Florida Department of Transportation

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KEVIN J. THIBAULT, P.E.
SECRETARY

OFFICE OF DESIGN BULLETIN 21-02
TRAFFIC ENGINEERING AND OPERATIONS BULLETIN 21-01
FREIGHT AND MULTIMODAL OPERATIONS BULLETIN 21-01

DATE: February 12, 2021

TO: District Directors of Transportation Operations, District Directors of Transportation Development, District Design Engineers, District Construction Engineers, District Structures Design Engineers, District Maintenance Engineers, District Consultant Project Management Engineers, District Roadway Design Engineers, District Traffic Operations Engineers, Program Management Engineers, District Materials Engineers, District Specifications Engineers, District Estimates Engineers, District Rail Administrators and Coordinators, District Safety Engineers, District Modal Administrators, District Intermodal Systems Development Administrators

FROM: Tim Lattner, P.E., Director, Office of Design
DocuSigned by: Tim Lattner C7704ED8972C440...

Trey Tillander, P.E., Director, Traffic Engineering and Operations Office
DocuSigned by: Trey Tillander D749973004EE41F...

Rickey Fitzgerald, Manager, Freight and Multimodal Operations
DocuSigned by: Rickey Fitzgerald 389FEA9308F5496...

COPIES: Courtney Drummond, Brad Thoburn, Will Watts, Dan Hurtado, Rudy Powell, Michael Shepard, Stefanie Maxwell, Scott Arnold, Paul Hiers, Vern Danforth, Daniel Strickland, Robert Robertson, Lora Hollingsworth, Gevin McDaniel, Kevin Burgess (FHWA), Chad Thompson (FHWA), Bren George (FHWA)

SUBJECT: **Railroad At-Grade Crossings: Signing and Pavement Markings**

This Bulletin introduces revisions to the ***FDOT Design Manual (FDM)*** and the ***FDOT Standard Plans for Road and Bridge Construction (Standard Plans)*** to further enhance safety at highway-railroad at-grade crossings.

REQUIREMENTS

1. Delete ***FDM 220.2.1.1*** and replace it with Attachment 'A'.
2. ***Standard Plans, Index 509-070*** (*Railroad Grade Crossing Traffic Control Devices*) has been updated to remove signing and pavement marking details and is released as an ***Interim Revision*** (***IR509-070-1***) to the ***FY 2020-21 Standard Plans***. See Attachment 'B'. An ***Interim Revision***

will also replace the original version of the Index published on October 30, 2020 with the ***FY 2021-22 Standard Plans***.

3. ***Standard Plans, Index 711-001*** (*Pavement Markings*) has been updated to include a '*Railroad Dynamic Envelope (RDE) Pavement Marking Detail'* and '*Railroad Crossing Pavement Message*' details. This update is released as an ***Interim Revision*** (***IR711-001-1***) to the ***FY 2020-21 Standard Plans***. See Attachment 'C'. An ***Interim Revision*** will also replace the original version of the Index published on October 30, 2020 with the ***FY 2021-22 Standard Plans***.

IMPLEMENTATION

These requirements are effective immediately for all projects where the Railroad Dynamic Envelope Safety Countermeasures (per Traffic Engineering and Operations Bulletin 20-01, Roadway Design Bulletin 20-02, Program Management Bulletin 20-01, Construction Bulletin 20-02, and Freight and Multimodal Operations Bulletin 20-01) have not been installed. For projects where Railroad Dynamic Envelope Safety Countermeasures have already been installed, this new criteria may be used if the District determines that it will enhance the safety of the railroad crossing.

CONTACT

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TL/TT/RF/gjm

Attachment ‘A’

220.2.1.1 Signing and Pavement Markings

Exhibits 220-1 through ***220-4*** provide typical signing and pavement markings for Active Grade Crossings. Refer to the ***MUTCD*** for definitions and signing and pavement markings at Passive Grade Crossings.

Do not place turning movement lane-use pavement markings on the upstream approach between the railroad crossing pavement message and the tracks.

Where intersections occur between the W10-1 sign shown in ***Exhibits 220-1*** through ***220-4*** and the tracks, place an additional W10-1 sign between the intersection and the railroad gate.

Include Railroad Dynamic Envelope (RDE) pavement markings at Active and Passive Grade Crossings on:

- State Roads,
- State-owned rails, and
- State-owned property.

Any Variations to not install an RDE are to be approved by the Chief Engineer.

The determination of slightly or significantly skewed is at the discretion of the EOR.

Detail RDE pavement markings in the Plans in accordance with ***Standard Plans, Index 711-001*** and the details shown in ***Exhibits 220-1*** through ***220-4***. Ensure the details in the plans include the following:

(1) Orient RDE pavement markings:

(a) In the direction of the travel lanes at all approaches upstream of the crossing (i.e., transverse to the travel lanes).

i. For slightly skewed railroads extend the RDE markings transverse across all lanes, as shown in ***Exhibits 220-2*** and ***220-3***.

ii. For significantly skewed railroads, step the RDE markings transverse across each lane, as shown in ***Exhibit 220-4***.

(b) Along the railroad (i.e., parallel to the railroad tracks) for areas between tracks and downstream of the crossing.

(c) To maximize the visibility of the RDE pattern for both the upstream and downstream sides of the track. Locate markings in a manner to ensure the "X" pattern is identifiable to the motorists and bicyclists and centered in the lanes to the extent practicable.

(2) Place RDE markings through the foul area as shown in ***Exhibits 220-3*** and ***220-4***. If the railroad owner will not allow the RDE markings through the foul area, or the substrate material will not provide an appropriate bonding surface for the markings, keep the RDE markings outside of the railroad's foul area as shown in ***Exhibits 220-1*** and ***220-2***.

(3) Replace all skip lane lines with solid lines for the following distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.

(4) Continue solid longitudinal edge line, lane line, and centerline markings through the RDE pattern, maintaining a 9-inch clear space between the RDE pattern and the longitudinal lane lines or gore areas.

(5) Refurbish all existing longitudinal lane lines, edge lines, and centerlines to remain in-place for the following minimum distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.

(6) Place RPMs at 10' maximum on center for the following distance: From stop bar to stop bar of each approach excluding the foul area, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.

(7) For conditions where multiple tracks are configured non-parallel to each other, maintain the typical RDE pattern and fill the gap between the tracks, as necessary.

(8) RDE markings must not interfere with any pedestrian crosswalk.

Consider the following additional provisions for Active and Passive Grade Crossings:

- For significantly skewed angles, corridor highway lighting for the following minimum distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance "A" plus 15 feet. For Distance "A", see table in ***Exhibit 220-1***.
- For significantly skewed angles, curves, and intersections directly adjacent to crossings, consider using additional channelization techniques for the roadway alignment. Some channelization techniques include Internally Illuminated RPMs

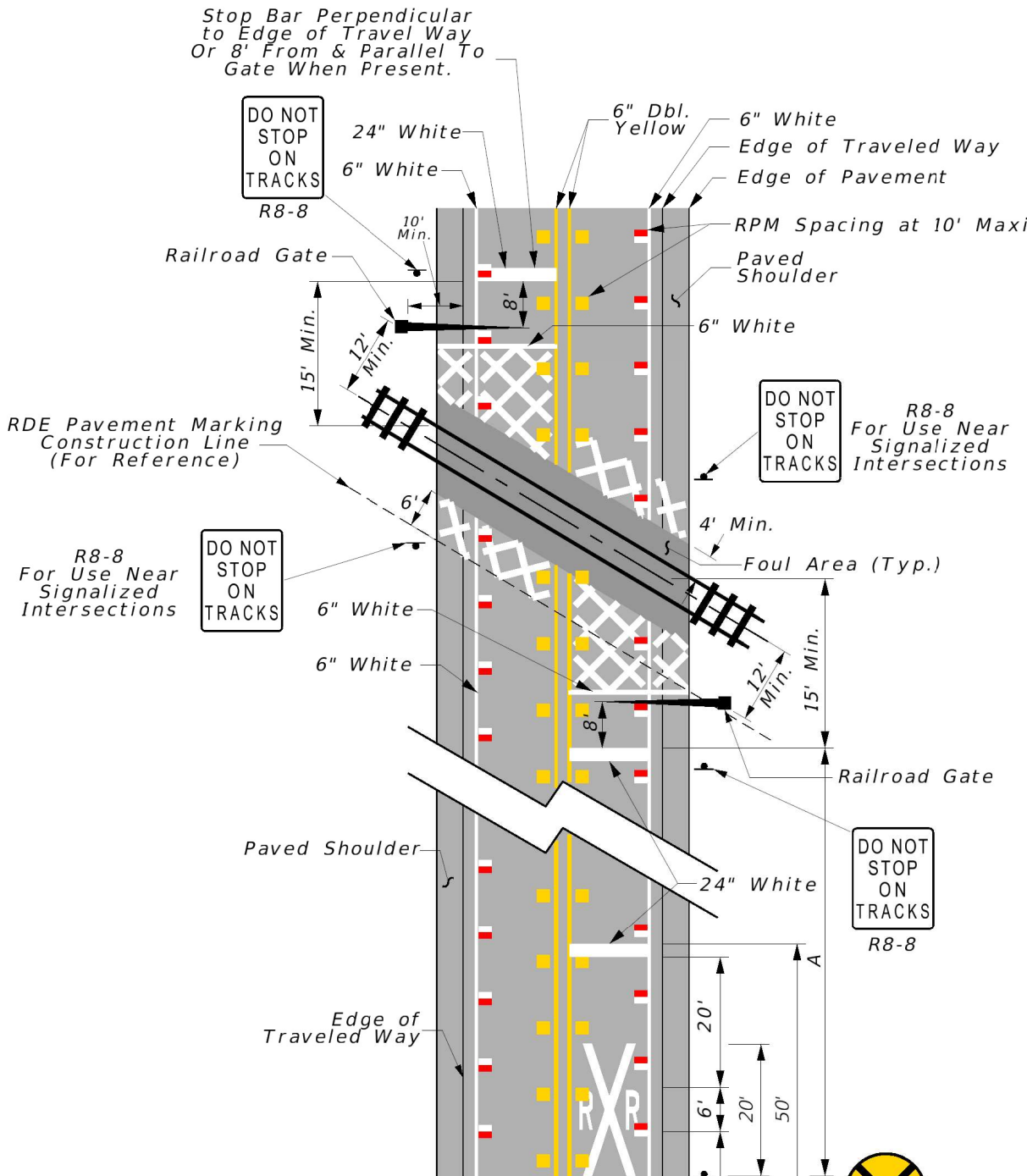
and Tubular Markers. When crest vertical curves impede the visibility of RPMs, Tubular Markers should be used. Consider excluding downstream RDE pattern when traffic queuing is not expected.

- Consider the use of through lane-use arrows. For turn lanes, a route shield may be used in conjunction with the through lane-use arrow.
- Remove all existing traffic control signs and pavement markings (e.g., turning signs and turning arrow lane-use pavement markings) from the upstream approach that may lead to driver confusion on the correct turning point for downstream turning movements.

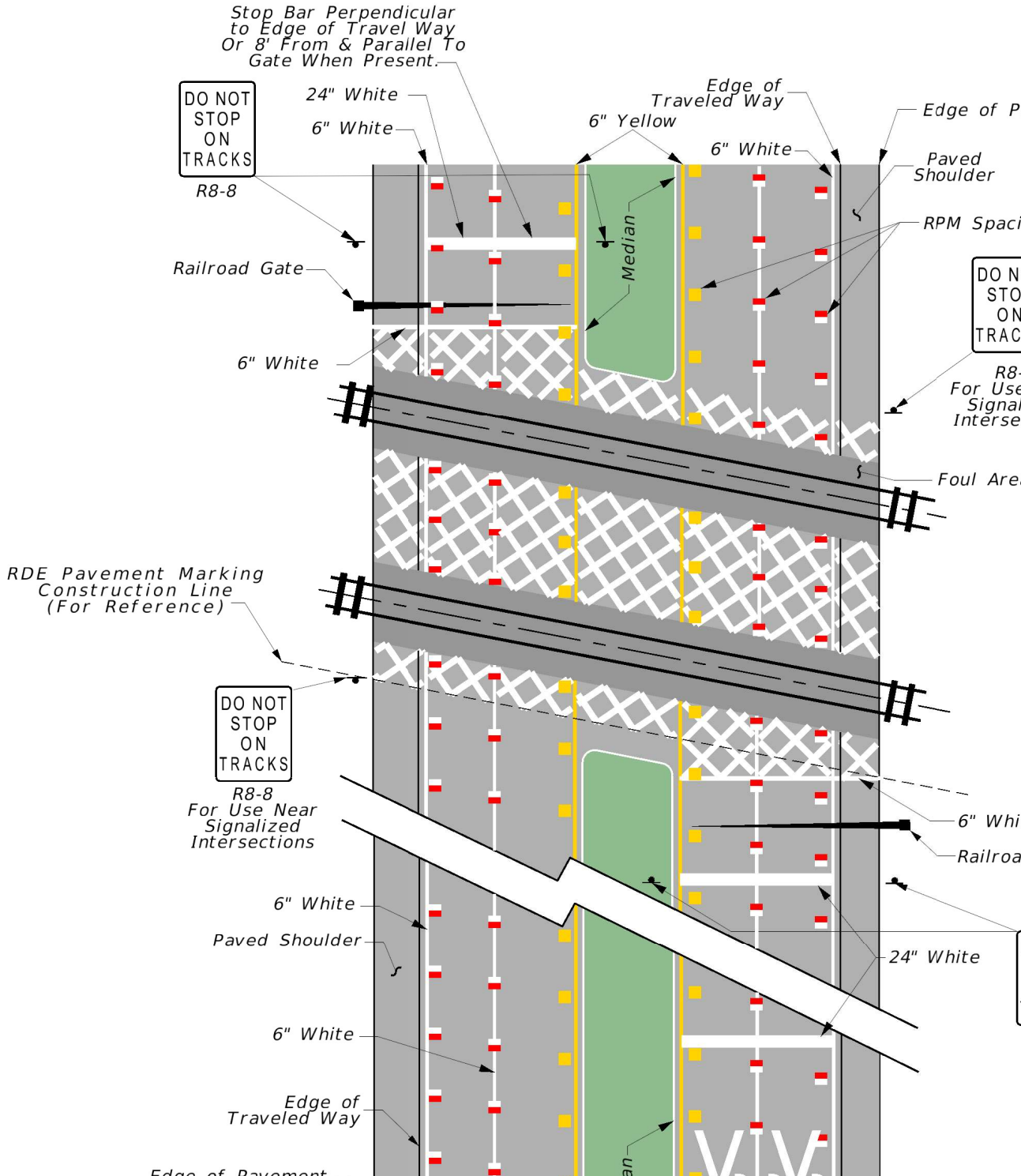
For pavement marking material selection, see ***FDM 230***.

For side roads with Active and Passive Grade Crossings within 100 feet of the edge of traveled way, include W10-2, W10-3 or W10-4 signs on the mainline state road in accordance with the ***MUTCD***.

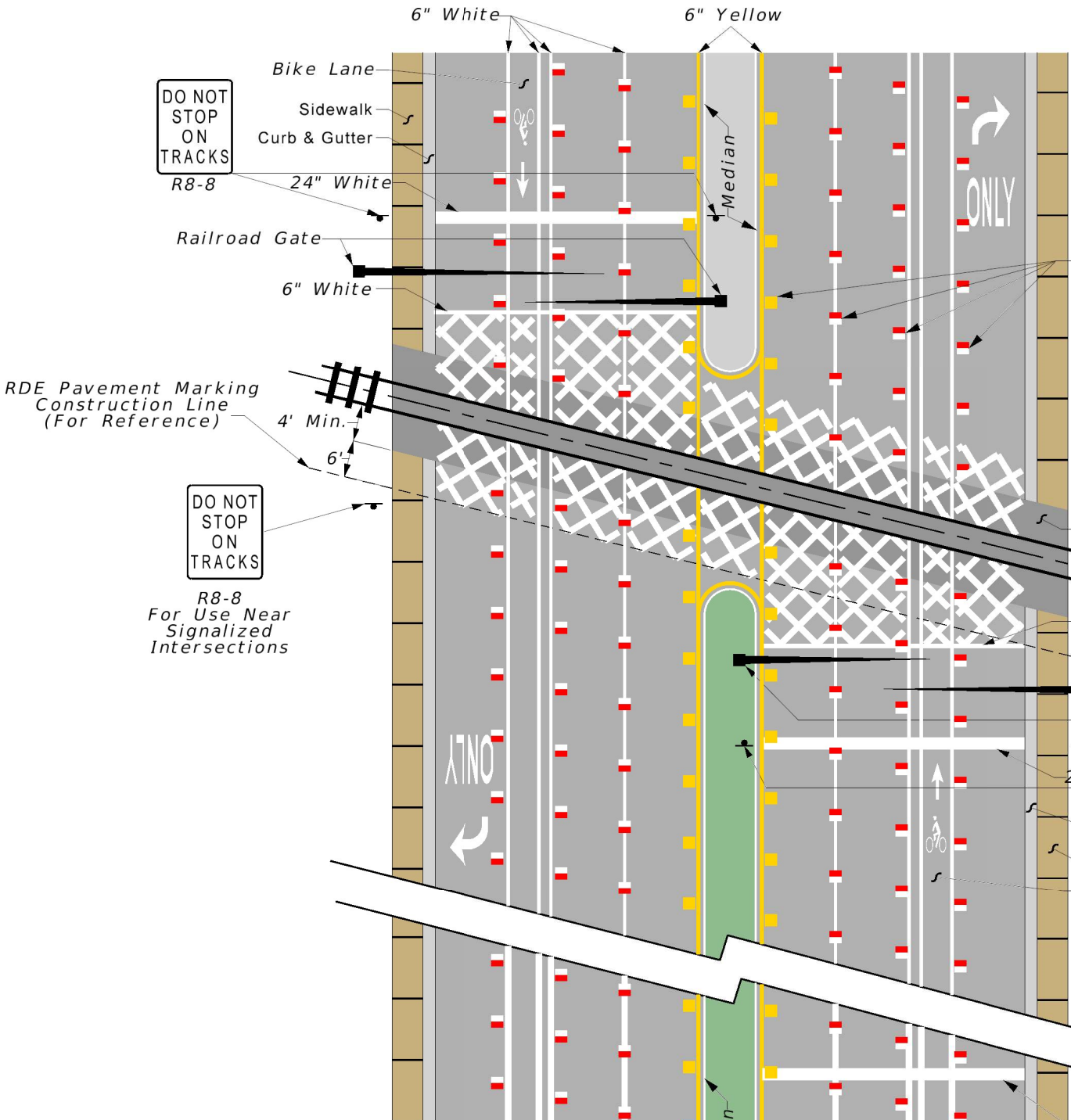
RAILROAD CROSSING AT TWO-LANE RO



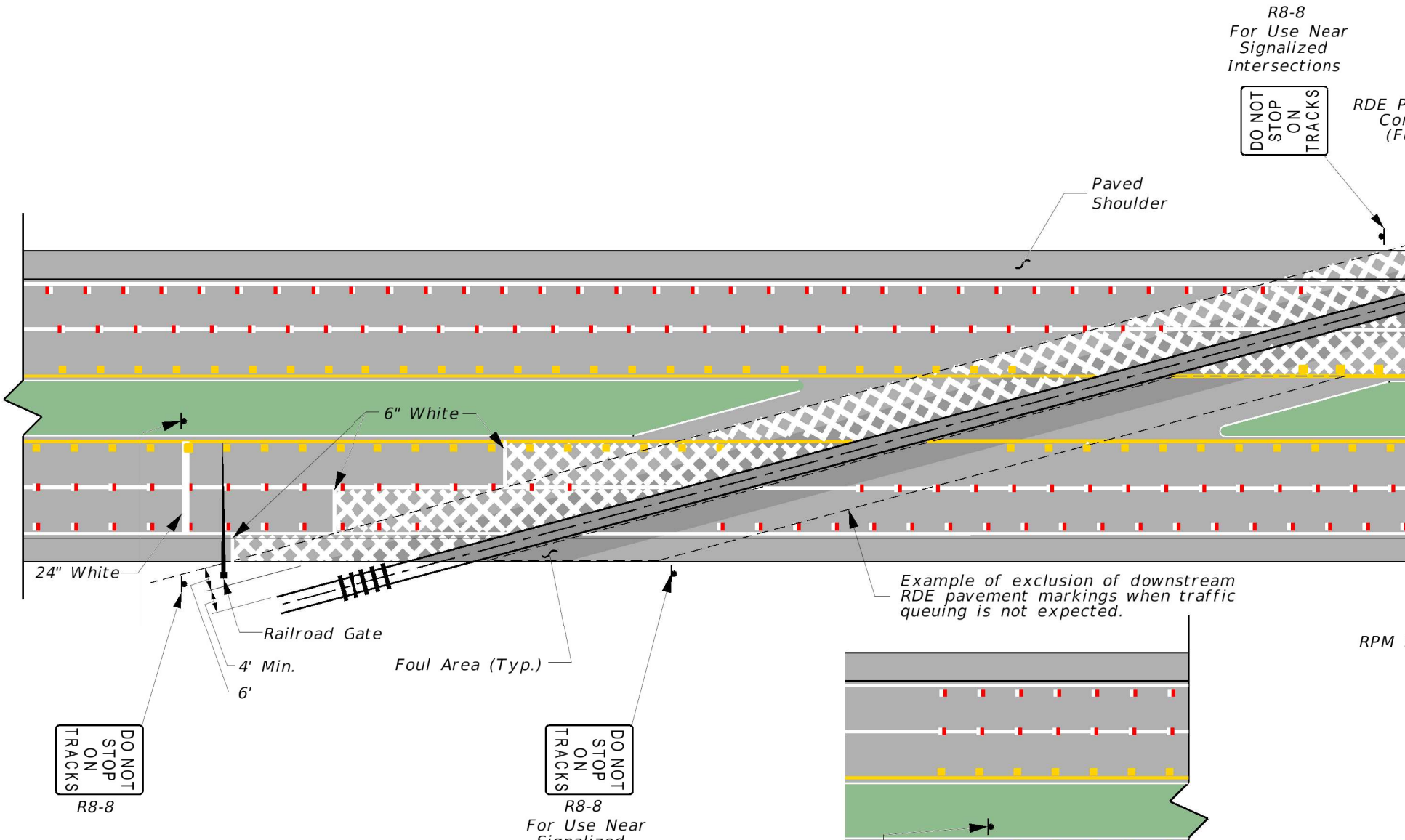
RAILROAD CROSSING AT MULTILANE R



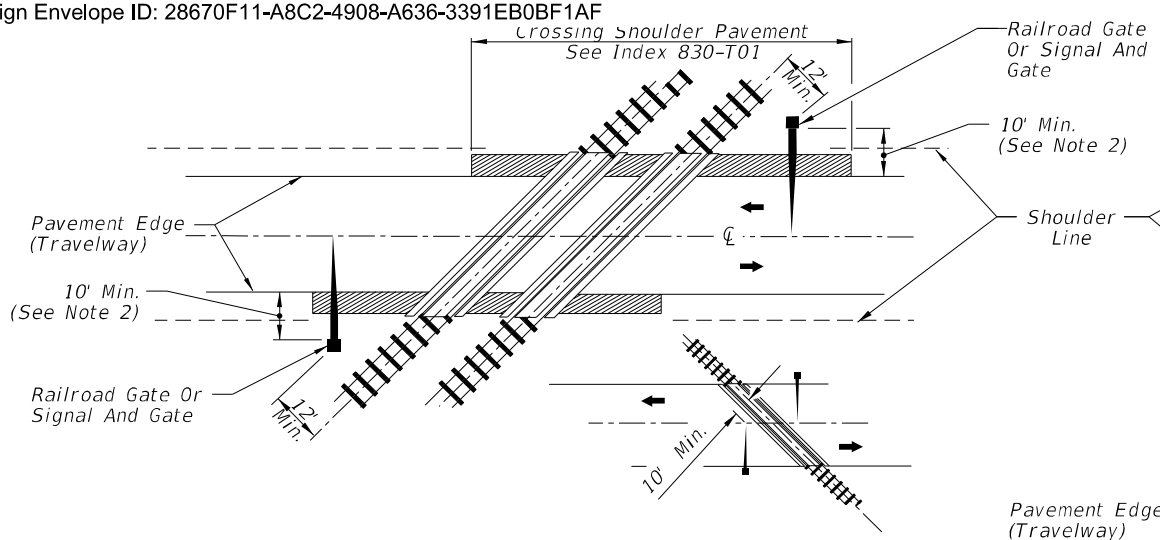
RAILROAD CROSSING AT URBAN
MULTILANE ROADWAY WITH TURN LA



RAILROAD CROSSING WITH SIGNIFICANT SKEW TO THE ROADW

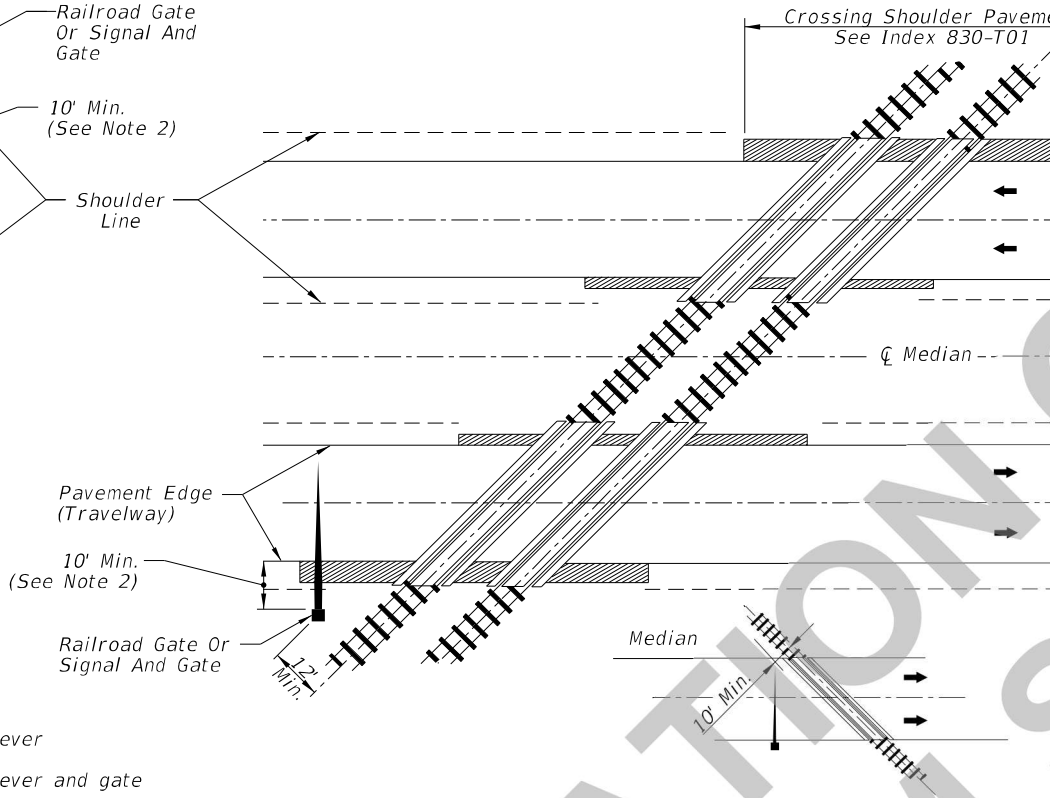


Attachment ‘B’



SIGNAL PLACEMENT AT RAILROAD CROSSING

(2 - LANE DESIGN)

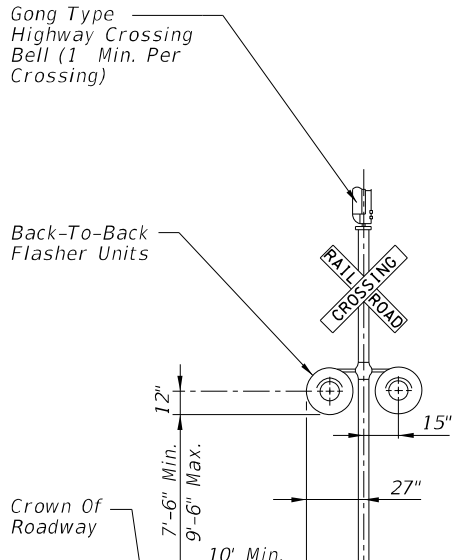


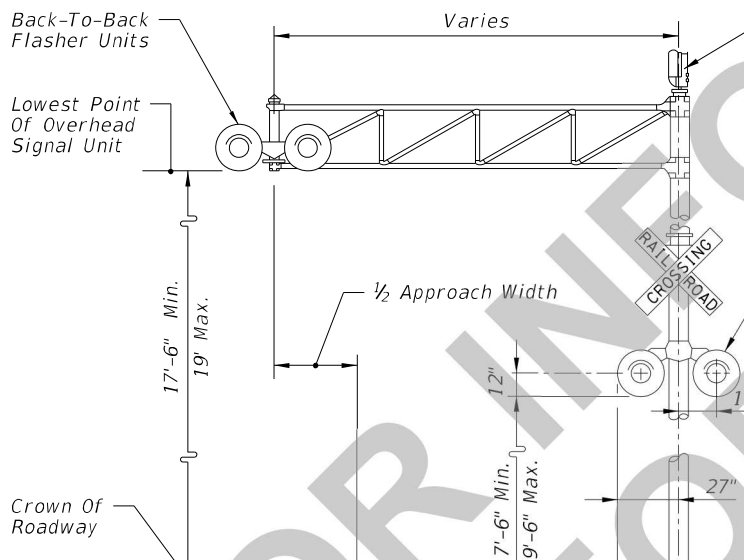
SIGNAL PLACEMENT AT RAILROAD CROSSING

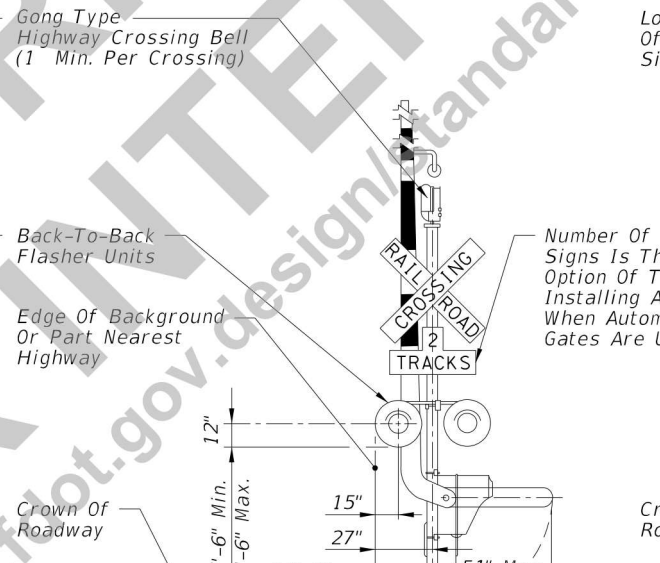
(4 - LANE DESIGN)

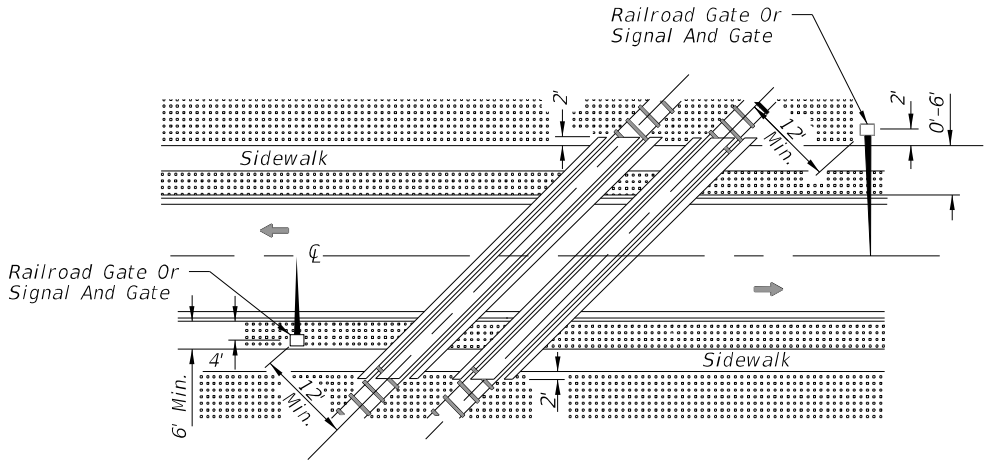
GENERAL NOTES:

1. *No guardrail is proposed for signals; however, some form of impact attenuation device may be specified for certain locations.*
2. *Advance flasher to be installed when and if called for in Plans or Specifications.*
3. *Top of foundation shall be no higher than 4" above finished shoulder grade.*
4. *Type of traffic control device*
   - *I Flashing warning devices*
   - *II Flashing warning devices with cantilever*
   - *III Flashing warning devices with gate*
   - *IV Flashing warning devices with cantilever and gate*
   - *V Gate*
5. *Class of traffic control devices (Not Shown)*
   - *I 2 Quadrant flashing warning devices-one track*
   - *II 2 Quadrant flashing warning devices-multiple tracks*
   - *III 2 Quadrant flashing warning devices and gates-one track*
   - *IV 2 Quadrant flashing warning devices and gates-multiple tracks*
   - *V 3-4 Quadrant flashing warning devices and gates-one track*
   - *VI 2-4 Quadrant flashing warning devices and gates-multiple tracks*





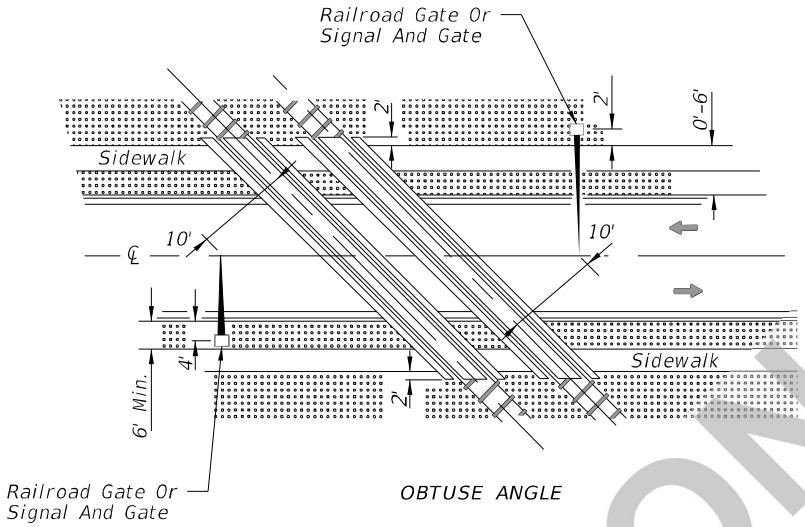




ACUTE ANGLE (AND RIGHT ANGLE)

SIGNAL PLACEMENT AT RAILROAD CROSSING

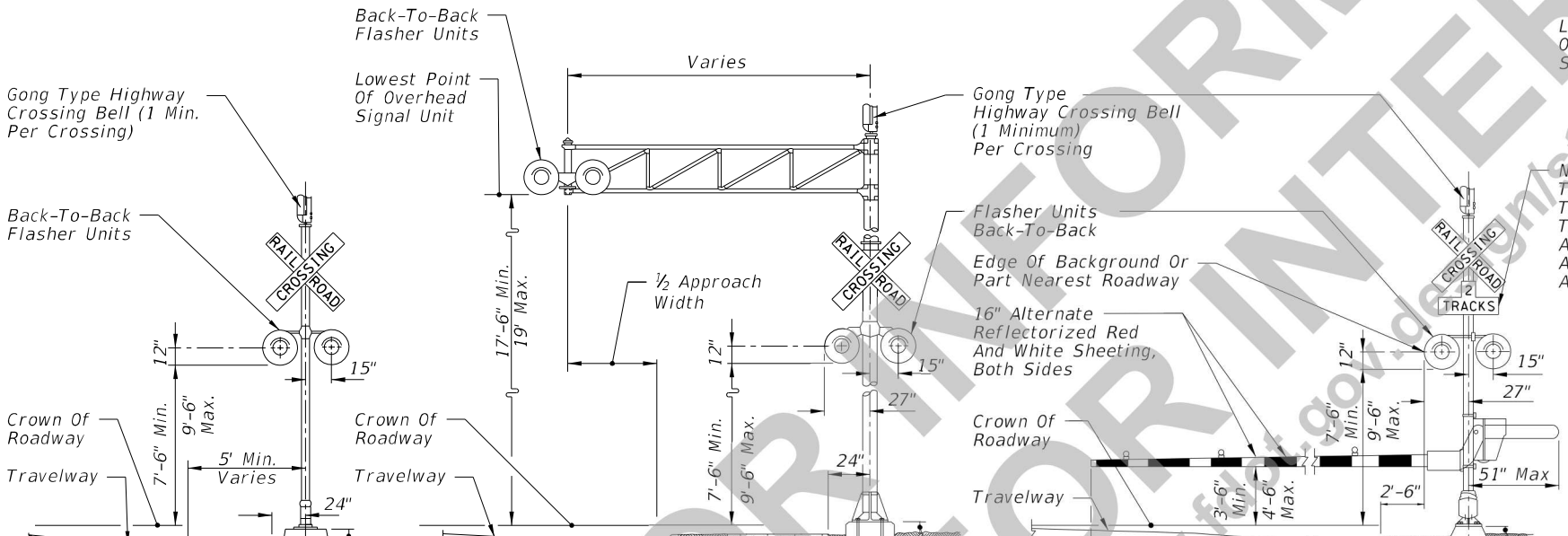
(2 LANES, CURB & GUTTER)

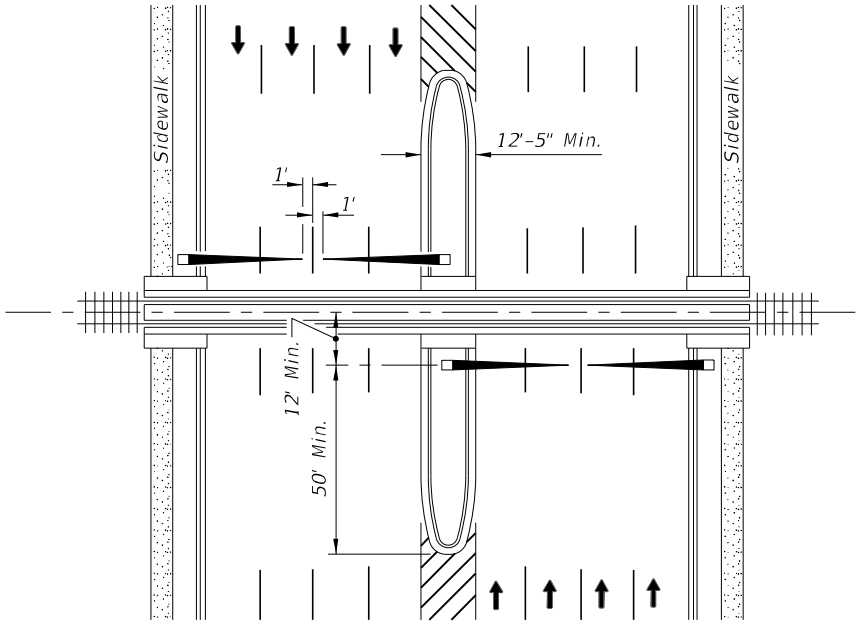


OBTUSE ANGLE

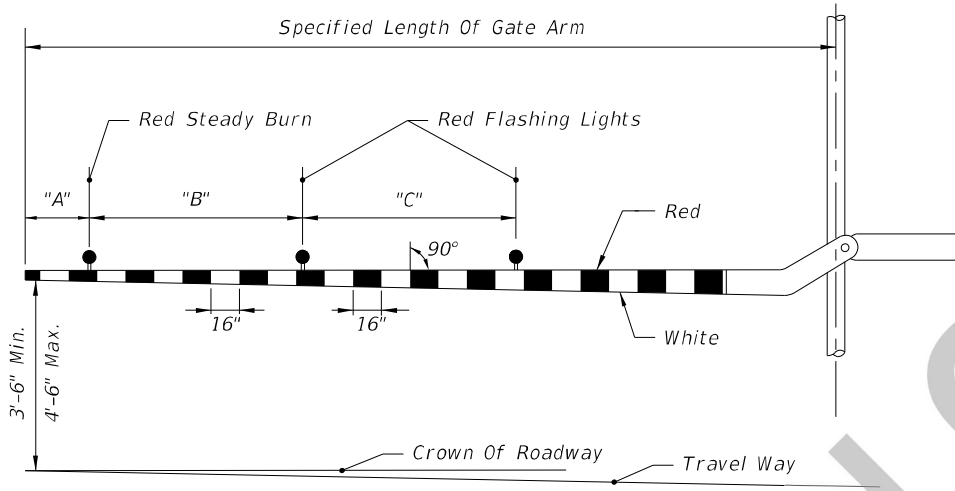
SIGNAL PLACEMENT AT RAILROAD CROSSING

(2 LANES, CURB & GUTTER)



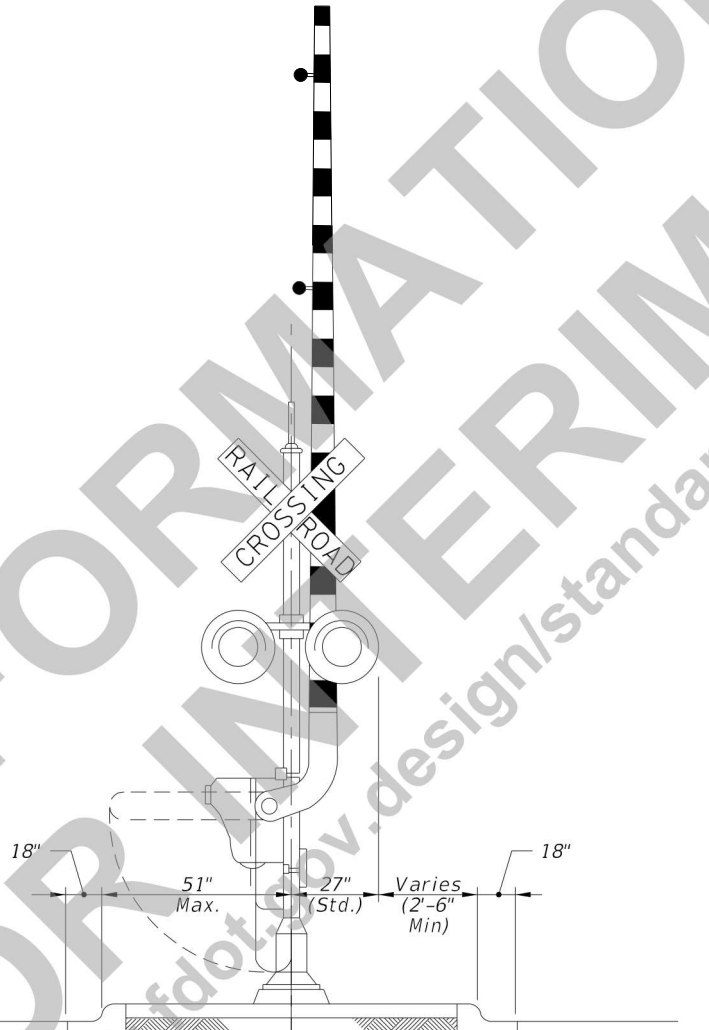


PLAN



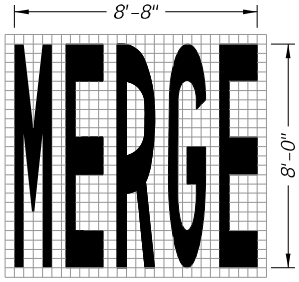
GATE ARM DETAIL

RAILROAD GATE ARM LIGHT SPACING			
Specified Length Of Gate Arm	Dimension "A"	Dimension "B"	Dimension "C"
14 Ft.	6"	36"	5'
15 Ft.	18"	36"	5'
16-17 Ft.	24"	36"	5'
18-19 Ft.	28"	41"	5'
20-23 Ft.	28"	4'	5'
24-28 Ft.	28"	5'	5'
29-31 Ft.	36"	6'	6'
32-34 Ft.	36"	7'	7'
35-37 Ft.	36"	9'	9'
38 And Over	36"	10'	10'

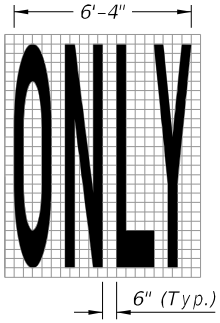


NOTE:

Attachment ‘C’



34 S.F.



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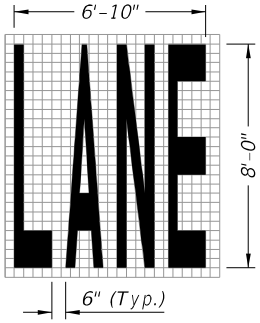

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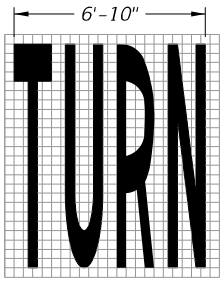

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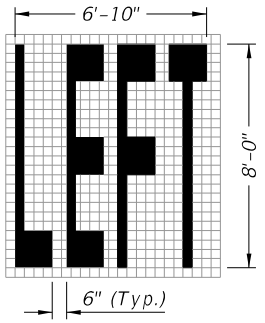

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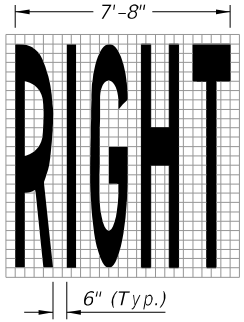

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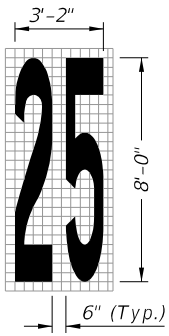

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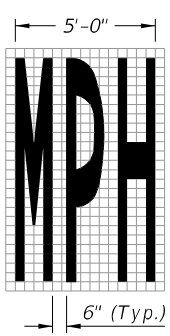

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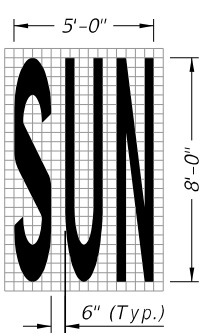

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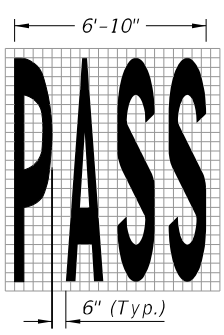

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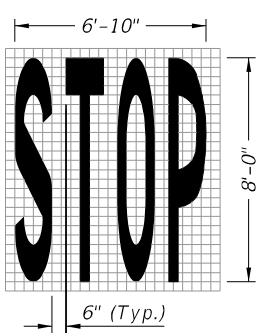

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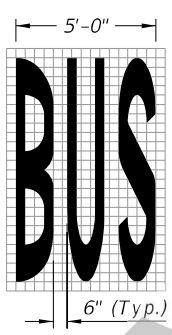

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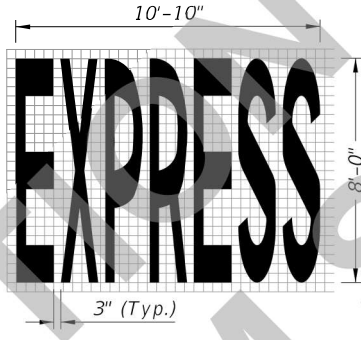

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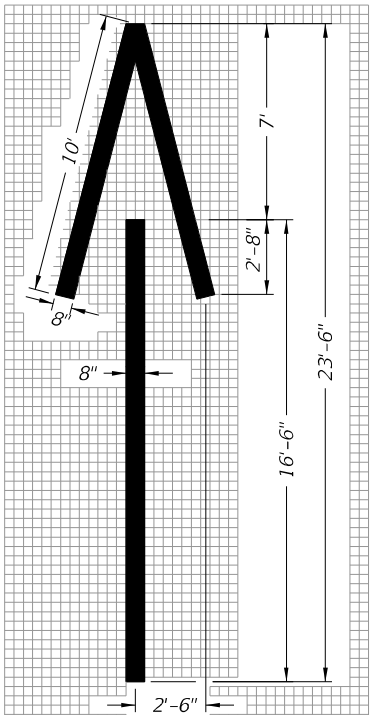
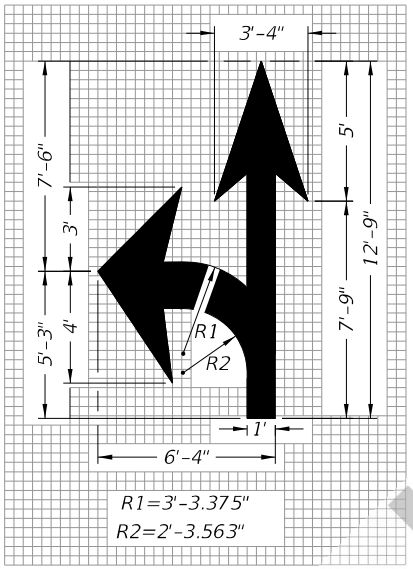
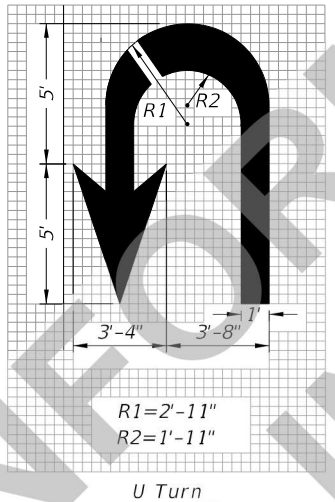




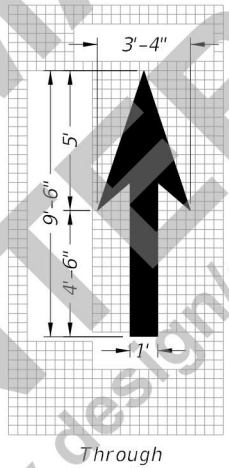
Turn and Through Lane-Use Arrow

29 S.F.



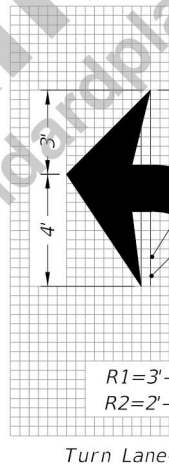
U Turn Lane-Use Arrow

27 S.F.



Through Lane-Use Arrow

12 S.F.



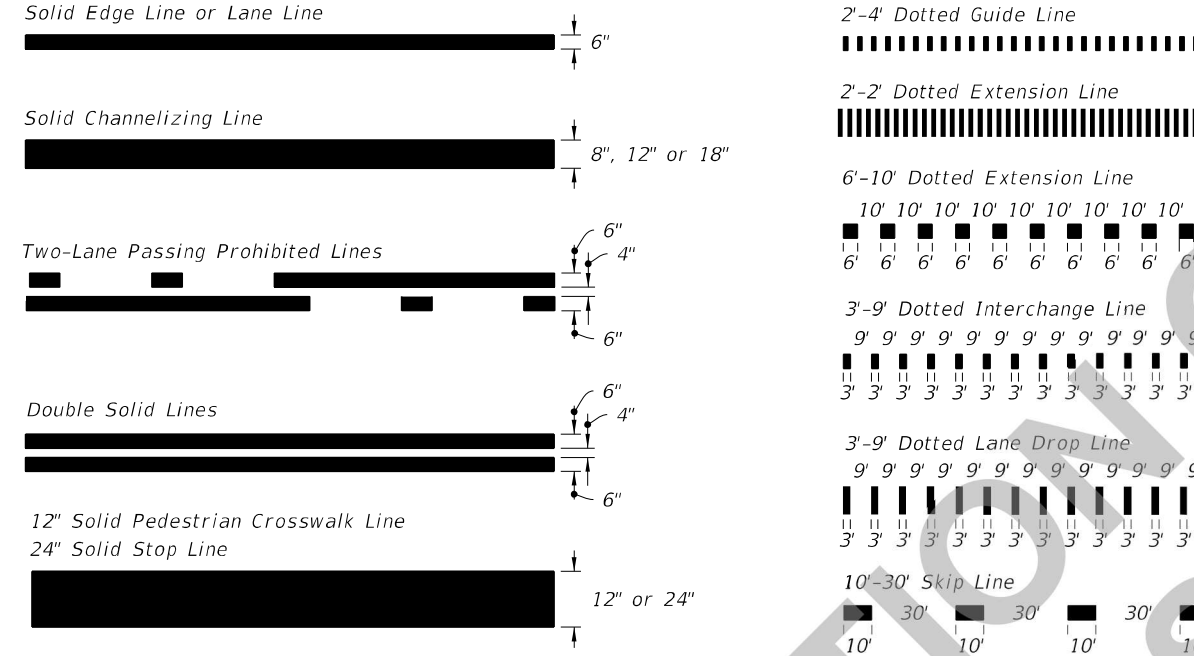
Turn Lane (Left Tur Right Tur

17

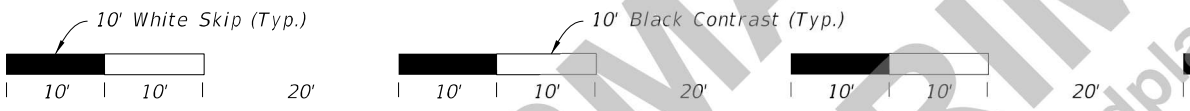
NOTES FOR PAVEMENT MESSAGES:

1. When an arrow or another pavement message is used with

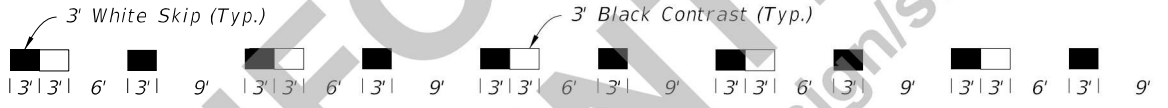
3. Dimensions are within 1" +



PAVEMENT MARKING LINES



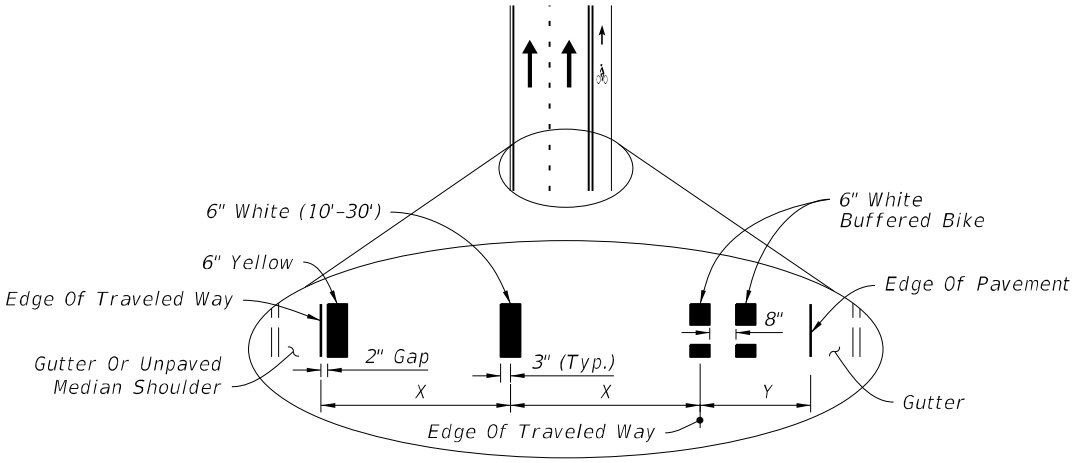
10'-30' SKIP LINE WITH SHADOW MARKINGS



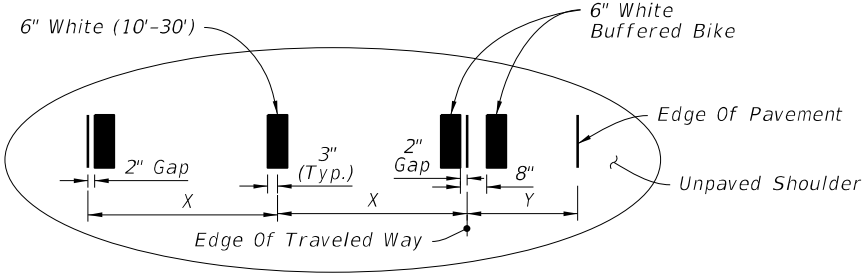
DOTTED LINE WITH ALTERNATING SHADOW MARKINGS

(3'-9' Dotted Line Shown, Other Dotted Lines Similar)

Yield Lines c
five – 18" X
triangles wh
traffic. Equa



CURB AND GUTTER

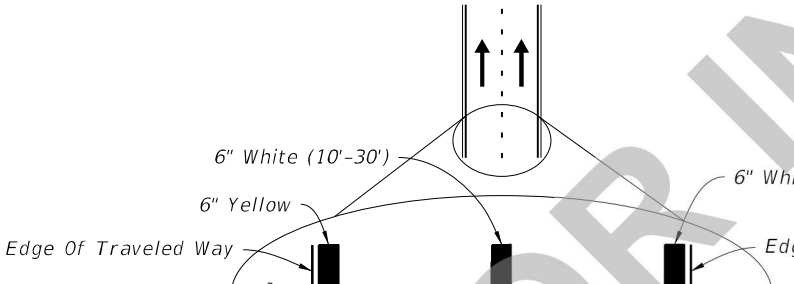


FLUSH SHOULDER

X = LANE WIDTH (FT.)

Y = BUFFERED BIKE LANE WIDTH (FT.)

STRIPING FOR BUFFERED BIKE LANE

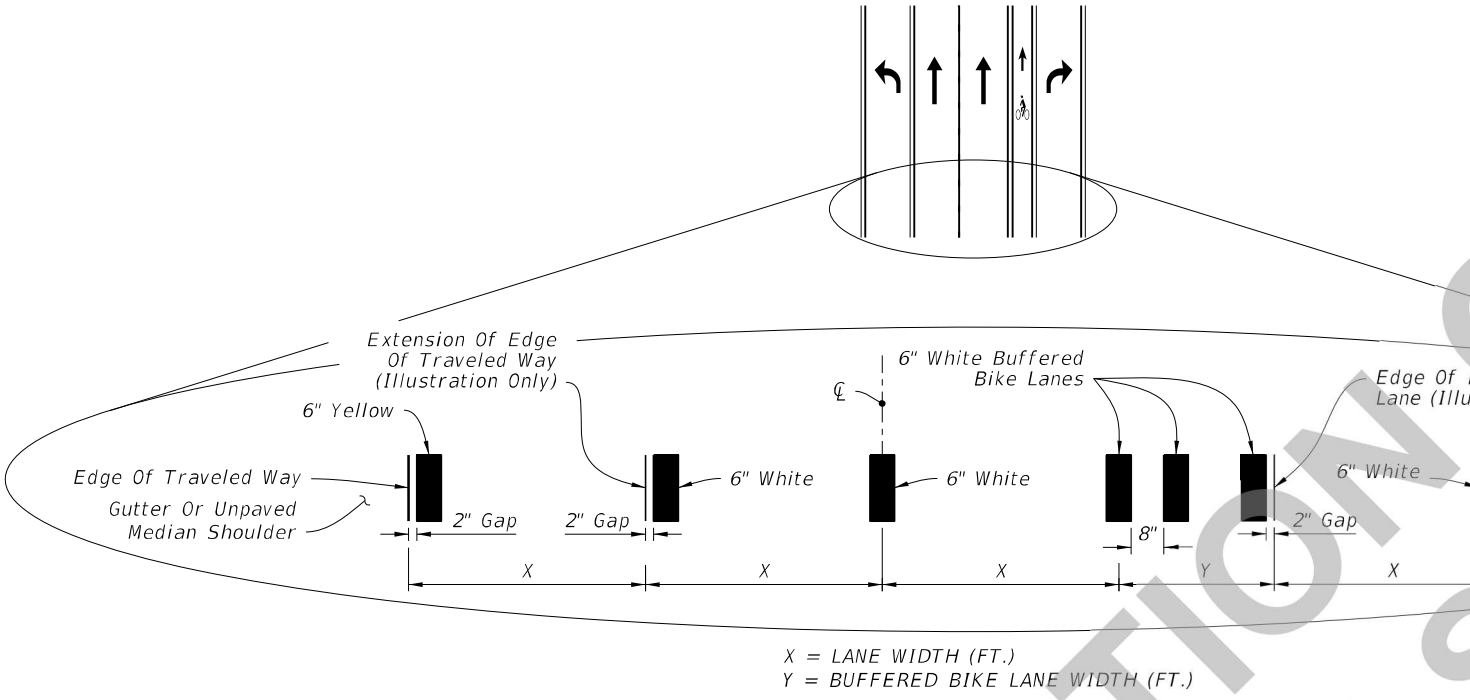


STRIPING W

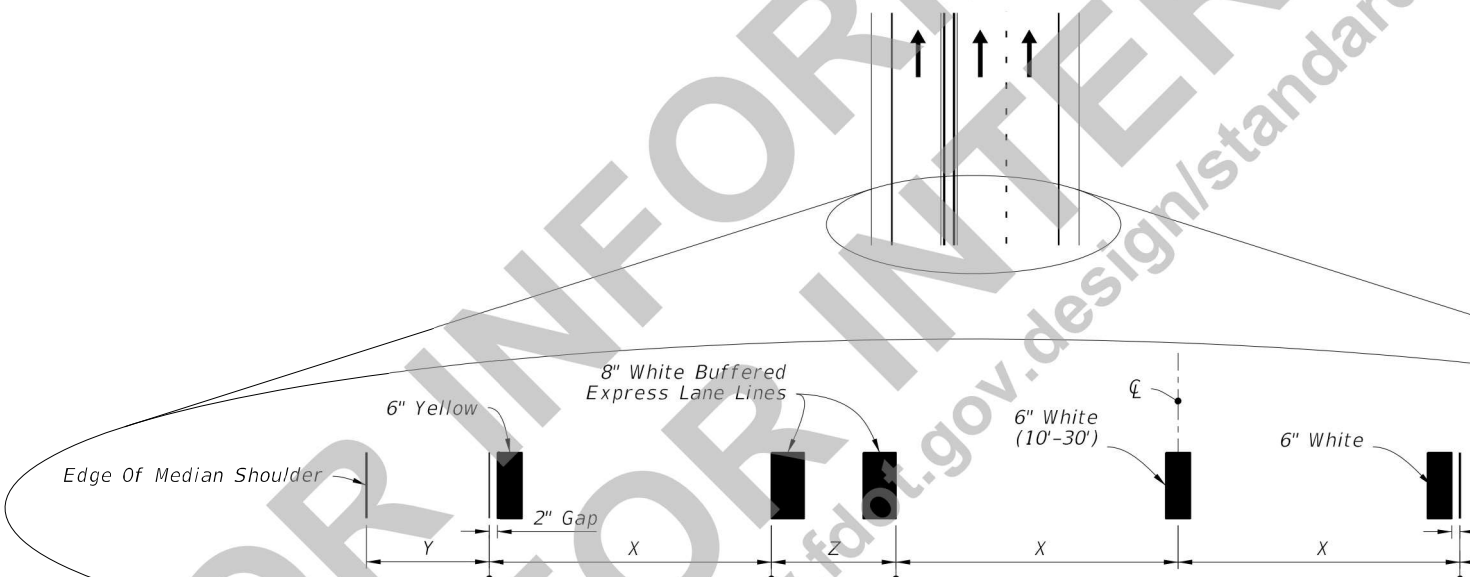
NOTE

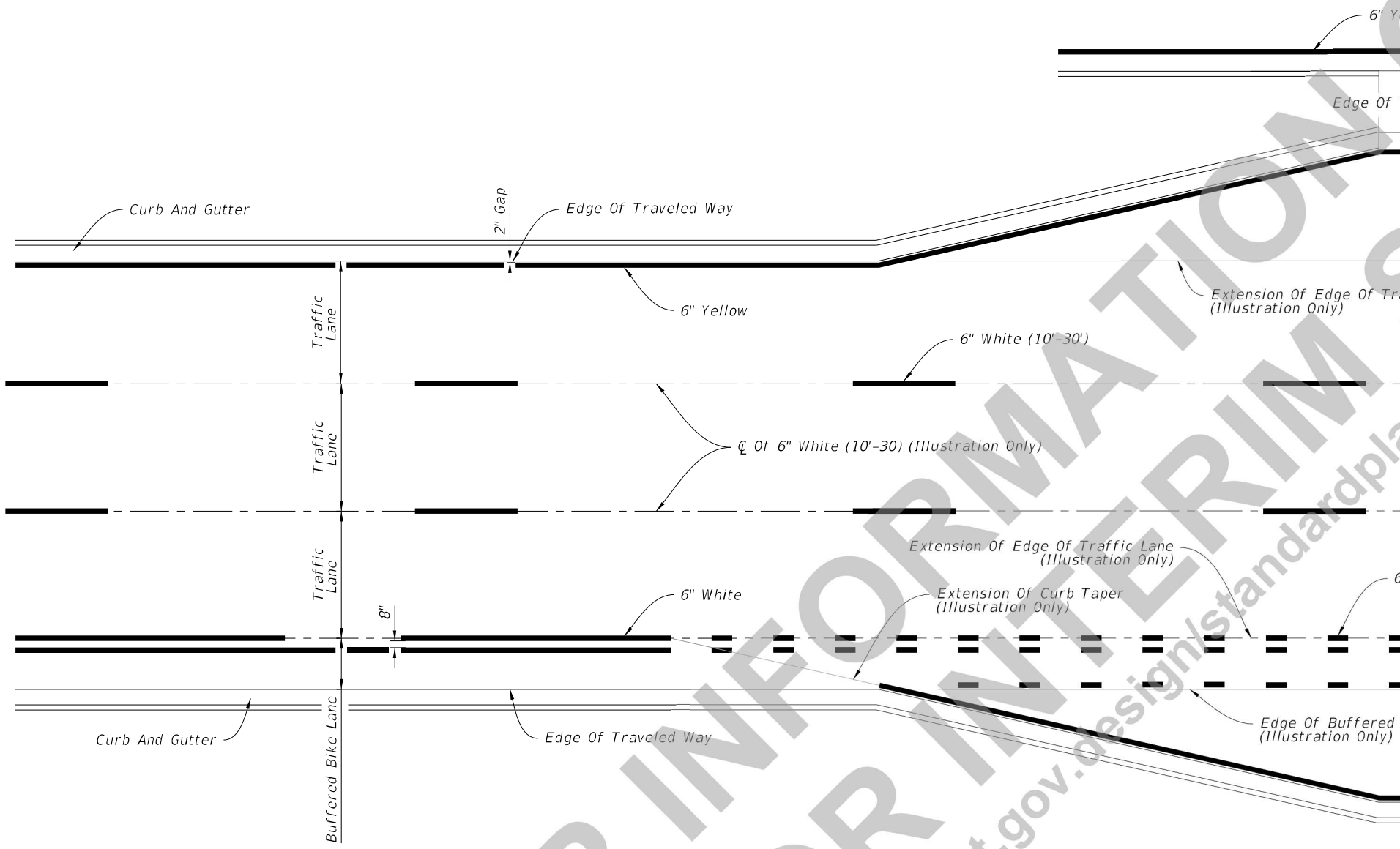
1. Lane

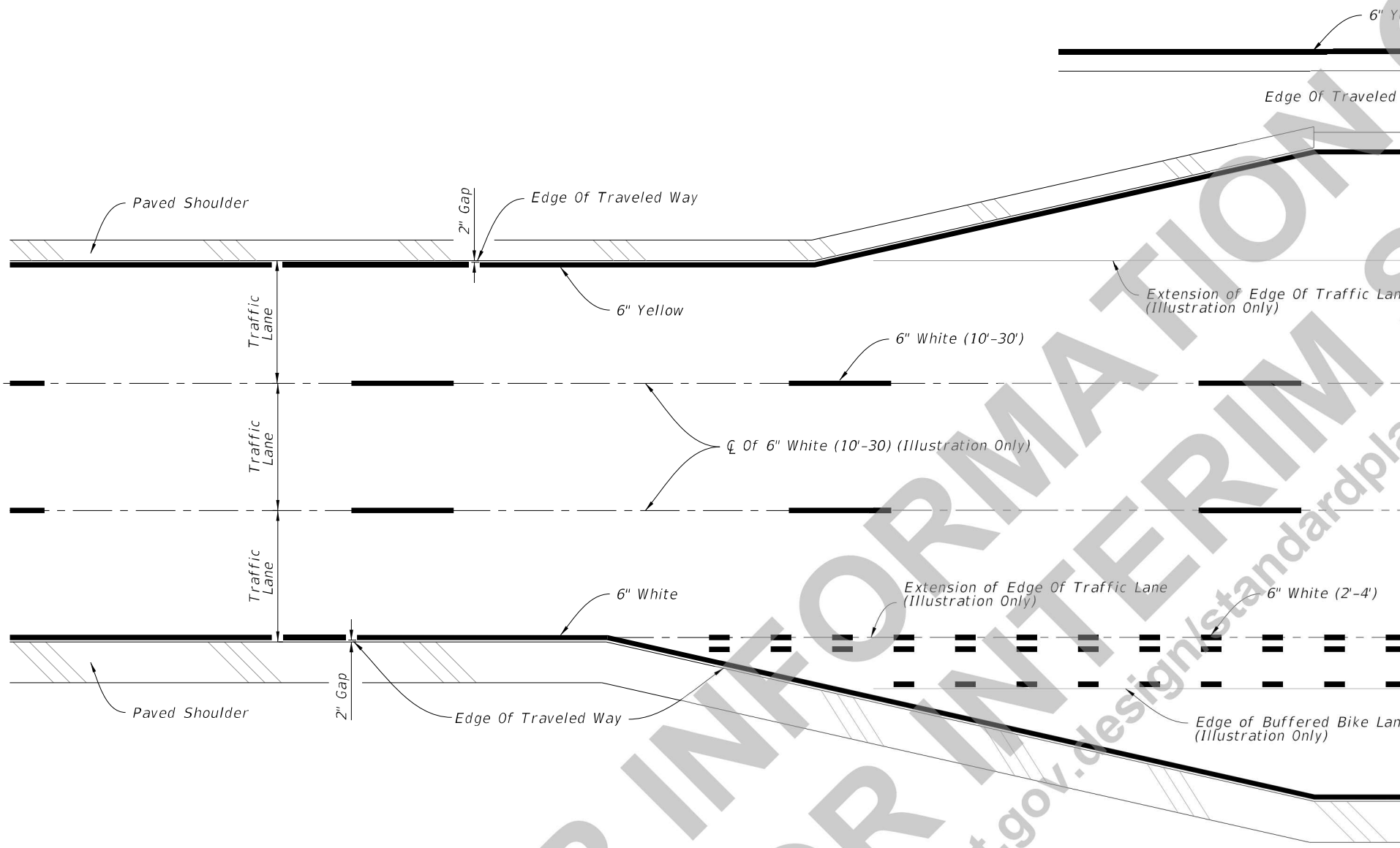
2. For

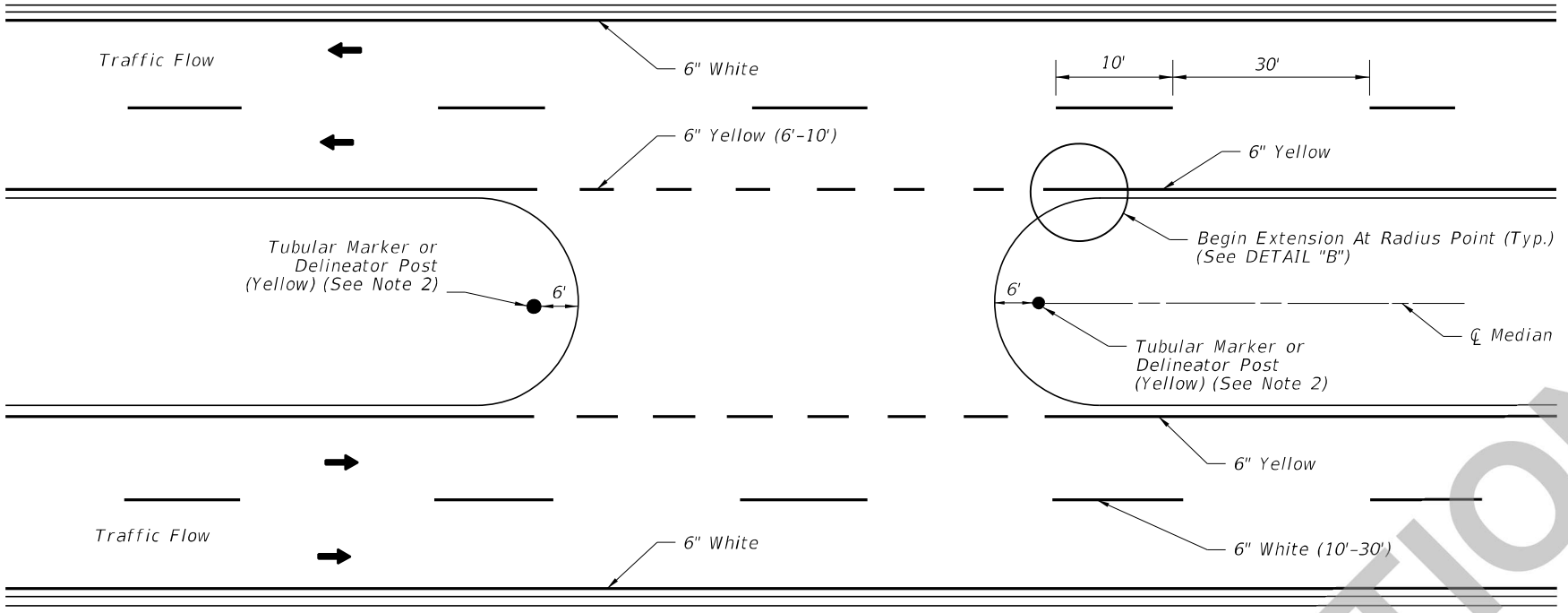


INTERSECTION APPROACH STRIPING WITH TURN LANES AND BUFFERED BIKE LANE KEY HOLE

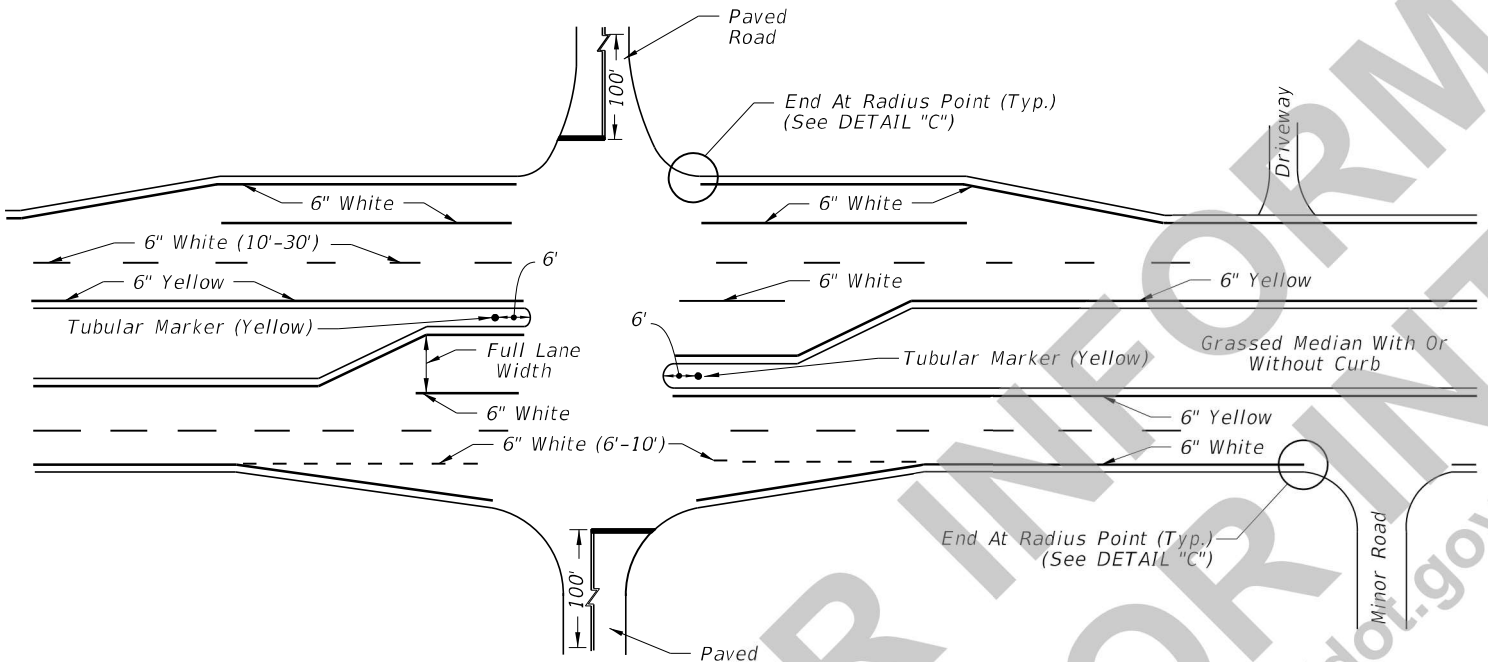








PAVEMENT MARKINGS AND DELINEATORS FOR MEDIAN CROSSOVER

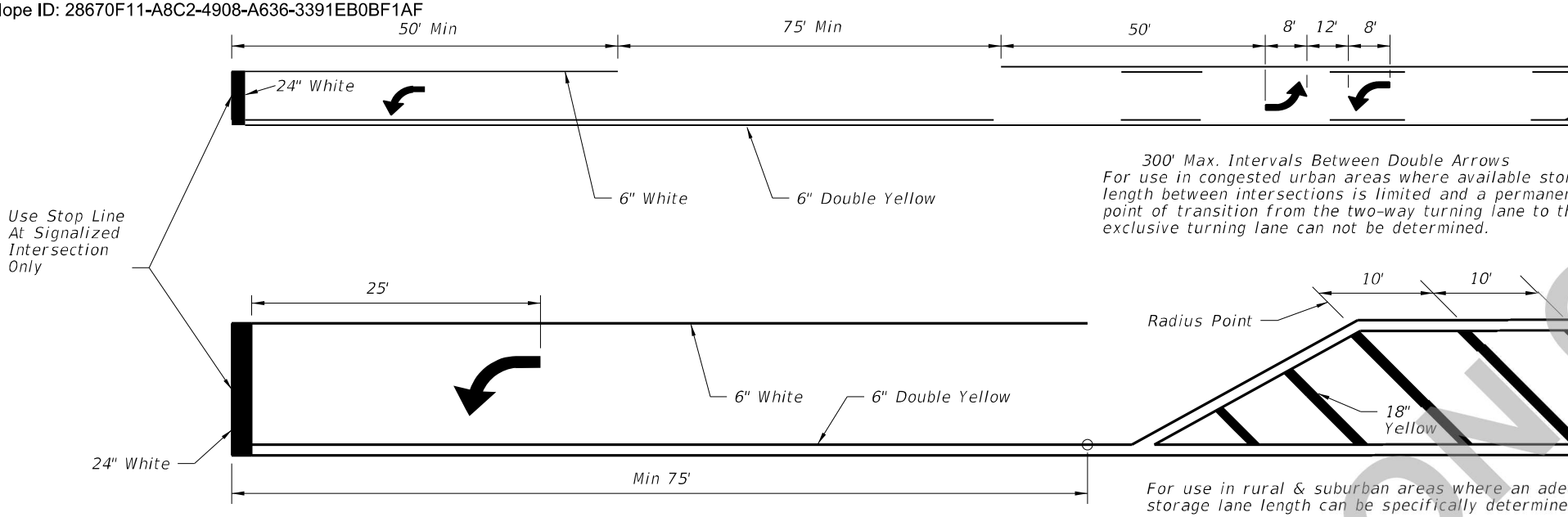


R3-4

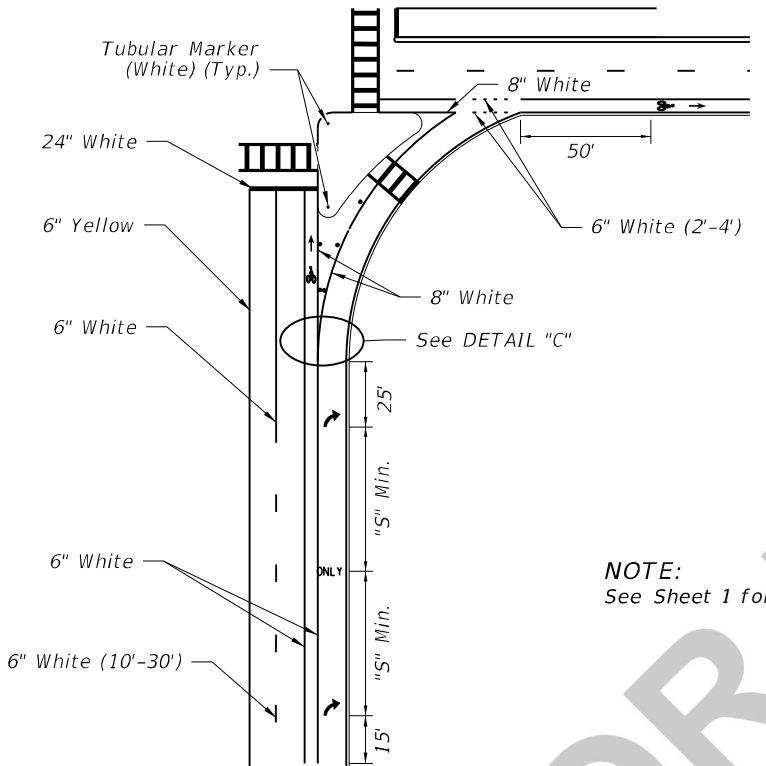
NOTE:

1. Apply yellow reflective paint to the noses traffic separators, and raised islands. W reflective paint in conjunction with Raise see Index 706-001.

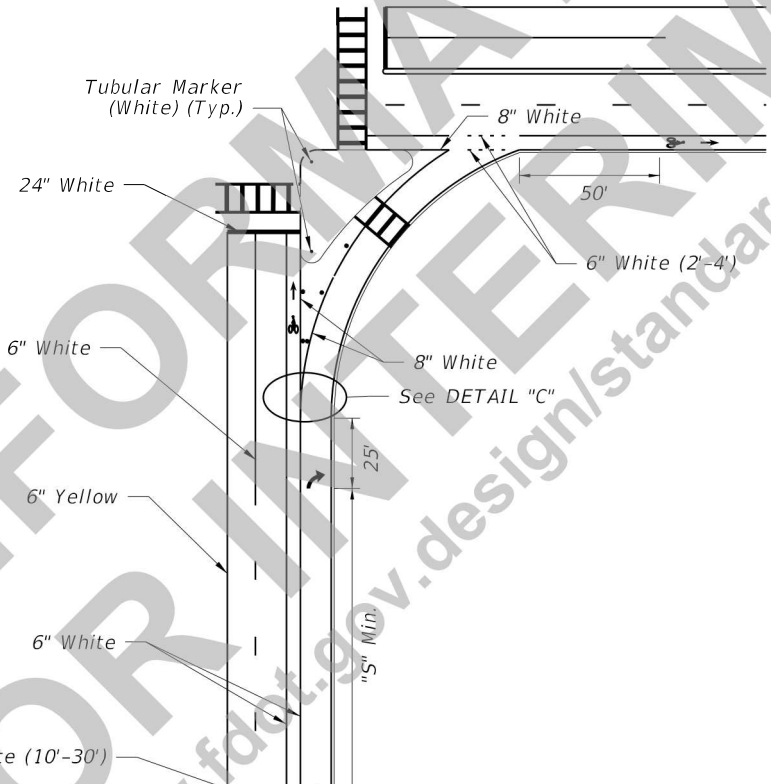
2. Options for grassed medians:
   A. Option 1: Tubular Marker (Yellow). Att according to manufacturer's instructio

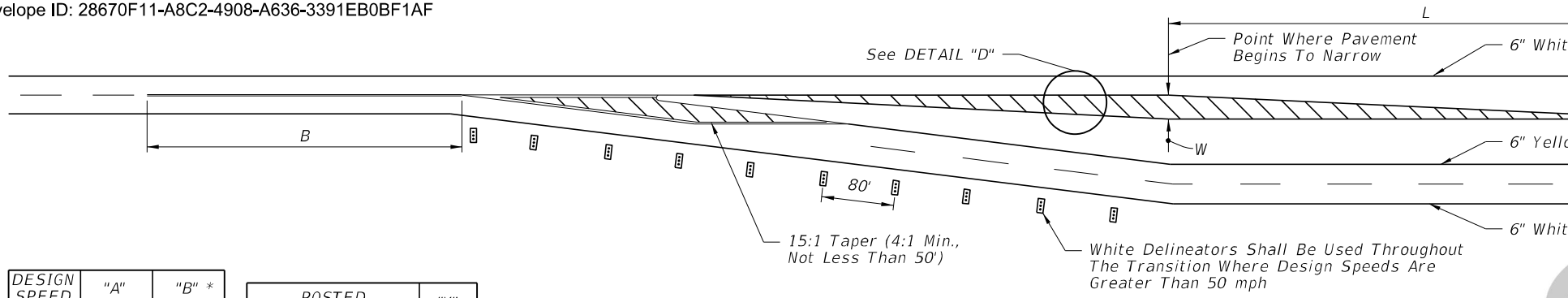


TWO WAY LEFT TURN LANE
(With Single Lane Left Turn Channelization)



NOTE:
See Sheet 1 for "S" value.





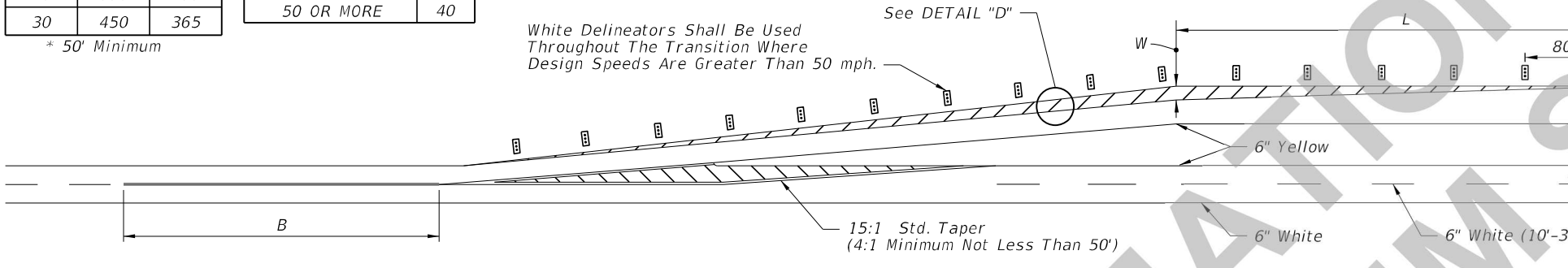
DESIGN SPEED (MPH)	"A" (FT.)	"B" * (FT.)
60	---	640
55	950	595
50	850	550
45	750	500
40	650	455
30	450	365

* 50' Minimum

POSTED SPEED LIMIT MPH	"Y" (FT.)
30 OR LESS	10
35	20
40	20
45	30
50 OR MORE	40

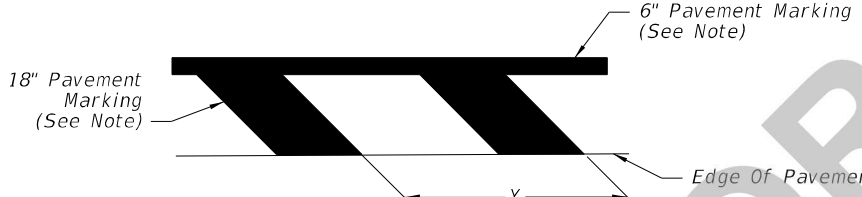
DESIGN SPEED 'S' (MPH)	Length 'L' (FT.)
40 or Less	$L = WS^2/60$
45 or Greater	$L = WS$

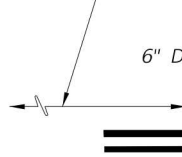
LEFT ROADWAY CENTERED ON EXISTING ROADWAY

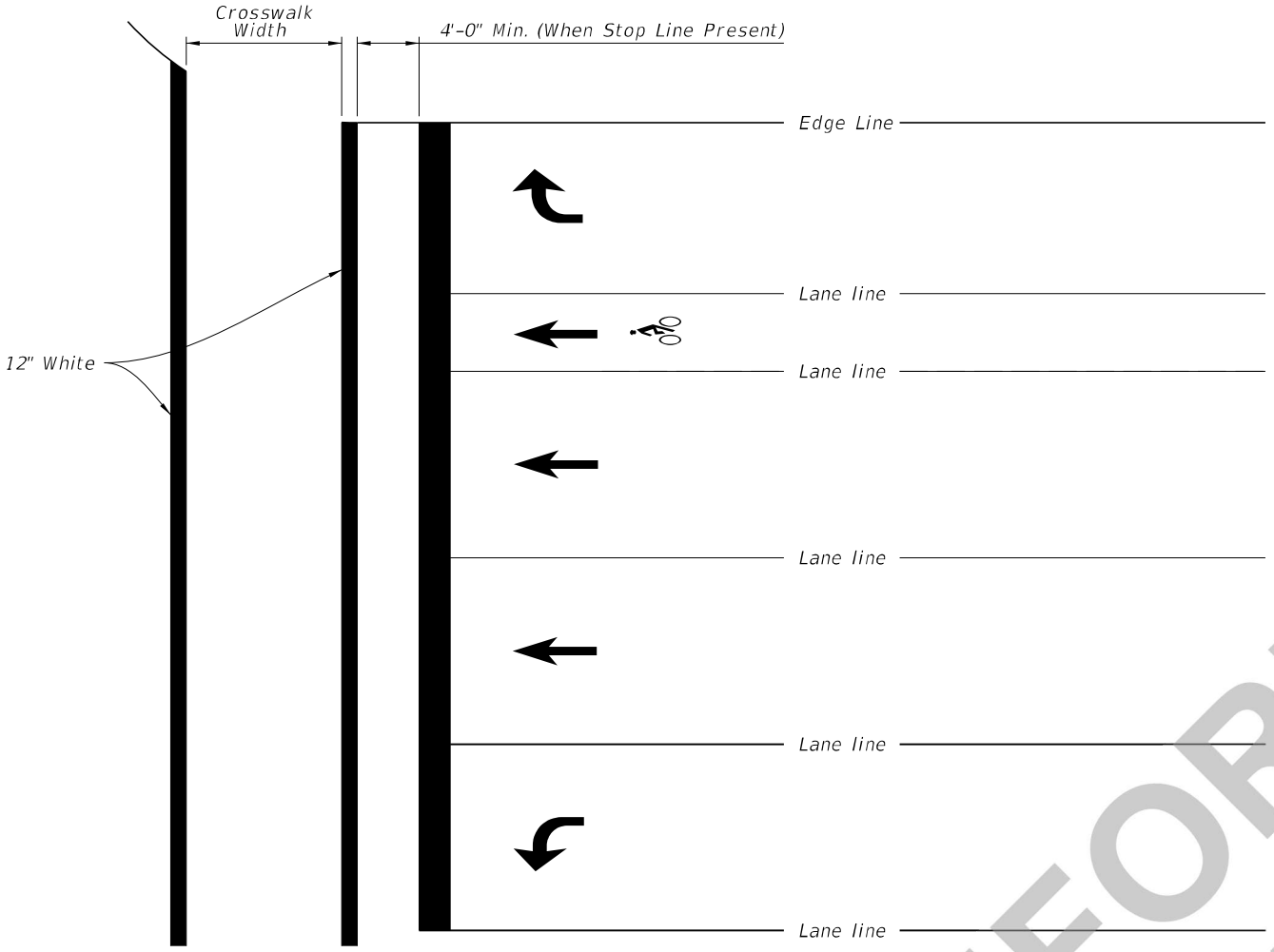


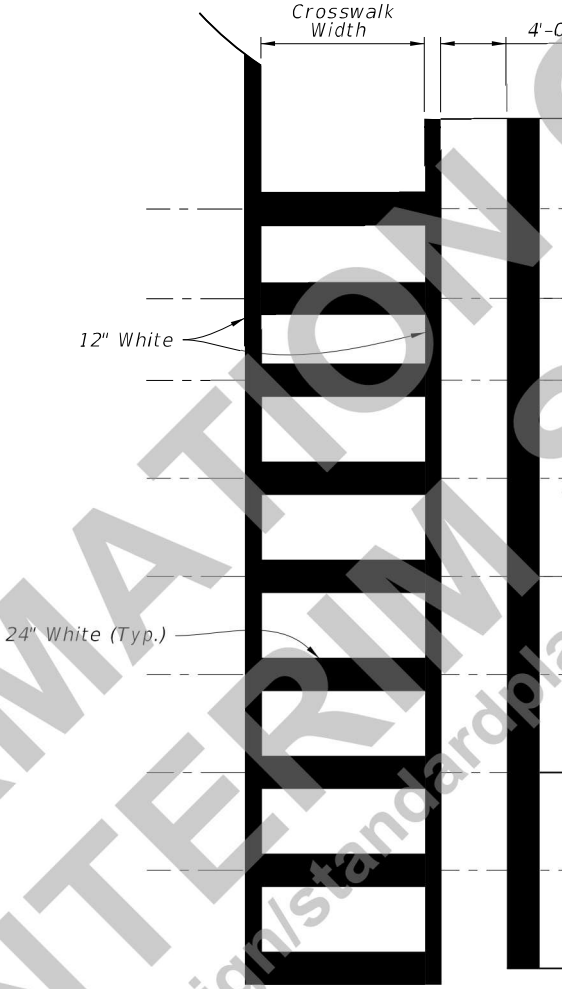
RIGHT ROADWAY CENTERED ON EXISTING ROADWAY

SCHEMES FOR TRANSITION - 2 LANE / 4 LANE ROADW







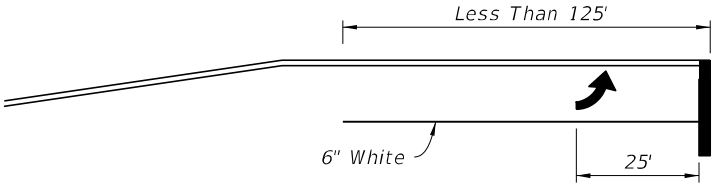


STANDARD CROSSWALK DETAILS

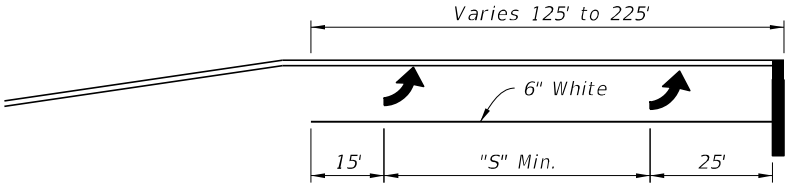
SPE

NOTES:

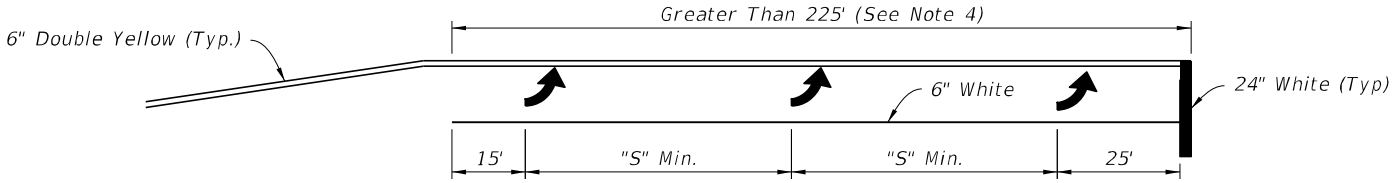
1. For crosswalk width, exceed width of the adjacent sidewalk, but do not make width less than 6' for crosswalks and 10' for midblock crosswalks. Measure width from the inside of the transverse crossw



1 ARROW

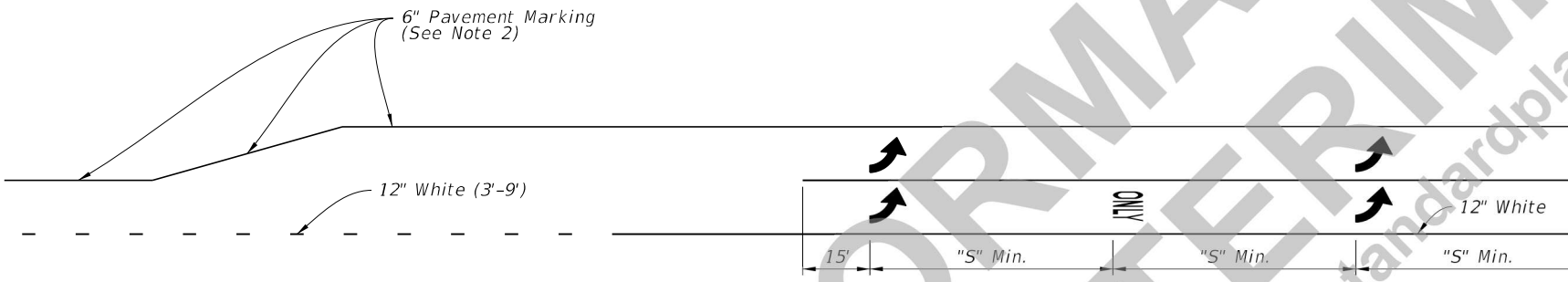


2 ARROW

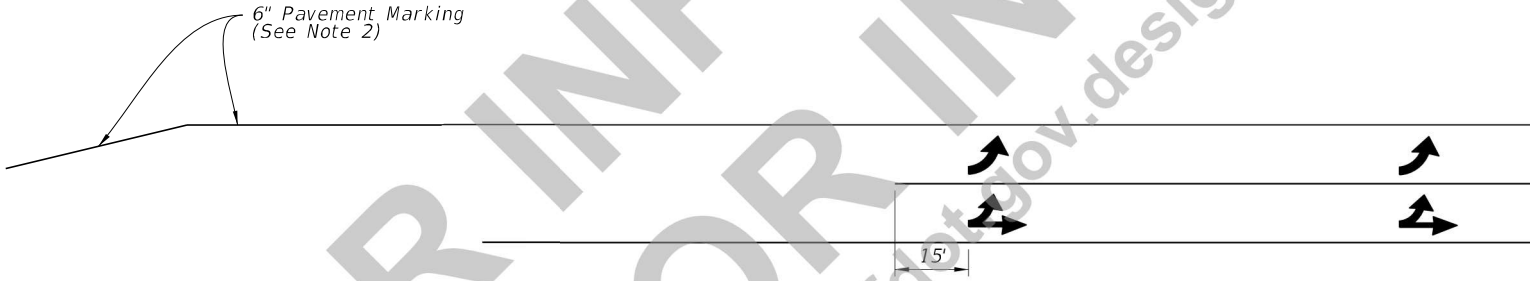


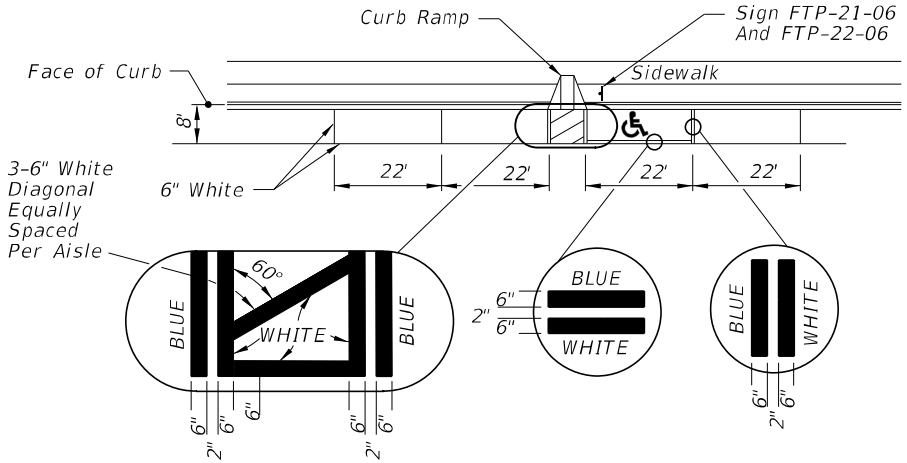
3 ARROW

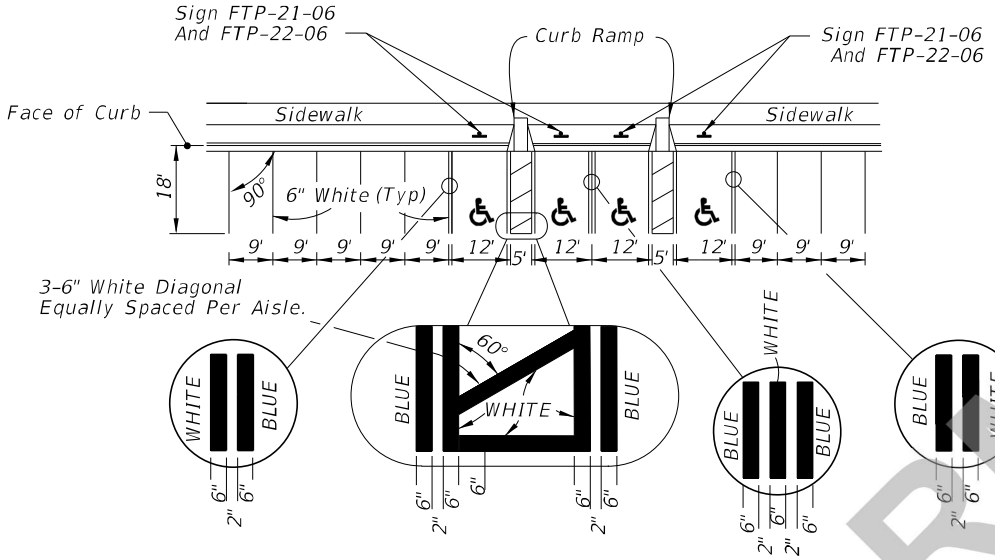
SINGLE LEFT TURNS



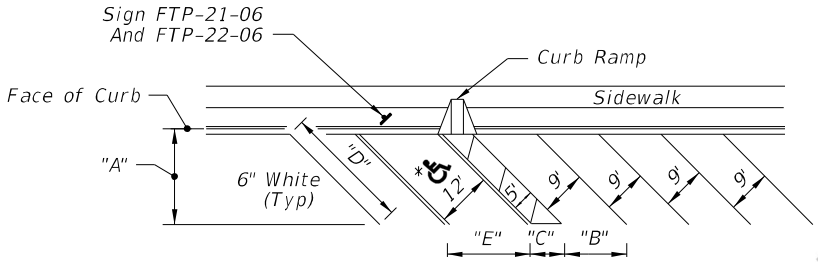
Through Lane Becomes Exclusive Left Turn



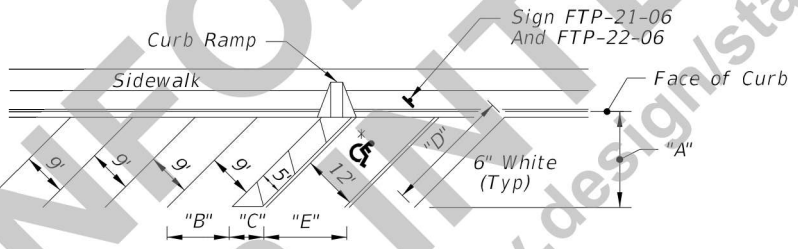




TYPICAL



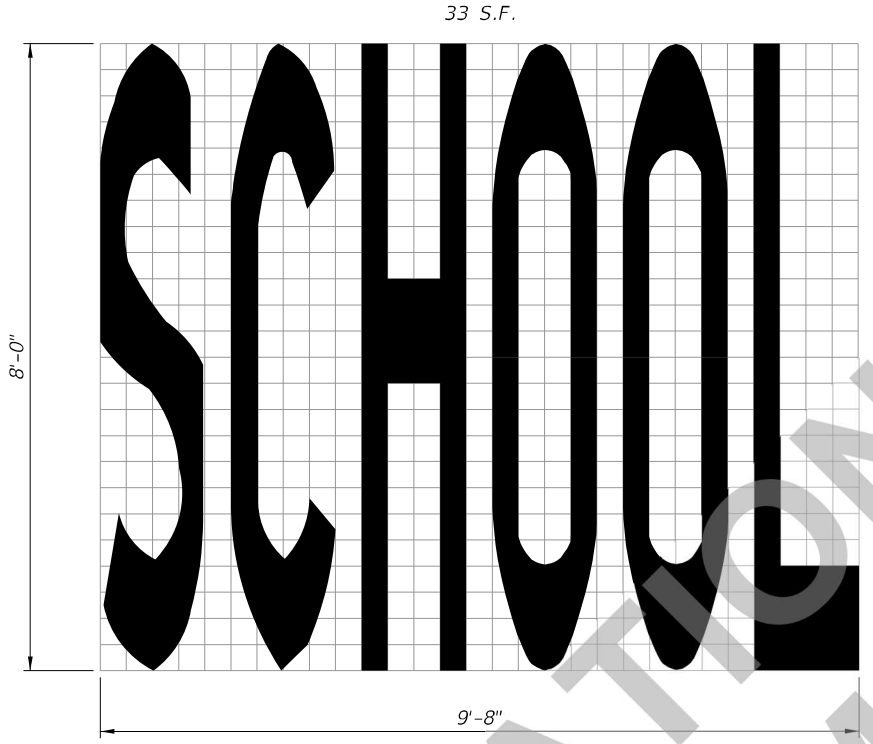
FORWARD-IN PARKING



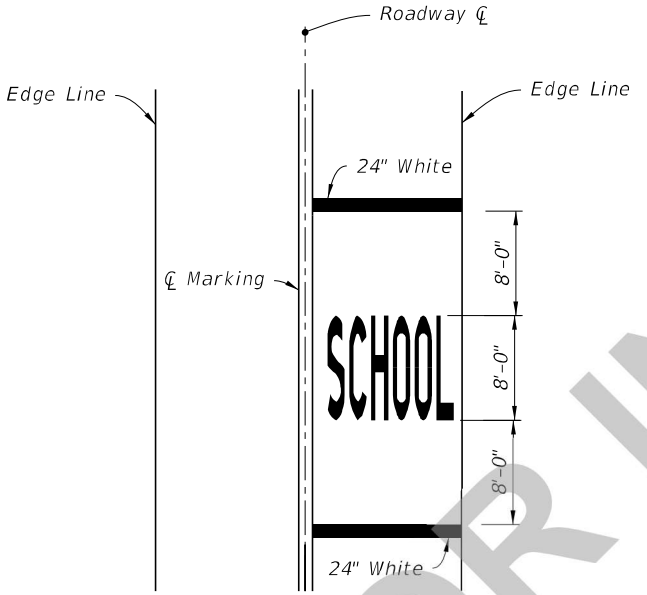
REVERSE-IN PARKING

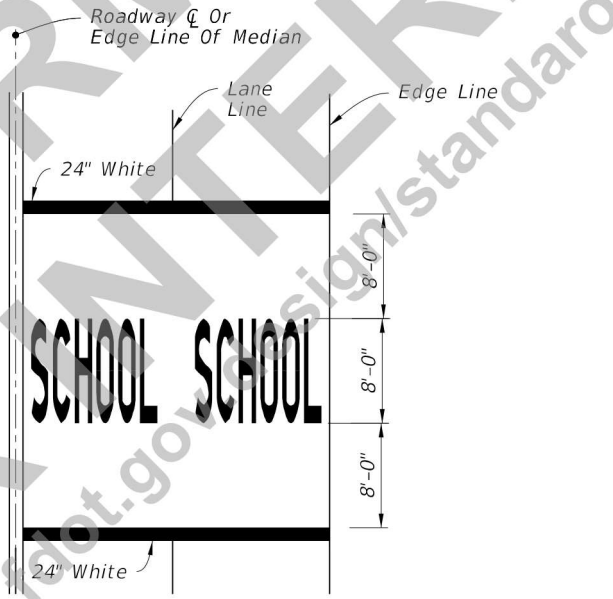
*FOR ACCESSIBLE MARKINGS - SEE ABOVE

DIMENSIONS					
	"A"	"B"	"C"	"D"	"E"



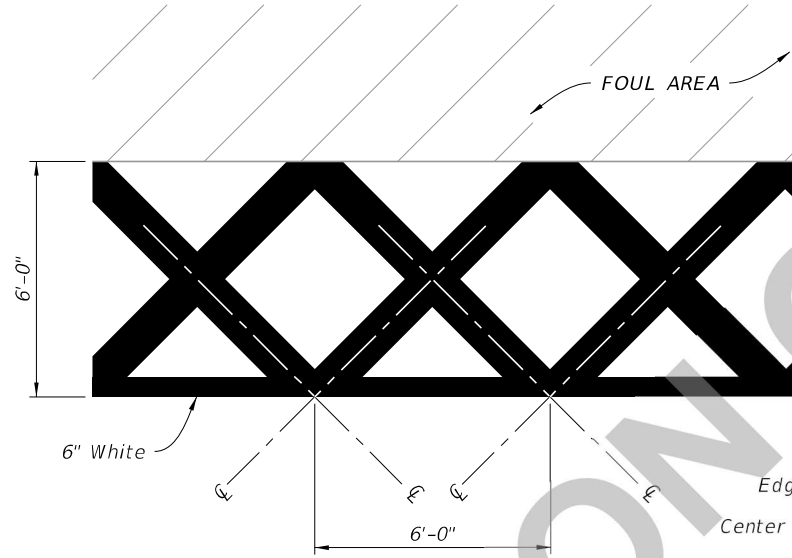
SCHOOL PAVEMENT MARKING





NOTE:

Orient Railroad Dynamic Envelope Marking as shown in the Plans.



RAILROAD DYNAMIC ENVELOPE (RDE) PAVEMENT MARKING DETAI