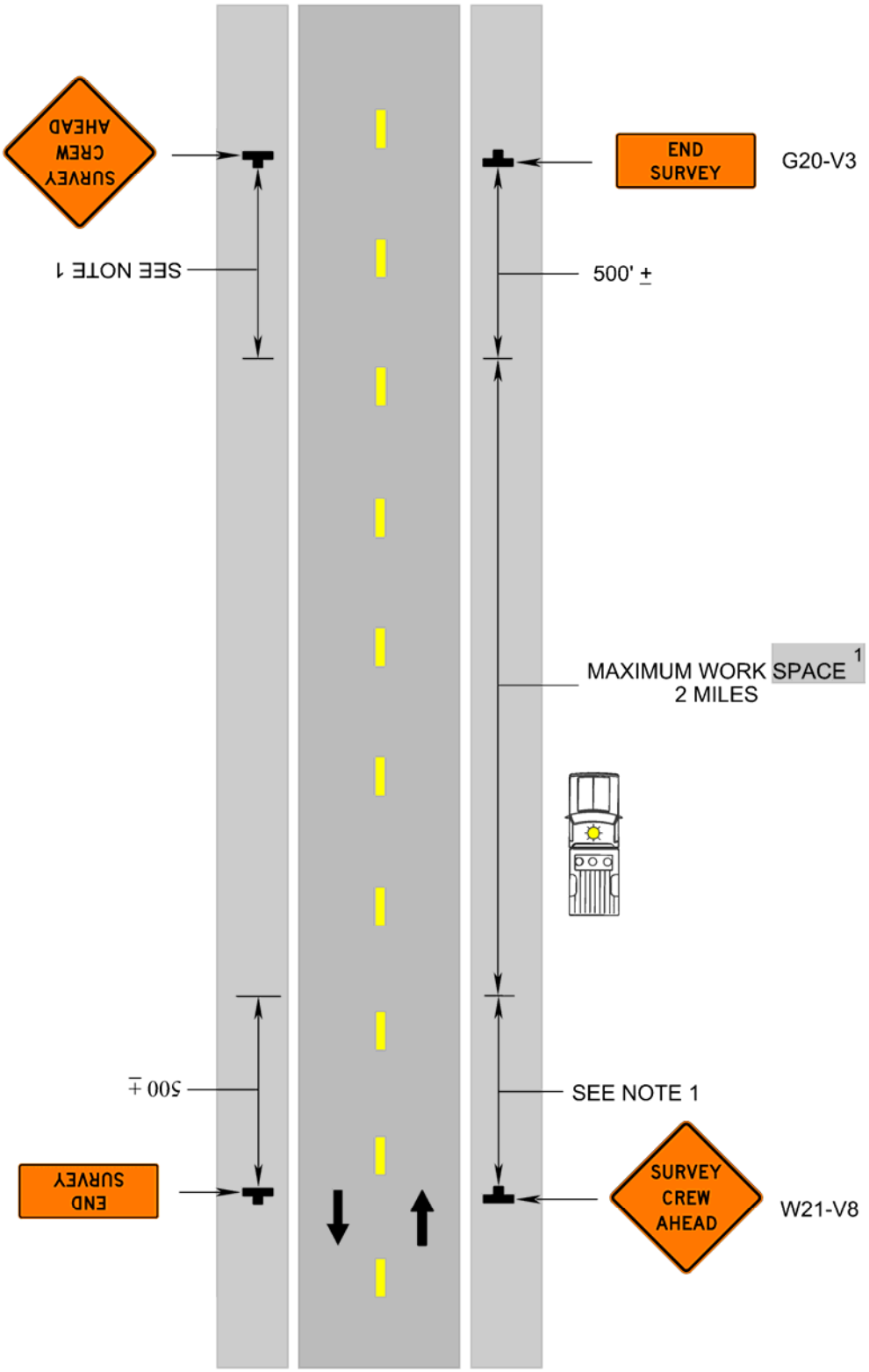
ON TRAVELWAY -

Guidance:

8. *For surveying operations on the travelway, Typical Traffic Control Figure TTC-23, Lane Closure on a Two-Lane Roadway Using Flaggers, or Typical Traffic Control Figure TTC-16 or TTC-17, Outside or Inside Lane Closure Operation on a Four-Lane Roadway, should be used.*

1: Revision 1 – 4/1/2015

Surveying Operation
(Figure TTC-49.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Disruption Operation on a Multi-Lane Roadway

(Figure TTC-50.0)

NOTES

Support:

1. Conditions represented are a planned closure not exceeding 20 minutes during the daytime.

Guidance:

2. *On Limited Access highways, the sign spacing distance and flagger distance should be 1300'- 1500'. For all other roadways, the distance between the advance warning signs and between the flagger should be 500'-800' where the posted speed limit is 45 mph or less.*
3. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*
4. *The buffer space length should be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.*

Standard:

5. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
6. **Flagging stations shall be located far enough in advance of the operation to permit approaching traffic to reduce speed and/or stop before passing into the operation.**
7. **All flaggers shall be state certified and have their certification card in their possession when performing flagging duties and shall follow the procedures noted in Sections 6E.04 and 6E.05.**
8. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

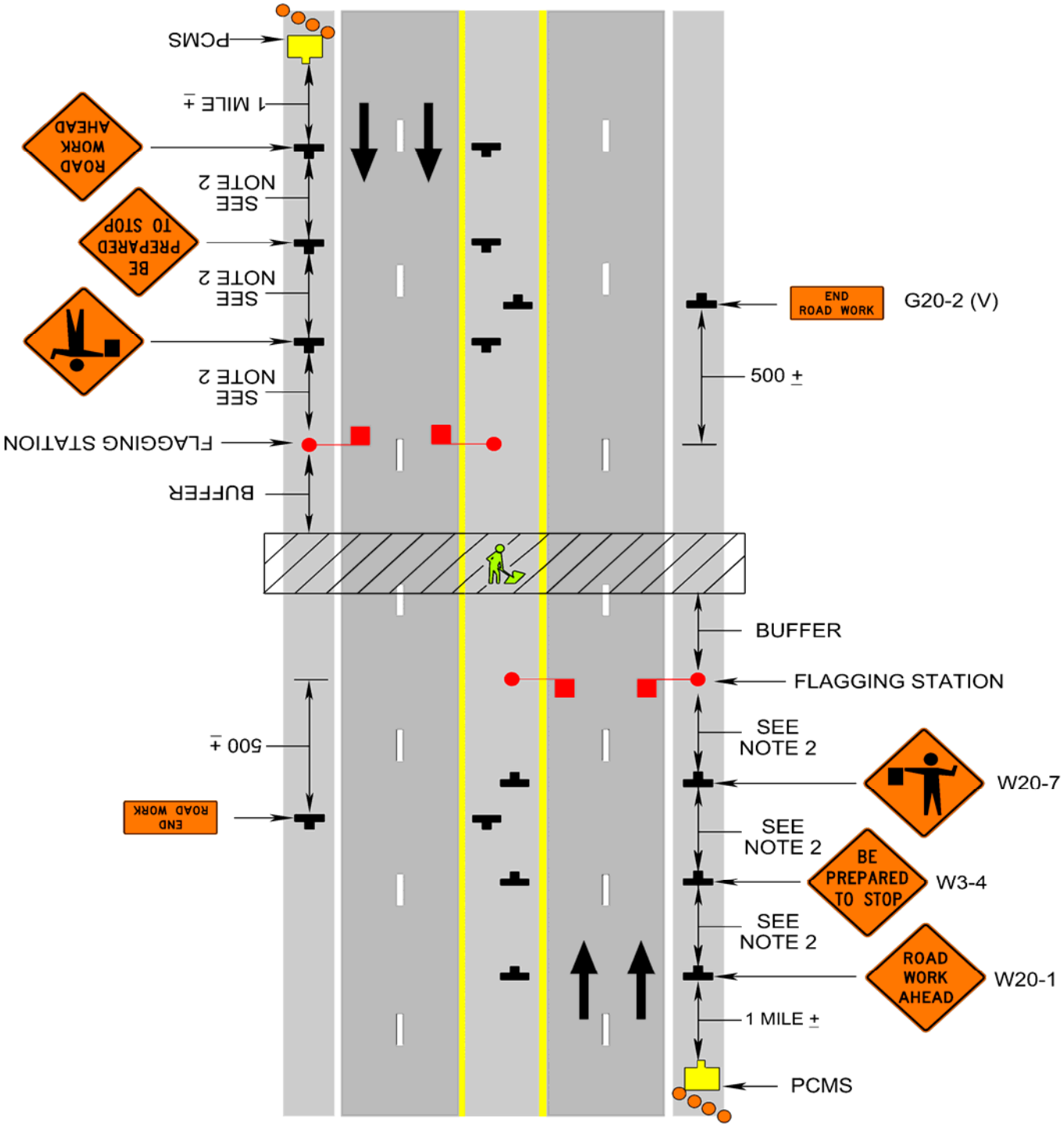
Guidance:

9. *A Portable Changeable Message Sign (PCMS) should be used on Limited Access highways and placed a minimum of one mile in advance of the warning signs warning of the operation ahead (UTILITY WORK AHEAD) and advising of the action required (BE PREPARED TO STOP).*
10. *Disruptions to traffic should be coordinated with all entities involved in advance and performed during off-peak hours to minimize the impact on the motoring public. On Limited Access highways, State Police should assist with the stoppage of traffic.*

Option:

11. A uniformed law enforcement officer may be used for this application in place of the flagger.
12. The ROAD WORK AHEAD (W20-1) sign may be replaced with other appropriate signs such as UTILITY WORK AHEAD (W21-7).

Disruption Operation on a Multi-Lane Roadway
(Figure TTC-50.0)



Typical Traffic Control
Haul Road Crossing Operation
(Figure TTC-51.1)
NOTES

Guidance:

1. *Overhead temporary lighting should be used to illuminate haul road crossings where existing light is inadequate.*
2. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
3. *Where no passing lines are not already in place, they should be added.*

Standard:

4. **The traffic control signing shall be the same in both directions.**
5. **A NO PASSING ZONE (W14-3) sign shall be used directly across from the DO NOT PASS (R4-1) sign.**
6. **When a road used exclusively as a haul road is not in use, Type 3 Barricades with a ROAD CLOSED (R11-2) sign shall be in place and the Flagger (W20-7) symbol or Signal Ahead (W3-3) and BE PREPARED TO STOP (W3-4) signs covered or removed.**
7. **All flaggers shall be state certified and have their certification card in their possession when performing flagging duties.**

Flagging Method

Guidance:

8. *The buffer space length should be as shown in Table 6H-3 on Page 6H-5 for the posted speed limit.*

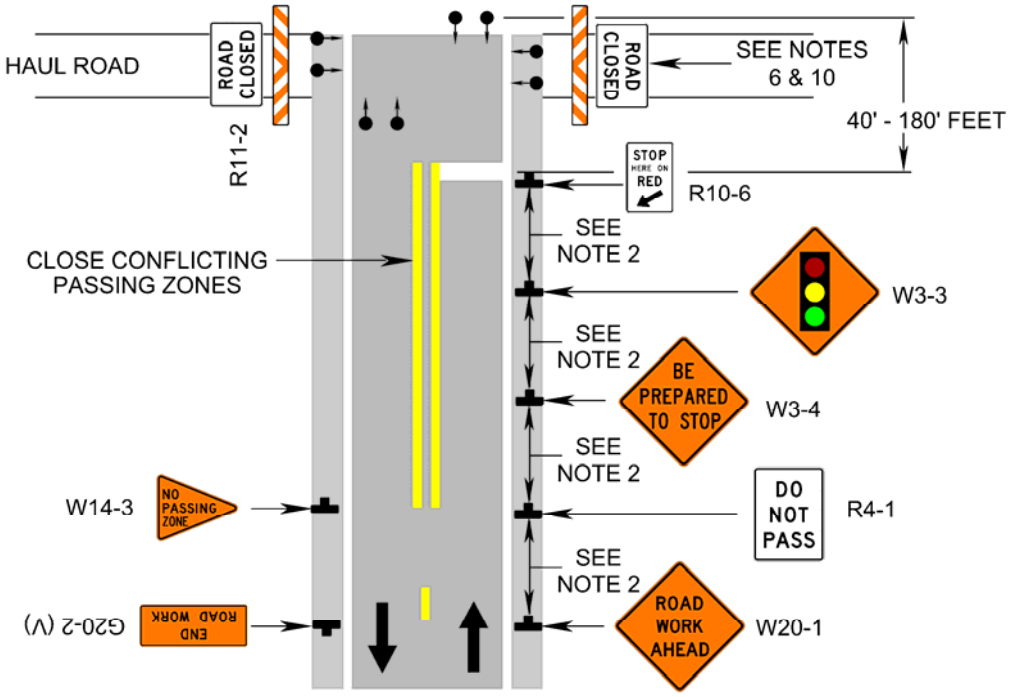
Standard

9. **At night, flagger stations shall be illuminated, except in emergencies.**

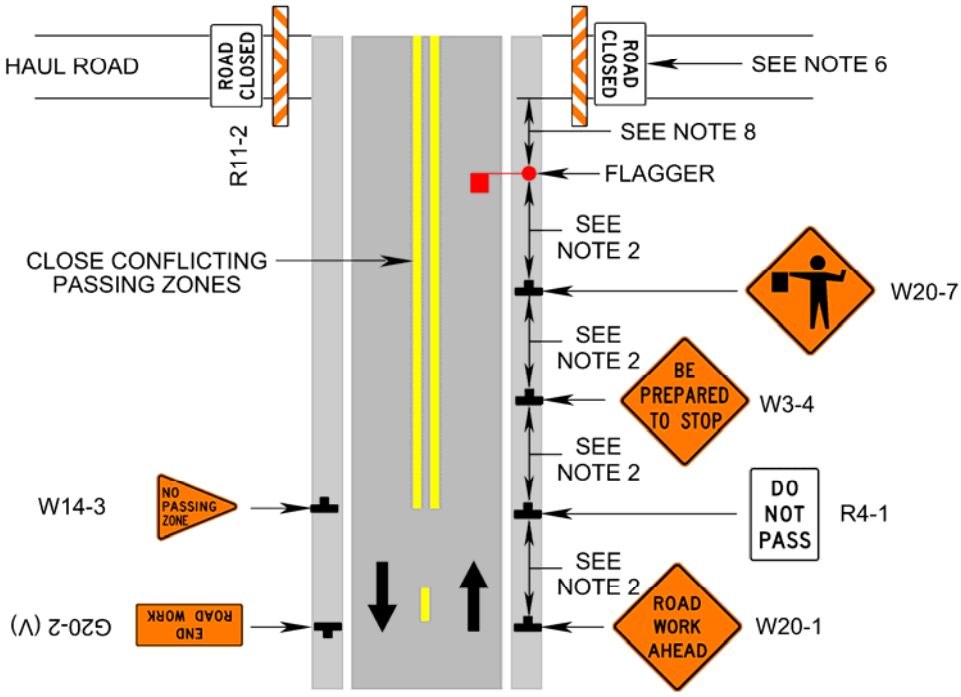
Signalized Method

10. **When the haul road is not in use, the signals shall either flash yellow on the main road or be covered, and the Signal Ahead and STOP HERE ON RED (R10-6) signs shall be covered or removed.**
11. **The temporary traffic control signals shall control both the highway and the haul road and shall meet the physical display and operational requirements of conventional traffic control signals as described in Part 4 of the 2009 MUTCD. Authorized officials shall establish traffic control signal timing.**
12. **Stop lines shall be used on existing highway with temporary traffic control signals.**
13. **Existing conflicting pavement markings and raised pavement marker reflectors between the stop lines shall be removed. After the temporary traffic control signal is removed, the stop lines and other temporary pavement markings shall be removed and the permanent pavement markings restored.**
14. **Safeguards shall be incorporated to avoid the possibility of conflicting signal indications at each end of the TTC zone.**

Haul Road Crossing Operation
(Figure TTC-51.1)



SIGNALIZED METHOD [1]



FLAGGER METHOD [1]

1: Revision 1 – 4/1/2015

Typical Traffic Control

Signing for Speed Limit and Fine Signs in Work Zones

(Figure TTC-52.1)

NOTES

Standard:

1. **Prior to the implementation of this Typical Traffic Control layout, the Regional Traffic Engineer must approve a speed reduction[1] in a work zone after performing and evaluating[1] a Traffic Engineering investigation[1] per Traffic Engineering Division Memorandum TE-350.**

Option:

2. This layout depicts signing requirements for speed limits and increased fines in work zones. Additional signing and traffic control devices may be required based on the operation being performed.

Guidance:

3. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Standard:

4. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**
5. **The use of the WORK ZONE $500 MAX FOR EXCEEDING SPEED LIMIT WHEN FLASHING (R2-V1) [1] sign shall be approved by the Regional Traffic Engineer prior to installation. Type B warning lights shall be installed above the R2-V1 sign and controlled remotely with activation only when workers are present in the work zone.[1] If the R2-V1 sign is used the WORK ZONE (G20-5ap) plaque shall be installed above the SPEED LIMIT (R2-1) sign and the[1] FINES HIGHER (R2-6P) plaque below.**

Option:

6. For Secondary and Minor Primary road systems, a 66" x 42" R2-V1[1] sign may be used.

Standard:

7. **If the entire project is signed for a reduced speed, and an original speed limit sign is not within 1000 feet of the END ROAD WORK (G20-2 (V)) sign, signs depicting the original speed limit shall be erected 500'± past the END ROAD WORK sign. On secondary roads without posted speed limits, an END WORK ZONE SPEED LIMIT (R2-12) sign shall be used in place of erecting an R2-1 sign. If only part of the project is signed for a reduced speed, then the original speed limit shall be posted 500'± past the work area.**

Option:

8. Experience has shown that compliance to the reduced speed signing is greater if these signs are placed as close to the work as possible, as opposed to placement prior to the advance warning signs (ROAD WORK AHEAD, etc.).

Standard:

9. **The Reduced Speed Limit Ahead (W3-5) graphic signs are only required if the speed limit is being reduced in the work zone.**

Option:

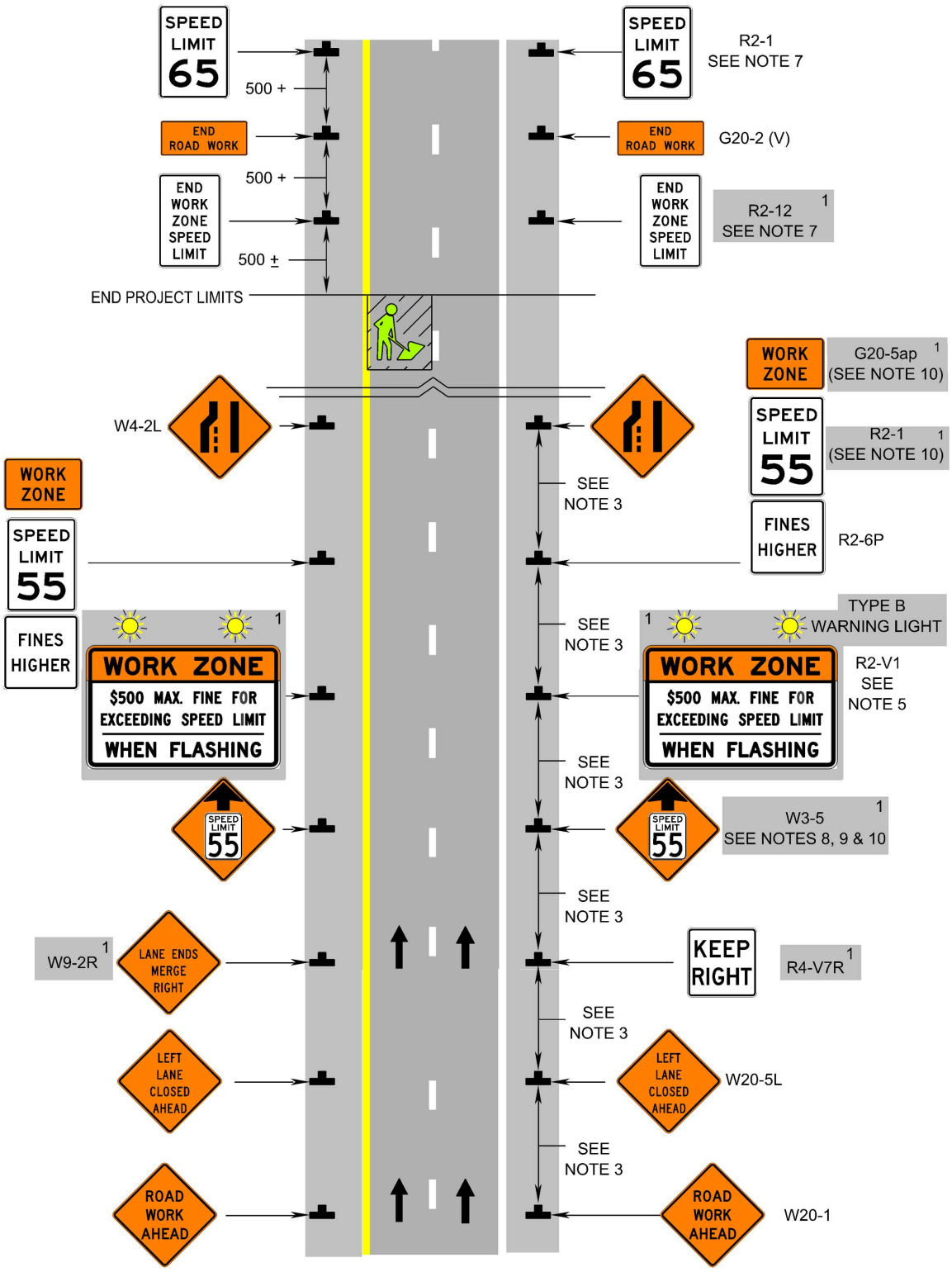
10. During short-term (less than 72 hours) operations, if the speed limit is reduced, the Reduced Speed Limit Ahead graphic signs and the SPEED LIMIT signs may be mounted on a temporary (portable) sign support. The use of the WORK ZONE sign is not required.[1]

Guidance:

11 *The speed limit should be stepped down in advance of the location requiring the lowest speed in ten-mile per hour increments. Additional TTC warning devices should be used.*

1: Revision 1 – 4/1/2015

Signing for Speed Limit and Fine Signs in Work Zones
(Figure TTC-52.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control
Signing for Project Limits
(Figure TTC-53.0)
NOTES

Support:

1. This layout depicts signing requirements for notifying motorist when they are entering and exiting a potential construction/maintenance area with a duration equal to or greater than 60 days.

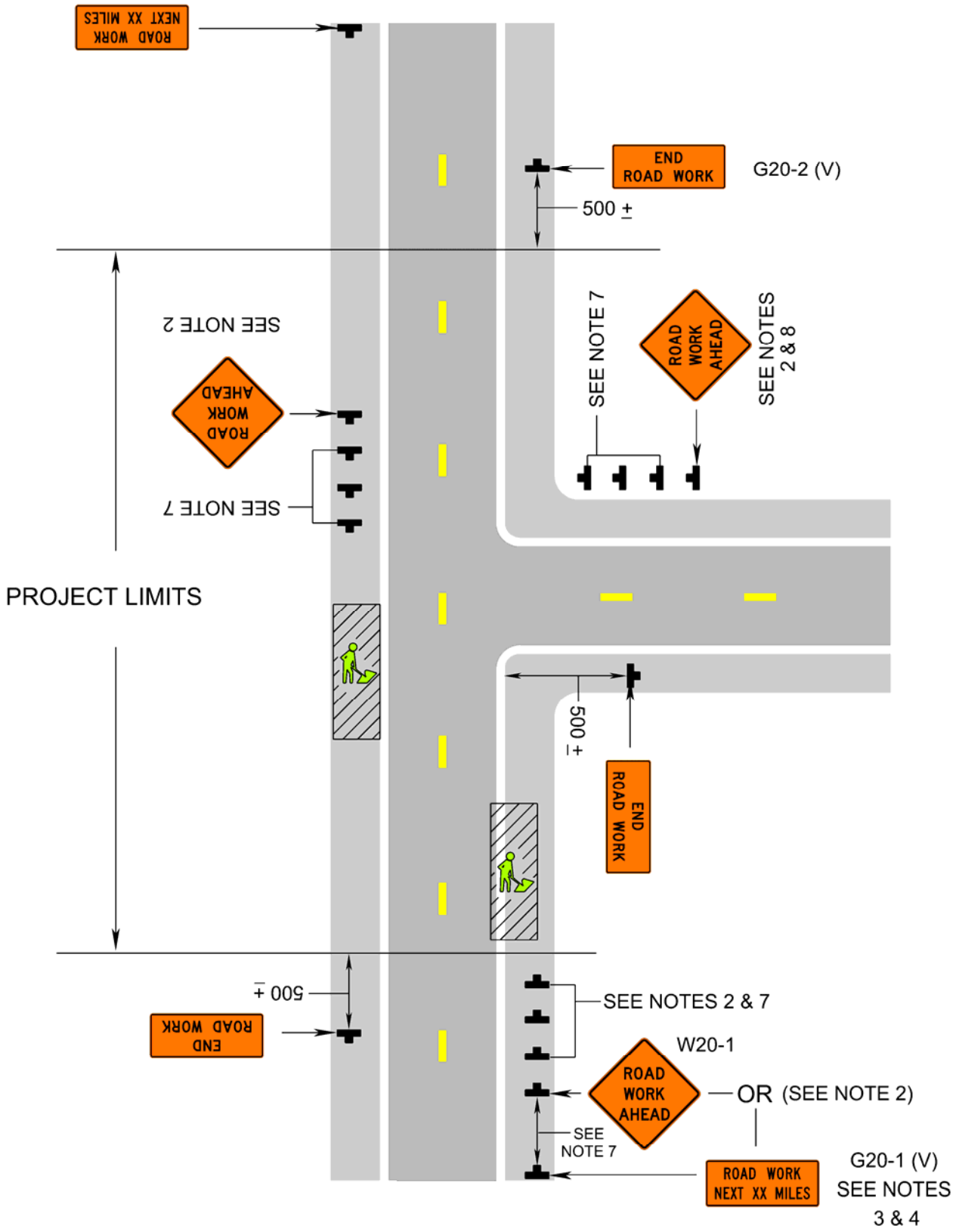
Standard:

2. **The ROAD WORK AHEAD (W20-1) sign or the ROAD WORK NEXT XX MILES (G20-1 (V)) sign shall be placed far enough in advance of the project limits so that other warning signs in a series may be adequately placed prior to the condition they are warning about.**
3. **The ROAD WORK NEXT XX MILES sign shall be used for projects with activity areas greater than 2 miles in length, or when multiple work activities (such as pavement patching, guardrail installations, shoulder restoration, etc.) occur along a highway.**
4. **The distance displayed on the ROAD WORK NEXT XX MILES sign shall be stated to the nearest whole mile from the point of installation to the END ROAD WORK (G20-2 (V)) sign.**
5. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Guidance:

6. *For projects with activity areas 2 miles or less in length, the ROAD WORK AHEAD sign should be the first sign motorist encounter.*
7. *Sign spacing should be 1300'-1500' for Limited Access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*
8. *All connections within the project limits should be identified with signs indicating to motorist they are entering or exiting a potential construction/maintenance area.*

Signing for Project Limits
(Figure TTC-53.0)



Typical Traffic Control

Motorist Survey Operation on a Two-Lane Roadway

(Figure TTC-54.0)

NOTES

Guidance:

1. *Care should be exercised when establishing the limits of the work zone to insure maximum possible sight distance in advance of the transition, based on the posted speed limit and at least equal to or greater than the values in Table 6H-3. For Limited Access highways a minimum of 1000' is desired.*
2. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*

Standard:

3. **Flagging stations shall be located far enough in advance of the survey area to permit approaching traffic to reduce speed and/or stop before passing through the survey area.**

Option:

4. A supplemental flagger may be required in the advance warning of the operation to slow approaching traffic prior to reaching the flagger station or queued traffic.

Guidance:

5. *If the queue of traffic reaches the BE PREPARED TO STOP (W3-4) sign, the flaggers controlling the traffic in both directions should turn their flagging paddles to SLOW to allow the traffic to clear. Also, the advance warning signs should be readjusted at greater distances.*

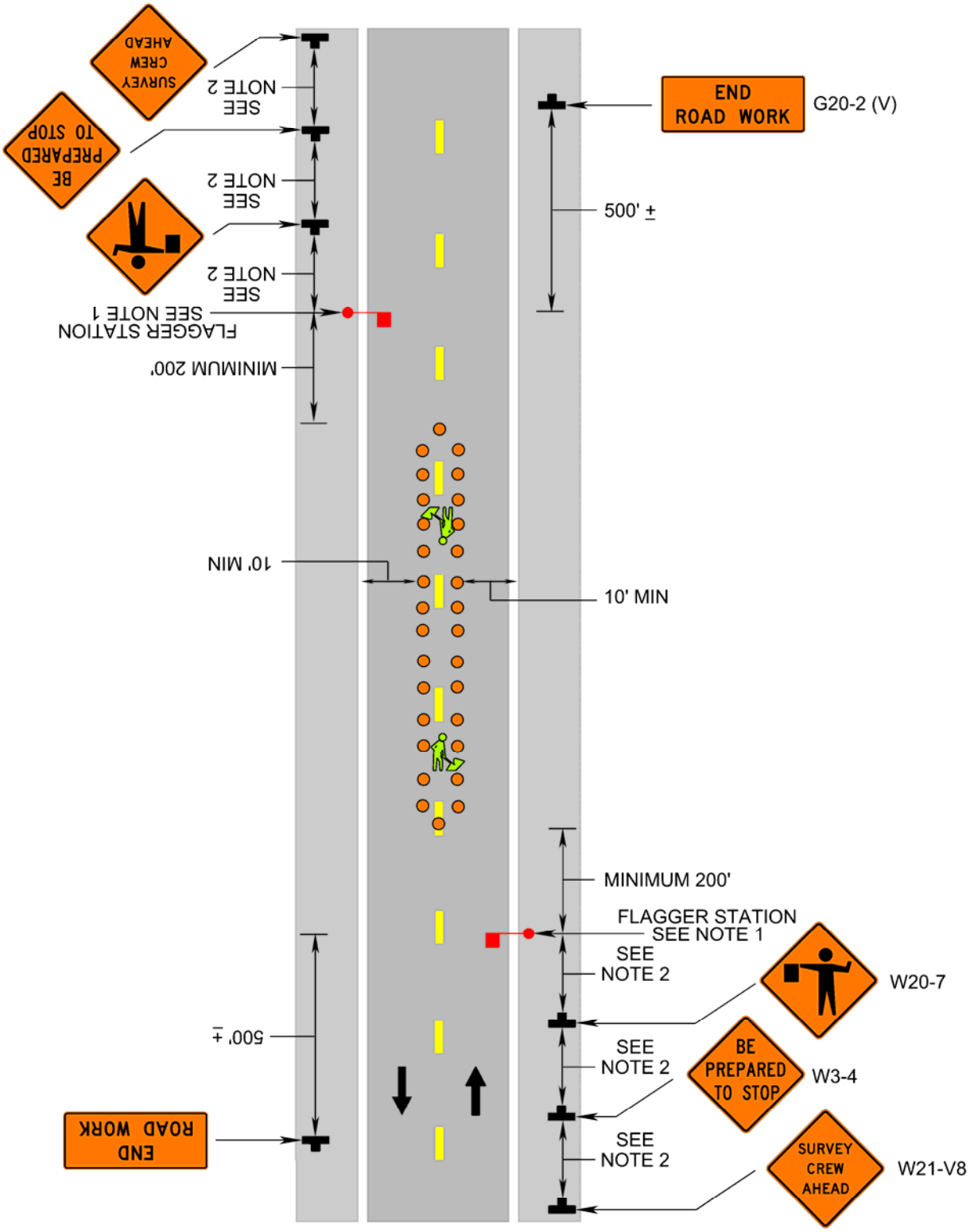
Standard:

6. **All flaggers shall be state certified and have their certification card in their possession when performing flagging duties.**
7. **Cones spaced a maximum of 20' on center shall be used to delineate the survey area.**
8. **The minimum width of the open travel lane shall be 10 feet.**
9. **All workers in or near the roadway shall wear high-visibility clothing (see Section 6D-03).**
10. **For surveying on the centerline of a high-volume road, one lane shall be closed using the information illustrated in Figure TTC-23.**

Option:

11. Additional traffic control devices may be needed as determined by the Regional Traffic Engineer.
12. TTC-54 may be used for law enforcement checkpoints by replacing SURVEY CREW AHEAD (W21-V8) with an appropriate sign (Examples such as LICENSE CHECK AHEAD, CAR SEAT CHECKPOINT AHEAD, SHERIFF STOP AHEAD, etc.).

Motorist Survey Operation on a Two-Lane Roadway
(Figure TTC-54.0)



Typical Traffic Control

Eradication of Pavement Markings in a Work Zone

(Figure TTC-55.1)

NOTES

Support:

1. This figure depicts requirements for pavement marking removal for long-term (over 3 days continuous duration) work zones. These are minimum removal requirements for existing pavement markings.

Standard:

2. **All skip lines shall be removed a minimum of 200' in advance of the beginning of a lane closure transition in the lane being closed to the point where the new edge line covers the skips.**
3. **The existing edge line shall be removed a minimum of 200' past the beginning point where the new edge line is transitioned over.**
4. **In lane shift situations, all pavement markings and markers[1] not behind temporary[1] traffic barriers and within 6' of the new edge line shall be removed.**

Option:

5. In lane shift situations, if Group 2 channelizing devices are placed between the barrier service or work area and the travel lanes, removal of skip lines in excess of 6' away from the new edge line is not required and may remain.

Standard:

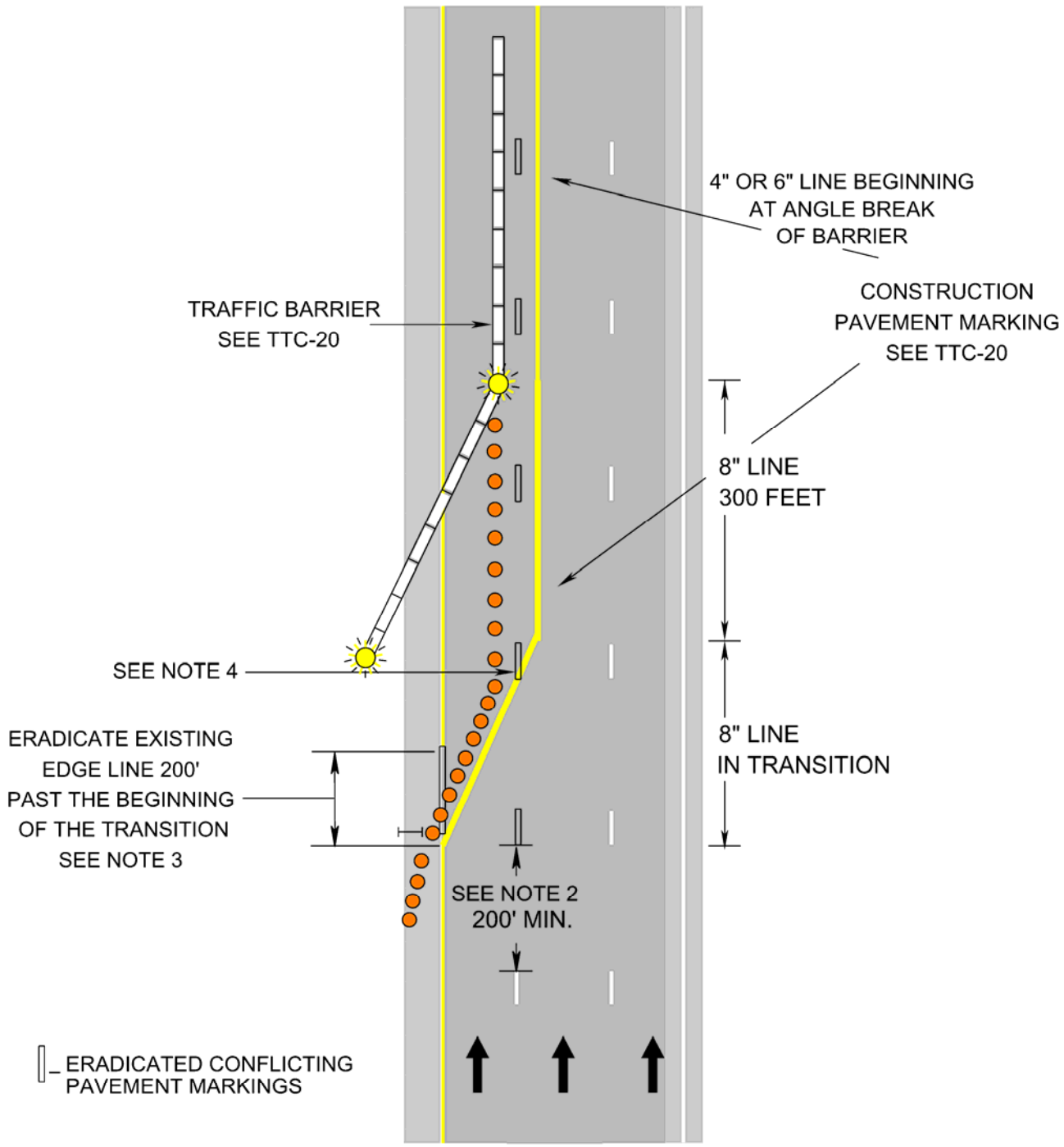
6. **All existing pavement markers in conflict with the new construction pavement markings shall have the reflective element removed.**
7. **Work zones shall be reviewed the first night period after changes have been made to the pavement markings to ensure all conflicting markings and markers have been adequately removed, and the new markings and markers properly delineate the intended travel path.**

Guidance:

8. *Removal of additional pavement markings and pavement markers should be removed based on roadway geometrics and specific site conditions so that traffic will be guided safely if additional traffic control devices such as drums become displaced.*[1]

1: Revision 1 – 4/1/2015

Eradication of Pavement Markings in a Work Zone
(Figure TTC-55.1)



Typical Traffic Control

Work in the Vicinity of a Highway-Rail Crossing

(Figure TTC-56.1)

NOTES

Guidance:

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

Standard:

2. **If the queuing of vehicles across active rail tracks cannot be avoided, a law enforcement officer or flagger shall be provided at the highway-rail grade crossing to prevent vehicles from stopping within the highway-rail grade crossing (as described in Note 1), even if automatic warning devices are in place.**

Guidance:

3. *Early coordination with the railroad company should occur before work starts.*
4. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, and 500'-800' where the posted speed limit is greater than 45 mph.*
5. *In the example depicted in TTC-56, the buffer space should be extended upstream of the highway-rail grade crossing (as shown) so that a queue created by the flagging operation will not extend across the highway-rail grade crossing.*
6. *The DO NOT STOP ON TRACKS (R8-8) sign should be used on all approaches to a highway-rail grade crossing within the limits of the temporary traffic control zone.*

Standard:

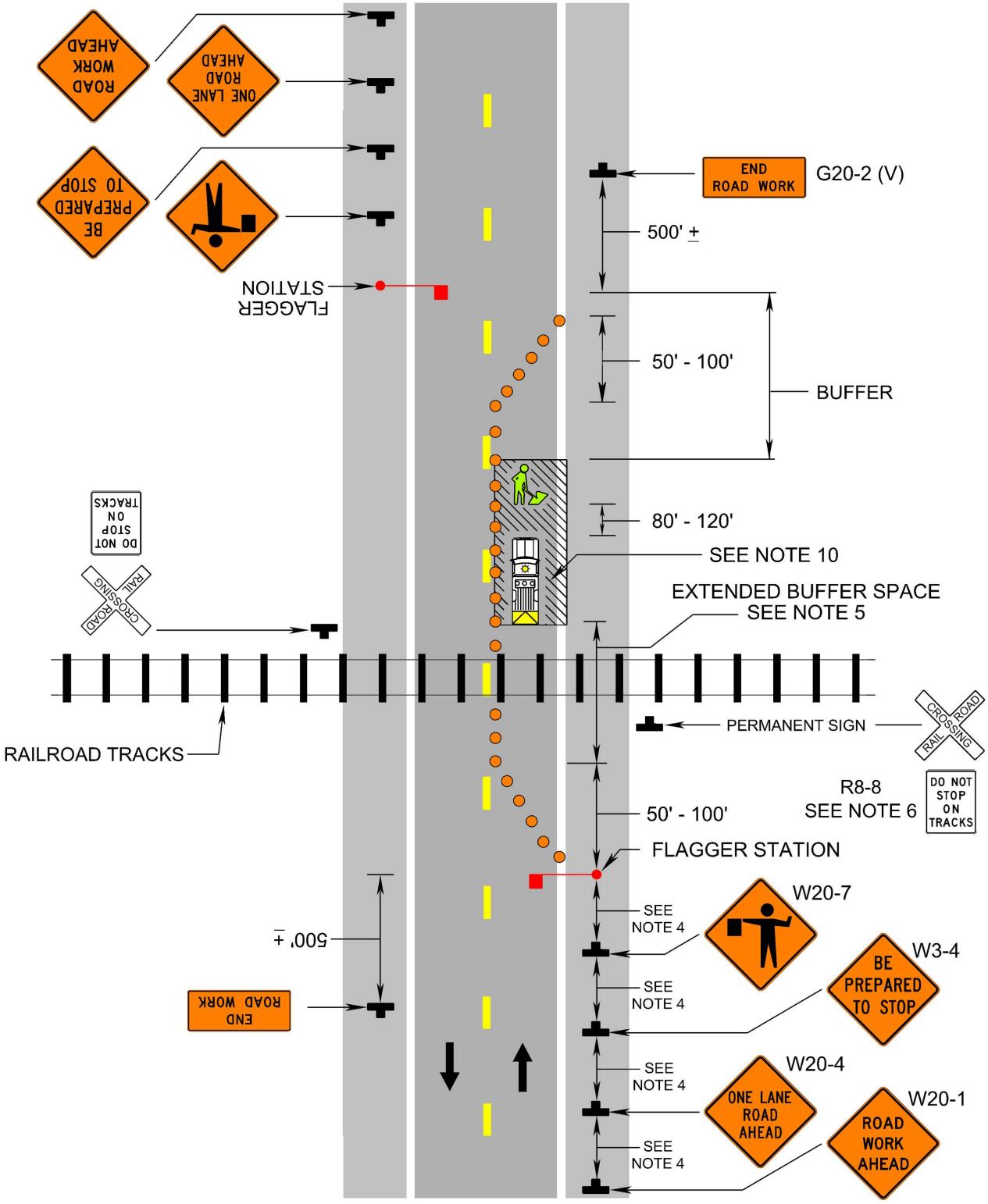
7. **Flaggers shall be state certified and have their certification card in their possession when performing flagging duties (see Section 6E.01, Qualifications for Flaggers).**
8. **At night, flagger stations shall be illuminated, except in emergencies. Street lights and vehicle headlights shall not be used to illuminate the flagger station.**
9. **Cones shall not be required on roadways 20 feet or less in width. For roadways greater than 20 feet in width, cones shall be used at the following spacing:**

Location	Posted Speed Limit (mph)	
	0 - 35	36 +
Transition Spacing	20'	40'
Travelway Spacing	40'	80'
Construction Access*	80'	120'
* Spacing may be increased to this distance, but shall not exceed one access per ¼ mile.		

10. **A shadow vehicle with at least one high intensity amber rotating, oscillating or flashing[1] light shall be parked 80'-120' in advance of the first work crew. If the work is performed on a multi-lane highway with posted speeds of 45 mph or greater, it shall be a truck-mounted attenuator.**
11. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity amber rotating, flashing, or[1] oscillating lights but can be used as a supplement[1].**
12. **When a side road intersects the highway within the temporary traffic control zone, additional traffic control devices shall be placed as needed.**

1: Revision 1 – 4/1/2015

Work in the Vicinity of a Highway-Rail Crossing
(Figure TTC-56.1)



Typical Traffic Control

End of Day Signing for Partial Paving Operations on a Multi-Lane Roadway

(Figure TTC-57.1)

NOTES

Standard:

1. **On divided highways having a median wider than 8', right and left sign assemblies shall be used. Median barrier is considered to be part of the shoulder and its measurement shall be used to determined the total width of the shoulder.**
2. **The maximum pavement edge drop-off between traffic lanes shall be 2 inches or less.**
3. **Open travel lane(s) shall not be exposed to more than 2 to 3 mile sections of milled or uneven surface.**
4. **A portable changeable message sign with "ROUGH ROAD AHEAD" and other appropriate messages shall be used.**
5. **A BUMP (W8-1) sign shall be placed in advance of the end of the pavement drop-off.[1]**
6. **The Regional Traffic Engineer shall determine speed reductions.**
7. **The UNEVEN LANES (W8-11), STAY IN LANE (R4-9), and BUMP signs shall be adjusted daily with the work operation and their sign stand shall be supported with a sand bag weighing approximately 25-pounds on each leg or two (2) drum collar weights positioned on the center of the sign stand[1]. Additional UNEVEN LANES signs shall be installed every 2 miles and on entrance ramps.**
8. **Where conditions warrant, ROUGH ROAD (W8-8) and BUMP signs shall be installed 500' ± in advance of the affected roadway surface on entrance ramps, and BUMP signs shall be installed 500' ± in advance of unaffected roadway surface on exit ramps.**
9. **All signs shall be post-mounted at locations after 72 consecutive hours of non-work activities.**

Guidance:

10. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Option:

11. Only traffic control signing for partial pavement resurfacing is shown. Other devices may be used for the control of traffic through the work area.
12. Temporary pavement markers spaced at 10 foot centers for two-way traffic centerlines or three per skip line for lane division lines may be added as directed by the engineer.
13. The LOW SHOULDER (W8-9) sign may be used to warn of a shoulder condition where there is an elevation difference of less than 2 inches between the shoulder and the travel lane.

Standard:

14. **If used, the LOW SHOULDER sign shall be repeated at 1 mile intervals if the condition extends over a distance in excess of 1 mile.**
15. **The SHOULDER DROP OFF (W8-V5) sign shall be used when an unprotected shoulder drop-off, adjacent to the travel lane, exceeds 2 inches depth between the shoulder and the travel lane. Where the condition extends over a distance in excess of 1 mile, the sign shall be repeated at 1 mile intervals.**

Option:

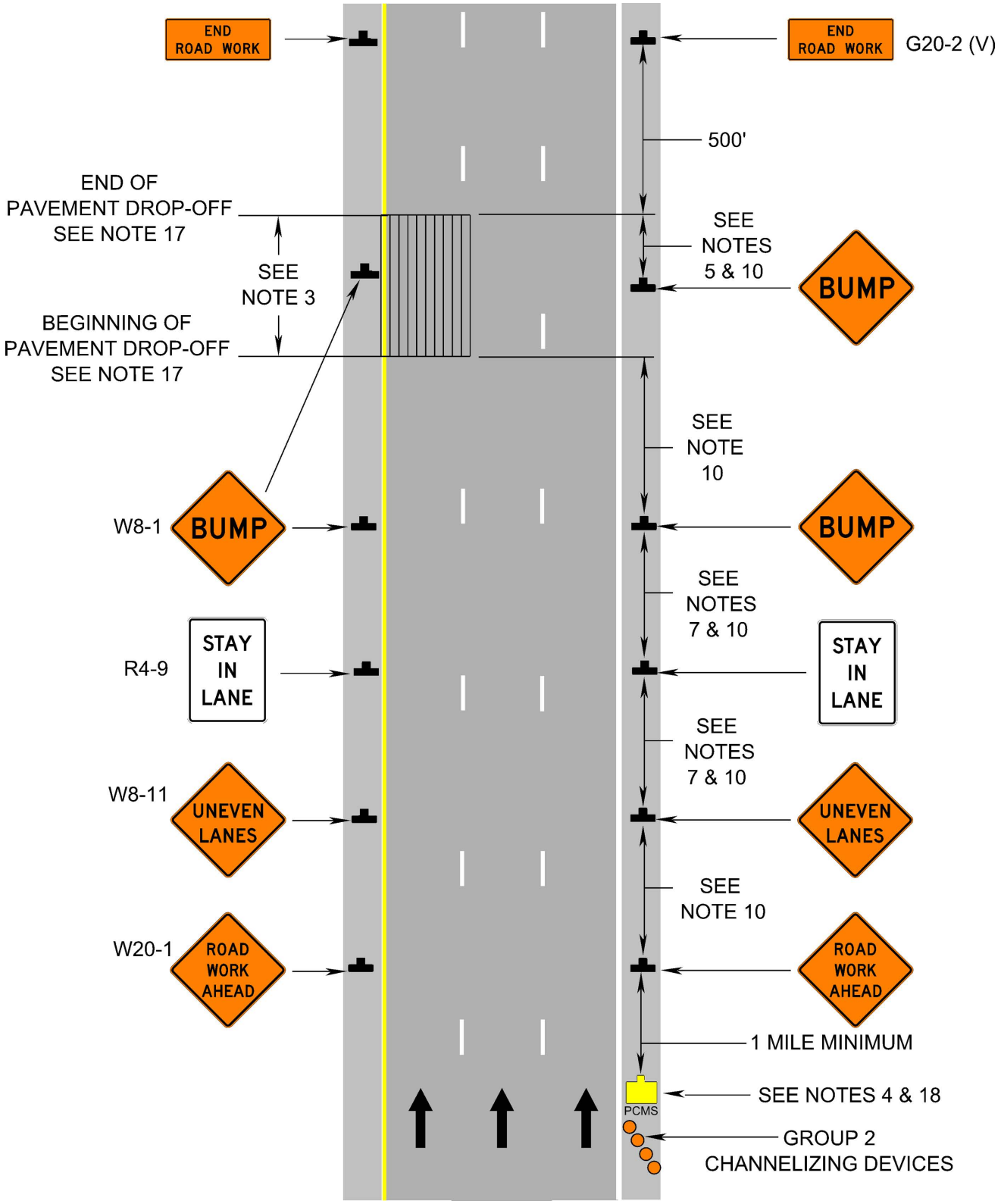
16. The SHOULDER DROP OFF sign may be eliminated if a 6:1 (desirable) to 4:1 (minimum) wedge is used between the travel lane and the shoulder.

Standard:

17. **A temporary pavement wedge shall be constructed of surface mix asphalt a minimum of three (3) feet in length for every inch of depth of pavement milling on the approach and departure end of the milled travel lane(s). Refer to Standard ACOT-1 of the Road and Bridge Standards for details.**
18. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

1: Revision 1 – 4/1/2015

End of Day Signing for Partial Paving Operations on a Multi-Lane Roadway
(Figure TTC-57.1)



Typical Traffic Control

End of Day Signing for Full Paving Operations on a Multi-Lane Roadway

(Figure TTC-58.1)

NOTES

Standard:

1. **On divided highways having a median wider than 8', right and left sign assemblies shall be used. Median barrier is considered to be part of the shoulder and its measurement shall be used to determined the total width of the shoulder.**
2. **The maximum pavement edge drop-off between traffic lanes shall be 2 inches or less.**
3. **Open travel lane(s) shall not be exposed to more than 2 to 3 mile sections of milled or uneven surface.**
4. **A portable changeable message sign with "ROUGH ROAD AHEAD" and other appropriate messages shall be used.**
5. **A BUMP (W8-1) sign shall be placed in advance of the end of the pavement drop-off.[1]**
6. **The Regional Traffic Engineer shall determine speed reductions.**
7. **The ROUGH ROAD (W8-8), UNMARKED PAVEMENT AHEAD (W8-V4) and BUMP signs shall be adjusted daily with the work operation and their sign stand shall be supported with a sand bag weighing approximately 25-pounds on each leg or two (2) drum collar weights positioned on the center of the sign stand[1]. Additional ROUGH ROAD and UNMARKED PAVEMENT AHEAD signs shall be installed every 2 miles.**
8. **Where conditions warrant, ROUGH ROAD and BUMP signs shall be installed 350' ± in advance of the affected roadway surface on entrance ramps, and BUMP signs shall be installed 500' ± in advance of unaffected roadway surface on exit ramps.**
9. **All signs shall be post-mounted at locations after 72 consecutive hours of non-work activities.**

Guidance:

10. *Sign spacing distance should be 1300'-1500' for Limited Access highways, and on all other roadways 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less.*

Option:

11. Only traffic control signing for partial pavement resurfacing is shown. Other devices may be used for the control of traffic through the work area.
12. Temporary pavement markers spaced at 10 foot centers for two-way traffic centerlines or three per skip line for lane division lines may be added as directed by the engineer.
13. The LOW SHOULDER (W8-9) sign may be used to warn of a shoulder condition where there is an elevation difference of less than 2 inches between the shoulder and the travel lane.

Standard:

14. **If used, the LOW SHOULDER sign shall be repeated at 1 mile intervals if the condition extends over a distance in excess of 1 mile.**
15. **The SHOULDER DROP OFF (W8-V5) sign shall be used when an unprotected shoulder drop-off, adjacent to the travel lane, exceeds 2 inches depth between the shoulder and the travel lane. Where the condition extends over a distance in excess of 1 mile, the sign shall be repeated at 1 mile intervals.**

Option:

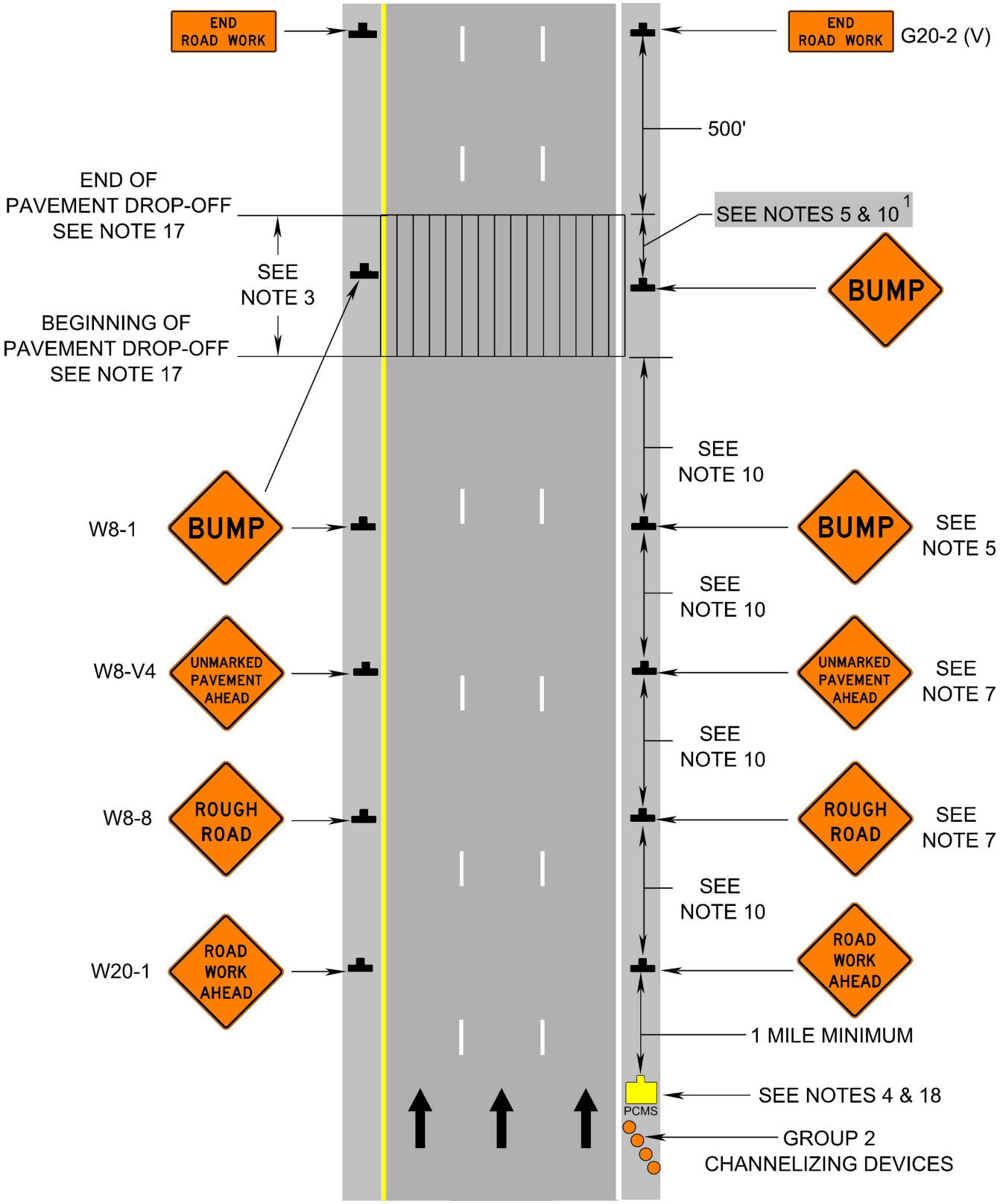
16. The SHOULDER DROP OFF sign may be eliminated if a 6:1 (desirable) to 4:1 (minimum) wedge is used between the travel lane and the shoulder.

Standard:

17. **A temporary pavement wedge shall be constructed of surface mix asphalt a minimum of three (3) feet in length for every inch of depth of pavement milling on the approach and departure end of the milled travel lane(s). Refer to Standard ACOT-1 of the Road and Bridge Standards for details.**
18. **A minimum of four (4) drum channelizing devices shall be placed on the shoulder in advance of the PCMS in a taper for delineation (see Figure 6F-6).**

1: Revision 1 – 4/1/2015

End of Day Signing for Full Paving Operations on a Multi-Lane Roadway
(Figure TTC-58.1)



1: Revision 1 – 4/1/2015

Typical Traffic Control

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

(Figure TTC-59.1)

NOTES

Standard:

1. **Open travel lane(s) shall not be exposed to more than 2 to 3 mile sections of milled or uneven surface.**
2. **The maximum pavement edge drop-off shall be 2 inches or less.**
3. **NO CENTER LINE (W8-12) sign 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.**
4. **A DO NOT PASS (R4-1) sign shall be used when the centerline has been obliterated or until 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 weighing approximately 25-pounds on each leg or two (2) drum collar weights positioned on the center of the sign stand[1]. Thereafter the DO NOT PASS sign 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.**
5. **In the vicinity of a turning lane a BUMP (W8-1) sign shall be installed.**
6. **The UNEVEN LANES (W8-11) sign and BUMP sign shall be adjusted daily with the work operation and their sign stand shall be supported with a sand bag weighing approximately 25-pounds on each leg or two (2) drum collar weights positioned on the center of the sign stand[1]. Additional UNEVEN LANES signs shall be installed every mile.**
7. **Signs shall be post-mounted at locations after 72 consecutive hours of non-work activities.**

Guidance:[1]

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

Option:[1]

9 Only traffic control signing for pavement resurfacing is shown. Other devices may be used for the control of traffic through the work area.

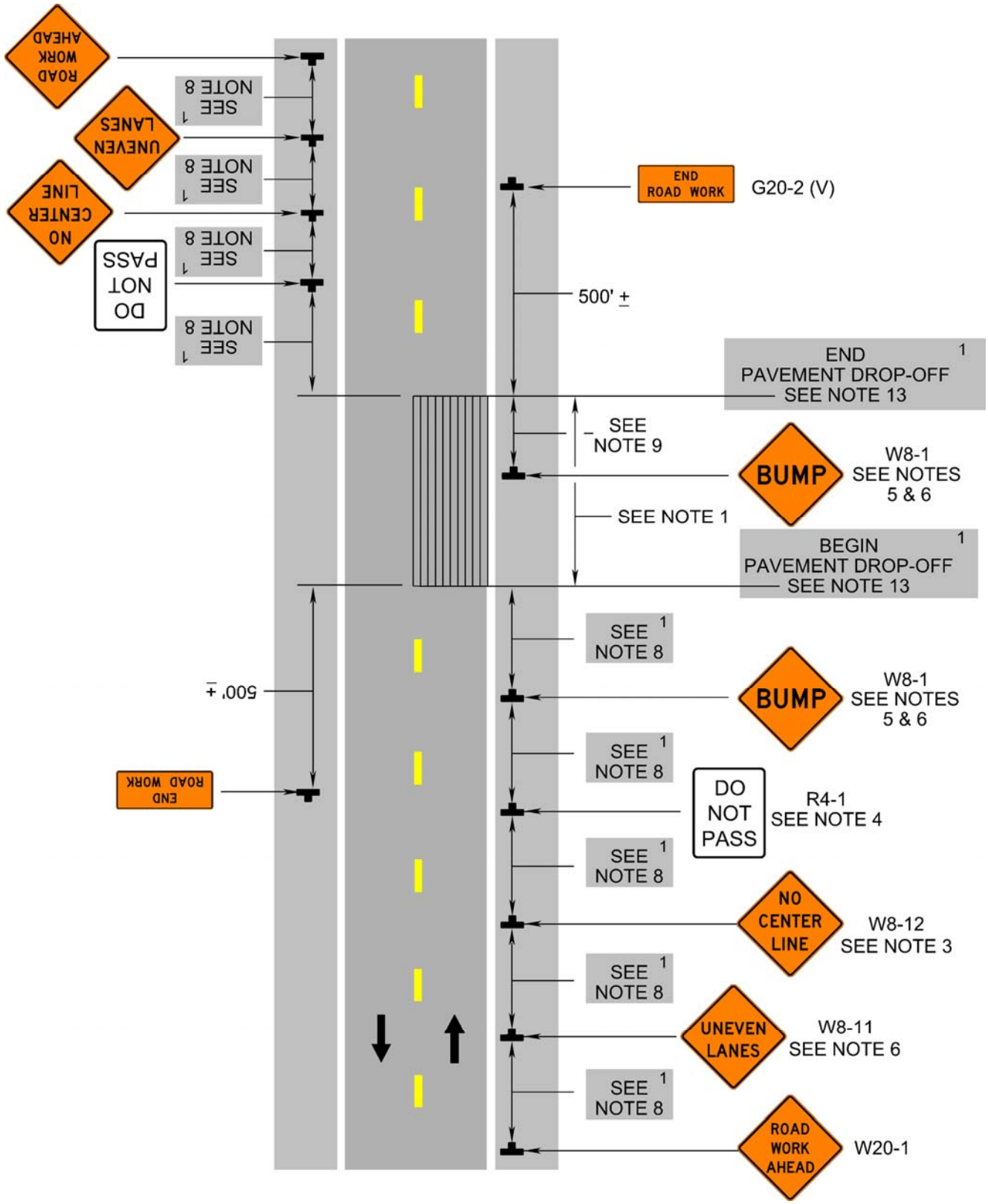
10 The LOW SHOULDER (W8-9) sign may be used to warn of a shoulder condition where there is an elevation difference of less than 2 inches between the shoulder and the travel lane.

Standard:

11. **The LOW SHOULDER sign shall be repeated at 1 mile intervals where there is an elevation difference of less than 2 inches between the shoulder and the travel lane extends over a distance in excess of 1 mile.**
12. **If pavement marking cannot be installed in accordance with Section 704.03 of the Road and Bridge Specifications, then yellow temporary pavement markers spaced at 10 foot centers for two-way traffic shall be placed along the centerline for lane division. No edge markers will be required.**
13. **A temporary pavement wedge shall be constructed of surface mix asphalt a minimum of three (3) feet in length for every inch of depth of pavement milling on the approach and departure end of the milled travel lane(s). Refer to Standard ACOT-1 of the Road and Bridge Standards for details.**

1: Revision 1 – 4/1/2015

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



1: Revision 1 – 4/1/2015

Typical Traffic Control

Temporary Pavement Marking and Marker Guidelines

(Figure TTC-60.0)

NOTES

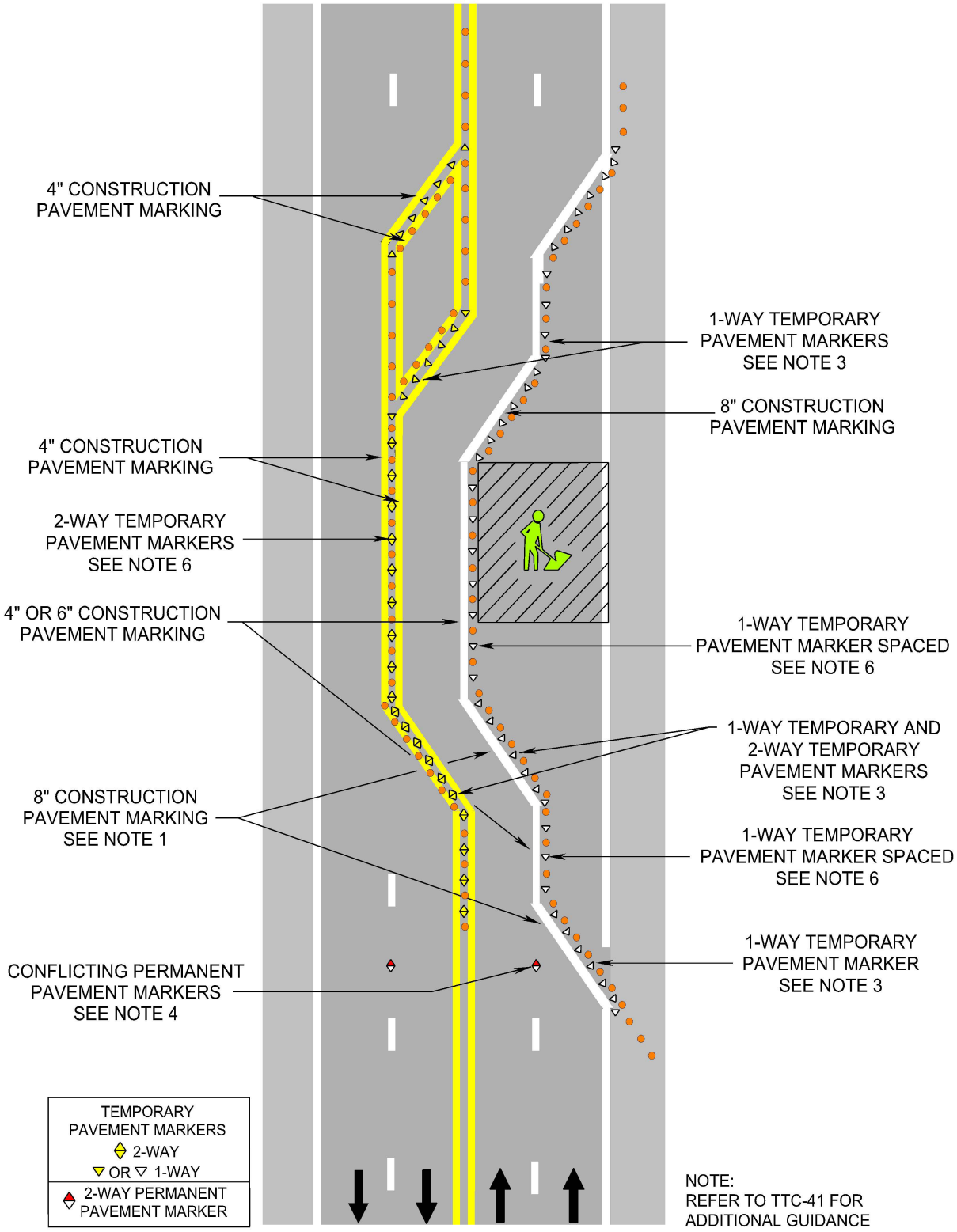
Standard:

1. **Unless otherwise noted, construction pavement marking lane lines in transitions shall be 8 inches in width.**
2. **For long-term stationary work (more than 3 days duration), existing conflicting pavement markings shall be removed and temporary markings shall be installed.**
3. **Temporary pavement markers, on 20 foot center to center spacing, shall be installed in transitions.**
4. **Conflicting permanent pavement markers shall be covered or removed.**
5. **Eradication of existing pavement markings shall be as shown in Figure TTC-55.**

Option:

6. Temporary pavement markers, on a 40' center to center spacing, may be added between transitions/shifting tapers as directed by the engineer.
7. For short-term stationary work (less than 3 days duration), lanes may be delineated by retroreflectorized channelizing devices or removable pavement marking instead of temporary pavement markings.

Temporary Pavement Marking and Marker Guidelines
(Figure TTC-60.0)



Typical Traffic Control

Pre-Storm Treatment Operation

(Figure TTC-61.1)

NOTES

Standard:

1. **Each vehicle involved in the moving operation shall be equipped with at least one high-intensity amber rotating, oscillating, or flashing[1] light. The illuminated flashing arrow on Shadow Vehicle 1 shall be a Type C (96 x 48 inch) arrow board unless replaced with a Changeable Message Sign (CMS). Vehicle hazard warning signals shall not be used instead of rotating lights or strobe lights, but as a supplement**.
2. **Shadow Vehicle 1 shall be equipped with a truck-mounted attenuator (TMA) for operations on a four or more lane roadway with posted speeds of 45 mph or greater and shall display a PRE-STORM TREATMENT – RIGHT (or LEFT, CENTER) LANE CLOSED (W20-V8Ra, W20-V8La, W20-V8C) sign.**
3. **For roadways not requiring the use of a TMA on the shadow vehicle, Shadow Vehicle 1 shall display a PRE-STORM TREATMENT (W20-V9) warning sign.**
4. **The shadow vehicle on two-lane roadways shall not display a flashing arrow. The display shall be either a Type B or C arrow board operating in the caution mode or a high-intensity amber rotating, oscillating, or strobe light.**
5. **For operations in the center lane of multi-lane roads, Shadow Vehicle 1 shall display a flashing double arrow.**
6. **Each vehicle involved in the moving operation shall have radio or mobile communication between vehicles.**
7. **The work operation vehicle shall display the KEEP BACK 100 FT (W20-V10) sign.**

Option:

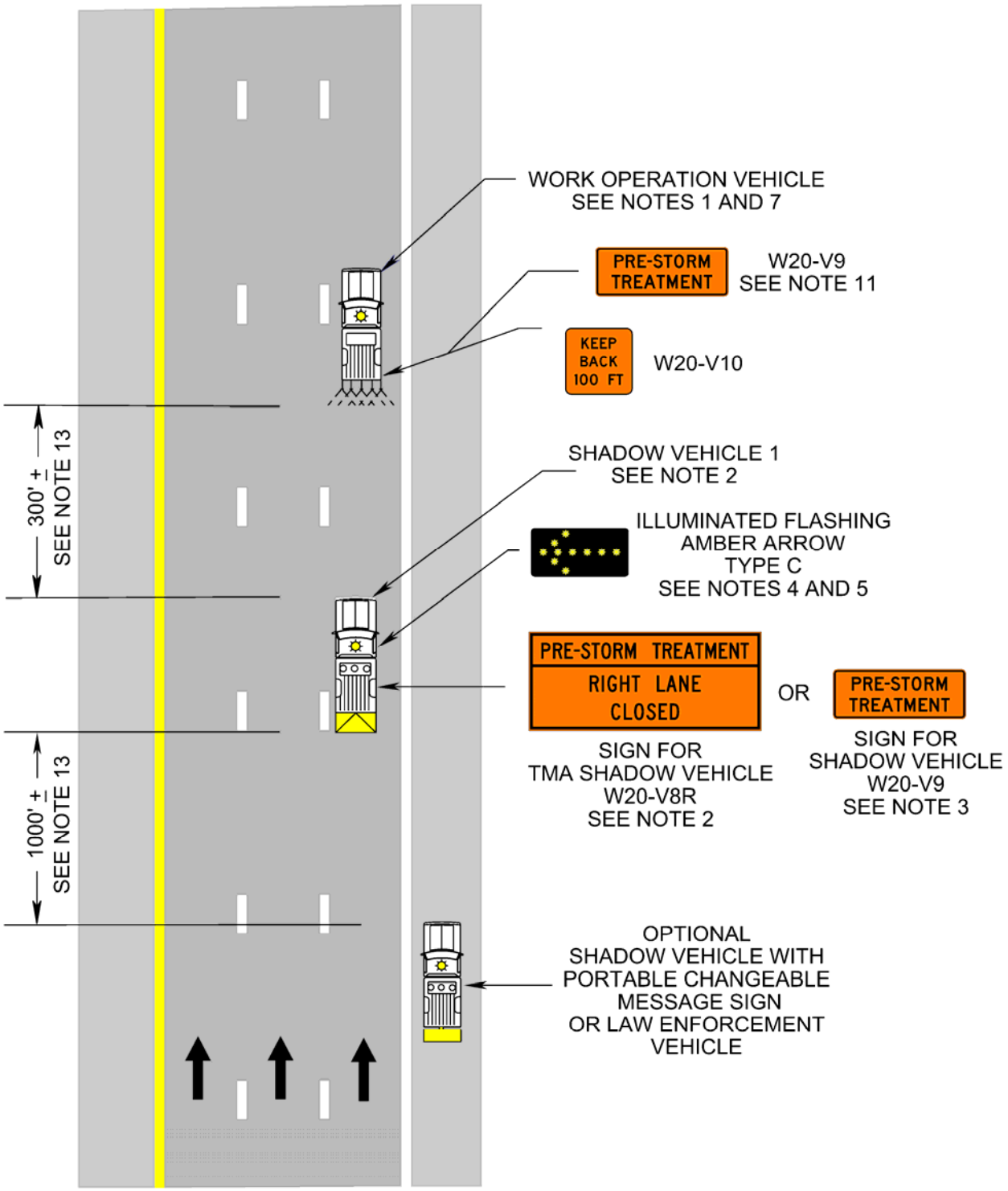
8. The static warning sign and arrow board on Shadow Vehicle 1 may be replaced with a vehicle-mounted CMS with a minimum character height of 10".
9. Arrow direction may change as needed. The lane designation on W20-V8 sign may be covered due to the rapid lane changes during the brine application.
10. Actual conditions could dictate additional traffic control devices for the operation. On high speed, high volume roads, an optional shadow vehicle on the shoulder with a Portable Changeable Message Sign (PCMS) or a marked law enforcement vehicle driving on the shoulder only may be used to further enhance safety. Suggested messages for the PCMS: "PRE-STORM WORK, RIGHT (or LEFT, CENTER) LANE CLOSED."
11. The PRE-STORM TREATMENT sign may be eliminated from the work operations vehicle if physically impossible to mount the sign to the back of the vehicle.
12. The shadow vehicle may be eliminated on two-lane roadways where the speed limit is posted below 45 mph.

Guidance:

13. *Spacing between vehicles may vary, depending on the speed, sight distance, and type of pre-storm treatment being applied. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle(s) should maintain the minimum distance shown and proceed at the same speed as the work operation vehicle. The shadow vehicle(s) should slow down in advance of vertical or horizontal curves that restrict sight distance.*
14. *When using a vehicle CMS to replace the static sign and arrow board on Shadow Vehicle 1, each word message phase should be followed by a Type B arrow display.*
15. *Advanced warning messages should be considered on overhead Changeable Message Signs to enhance the safety of the operation. Suggested messages: "PRE-STORM TREATMENT AHEAD, RIGHT (or LEFT, CENTER) LANE CLOSED."*

1: Revision 1 – 4/1/2015

Pre-Storm Treatment Operation
(Figure TTC-61.1)



Typical Traffic Control

Litter Pick-Up on Limited Access Highways

(Figure TTC-62.1)

NOTES

Standard:

1. **Each vehicle involved in the mobile operation shall be equipped with at least one high-intensity amber rotating, oscillating, or flashing[1] light. The illuminated flashing arrow on Shadow Vehicle 1 shall be a Type C (96 x 48 inch) arrow board unless replaced with a Changeable Message Sign (CMS). Vehicle hazard warning signals shall not be used instead of rotating lights or strobe lights, but as a supplement**.
2. **If Shadow Vehicle 1 cannot run completely on the shoulder and[1] out of the travel lane and would be partially in the travel lane, it shall be equipped with a truck-mounted attenuator.**
3. **Shadow Vehicle 2 shall be equipped with a truck-mounted attenuator (TMA) for operations on a four or more lane roadway with posted speeds of 45 mph or greater.**
4. **Each vehicle involved in the mobile operation shall have radio or mobile communication between vehicles.**

Option:

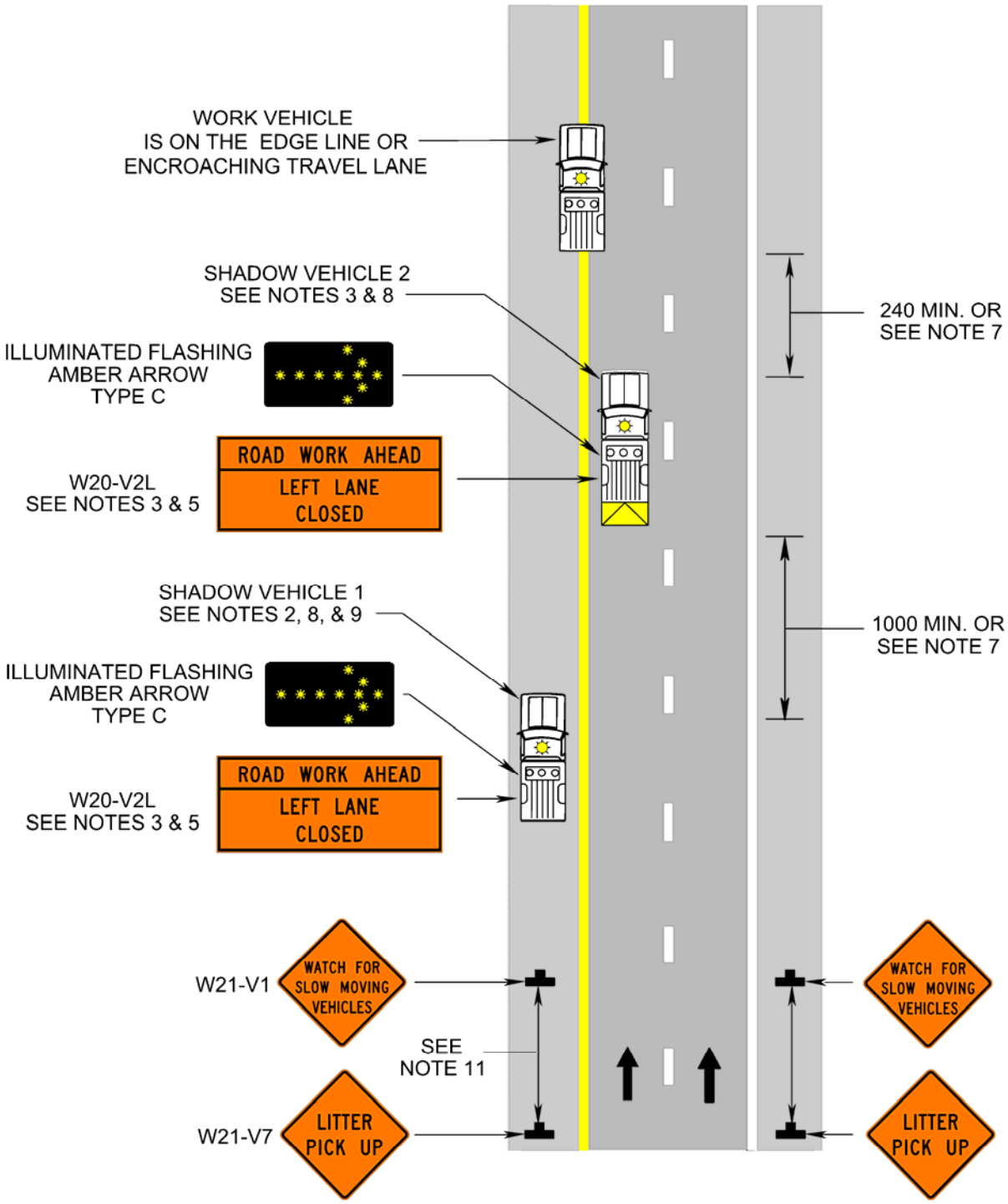
5. The static warning sign and arrow board on the advanced warning vehicle may be replaced with a vehicle-mounted CMS with a minimum character height of 10".
6. Actual conditions could dictate additional traffic control devices for the operation. On high speed, high volume roads, an optional shadow vehicle on the shoulder with a Portable Changeable Message Sign (PCMS) or a marked law enforcement vehicle driving on the shoulder only may be used to further enhance safety. Suggested messages for the PCMS: ROAD WORK AHEAD, RIGHT (or LEFT) LANE CLOSED.

Guidance:

7. *Spacing between vehicles may vary, depending on the speed, sight distance, and operation type. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle(s) should maintain the minimum distance shown and proceed at the same speed as the work operation vehicle. The shadow vehicle(s) should slow down in advance of vertical or horizontal curves that restrict sight distance.*
8. *When using a vehicle CMS to replace the static sign and arrow board on Shadow Vehicle 1, each word message phase should be followed by a Type B arrow display.*
9. *Advanced warning messages should be considered on overhead Changeable Message Signs to enhance the safety of the operation. Suggested messages: ROAD WORK AHEAD, RIGHT (or LEFT) LANE CLOSED.*
10. *Sign spacing distance should be 1300'-1500' for Limited Access highways.*

1: Revision 1 – 4/1/2015

Litter Pick-Up on Limited Access Highways
(Figure TTC-62.1)



Typical Traffic Control
Logging Operations
(Figure TTC-63.1)
NOTES

Standard:

1. **Prior to the installation of the entrance and placement of any traffic control devices, the appropriate state/local agencies shall be notified.**

Guidance:

2. *Care should be exercised when establishing the location of the permitted temporary entrance to insure maximum possible sight distance in advance of the entrance, and should be based on the posted speed limit and at least equal to or greater than the values in the Intersection Sight Distance (ISD) table.*

Intersection Sight Distance (ISD)

Posted Speed Limit (mph)	20	25	30	35	40	45	50	55	60	65	70
Minimum ISD	195	240	290	335	385	430	480	530	575	625	670

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

Standard:

4. **TRUCKS ENTERING HIGHWAY (W11-V4) sign shall be used to warn of logging trucks entering roadways. LOG TRUCKS ENTERING HIGHWAY sign is not allowed for use.[1]**
5. **On divided highways having a median wider than 8', right and left sign assemblies shall be used. Median barrier is considered to be part of the shoulder and its measurement shall be used to determine the total width of the shoulder.**

Guidance:

6. *For operations that disrupt (stop) traffic on the travelway, Typical Traffic Control Figure TTC-23, Lane Closure on a Two-Lane Roadway Using Flaggers, or Typical Traffic Control Figure TTC-16 or 17, Outside or Inside Lane Closure Operation on Four-Lane Roadway, should be used.*

Standard:

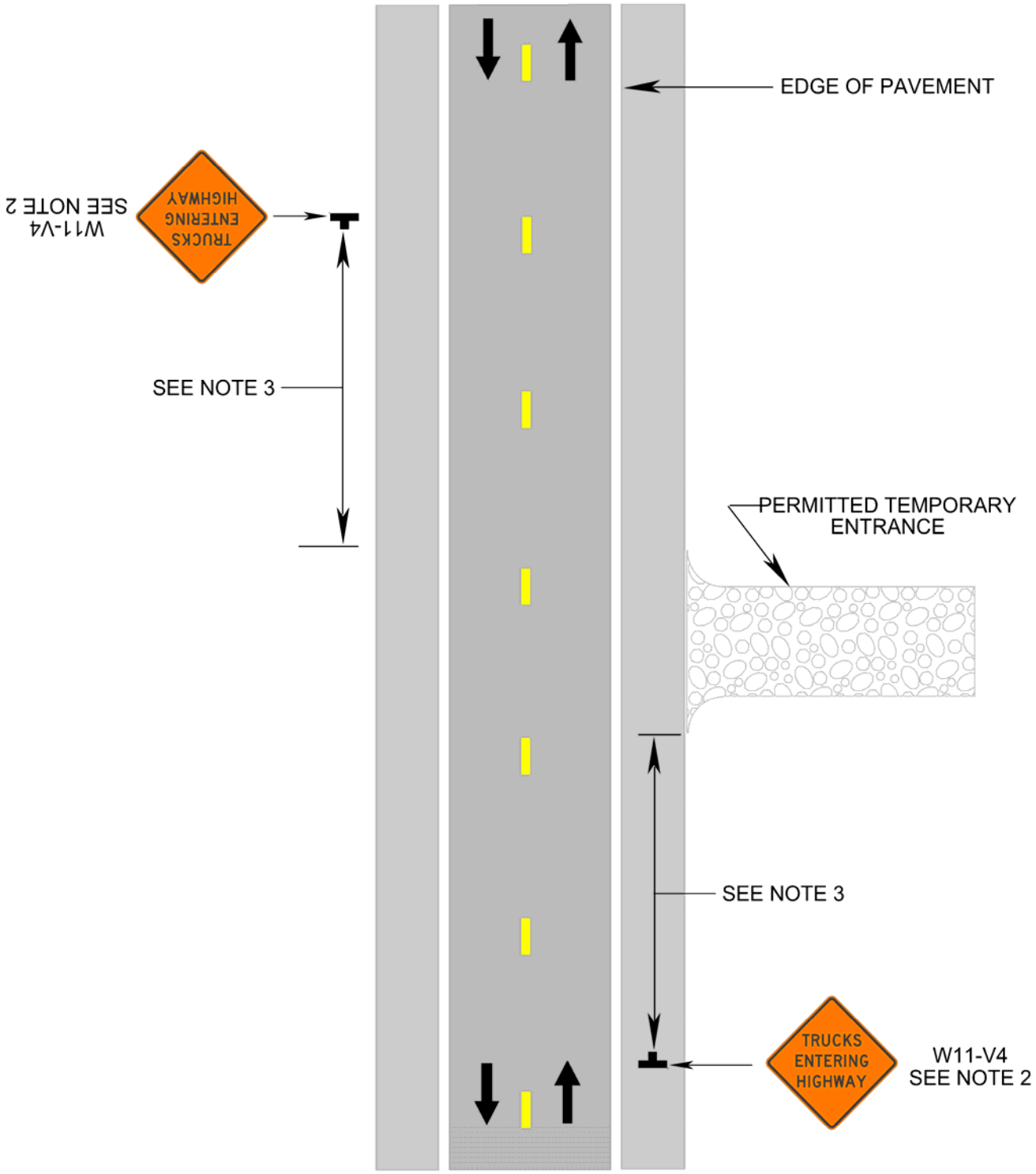
7. **Flaggers shall be state certified and have their certification card in their possession when performing flagging duties (see Section 6E.01, Qualifications for Flaggers).**
8. **The organization receiving the entrance permit shall be responsible for the removal of all debris (gravel, mud, dust, hauled materials, etc.), obstructions and irregularities caused by the operation in accordance with Section 105 of the Road and Bridge Specifications.**

Guidance:

9. *For the removal of debris on the roadway, Typical Traffic Control Figure TTC-14, Moving/Mobile Operation on a Two-Lane Roadway, or Typical Traffic Control Figure TTC-13, Moving/Mobile Operation on a Multi-Lane Roadway, should be used.*

1: Revision 1 – 4/1/2015

Logging Operations
(Figure TTC-63.1)



Typical Traffic Control
End of Day Signing for Surface Treatment, Slurry Seal and Latex Emulsion Treatment Operations[1]
(Figure TTC-64.0)

NOTES

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 obiliterated 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 consective 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.*

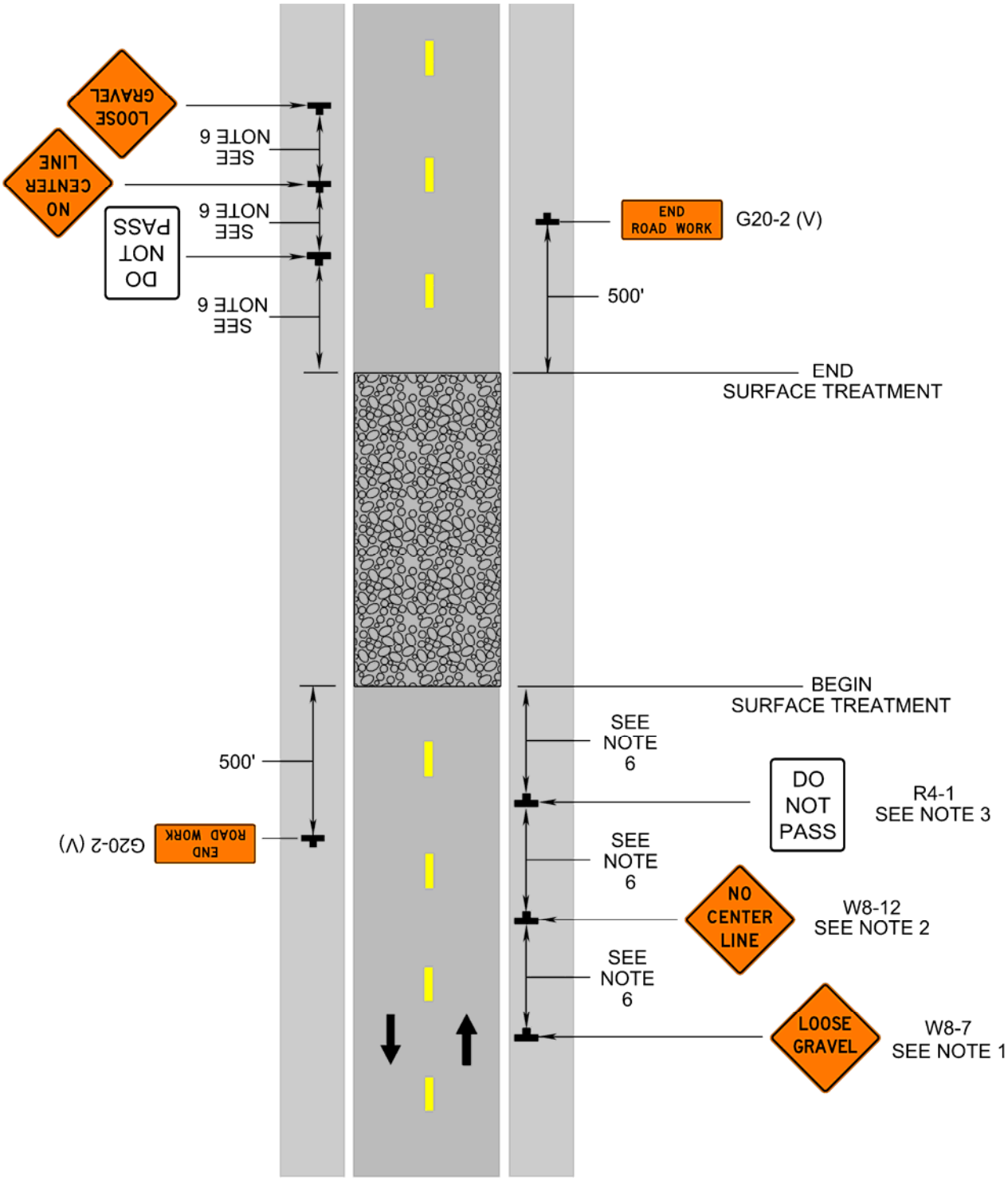
Option

7. Only traffic control signing for surface treatment/slurry/latex emlusion treatment operations is shown. Other traffic contro; 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.

1: Revision 1 – 4/1/2015

End of Day Signing for Surface Treatment, Slurry Seal and Latex Emulsion Treatment Operations[1]

(Figure TTC-64.0)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Short Duration Road Patching Operation on a Low Volume Two-Lane Roadway[1]

(Figure TTC-65.0)

NOTES

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:

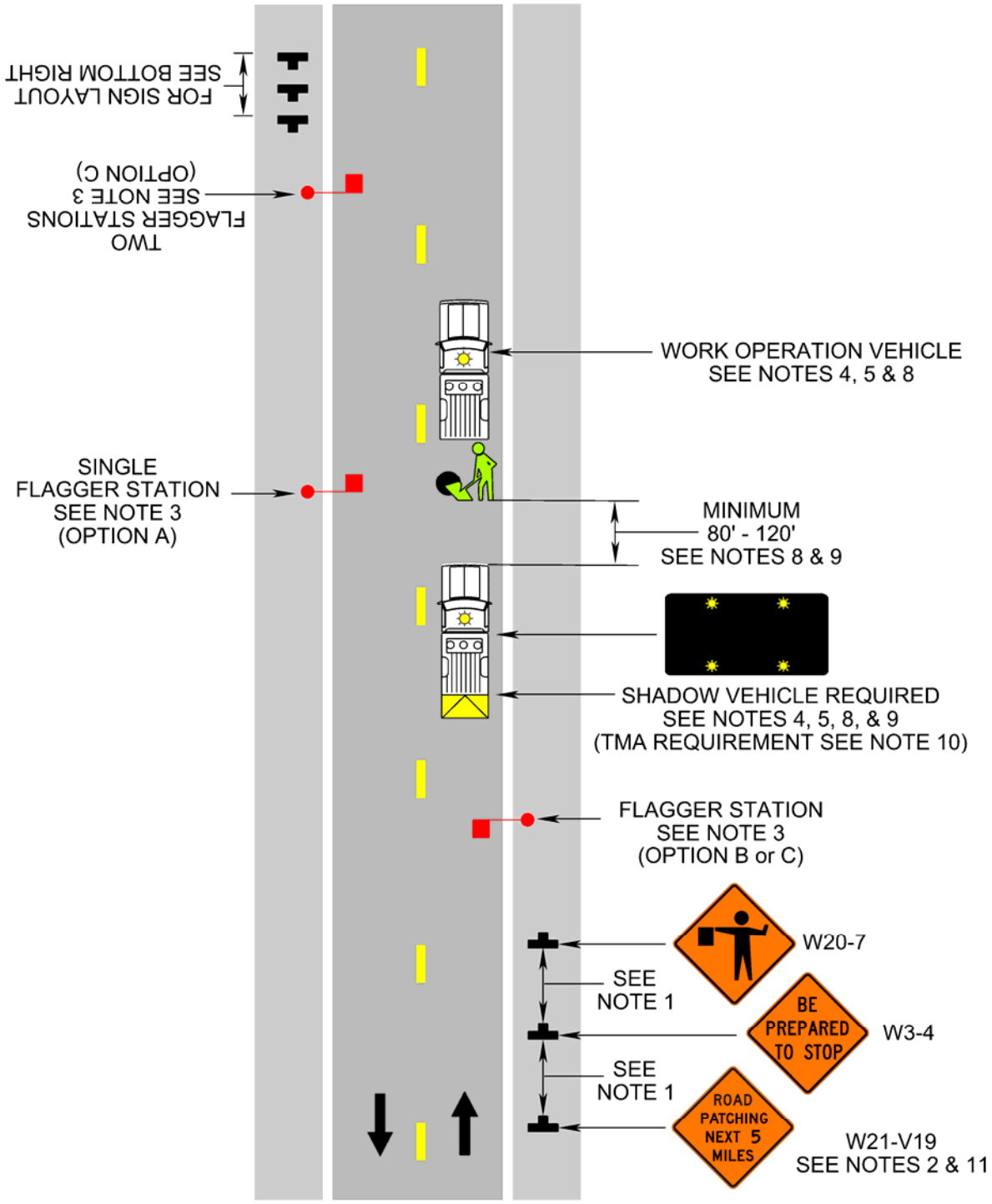
6. *When using a CMS to replace the arrow board it should display the Type B caution mode.*
7. *Care should be exercised when establishing the flagger station to insure maximum possible sight distance based on the posted speed limit and at least equal to or greater than the values in Table 6H-3.*
8. *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".

1: Revision 1 – 4/1/2015

Short Duration Road Patching Operation on a Low Volume Two-Lane Roadway[1] (Figure TTC-65.0)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Slow Roll Operation on a Muli-Lane Roadway[1]

(Figure TTC-66.0)

NOTES

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

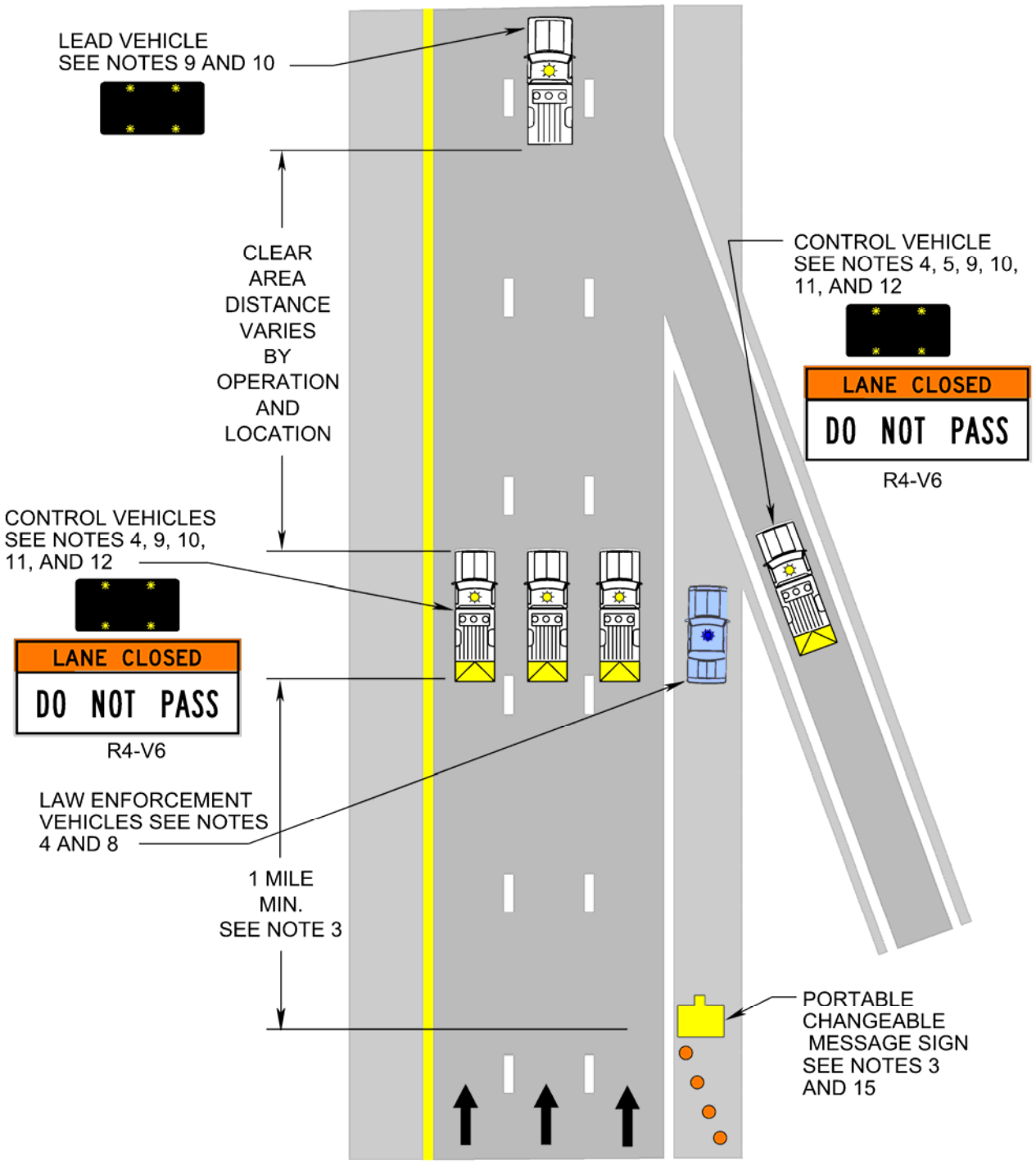
5. Once the Slow Roll operation has passed a closed entrance ramp, the ramp may be reopened.

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.**

1: Revision 1 – 4/1/2015

Slow Roll Operation on a Multi-Lane Roadway[1]
(Figure TTC-66.0)



1: Revision 1 – 4/1/2015

Typical Traffic Control

Lane Closure Operation through an Unsignalized Intersection[1]

(Figure TTC-67.0)

NOTES

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:

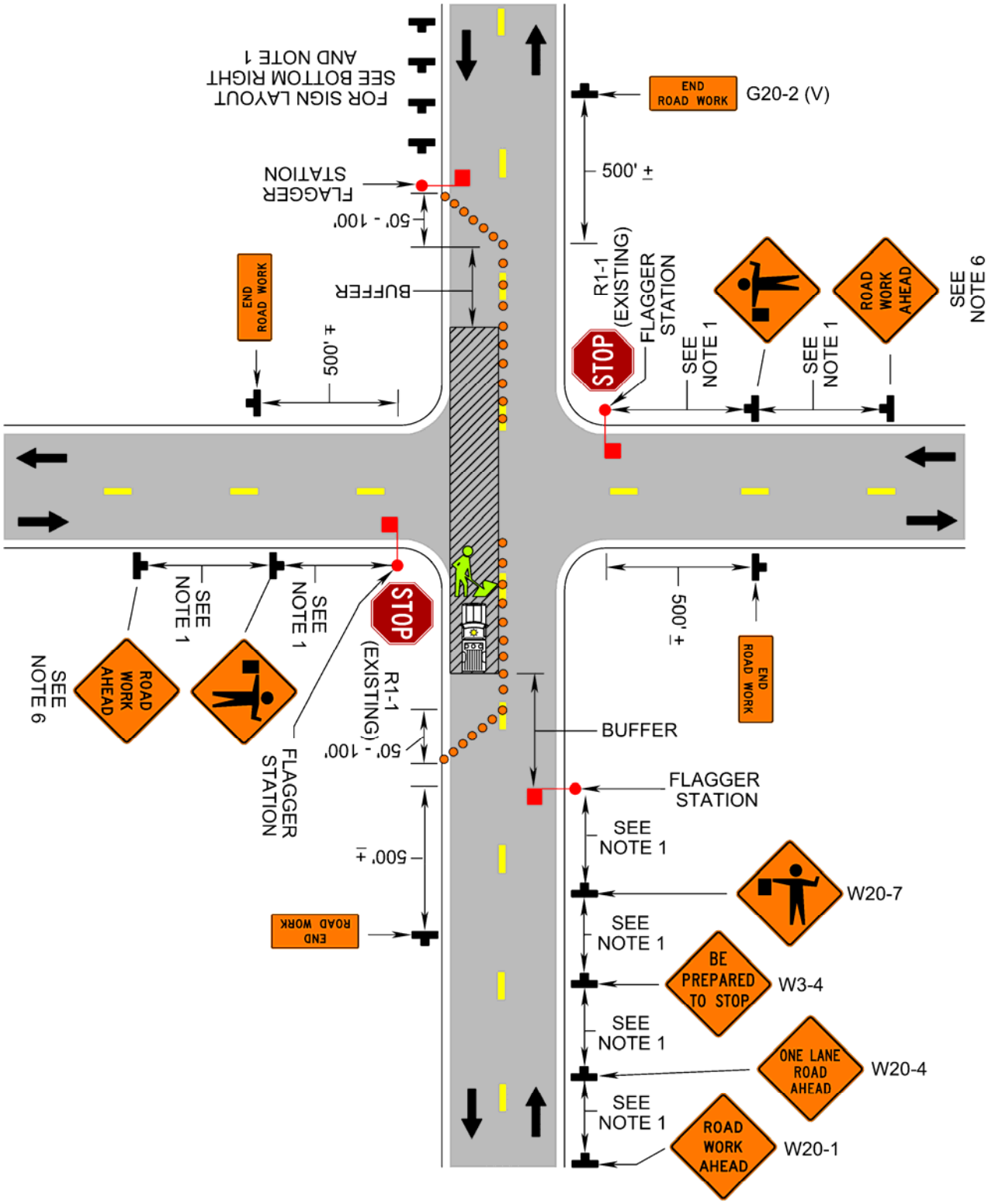
3. *If room permits, a shadow vehicle with at least one rotating amber light or high intensity amber strobe light should be parked 80'-120' in advance of the first work crew.*
4. *If the posted speed limit is 45 mph or greater, the shadow vehicle should have a truck-mounted attenuator.*
5. *If the work 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.

1: Revision 1 – 4/1/2015

Lane Closure Operation through an Unsignalized Intersection[1]
(Figure TTC-67.0)



1: Revision 1 – 4/1/2015

Intentionally Left Blank