

Traffic Sign and Pavement Marking Manual

1.0 Introduction

1.1 General Information

The designer is responsible for ensuring signing and/or pavement marking projects comply with the following documents:

- **Manual on Uniform Traffic Control Devices (MUTCD), 11th Edition:** The MUTCD is the obligatory guide for signing and pavement marking and is published by FHWA in conjunction with the ITE, ATSSA, and AASHTO. The designer should review the FHWA MUTCD website for the latest edition of the MUTCD along with any interim updates and compliance dates.
- **Standard Highway Signs, FHWA:** This document contains detailed drawings of all standard highway signs in addition to standard alphabets, symbols, and arrows. Each sign is identified by a unique designation. Signs not included in the Standard Highway Signs or in the TDOT Tennessee Supplement to Standard Highway Signs must be detailed in the plans.
- **TDOT Supplement to Standard Highway Signs:** This document provides detailed drawings for signs and symbols that are applicable to Tennessee but are not addressed in the MUTCD.
- **Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, AASHTO:** This document provides the design criteria for the structural design of highway sign supports, luminaires, and traffic signals.
- **Roadway and Traffic Operations Standard Drawings:** These standards are composed of a number of standard drawings or indexes that address specific situations that occur on a large majority of construction projects.
- **TDOT Standard Specifications for Road and Bridge Construction (Standard Specifications):** The standard specifications are the requirements adopted by TDOT for work methods, materials, and basis of payment used in construction. The standard specifications are intended for general and repetitive use. They provide TDOT criteria for the scope of work, control of work, control of materials, legal regulations and responsibilities to the public, contract prosecution and progress, and measurement and payment of contract items.
- **TDOT Roadway and Traffic Design Guidelines:** These guidelines establish uniform procedures for roadway and traffic design activities within TDOT and provide guidance in the preparation of construction plans and estimates.

1.2 MUTCD

The guidance provided in the MUTCD is divided into four categories:

- Standard;
- Guidance;
- Option; and
- Support.

These categories are used to determine the appropriate application for the various traffic control devices. Where applicable, the designer is required to meet the criteria presented in the Standard category. Where applicable, the designer is recommended to meet the criteria presented in the Guidance category. If the designer decides to deviate from the guidance based on engineering judgment or engineering study, the designer should document why. Where applicable, the designer is permitted to meet the criteria presented in the option category.

2.0 Signing

All regulatory and warning signs shall meet the design and installation requirements of the MUTCD. Effective signing provides clear information and instruction to motor vehicle operators, pedestrians, and bicyclists. Properly installed signing facilitates legal, safe, and orderly progress on public roadways.

2.1 Application

Signs should be used only where required by the MUTCD and justified by engineering judgment or studies. Results from traffic engineering studies of physical and traffic factors should indicate the locations where signs are deemed necessary or desirable. Roadway geometric design and sign application should be coordinated so that signing can be effectively placed to give the road user any necessary regulatory, warning, guidance, and other information.

2.2 Sign Layouts

The MUTCD, TDOT Supplement to Standard Highway Signs, and TDOT Roadway and Traffic Operations Standard Drawings provide guidance on the placement of regulatory signs, warning signs, guide signs, information signs, service signs, and other signs used in Tennessee.

2.3 Conventional Highways (Non-Access Controlled) Signs

- **Directional and Route Signing at Intersections:** The following figures illustrate typical sign assemblies for directional assemblies and route signing at intersections:

- Figure 2.1 – Intersection of Two Major Routes (4-Way Intersection)
 - Figure 2.2 – Intersection of Two Major Routes (3-Way Intersection)
 - Figure 2.3 – Intersection of Two Major Routes with Overlapping Route Numbers
 - Figure 2.4 – 4-Way Intersection Route Signing with Scenic (Bird) Route
 - Figure 2.5 – 3-Way Intersection Route Signing with Scenic (Bird) Route
 - Figure 2.6 – 3-Way Intersection Route Signing with Scenic (Bird) Route with Overlapping Route Numbers
- **One-Way and Wrong-Way Signing at Median Crossovers:** ONE-WAY signs shall be used to denote streets where only one direction of traffic is allowed. When installed, they should be placed on the near right and far left corners of the intersection. ONE-WAY signs are not required for divided streets with a median width of less than 30 feet. The following figures illustrate typical ONE-WAY and WRONG-WAY signing at median crossovers:
- Figure 2.7 – Crossroad Signing, Medians less than 30 feet, One-Way and Wrong-Way Signing
 - Figure 2.8 – Signalized Intersection, Medians less than 30 feet, One-Way and Wrong-Way Signing
 - Figure 2.9 – “T” Intersection Right, Medians less than 30 feet, One-Way and Wrong-Way Signing
 - Figure 2.10 – “T” Intersection Left, Medians less than 30 feet, One-Way and Wrong-Way Signing
 - Figure 2.11 – Median Crossover, Medians less than 30 feet, One-Way and Wrong-Way Signing
 - Figure 2.12 – Crossroad Signing, Medians 30 feet or greater, One-Way and Wrong-Way Signing
 - Figure 2.13 – Signalized Intersection, Medians 30 feet or greater, One-Way and Wrong-Way Signing
 - Figure 2.14 – “T” Intersection Right, Medians 30 feet or greater, One-Way and Wrong-Way Signing
 - Figure 2.15 – “T” Intersection Left, Medians 30 feet or greater, One-Way and Wrong-Way Signing
 - Figure 2.16 – Median Crossover, Medians 30 feet or greater, One-Way and Wrong-Way Signing

Figure 2.1 – Intersection of Two Major Routes (4-Way Intersection)

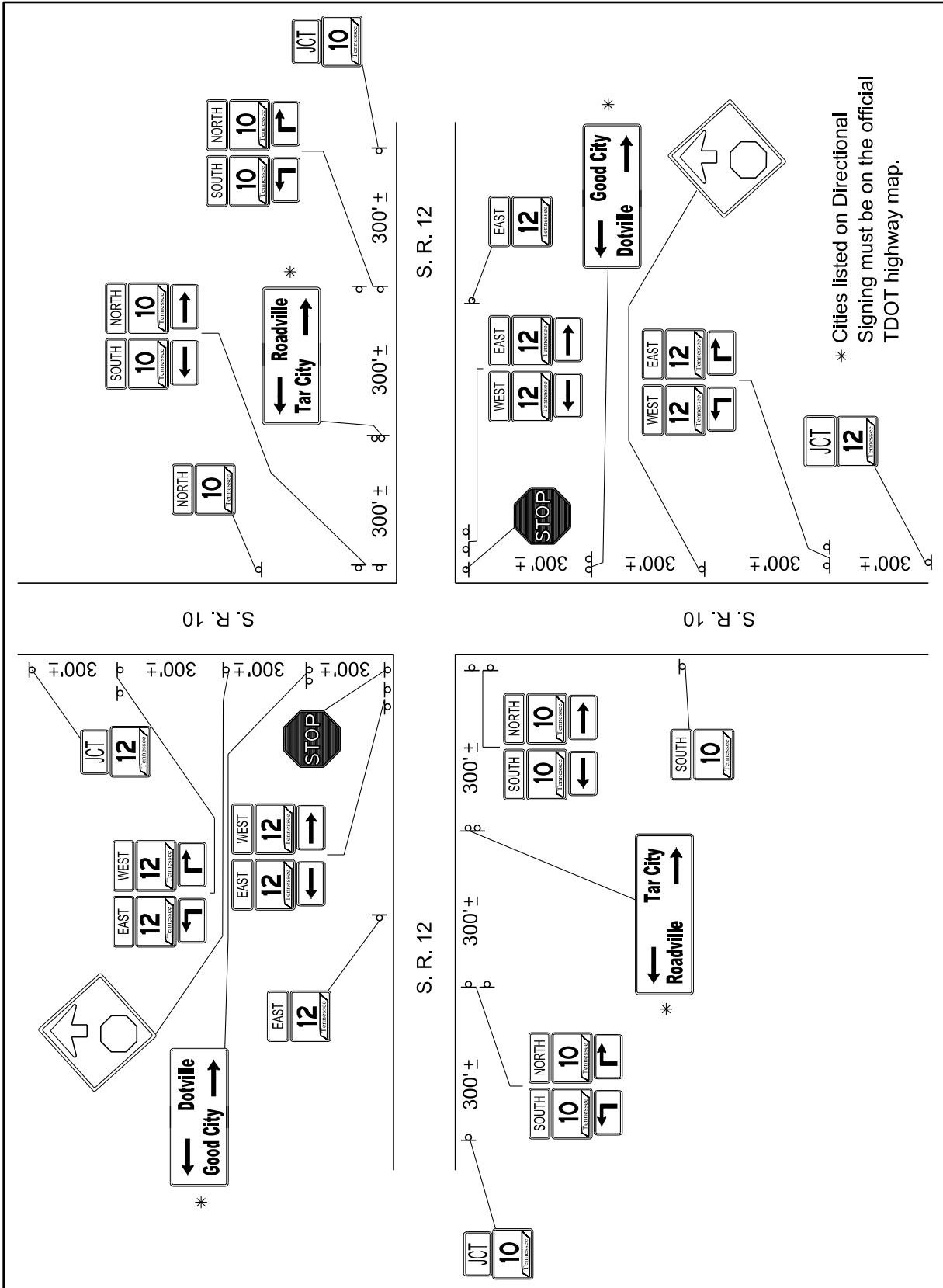


Figure 2.2 – Intersection of Two Major Routes (3-Way Intersection)

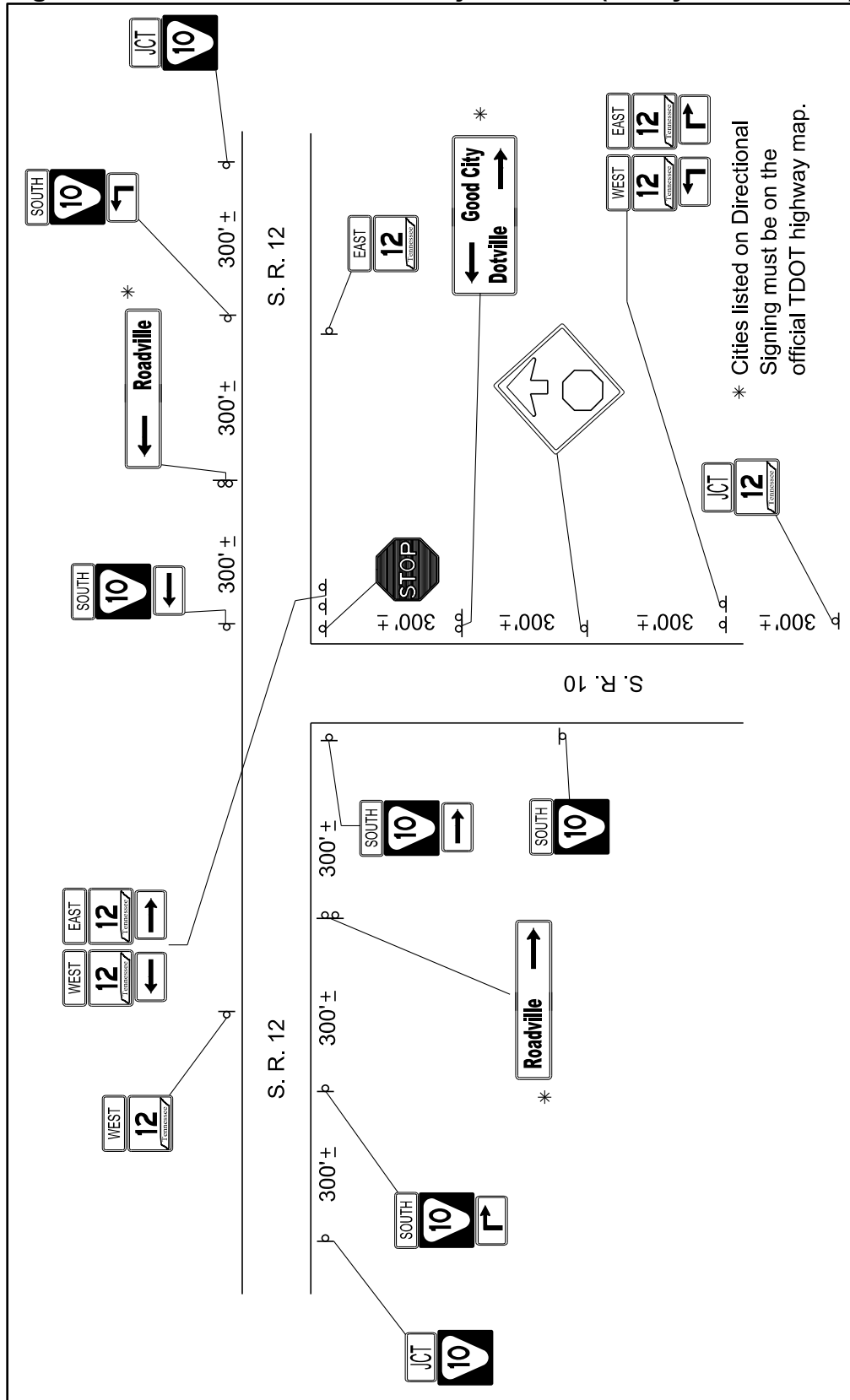


Figure 2.3 – Intersection of Two Major Routes with Overlapping Route Numbers

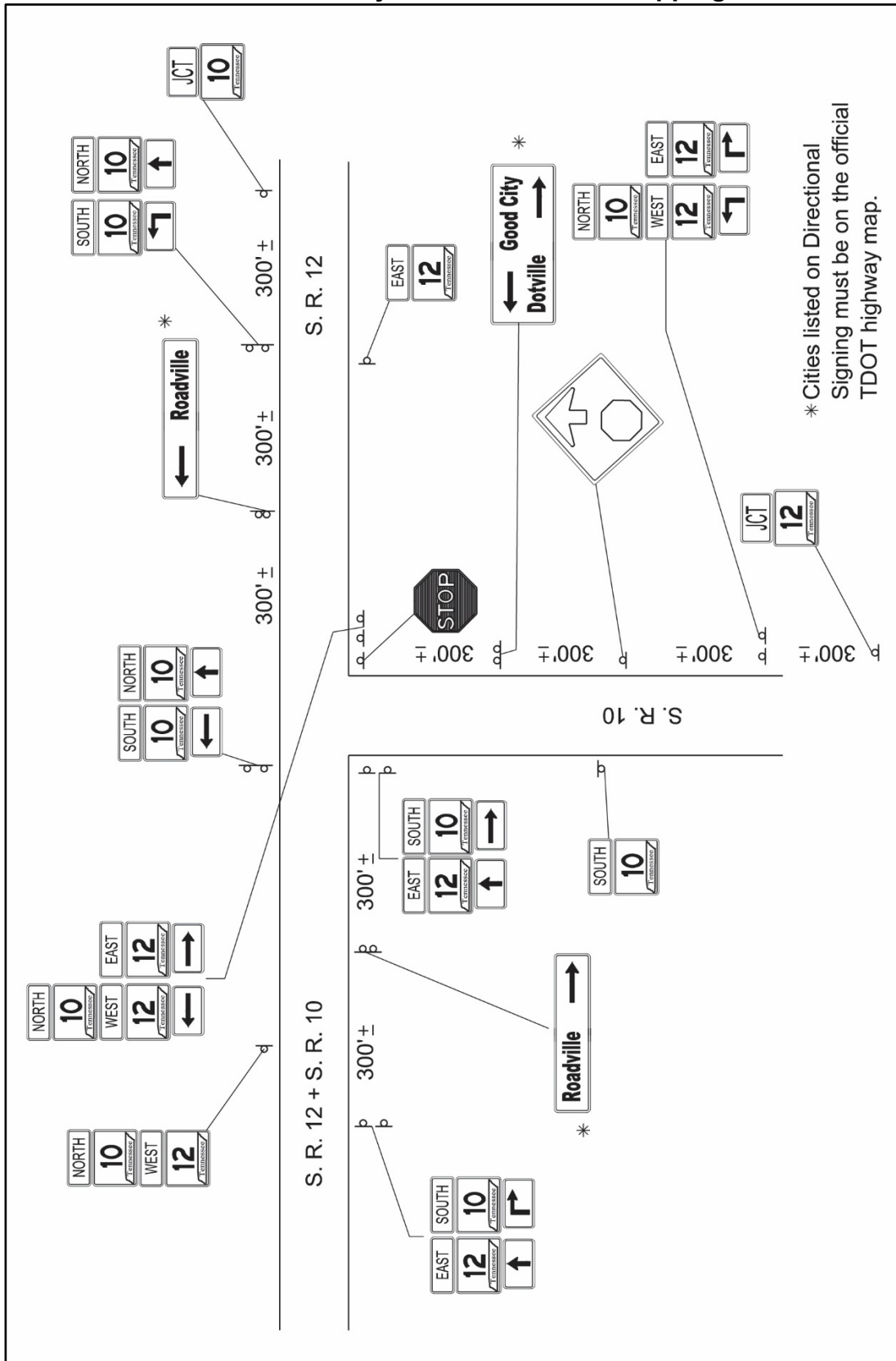


Figure 2.4 – 4-Way Intersection Route Signing with Scenic (Bird) Route

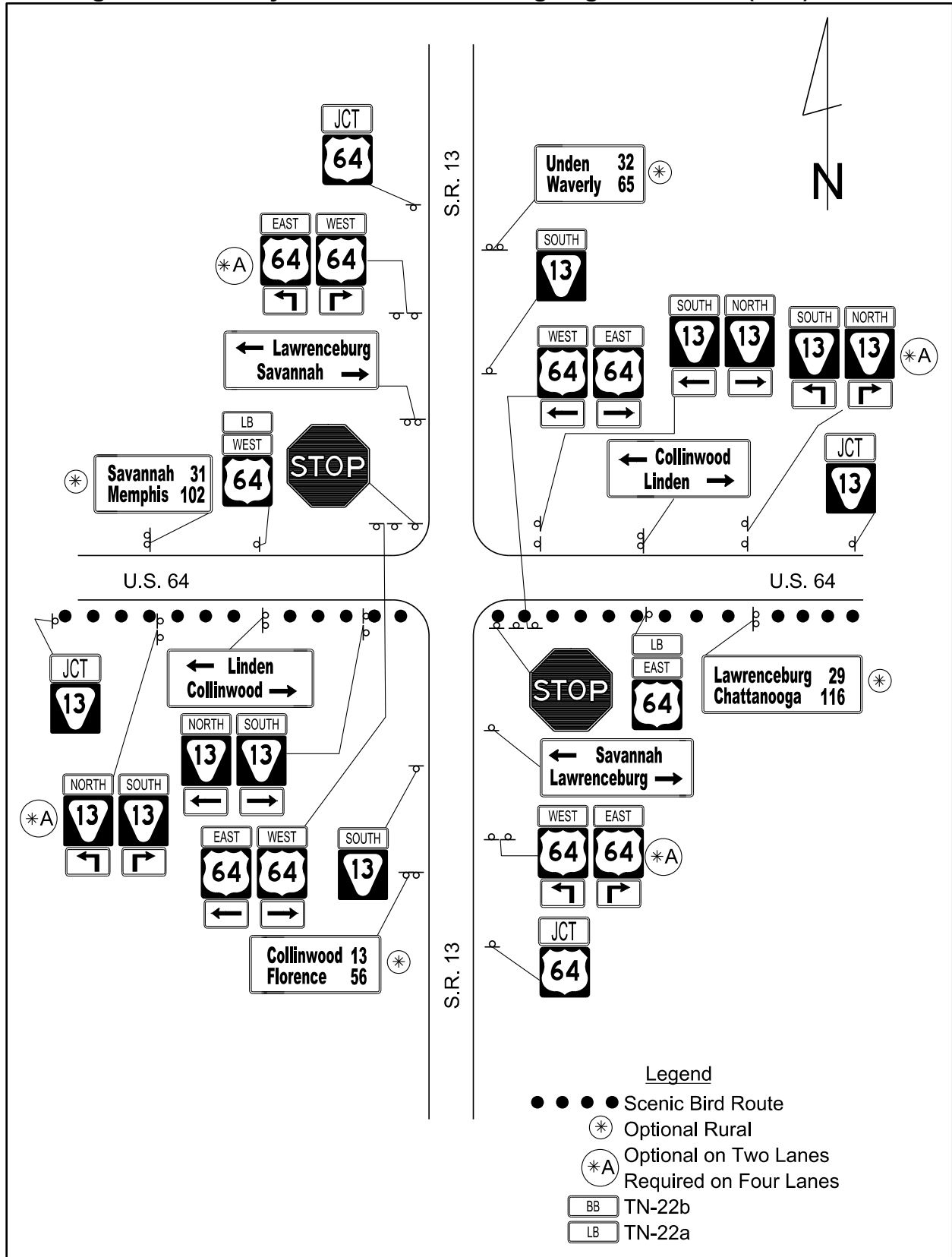


Figure 2.5 – 3-Way Intersection Route Signing with Scenic (Bird) Route

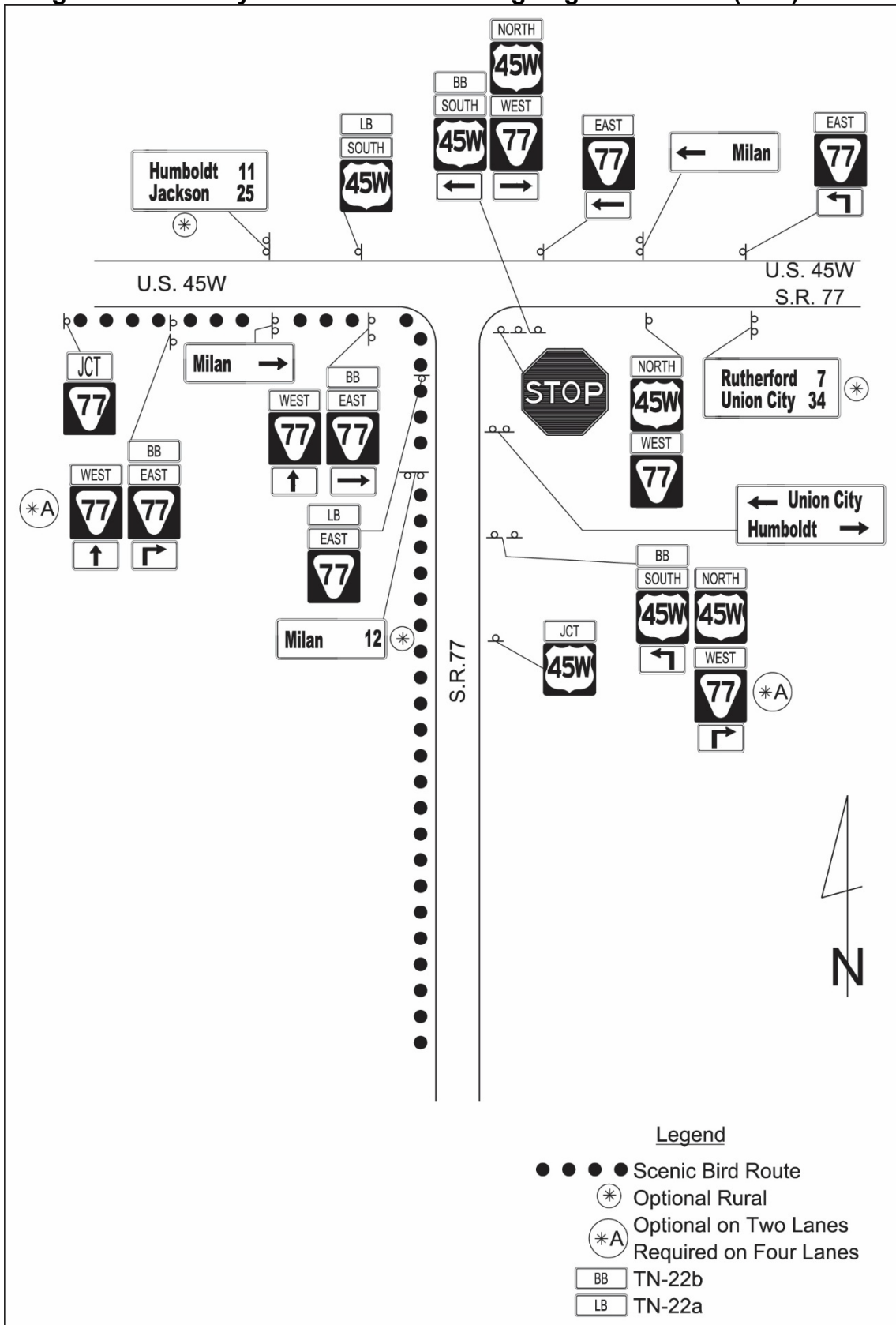


Figure 2.6 – 3-Way Intersection Route Signing with Scenic (Bird) Route with Overlapping Route Numbers

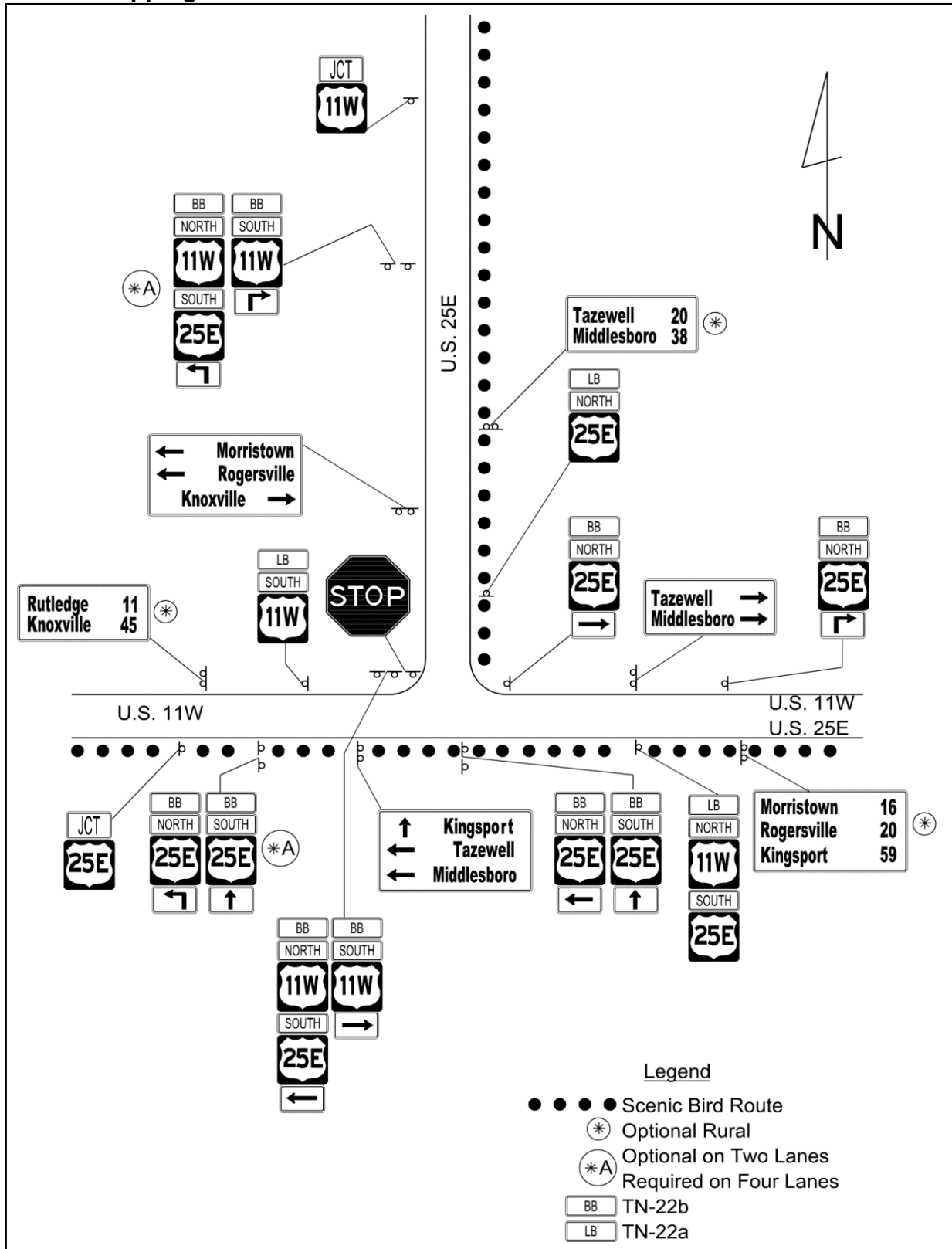


Figure 2.7 – Crossroad Signing, Medians less than 30 feet, One-Way and Wrong-Way Signing

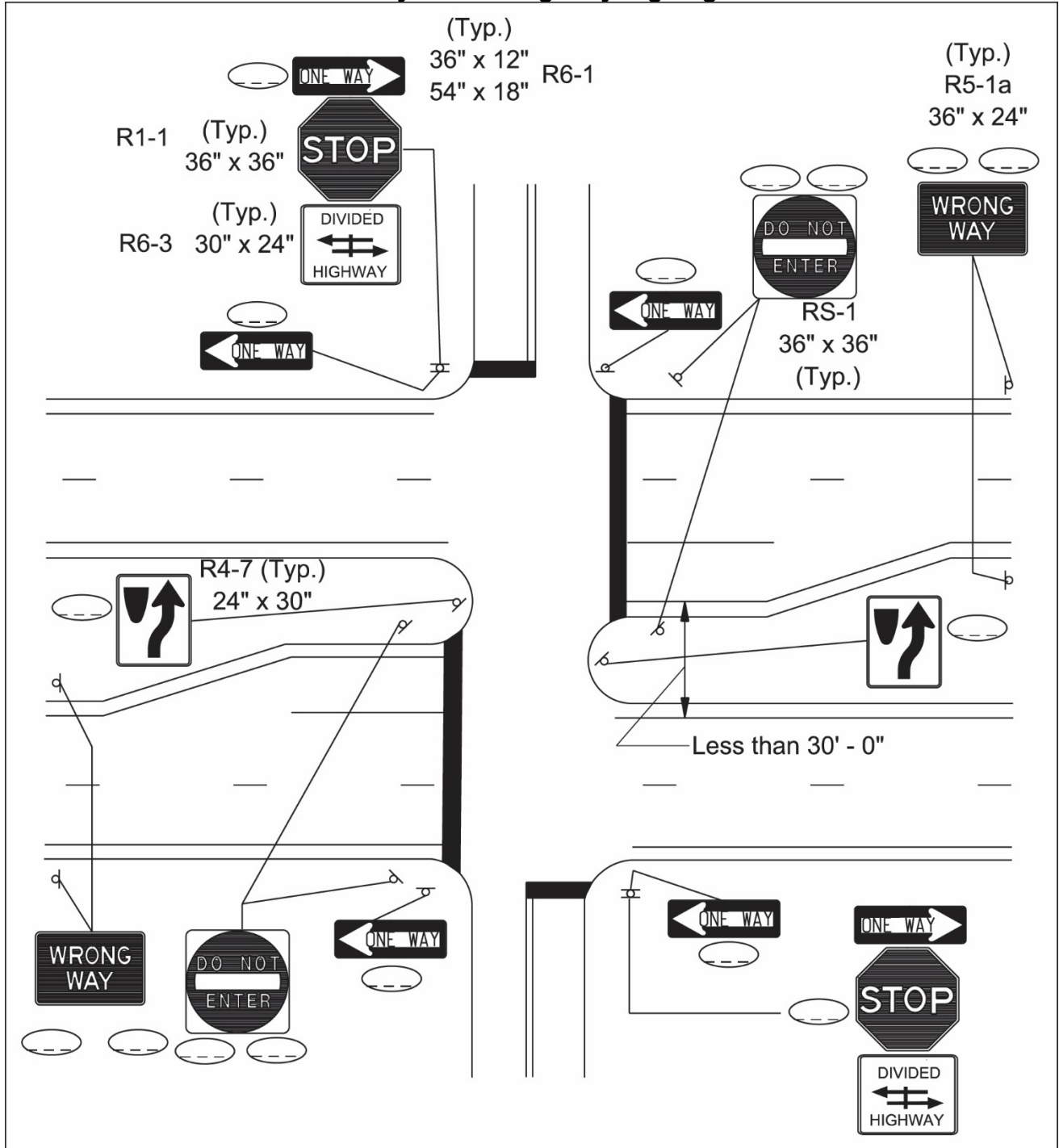


Figure 2.8 – Signalized Intersection, Medians less than 30 feet, One-Way and Wrong-Way Signing

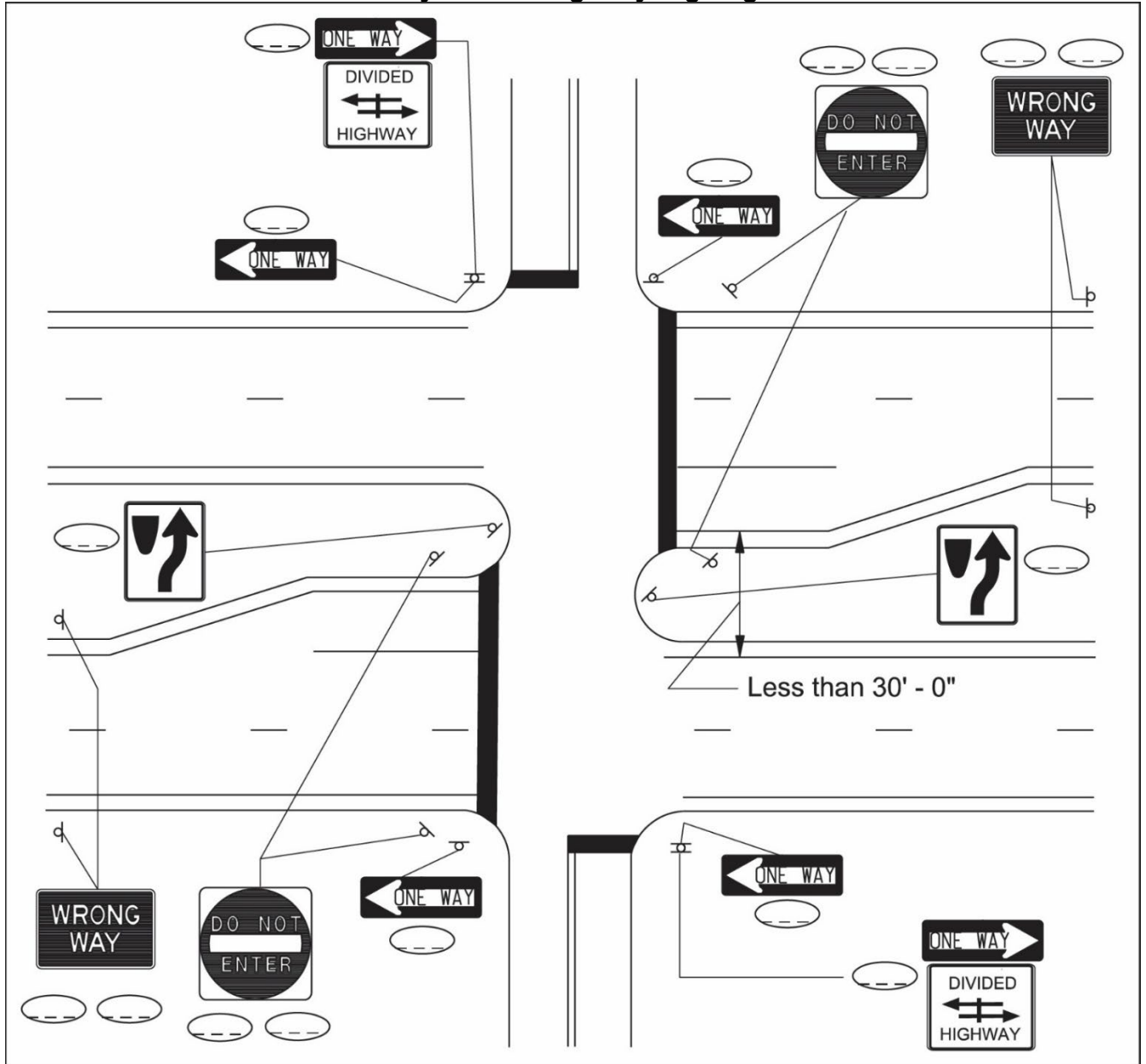


Figure 2.9 – “T” Intersection Right, Medians less than 30 feet, One-Way and Wrong-Way Signing

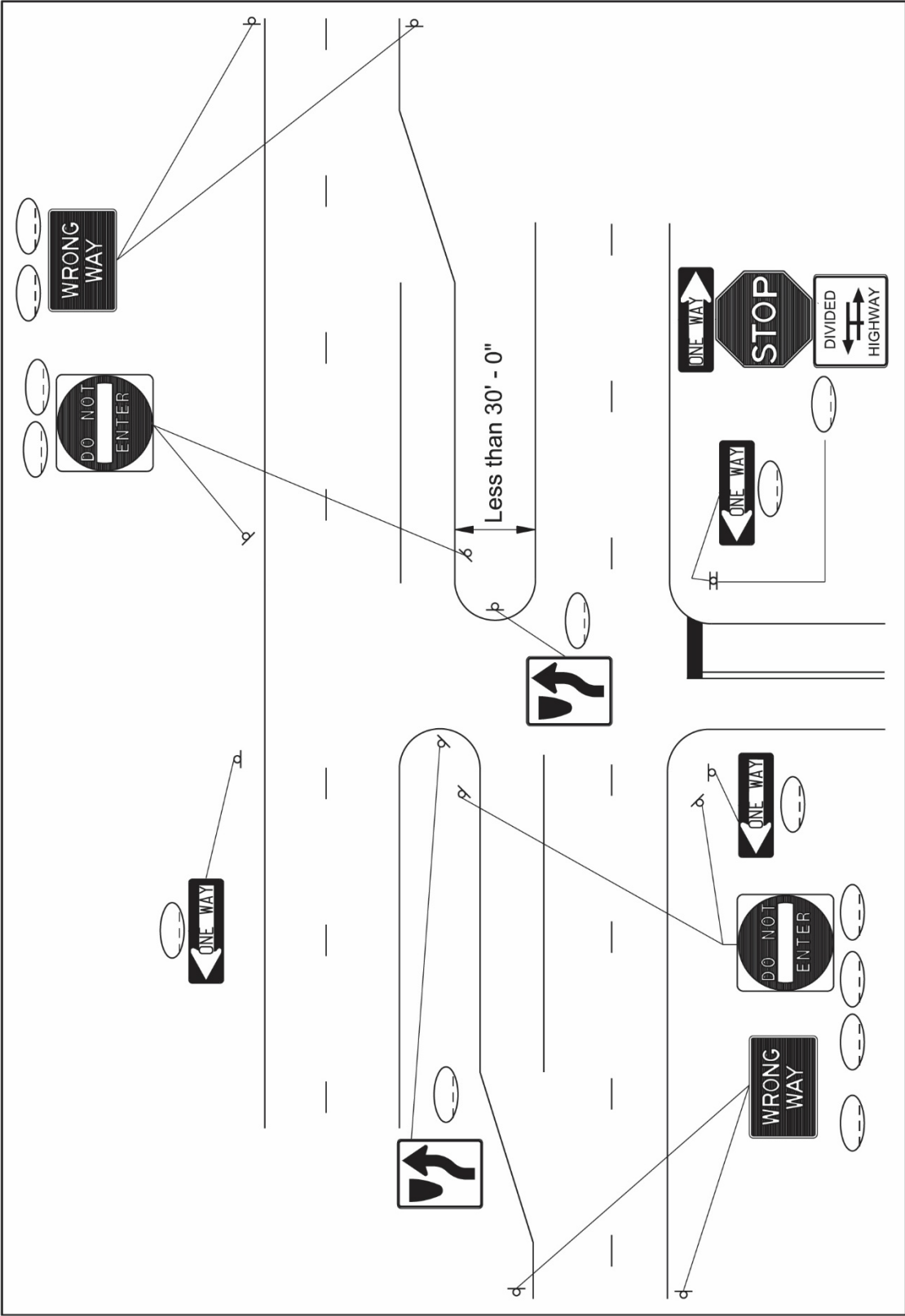


Figure 2.10 – “T” Intersection Left, Medians less than 30 feet, One-Way and Wrong-Way Signing

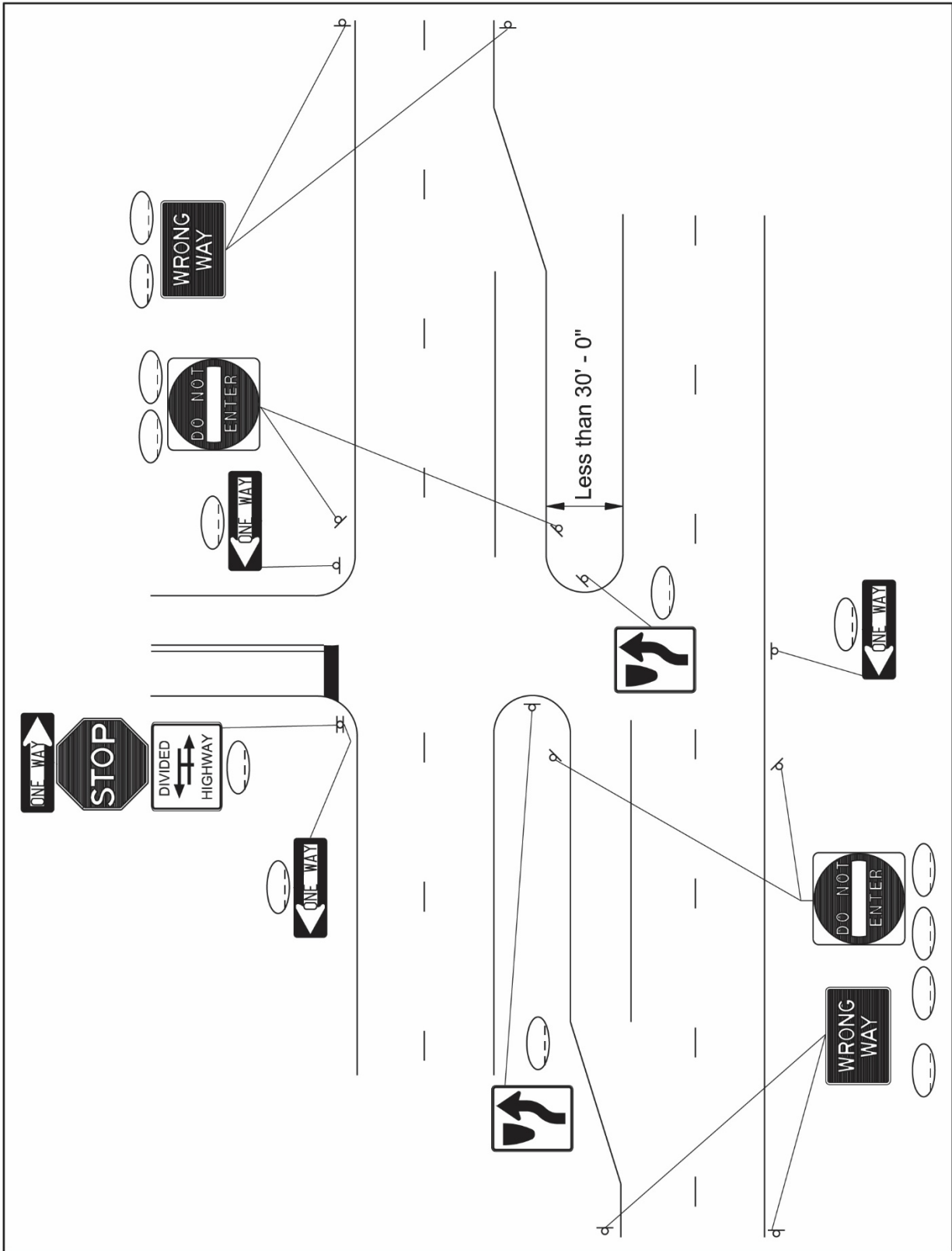


Figure 2.11 – Median Crossover, Medians less than 30 feet, One-Way and Wrong-Way Signing

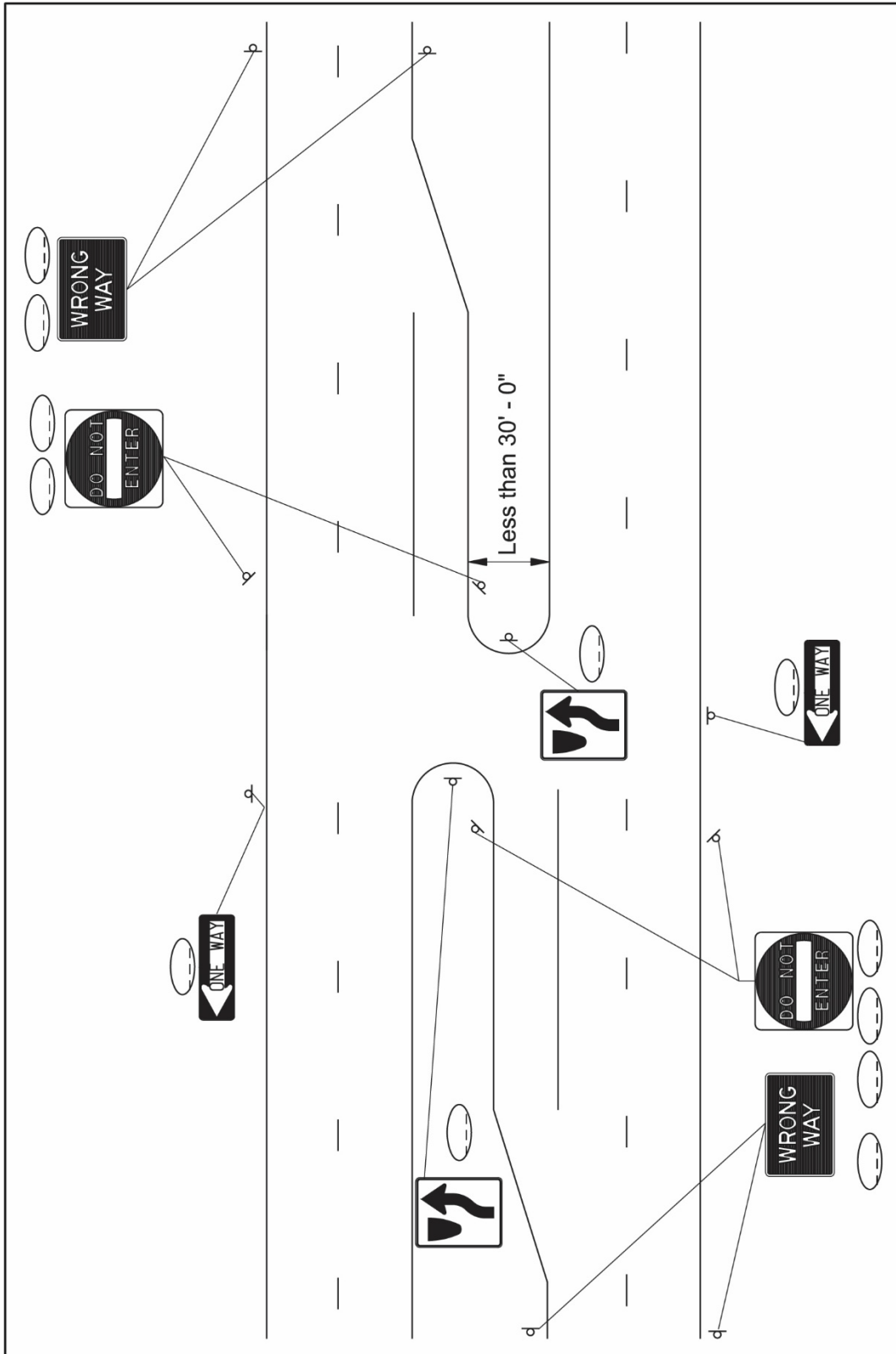


Figure 2.12 – Crossroad Signing, Medians 30 feet or greater, One-Way and Wrong-Way Signing

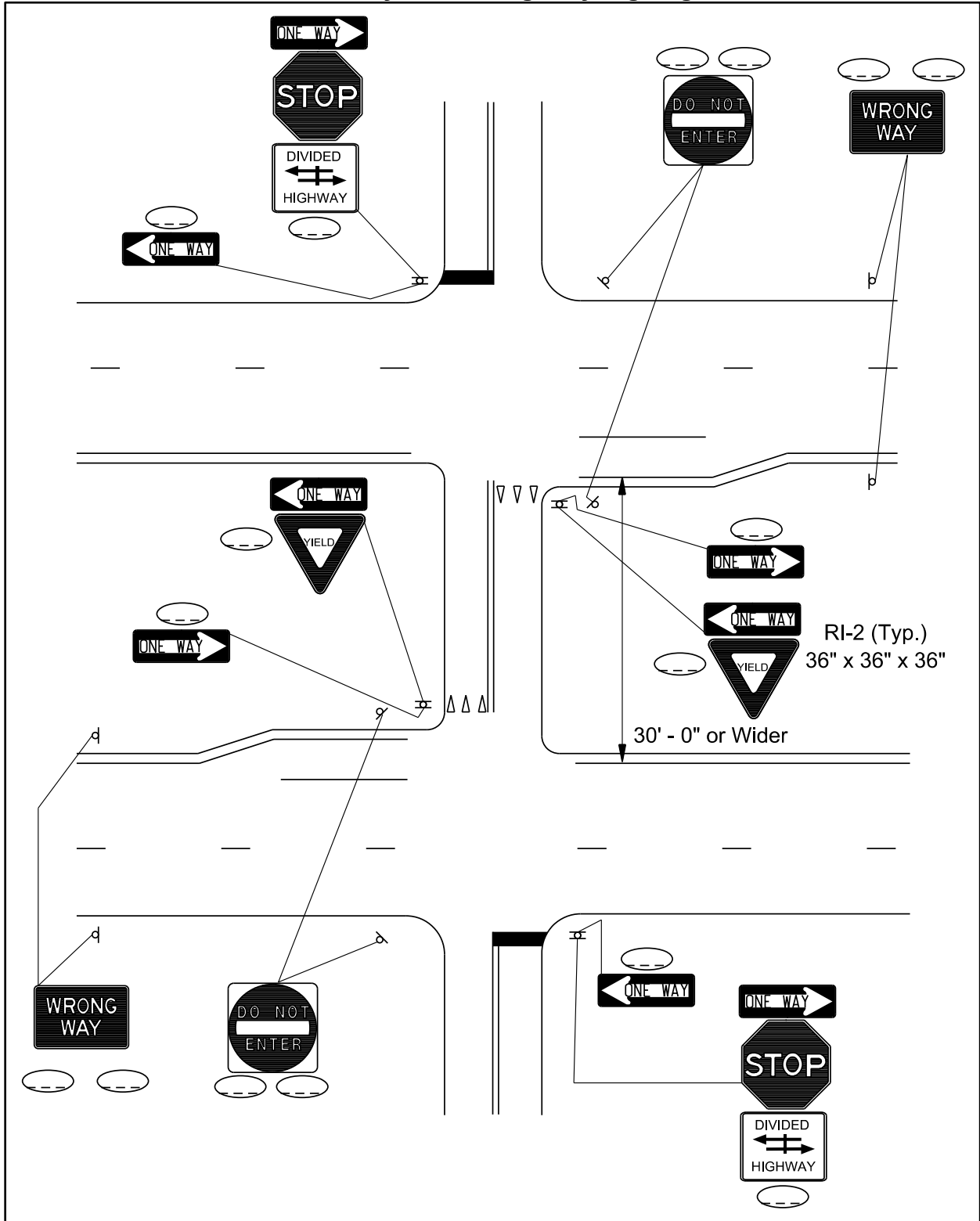


Figure 2.13 – Signalized Intersection, Medians 30 feet or greater, One-Way and Wrong-Way Signing

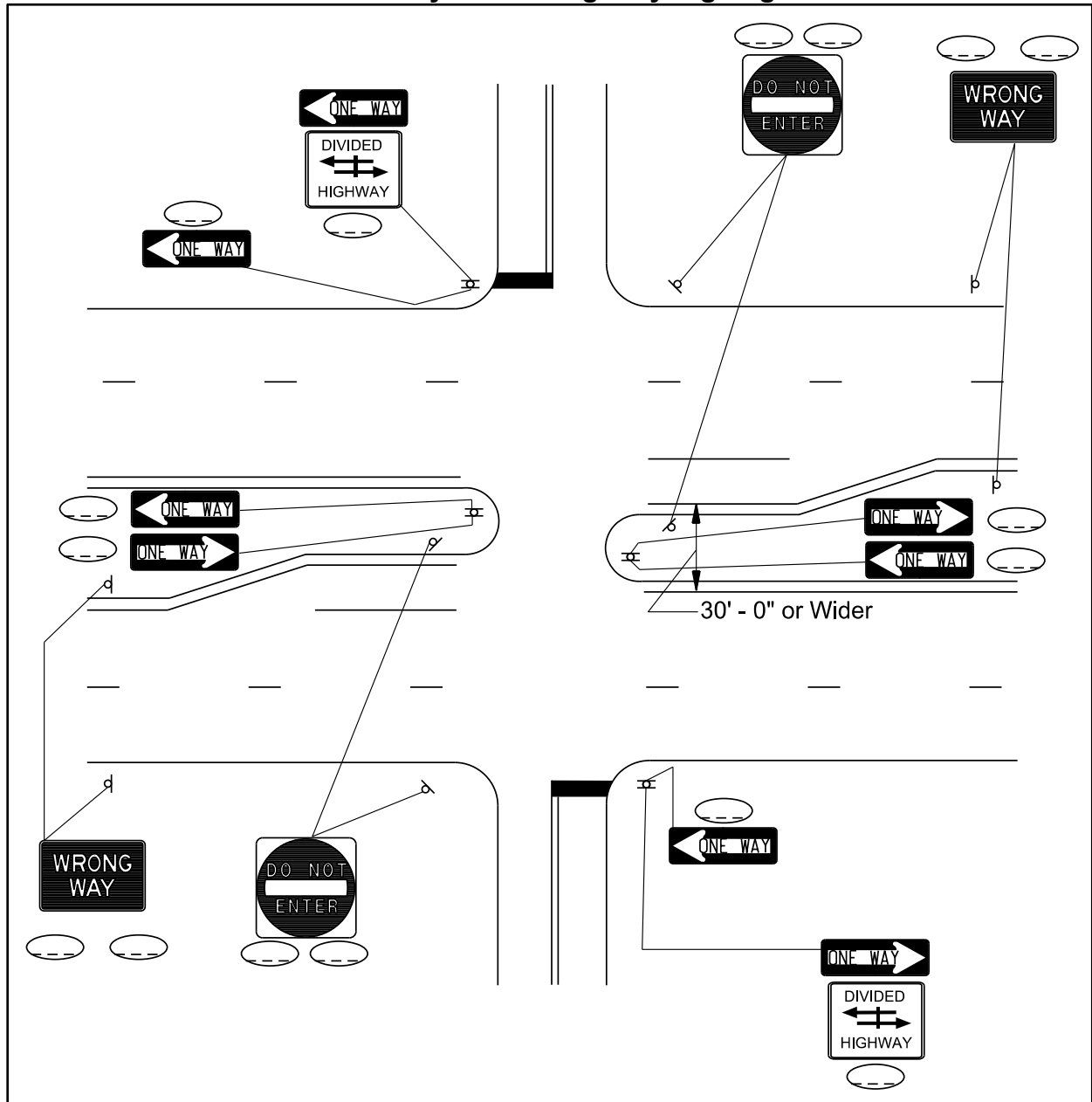


Figure 2.14 – “T” Intersection Right, Medians 30 feet or greater, One-Way and Wrong-Way Signing

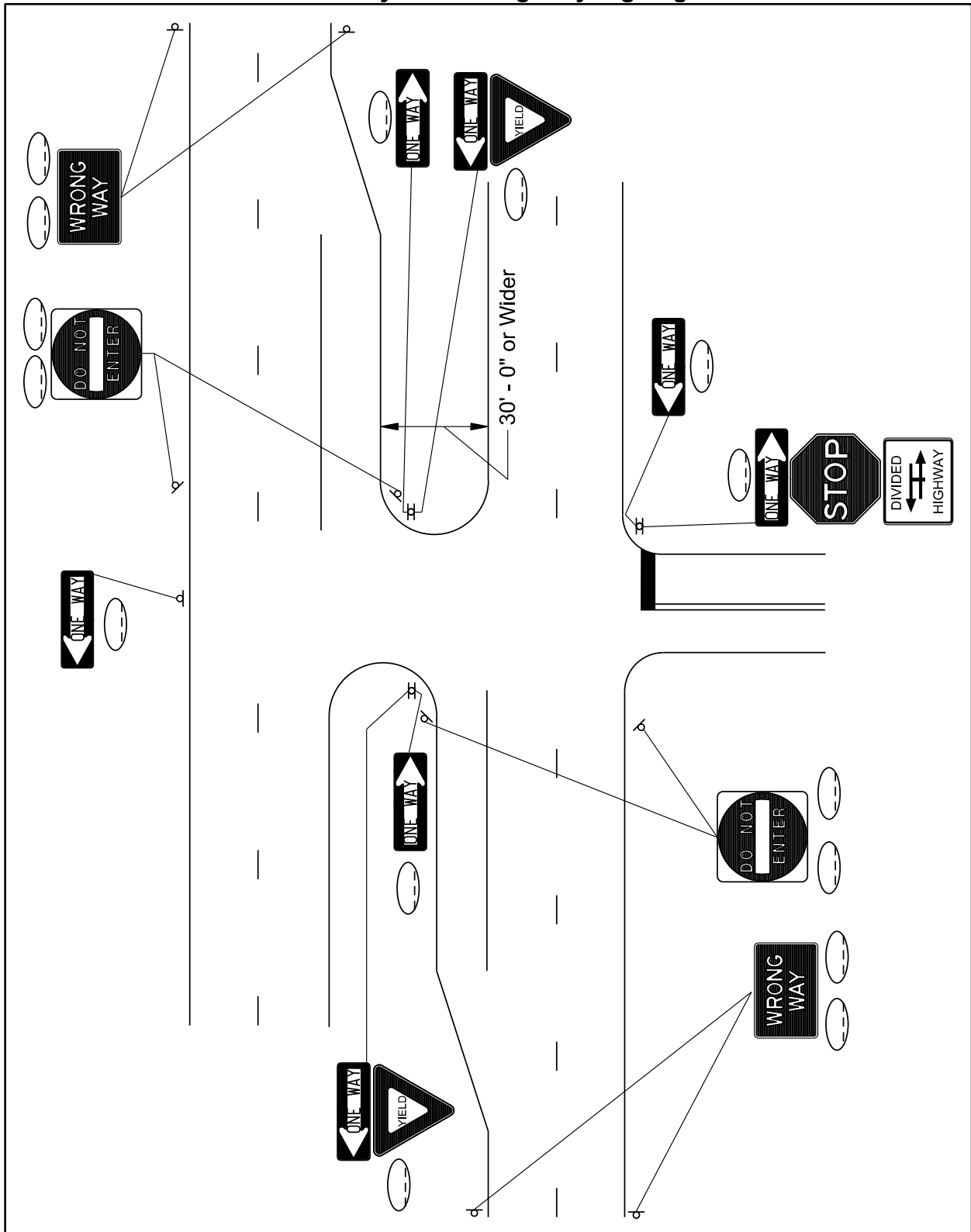


Figure 2.15 – “T” Intersection Left, Medians 30 feet or greater, One-Way and Wrong-Way Signing

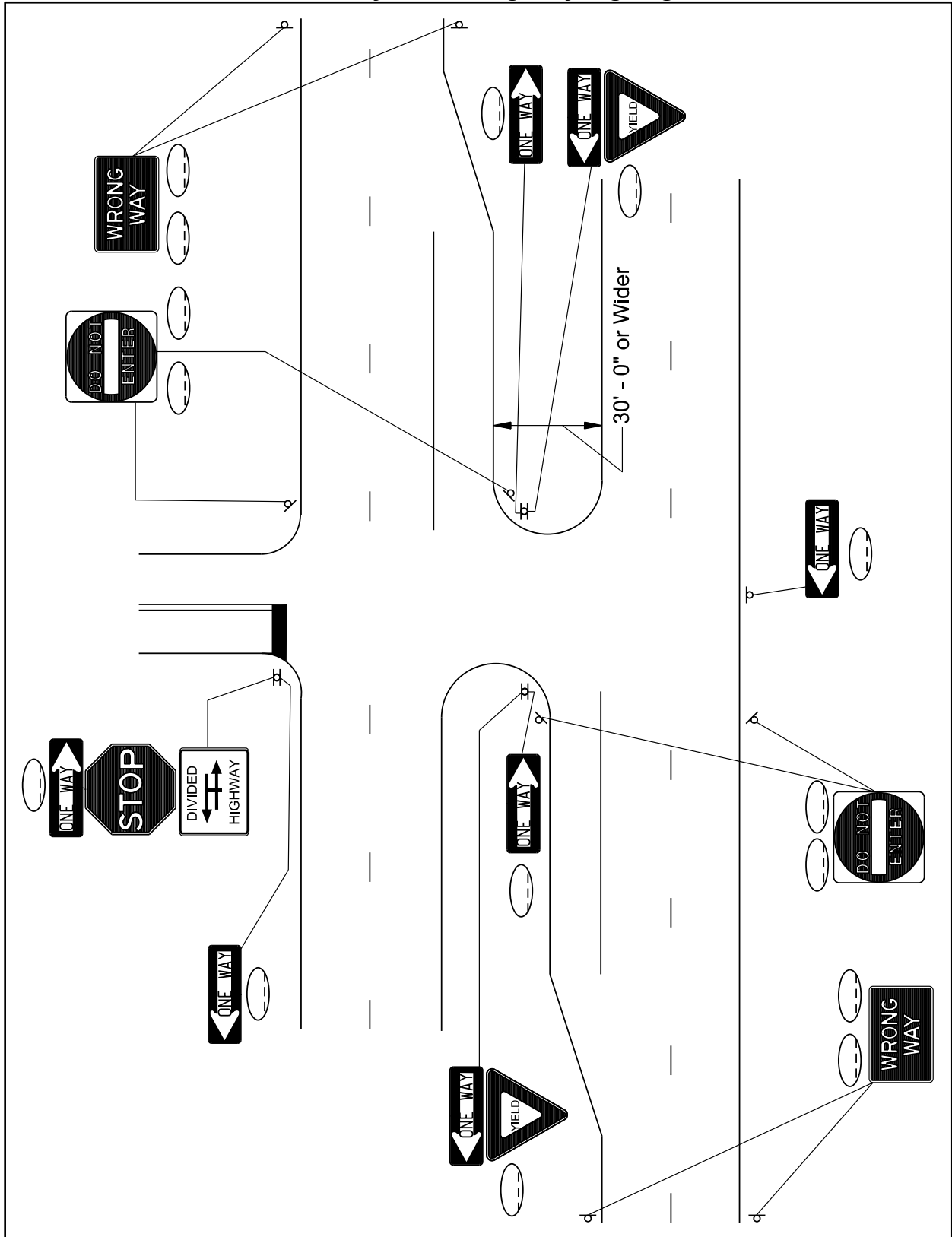
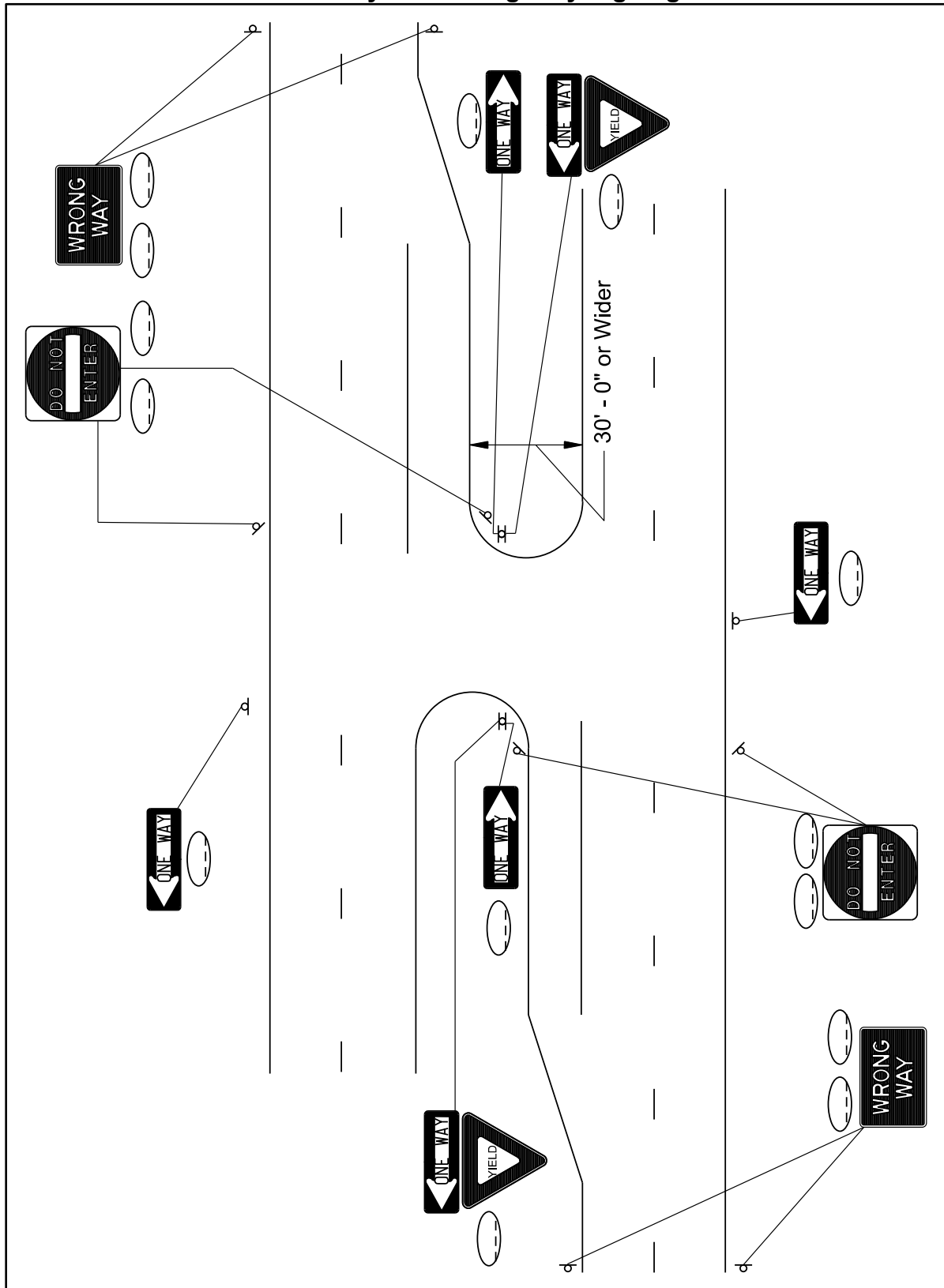


Figure 2.16 – Median Crossover, Medians 30 feet or greater, One-Way and Wrong-Way Signing



2.4 Post Selection

- **Roadside Sign Supports:** For roadside signs on two-lane, four-lane, and five-lane non-access controlled, conventional highways, U-post and P-post sign supports are most commonly used. Table 2.1 provides guidance on the selection of the appropriate post types based on the support length and sign assembly. For design purposes and quantity calculations, only use P posts or U-posts, as applicable. When noted on the Sign Schedule Sheet, the Contractor may substitute the post type used in the design with an alternative post type (i.e., MU-post or R-posts). Figure 2.17 illustrates how to estimate the length of the sign supports for rural and urban roadside signs. Note the support lengths shown in Table 14.1 do not include the stub length in the ground. For P-posts, add three feet for the stub. For U-Posts, add 3.5 feet for the stub. For guidance on larger sign supports including breakaway supports, see Sections 2.5 and 2.6. Supply and installation of U-posts and P-posts are measured for payment by the pound. Compute the weight of U-posts using the weight per foot of the support multiplied by the combined length of the main post and stub post. Compute the weight of P-Posts using the weight per foot multiplied by the length of the support (excluding the stub) and then add the weight of the stub to the total. Table 2.2 provides the nominal weight per foot for the U-post and P-posts supports used by TDOT.
- **Strain Poles:** Certain overhead signs (e.g., street name signs, exclusive lane signs) are commonly attached to a cable wire over the roadway. The cable is then attached to a steel strain pole. Where steel strain poles are included in the design, the designer is responsible for including the strain pole foundation design in the Signing Detail Sheets. Figure 2.18 illustrates a typical foundation design and cable connection details for a strain pole. The strain pole itself is to be designed by the Contractor and is to meet the criteria in the latest version of the AASHTO's Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Table 2.1 Post Selection for Various Sign Assemblies (1 of 11)

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
1	21"X15"	9'-11'; 12'-13'	P2; P3/P8	9'-10'; 11'-13'	U3; U6
	24"X24"	9'-11'; 12'-13'	P2; P3/P8	9'-10'; 11'-13'	U3; U6
2	21"X15"	9'-10'; 11'-13'	P2; P3/P8	9'-12'; 13'	U6; Not applicable
	30"X24"	9'-10'; 11'-13'	P2; P3/P8	9'-12'; 13'	U6; Not applicable
3	21"X15"	11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
	24"X24"	11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
	24"X24"	11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
4	21"X15"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	30"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	24"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
5	21"X15"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	30"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	30"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable

Table 2.1 Post Selection for Various Sign Assemblies (continued)

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Sign Assembly Number	Sign Face Dimensions (in)
5	21"X15"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	30"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	30"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
6	24"X12"	9'-11; 12'-13'	P2; P3/P8	9'-10'; 11'-13'	U3; U6
	24"X24"	9'-11; 12'-13'	P2; P3/P8	9'-10'; 11'-13'	U3; U6
7	24"x12"	9'-11; 12'-13'	P2; P3/P8	9'-12'; 13'	U6; Not applicable
	30"X24"	9'-11; 12'-13'	P2; P3/P8	9'-12'; 13'	U6; Not applicable
8	24"X12"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	24"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
	24"X24"	11';12'-15'	P3/P8; P5	Not applicable	Not applicable
9	24"X12"	11'-15'	P5	Not applicable	Not applicable
	24"X24"	11'-15'	P5	Not applicable	Not applicable
	30"X24"	11'-15'	P5	Not applicable	Not applicable

Table 2.1 Post Selection for Various Sign Assemblies (continued)

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
10	24"X12"	11'-15'	P5	Not applicable	Not applicable
	30"X24"	11'-15'	P5	Not applicable	Not applicable
	30"X24"	11'-15'	P5	Not applicable	Not applicable
11	24"X12"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
	24"X24"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
	24"X12"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
	24"X24"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
12	24"X12"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable
	24"X24"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable
	24"X12"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable
	30"X24"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable
13	24"X12"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable
	24"X24"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable
	24"X12"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable

Table 2.1 Post Selection for Various Sign Assemblies (continued)

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
13	30"X24"	12'-14'; 15'-16'	P5; P6	Not applicable	Not applicable
14	24"X12"	10'-12'; 13'-14'	P3/P8; P5	10'-11'; 12'	U6; Not applicable
	24"X24"	10'-12'; 13'-14'	P3/P8; P5	10'-11'; 12'	U6; Not applicable
	21"X15"	10'-12'; 13'-14'	P3/P8; P5	10'-11'; 12'	U6; Not applicable
15	24"X12"	10'-12'; 13'-14'	P3/P8; P5	Not applicable	Not applicable
	30"X24"	10'-12'; 13'-14'	P3/P8; P5	Not applicable	Not applicable
	21"X15"	10'-12'; 13'-14'	P3/P8; P5	Not applicable	Not applicable
16	24"X12"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
	24"X24"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
	24"X24"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
	21"X15"	12'-15'; 16'	P5; P6	Not applicable	Not applicable
17	24"X12"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable
	24"X24"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable
	30"X24"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable

Table 2.1 Post Selection for Various Sign Assemblies (continued)

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
17	21"X15"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable
18	24"X12"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable
	30"X24"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable
	30"X24"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable
	21"X15"	12'-13'; 14'-16'	P5; P6	Not applicable	Not applicable
19	24"X12"	13'-14'; 15'-17'	P5; P6	Not applicable	Not applicable
	24"X24"	13'-14'; 15'-17'	P5; P6	Not applicable	Not applicable
	24"X12"	13'-14'; 15'-17'	P5; P6	Not applicable	Not applicable
	24"X24"	13'-14'; 15'-17'	P5; P6	Not applicable	Not applicable
	21"X15"	13'-14'; 15'-17'	P5; P6	Not applicable	Not applicable
20	24"X12"	12'-14'; 15'-16'; 17	P5; P6; Not applicable	Not applicable	Not applicable
	24"X24"	12'-14'; 15'-16'; 17	P5; P6; Not applicable	Not applicable	Not applicable
	24"X12"	12'-14'; 15'-16'; 17	P5; P6; Not applicable	Not applicable	Not applicable
	30"X24"	12'-14'; 15'-16'; 17	P5; P6; Not applicable	Not applicable	Not applicable
	21"X15"	12'-14'; 15'-16'; 17	P5; P6; Not applicable	Not applicable	Not applicable

Table 2.1 Post Selection for Various Sign Assemblies (continued)

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
21	24"X12"	13'; 14'-16'; 17'	P5; P6; Not applicable	Not applicable	Not applicable
	30"X24"	13'; 14'-16'; 17'	P5; P6; Not applicable	Not applicable	Not applicable
	24"X12"	13'; 14'-16'; 17'	P5; P6; Not applicable	Not applicable	Not applicable
	30"X24"	13'; 14'-16'; 17'	P5; P6; Not applicable	Not applicable	Not applicable
	21"X15"	13'; 14'-16'; 17'	P5; P6; Not applicable	Not applicable	Not applicable
22	24"X12"	Not applicable	Not applicable	Not applicable	Not applicable
	24"X24"	Not applicable	Not applicable	Not applicable	Not applicable
	24"X24"	Not applicable	Not applicable	Not applicable	Not applicable
	24"X12"	Not applicable	Not applicable	Not applicable	Not applicable
	24"X24"	Not applicable	Not applicable	Not applicable	Not applicable
	21"X15"	Not applicable	Not applicable	Not applicable	Not applicable
27	24"X12"	11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
	24"X12"	11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
	24"X24"	11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
	21"X15"	11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable

Table 2.1 Post Selection for Various Sign Assemblies (continued)

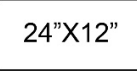
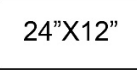
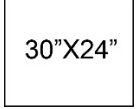
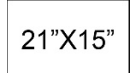

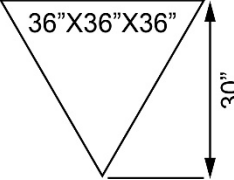



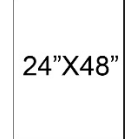

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
28		11'-15'	P5	Not applicable	Not applicable
		11'-15'	P5	Not applicable	Not applicable
		11'-15'	P5	Not applicable	Not applicable
		11'-15'	P5	Not applicable	Not applicable
29		8'; 9'-12'	P1; P2	8'; 9'-11'; 12'	U1; U3; U6
30		8'-11'; 12'	P1; P2	8'-9'; 10'-12'	U1; U3
31		7'-11'	P1	7'-11'	U1
32		7'-10'; 11'	P1; P2	7'-11'	U1
33		8'-9'; 10'-12'	P1; P2	8'; 12'-12'	U1; U3
34		9'; 10'-12'; 13'	P2; P3/P8; P5	9'-11'; 12'	U6; Not applicable
35		8'-11'; 12'	P2; P3/P8	8'; 9'-12'	U3' U6

Table 2.1 Post Selection for Various Sign Assemblies (continued)

Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
36	36"X12"	6'-10'	P1	6'-10'	U1
37	36"X24"	7'; 8'-11'	P1; P2	7'; 8'-11'	U3; U6
38	36"X48" 2-Post	9'-12'; 13'	P2; P3/P8	9'-10'; 11'-12'; 13'	U1; U3; U6
39	36"X72" 2-Post	11'-14'; 15'	P3/P8; P5	11'-13'; 14'	U6; Not applicable
40	48"X24" 2-Post	7'-10'; 11'	P1; P2	7'-11'	U1
41	24"X24"	9'-10'; 11'-13'	P2; P3/P8	9'-12'; 13'	U6; Not applicable
	24"X18"	9'-10'; 11'-13'	P2; P3/P8	9'-12'; 13'	U6; Not applicable
42	24"X24"	9'-11'; 12'-13'	P2; P3/P8	9'-10'; 11'-13'	U3; U6
	24"X6"	9'-11'; 12'-13'	P2; P3/P8	9'-10'; 11'-13'	U3; U6
	24"X6"	9'-11'; 12'-13'	P2; P3/P8	9'-10'; 11'-13'	U3; U6
43	24"X8"	10'-13'; 14'	P3/P8; P5	10'-11'; 12'	U6; Not applicable
	24"X30"	10'-13'; 14'	P3/P8; P5	10'-11'; 12'	U6; Not applicable
	24"X10"	10'-13'; 14'	P3/P8; P5	10'-11'; 12'	U6; Not applicable

Table 2.1 Post Selection for Various Sign Assemblies (continued)

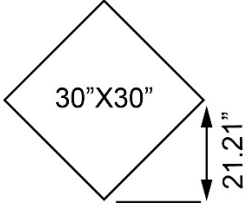

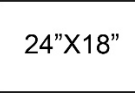
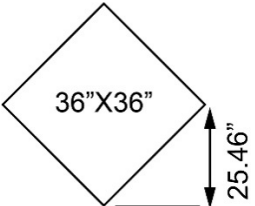
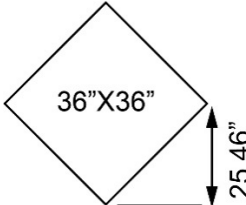
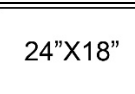
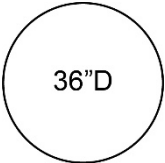
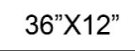

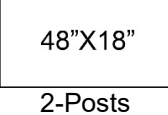
Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
44		9'-11"; 12'-13'	P2; P3/P8	9'-11; 12'	U6; Not applicable
45		11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
		11'; 12'-15'	P3/P8; P5	Not applicable	Not applicable
46		10'-11"; 12'-14'	P3/P8; P5	Not applicable	Not applicable
47		10'-11"; 12'-14'	P3/P8; P5	Not applicable	Not applicable
		10'-11"; 12'-14'	P3/P8; P5	Not applicable	Not applicable
48		8'-10"; 11'-12'	P2; P3/P8	8'-11"; 12'	U6; Not applicable
49		9'; 10'-13'	P8; P5	Not applicable	Not applicable
		9'; 10'-13'	P8; P5	Not applicable	Not applicable
50		7'-11'	P1	7'-11'	U1

Table 2.1 Post Selection for Various Sign Assemblies (continued)


Sign Assembly Number	Sign Face Dimensions (in)	Perforated Tube		U-Post (Franklin)	
		Support Length (ft)	Post Type	Support Length (ft)	Post Type
51	60"X18" 2-Posts	7'-10'; 11'	P1; P2	7'-11'	U1
52	72"X18" 2-Posts	7'-9'; 10'-11'	P1; P2	7'-11'	U1
53	84"X18" 3-Posts	7'-11'	P1	7'-11'	U1
54	96"X18" 3-Posts	7'-10'; 11'	P1; P2	7'-11'	U1
55	48"X30" 2-Posts	8'-9'; 10'-12'	P1; P2	8'-11'; 12'	U1; U3
56	60"X30" 2-Posts	8'-9'; 11'-12'	P2; P3/P8	8'-9'; 10'-11'; 12'	U1; U3; U6
57	72"X30" 2-Posts	8'-9'; 10'-12'	P2; P3/P8	8'; 9'; 10'-12'	U1; U3; U6
58	84"X30" 3-Posts	8'-11'; 12'	P2; P3/P8	8'-9'; 10'-11'; 12'	U1; U3; U6
59	96"X30" 3-Posts	8'-9'; 10'-12'	P2; P3/P8	8'; 9'-10'; 11'- 12'	U1; U3; U6
60	36"X36" 	10'-11'; 12'-14'	P3/P8; P5	Not applicable	Not applicable

Figure 2.17 – Estimating Length of Sign Support

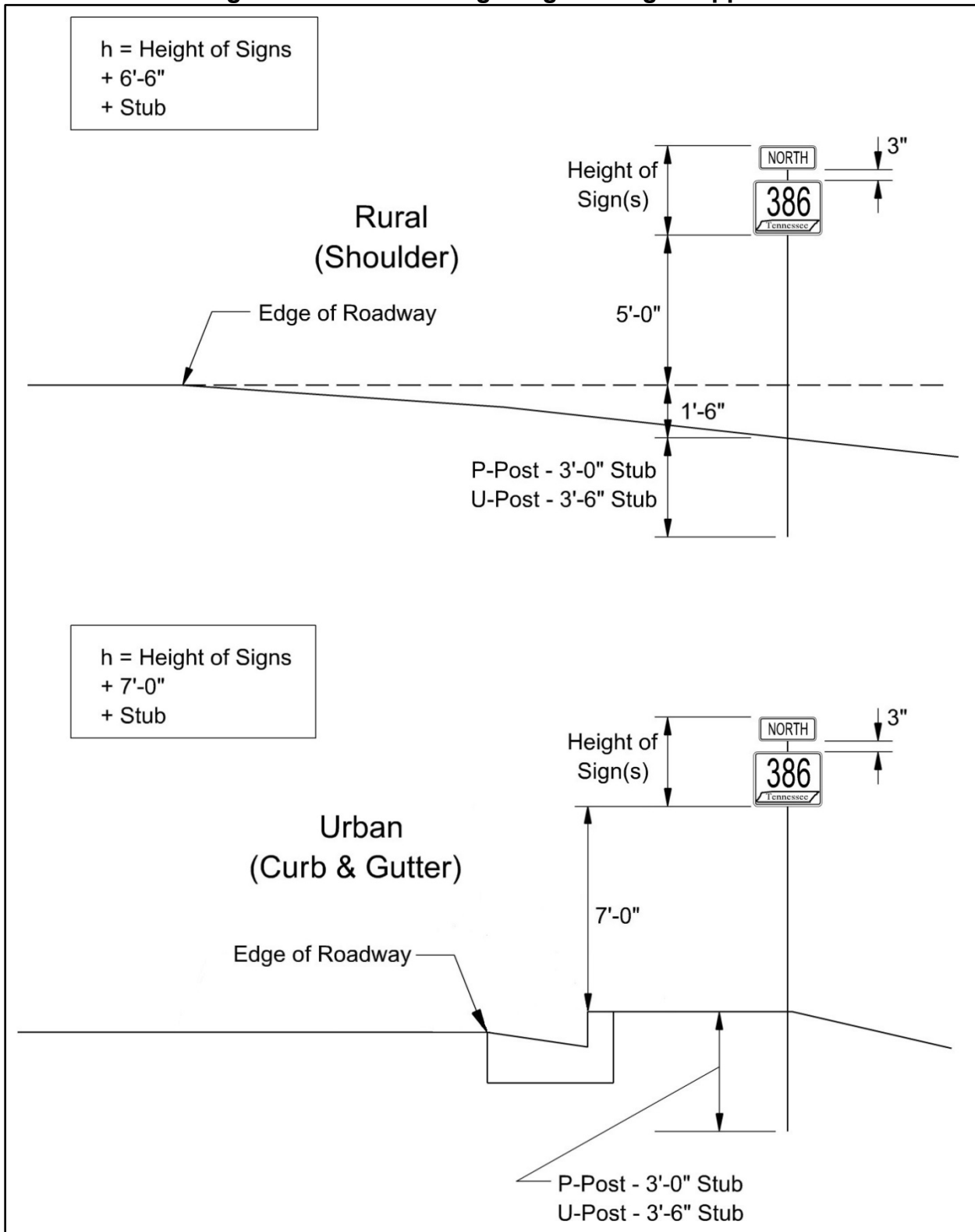
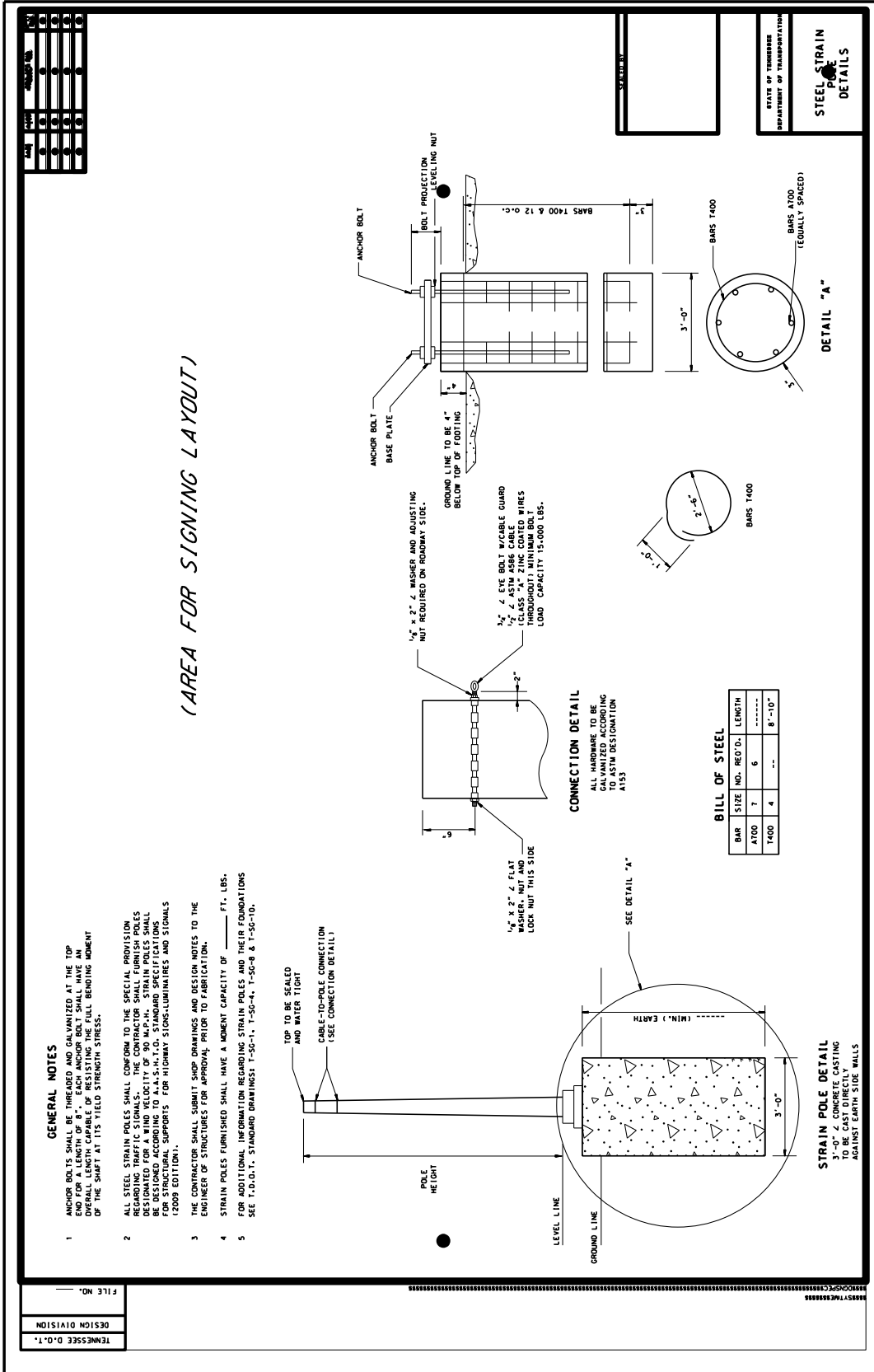


Table 2.2 – Determining Weight of Sign Supports

Perforated Tube (P-Post)			U-Post		
Member Designation	Unit Post Weight (lbs/ft)	Stub Below Ground ⁽¹⁾ (lbs)	Member Designation	Unit Post Weight (lbs/ft)	Stub Below Ground ⁽²⁾ (lbs)
P1	1.702 1½" ⌀	11.09	U1	2.00	2.00
P2	2.060 1¾" ⌀	12.96	U2	2.25	2.25
P3	2.416 2" ⌀	14.84	U3	2.50	2.50
P4	2.773 2¼" ⌀	14.84	U4	2.75	2.75
P5	3.141 2½" ⌀	23.72	U5	2.75	2.75
P6	4.006 2½" ⌀	24.59	U6	3.00	3.00
P7	1.882 1¾" ⌀	8.66	U7	4.00	4.00
P8	2.164 2" ⌀	9.94			

- To determine the weight of the post, multiply the length of the support (above ground) by the unit weight in the table and then add the weight of the stub.
- Add the length of stub (3.5 feet) to the post length as determined from Figure 2.17 and multiply the total length by the unit weight shown in the table.

Figure 2.18 – Strain Pole Foundation and Cable Connection Details



2.5 Freeway and Expressway Signs (Access Controlled)

- **Overhead Signing:** For overhead signs on access-controlled facilities, the designer is responsible for including the necessary information on the Signing Detail Sheets to allow the Contractor to adequately design the overhead sign bridge (bridge or butterfly). Cantilevers are prohibited except when exceptional cases arise in which a cantilever sign support appears to be the only alternative. The cross-sectional view should include the following:
- The overall span length of the overhead structure;
 - Width and height dimensions of the overhead sign, including the dimension for any auxiliary plaques;
 - Distance from each structural support to the overhead sign, width of the sign, and spacing between signs (if applicable);
 - The traveled way width and the distance from edge of the traveled way to each structural support;
 - Signs centered vertically on the truss and centered over the appropriate lane of traffic;
 - The location and distance of the minimum clearance between the roadway surface and the bottom of the tallest overhead sign;
 - The sign number and station of the sign;
 - The sign structure ID number (Note: The designer must submit a print of the detail sheet to the TDOT Structures Division to obtain the ID number.);
 - Sign design data includes the design area of the sign, the minimum wind velocity, and applicable soil data parameters (See TDOT Standard Drawing STD-8-4 for guidance); and
 - Other sign details and notes to the Contractor.

Figure 2.19 illustrates an example of an Overhead Sign Detail Sheet. The design area of the sign is determined by multiplying the width of the traveled way, auxiliary lanes, and ramp width by the height of the tallest sign. Typically, the sign area for auxiliary plaques is not included in the overall design area of the sign. The minimum wind velocity for overhead signs is 90 mph. See the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals for guidance.

- **Structural Support Foundations:** If a sign is mounted on a CMB, the designer is responsible for ensuring the applicable standard drawings are noted in the contract plans.

- **Roadside Supports:** The following supports are commonly used for roadside signs on four-lane, six-lane and eight-lane access-controlled freeways and expressways:
 - 2, 2½, and 3-inch square posts (TDOT Standard Drawing T-S-12);
 - S3x5.7 to S7x15.3 steel posts (TDOT Standard Drawing T-S-13);
 - W6x15 to W10x30 I-beam steel posts (TDOT Standard Drawing T-S-14).

2.6 Sign Vertical Clearances

Sign vertical clearances are as follows:

- **Rural:** The minimum height of signs installed at the side of the road in rural areas shall be five feet, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement (See Figure 2.20). The height to the bottom of a secondary sign mounted below another sign may be one foot less.
- **Urban:** The minimum height of signs installed at the side of the road in business, commercial, or residential areas where parking or pedestrian movements are likely to occur, or where the view of the sign might be obstructed, shall be seven feet, measured vertically from the bottom of the sign to the top of the curb (See Figure 2.20). In the absence of curb, the minimum height is measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way. The height to the bottom of a secondary sign mounted below another sign may be one foot less than the height specified above. The minimum height of signs installed above sidewalks shall be seven feet, measured vertically from the bottom of the sign to the sidewalk. If the bottom of a secondary sign that is mounted below another sign is mounted lower than seven feet above a pedestrian sidewalk or pathway, the secondary sign shall not project more than four inches into the pedestrian facility. Signs that are placed 30 feet or more from the edge of the traveled way may be installed with a minimum height of five feet, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement.
- **Freeways and Expressways:** Directional signs on freeways and expressways shall be installed with a minimum height of seven feet, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement. All route signs, warning signs, and regulatory signs on freeways and expressways shall be installed with a minimum height of seven feet, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement. If a secondary sign is mounted below another sign on a freeway or expressway, the major sign shall be installed with a minimum height of eight feet and the secondary sign shall be installed with a minimum height of five feet, measured vertically from the bottom of the sign to the elevation of the near edge of the

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

- **Route Signs:** A route sign assembly consisting of a route sign and auxiliary signs may be treated as a single sign for the purposes of this Section.
- **Steep Backslopes:** The mounting height may be adjusted when supports are located near the edge of the right-of-way on a steep backslope in order to avoid the sometimes less desirable alternative of placing the sign closer to the roadway.
- **Overhead Signs/Structures:** Overhead signs shall provide a minimum vertical clearance of not less than 19.5 feet to the sign, light fixture, sign bridge, or walkway over the entire width of the pavement and shoulders, except where the structure on which the overhead signs are to be mounted or other structures along the roadway near the sign structure have a lesser vertical clearance. If the vertical clearance of other structures along the roadway near the sign structure is less than 16 feet, the vertical clearance to an overhead sign structure or support may be as low as 1-foot higher than the vertical clearance of the other structures in order to improve the visibility of the overhead signs.

2.7 Traffic Signal Signs

The following guidance is provided for traffic control signs at or in advance of signalized intersections. Figure 2.21 illustrates some of the traffic signs associated with traffic signals.

- **Span Wire/Mast Arm Mounted:** Where overhead signs are provided, the minimum vertical clearance over the entire roadway is 19.5 feet.
 - **LEFT TURN SIGNAL Signs (R10-10, R10-12)**
 - **LEFT TURN SIGNAL Sign (R10-10):** This sign is normally installed for a protected only left turn phase. The R10-10 sign is recommended when a Red Ball indication is used (R, ←Y, ←G). Install the sign directly adjacent to and left of the signal head. Additionally, install this sign to the left of each left turn signal (R, ←Y, ←G) in a dual left turn situation.
 - **LEFT TURN YIELD ON GREEN BALL Signs (R10-12):** This optional sign may be installed with a protected–permissive left turn phase adjacent to and to the left of the five-section left turn signal head (R, Y, G, ←Y, ←G).

Figure 2.20 – Sign Vertical Clearances

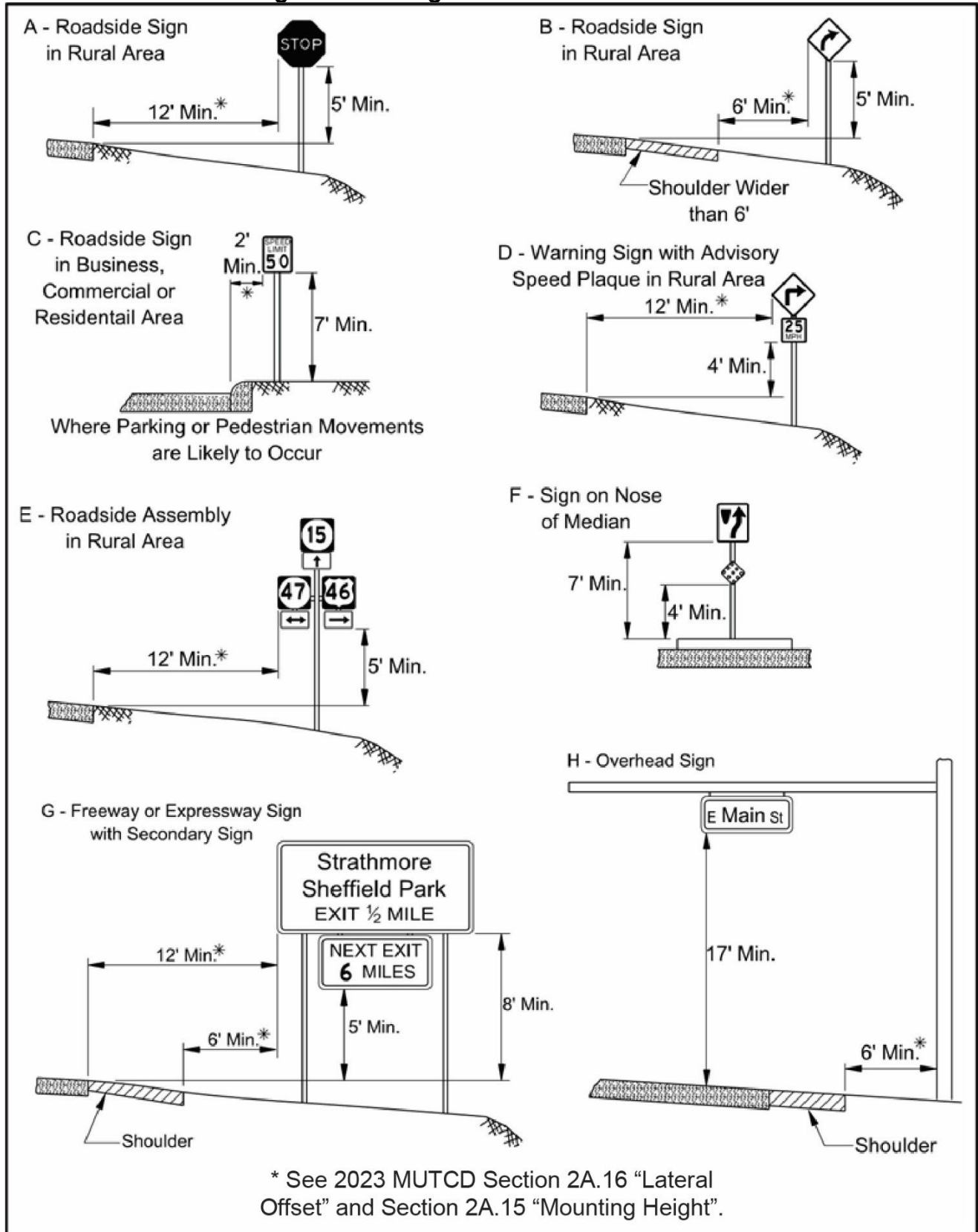
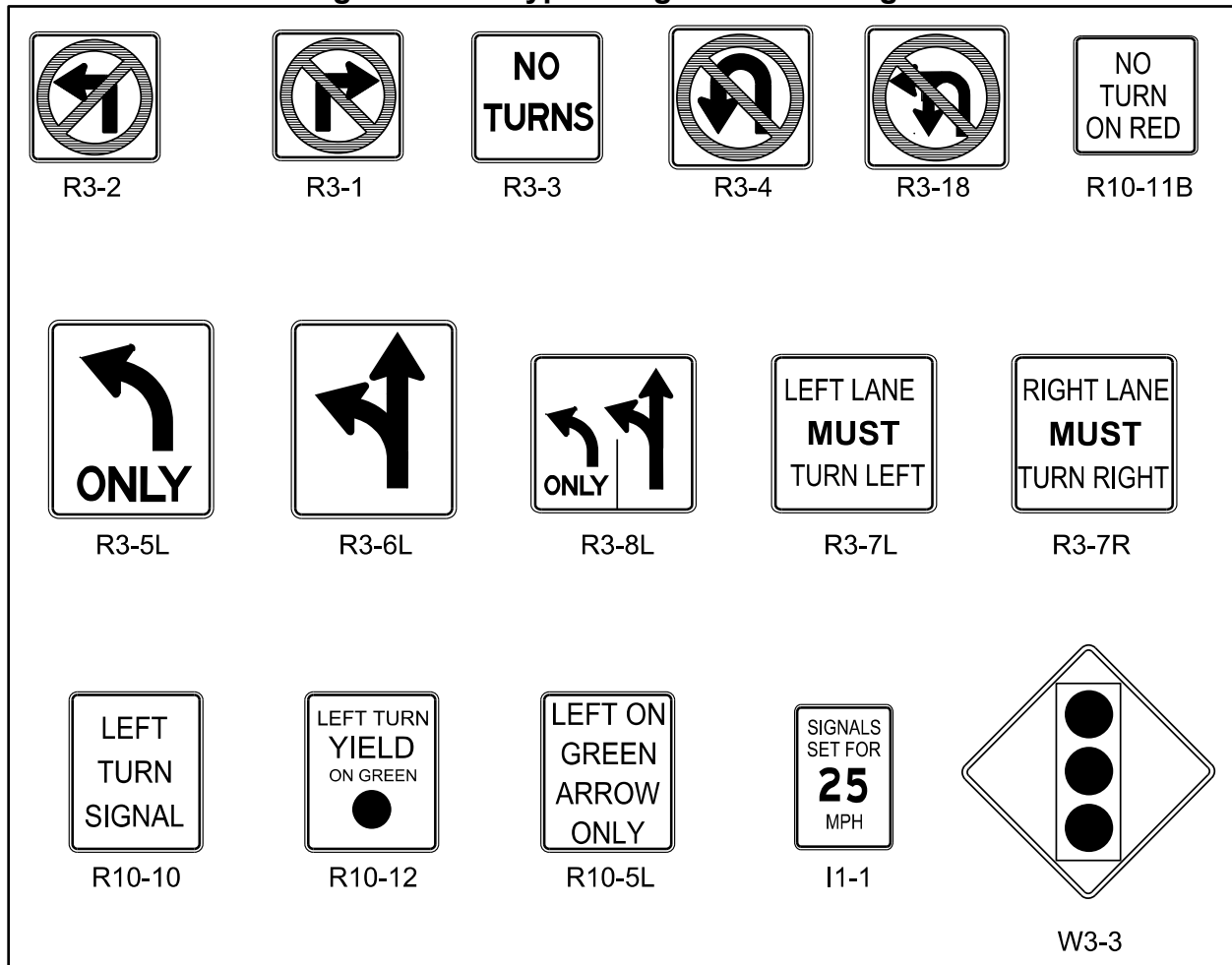


Figure 2.21 – Typical Signal Related Signs



- **Shared Lanes:** Where there are two or more movements from a specific lane and one of those movements is not normally expected, install an Optional Movement Lane Control Sign (R3-6).
 - **Lane Control Signs (R3-5 and R3-8):** Lane use control signs should be used to alert drivers of unexpected or unusual turn requirements for a lane. Where needed, mount these signs overhead in the center of the lane to which they apply. The use of an overhead sign for one lane does not require the installation of signs for the other lanes. The R3-5 and R3-8 series signs are intended for overhead use. Install these signs directly over a lane for which they apply in order to convey the proper message to a driver. They should not be used for side of road installations. See the MUTCD for guidance on post mounted lane use control signs.
 - **Turn Prohibition Signs (Signs R3-1, R3-2, R3-3, R3-4):** In general, where turns are prohibited, install the appropriate turn prohibition signs (R3-1 through R3-4), unless one-way signs are used.

- o The NO RIGHT TURN sign (R3-1) may be installed adjacent to the signal face for the right lane;
- o The NO LEFT TURN (R3-2) or NO U-TURN (R3-4) signs may be installed adjacent to a signal face viewed by road users in the left lane;
- o A NO TURNS (R3-3) sign may be placed adjacent to a signal face for all lanes on that approach or two signs should be used;
- o Where ONE-WAY signs are used, turn prohibition signs may be omitted.
- LEFT or RIGHT ON GREEN ARROW ONLY Sign (R10-5): Where needed, install the R10-5 sign adjacent to the applicable turn signal head. The R10-5 sign is used where it is unsafe to turn left or right except when protected by the green arrow display. The R10-5 sign or a modified R-10-11a sign shall be used if an all-arrow turn signal (Type 130A3) is installed (See TDOT Standard Drawing T-SG-7).
- NO TURN ON RED Sign (R10-11 Series): Where a turn on red is to be prohibited and the approach is controlled by both red arrow and circular red indications, install the R10-11a sign near the appropriate signal head. If the right turn (or a left turn from a one-way to a one-way) controlled by a circular red is prohibited, install a No Turn on Red message sign (R10-11 or R10-11b). A No Turn on Red sign should be considered when an engineering study finds that one or more of the following conditions exists:
 - o Where there is inadequate sight distance to vehicles approaching from the left (or right, if applicable);
 - o Where there are geometrics or operational characteristics of the intersection that might result in unexpected conflicts;
 - o Where there is an exclusive pedestrian or bicycle phase;
 - o Where there are an unacceptable number of conflicting pedestrian movements with RTOR maneuvers, especially involving children, older pedestrians, or persons with disabilities;
 - o Where there are more than three RTOR crashes reported in a 12-month period for the particular approach;
 - o Where the skew angle of the intersecting roadways creates difficulty for drivers to see traffic approaching from their left;
 - o At railroad crossings where the design vehicle cannot be safely stored in the clear storage distance between the railroad crossing and the adjacent traffic signal (i.e., to prevent trapping a vehicle) (See Module 1: Traffic Signal Design for further guidance);

- o For multi-lane applications, the use of R10-11c or R10-11d may be used to restrict the RTOR from a specific lane.
- **Blank Out Signs:** Blank Out Signs are internally illuminated signs that are blanked out (show no message) when not illuminated. They are often used when a turn prohibition is in effect only at certain times of the day or during one or more portion(s) of a particular cycle of the traffic signal. Another application of blank out signs is where a traffic signal has a railroad preemption sequence and the left-turns and right-turns towards the tracks are prohibited once an approaching train is detected. In this turn prohibition application, the blank sign would be located to the right of the right-most signal if the right-turn is prohibited, and to the left of the left-most signal if the left-turn is prohibited.
- **Street Name Sign (D3-1):** For overhead mounted street name signs, ensure the support poles are designed to accommodate loadings for street name signs if they will be installed during or after the project. For proposed overhead street name sign layouts, see Section 2.9.
- **Ground Mounted Signs:** The following discusses ground-mounted signs to be used at or in advance of signalized intersections.
 - Turn Lane Supplemental Signs (R3-7): Ground mounted mandatory lane control signs should be used to alert drivers of unexpected or unusual turn requirements for a lane or if turning movement traffic frequently fills the turn lane to capacity. The R3-7 signs, LEFT (RIGHT) LANE MUST TURN LEFT (RIGHT) can be installed to alert the driver, but is not required for all turn lanes. Simply having a dedicated right turn lane does not automatically require the installation of RIGHT LANE MUST TURN RIGHT signs. However, if a through lane ends as a right turn only lane, then install the appropriate R3-5 overhead sign and/or R3-7 ground mounted sign.
 - SIGNAL AHEAD Sign (W3-3): The installation of this sign is appropriate under the following conditions:
 - o Signal Visibility: Where visibility of the traffic signal heads on any approach is less than the distances shown in MUTCD Table 4D-2, install an advance Signal Ahead sign (W3-3) to warn approaching traffic of the signal.
 - o Speed: On high-speed rural approaches, approaching the first signal in an urbanized area, the W3-3 sign may be justified.
 - o Engineering Judgment: In other situations where engineering judgment reveals the need for and the location of the W3 3 sign (e.g. for additional emphasis even where the visibility distance to the device is sufficient).

A warning beacon may be used to provide additional emphasis to a Signal Ahead sign (see Module 1: Traffic Signal Design for further guidance).

- **Street Name Signs (D3-1):** Ground mounted street name signs are typically installed by the local jurisdiction. The minimum lettering heights are six inches for initial upper-case letters and 4.5 inches for lower-case letters. For multi-lane facilities where the speed limit is greater than 40 mph, the minimum lettering heights are eight inches for initial upper-case letters and six inches for lower-case letters.

2.8 Other Traffic Control Signs:

The following discusses other traffic control signs to be used at or in advance of signalized intersections.

- **SPEED LIMIT Signs (R-2 series):** SPEED LIMIT signs shall be posted at the points where the speed limit changes. Ensure that both directions are consistent. Additional signs should be installed beyond major intersections to inform traffic of the posted speed limit.
- **Two-Way Left-Turn Lane Signs (R3-9 series):** Two-Way Left-Turn Lane signs are installed to inform drivers of the required use of a center turn lane. They are installed as a supplement to the standard pavement markings and should be located as often as the speed limit signs.
- **School Signs (S Series):** School signs shall have a fluorescent yellow-green background with a black legend and border.

2.9 Proposed Overhead Street Name Sign Layouts

For traffic signal design projects, the size of the proposed overhead street name sign should be as follows:

- Height: 24 inches.
- Width: Varies depending on the legend required (6-foot minimum, 8-foot maximum except as noted below).

To determine the width of the proposed overhead street name sign, the recommended procedure to follow is:

1. Using Series "D" lettering style (12-inch upper-case, 9-inch lower-case), calculate the length of the legend required and include the design criteria listed in the following section to determine the overall sign width. Round up to the nearest six inch increment (e.g. 7-foot, 6-inch). Supplementary lettering to indicate the type of street (i.e. Street, Avenue, or Road, etc.) or the section of

- the city (i.e. NE, NW, SE, SW, etc.) can be downsized to 8-inch upper-case, 6-inch lower-case.
2. If the Series "D" calculated sign width distance exceeds eight feet, then use Series "C" lettering style (12-inch upper-case, 9-inch lower-case). Supplementary lettering downsizing as described previously is still applicable.
 3. If the Series "C" calculated sign width distance exceeds eight feet, then use Series "B" lettering style (12-inch upper-case, 9-inch lower-case). Supplementary lettering downsizing as described previously is still applicable.
 4. If the Series "B" calculated sign width distance exceeds eight feet, then the maximum sign width can be increased up to ten feet. Supplementary lettering downsizing as described previously is still applicable.
 5. If the Series "B" calculated sign width distance still exceeds ten feet, then contact the Traffic Operations Division for further guidance.

Other proposed overhead street name sign design criteria includes:

- **Color:** White on green background.
- **Sheeting:** Retro-reflective.
- **Corner Radii:** 2.25 inches.
- **Border Color:** White.
- **Border Width:** One inch.
- **Minimum distance between the Sign Border and the Legend:** Six inches.

3.0 Pavement Markings

All pavement markings shall meet the design and installation requirements of the MUTCD. Pavement markings are constantly degrading and must be replaced at regular intervals to be effective.

3.1 Stop Lines

- **Guidance:** Stop lines should be used to indicate the point behind which vehicles are required to stop to be in compliance with a stop sign, traffic signal, or other traffic control devices. Stop lines have the following characteristics:
 - Line Type: Solid.
 - Line Width: 24 Inches.
 - Color: White.

- Orientation: Generally parallel to cross street curb line (See Figures 3.1 and 3.2).
- Placement: When determining the placement of the stop line, consider the following:
 - Sight Distance: Position the stop line to allow the motorist adequate sight distance of the cross street traffic.
 - Staggered: Stop lines may be staggered longitudinally on a lane-by-lane basis (See Figure 3.1). Stop lines may also be staggered so the general-purpose lanes stop farther from the intersection than the bicycle lane to improve visibility of bicyclists for drivers of turning vehicles. Check turning paths of the design vehicles from the cross street to ensure there are no conflicts. For most intersections, use the turning path of a single-unit (SU) design vehicle to determine the location of the stop line.
 - Crosswalks: Where crosswalks are used, place the stop line a minimum of four feet in advance of the nearest crosswalk line at controlled intersections, except at midblock crosswalks (See Figure 3.2).
 - No Crosswalk: In the absence of a marked crosswalk, place the stop line at the desired stopping point, but not more than 30 feet or less than four feet from the nearest edge of the intersecting traveled way (See Figure 3.2).
 - Mid-block Crossings: Stop lines at midblock signalized locations should be placed at least 50 feet in advance of the nearest signal indication.

Figure 3.1 – Stop Line Placement

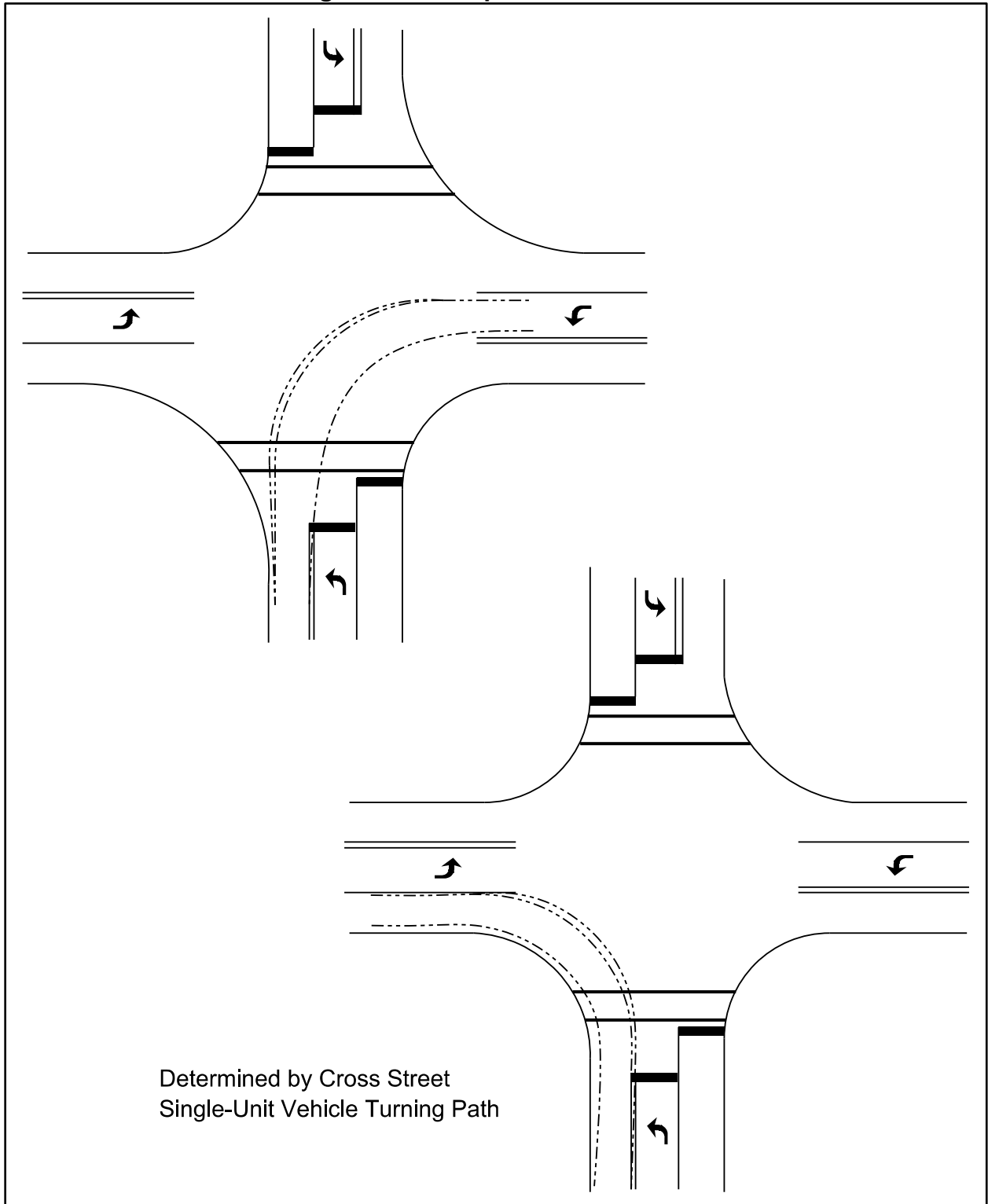
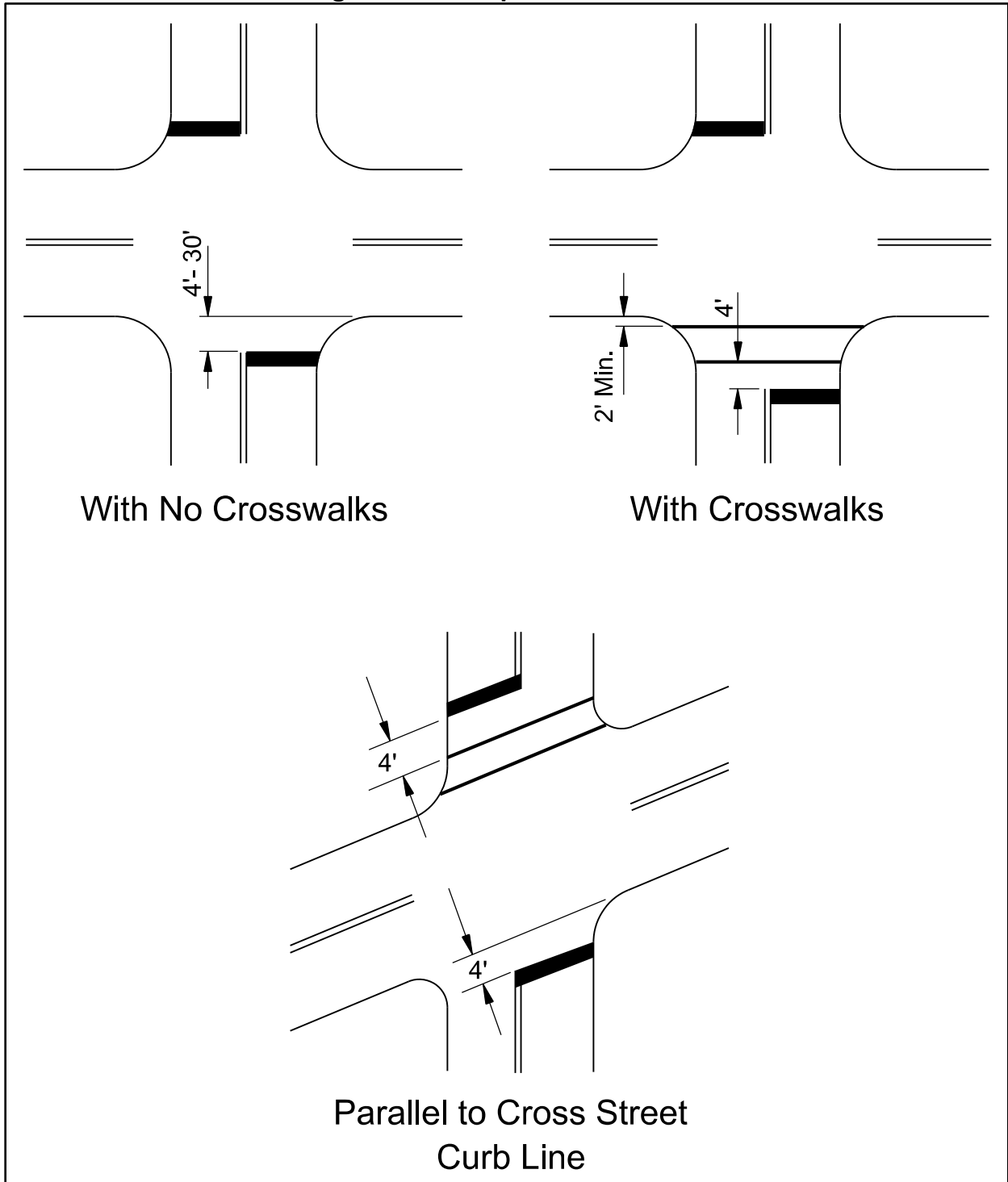


Figure 3.2 – Stop Line Locations



3.2 Yield Lines

- **Guidance:** Yield lines may be used to indicate the point behind which vehicles are required to yield in compliance with a YIELD (R1-2) sign or a Yield Here To Pedestrians (R1-5 or R1-5a) sign. Yield lines have the following characteristics:
 - **Symbol:** Solid triangle.
 - **Base Width:** Twelve inches to 24 inches.
 - **Height:** 1.5 times the base width.
 - **Color:** White.
 - **Orientation:** Generally parallel to cross street curb line.
 - **Spacing between Triangles:** Three inches to twelve inches.

- **Placement:** When determining the placement of the yield line, consider the following:
 - **Sight Distance:** Position the yield line to allow the motorist adequate sight distance of the cross-street traffic.
 - **Staggered:** Yield lines may be staggered longitudinally on a lane-by-lane basis. Check turning paths of the design vehicles from the cross street to ensure there are no conflicts. For most intersections, use the turning path of a single-unit (SU) design vehicle to determine the location of the yield line.
 - **Crosswalks:** Where crosswalks are used, place the yield line a minimum of four feet in advance of the nearest crosswalk line at controlled intersections or roundabouts, except at midblock crosswalks.
 - **No Crosswalk:** In the absence of a marked crosswalk, place the yield line at the desired yield point, but not more than 30 feet or less than four feet from the nearest edge of the intersecting traveled way.
 - **Uncontrolled Multi-lane Approaches:** If yield lines are used at a crosswalk that crosses an uncontrolled multi-lane approach, the yield line should be placed 30 feet to 50 feet in advance of the nearest crosswalk line, and parking should be prohibited in the area between the yield line and the crosswalk. If yield lines are used at a crosswalk that crosses an uncontrolled multi-lane approach, Pedestrians (R1-5 series) signs shall be used.

- **Roundabouts:** A yield line may be used to indicate the point behind which vehicles are required to yield at the entrance to a roundabout.

3.3 Crosswalks

- **Guidance:** Crosswalks are used to define a location where pedestrians are to cross a roadway and to alert motorists as to the crossing location. Crosswalks should be installed at locations controlled by traffic control signals or on approaches controlled by STOP or YIELD signs, or where engineering judgment indicates they are needed to direct pedestrians to the proper crossing path(s). Crosswalk markings shall be provided at legally established crosswalks at non-intersection locations. Transverse crosswalk markings are typically used on local roads and streets where ADT < 2,000 vehicles per day. Longitudinal crosswalk markings are the preferred pavement crosswalk type and shall be used where V > 40 mph. Crosswalks have the following characteristics:
 - **Type lines:** Solid.
 - **Line width:** Six inch minimum to 24 inch maximum for transverse lines and 24 inches for longitudinal bars.
 - **Color:** White.
 - **Crosswalk Width:** Six feet minimum for transverse crosswalks and 10 feet minimum for longitudinal crosswalks.
- **Engineering Study:** Crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign. The engineering study should consider:
 - Total number of approach lanes;
 - Presence of a median;
 - Distance from adjacent signalized intersections or other controlled crossings;
 - Projected pedestrian and bicyclist volumes, paths of travels, ages and abilities, and delays;
 - Location or frequency of public transit stops;
 - Average Daily Traffic (ADT);
 - Posted or statutory speed limit (i.e. 85th-percentile speed);
 - Vertical and horizontal geometry of the crossing location;
 - Possible consolidation of multiple crossing points;
 - Availability of street lighting; and

- Other appropriate factors.
- **Placement:** When determining the placement of crosswalks, consider the following:
 - **Location:** Crosswalks should be in line with the sidewalk approaches. Crosswalk lines should extend across the full width of pavement or to the edge of the intersecting crosswalk to discourage diagonal walking between crosswalks.
 - **Type:** Normally, transverse lines are used. Where additional crosswalk visibility is required, diagonal or longitudinal lines should be used.
 - **Orientation:** The crosswalk should be oriented parallel to the cross street.
 - **Accessibility:** A pedestrian access route shall be provided within pedestrian street crossings, including medians and pedestrian refuge islands, and pedestrian at-grade rail crossings. The pedestrian access route shall connect departure and arrival sidewalks. All pedestrian street crossings must be accessible to pedestrians with disabilities. If pedestrian crossing is prohibited at certain locations, No Pedestrian Crossing signs (R9-3) should be provided, along with detectable features (e.g. grass strips, landscaping, planters, chains, fencing, and railings).
 - **Curb Ramps:** The curb ramp, excluding any flared sides, or blended transition shall be contained wholly within the width of the pedestrian street crossing served.
 - **Roundabouts:** Pedestrian crosswalks shall not be marked to or from the central island of roundabouts. If pedestrian facilities are provided, crosswalks should be marked across roundabout entrances and exits to indicate where pedestrians are intended to cross. Crosswalks should be a minimum of 20 feet from the edge of the circulatory roadway.

3.4 Turn Arrows

Pavement marking arrows should be used for specific turn lanes. The turn arrow marking will suffice and the word ONLY is optional. Where a through lane approaching

an intersection becomes a mandatory turn lane, the word ONLY used with the turn arrow is required (See TDOT Standard Drawing T-M-4 for guidance).

3.5 Materials

All stop lines, crosswalks, and arrows shall be constructed of reflectorized thermoplastic or pre-formed plastic pavement marking material. The material used shall be in accordance with the TDOT Standard Specifications.