

## TRAFFIC MANUAL

# CHAPTER 6 - MARKINGS

- 6-00 Table of Contents and List of Figures
- 6-01 General Principles
- 6-02 Application of Pavement and Curb Markings
- 6-03 Special Pavement Treatments
- 6-04 Delineators
- 6-05 Object Markers
- 6-06 Channelizers



July, 1996

## CHAPTER 6 TABLE OF CONTENTS

<i>Index No.</i>		<i>Page No.</i>	<i>Date</i>
6-01	GENERAL PRINCIPLES.....	6-1	January, 1996
6-01.1	Functions and Limitations.....	6-1	January, 1996
6-01.2	Standardization of Application.....	6-1	July, 1981
6-01.3	Materials.....	6-2	November, 1991
6-01.4	Colors.....	6-2	January, 1996
6-01.5	General Principles of Longitudinal Pavement Markings.....	6-2	November, 1991
6-01.6	Widths and Patterns of Longitudinal Lines.....	6-2	November, 1991
6-01.7	Types of Longitudinal Lines.....	6-2	January, 1996
6-01.8	Transverse Markings.....	6-3	November, 1991
6-01.9	Diagonal Markings.....	6-4	November, 1991
6-01.10	Curb Markings.....	6-4	January, 1996
6-01.11	Legal Authority.....	6-4	January, 1996
6-02	APPLICATION OF PAVEMENT AND CURB MARKINGS.....	6-5	January, 1996
6-02.1	Centerlines.....	6-5	January, 1996
6-02.2	Lanelines.....	6-5	January, 1996
6-02.3	No-Passing Zone Markings.....	6-7	January, 1996
6-02.4	Edgelines.....	6-7	January, 1996
6-02.5	Pavement Marking Extensions Through Intersections.....	6-8	July, 1981
6-02.6	Lane Reduction Transitions.....	6-8	November, 1991
6-02.7	Islands and Channelizing Lines.....	6-8	January, 1996
6-02.8	Marking of Interchange Ramps.....	6-9	July, 1981
6-02.9	Two-Way Left Turn Lanes.....	6-9	July, 1981
6-02.10	Approach to an Obstruction.....	6-9	July, 1981
6-02.11	Limit Lines (Stoplines).....	6-10	January, 1996
6-02.12	Crosswalks and Crosswalk Lines.....	6-10	January, 1996
6-02.13	Parking Stall Markings.....	6-11	January, 1996
6-02.14	Pavement Word and Symbol Markings.....	6-12	January, 1996
6-02.15	Curb Markings for Parking Restrictions.....	6-13	July, 1981
6-02.16	HOV (High Occupancy Vehicle) Lane Markings and Signing.....	6-13	January, 1996
6-02.17	Highway Markings and Signs Where Speed is Enforced by Aircraft.....	6-13	July, 1981
6-02.18	Railroad and Light Rail (Trolley) Grade Crossing Markings.....	6-14	November, 1991
6-02.19	Divided Highway Illusion.....	6-14	July, 1981
6-03	SPECIAL PAVEMENT TREATMENTS.....	6-15	January, 1996
6-03.1	Advance Markers - Exit Ramps.....	6-15	January, 1996
6-03.2	Rumble Strips.....	6-15	January, 1996

## TABLE OF CONTENTS (Continued)

<i>Index No.</i>		<i>Page No.</i>	<i>Date</i>
6-03.3	Contrast Treatment.....	6-16	July, 1981
6-03.4	Location Markers - Fire Hydrants.....	6-16	January, 1996
6-04	DELINEATORS.....	6-17	January, 1996
6-04.1	Introduction.....	6-17	November, 1991
6-04.2	Delineator Design.....	6-17	January, 1996
6-04.3	Delineator Application.....	6-17	January, 1996
6-04.4	Delineator Placement and Spacing.....	6-18	January, 1996
6-04.5	Culvert Markers.....	6-20	July, 1981
6-04.6	Kilometer Post Markers.....	6-20	January, 1996
6-04.7	Emergency Passageway Markers.....	6-20	January, 1996
6-04.8	Narrow Bridge Signing and Markings.....	6-20	July, 1981
6-04.9	Median Barrier Delineation.....	6-20	January, 1996
6-05	OBJECT MARKERS.....	6-21	January, 1996
6-05.1	Object Marker Design.....	6-21	January, 1996
6-05.2	Objects Within the Roadbed.....	6-22	January, 1996
6-05.3	Objects Adjacent to the Roadbed.....	6-22	January, 1996
6-05.4	End of Road (Street).....	6-22	January, 1996
6-06	CHANNELIZERS.....	6-23	January, 1996
6-06.1	Introduction.....	6-23	January, 1996
6-06.2	Channelizer Design.....	6-23	January, 1996
6-06.3	Channelizer Application.....	6-23	January, 1996
6-06.4	Channelizer Placement and Spacing.....	6-23	January, 1996

## CHAPTER 6 LIST OF FIGURES

<i>Figure No.</i>		<i>Page No.</i>	<i>Date</i>
6-1	Centerline - 2 Lane Highway.....	6-25	January, 1996
6-2	Laneline - Multilane Highways.....	6-26	January, 1996
6-3	No Passing Zones - One Direction.....	6-27	January, 1996
6-4	No Passing Zones - Two Direction.....	6-28	January, 1996
6-5	Left Edgelines for Divided Highways.....	6-29	January, 1996
6-6	Right Edgeline and Right Edgeline Extension Through Intersections.....	6-30	January, 1996
6-7	Median Islands.....	6-31	January, 1996
6-8	Two-Way Left-Turn Lanes.....	6-32	January, 1996
6-9	Intersection Markings.....	6-33	January, 1996
6-10	Freeway Exit and Entrance Ramp Channelizing Lines.....	6-34	January, 1996
6-11	Lane Drop Markings.....	6-35	January, 1996
6-12	Channelizing, Bike Lane and Lane Line Extensions.....	6-36	January, 1996
6-13	Lane Drop Signing and Markings at Exit Ramps.....	6-37	January, 1996
6-14	Freeway to Freeway Connector Signing and Markings.....	6-38	January, 1996
6-15	Typical Lane Reduction Transition.....	6-39	January, 1996
6-16	Transition From Two - Lane to Four - Lane Divided.....	6-40	January, 1996
6-17	Lane Drop Signing and Markings at Conventional Highway Intersections.....	6-41	January, 1996
6-18	Signing and Marking Passing Lanes.....	6-42	January, 1996
6-19	Typical Two - Way Left - Turn Lanes.....	6-43	January, 1996
6-20	Typical Left - Turn Channelization Delineation and Markings.....	6-44	January, 1996
6-21	No Passing Zones.....	6-45	January, 1996
6-22	Signing and Marking Turnouts.....	6-46	January, 1996
6-23	Typical Exit and Connector Ramp Markings.....	6-47	January, 1996
6-24	Typical Entrance and Connector Ramp Markings.....	6-48	January, 1996
6-25	Typical Acceleration/Deceleration and Parallel Acceleration Lane Markings.....	6-49	January, 1996
6-26	Typical Entrance/Exit Ramp Terminal Signing and Pavement Markings.....	6-50	January, 1996
6-27	Typical Entrance/Exit Ramp Terminal Signing and Pavement Markings.....	6-51	January, 1996
6-28	Typical Exit Ramp Terminal Signing and Pavement Markings.....	6-52	January, 1996
6-29	Typical Entrance/Exit Ramp Terminal Signing and Pavement Markings.....	6-53	January, 1996
6-30	Typical Entrance/Exit Ramp Terminal Signing and Pavement Markings.....	6-54	January, 1996

## LIST OF FIGURES (Continued)

<i>Figure No.</i>		<i>Page No.</i>	<i>Date</i>
6-31	Typical Entrance/Exit Ramp Terminal Signing and Pavement Markings.....	6-55	January, 1996
6-32	Typical Obstruction Markings.....	6-56	January, 1996
6-33	Typical Intersection Markings.....	6-57	January, 1996
6-34	Typical Rural Expressway Intersection Signs and Markings.....	6-58	January, 1996
6-35	Typical Parking Stall Markings.....	6-59	January, 1996
6-36	Typical Pavement Legend Markings.....	6-60	January, 1996
6-37	Typical Pavement Symbol and Arrow Markings.....	6-61	January, 1996
6-38	Typical Pavement Arrow Markings.....	6-62	January, 1996
6-39	Typical Signing and Markings for Highway Where Speed is Enforced by Aircraft.....	6-63	January, 1996
6-40	Railroad Crossing Pavement Markings.....	6-64	January, 1996
6-41	Typical Railroad Crossing Pavement Markings.....	6-65	January, 1996
6-42	Typical Railroad Crossing Pavement Markings.....	6-66	January, 1996
6-43	Treatment for Divided Highway Illusion.....	6-67	January, 1996
6-44	Typical Fire Hydrant Location Pavement Markers.....	6-68	January, 1996
6-45	Typical Delineators.....	6-69	January, 1996
6-46	Typical Examples of Delineator Placement When Used at Intersections, Islands , Ramps and Connectors.....	6-70	January, 1996
6-47	Delineator Spacing on Curves.....	6-71	January, 1996
6-48	Narrow Bridge Signing and Markings.....	6-72	January, 1996
6-49	Typical Runaway Truck Ramp Signing and Markings.....	6-73	January, 1996
6-50	Typical Median Barrier Delineation and Channelizers.....	6-74	January, 1996
6-51	Typical Object Markers (Type K, Q and L).....	6-75	January, 1996
6-52	Typical Object Markers (Type N, P and R).....	6-76	January, 1996

## CHAPTER 6

### MARKINGS

#### General Principles 6-01

##### 6-01.1 Functions and Limitations

Markings, as covered in this chapter, include lines and markings applied to the pavement, raised pavement markers, delineators, object markers, and special pavement treatments.

Markings have definite and important functions to perform in a proper scheme of traffic control. In some cases, they are used to supplement the regulations or warnings of other devices such as traffic signs or signals. In other instances, they are used alone and produce results that cannot be obtained by the use of any other device. In such cases they serve as a very effective means of conveying certain regulations and warnings that could not otherwise be made clearly understandable.

Pavement markings have definite limitations. They are obscured by snow, may not be clearly visible when wet, and may not be very durable when subjected to heavy traffic. In spite of these limitations, they have the advantage, under favorable conditions, of conveying warnings or information to the driver without diverting the motorists attention from the roadway.

The geometric design of a highway is outlined by pavement markings such as centerlines, lanelines, edgelines, channelizing lines, etc. On State highways, Office of Project Planning and Design approval is required if a change in markings would result in a highway design which does not meet the mandatory standards. Federal approval must also be obtained for such changes on projects which were constructed or will be constructed with Federal-aid funds.

California Vehicle Code (CVC) references are used throughout this chapter when the subject matter relates to the law.

##### 6-01.2 Standardization of Application

Each standard marking shall be used only to convey the meaning prescribed for it in this Manual. Before any new highway, detour, or temporary route is opened to traffic, all necessary markings should be in place. Markings which must be visible during hours of darkness shall be reflectorized unless ambient illumination assures adequate visibility. All markings shall be retroreflectorized unless otherwise noted.

Markings no longer applicable which may create confusion in the mind of the motorist shall be removed or obliterated as soon as practicable. Other markings required by road conditions or restrictions should be removed or obliterated when those conditions cease to exist. The removed or obliterated marking should not reappear under various lighting and surface conditions.

Of growing importance is the tendency of traffic authorities to accommodate variable traffic conditions. For this purpose, signs and signals with the ability to display variable messages have been developed. The use of variable messages in the field of markings, however, has been limited and confined to the placement of flexible cones and posts, and to a few mechanically operated devices. It is to be expected that the future will bring forth new, practical methods of conveying variable messages by means of markings. When such need and opportunity occur, care should be used to adhere to the principles set forth in this Manual.

### 6-01.3 Materials

The most common method of placing pavement markings is by means of paint or thermoplastic; however, a wide variety of other suitable marking materials including plastic or ceramic raised pavement markers (RPM) are available. Materials used should provide the specified color throughout their useful life.

For State highways, appropriate pavement delineation patterns shall be selected from those alternate details showing either painted traffic lines with raised reflective pavement markers or raised pavement markers to simulate painted lines. See Figures 6-1 through 6-12.

Raised pavement markers are not normally placed where snow plows would damage the markers and require an unusual amount of replacement. When used in these areas, they should be recessed, as shown in Caltrans' Standard Plans, PAVEMENT MARKERS AND TRAFFIC LINES, TYPICAL DETAILS (Plan A20-D).

### 6-01.4 Colors

Pavement markings shall be yellow or white (for exceptions, see CVC 21374). The color of curb markings is set forth in Section 6-01.10, CURB MARKINGS. The use of black is permitted in combination with yellow or white where the pavement itself does not provide sufficient contrast.

The colors for pavement markings shall conform to the standard highway colors.

### 6-01.5 General Principles of Longitudinal Pavement Markings

Longitudinal pavement markings shall conform to the following basic concepts:

1. Yellow lines delineate the separation of traffic flows in opposing directions or mark

the left edgeline of divided highways and one-way roadways.

2. White lines delineate the separation of traffic flows in the same direction or mark the right edgeline.
3. Broken lines are permissive in character.
4. Solid lines are restrictive in character.
5. Width of line indicates the degree of emphasis.
6. Solid double lines indicate maximum restrictions.
7. All longitudinal pavement markings shall be reflectorized except non-reflective markers and directional markings for tourists (CVC 21374).
8. Red pavement markers are used to alert possible wrong way drivers on freeways as shown in Figure 6-2, LANELINES - MULTILANE HIGHWAYS, Detail 14.

### 6-01.6 Widths and Patterns of Longitudinal Lines

The widths and patterns of longitudinal lines shall conform to the details shown in the Figures in this chapter. See Figures 6-1 through 6-12.

### 6-01.7 Types of Longitudinal Lines

The following examples illustrate the application of the principles and standards set forth in Section 6-01.4, COLORS, Section 6-01.5, GENERAL PRINCIPLES OF LONGITUDINAL PAVEMENT MARKINGS and Section 6-01.6, WIDTHS AND PATTERNS OF LONGITUDINAL LINES:

1. A single broken white line is used to delineate the edge of a traffic lane where travel is permitted in the same direction on both sides of the line. Its most frequent application is as a lane line of a multilane roadway.
2. A single broken yellow line is used to delineate the left edge of a traffic lane where travel on the other side of the line is in the opposite direction. A frequent application is as a center line of a two-lane, two-way roadway where overtaking and passing is permitted.
3. A single solid white line is used to delineate the edge of a traffic lane where travel in the same direction is permitted on both sides of the line, but crossing the line is discouraged. It is also used to mark the right edgeline. A wide solid white line is used for emphasis where crossing it requires unusual care. It is also used as a line to delineate turnouts, left or right-turn lanes, freeway entrance and exit ramps and bicycle lanes.
4. A single solid yellow line delineates the left edgeline of each roadway of divided streets or highways, one-way roadways, and ramps in the direction of travel.
5. A double line consisting of a single broken yellow line and single solid yellow line delineates a separation between traffic lanes in opposite directions where overtaking and passing is permitted for traffic adjacent to the broken line and is prohibited for traffic adjacent to the solid line. It is used on two-way roadways to regulate passing in one direction. It is also used to delineate a two-way left-turn lane in which the solid line is placed on the outside, as shown in Figure 6-8, TWO-WAY LEFT-TURN LANES. Traffic adjacent to the solid line may cross this marking only as part of a left-turn or U-turn maneuver.
6. A double line consisting of two solid yellow lines delineates the separation between traffic lanes in opposite directions where overtaking and passing is prohibited in both directions. This is a two direction no-passing marking. Crossing this marking is permitted only as part of a left-turn maneuver. It is frequently used as a channelizing line in advance of an obstruction which must be passed on the right and to form a channelizing island separating traffic in opposite directions. It may also be used as a left edgeline on a divided roadway, where additional visibility is desired.
7. A dotted line may be used to delineate the extension of a line through an intersection or interchange area. It shall be the same color as the line it extends.

#### **6-01.8 Transverse Markings**

Transverse markings which include shoulder markings, word and symbol markings, limit lines (stoplines), crosswalk lines, marking of highways patrolled by aircraft, parking stall markings, and others shall be white, except for yellow markings near schools as provided in Chapter 10, SCHOOL AREA PEDESTRIAN SAFETY of this manual.

Because of the low approach angle at which pavement markings are viewed, it is necessary that transverse lines be proportioned to give adequate visibility. They are usually elongated longitudinally to the roadway. Pavement marking letters, numerals, and symbols should be in

accordance with standard alphabets for highway signs and pavement markings approved by Caltrans.

#### 6-01.9 Diagonal Markings

Diagonal markings should be used only, when in the opinion of an engineer, it is necessary to add emphasis or to discourage vehicular travel upon a paint formed roadway feature such as an unusually wide shoulder area, a pedestrian refuge island, or a traffic divisional or channelization island.

These markings are normally 300 mm wide diagonal lines or chevrons. These lines shall be the same color as the line or lines they are emphasizing. The spacing between these lines may vary from 0.3 m in a pedestrian crosswalk to 60 m for vehicular traffic.

Diagonal lines, when used, should be with an edgeline or traffic island that has opposing traffic flows.

Chevrons, when used, should be used with traffic islands that allow traffic to pass on either side in the same direction.

#### 6-01.10 Curb Markings

The color of curb markings shall conform to CVC 21458 quoted below:

##### ***21458. Curb markings***

***(a) Whenever local authorities enact local parking regulations and indicate them by the use of paint upon curbs, the following colors only shall be used, and the colors indicate as follows:***

***(1) Red indicates no stopping, standing, or parking, whether the vehicle is attended or unattended, except that a bus may stop in a red zone marked or signposted as a bus loading zone.***

***(2) Yellow indicates stopping only for the purpose of loading or unloading passengers or freight for such time as may be specified by local ordinance.***

***(3) White indicates stopping for either of the following purposes:***

***(A) Loading or unloading of passengers for the time as may be specified by local ordinance.***

***(B) Depositing mail in an adjacent mailbox.***

***(4) Green indicates time limit parking specified by local ordinance.***

***(5) Blue indicates parking limited exclusively to the vehicles of disabled persons and disabled veterans***

***Regulations adopted pursuant to subdivision (a) shall be effective on days and during hours or times as prescribed by local ordinances.***

#### 6-01.11 Legal Authority

CVC 21400 provides that the California Department of Transportation (Caltrans) shall, after consultation with local agencies and public hearings, adopt rules and regulations prescribing uniform standards and specifications for all official traffic control devices placed pursuant to the provisions of the Code. CVC 21401 provides that only those official traffic control devices that conform to the uniform standards and specifications promulgated by Caltrans shall be placed upon a street or highway. CVC 21350 and 21351 give basic authority to the Caltrans and local authorities, in their respective jurisdictions, to place and maintain such official traffic control devices.

## Application of Pavement and Curb Markings 6-02

### 6-02.1 Centerlines

A yellow centerline separates traffic traveling in opposite directions. It need not be at the geometrical center of the pavement. Centerlines provide important guidance to motorists. On roads where a continuous centerline is not used, short sections may be used to control the position of traffic at specific locations, such as around curves, over hills, and on approaches to intersections, railroad crossings, and bridges.

Centerlines should be used on paved highways or portions thereof under the following conditions:

1. In rural areas on two-lane pavements 4.88 m or greater in width with speed zones of 55 km/h or more.
2. In business or residential districts on through highways, and on other highways where there are significant traffic volumes.
3. On all undivided pavements of four or more lanes.
4. At other locations where an engineering study indicates a need for them.

The centerline on undivided highways where three or more lanes are always available shall be a double solid yellow line.

Centerline patterns shall be selected from those shown in Figure 6-1, CENTERLINES - 2 LANE HIGHWAYS. Raised reflective pavement markers shall be used to supplement the centerline markings on State highways, except in snow areas.

INTERSECTION MARKINGS - CVC 21752 restricts passing (driving on left side of a two-way roadway) when approaching within 30 m (100 feet) of or when traversing any intersection. The patterns and policy are shown in Figure 6-9, INTERSECTION MARKINGS.

### 6-02.2 Lanelines

White lanelines separate lanes of traffic traveling in the same direction and shall be used on all multilane highways.

A single solid white line may be used as the laneline in critical areas to discourage lane changing. Typical locations for such applications are tunnels or bridges having width restrictions, interchange areas where lane changing disrupts traffic flow and the delineation of separate turn lanes.

It may also be used to separate through traffic lanes from special secondary lanes, such as passing lanes, left or right-turn lanes and transit bus lanes.

Laneline patterns shall be selected from those shown in Figure 6-2, LANELINES - MULTILANE HIGHWAYS. Detail 10 (60 km/h or less) or Detail 13 (70 km/h or more) shall be used on State freeways, expressways, freeway ramps, freeway to freeway connectors and collector roads, except in snow areas.

#### 1. LANE DROPS

A. **Freeways** - A 200 mm wide dotted white lane drop line shall be placed in advance of lane drops at exit-ramps. The basic purpose of this line is to provide a "crossable" line to show the edge of the roadway to entering, exiting, and through traffic. If the dropped lane is an auxiliary lane 0.8 km or less in length, the lane drop line should extend throughout the entire length. The lane drop line pattern shall be as shown in Figure 6-11, LANE DROP MARKINGS. Also, see Figure 6-13, LANE DROP SIGNING AND MARKINGS AT EXIT RAMPS, and Figure 6-14, FREEWAY TO FREEWAY CONNECTOR SIGNING AND MARKINGS, for further details of marking and signing on State freeways.

See Figure 6-15, TYPICAL LANE REDUCTION TRANSITION, for details of marking and signing where a lane is dropped between interchanges.

B. **Conventional Highways** - A 200 mm wide single solid white line preceded by a 200 mm wide dashed white line may be placed in advance of an intersection where the outside lane is dropped at the intersection, and as a result, creates a mandatory turn lane. See Figure 6-11, Details 37B and 37C, LANE DROP MARKINGS and Figure 6-17, LANE DROP SIGNING AND MARKINGS AT CONVENTIONAL HIGHWAY INTERSECTIONS, for details of markings and signing.

## 2. PASSING AND TRUCK LANES

A. **Passing Lanes** - When a passing lane is provided, a two-direction no passing marking shall be used when the Average Daily Traffic (ADT) exceeds 3,000. A typical example is shown in Figure 6-18, SIGNING AND MARKING PASSING LANES.

Passing in both directions may be provided by alternating the direction of the middle lane at about 1.6 km intervals.

A one-direction no passing marking with one or more YIELD TO UPHILL TRAFFIC signs (R55) may be used when the ADT is 3,000 or less.

B. **Truck Lanes** - When a climbing lane is provided on an upgrade and it is necessary to prohibit trucks from passing slower moving vehicles, a 200 mm solid white line shall be used in place of the standard lane line stripe.

The TRUCKS RIGHT LANE ONLY sign (R53B) shall be placed at the beginning of the restriction and at approximately 0.4 km intervals.

When the restriction is necessary only during certain hours, the R82A plate shall be placed below the R53B sign.

A TRUCK LANE \_\_\_\_ FEET sign (R53) shall be placed in advance of the truck lane. An END TRUCK LANE sign (R53A) shall be placed at the end of the restriction. See Figure 6-15, TYPICAL LANE REDUCTION TRANSITION for signing and marking the end of an extra lane.

Typical examples of passing lanes are shown in Figure 6-18, SIGNING AND MARKING PASSING LANES.

## 3. TURN LANES

Left-turn or right-turn lanes shall be separated from the through lanes by a single solid 200 mm wide white line as shown in Figure 6-12, CHANNELIZING, BIKE LANE AND LANE LINE EXTENSIONS. Also see Figure 6-19, TYPICAL TWO-WAY LEFT-TURN LANES, Figure 6-20, TYPICAL LEFT-TURN CHANNELIZATION DELINEATION AND MARKINGS and Caltrans' Highway Design Manual, Section 405.2, LEFT-TURN CHANNELIZATION.

## 4. TURNOUTS

Paved turnouts should be marked with a 200 mm wide single solid white line between the through lane and the turnout. The line should not extend through the entry and exit areas. See Figure 6-22, SIGNING AND MARKING TURNOUTS, for details.

Geometric design standards for turnouts are in the Caltrans' Highway Design Manual, Section 204.5 (4), TURNOUTS.

### 6-02.3 No-Passing Zone Markings

There are two kinds of no-passing zones as follows:

1. ***One Direction No-Passing Marking.***  
Consists of double (two) yellow lines, one solid and one broken. The driver on that side of the roadway in which the broken line is in place may cross over the double line or drive to the left thereof when overtaking or passing other vehicles in accordance with CVC 21460.
2. ***Two Direction No-Passing Marking.***  
Consists of double (two) solid yellow lines. The driver shall not drive to the left of these lines in accordance with CVC 21460. When approaching curves, either vertical or horizontal, on two-lane highways, drivers may be unable to decide if there is sufficient distance to make a passing maneuver. When such curves restrict sight distance, a study should be made to determine the advisability of marking no-passing zones.

Markings for a no-passing zone on a crest vertical curve are based on the distance at which an object 1.07 m above the pavement surface can just be seen from another point 1.07 m above the pavement.

Similarly, markings for a no-passing zone on a horizontal curve are based on the distance measured along the centerline between two points 1.07 m above the pavement on a line tangent to the embankment or other obstruction that cuts off the view on the inside of the curve. A table showing sight distances for marking no-passing zones for the different prevailing (85 percentile) speeds is shown in Figure 6-21, NO PASSING ZONES.

When a no-passing zone is warranted, a minimum zone length of one-half of the passing sight distance shall be used. If the gap between successive no-passing zones is less than the sight distance for the prevailing speed shown in Figure 6-21, NO PASSING ZONES, the no-passing zone shall be continuous.

No-passing zone patterns shall be selected from those shown in Figure 6-3, NO PASSING ZONES - ONE DIRECTION, and Figure 6-4, NO PASSING ZONES - TWO DIRECTION.

The no-passing zone markings at intersections, when used, should be between 30 m and 90 m in length at the approach to an intersection and placed in a pattern as shown in Figure 6-9, INTERSECTION MARKINGS.

### 6-02.4 Edgelines

Edgelines delineate the edge of traveled way for motorists. They have a unique value as a visual reference during adverse weather and visibility conditions. They also are used to reduce driving on paved shoulders or refuge areas of lesser structural strength than the adjacent pavement. Where more emphasis is required, 45½ diagonal 300 mm wide lines may be added on shoulders. Diagonal lines, if used, shall be the same color as the edgeline. Edgelines are generally not continued through intersections and are not broken for driveways.

Edgelines shall be used on all State highways, except urban type streets with curbs, parking provisions, etc. Edgelines may be used on streets and highways under local jurisdiction.

#### 1. LEFT EDGELINE

A left edgeline shall consist of a solid 100 mm wide yellow line, yellow reflective pavement markers or a combination of line and markers as shown in Figure 6-5, LEFT EDGELINES FOR DIVIDED HIGHWAYS.

Solid double yellow lines may be used for more emphasis when motorists tend to use the shoulder for a through lane or where encroachments onto the shoulder occasionally occur.

Left edgeline patterns for median islands are shown in Figure 6-7, MEDIAN ISLANDS.

## 2. RIGHT EDGELINE

A right edgeline shall consist of a solid 100 mm wide white line. The edgeline should be placed 50 mm in from the edge of traveled way, approximately 3.6 m from the laneline or centerline on highway mainlines, ramps, and connectors. See Figure 6-6, RIGHT EDGELINE AND RIGHT EDGELINE EXTENSION THROUGH INTERSECTIONS.

Generally, the solid edgeline should be dropped at the beginning of intersection flares. In heavy fog areas, or locations where additional guidance would be beneficial, a dashed 100 mm wide white right edgeline may be continued across an intersection. Edgeline is not used at turnouts. See Figure 6-22, SIGNING AND MARKING TURNOUTS.

### 6-02.5 Pavement Marking Extensions Through Intersections

A dashed line or a pattern of non-reflective markers may be used to extend laneline or centerline markings through an intersection where offset, skew, complex multilegged intersections, reduced visibility, or multiple turn lanes require positive guidance. The extended marking shall be the same color as the line it extends. See Figure 6-12, CHANNELIZING, BIKE LANE AND LANE LINE EXTENSIONS.

A solid line may be used for a greater degree of restriction.

### 6-02.6 Lane Reduction Transitions

Pavement markings are used to guide traffic at points where the pavement width changes to a lesser number of through lanes. No-passing markings shall be used to prohibit passing, in the direction of the convergence, throughout the transition area.

Pavement markings (lane reduction arrows) at pavement width transitions supplement the standard signs.

Typical lane reduction transitions (four lane to two lane) and transitions from two lanes to four lanes are shown in Figure 6-15, TYPICAL LANE REDUCTION TRANSITION, and Figure 6-16, TRANSITION FROM TWO-LANE TO FOUR-LANE DIVIDED.

### 6-02.7 Islands and Channelizing Lines

An island is a defined area between traffic lanes for control of vehicle movements or for pedestrian refuge. Within an intersection area, a median or an outer separation is considered to be an island. An island may be designated by paint, raised bars, pavement markers, curbs, delineators, or other devices (CVC 21651).

The channelizing line may be used to form traffic islands where travel in the same direction is permitted on both sides. Other markings in the island area such as diagonal lines shall be white.

#### 1. MEDIAN ISLANDS

Double solid 100 mm wide yellow lines shall be used to delineate the edge of a median island where the median is an all-paved, at-grade section of the highway. The island formed by double

yellow lines shall be at least 2 feet (0.61 m) in width, as shown in Figure 6-7, MEDIAN ISLANDS.

This treatment is not intended for freeways or other highways with a positive barrier in the median. Single solid yellow left edgeline and markers as shown in Figure 6-5, LEFT EDGELINES FOR DIVIDED HIGHWAYS, are standard. When used, other markings in the median island area shall be yellow.

## 2. CHANNELIZING LINES

Channelizing lines are solid white lines that are used to guide motorists where travel in the same direction is permitted on both sides, such as at entrance and exit ramps, turn lanes and at other locations where crossing requires unusual care. The typical channelizing line is shown in Figures 6-12, CHANNELIZING, BIKE LANE AND LANE LINE EXTENSIONS.

Diagonal lines may be used where additional emphasis is desired.

### 6-02.8 Marking of Interchange Ramps

Channelizing lines at exit ramps direct traffic at the proper angle for smooth divergence into the ramp. The channelizing line at entrance ramps promotes safe and efficient merging with the through traffic.

Channelizing lines for exit ramps should be placed along both sides of the neutral area (gore) between the main roadway and the exit ramp lane. A channelizing line for entrance ramps should be placed along the side of the neutral area adjacent to the ramp lane.

Exit and entrance ramps, including freeway connectors, shall be marked with a yellow edgeline supplemented with yellow reflective pavement markers on the left and a white edgeline on the

right. See Figure 6-5, LEFT EDGELINES FOR DIVIDED HIGHWAYS.

Typical interchange markings are shown in Figures 6-26 through 6-31, TYPICAL ENTRANCE/EXIT RAMP TERMINAL SIGNING AND PAVEMENT MARKINGS.

### 6-02.9 Two-Way Left Turn Lanes

A two-way left-turn lane is a lane reserved in the center of a highway for exclusive use of left or U-turning vehicles (CVC 21460.5). It is normally used where there are many points of access.

The markings shall be selected from those shown in Figure 6-8, TWO-WAY LEFT-TURN LANES. Optional treatments at signalized, major and minor intersections are shown in Figure 6-19, TYPICAL TWO-WAY LEFT-TURN LANES. A gap in the markings should be made at all intersections.

Two-way opposing pavement arrows may be used as shown in Figure 6-19, TYPICAL TWO-WAY LEFT-TURN LANES. The arrows may be supplemented by TWO-WAY LEFT TURN LANE SYMBOL (R67) and TWO-WAY TURN LANE (R67A) signs at new installations and problem locations.

### 6-02.10 Approach to an Obstruction

Pavement markings shall be used to guide traffic on the approach to fixed obstructions within a paved roadway. An obstruction may be so located that all traffic must keep to the right, or the obstruction may be between two lanes of traffic moving in the same direction. The markings in either case guide traffic away from the obstruction. The use of channelizing lines as shown in Figure 6-12, CHANNELIZING, BIKE LANE AND LANE LINE EXTENSIONS, or no-passing markings as shown in Figure 6-4, NO-PASSING

ZONES-TWO DIRECTION, and as shown in Figure 6-32, TYPICAL OBSTRUCTION MARKINGS, are generally effective for marking obstructions such as bridge supports, refuge islands, median islands, and channelization islands.

#### 6-02.11 Limit Lines (Stoplines)

Limit lines (CVC 377) are solid white lines, normally 300 to 600 mm (12 to 24 inches) wide, extending across all approach lanes to indicate the point behind which vehicles are required to stop.

If a marked crosswalk (Section 6-02.12, CROSSWALKS AND CROSSWALK LINES) is in place, it would normally function as a limit line. For added emphasis, a limit line may be placed 1.22 m or further in advance of and parallel to the nearest crosswalk line. See Chapter 10, Section 10-04.3, CROSSWALK LINES, of this manual.

In the absence of a marked crosswalk, the limit line should be placed at the desired stopping point; this point is typically no more than 9.14 m nor less than 1.22 m from the nearest edge of traveled way of the intersecting roadway.

If a limit line is used in conjunction with a STOP sign, it should ordinarily be placed in line with the STOP sign. However, if the sign cannot be located exactly where vehicles are expected to stop, the limit line should be placed at the stopping point.

The word "STOP", in 2.44 m letters, may be placed on the pavement in advance of the limit line. A limit line shall be placed on paved approaches and a "STOP" pavement marking should be placed on all but minor approaches to State highways not controlled by signals.

Typical limit line markings are shown in Figure 6-33, TYPICAL INTERSECTION MARKINGS.

#### 6-02.12 Crosswalks and Crosswalk Lines

The principles and practices described in this section apply to pedestrian crossings, in general, but may apply to other types of crossings, such as equestrian, bicycles, etc. This section does not apply to school crosswalks which are described more completely in Chapter 10, SCHOOL AREA PEDESTRIAN SAFETY, of this manual.

Pedestrian crosswalk markings may be placed at intersections, representing extensions of the sidewalk lines, or on any portion of the roadway distinctly indicated for pedestrian crossing (CVC 275).

Crosswalk markings serve primarily to guide pedestrians into the proper path. Pedestrian crosswalk markings should not be used indiscriminately.

Pedestrian crosswalk markings may be installed where they are advisable to channelize pedestrians into the preferred path at intersections when the intended course is not readily apparent or when in the opinion of the engineer, their presence would minimize pedestrian-auto conflicts.

In general, crosswalks should not be marked at intersections unless they are intended to channelize pedestrians. Emphasis is placed on the use of marked crosswalks as a channelization device.

The following factors may be considered in determining whether a marked crosswalk should be used:

- Vehicular approach speeds from both directions.
- Vehicular volume and density.
- Vehicular turning movements.
- Pedestrian volumes.

- Roadway width.
- Day and night visibility by both pedestrians and motorists.
- Channelization is desirable to clarify pedestrian routes for sighted or sight impaired pedestrians.
- Discouragement of pedestrian use of undesirable routes.
- Consistency with markings at adjacent intersections or within the same intersection.

Crosswalk markings may be established between intersections (mid-block) in accordance with CVC 21106(a). Warning signs should be installed and adequate visibility provided by appropriate measures such as parking prohibitions.

Mid-block pedestrian crossings are generally unexpected by the motorist and should be discouraged unless, in the opinion of the engineer, there is strong justification in favor of such installation. Particular attention should be given to roadways with two or more traffic lanes in one direction as a pedestrian may be hidden from view by a vehicle yielding the right-of-way to a pedestrian.

Crosswalk markings, when used, should be solid white lines not less than 300 mm (12 inches) wide, marking both edges of the crosswalk. The lines should extend across the full width of pavement to discourage diagonal walking. A crosswalk should provide at least 1.82 m of clear width between the lines.

Diagonal or longitudinal lines may be placed within the crosswalk markings. These lines should be approximately 300 to 600 mm wide and spaced 300 to 600 mm apart. When diagonal or longitudinal lines are used to mark a crosswalk,

the transverse crosswalk lines may be omitted; except when the factor that determined the need to mark a crosswalk is the clarification of pedestrian routes for sight-impaired pedestrians, the transverse crosswalk lines shall be marked.

At controlled approaches, limit lines (stoplines) help to define pedestrian paths and are therefore a factor the engineer may consider in deciding whether or not to mark the crosswalk.

Where it is desirable to remove a marked crosswalk, the removal may be accomplished by repaving or surface treatment. A marked crosswalk should not be eliminated by allowing it to fade out or be worn away. The worn or faded crosswalk retains its prominent appearance to the pedestrian at the curb, but is less visible to the approaching driver.

Signs may be installed at or adjacent to an intersection directing that pedestrians shall not cross in a crosswalk indicated at the intersection in accordance with CVC 21106(b).

White PED XING pavement markings may be placed in each approach lane to a marked crosswalk, except at intersections controlled by traffic signals or STOP or YIELD signs.

#### 6-02.13 Parking Stall Markings

Parking stall markings shall be white. The marking of parking stalls on urban streets encourages more orderly and efficient use of parking areas. These markings tend to prevent encroachment on fire hydrant zones, bus stops, loading zones, approaches to corners, clearance spaces for islands and other zones where parking is prohibited.

The placement and maintenance of parking stalls is the responsibility of the local agency. An exception to the above practice may be made when State highway resurfacing projects obliterate existing parking stall lines.

The desirable dimensions of parking stalls are 2.4 m by 7.3 m, with a minimum length of 6.1 m.

At all intersections, one stall length on each side measured from the crosswalk or end of curb return should have parking prohibited. A clearance of 1.83 m measured from the curb return should be provided at alleys and driveways. At signalized intersections, parking should be prohibited for a minimum of two stall lengths on the near side and one stall length on the far side. See Figure 6-35, TYPICAL PARKING STALL MARKINGS.

Diagonal parking stalls are not permitted on State highways.

#### 6-02.14 Pavement Word and Symbol Markings

Word and symbol markings on the pavement may be used for the purpose of guiding, warning, or regulating traffic. They normally supplement standard signing. They should be limited to not more than a total of three lines of information, except as noted in Chapter 10, SCHOOL AREA PEDESTRIAN SAFETY, of this manual, they shall be white in color and should be no more than one lane in width.

Where a turning movement is mandatory, an arrow marking accompanied by a regulatory sign shall be used. When an additional clearly marked lane is provided (CVC 22101), the sign is not required. Signs or markings should be repeated in advance of mandatory turn lanes when necessary to prevent entrapment and to help motorists select the appropriate lane before reaching the end of the line of waiting vehicles.

Pavement markings should be 2.44 m or more in height. When the message consists of more than one word, it should read "up", i.e., the first word should be nearest to the driver.

The space between words should be at least four times the height of the characters for low speed roads, but not more than ten times the height

of the characters. The space may be reduced appropriately where there is limited space because of local conditions.

Since excessive use of pavement markings can result in driver confusion, the number of different word and symbol markings should be minimized.

The word "STOP" shall not be used on the pavement unless accompanied by a limit line (stop line) and STOP sign. See Figure 6-36, TYPICAL PAVEMENT LEGEND MARKINGS.

#### 1. EXIT RAMP ARROWS

A minimum of two pavement arrows shall be placed on each freeway exit ramp lane.

A Type V arrow shall be the first arrow, on the ramp, in the direction of travel when exiting the freeway.

Where a mandatory movement is required, a Type I, II, III, IV, VII, or VIII arrow shall be placed with its point approximately 6.10 m preceding the limit line, crosswalk or "STOP" pavement legend. Where no mandatory movement is required, a Type V arrow shall be used at this location.

All other additional arrows, when used, shall be a minimum of 7.32 m in length.

All arrows shall be placed in the center of the lane and spaced approximately 30 to 90 m apart. The actual position and spacing should be determined in the field to provide the optimum visibility for traffic that may attempt to enter the exit ramp in the wrong direction.

See Figures 6-26 through 6-31, TYPICAL ENTRANCE / EXIT RAMP TERMINAL SIGNING AND PAVEMENT MARKINGS and Figure 6-37, TYPICAL PAVEMENT SYMBOL AND ARROW MARKINGS and Figure 6-38, TYPICAL PAVEMENT ARROW MARKINGS.

## 2. ENTRANCE RAMP ARROWS

A minimum of one Type I arrow, not less than 5.49 m in length, shall be positioned in the center of each freeway entrance ramp lane so that it is clearly in view of a right-way driver. The distance between arrows, when more than one per lane is needed, should be 30 to 90 m. The Type V arrow should not be used on entrance ramps. See Figures 6-26 through 6-31, TYPICAL ENTRANCE/EXIT RAMP TERMINAL SIGNING AND PAVEMENT MARKINGS and Figures 6-37, TYPICAL PAVEMENT SYMBOL AND ARROW MARKINGS and Figure 6-38, TYPICAL PAVEMENT ARROW MARKINGS.

Additional information on signing of ramp terminals is shown in Chapter 4, Section 4-05, RAMP TERMINAL SIGNING, of this manual.

## 3. TURN LANE ARROWS

One directional arrow, a minimum of 2.44 m in length, shall be placed in the center of each turning lane near the point of entrance. High approach speeds may justify the use of a longer arrow. Two or more arrows may be placed in long turning lanes. See Figure 6-19, TYPICAL TWO-WAY LEFT-TURN LANES and Figure 6-20, TYPICAL LEFT-TURN CHANNELIZATION DELINEATION AND MARKINGS.

### 6-02.15 Curb Markings for Parking Restrictions

The policy for parking restrictions is shown in Chapter 8, TRAFFIC REGULATIONS, of this manual.

CVC Section 21458 specifies curb markings to indicate parking regulations. The colors for such markings are shown in Section 6-01.10, CURB MARKINGS.

Parking regulations must be covered by ordinance or order of the authority having jurisdiction over the street or highway.

The painting of the curb generally is done by local authorities.

### 6-02.16 HOV (High Occupancy Vehicle) Lane Markings

HOV lanes are lanes where usage is restricted to a class of vehicle occupancy. HOV lane assignments may be made on a full-time or part-time basis. Freeway mainline HOV lanes can be operated as physically separated, buffer separated, reversible, contiguous, or as contra-flow facilities. HOV lanes can also be operated on county roads or city streets.

The striping pattern for the lane lines between the HOV lane and the adjacent normal flow lanes will vary depending on the condition. See HOV GUIDELINES and RAMP METER DESIGN GUIDELINES published by Caltrans for the appropriate HOV lane line striping patterns and markings.

### 6-02.17 Highway Markings and Signs Where Speed is Enforced by Aircraft

The California Highway Patrol patrols certain highways with both helicopters and fixed-wing aircraft. The purpose of the patrol is to monitor traffic, provide motorist assistance and initiate appropriate enforcement action.

In order to make the air patrol effective, the California Highway Patrol and Caltrans have agreed upon markings and signs as shown in Figure 6-39, TYPICAL SIGNING AND MARKINGS FOR HIGHWAYS WHERE SPEED IS ENFORCED BY AIRCRAFT.

#### 6-02.18 Railroad and Light Rail (Trolley) Grade Crossing Markings

Pavement markings in advance of a railroad grade crossing shall consist of an "X", the letters "RR", a no-passing marking (2-lane roads), and certain transverse lines. Identical pavement markings shall be placed in each approach lane on all paved approaches to railroad grade crossings and all light rail grade crossing where automatic gates or flashing lights are present.

Pavement markings and no-passing zone markings may be omitted at exempt railroad grade crossings as provided in CVC 22452 and 22452.5.

Typical railroad crossing pavement markings are shown in Figures 6-40, RAILROAD CROSSING PAVEMENT MARKINGS, 6-41, TYPICAL RAILROAD CROSSING PAVEMENT MARKINGS (Near Highway Intersections), and 6-42, TYPICAL RAILROAD CROSSING PAVEMENT MARKINGS (Near Minor Road and Highway Intersections).

#### 6-02.19 Divided Highway Illusion

There are certain situations that may lead motorists to think they are on one-way roadways when in fact they are on two-lane, two-way highways. They may drive on the wrong side of the road without realizing that they are running the risk of a head-on collision with opposing traffic.

This situation is most prevalent on construction sites where a two-lane highway is being converted to a freeway or expressway and grading for the full width has been completed, and on two-lane, two-way highways between or following long sections of freeway.

Where this illusion exists, Type V arrows and warning signs as shown in Figure 6-43, TREATMENT FOR DIVIDED HIGHWAY ILLUSION, should be installed. Minor modifications to suit specific situations may be made.

## Special Pavement Treatments 6-03

### 6-03.1 Advance Markers - Exit Ramps

A 3-2-1 countdown pattern of one-way clear reflective pavement markers may be used to help motorists locate exit ramps in heavy fog areas.

The pattern consists of three markers placed on the right shoulder about 630 m in advance of the neutral area (gore), two markers at about 420 m and one marker at about 210 m. The markers are placed on a line perpendicular to the laneline at 0.3 m spacing beginning 50 mm off the edge of traveled way.

### 6-03.2 Rumble Strips

Rumble strips are bands of raised material or indentations formed or grooved in the traveled way on the centerline, or shoulders. Rumble strips call the motorist's attention to standard warning or regulatory devices or otherwise alert drivers by transmitting sound and/or vibration through the vehicle.

Rumble strips may be used in the traveled way on California's streets and highways if standard traffic control devices have been thoroughly evaluated and documented and the traffic engineer considers their use as the optimal solution to the identified problem.

Centerline rumble strips may be used on the state highway system. Traffic engineers may consider the use of this low cost improvement in response to observed or potential cross centerline collisions. Types of centerline rumble strips include: barrier strips with raised profile thermoplastic traffic strips, rumble strips (raised or ground in) within centerline buffer zones, surface mounted channelizers on a centerline buffer zone, black raised pavement markers on the centerline, etc.

The use of rumble strips on State highways requires approval by the District Traffic Engineer. Requests should include a description of location,

reasons for use, the alternatives which were considered, collision history and a discussion of standard traffic control devices which have been or are in place.

#### 1. TRAVELED WAY RUMBLE STRIPS

Rumble strips on the traveled way are 19 mm or less in height if raised, 25 mm or less in depth if rolled in indentations, 8.5 mm +/- 1.5 mm if ground in indentations and generally extend across the travel lanes.

There are several significant disadvantages to the use of rumble strips across the travel lanes. These include:

- An abrupt rise or depression in the roadway can present problems to bicyclists and motorcyclists. For this reason, there should be provisions made for cyclists to safely traverse through or around rumble strips or to use rumble strips which have been tested and demonstrated to be "bicycle friendly".
- Nearby residents may be subjected to continuous noise and vibration in residential areas prompting citizen's complaints.
- All motorists are subjected to the noise and vibration whereas only a few are in need of this effect to be alerted.
- Motorists may make unusual maneuvers to avoid rumble strips.

Typical locations where rumble strips on the traveled way have been used include:

- End of a freeway.
- In advance of toll booths.

- Within a construction zone in advance of the workers.
- In advance of a "T" Intersection where the motorist is not expecting to stop.

## 2. SHOULDER RUMBLE STRIPS

Shoulder rumble strips are 19 mm or less in height if raised, 25 mm or less in depth for rolled in indentations and 8.5 mm +/- 1.5 mm for ground in indentations. The maximum width of shoulder rumble strips is 300 mm for both rolled in and ground in indentations. Typically they should be placed at 150 mm from the edge of traveled way but may be moved to 300 mm to avoid longitudinal joints, paving tapers, etc. Shoulder rumble strips should never be ground or rolled into bridge decks or bridge approach slabs, if rumble strips are to be installed along a segment of highway and are needed across these locations they should be installed using a suitable raised or inverted profile thermoplastic.

Where bicycles are permitted, shoulder rumble strips should not be used unless approximately 1.5 m of clear shoulder width for bicycle use is available between the rumble strips and the outer edge of the shoulder. If shoulder width is less than 1.5 mm and rumble strips are required then only raised and inverted profile thermoplastic stripe shall be used.

Research findings indicate that the use of rumble strips on shoulders of freeways in remote areas may reduce drift-off-road accidents. The rumble strips may consist of grooves rolled into the hot mix as part of a resurfacing project, ground in indentation in Portland Concrete Cement or Asphalt Concrete in existing roadway shoulders, or the application of a raised and inverted profile thermoplastic. When freeways in remote areas are to be resurfaced, consideration should be given to the drift-off-road problem and any related collisions history for the subject roadway and the use of rumble strips considered.

Table 6-1, Rumble Strip Installation Guide, may be used by the District Traffic Engineer to determine the appropriate rumble strip treatment for various shoulder types.

**Table 6-1  
RUMBLE STRIP INSTALLATION GUIDE**

RUMBLE STRIP TREATMENT	RUMBLE STRIP DEPTH (mm)	SHOULDER TYPE	BICYCLES PERMITTED	SHOULDER WIDTH
Rolled in Rumble Strip Treatment Standard Plan A40A	25	ACC Only	YES	1.5 meters minimum
			NO	1.2 meters minimum
Ground In Rumble Strip Treatment Standard Plan A40B	8 (+/- 1.5)	ACC and PCC	YES	1.5 meters minimum
			NO	1.2 meters minimum
Raised and Inverted Profile Thermoplastic	N/A	ACC and PCC	YES	No minimum
			NO	No minimum
Centerline Ground In Rumble Strip Treatment Experimental	8 (+/- 1.5)	ACC and PCC	N/A	N/A

NOTE: Ground In Rumble Strip Treatments that are greater than 8.5 mm +/- 1.5 mm in depth shall not be installed on shoulders where bicyclists are allowed.

### 6-03.3 Contrast Treatment

Contrast treatment of the pavement surface may be used to reduce motorist confusion where surface texture changes in transition areas, such as from concrete to asphalt.

Contrast treatment should be placed to provide square endings across the traffic lanes to avoid the feathering out that may lead a motorist out of the proper traffic lane.

This treatment may be used for roadways, auxiliary lanes, exit ramps and other locations

### 6-03.4 Location Markers - Fire Hydrants

Blue raised reflective pavement markers, although not an official traffic control device, may be placed on a highway, street, or road, to mark fire hydrant and/or water supply locations. They shall not be used for any other purpose.

Local agencies shall not place blue reflective pavement markers on a State highway unless they first obtain an encroachment permit from the

Department of Transportation. The agency responsible for the placement will also be responsible for the maintenance and replacement. See Section 13060, of the Health and Safety Code.

In general, the blue reflective pavement markers should be placed 150 mm from the centerline stripe, or approximate center of the pavement where there is no centerline stripe, on the side nearest the fire hydrant.

When placed on expressways, freeways and freeway ramps, they should be placed on the shoulder, 0.31 m to the right of the edgeline, opposite the fire hydrant. Typical marker locations are shown on Figure 6-44, TYPICAL FIRE HYDRANT LOCATION PAVEMENT MARKERS.

Because fire hydrants adjacent to freeways may be out of the right-of-way and, in many locations, out of view from the freeway, some fire districts may want to install small supplemental signs or markings to identify the hydrant number or distance to the hydrant. These installations are optional and at the discretion of the District Division Chief for Operations.

## Delineators 6-04

### 6-04.1 Introduction

Delineators are retroreflective devices mounted at the side of the roadway, in series, to indicate the roadway alignment. Delineators are effective aids for night driving and under other conditions of reduced visibility. They are devices to guide rather than warn. Delineators may be used on long continuous sections of highway or through short stretches where there are changes in horizontal alignment, particularly where the alignment might

be confusing, or at pavement width transitions. An important advantage of delineators is that they remain visible when the roadway is wet or snow covered.

Delineators are normally placed in the ground outside of the edge of pavement. Where delineation is required within a paved area, surface mounted channelizers may be used. See Section 6-06, CHANNELIZERS.

Installations should be inspected at night to ensure that there are no confusing or misleading delineators.

### 6-04.2 Delineator Design

Delineators shall consist of retroreflector units capable of clearly reflecting light under normal atmospheric conditions from a distance of 300 m when illuminated by the upper beam of standard automobile lights. The size of retroreflector units shall be a minimum of 75 mm x 300 mm for the front, and when applicable, 75 mm x 75 mm for the back.

There are two classes of delineator posts and several types of retroreflectorization as shown in Figure 6-45, TYPICAL DELINEATORS.

### 6-04.3 Delineator Application

Delineation is intended to be a clear and simple guide to the motorist regarding alignment of the highway.

The color of the delineator retroreflectors shall conform to the color of edgelines except for the use of yellow on the right at narrow bridges and red at truck escape ramps.

Examples of the use of delineators are shown in Figure 6-45, TYPICAL DELINEATORS. Color exceptions, are shown in Figure 6-48, NARROW BRIDGE SIGNING AND MARKINGS and Figure 6-49, TYPICAL RUNAWAY TRUCK RAMP SIGNING AND MARKINGS.

#### TYPICAL DELINEATORS AND USES:

- Type E - White Retroreflector (2 Sided). For use on the left or right of 2-lane 2-way streets and highways when it is desirable to have a reflector on the front, and one on the back of the delineator facing the opposite direction of traffic.
- Type F - White Retroreflector (1 Sided). For use on the right of freeways and expressways. They may also be used on 2-lane 2-way streets and highways when the Type E is not needed.
- Type G - Yellow Retroreflector (1 Sided). For use on the left of divided highways and 2-lane highway intersections as shown in Figure 6-46, TYPICAL EXAMPLES OF DELINEATOR PLACEMENT WHEN USED AT INTERSECTIONS, ISLANDS, RAMPS AND CONNECTORS.
- Type I - Yellow Retroreflector (2 Sided). For use at approaches to narrow bridges as shown in Figure 6-48, NARROW BRIDGE SIGNING AND MARKINGS.
- Type J - Red Retroreflector (1 Sided). For placement on both sides of Truck Escape Ramps as shown in Figure 6-49, TYPICAL RUNAWAY TRUCK RAMP SIGNING AND MARKINGS.

Delineators with the appropriate retroreflector color are used to indicate the narrowing of the pavement where either an outside or inside lane merges into an adjacent lane. The delineators should be used adjacent to the lane affected for the full length of the convergence and should be so placed and spaced to show the width reduction as shown in Figure 6-15, TYPICAL LANE REDUCTION TRANSITION.

### 6-04.4 Delineator Placement and Spacing

Delineators, when used, shall be mounted so that the top of the retroreflector is about 1.2 m above the edge of traveled way. They shall be placed 0.61 to 1.83 m outside the outer edge of the shoulder, or if appropriate, in the line with the guardrail post.

Delineators should be placed at a constant distance from the edge of the roadway except that, where a guardrail or other obstruction intrudes into the space between the pavement edge and the extension of the line of delineators, the delineators should be in line with or taper to inside the innermost edge of the obstruction. See Figure 6-45, TYPICAL DELINEATORS.

Unless local conditions justify otherwise, delineators shall be placed on all State highways and should be provided on all city and county roads as follows:

- a. On the outsides of highway curves of 914 m radius or less (including medians in divided highways), freeway exit and entrance ramps and connectors. Exception to this, is where a median barrier is delineated as shown in the Median Barrier Delineation Detail in Figure 6-50, TYPICAL MEDIAN BARRIER DELINEATION AND CHANNELIZERS. Delineator spacing on curves is shown in Figure 6-47, DELINEATOR SPACING ON CURVES.
- b. On the right of tangent sections of freeway entrance and exit ramps, collector roads, freeway connectors and lane reduction transition sections at 60 m spacing.
- c. On embankments higher than 3.0 m and with side slopes steeper than 1:4. Delineator spacing is approximately 160 m.
- d. On approaches to narrow bridges as shown in Figure 6-48, NARROW BRIDGE SIGNING AND MARKINGS.
- e. On tangent sections of rural State highways where there are no reflective pavement markers, such as in snow areas. Delineator spacing is approximately 160 m.
- f. On all new guardrail or bridgerail installations, or when maintenance is required on existing guardrail or bridgerail, within 3.66 m of the edge of traveled way and curves of 900 m radius or less. The spacing on tangent sections is approximately 160 m. For spacing on curves, see Figure 6-47, DELINEATOR SPACING ON CURVES.

Delineators may also be placed as follows:

- a. At intersections, road approaches, and median openings, as shown in Figure 6-46, TYPICAL EXAMPLES OF DELINEATOR PLACEMENT WHEN USED AT INTERSECTIONS, ISLANDS, RAMPS AND CONNECTORS.
- b. On sections of highway with non-standard shoulder width.

Where normal uniform spacing is interrupted by driveways, intersections, etc., delineators may be moved a distance not exceeding 1/4 of the normal spacing. If they still fall within such areas, the delineator should be eliminated.

Delineator spacing should be adjusted on approaches to and throughout horizontal curves so that several are always visible to the motorist. On short radius curves, it may be necessary to adjust the delineator several degrees toward the roadway so that it is perpendicular to the line of oncoming traffic.

## Miscellaneous Delineators

### 6-04.5 Culvert Markers

Culvert markers may be placed on both sides of the highway at those culverts where they are necessary. They should be so placed as not to interfere with a line of delineators and shall not be reflectorized, or contain kilometer post marker information. Further information on culvert markers is shown in the Caltrans Maintenance Manual chapter on TRAFFIC SAFETY DEVICES.

### 6-04.6 Kilometer Post Markers

Procedures and responsibilities for establishing postmile values and placing markers on State highways are described in Chapter 3, ACCIDENT AND ROADWAY RECORDS, Kilometer Post Markers, of this Manual.

### 6-04.7 Emergency Passageway Marker

Where freeway median passageways are provided for emergency vehicles, delineation for the crossover should be as follows:

- a. At a point, 320 m in advance of the crossover, one Class 1 Delineator, with a yellow post and two 75 mm x 300 mm white retroreflectors stacked vertically (600 mm of white retroreflectance), should be placed on the left side of the through roadway facing approaching traffic.
- b. At a point, 160 m in advance of the crossover, one Class 1 Delineator, with a yellow post and two 75 mm x 300 mm yellow retroreflectors stacked vertically, should be placed on the left side as in (a).
- c. At the far side of the crossover, one Class 1 Delineator, with a yellow post and one 75 mm x 300 mm white retroreflector over one 75 mm x 300 mm yellow retroreflector stacked vertically, should be placed on the left side as in (a).

The need and location of emergency markers may be coordinated between the emergency agency and the Department. See Chapter 7, TRAFFIC SAFETY SYSTEMS of this manual, for a discussion of emergency passageways.

### 6-04.8 Narrow Bridge Signing and Marking

The placement of warning signs, object markers, delineators, and edgelines at narrow bridges is dependent upon the width of the bridge and approach roadway. Narrow bridge signing and marking shall conform to the details shown in Figure 6-48, NARROW BRIDGE SIGNING AND MARKINGS.

### 6-04.9 Median Barrier Delineation

Median barriers should be delineated when the clearance between the barrier and the edge of traveled way is less than 2.44 m.

In general, when delineated, it should be with an approved median barrier marker, the same color as the left edgeline. They should be placed on top of the barrier at 14.64 m centers.

Markers placed on the sides of barriers, near the splash zone, should be avoided because of the tendency to collect dirt which reduces their effectiveness. See Figure 6-50, TYPICAL MEDIAN BARRIER DELINEATION AND CHANNELIZERS.

## Object Markers 6-05

### 6-05.1 Object Marker Design

Object markers are used to mark obstructions within or adjacent to the roadbed (including paved shoulders). When used, object markers shall be one of the following types:

- **Type K Marker**  
A 150 mm x 300 mm target plate of yellow retroreflective sheeting or three each, yellow acrylic cube-corner retroreflectors (each with a minimum dimension of approximately 75 mm) on a 150 mm x 375 mm white target plate. The marker may be mounted either horizontally or vertically as shown on Figure 6-51, TYPICAL OBJECT MARKERS.
- **Type Q Marker**  
A vertical tubular marker, with a height of 450 to 600 mm, a minimum cross sectional dimension of 56 mm and either three each, 75 mm bands of yellow retroreflective sheeting or a 225 mm band of yellow retroreflective sheeting. See Figure 6-51, TYPICAL OBJECT MARKERS. The Type Q marker may be used to emphasize objects within the roadway, for example, curb noses, where it is desirable that the marker is visible from all directions.
- **Type L Marker**  
Type L-1, a strip of 150 mm x 300mm yellow retroreflective sheeting or three each, yellow acrylic cube-corner retroreflectors (each with a minimum dimension of approximately 75 mm) on a 200 mm x 600 mm, white target plate. Type L-2, a 150 mm x 300mm all yellow retroreflective sheeting target plate. See Figure 6-51, TYPICAL OBJECT MARKERS for installation details.
- **Type N Marker**  
A 450 mm x 450 mm diamond marker.  
**Yellow** - Yellow retroreflective sheeting background or nine each, yellow acrylic cube-corner retroreflectors, each with a minimum dimension of approximately 75 mm, mounted symmetrically on a non-reflective yellow panel.  
**Orange** - Used in construction zones. Background shall be orange retroreflective sheeting.  
**Red** - Used in end of roadway situations as set forth in Section 6-05.4, END OF ROAD (Street). Red retroreflective sheeting background or nine each, red acrylic cube-corner retroreflectors, each with a minimum dimension of approximately 75 mm, mounted symmetrically on a non-reflective red panel.  
The Type N marker may be larger than 450 mm where conditions warrant. See Figure 6-52, TYPICAL OBJECT MARKERS.
- **Type P Marker**  
A 300 mm x 900 mm vertical rectangular marker with alternating opaque black and retroreflective yellow stripes sloping downward at an angle of 45½ toward the side of the obstruction on which traffic is to pass.  
Type P markers with retroreflective orange and white stripes are used in construction zones. See Figure 6-52, TYPICAL OBJECT MARKERS.
- **Type R Marker**  
A 600 mm x 750 mm vertical rectangular marker with alternating opaque black and retroreflective yellow stripes (chevrons) sloping downward at an angle of 45½ toward each side of the sign. See Figure 6-52, TYPICAL OBJECT MARKERS.

### 6-05.2 Objects Within the Roadbed

Objects in a paved area, within 2.44 m of the traveled way, are marked with a Type P or R marker. For additional emphasis, a large surface such as a bridge pier may be painted with diagonal stripes, 300 mm or greater in width, similar in design to the Type P or R marker.

The Type P marker should be in line with the edge of the obstruction. If the Type P marker is located behind the guardrail, all of the marker panel should be visible to approaching traffic.

In addition to markings on the face of an object in the roadway, appropriate pavement markings shall be used to guide traffic on the approach to the obstruction set forth in Section 6-02.10, APPROACH TO AN OBSTRUCTION.

Where the vertical clearance of an overhead structure is less than 0.31 m above maximum legal vehicle height, the clearance in feet and inches should be clearly indicated on the structure. See VERTICAL CLEARANCE (W34B) sign in Chapter 4, SIGNS, of this manual.

### 6-05.3 Objects Adjacent to the Roadbed

In determining the need for marking objects adjacent to the roadbed, consideration should be given to driver expectancy based on the driving environment.

Objects outside of the paved shoulder, within 3.66 m of the traveled way, are marked with a Type L marker. These may include underpass piers, bridge abutments, handrails, culvert headwalls, utility poles, traffic signal poles, street light poles on nonbreakable bases, trees and the beginning of a dike, curb or guardrail at the edge of traveled way or shoulder.

In some cases, a physical object may not be involved, but other roadside conditions such as narrow shoulders, drop-offs, neutral areas, small islands, and abrupt changes in roadway alignment

may justify special consideration. Type L markers are for use at such locations and should be approximately in line with the edge of the obstruction.

Type L markers can be placed in front of, alongside of, or attached to the object. Where objects are very close together, only the first object may need to be marked. Standard warning signs should also be used where applicable.

The need to make drivers aware of the object is the major consideration in determining the need to mark objects adjacent to the pavement. Special attention should be given objects in traversable areas adjacent to the pavement where drivers are likely to leave the road intentionally or unintentionally. Engineering judgment may indicate that the need for marking objects is greater where the objects are closer to the roadbed, increased speeds, lanes are narrow, special roadway geometry exists (vertical or horizontal curves, pavement constrictions, etc.) or the collision history demonstrates a need. Conversely, engineering judgment may indicate that the need for marking is less where parking is common, the roadside is well lighted, the object is located behind a dike, curb or similar feature, or the object is closely spaced behind a marked object.

### 6-05.4 End of Road (Street)

A red Type N marker shall be used at the end of a road or cul-de-sac street where there is no alternate vehicular path. The minimum mounting height to top of this marker shall be 1.22 m. More than one marker or a larger one may be used where conditions warrant. See Type N marker details shown in Figure 6-52, TYPICAL OBJECT MARKERS.

The END (W31) sign may be used above and on the same post as the red Type N marker. The ROAD/STREET ENDS \_\_\_ FEET (W31A) sign may be used in advance with the appropriate distance shown on the sign.

## Channelizers 6-06

### 6-06.1 Introduction

Channelizers are flexible retroreflective devices for installation within the roadway to discourage motorists from crossing a line or area of the roadway. They are generally used in series to create a visual fence/barrier. Unlike delineators, which indicate the roadway alignment, channelizers are intended to provide additional guidance and/or restriction to traffic by supplementing pavement markings and delineation. They may also be used to warn and alert drivers of hazards near the traveled way, and to guide and direct traffic. Channelizers may be used for additional emphasis to discourage illegal median crossings at traffic islands and at Bus-Carpool lane separations.

### 6-06.2 Channelizer Design

The retroreflective unit used on channelizers shall be a minimum of 75 mm x 300 mm as shown on Figure 6-50, TYPICAL MEDIAN BARRIER DELINEATION AND CHANNELIZERS. The retroreflective unit shall be capable of clearly reflecting light under normal atmospheric conditions from a distance of 300 m when illuminated by the upper beam of standard automobile lights.

Since channelizers require closer spacing, their post size requirements differ from those of delineators. The post shall be flexible with a 56 mm minimum width, except that the portion containing the retroreflective unit shall be a minimum width of 75 mm. The post shall be a minimum height of 900 mm above the pavement on State highways, except at locations where speeds are 64 km/h or less a minimum post height of 700 mm may be used.

There are two basic types of channelizers: one attaches to the pavement surface (usually by epoxy), and the other attaches to an anchoring device imbedded in the pavement. Both the base and

anchor systems are designed to permit replacement of the channelizer post. See Figure 6-50, TYPICAL MEDIAN BARRIER DELINEATION AND CHANNELIZERS.

### 6-06.3 Channelizer Application

The color of the channelizer retroreflective unit shall conform to that of the pavement marking which it supplements, with the following exceptions:

- Retroreflective units used in narrow bridge shoulder tapers shall be yellow as shown in Figure 6-48, NARROW BRIDGE SIGNING AND MARKING.
- Retroreflective units shall be white when used in construction and maintenance zones (posts shall be orange). See Chapter 5, CHANNELIZING DEVICES of this Manual.

### 6-06.4 Channelizer Placement and Spacing

Channelizers should be placed a minimum of 0.61 m from the traffic line, away from traffic, to allow for future maintenance of the line. Space limitations may dictate exceptions to this criteria. At certain locations, placement directly on the traffic line may be required.

Spacing of the channelizers depends on the type of facility where they are to be used, the speed and volume of traffic, and the alignment to be channelized. Spacing which results in a visual fence/barrier effect is a key factor in channelizer installation.

A maximum post spacing of 30 m is recommended on bus and carpool lanes where channelizers are used primarily to delineate the separation between the carpool lane and the main facility.

In locations where a relatively high number of violations of the separation occur, a post spacing of 7.5 m is recommended. Where barrier violations are relatively minimal, a post spacing of 15 m may be adequate. However, spacing in excess of 15 m

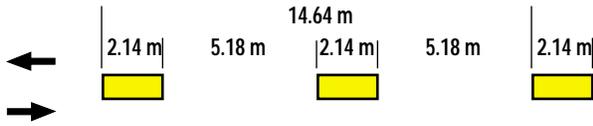
is of negligible value as a deterrent to intentional barrier violations.

Post spacing closer than 7.5 m should be considered on lower speed roads, urban streets and at specific locations such as traffic islands.

**Figure 6-1  
CENTERLINES - 2 LANE HIGHWAYS**

**FOR SPEED ZONES 60 KM/H OR LESS**

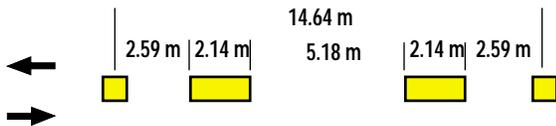
**DETAIL 1**



**POLICY**

Centerline pattern for use on two-lane streets and highways (normally used on local streets and highways).

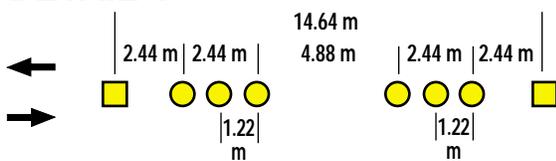
**DETAIL 2**



Centerline pattern with pavement markers for use on two-lane streets and highways.

**DETAIL 3  
(Deleted)**

**DETAIL 4**



Alternate to Detail 2. For use at problem locations where it is difficult to place and maintain centerline because of moisture, sand, etc.

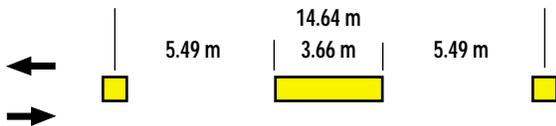
**FOR SPEED ZONES 70 KM/H OR MORE**

**DETAIL 5**



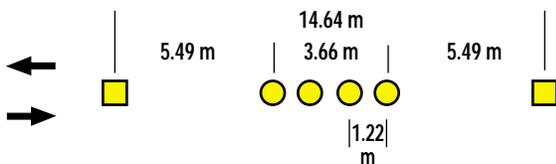
Centerline pattern for use on two-lane streets and highways (normally used on local streets and highways).

**DETAIL 6**



Centerline pattern with pavement markers for use on two-lane streets and highways.

**DETAIL 7**



Alternate to Detail 6. For use at problem locations where it is difficult to place and maintain centerline because of moisture, sand, etc.

**LEGEND**

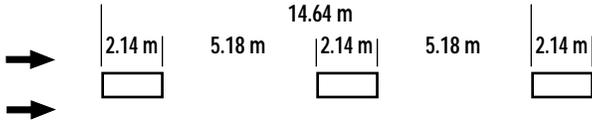
-  100 mm Yellow
-  Two-Way Yellow Reflective Markers
-  Direction of Travel
-  Non-Reflective Yellow Markers

NOT TO SCALE

**Figure 6-2  
LANELINES - MULTILANE HIGHWAYS**

**FOR SPEED ZONES 60 KM/H OR LESS**

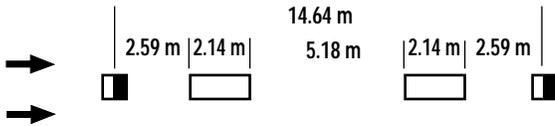
**DETAIL 8**



**POLICY**

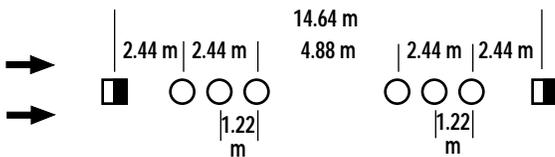
Laneline pattern for use on multilane streets and highways (normally used on local streets and highways).

**DETAIL 9**



Laneline pattern with pavement markers for use on multilane streets and highways.

**DETAIL 10**



Laneline pattern with pavement markers for use on multilane streets, highways and freeway ramps.

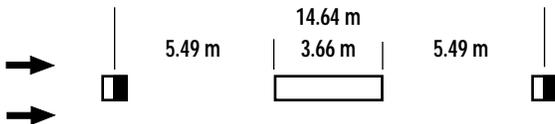
**FOR SPEED ZONES 70 KM/H OR MORE**

**DETAIL 11**



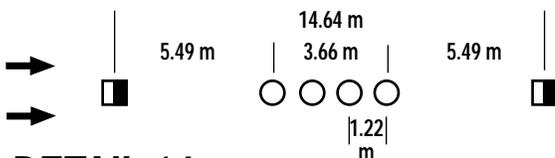
Laneline pattern for use on multilane streets and highways (normally used on local streets and highways).

**DETAIL 12**



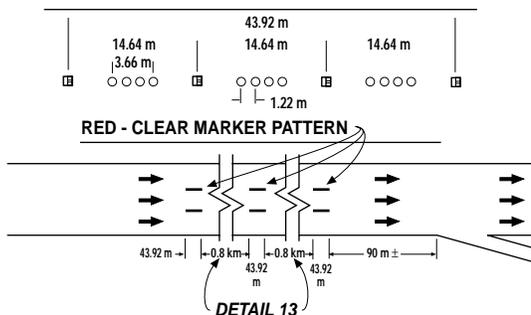
Laneline pattern with pavement markers for use on multilane conventional streets and highways.

**DETAIL 13**



Laneline pattern with pavement markers for use on State freeways, expressways, freeway ramps, freeway to freeway connectors and collector roads. See Detail 14.

**DETAIL 14**



Laneline pattern with red-clear pavement markers shall be use on freeways approaching exit ramps. Used with Detail 13, in a pattern of four red-clear pavement markers, at intervals as shown.

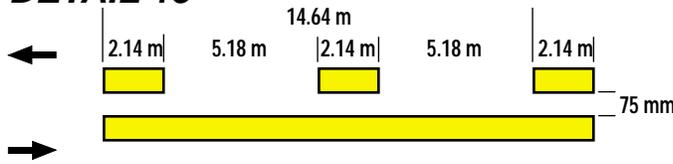
**LEGEND**

- 100 mm White
- One-Way Clear Reflective Markers
- Non-Reflective White Markers
- Red-Clear Reflective Markers
- Direction of Travel
- NOT TO SCALE**

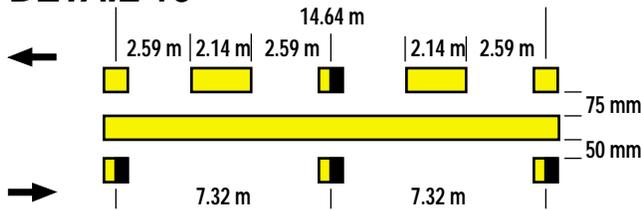
**Figure 6-3  
NO PASSING ZONES - ONE DIRECTION**

**FOR SPEED ZONES 60 KM/H OR LESS**

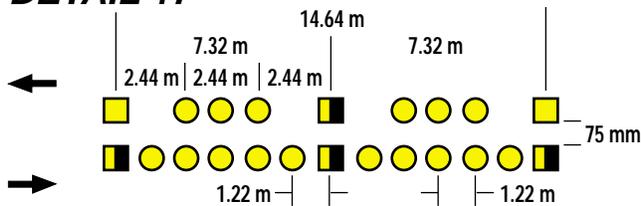
**DETAIL 15**



**DETAIL 16**

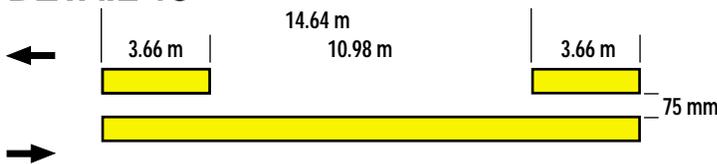


**DETAIL 17**

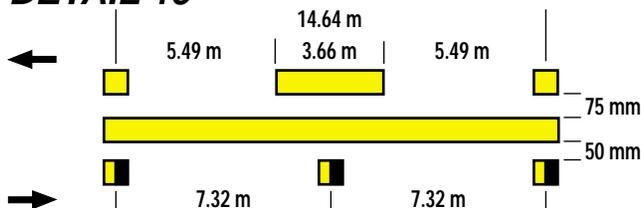


**FOR SPEED ZONES 70 KM/H OR MORE**

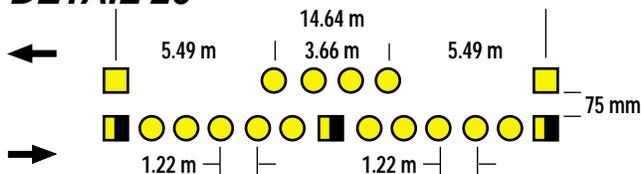
**DETAIL 18**



**DETAIL 19**



**DETAIL 20**



- NOTES:** 1. Pavement markers shown off the solid line in Details 16 and 19 may be placed on the line.  
2. A 75 mm black line shall be placed between the 100 mm yellow lines on State highways and may be placed on streets and highways under local jurisdiction.

**LEGEND**

- 100 mm Yellow
  - Two-Way Yellow Reflective Markers
  - Non-Reflective Yellow Markers
  - Direction of Travel
  - One-Way Yellow Reflective Markers
- NOT TO SCALE**

**POLICY**

One direction no-passing pattern for use on two-lane streets and highways (normally used on local streets and highways). See Note 2.

One direction no-passing pattern with pavement markers for use on two-lane streets and highways. See Notes 1 and 2.

Alternate to Detail 16. For use with Detail 4.

One direction no-passing pattern for use on two-lane streets and highways (normally used on local streets and highways). See Note 2.

One direction no-passing pattern with pavement markers for use on two-lane streets and highways. See Notes 1 and 2.

Alternate to Detail 19. For use with Detail 7.

**Figure 6-4  
NO PASSING ZONES - TWO DIRECTION**

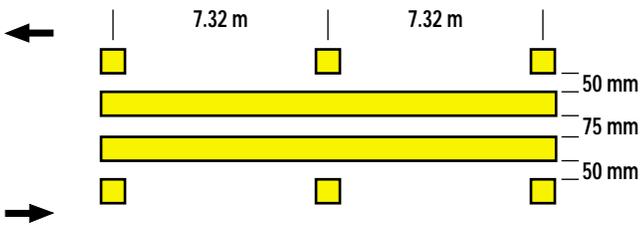
**DETAIL 21**

**POLICY**



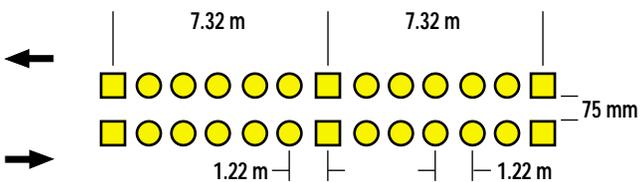
Two-direction no-passing pattern for use on two-lane streets and highways (normally used on local streets and highways). See Note 2.

**DETAIL 22**



Two-direction no-passing pattern with pavement markers for use on two-lane streets and highways. See Notes 1 and 2.

**DETAIL 23**



Alternate to Detail 22. For use with either Detail 4 or Detail 7.

- NOTES:**
1. Pavement markers shown off the solid line in Detail 22 may be placed on the line.
  2. A 75 mm black line shall be placed between the 100 mm yellow lines on State highways and may be placed on streets and highways under local jurisdiction.

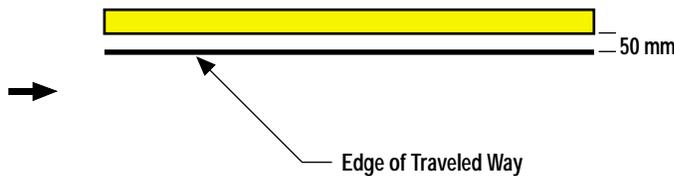
**LEGEND**

- 100 mm Yellow
- Two-Way Yellow Reflective Markers
- Direction of Travel
- Non-Reflective Yellow Markers

NOT TO SCALE

**Figure 6-5  
LEFT EDGELINES FOR DIVIDED HIGHWAYS**

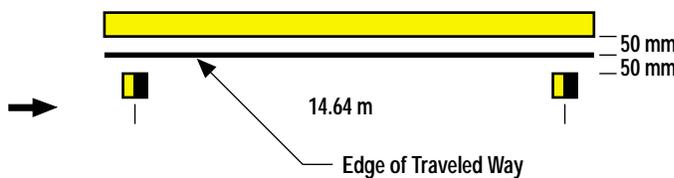
**DETAIL 24**



**POLICY**

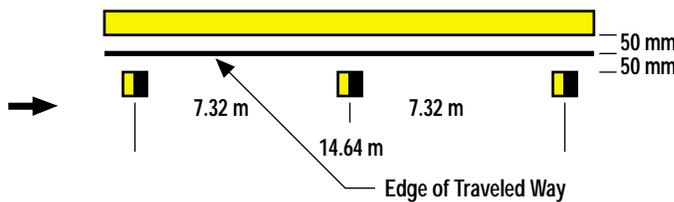
Left Edgeline pattern for use on streets and highways (normally used on local streets and highways).

**DETAIL 25**



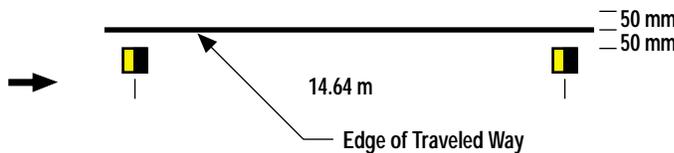
Left Edgeline for use on State highways.

**DETAIL 25A**



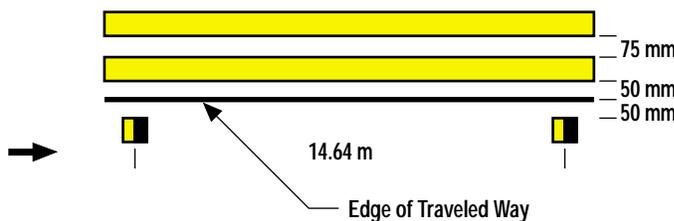
Left Edgeline for use on freeway ramps and connectors.

**DETAIL 26**



Alternate to Details 24 and 25 when there is adequate contrast between travelled way and shoulder.

**DETAIL 27**



Alternate to Detail 25. A double solid yellow line may be used for more emphasis when motorists tend to use the shoulder for a through lane, or where encroachments onto the shoulder occasionally occur. See Note 1.

**NOTE: 1.** A 75 mm black line shall be placed between the 100 mm yellow lines on State highways and may be placed on streets and highways under local jurisdiction.

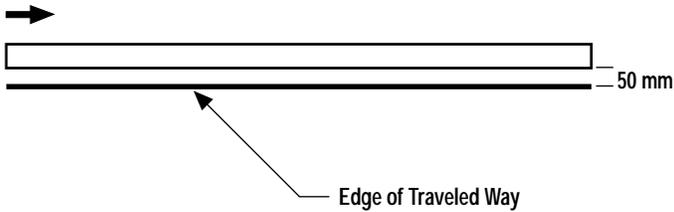
**LEGEND**

- 100 mm Yellow
- One-Way Yellow Reflective Markers
- Direction of Travel

NOT TO SCALE

### Figure 6-6 RIGHT EDGELINE AND RIGHT EDGELINE EXTENSION THROUGH INTERSECTIONS

#### DETAIL 27B Right Edgeline



#### POLICY

Right Edgeline pattern for use on all State highways may be used on local streets and highways. It is generally dropped at the beginning of the intersection flares on conventional highways. See also Detail 27C. On freeways, it may be flared in advance of the exit ramp as shown in Figure 6-27.

#### DETAIL 27C Right Edgeline Extension Through Intersections



Right Edgeline Extension Through Intersections pattern for use to extend the right edgeline through an intersection where climatic conditions, such as areas of heavy fog, may require additional guidance.

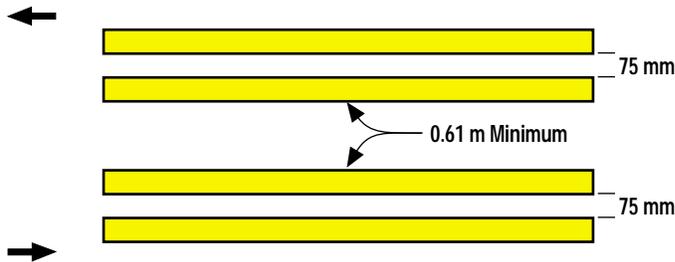
#### LEGEND



NOT TO SCALE

**Figure 6-7  
MEDIAN ISLANDS**

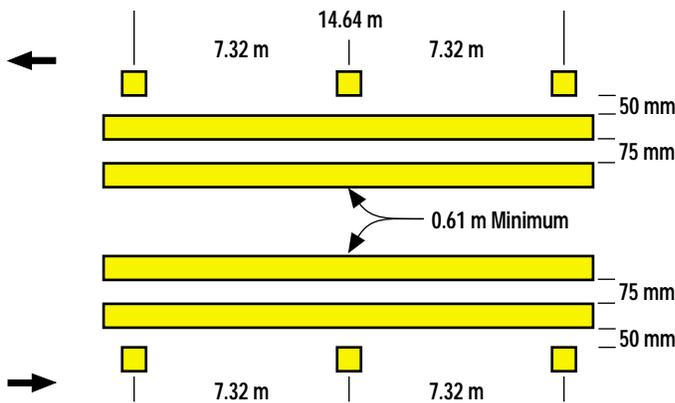
**DETAIL 28**



**POLICY**

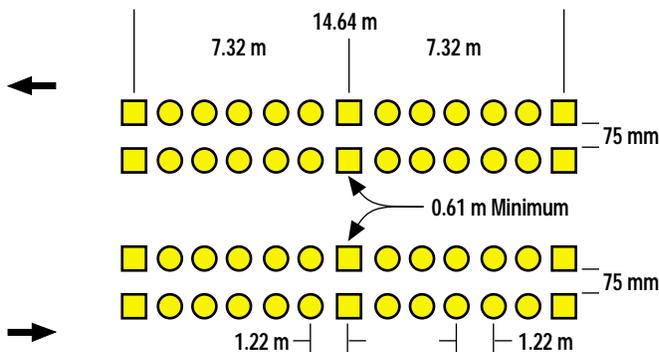
Double Left Edgeline pattern for use on all-paved sections of streets and highways (normally used on local streets and highways). See Note 2.

**DETAIL 29**



Double Left Edgeline pattern with pavement markers for use on all-paved sections of streets and highways. See Notes 1 and 2.

**DETAIL 30**



Alternate to Detail 29. For use at problem locations where it is difficult to place and maintain lines because of moisture, sand, etc.

- NOTES:**
1. Pavement markers shown off the solid line in Detail 29 may be placed on the line.
  2. A 75 mm black line shall be placed between the 100 mm yellow lines on State highways and may be placed on streets and highways under local jurisdiction.

**LEGEND**

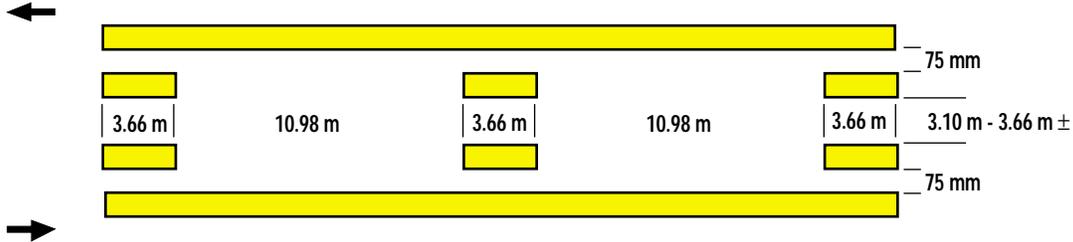
- 100 mm Yellow
- Two-Way Yellow Reflective Markers
- Direction of Travel
- Non-Reflective Yellow Markers

NOT TO SCALE

**Figure 6-8  
TWO-WAY LEFT-TURN LANES**

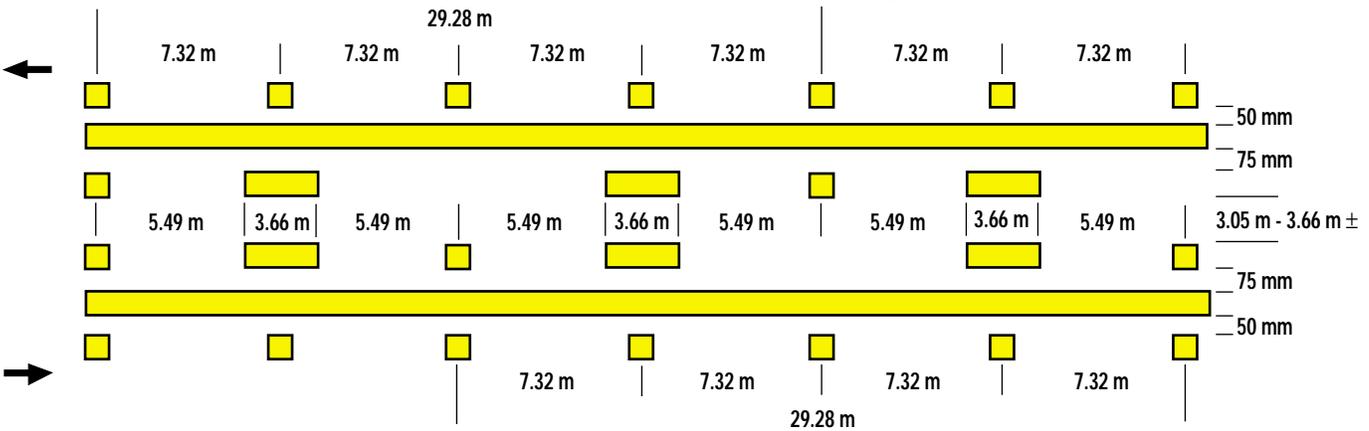
**DETAIL 31 POLICY**

Two-way left-turn lane pattern for use on streets and highways (normally used on local streets and highways). See Note 2.



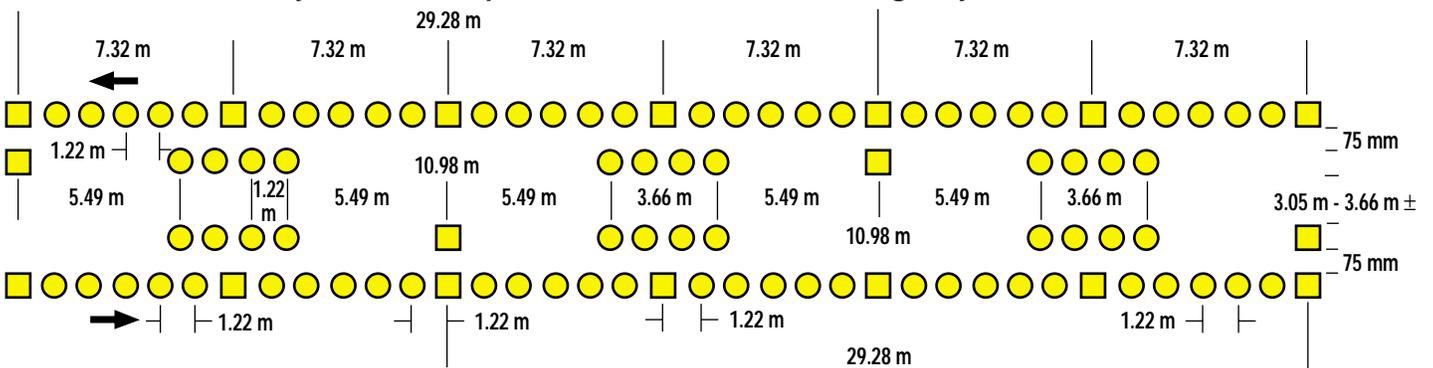
**DETAIL 32 POLICY**

Two-way left-turn lane pattern for use on streets and highways. See Note 2.



**DETAIL 33 POLICY**

Two-way left-turn lane pattern for use on streets and highways. See Note 2.



- NOTES: 1. Pavement markers shown off the solid line in Detail 32 may be placed on the line.  
2. A 75 mm black line shall be placed between the 100 mm yellow lines on State highways and may be placed on streets and highways under local jurisdiction.

**LEGEND**

- 100 mm Yellow
- Two-Way Yellow Reflective Markers
- Direction of Travel
- Non-Reflective Yellow Markers

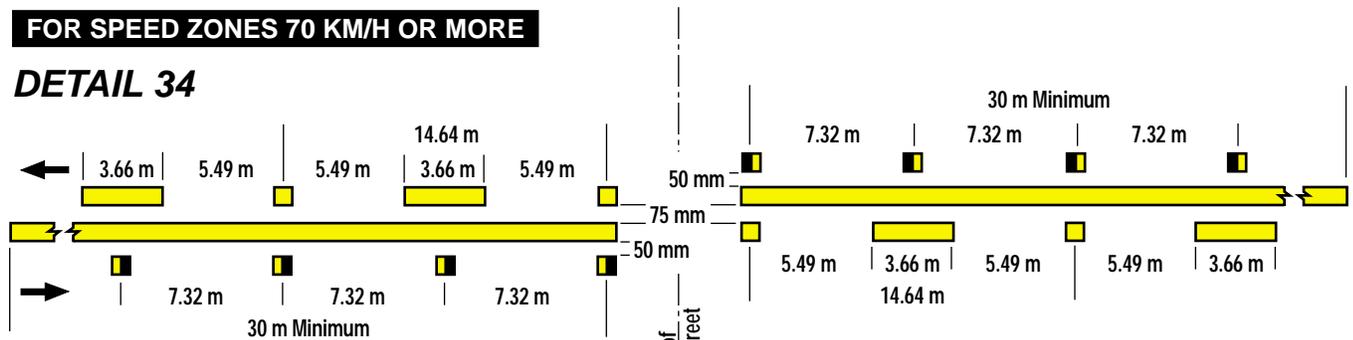
NOT TO SCALE

### Figure 6-9 INTERSECTION MARKINGS POLICY

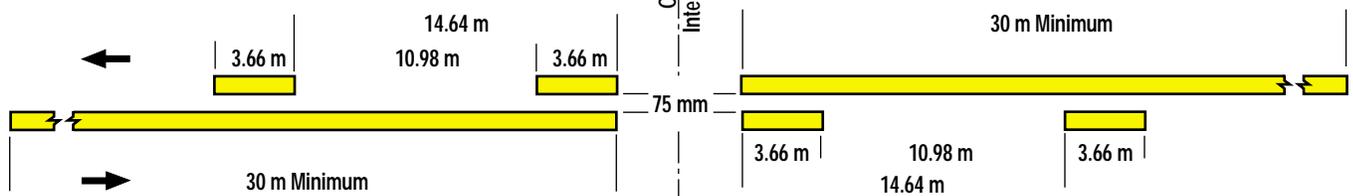
The length of intersection markings is usually between 30 m and 90 m on either side of the intersection for through highways where the motorist is not required to stop. These treatments may also be used on the intersecting streets where the motorist is required to stop when additional emphasis is desirable. The Two Direction No-Passing Zone (Double Yellow) pattern may be used where the adjacent section of street or highway is so marked.

**FOR SPEED ZONES 70 KM/H OR MORE**

**DETAIL 34**

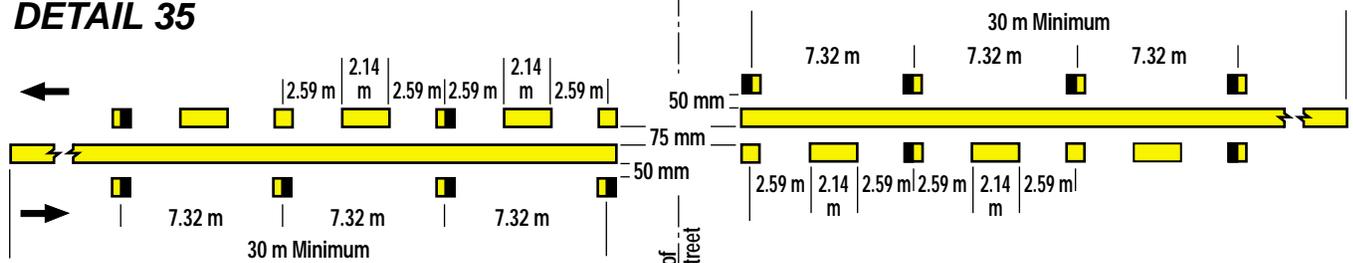


**DETAIL 34A**

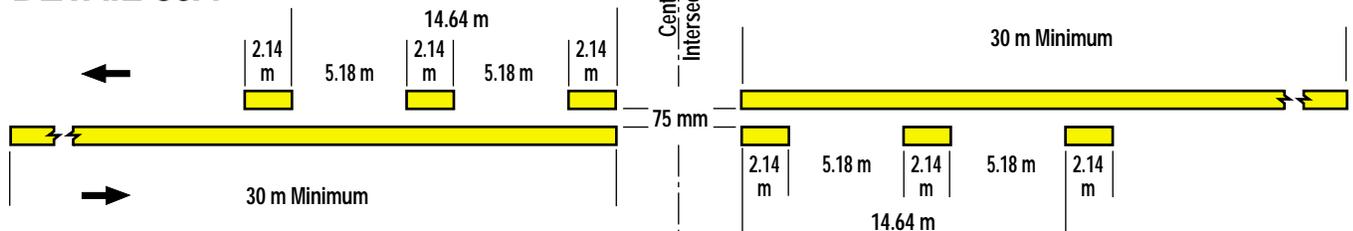


**FOR SPEED ZONES 60 KM/H OR LESS**

**DETAIL 35**



**DETAIL 35A**



- NOTES:**
1. Raised Pavement Markers are optional on non-state highways.
  2. Raised Pavement Markers shown off the solid line may be placed on the line.
  3. A 75 mm black line shall be placed between the 100 mm yellow lines on State highways and may be placed on streets and highways under local jurisdiction.

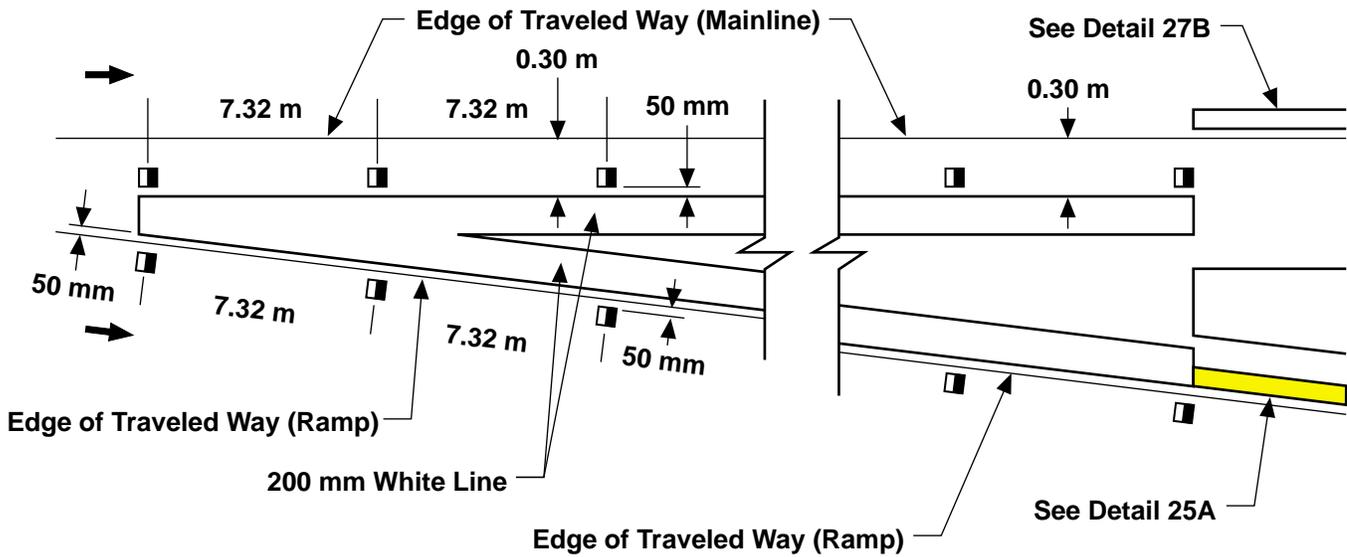
**LEGEND**

- 100 mm Yellow
- Two-Way Yellow Reflective Markers
- Direction of Travel
- One-Way Yellow Reflective Markers

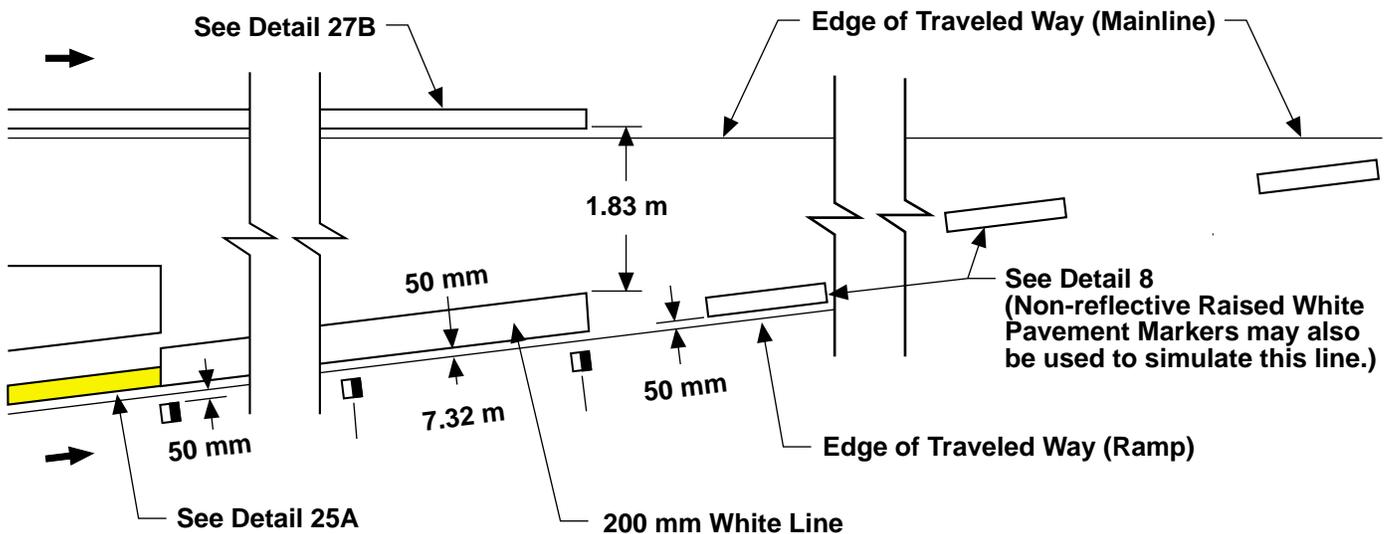
NOT TO SCALE

**Figure 6-10  
FREEWAY EXIT AND ENTRANCE RAMP CHANNELIZING LINES**

**DETAIL 36 - Exit Ramp Neutral Area (Gore) Channelizing Lines (See Figure 6-28)**



**DETAIL 36A - Entrance Ramp Neutral Area (Merge) Channelizing Lines (See Figure 6-29)**



**LEGEND**

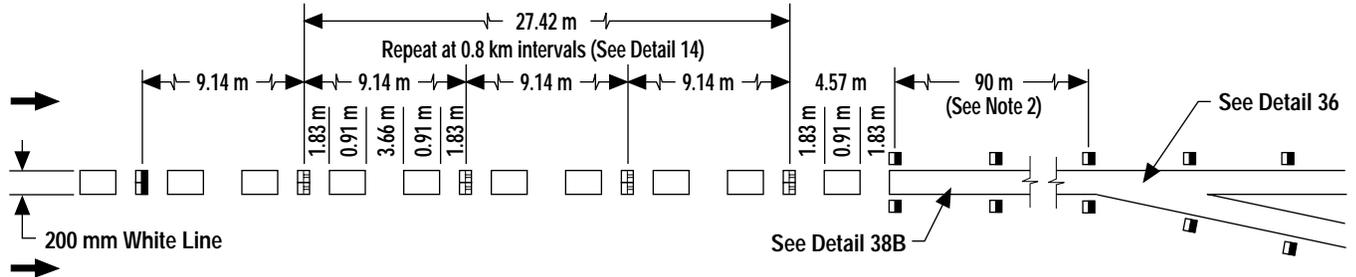
-  100 mm White
-  100 mm Yellow
-  One-Way Clear Reflective Markers
-  Direction of Travel

NOT TO SCALE

**Figure 6-11  
LANE DROP MARKINGS**

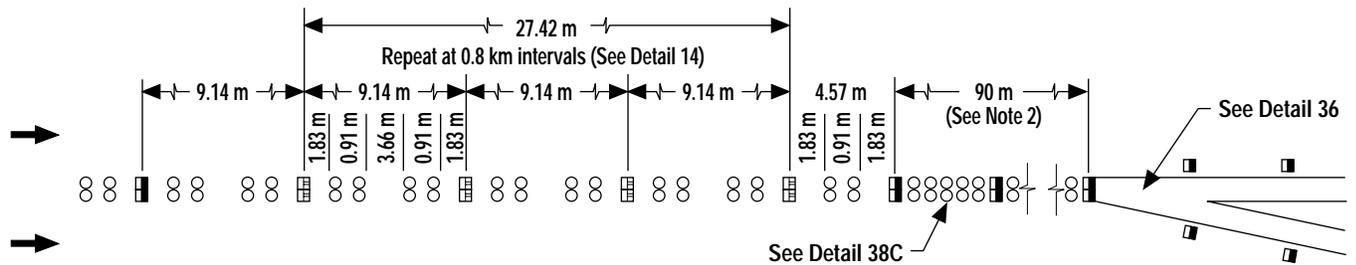
**DETAIL 37 - Lane Drop Markings at Exit Ramps**

Marking pattern for use on mandatory lane drops at freeway exit ramps and freeway to freeway connectors.



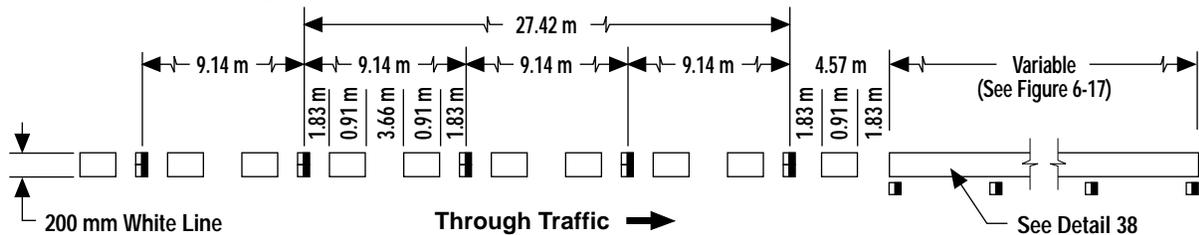
**DETAIL 37A - Alternate to Detail 37**

For use with Detail 10 and 13.



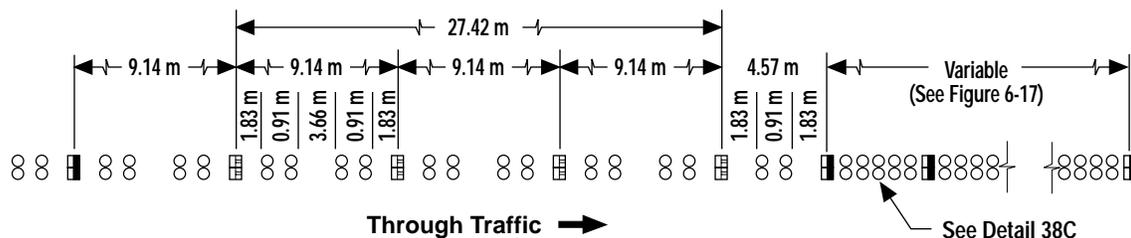
**DETAIL 37B - Lane Drop Markings at Conventional Highway Intersections**

Marking pattern for use on mandatory turn lanes at intersections. Pavement markers shown are optional on local streets and highways.



**DETAIL 37C - Alternate to Detail 37B**

For use with Detail 10 and 13.



- NOTES: 1. Pavement markers shown off the solid line in Detail 37 may be placed on the line.  
2. The Solid Channelizing Line shown in Detail 37 and 37A may be omitted on short auxiliary lanes where weaving length is critical.

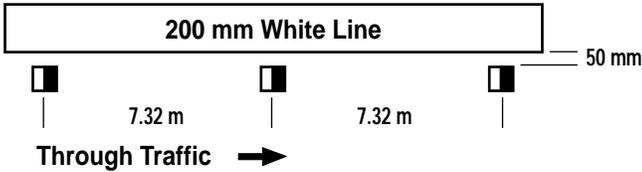
**LEGEND**

- ⊘⊘ Non-Reflective White Markers
- ➡ Direction of Travel
- ▬ One-Way Clear Reflective Markers
- ▬ Red-Clear Reflective Markers

NOT TO SCALE

**Figure 6-12**  
**CHANNELIZING, BIKE LANE AND LANE LINE EXTENSIONS**

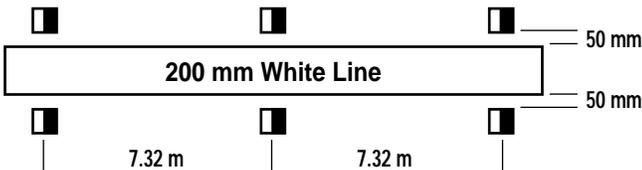
**DETAIL 38 - Channelizing Line**



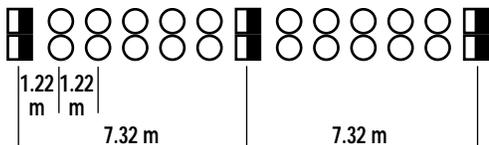
**DETAIL 38A - Channelizing Line**



**DETAIL 38B - Channelizing Line at Exit Ramps**



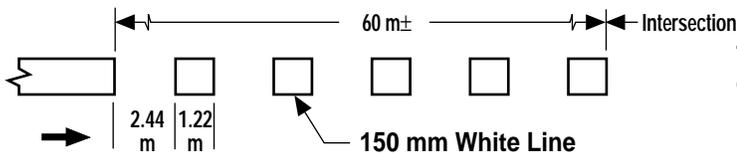
**DETAIL 38C - Alternate to Detail 38 and 38B**



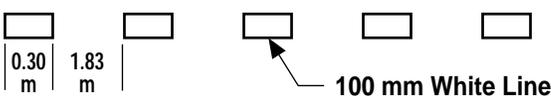
**DETAIL 39 - Bike Lane Line**



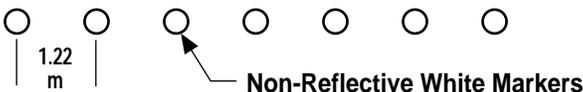
**DETAIL 39A - Bike Lane Intersection Line**



**DETAIL 40 - Lane Line Extension Through Intersections**



**DETAIL 40A - Alternate to Detail 40**



**POLICY**

Typical channelizing line for use on Left-Turn or Right-Turn lanes on State highways. Pavement Markers when used should be placed on the through traffic side only. See Section 6-02.2.

Typical channelizing line for use on Left-Turn or Right-Turn lanes on local streets and highways and freeway off-ramp terminals.

Typical channelizing line for use on Exit Ramps. See Section 6-02.2. Pavement Markers as shown may also be placed on the line.

The Bike Lane line is used to mark lanes for the specific use of bicycles (See CVC 21208 and 21209).

The Bike Lane Intersection line may be used to extend the bike lane to or through an intersection.

The Lane Line Extension Through Intersections line is used to extend the lane line through an intersection that might otherwise be confusing to the motorist.

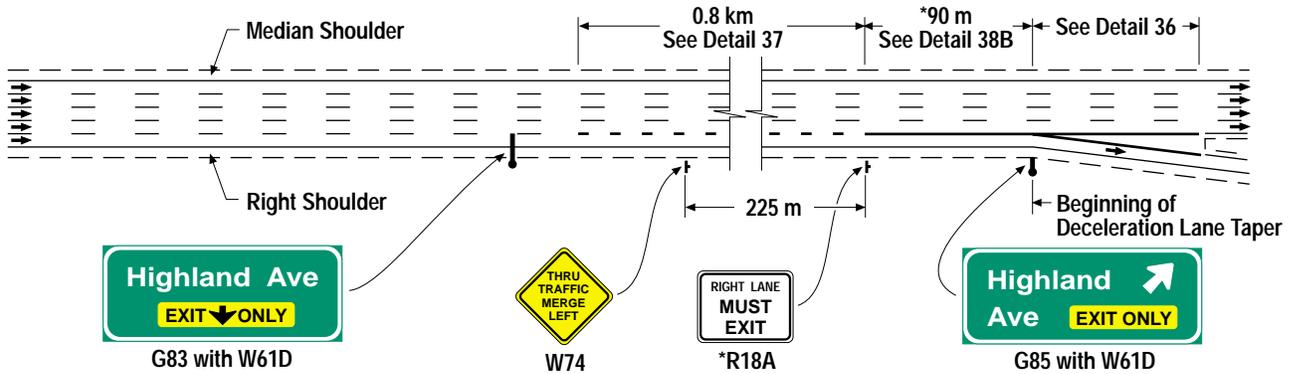
**LEGEND**

- White Line
- One-Way Clear Reflective Markers
- Direction of Travel
- Non-Reflective White Markers

NOT TO SCALE

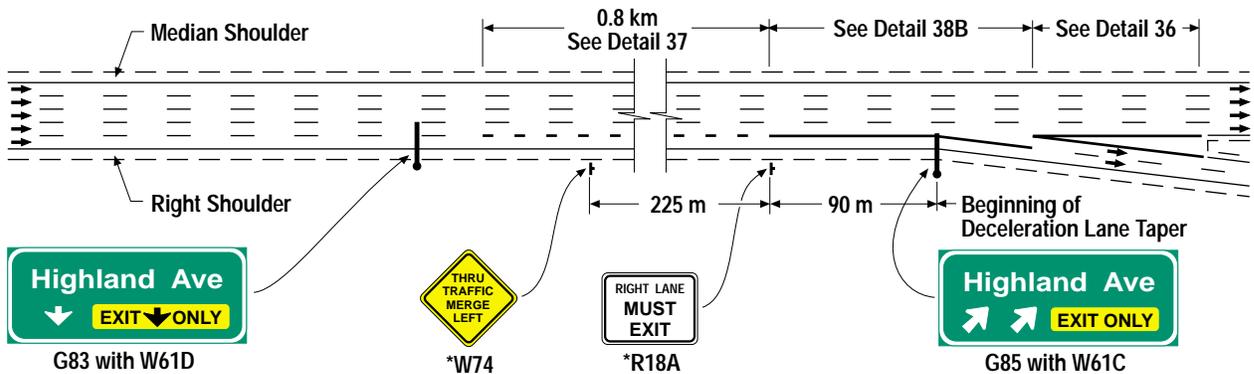
**Figure 6-13**  
**LANE DROP SIGNING AND MARKINGS AT EXIT RAMP**

**CASE: 1 - MAINLINE LANE DROP TO A ONE LANE EXIT**



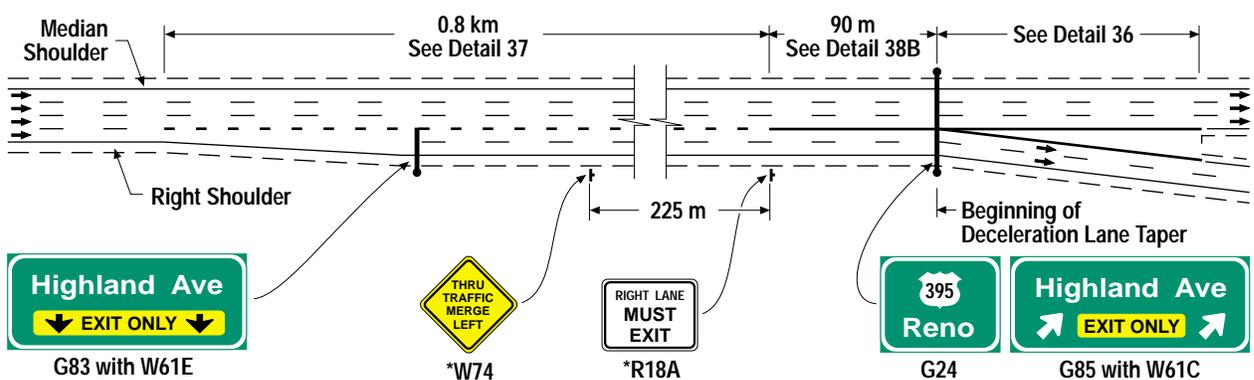
**\* Note:**  
The solid line may be eliminated where additional weaving distance is needed. When it is eliminated, a RIGHT LANE MUST EXIT (W73) sign shall be used in lieu of the R18A sign.

**CASE: 2 - MAINLINE LANE DROP TO A TWO LANE EXIT (Optional Lane)**



**\* Note:**  
At locations where the overhead EXIT ONLY (W61) signs are not in place, a RIGHT LANE MUST EXIT (W73) sign shall be placed, approximately midway, between the W74 and the R18A signs.

**CASE: 3 - MAINLINE LANE DROP TO A TWO LANE EXIT**



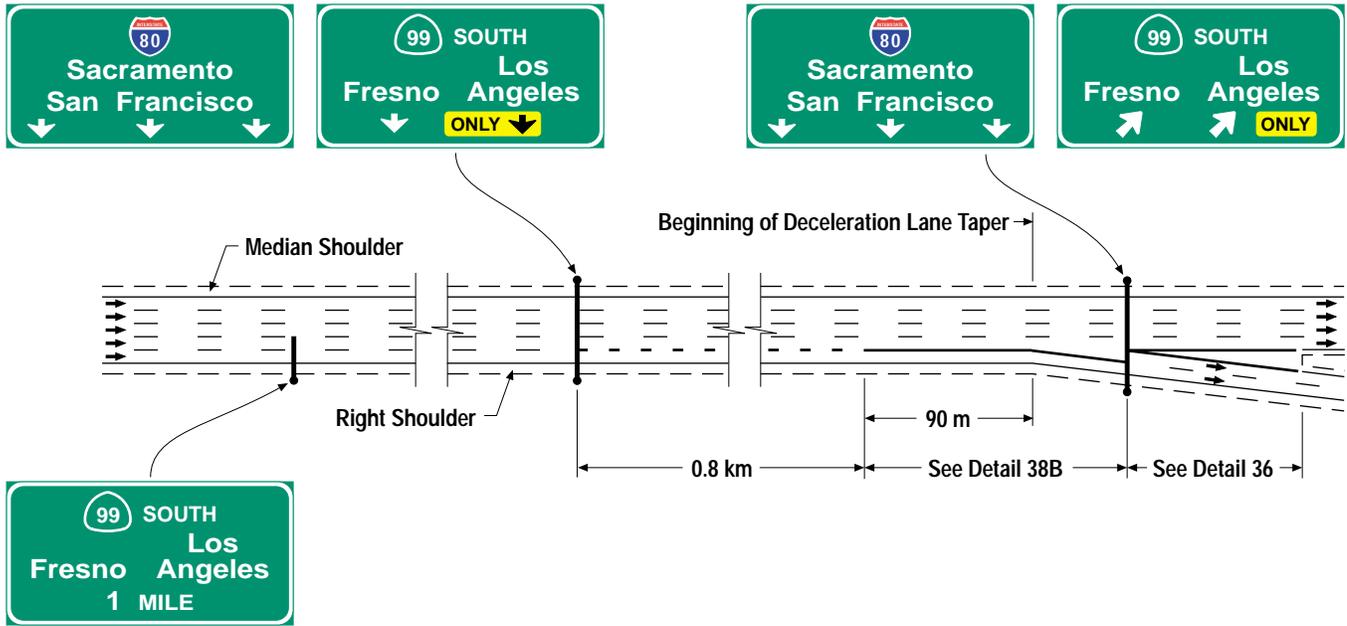
**LEGEND**

➔ Direction of Travel    - - - Lane Drop Pattern

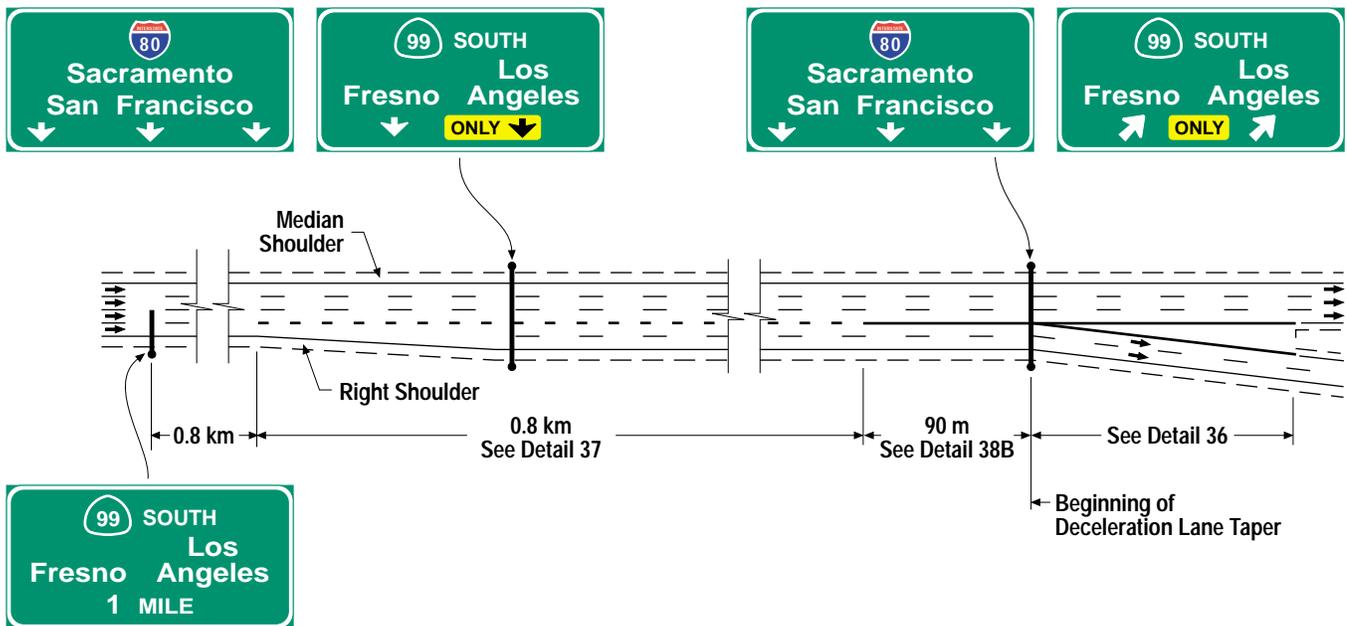
NOT TO SCALE

Figure 6-14  
FREEWAY TO FREEWAY CONNECTOR SIGNING AND MARKINGS

TWO LANE BRANCH CONNECTOR with One Lane Optional  
(See Section 4-04.21)



TWO LANE BRANCH CONNECTOR  
(See Section 4-04.21)

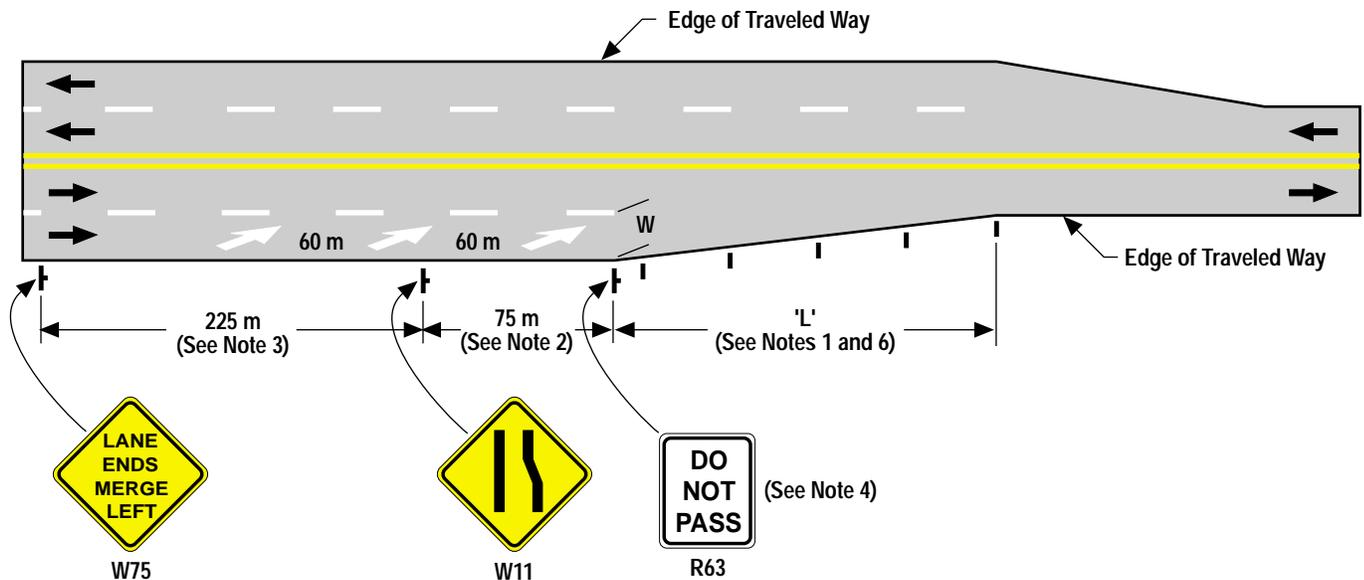


LEGEND

➔ Direction of Travel    - - - Lane Drop Pattern

NOT TO SCALE

**Figure 6-15  
TYPICAL LANE REDUCTION TRANSITION**



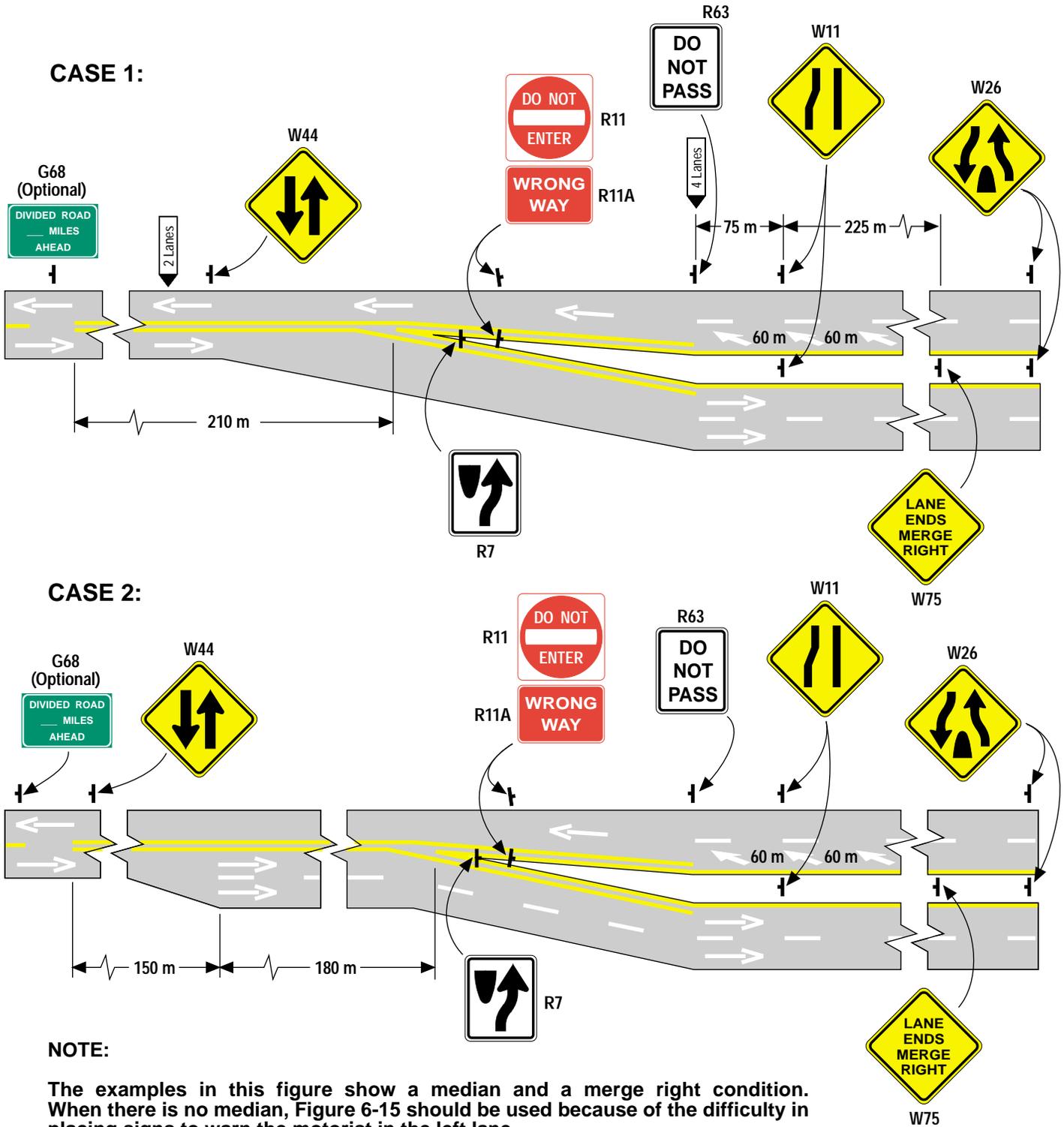
**NOTES:**

1. The Length of Transition (L) is a minimum desirable length. It is computed by formula  $L = 2/3(WS)$  for all highways with speeds of 70 km/h or more. On urban, residential and other streets where speeds are 65 km/h or less, the formula  $L = WS^2 \div 150$  may be used. Adequate sight distance and the proximity to a freeway ramp, crossroad, etc., may dictate the need for adjustments. In general, better traffic operations will result when the adjustments consist of increasing the length of a transition rather than a reduction.
2. On urban, residential or other streets where speeds are 65 km/h or less, the distance for placement of the W11 sign may be reduced to a minimum of 30 m.
3. A LANE ENDS MERGE LEFT (W75) sign should be placed in conjunction with the W11 sign. Adequate sight distance or the proximity to a freeway ramp, crossroad, etc., may dictate the need and/or the location.
4. The R63 sign should not be used on a freeway or expressway, etc., where two or more lanes remain after a lane is dropped.
5. Lane Reduction Arrows are placed in groups of three. They are optional on highways where speeds are 65 km/h or less. Where speeds are 70 km/h or more or a W75 sign is used, an additional group of arrows may be placed. See also Note 3.
6. Delineators should be spaced approximately 60 m apart. There should be a minimum of 3 delineators throughout the entire length of a lane reduction transition. See Section 6-04.4.
7. A left lane drop should be avoided on undivided roadways because of the difficulty in placing signs to warn motorists in the left lane.

**LEGEND**

- |   |                        |
|---|------------------------|
| L = Lane Reduction Length (in meters)   | ➔ Direction of Travel  |
| W = Offset Distance (in meters)   | ➤ Lane Reduction Arrow |
| S = Off Peak 85 Percentile Speed (in 5 km/h intervals), or the Design Speed may be used for new construction. | I Delineators (Type F) |
- NOT TO SCALE**

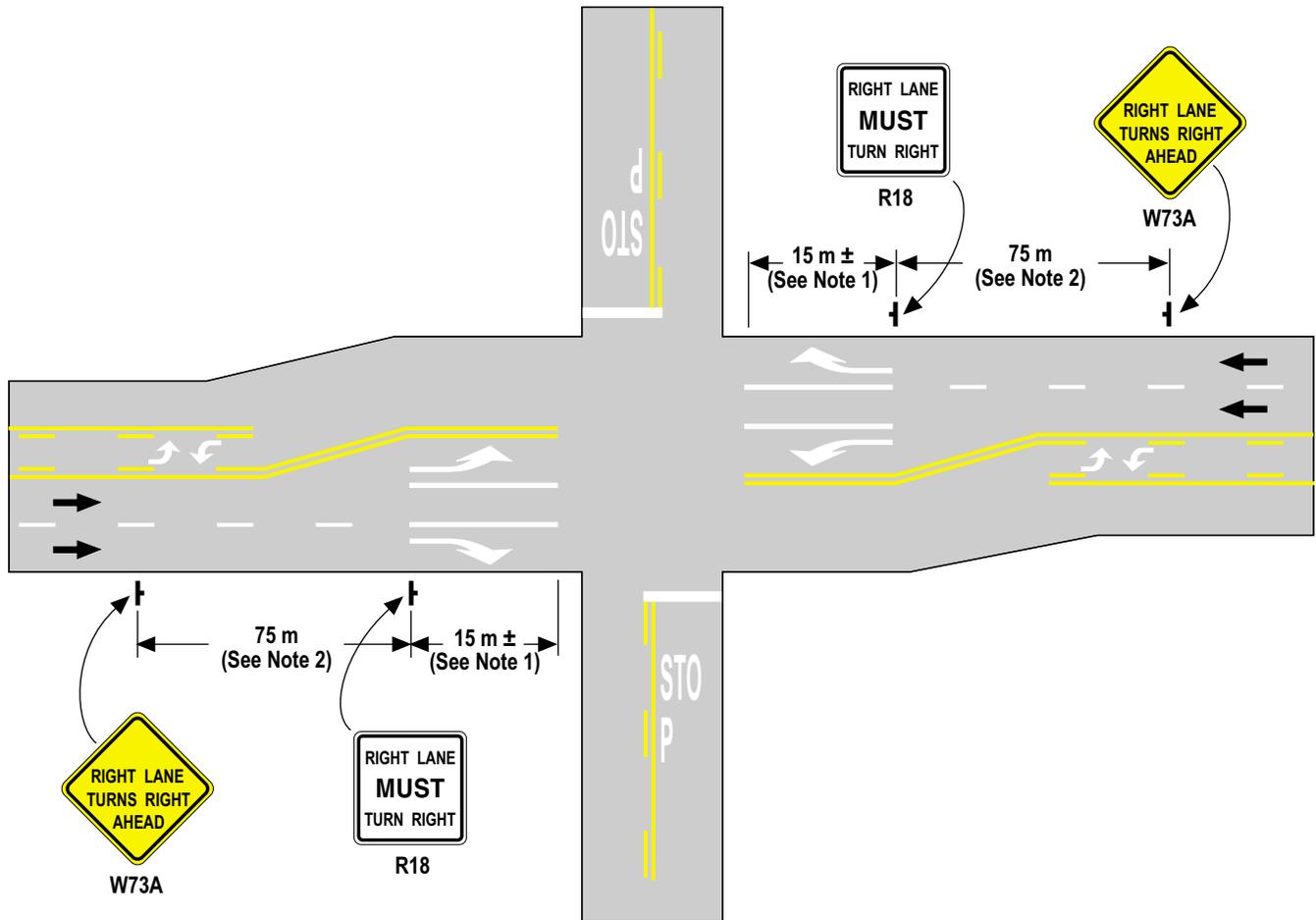
Figure 6-16  
TRANSITION FROM TWO-LANE TO FOUR-LANE DIVIDED



LEGEND

-  Wrong Way Arrow
-  Lane Reduction Arrow
-  Delineator (Type F)
- NOT TO SCALE

**Figure 6-17  
LANE DROP SIGNING AND MARKINGS  
AT CONVENTIONAL HIGHWAY INTERSECTIONS**



**NOTES:**

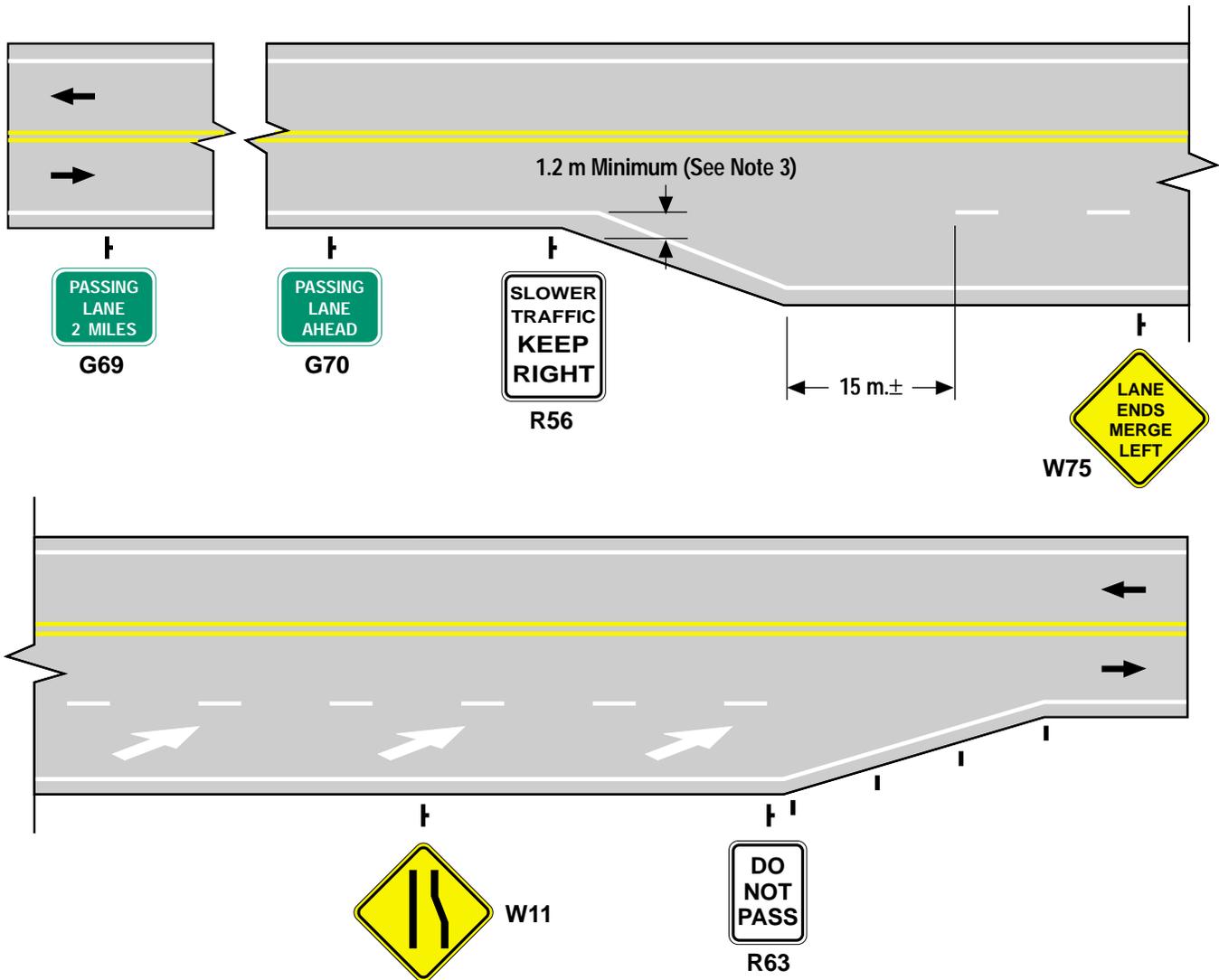
1. The storage length plus the deceleration length should be of sufficient length to avoid the possibility of turning vehicles stopping in the through lane. See Figure 6-20 for taper and storage lengths. See Detail 37B and 37C for lane drop markings. The minimum length of solid channelizing line is 15 m. However, if using Detail 37C, the minimum length will be 14.64 m.
2. The RIGHT LANE TURNS RIGHT AHEAD (W73A) sign should be placed in conjunction with the RIGHT LANE MUST TURN RIGHT (R18) sign and the appropriate lane line and markings. A THRU TRAFFIC MERGE LEFT (W74) sign may be placed in advance of the W73A sign. However, adequate sight distance or proximity to a freeway ramp, cross road, etc., may dictate the need and location of additional signs and the length of the turn lane.

**LEGEND**

- ➔ Direction of Travel
- ▬ Pavement Arrows
- † Sign Location

NOT TO SCALE

**Figure 6-18  
SIGNING AND MARKING PASSING LANES**



**NOTES:**

1. For sign and delineator placement, see Figure 6-15.
2. Lane Reduction Arrows may be placed when a passing lane is 1.6 km or more in length.
3. To discourage vehicular travel off the traveled way, the Right Edgeline should be continued until there is at least 1.2 m between the beginning of the edgeline taper and the edge of the traveled way.

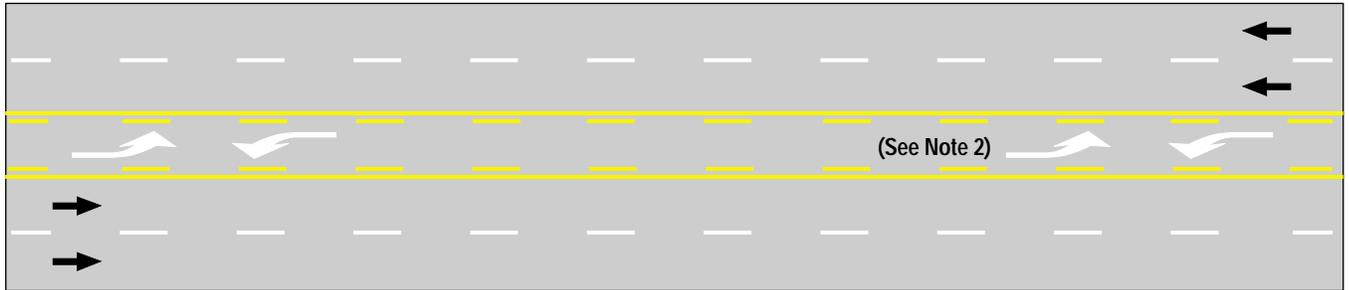
**LEGEND**

- |                 |                        |
|-----------------|------------------------|
| † Sign Location | ➔ Direction of Travel  |
| ┆ Delineator    | ➤ Lane Reduction Arrow |

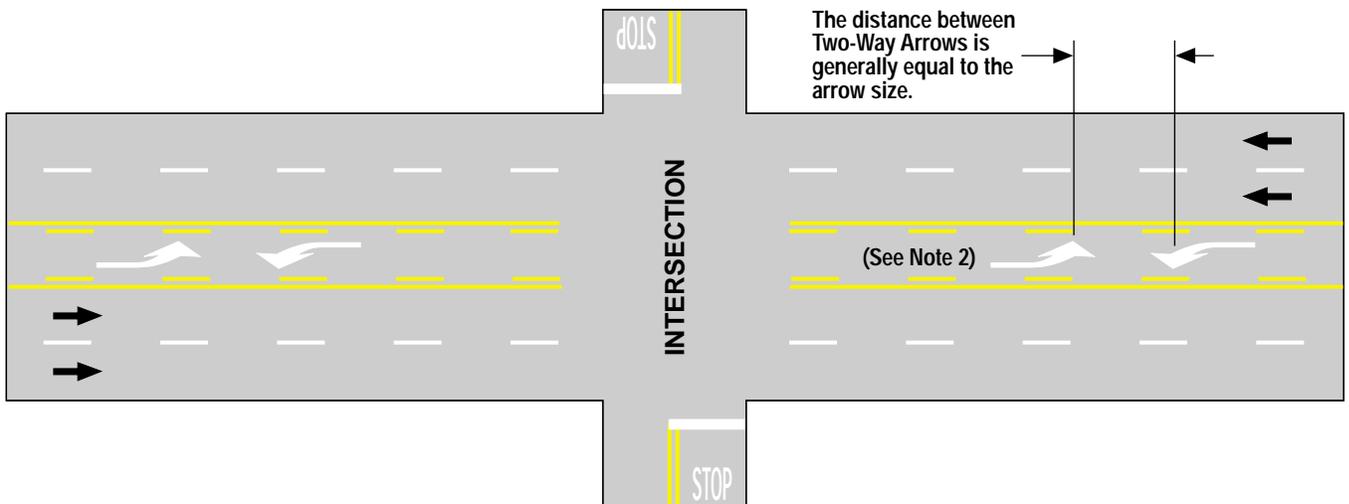
NOT TO SCALE

**Figure 6-19  
TYPICAL TWO-WAY LEFT-TURN LANES**

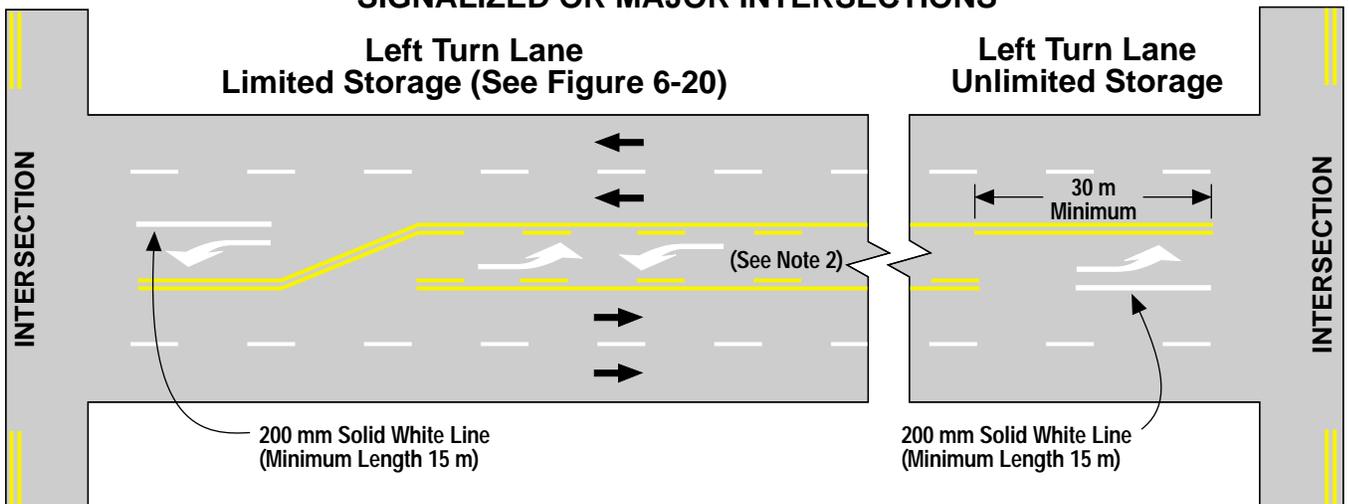
**STANDARD STRIPE**



**MINOR INTERSECTION**



**SIGNALIZED OR MAJOR INTERSECTIONS**



- NOTES: 1. See Figure 6-8 for Two-Way Left-Turn Lane line markings.  
2. Two-Way Pavement Arrows and the R67 and R67A signs are optional.

**LEGEND**

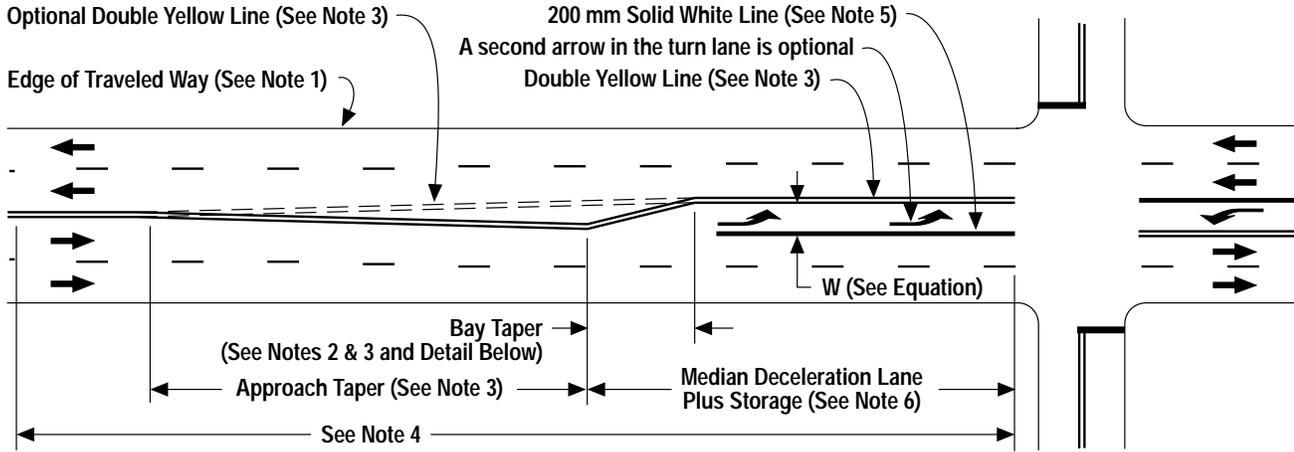
➔ Direction of Travel



Two-Way Pavement Arrows

NOT TO SCALE

**Figure 6-20**  
**TYPICAL LEFT-TURN CHANNELIZATION DELINEATION AND MARKINGS**  
 NOT TO SCALE



**EQUATION:**

Approach Taper =  $\frac{WS^2}{150}$  for speeds of 65 km/h or less and  $\frac{2}{3}(WS)$  for speeds of 70 km/h or more.

Where S = Off Peak 85th Percentile Speed. (In urban areas where space is restricted, "S" may be reduced 15 or 30 km/h).

W = Width of Lateral Traffic Shift in Meters.

**NOTES:**

1. Where conditions do not permit, shoulders may be omitted and parking restricted.
2. Bay taper length = 18 m or 27 m for Business, Residential and Urban Areas and 40 m for high speed Rural Areas.
3. See Striping Details 21 through 23 or 28 through 30.
4. On two lane roads, use Striping Details 15 through 20 for one half (1/2) of the passing sight distance for the prevailing speed.
5. See Striping Detail 38 (15 m Minimum Storage Length).
6. Storage length plus the deceleration length should be of sufficient length to avoid the possibility of left turning vehicles stopping in the through lane.
7. See Highway Design Manual, Section 405.2 for design details.

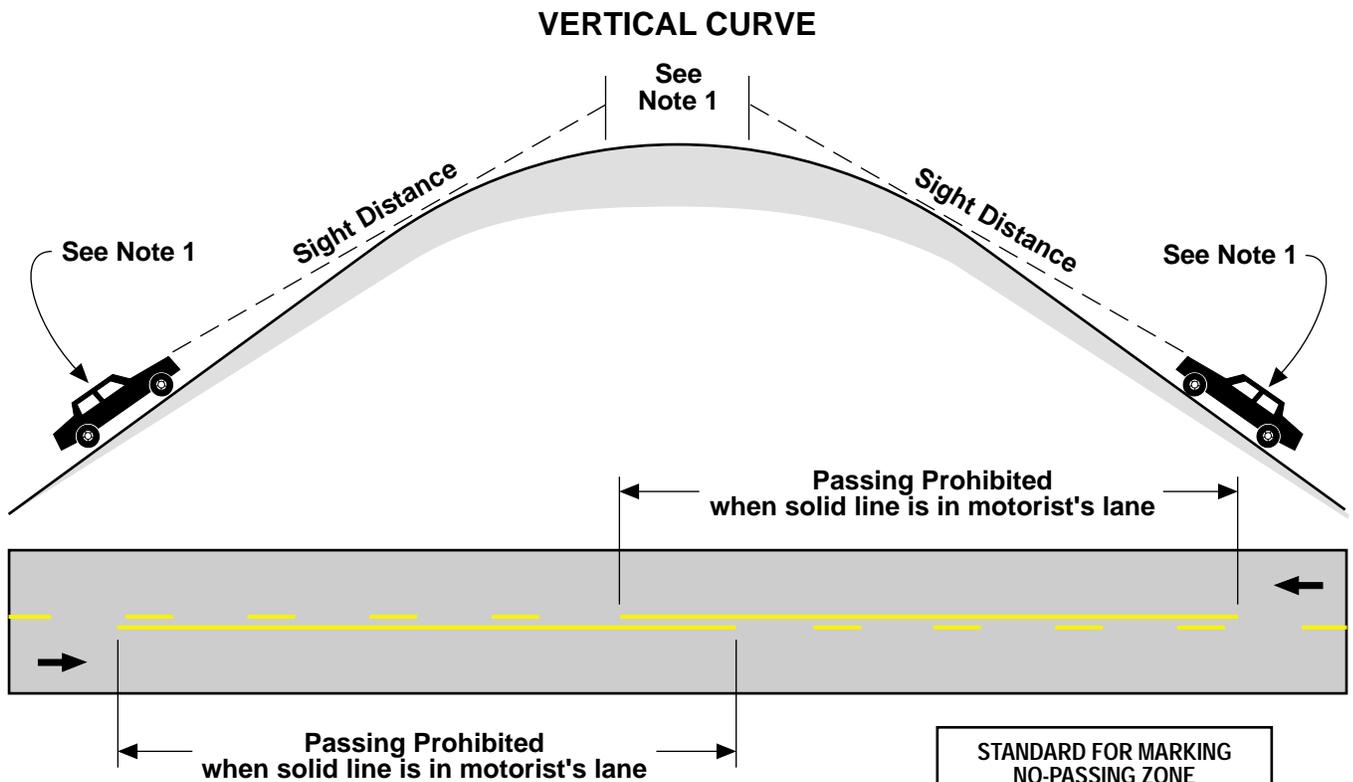
	LENGTH OF TAPER (Meters)			OFFSET DISTANCE		
	18	27	36	DD'=3.0 m	DD'=3.3 m	DD'=3.6 m
	Distance from Point "A"					
	-	-	-	0	0	0
	1.5	2.25	3.0	0.048	0.061	0.057
	3.0	4.5	6.0	0.186	0.207	0.225
	4.5	6.75	9.0	0.423	0.465	0.507
B'	6.0	9.0	12.0	0.75	0.825	0.90
	9.0	13.5	18.0	1.50	1.65	1.80
C'	12.0	18.0	24.0	2.25	2.475	2.70
	13.5	20.25	27.0	2.58	2.84	3.10
	15.0	22.5	30.0	2.81	3.09	3.38
	16.5	24.75	33.0	2.95	3.25	3.54
	18.0	27.0	36.0	3.00	3.30	3.60

AD = Length of Taper  
 AB = BC = CD = 1/3 AD  
 AB' & CD' are Parabolic Curves

**NOTES:**

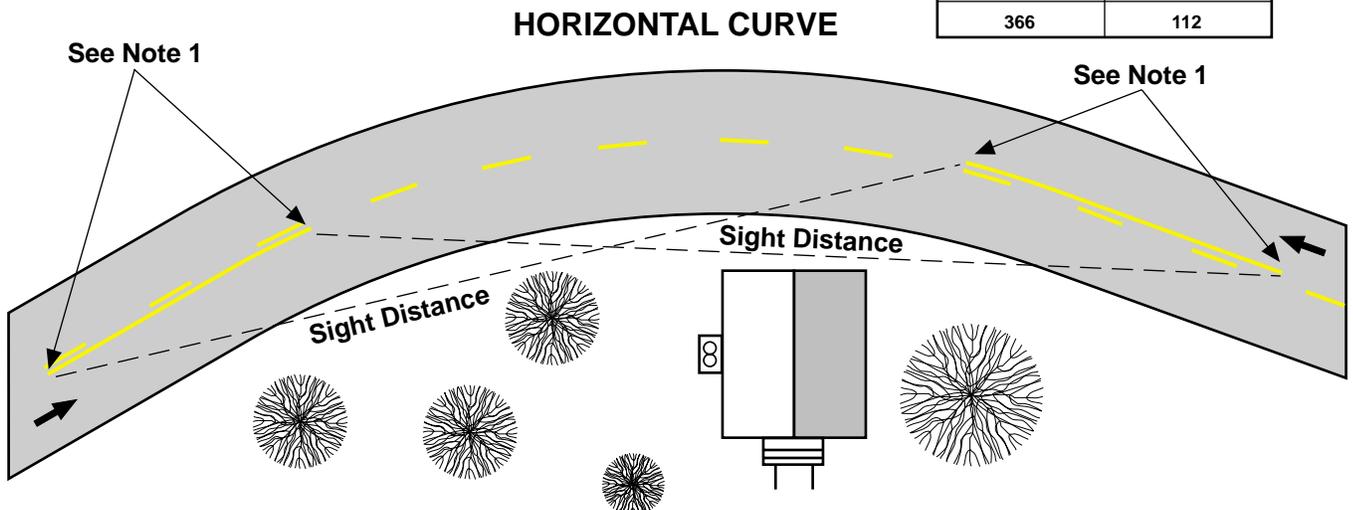
8. The table gives offsets from a base line parallel to the edge of traveled way at intervals measured from point "A". Add "E" for measurements from the edge of traveled way.
9. Where the edge of traveled way is a curve, neither base line nor taper between B & C will be a tangent. Use proportional offsets from B to C.
10. The offset "E" is usually 50 mm along outside edge of traveled way, but may vary in some cases.

**Figure 6-21  
NO PASSING ZONES**



NOT TO SCALE

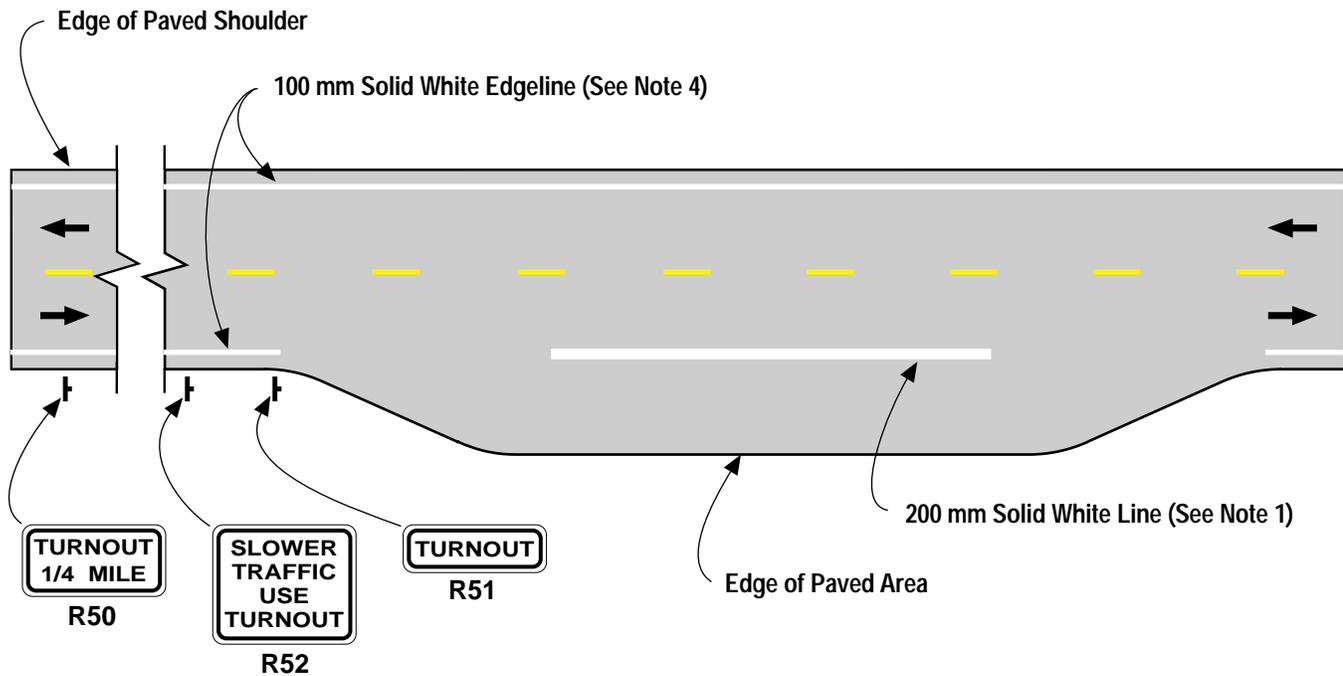
STANDARD FOR MARKING NO-PASSING ZONE	
MINIMUM PASSING SIGHT DISTANCE (m)	85th PERCENTILE SPEED (km/h)
153	48
183	64
244	80
305	96
366	112



**NOTES:**

1. Height of eye is 1.07 m and height of object above pavement is 1.07 m.
2. No-passing zones in opposite directions may or may not overlap, depending on alignment.
3. A minimum length of a no-passing zone shall be one half of the passing sight distance.
4. If the gap between successive no-passing zones is less than the sight distance for the prevailing speed, the no-passing zone shall be continuous.

**Figure 6-22  
SIGNING AND MARKING TURNOUTS**



**NOTES:**

1. Turnouts should be 60 m to 150 m in length including a short taper (15 m±) at each end.
2. Turnouts longer than 150 m are not recommended.
3. Turnout length may be increased 30 m on down grades over 3 %.
4. The Right Edgeline should be dropped throughout the length of the turnout.

**LEGEND**

┆ Sign Location      ➔ Direction of Travel

NOT TO SCALE

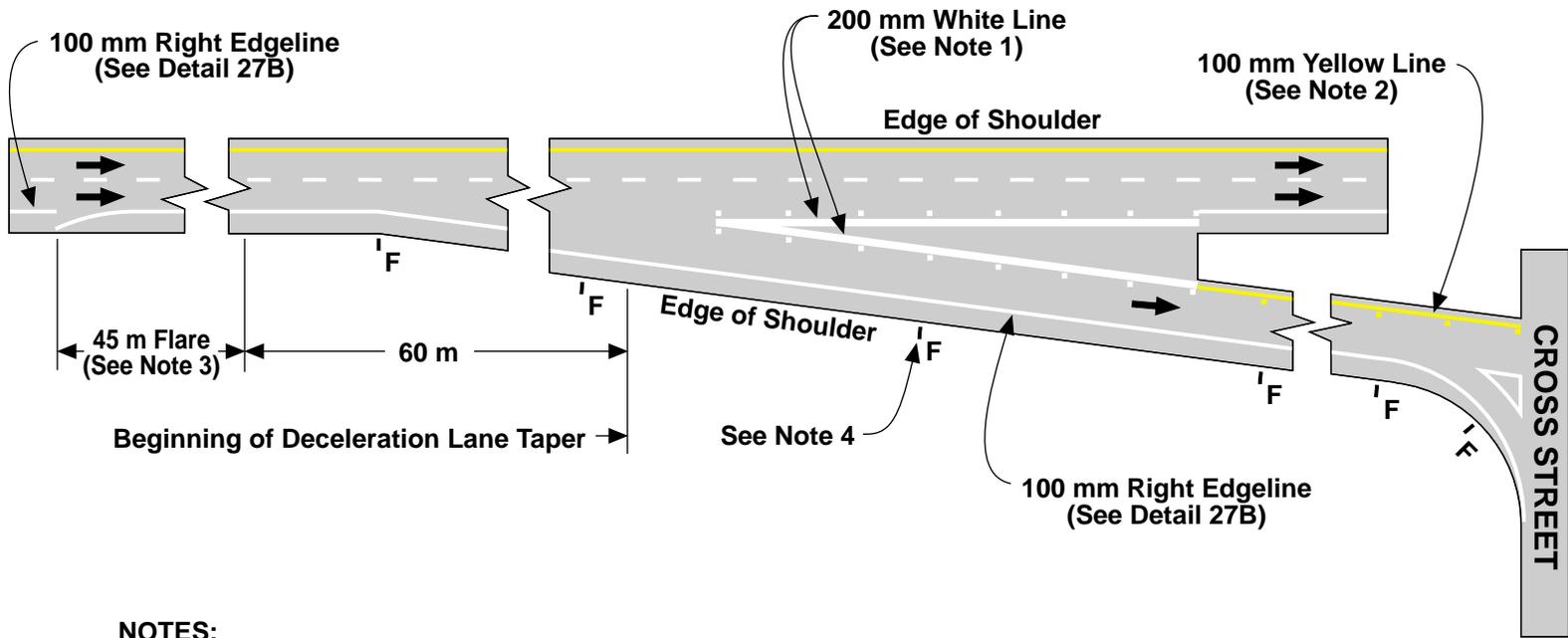


Figure 6-23  
TYPICAL EXIT AND CONNECTOR RAMP MARKINGS

**NOTES:**

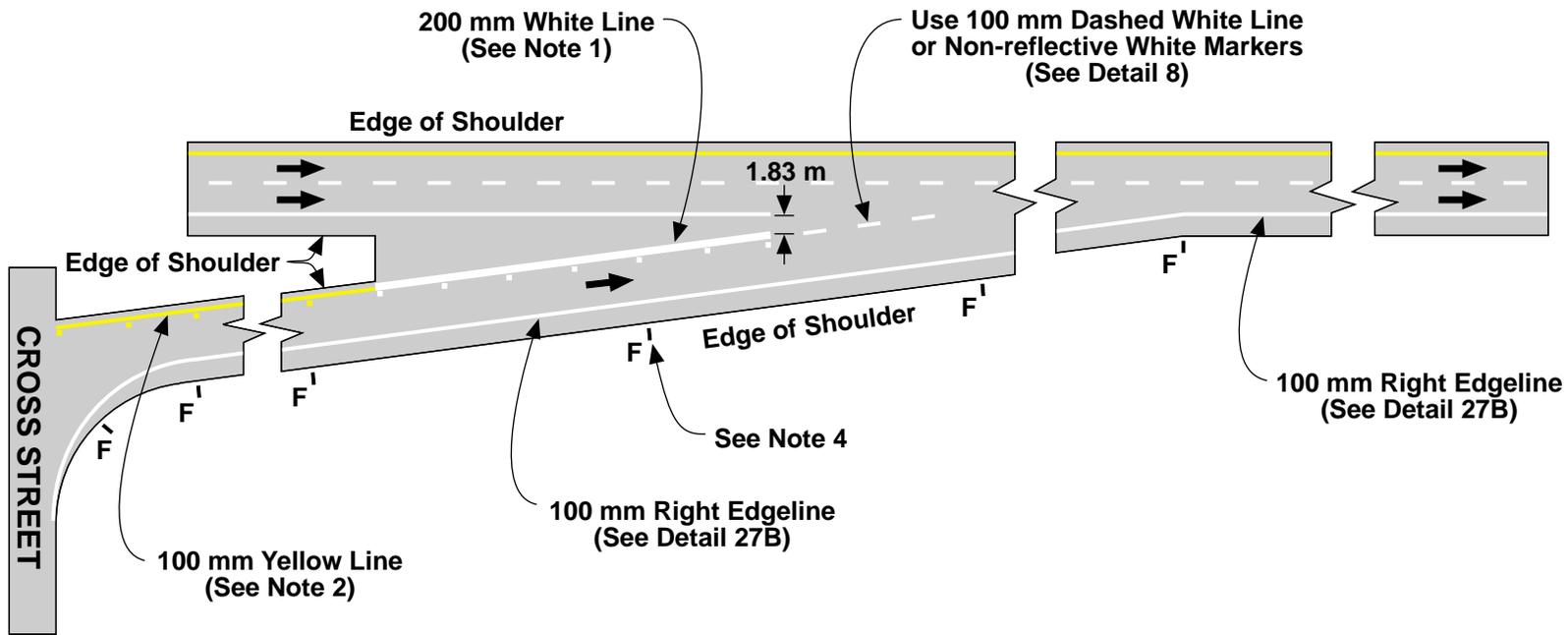
1. Place a 200 mm Solid White Line and One-Way Clear Reflective Markers on 7.32 m centers. See Detail 36.
2. Place a 100 mm Solid Yellow Left Edgeline and One-Way Yellow Reflective Pavement Markers on 7.32 m centers. See Detail 25A.
3. A flared Right Edgeline 60 m in advance of an exit ramp, is recommended where climatic conditions, such as areas that experience heavy fog, may require additional guidance. In areas that normally do not experience these conditions, a continuous edgeline may be used. See also Section 6-03.1, Advance Markers - Exit Ramps.
4. Place delineators 0.6 m to 1.8 m outside edge of paved shoulder, approximately 60 m apart with a minimum of 3 delineators per tangent. For additional details on delineator locations and spacing on curves, see Figures 6-46 and 6-47.
5. See Figures 6-26 through 6-31 for Ramp Terminal Markings and Chapter 4, Section 4-05 of this manual for Ramp Terminal Signing.

**LEGEND**

- I Delineator
- ➔ Direction of Travel

NOT TO SCALE

Figure 6-24  
TYPICAL ENTRANCE AND CONNECTOR RAMP MARKINGS



**NOTES:**

1. Place a 200 mm Solid White Line and One-Way Clear Reflective Markers on 7.32 m centers. See Detail 36A.
2. Place a 100 mm Solid Yellow Left Edgeline and One-Way Yellow Reflective Pavement Markers on 7.32 m centers. See Detail 25A.
3. Place delineators 0.6 m to 1.8 m outside the edge of paved shoulder, approximately 60 m apart with a minimum of 3 delineators per tangent. For additional details on delineator locations and spacing on curves, see Figures 6-46 and 6-47.
4. When the entrance ramp lane becomes an added freeway lane, it shall be marked as a standard lane line. If the additional lane terminates at an exit ramp within 0.8 km, see Figure 6-25.

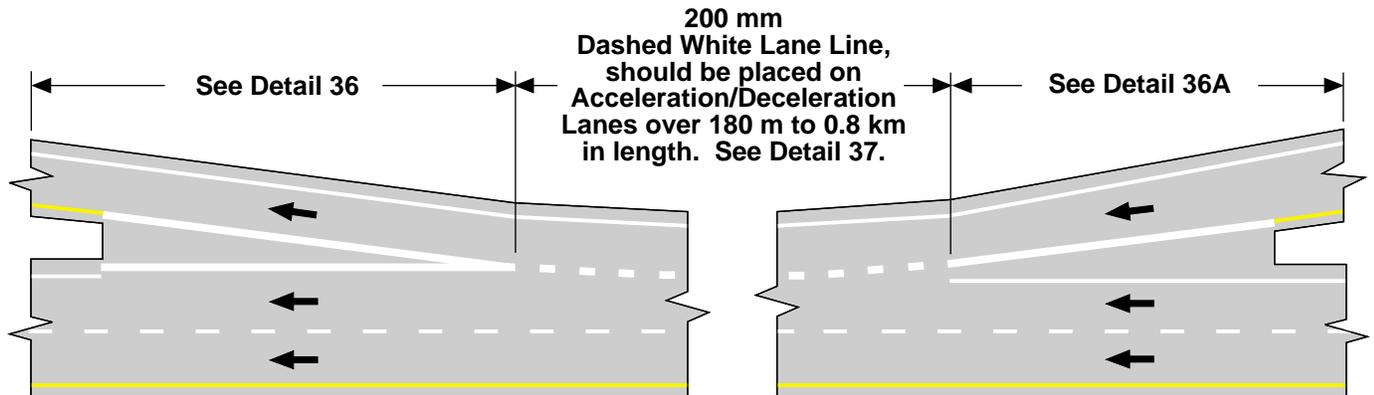
**LEGEND**

- I Delineator                      ➔ Direction of Travel

NOT TO SCALE

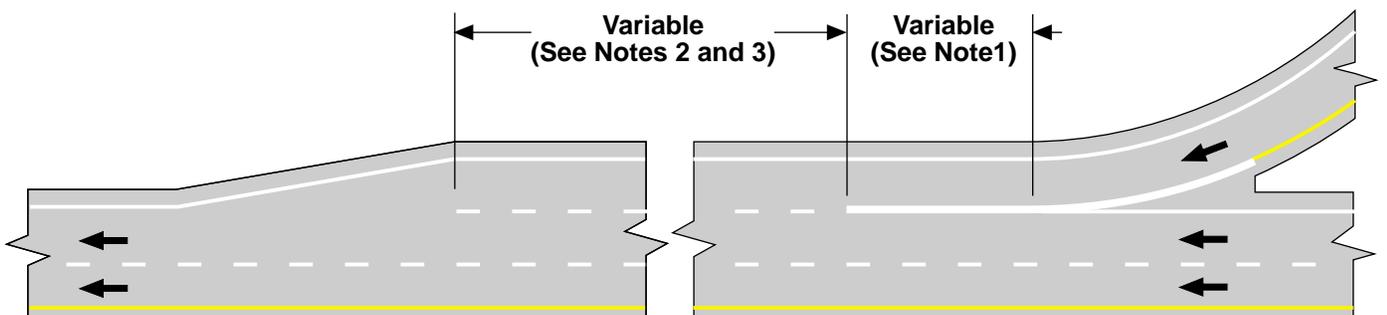
**Figure 6-25  
TYPICAL ACCELERATION/DECELERATION  
AND PARALLEL ACCELERATION LANE MARKINGS**

**ACCELERATION/DECELERATION (Weaving) LANE**



**NOTE:** Acceleration/Deceleration Lanes less than 180 m are normally not striped. Lanes more than 180 m and less than 0.8 km should use a 200 mm Dashed White Stripe (Detail 37). Lanes longer than 0.8 km, a 100 mm Dashed White Line (Detail 8 or 11) should be used.

**PARALLEL ACCELERATION LANE**



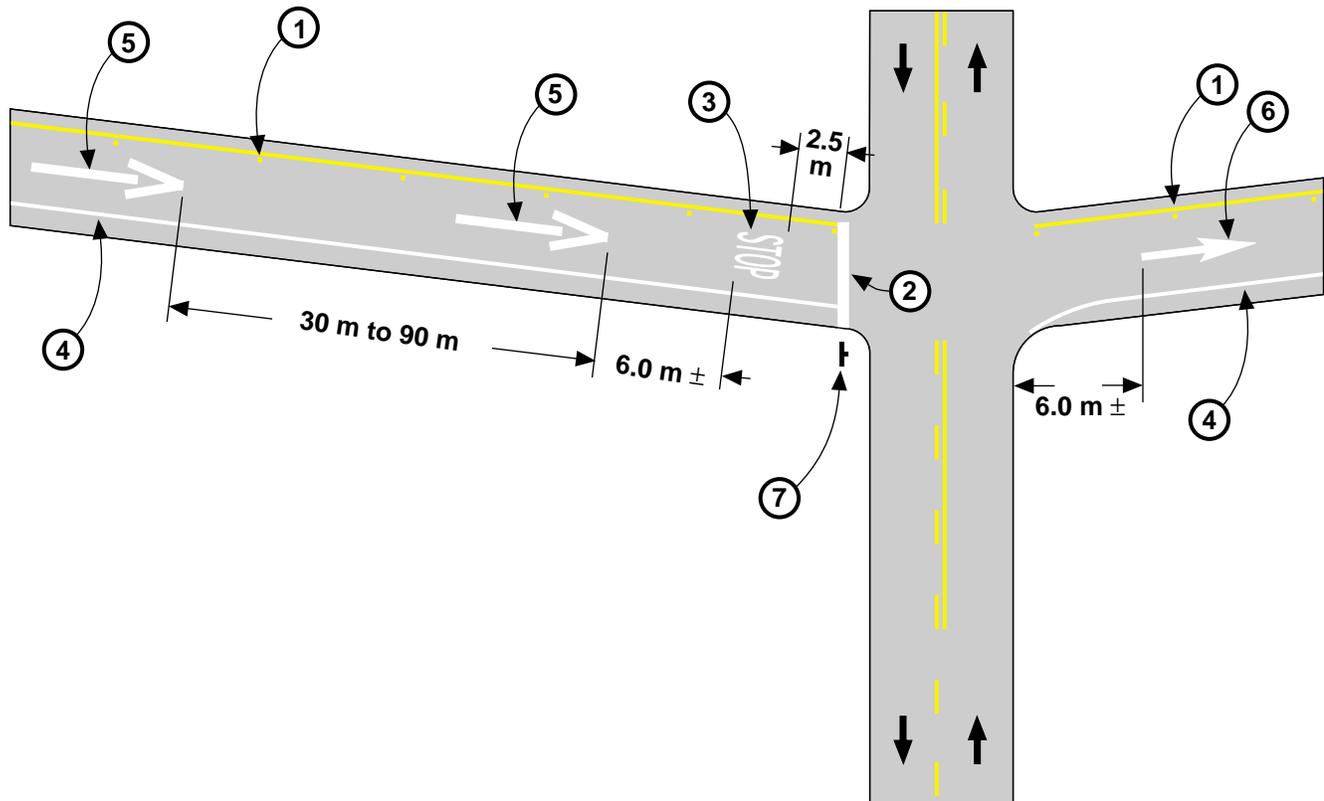
**NOTES:**

1. A 200 mm Solid White Channelizing Line should be continued for approximately one-tenth the length of the acceleration lane beyond the tangent point. See Detail 36A.
2. A 100 mm Dashed White Lane Line (Detail 8 or 11) is normally used for the remaining length of the lane. However, in those locations where the lane may give the appearance of an added lane and to discourage its use by through traffic, a 200 mm Dashed White Channelizing Line (Detail 37) may be considered.
3. See Figure 6-15, Typical Lane Reduction Transition, for transition area signing and marking details, when the acceleration lane is longer than 1.6 km.

**LEGEND**

← Direction of Travel      NOT TO SCALE

**Figure 6-26  
TYPICAL ENTRANCE/EXIT RAMP TERMINAL  
SIGNING AND PAVEMENT MARKINGS**



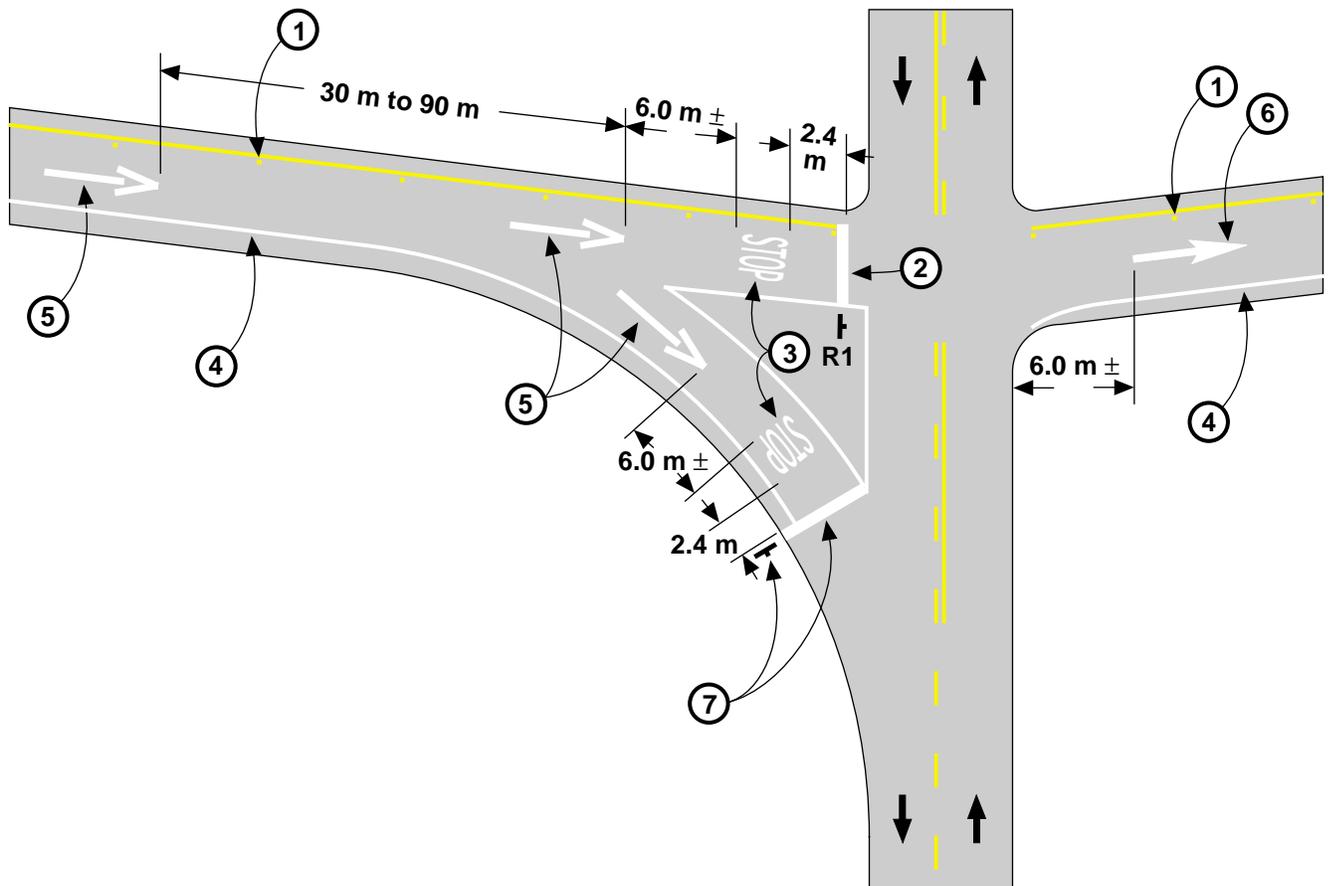
**NOTES:**

1. Place 100 mm Solid Yellow Left Edgeline and One-Way Yellow Reflective Pavement Markers on 7.32 m centers as shown. See Edgeline Detail 25A.
2. Place Limit Line as shown. See also Note 7 and Section 6-02.11.
3. Place "STOP" legend as shown. See Section 6-02.11.
4. Place 100 mm Solid White Right Edgeline, flared end optional, as shown. See Edgeline Detail 27B.
5. Place Type V Arrows, in pairs, as shown. See Section 6-02.14.
6. Place Type I Arrow as shown. See Section 6-02.14.
7. A "YEILD" (R1-2) sign and "YEILD" pavement legend may be used in lieu of the "STOP" (R1) sign, Limit Line and "STOP" pavement legend on low volume roads.

**LEGEND**

➔ Direction of Travel      NOT TO SCALE

**Figure 6-27  
TYPICAL ENTRANCE/EXIT RAMP TERMINAL  
SIGNING AND PAVEMENT MARKINGS**



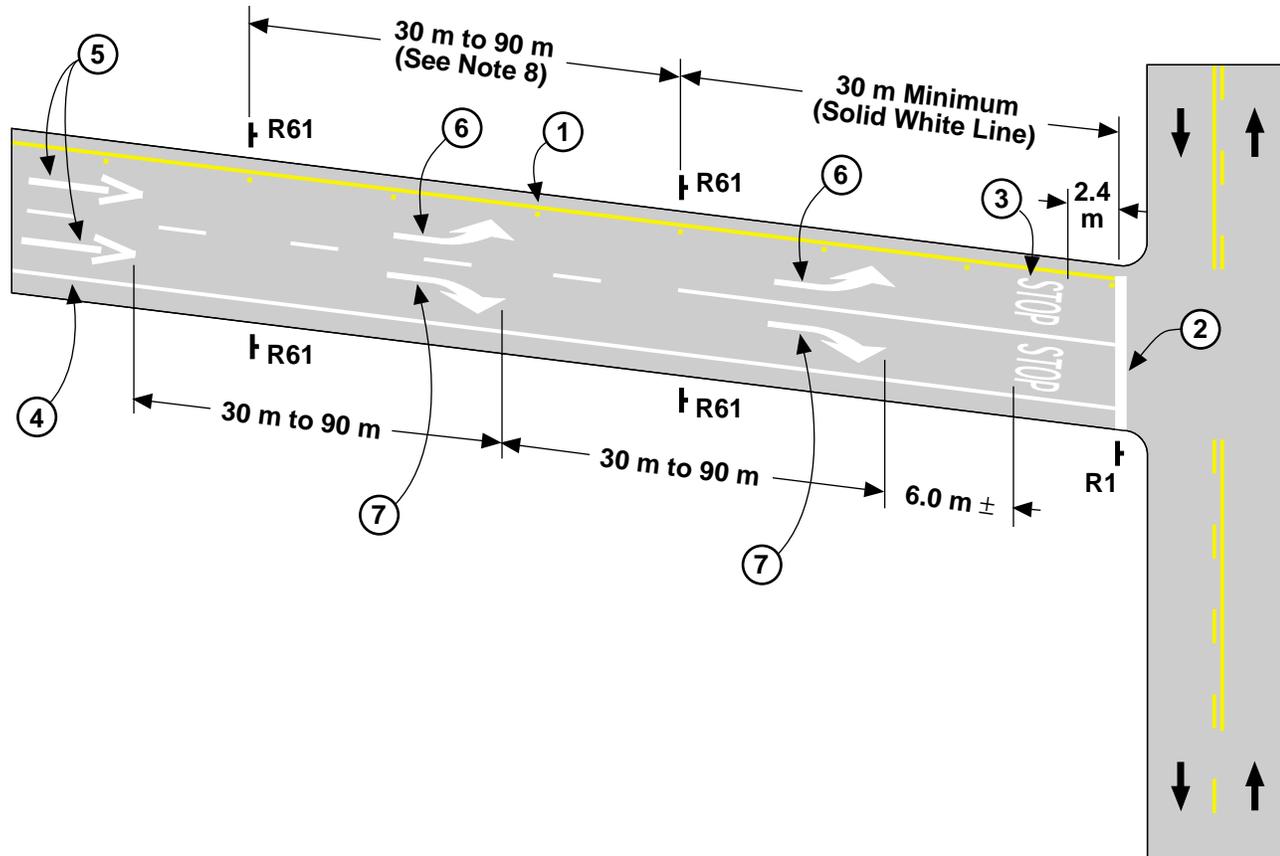
**NOTES:**

1. Place 100 mm Solid Yellow Left Edgeline and One-Way Yellow Reflective Pavement Markers on 7.32 m centers as shown. See Edgeline Detail 25A.
2. Place Limit Line as shown. See Section 6-02.11.
3. Place "STOP" legend as shown. See Section 6-02.11.
4. Place 100 mm Solid White Right Edgeline, flared end optional, as shown. See Edgeline Detail 27B.
5. Place Type V Arrows, in pairs, as shown. See Section 6-02.14.
6. Place Type I Arrow as shown. See Section 6-02.14.
7. A "YEILD" (R1-2) sign and "YEILD" pavement legend may be used in lieu of the "STOP" (R1) sign, Limit Line and "STOP" pavement legend on low volume roads.

**LEGEND**

➔ Direction of Travel      NOT TO SCALE

**Figure 6-28**  
**TYPICAL EXIT RAMP TERMINAL SIGNING**  
**AND PAVEMENT MARKINGS**



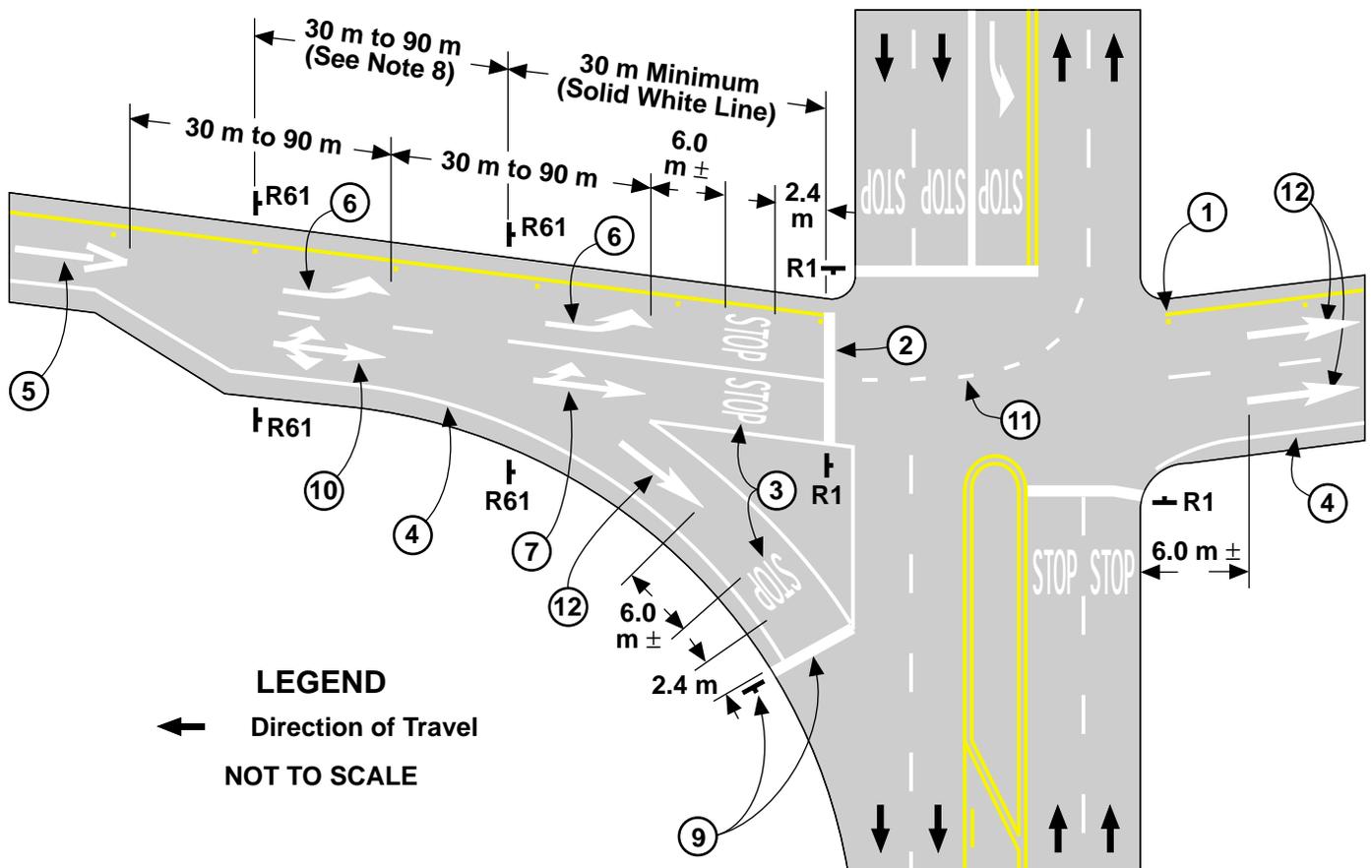
**NOTES:**

1. Place 100 mm Solid Yellow Left Edgeline and One-Way Yellow Reflective Pavement Markers on 7.32 m centers as shown. See Edgeline Detail 25A.
2. Place Limit Line as shown. See Section 6-02.11.
3. Place "STOP" legend as shown. See Section 6-02.11.
4. Place 100 mm Solid White Right Edgeline, flared end optional, as shown. See Edgeline Detail 27B.
5. Place Type V Arrows as shown. See Section 6-02.14.
6. Place Type III (L) Arrows, in pairs, as shown when distance permits. See Section 6-02.14.
7. Place Type III (R) Arrows, in pairs, as shown when distance permits. See Section 6-02.14.
8. Lane Use Control (R61) signs should be placed on both sides of the exit ramp, at the beginning of the Solid White Line. An additional set should also be placed in advance where distance permits, to alert the motorist of lane use controls ahead.

**LEGEND**

➔ Direction of Travel      NOT TO SCALE

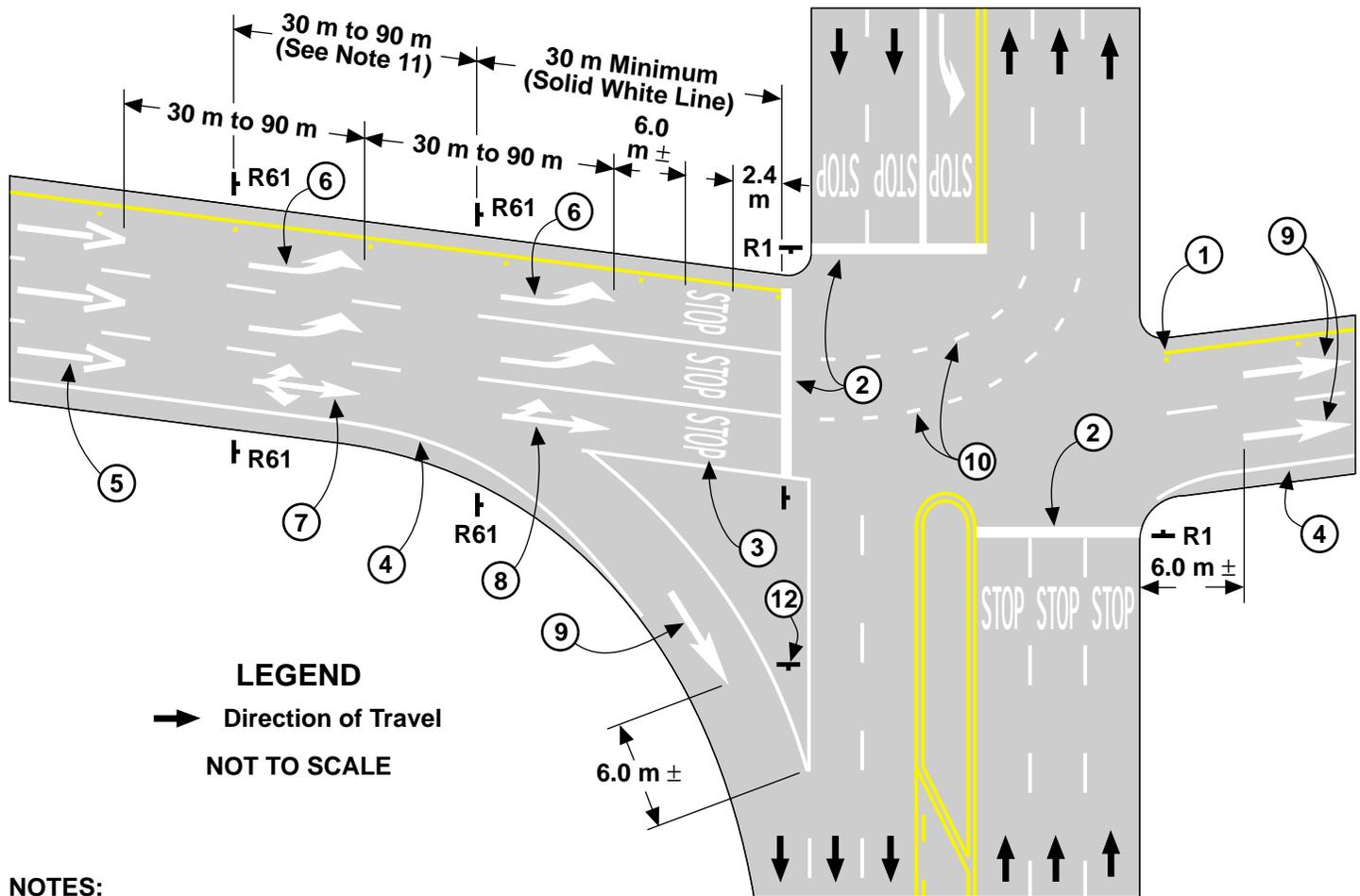
**Figure 6-29**  
**TYPICAL ENTRANCE/EXIT RAMP TERMINAL SIGNING AND PAVEMENT MARKINGS**



**NOTES:**

1. Place 100 mm Solid Yellow Left Edgeline and One-Way Yellow Reflective Pavement Markers on 7.32 m centers as shown. See Edgeline Detail 25A.
2. Place Limit Line as shown. See Section 6-02.11.
3. Place "STOP" legend as shown. See Section 6-02.11.
4. Place 100 mm Solid White Right Edgeline, flared end optional, as shown. See Edgeline Detail 27B.
5. Place Type V Arrow as shown. See Section 6-02.14.
6. Place Type III(L) Arrows, in pairs, as shown where distance permits. See Section 6-02.14.
7. Place Type II(L) Arrow, as shown where distance permits. See Section 6-02.14.
8. Lane-Use Control (R61) signs should be placed on both sides of the exit ramp, at the beginning of the Solid White Line. An additional set should also be placed in advance where distance permits, to alert the motorist of lane use controls ahead.
9. A "YEILD" (R1-2) sign and "YEILD" pavement legend may be used in lieu of the "STOP" (R1) sign, Limit Line and "STOP" pavement legend on low volume roads.
10. Place Type II(B) Arrow, as shown. See Section 6-02.14.
11. Lane Line Extensions through the intersection may be used, as shown. See Lane Line Detail 40.
12. Place Type I (7.32 m) Arrows as shown. See Section 6-02.14.

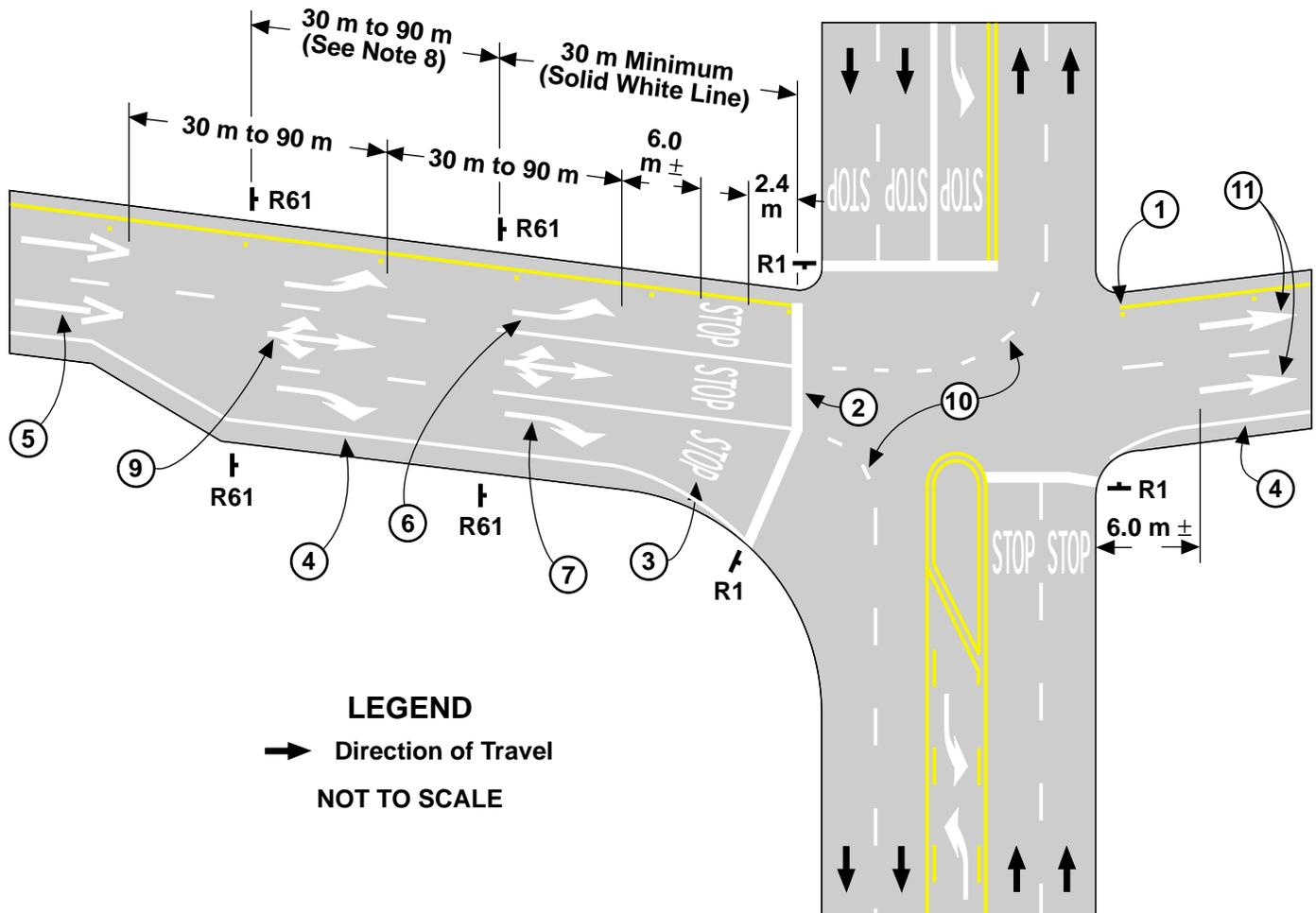
**Figure 6-30**  
**TYPICAL ENTRANCE/EXIT RAMP TERMINAL SIGNING AND PAVEMENT MARKINGS**



**NOTES:**

1. Place 100 mm Solid Yellow Left Edgeline and One-Way Yellow Reflective Pavement Markers on 7.32 m centers as shown. See Edgeline Detail 25A.
2. Place Limit Line as shown. See Section 6-02.11.
3. Place "STOP" legend as shown. See Section 6-02.11.
4. Place 100 mm Solid White Right Edgeline, flared end optional, as shown. See Edgeline Detail 27B.
5. Place Type V Arrows as shown. See Section 6-02.14.
6. Place Type III(L) Arrows, in pairs, as shown where distance permits. See Section 6-02.14.
7. Place Type II(B) Arrow, as shown where distance permits. See Section 6-02.14.
8. Place Type II(L) Arrow, as shown. See Section 6-02.14.
9. Place Type I (7.32 m) Arrow as shown. See Section 6-02.14.
10. Lane Line Extensions through the intersection may be used, as shown. See Lane Line Detail 40.
11. Lane-Use Control (R61) signs should be placed on both sides of the exit ramp, at the beginning of the Solid White Line. An additional set should also be placed in advance where distance permits, to alert the motorist of lane use controls ahead.
12. The Added Lane Symbol (W60) sign should be used in lieu of the Merge Symbol (W59) sign, when an extra lane is provided of more than 0.8 km in length.

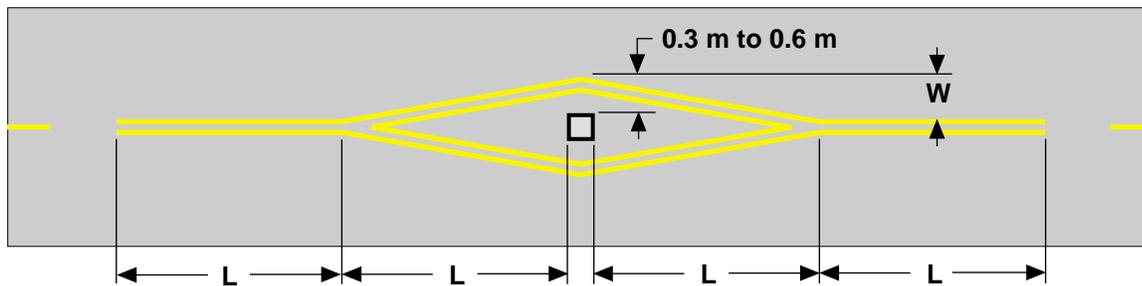
**Figure 6-31  
TYPICAL ENTRANCE/EXIT RAMP TERMINAL SIGNING AND PAVEMENT MARKINGS**



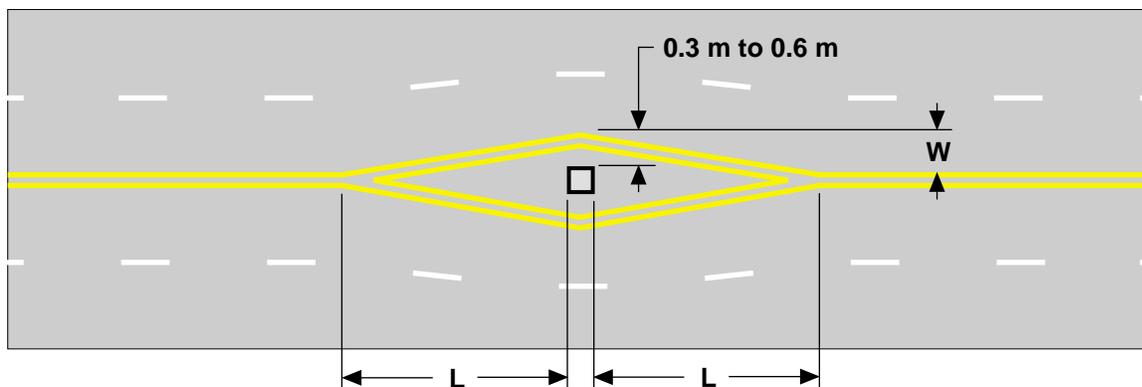
**NOTES:**

1. Place 100 mm Solid Yellow Left Edgeling and One-Way Yellow Reflective Pavement Markers on 7.32 m centers as shown. See Edgeline Detail 25A.
2. Place Limit Line as shown. See Section 6-02.11.
3. Place "STOP" legend as shown. See Section 6-02.11.
4. Place 100 mm Solid White Right Edgeline, flared end optional, as shown. See Edgeline Detail 27B.
5. Place Type V Arrows as shown. See Section 6-02.14.
6. Place Type III(L) Arrows, in pairs, as shown where distance permits. See Section 6-02.14.
7. Place Type III(R) Arrows, in pairs, as shown where distance permits. See Section 6-02.14.
8. Lane-Use Control (R61) signs should be placed on both sides of the exit ramp, at the beginning of the Solid White Line. An additional set should also be placed in advance where distance permits, to alert the motorist of lane use controls ahead.
9. Place Type II(B) Arrows, in pairs, as shown where distance permits. See Section 6-02.14.
10. Lane Line Extensions through the intersection may be used, as shown. See Lane Line Detail 40.
11. Place Type I (7.32 m) Arrows as shown. See Section 6-02.14.

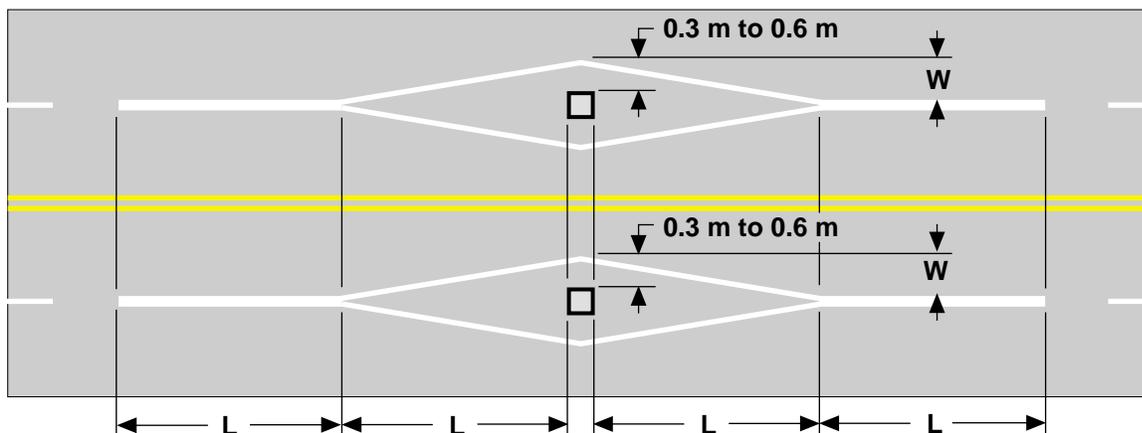
**Figure 6-32**  
**TYPICAL OBSTRUCTION MARKINGS**  
**CENTER OF TWO-LANE ROAD**



**CENTER OF FOUR-LANE ROAD**



**TRAFFIC PASSING BOTH SIDES OF OBSTRUCTION**



**NOTES:**

1. The length (L) should be computed by formula  $L = 2/3(WS)$  for all highways with speeds more than 65 km/h.
2. On urban, residential and other streets where speeds are 65 km/h or less, the formula  $L = \frac{WS^2}{150}$  may be used.
3. The minimum length (L) is 30 m in urban areas and 60 m in rural areas.
4. The length (L) should be extended as required by sight distance conditions.
5. Diagonal marking of the same color as channelizing lines may be placed in the triangular area for added emphasis.

**LEGEND**

L = Length of Transition (in meters).

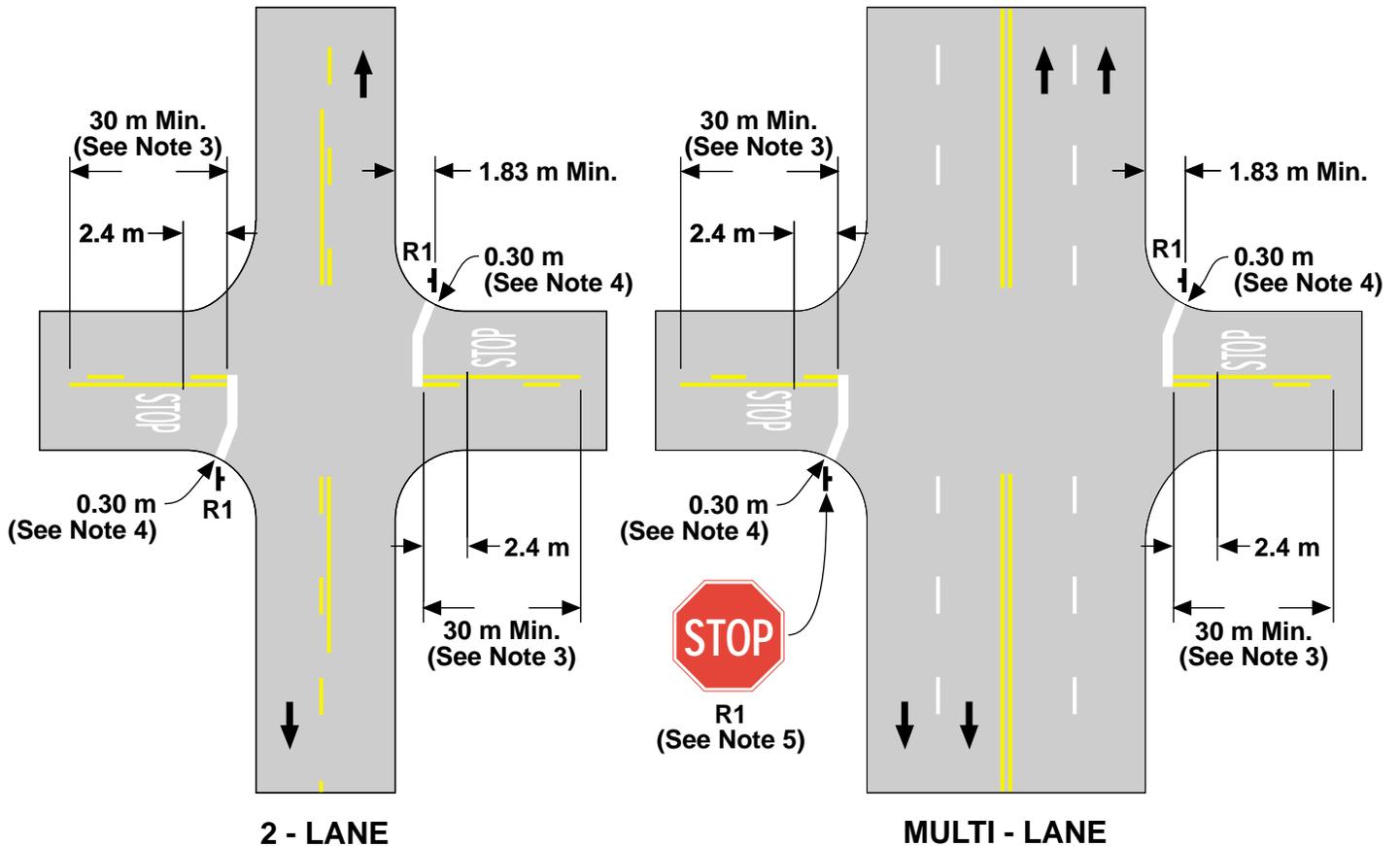
➔ Direction of Travel

W = Offset Distance (in meters).

S = Off Peak 85th Percentile Speed (in 5 km/h increments).  
 For new construction, the design speed may be used.

**NOT TO SCALE**

**Figure 6-33  
TYPICAL INTERSECTION MARKINGS**



**NOTES:**

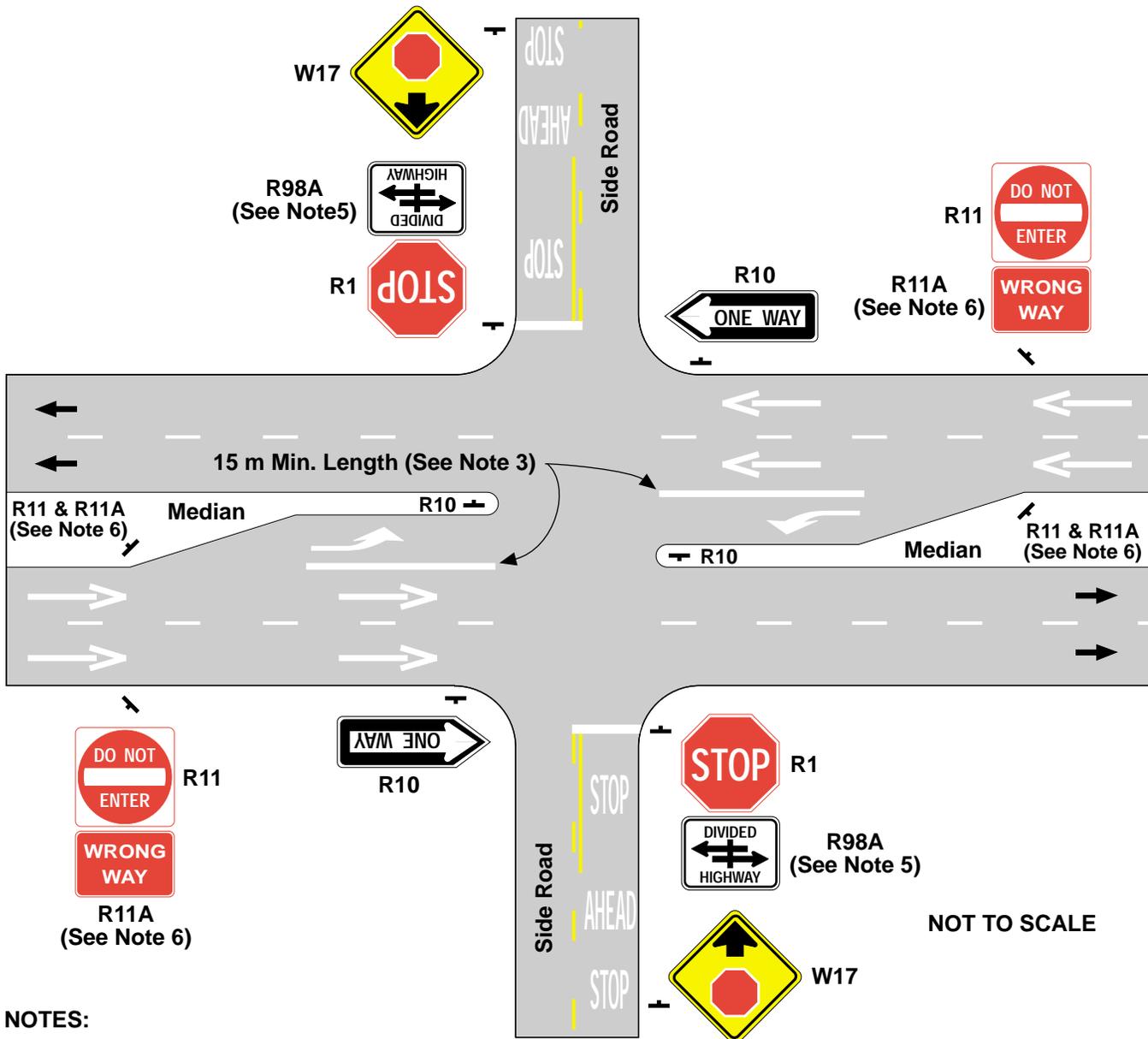
1. A Limit Line shall be placed on paved approaches and a "STOP" pavement legend should be placed on all but minor approaches to State Highways.
2. The Limit Line should be located to indicate the point at which traffic is required to stop. See Section 6-02.11.
3. See Figure 6-9 for additional information regarding intersection markings on the through highway.
4. The Limit Line on wide side roads on long radius corners may be bent at a  $45^{\circ} \pm$  angle for traffic making a right turn.
5. When a STOP AHEAD (W17) sign is used, a pavement legend may be placed to supplement the sign according to Section 6-02.14.

**LEGEND**

➔ Direction of Travel

NOT TO SCALE

**Figure 6-34**  
**TYPICAL RURAL EXPRESSWAY INTERSECTION SIGNS AND MARKINGS**



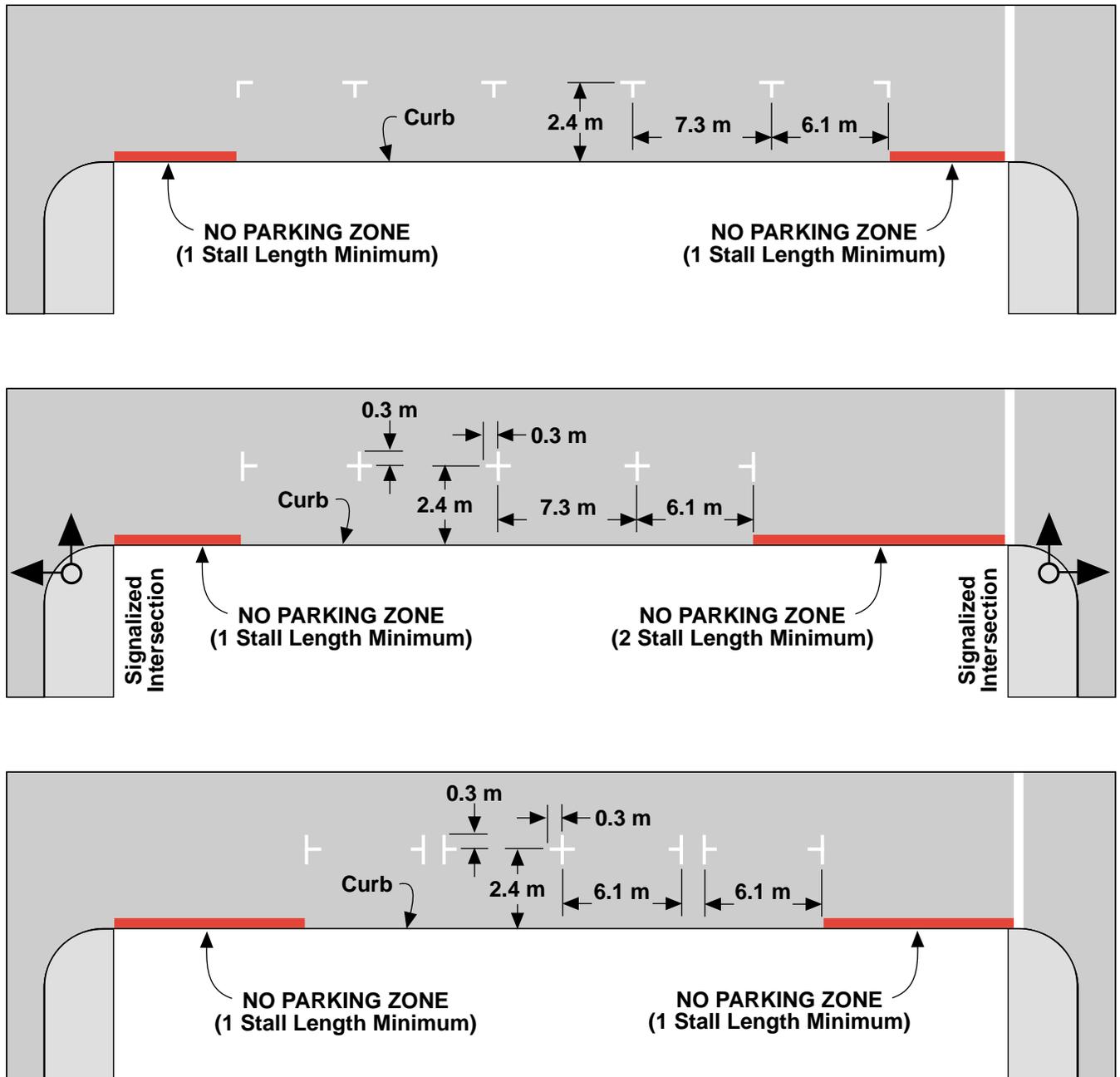
**NOTES:**

1. The intersection shown is a typical design with most options included. Actual designs will vary based on site and traffic conditions.
2. For typical Intersection markings details, see Figure 6-33.
3. Left-Turn Lane Line is a 200 mm solid white line. For details, see Figure 6-20.
4. When used, the distance between groups of Type V Arrows is approximately 30 m ±.
5. When used, the R98A sign may also be placed as a separate installation in advance of the Stop sign.
6. When used, the R11 and R11A signs should be placed in a location that is directly in the view of a driver who would be making a wrong way entry from the cross street. The R11A sign is optional on local streets and highways.

**LEGEND**



**Figure 6-35  
TYPICAL PARKING STALL MARKINGS**

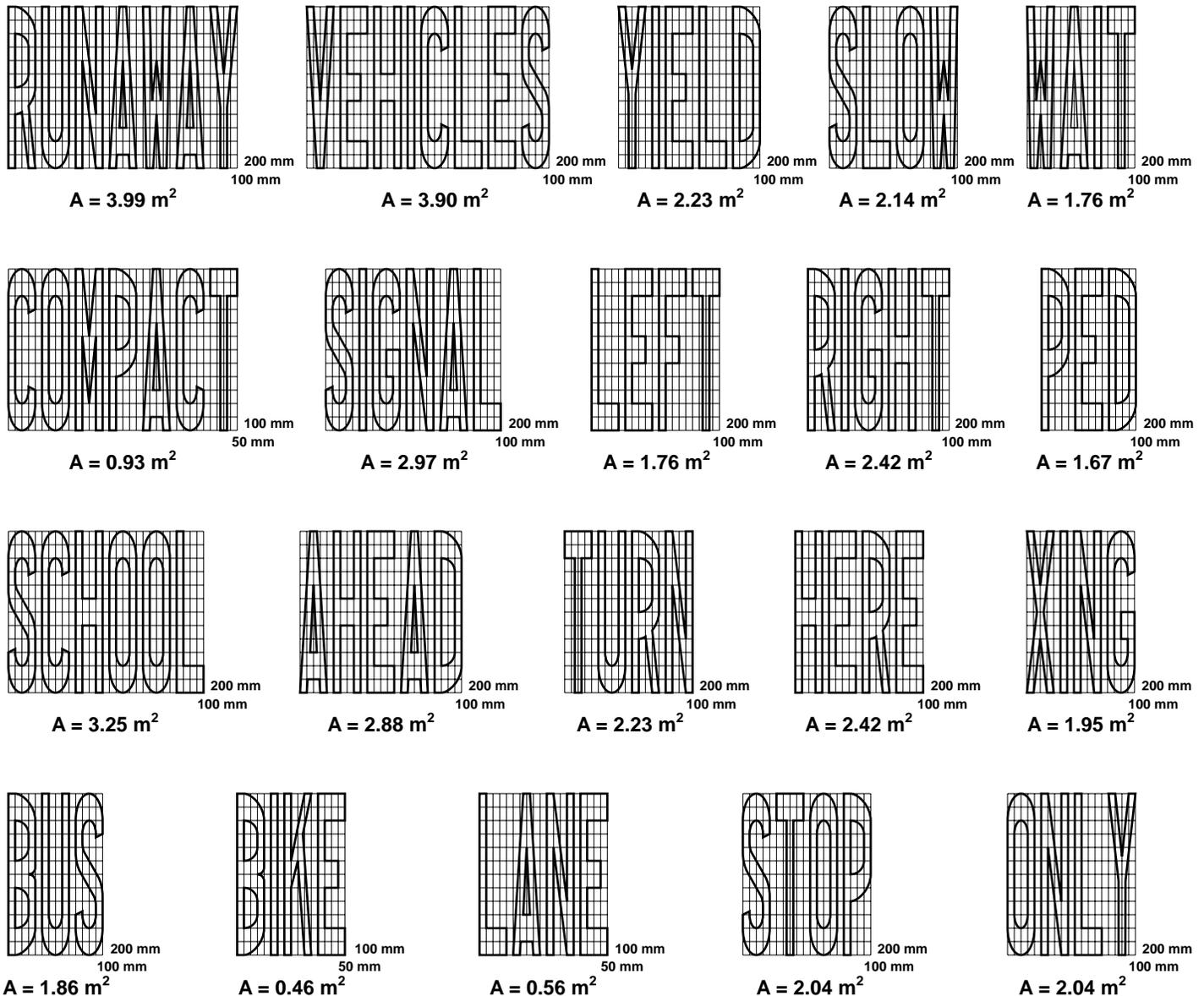


NOT TO SCALE

**NOTES:**

1. For Parking Stalls along the left side curb on one-way streets, markings may be placed on the curb delineating the ends of the individual stalls.
2. All stall markings are made with 100 mm wide white lines. The shape is optional.
3. The parking stall cross line, 2.4 m from the curb, may be continuous longitudinally.
4. For more information on parking stall markings, see Section 6-02.13.

**Figure 6-36**  
**TYPICAL PAVEMENT LEGEND MARKINGS**

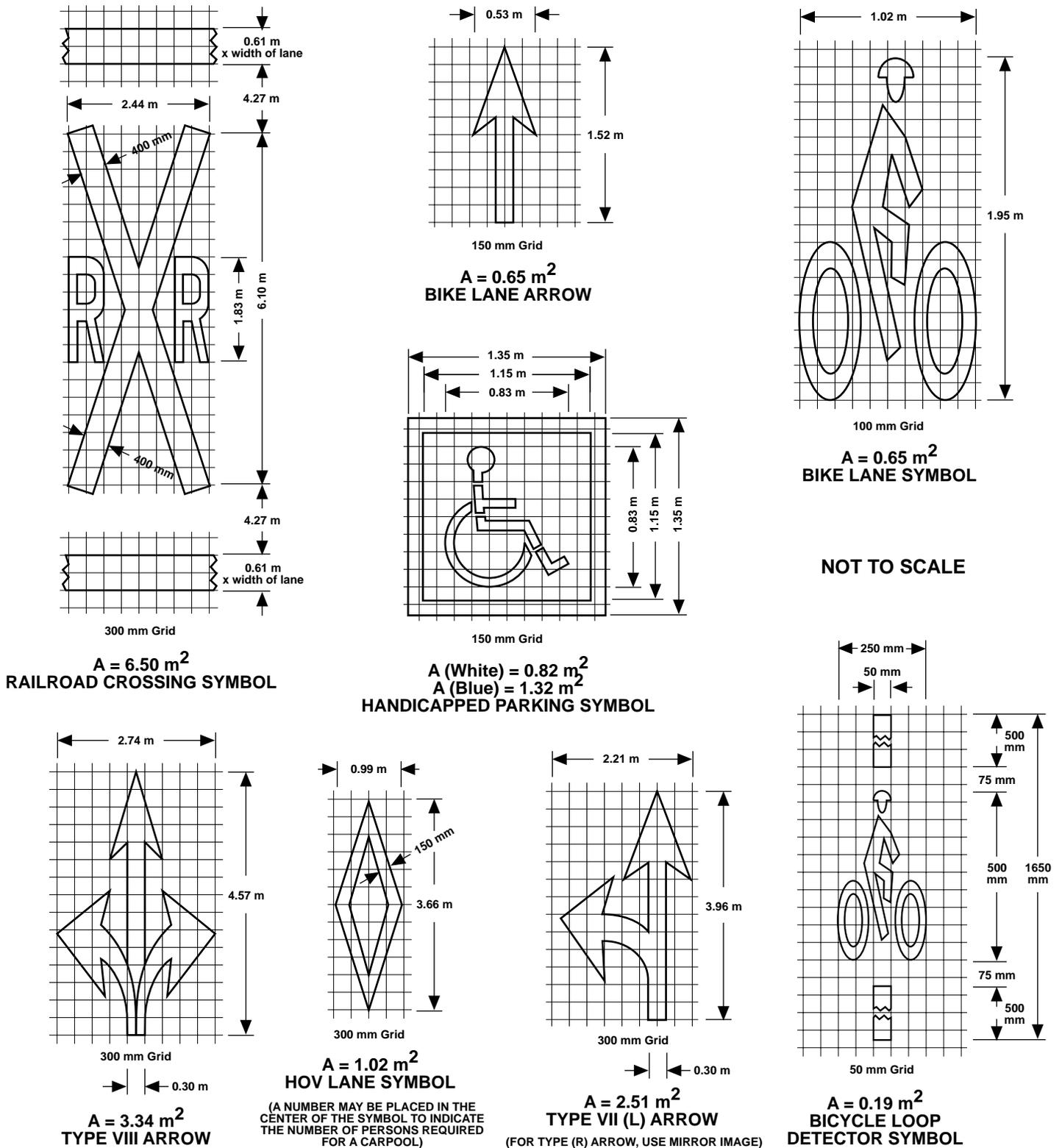


**NOTES:**

1. All letters and numerals should be in conformance with the standard alphabets for highway signs and pavement markings approved by Caltrans. Letters and numerals 2.4 m or more in height, should be used.
2. The space between lines should be at least four times the height of the characters for low speed roads, but not more than ten times the height of the characters. The space between lines may be reduced appropriately where there is limited space because of local conditions.
3. Pavement messages should generally be no more than one lane in width.
4. The design details for various words are shown in the Standard Plans published by Caltrans.

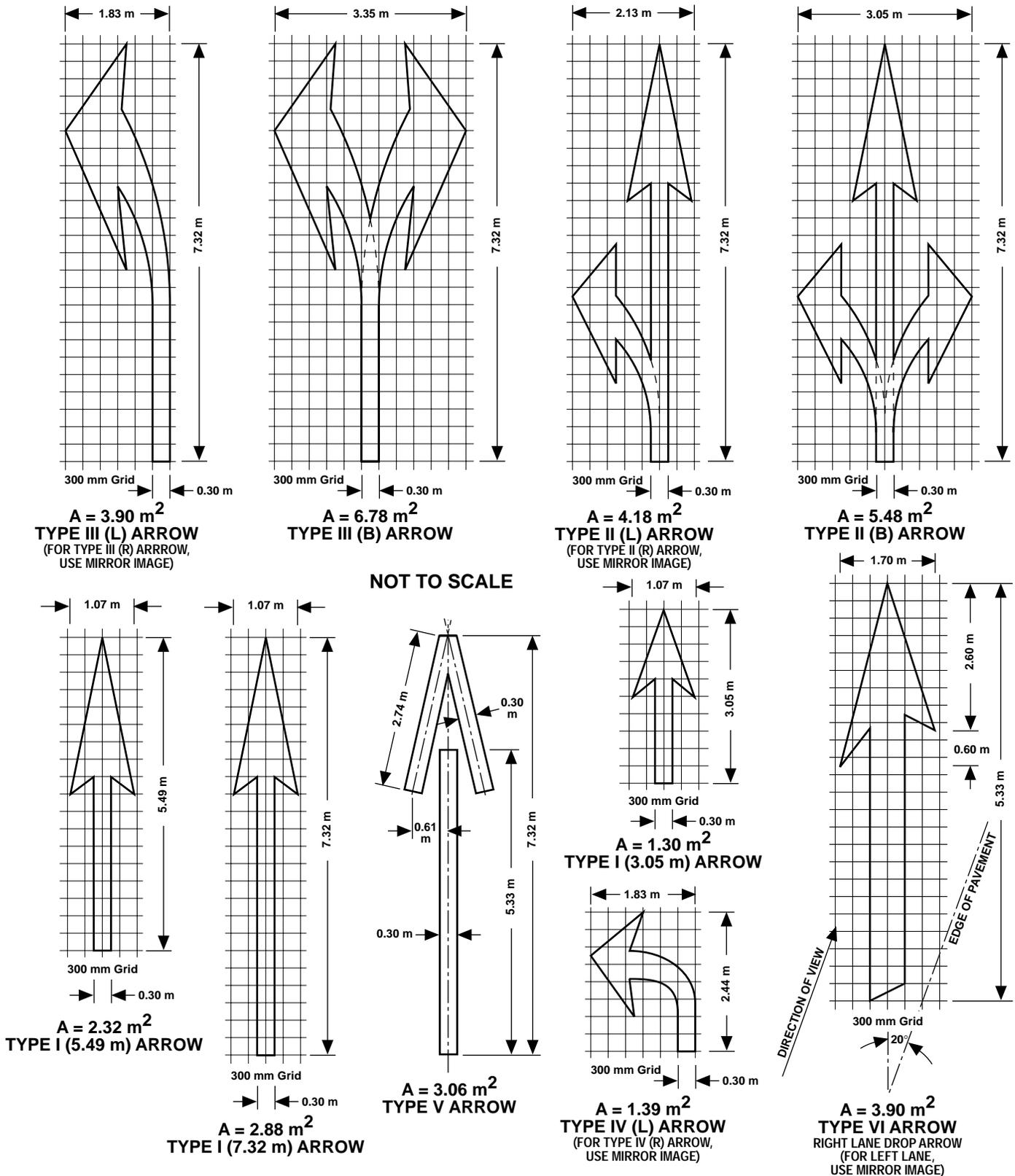
NOT TO SCALE

**Figure 6-37**  
**TYPICAL PAVEMENT SYMBOL AND ARROW MARKINGS**



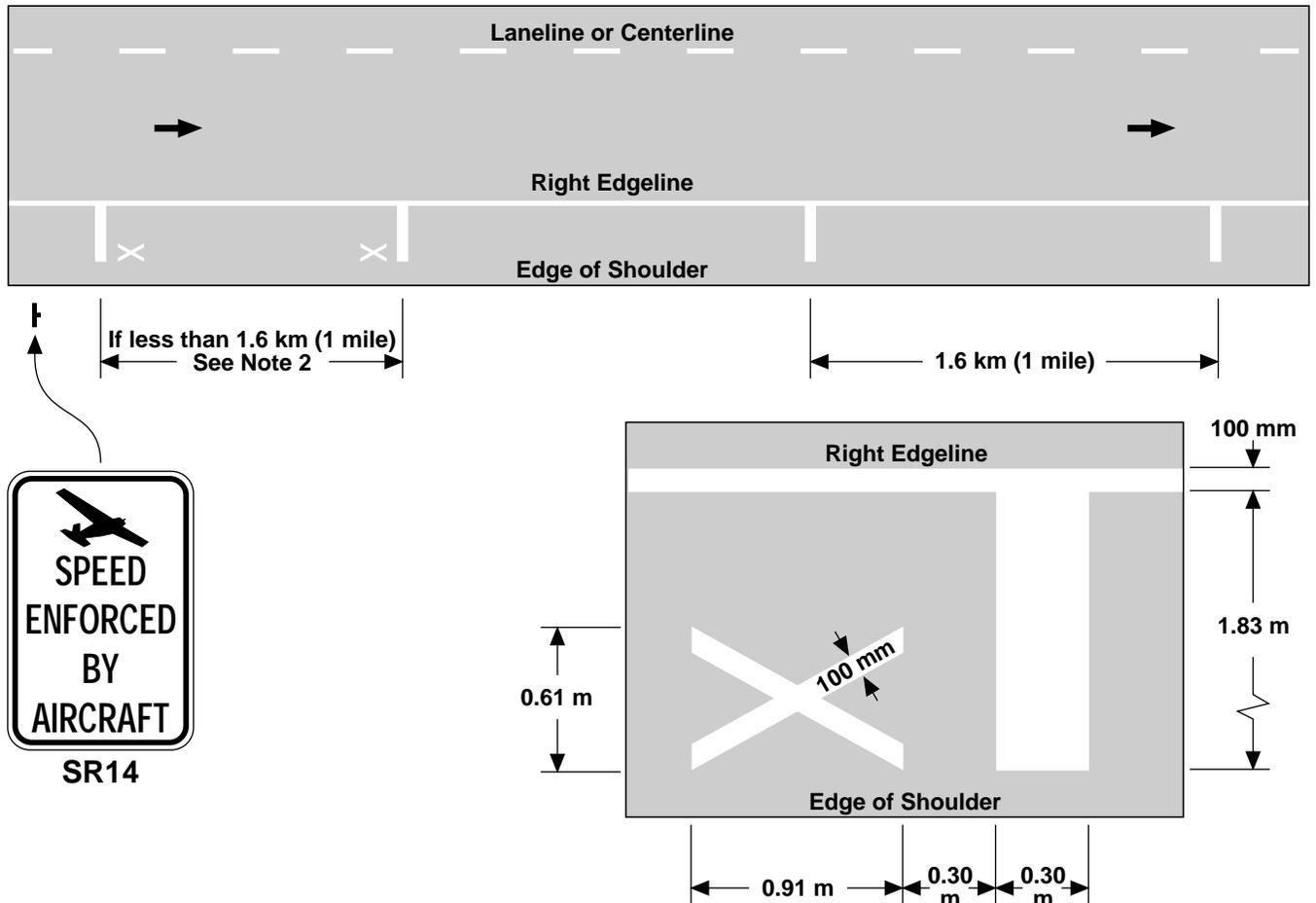
NOTE: The design details for various arrows and symbols are shown in the Standard Plans published by Caltrans.

**Figure 6-38  
TYPICAL PAVEMENT ARROW MARKINGS**



**NOTE:** The design details for various arrows are shown in the Standard Plans published by Caltrans.

**Figure 6-39  
TYPICAL SIGNING AND MARKINGS  
FOR HIGHWAYS WHERE SPEED IS ENFORCED BY AIRCRAFT**



**NOTES:**

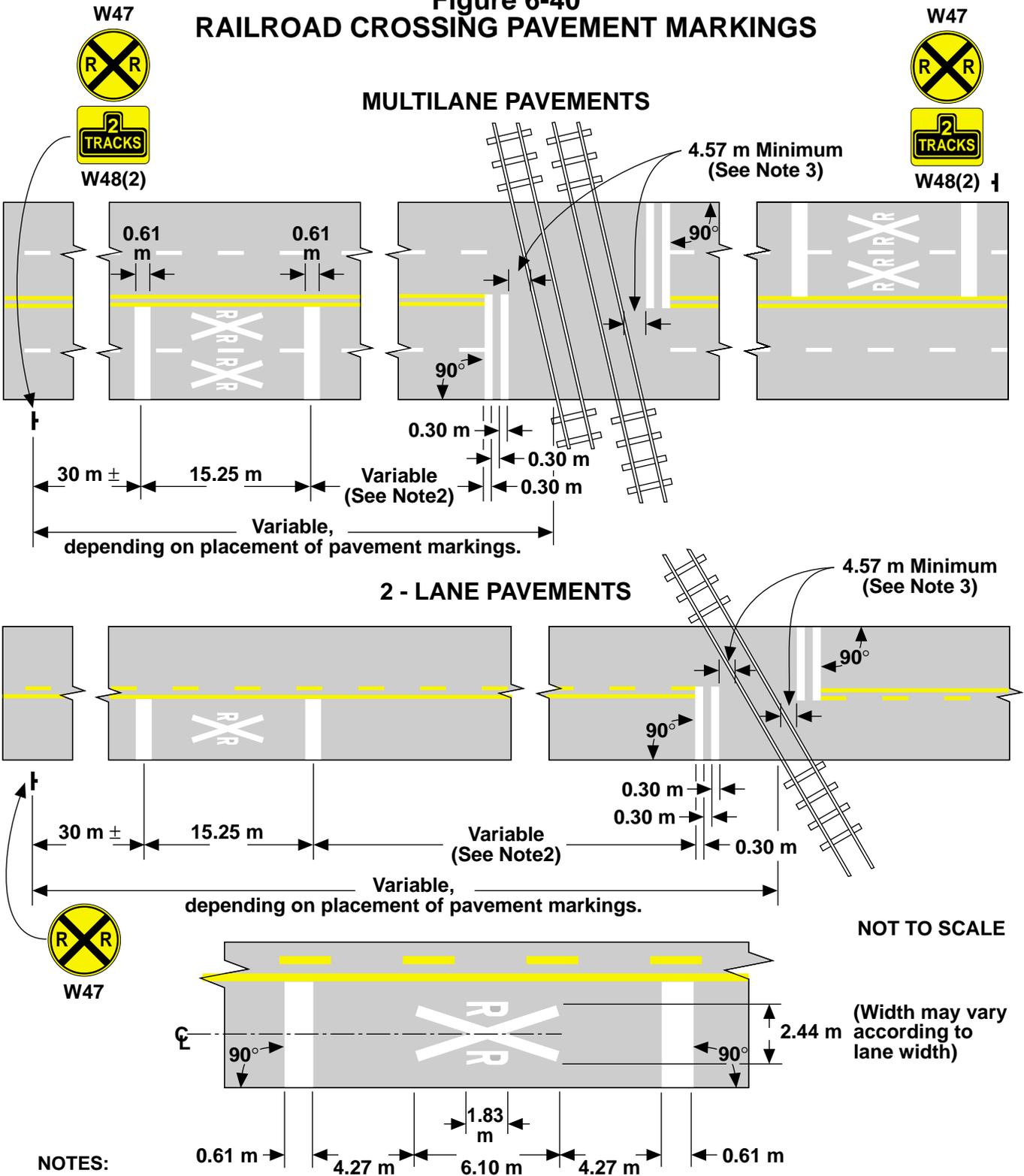
1. Markings may be placed on the right shoulder in areas patrolled by aircraft as requested by the CHP.
2. Where there is an equation of more than 30 m in a 1.6 km (1 mile) posting, a white 'X' pavement marking shall be placed at each end of the section to indicate the markings are less than 1.6 km (1 mile) apart.
3. The SR14 sign should be used for both directions of travel and should be spaced at 40 km (25 mile) intervals.
4. Pavement marking should be placed on the shoulder in one direction only, except where the opposing roadway is widely separated.
5. In areas where identifying features are widely separated, white 0.91 m high post kilometer (mile) numbers may be placed at 8 km (5 mile) points where needed for aircraft reference.
6. Markings shall not be on the traveled way. If routes with narrow shoulders are requested for marking, the standard marking shape may be modified to provide an equivalent area without encroaching on the traveled way or the Alternate Marking System described in Note 7 may be used.
7. The Alternate Marking System is a 200 mm wide solid white longitudinal line, 6.1 m in length and in line with the right edgeline. It is preceded and followed by a 6.1 m gap in the right edgeline.

**LEGEND**

➔ Direction of Travel      † Sign

NOT TO SCALE

**Figure 6-40  
RAILROAD CROSSING PAVEMENT MARKINGS**

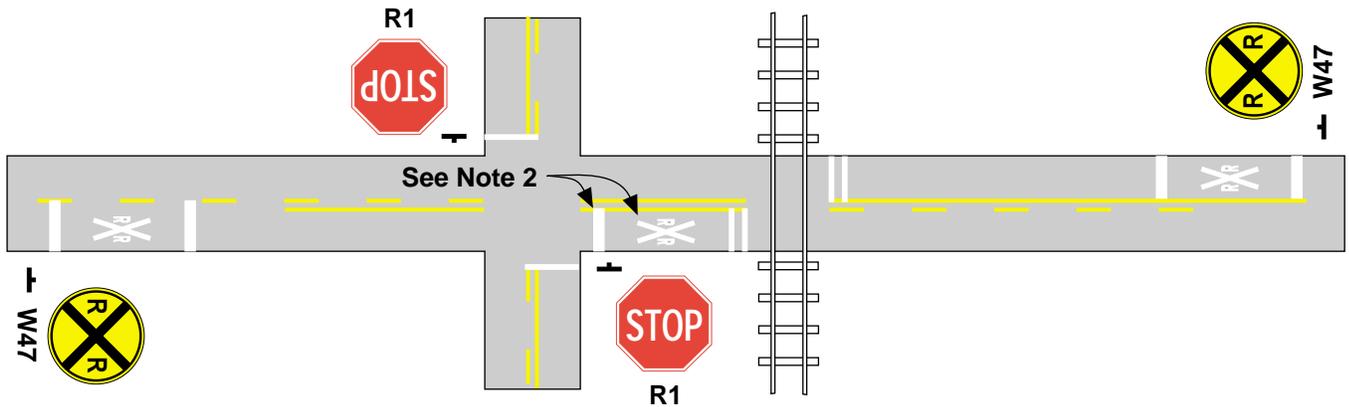


NOT TO SCALE

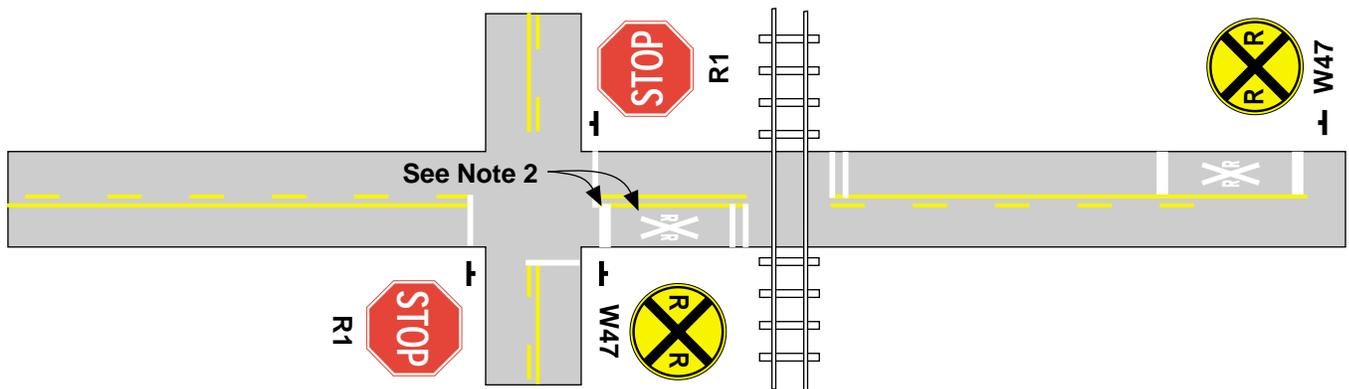
(Width may vary according to lane width)

**Figure 6-41  
TYPICAL RAILROAD CROSSING PAVEMENT MARKINGS  
(Near Highway Intersections)**

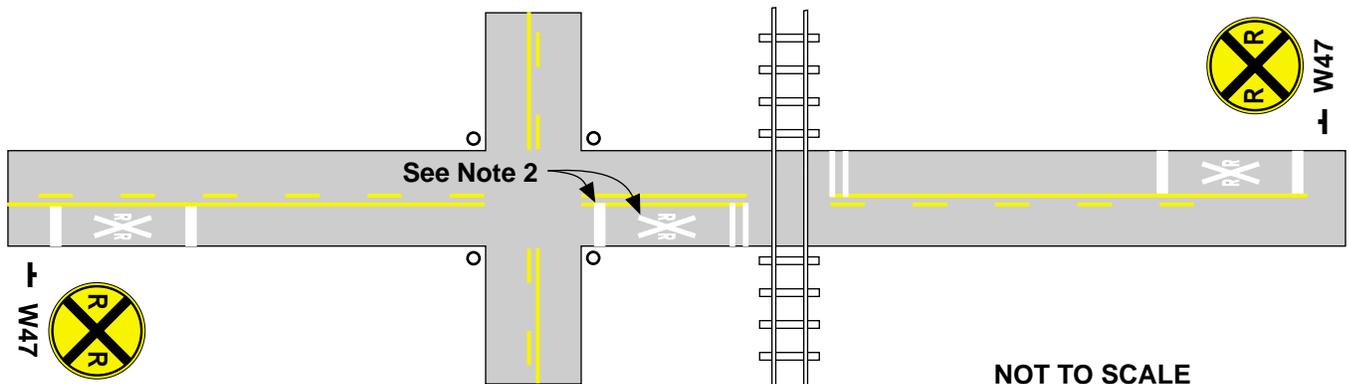
**RAILROAD CROSSING TRAFFIC  
(Uncontrolled Intersection)**



**RAILROAD CROSSING TRAFFIC  
(Controlled by Stop Signs at Intersection)**



**RAILROAD CROSSING TRAFFIC  
(Highway Intersection Signalized)**

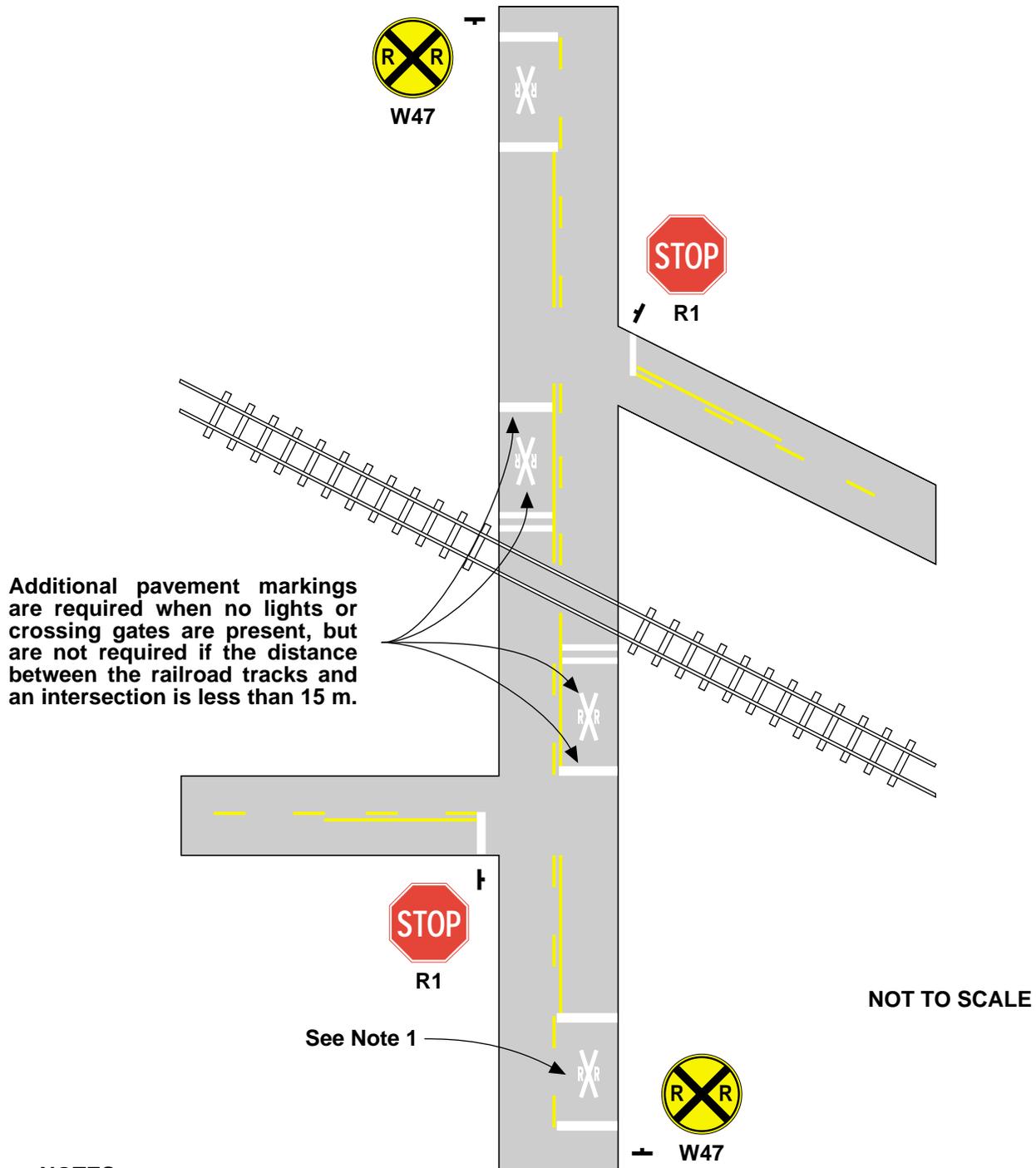


NOT TO SCALE

**NOTES:**

1. See Figure 6-40 for pavement marking details.
2. Not required if the distance between the cross street and railroad is less than 15 m.

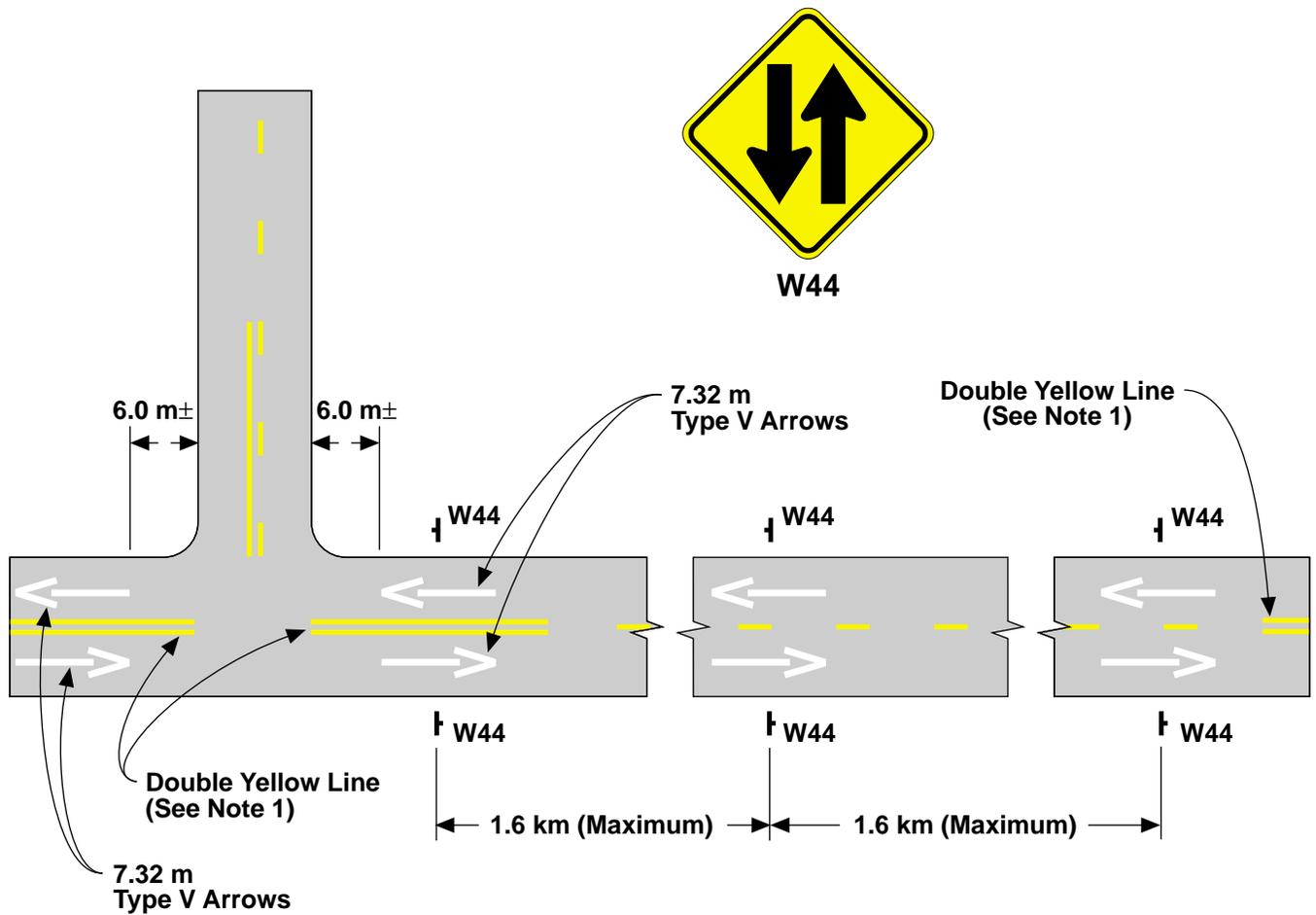
**Figure 6-42  
TYPICAL RAILROAD CROSSING PAVEMENT MARKINGS  
(Near Minor Road and Highway Intersections)**



**NOTES:**

1. See Figure 6-40 for pavement marking details.
2. The centerline stripe may be extended across the tracks at unusually long crossings, due to extreme crossing angles and/or multiple tracks where the motorist may need additional delineation.

**Figure 6-43  
TREATMENT FOR DIVIDED HIGHWAY ILLUSION**



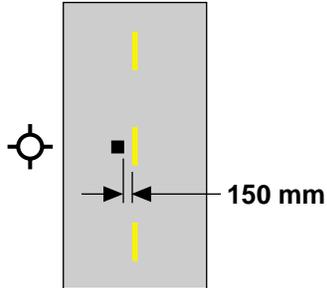
**NOTE:**

1. Use a Double Yellow Line (Two Direction - No Passing) to discourage wrong way movements at critical locations, such as entering roads or approaches to transitions.

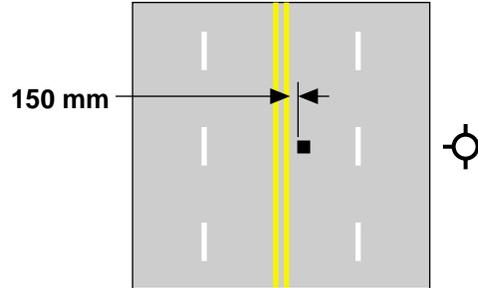
NOT TO SCALE

Figure 6-44  
TYPICAL FIRE HYDRANT LOCATION PAVEMENT MARKERS

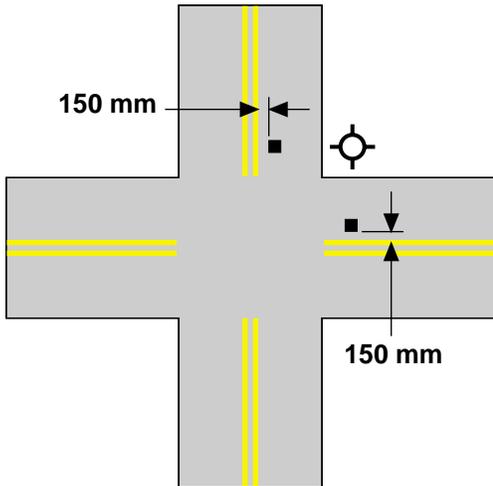
TWO LANE STREET



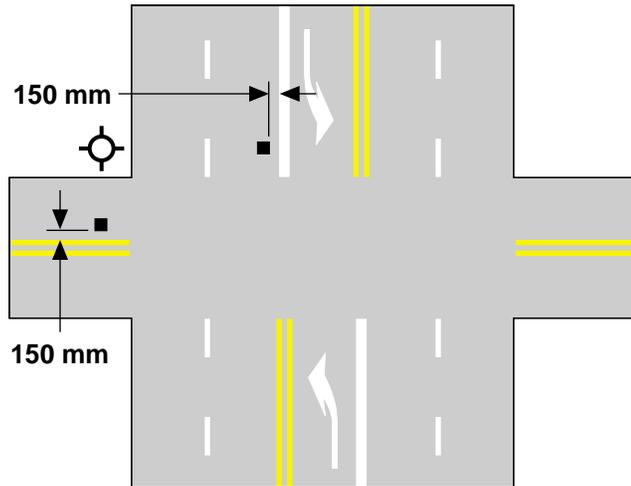
MULTI-LANE STREET



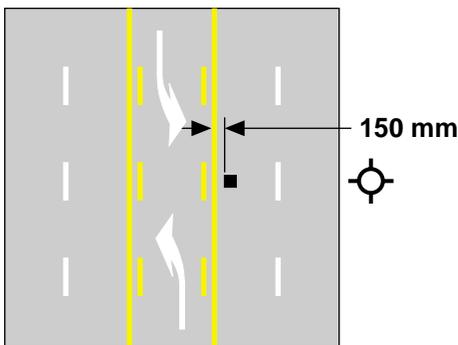
TWO LANE STREET AT INTERSECTION



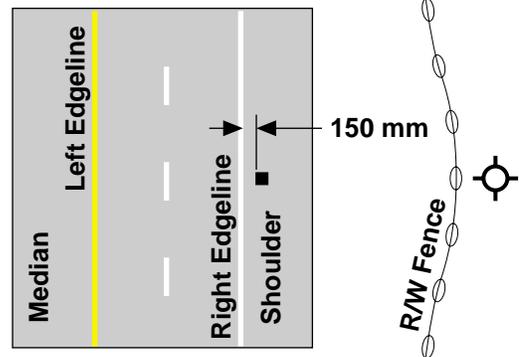
FOUR LANE STREET WITH TURN LANE AT INTERSECTION



MULTI-LANE STREET WITH TURN LANE



FREEWAYS AND EXPRESSWAYS

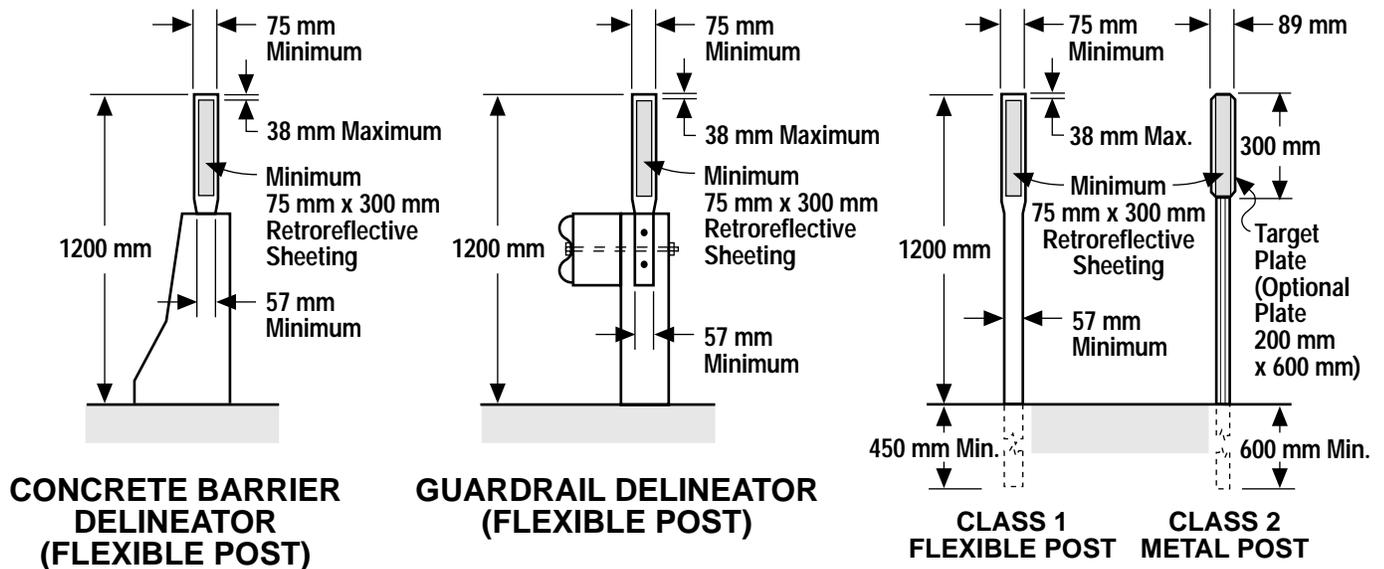


LEGEND

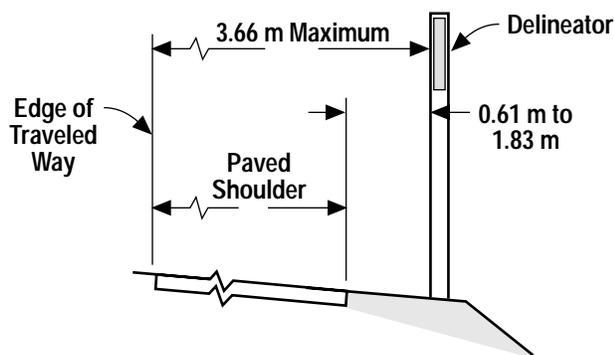
-  Fire Hydrant
-  Blue Retroreflective Raised Pavement Marker

NOT TO SCALE

**Figure 6-45  
TYPICAL DELINEATORS**



NOT TO SCALE



**TYPICAL DELINEATOR PLACEMENT**

**TYPES OF DELINEATORS**

TYPE	RETROREFLECTOR COLOR	
	FRONT	BACK*
E	WHITE	WHITE
F	WHITE	NONE
G	YELLOW	NONE
I	YELLOW	YELLOW
J	RED	NONE

\*Back Retroreflector:

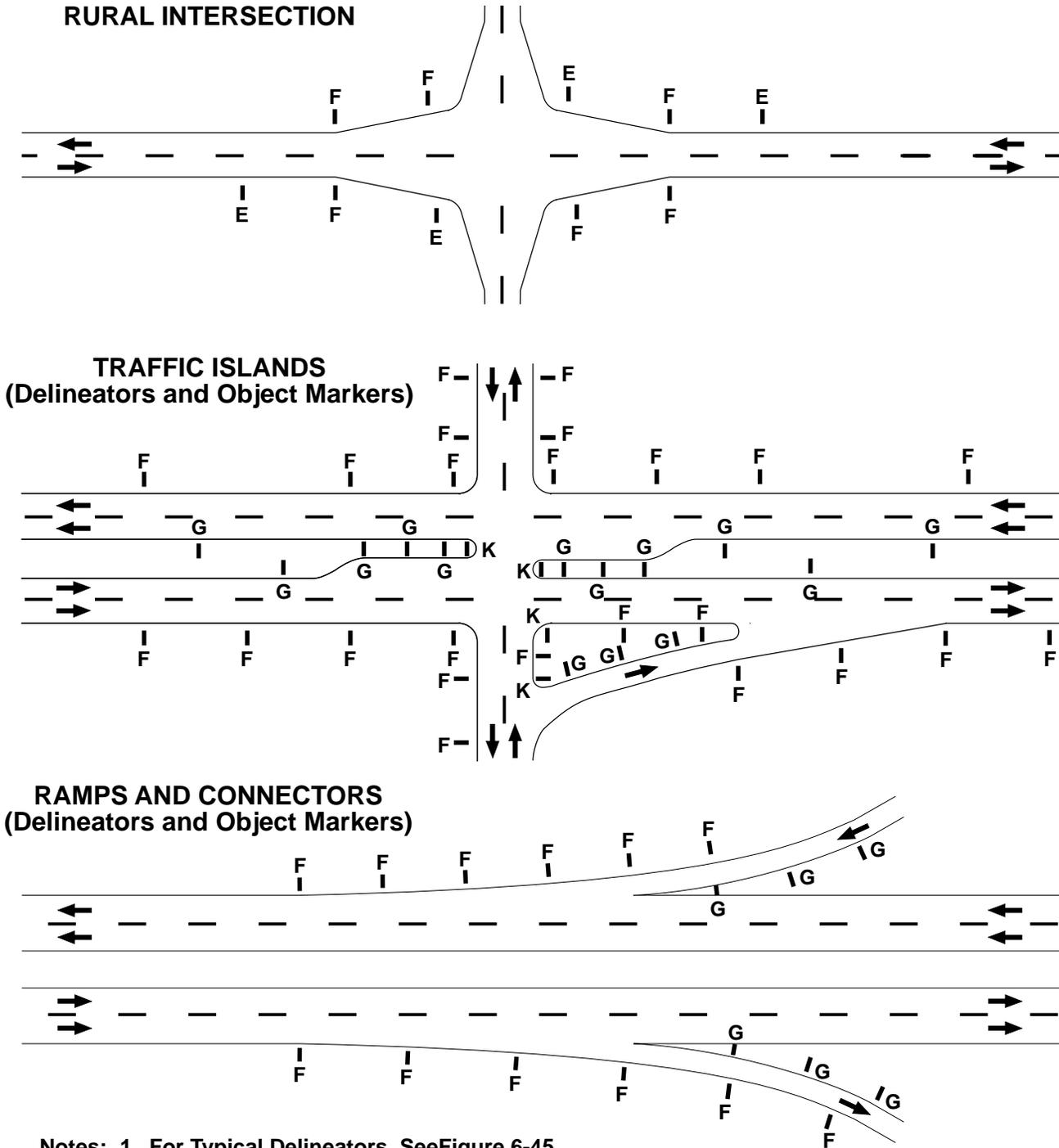
Class 1 Delineator - 75 mm ± square of retroreflective sheeting.

Class 2 Delineator - 75 mm ± acrylic cube-corner retroreflective element.

**NOTES:**

1. Class 1 (Flexible Post) Delineators are standard on State highways, except for certain locations, e.g., snow or protected areas behind guardrail, etc. The color of the post is white.
2. Class 1 (Flexible Post) Delineators used in construction or maintenance zones shall be orange with white retroreflective sheeting. However, if the delineators are to remain in place as a permanent roadway feature after the construction or maintenance period, the color of the post shall be white with the appropriate color of retroreflective sheeting as specified in Section 6-04.3.
3. The Type of Retroreflective Element and Class of Post is designated as E-1, F-2, etc.

Figure 6-46  
TYPICAL EXAMPLES OF DELINEATOR PLACEMENT  
WHEN USED AT INTERSECTIONS, ISLANDS, RAMPS AND CONNECTORS



- Notes: 1. For Typical Delineators, See Figure 6-45.  
 2. For Delineator Spacing on Curves, See Figure 6-47.  
 3. For Typical Object Markers, See Figure 6-51.

LEGEND

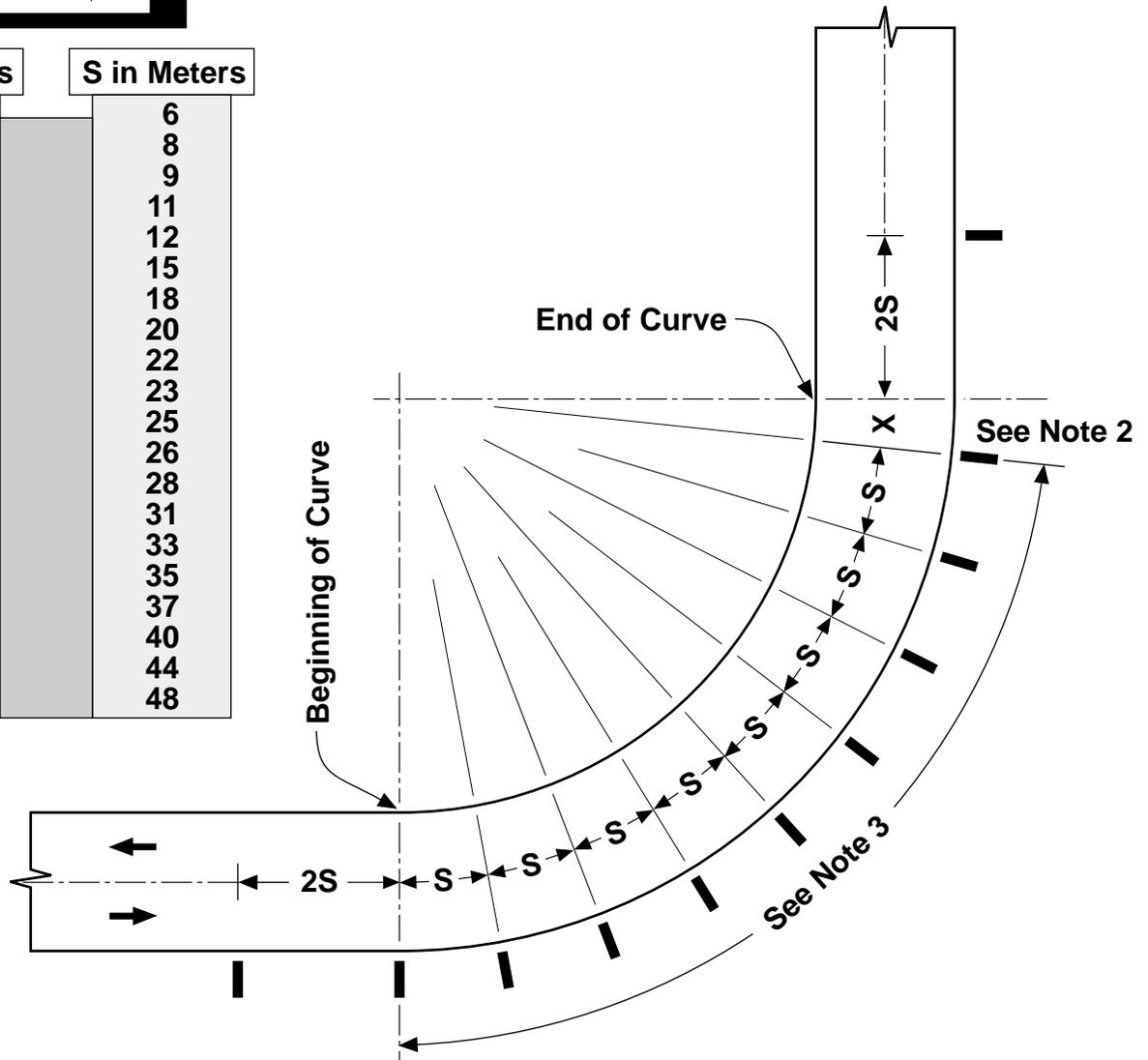
- K = Type of Object Marker
  - E, F, G = Types of Delineators
  - ← Direction of Travel
- NOT TO SCALE

**Figure 6-47  
DELINEATOR SPACING ON CURVES**

**Formula**

$$S = 1.6 \sqrt{R}$$

R in Meters	S in Meters
15	6
23	8
30	9
46	11
61	12
91	15
122	18
152	20
183	22
213	23
244	25
274	26
305	28
366	31
427	33
488	35
548	37
610	40
762	44
914	48



**Notes:**

1. The maximum spacing between delineators on a curve is 48 m.
2. Prorate distance "X" among all spacing so the last delineator falls at the end of the curve.
3. Install delineators perpendicular to the oncoming traffic.

**LEGEND**

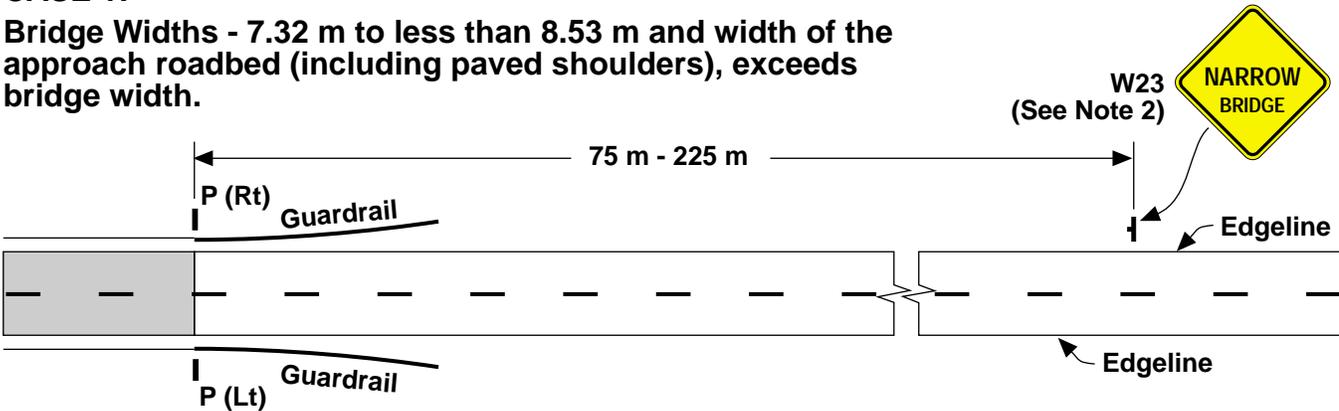
S = Delineator spacing in meters.  
 R = Centerline curve radius in meters.  
 X = Distance from End of Curve to the calculated location of the last delineator.

 Delineator  
 Direction of Travel  
 NOT TO SCALE

**Figure 6-48  
NARROW BRIDGE SIGNING AND MARKINGS  
(One-Way and Two-Way Roadways)**

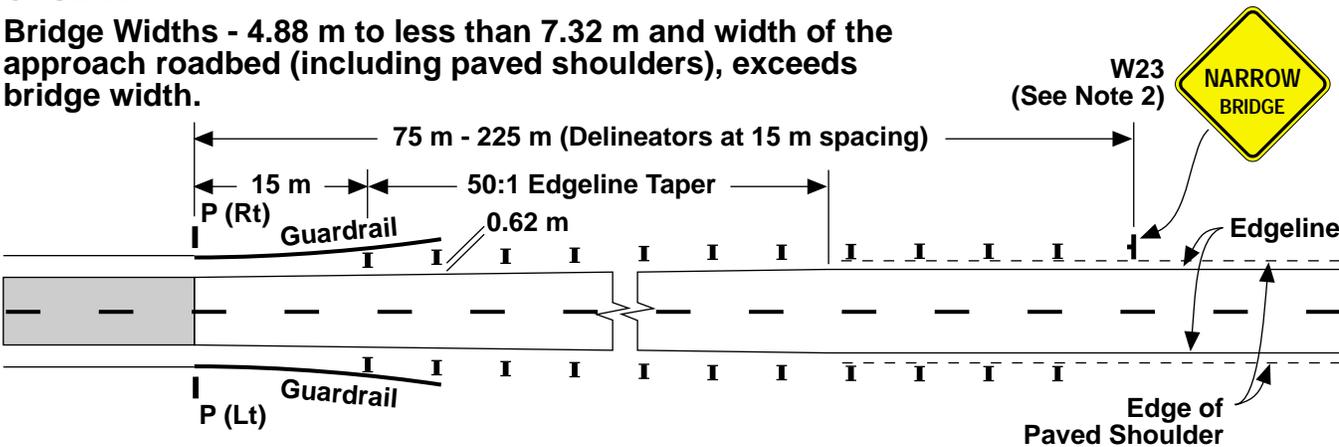
**CASE 1:**

Bridge Widths - 7.32 m to less than 8.53 m and width of the approach roadbed (including paved shoulders), exceeds bridge width.



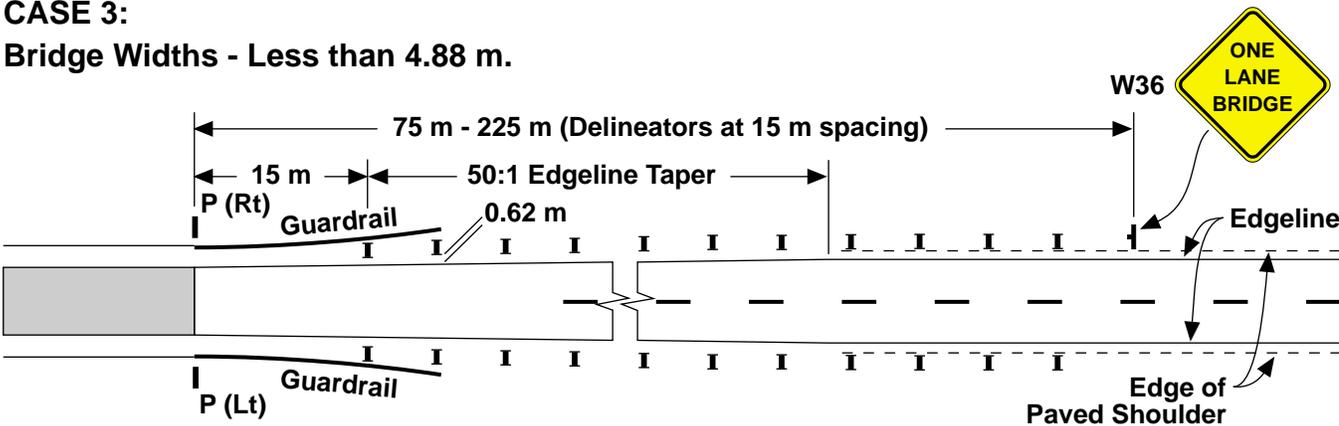
**CASE 2:**

Bridge Widths - 4.88 m to less than 7.32 m and width of the approach roadbed (including paved shoulders), exceeds bridge width.



**CASE 3:**

Bridge Widths - Less than 4.88 m.

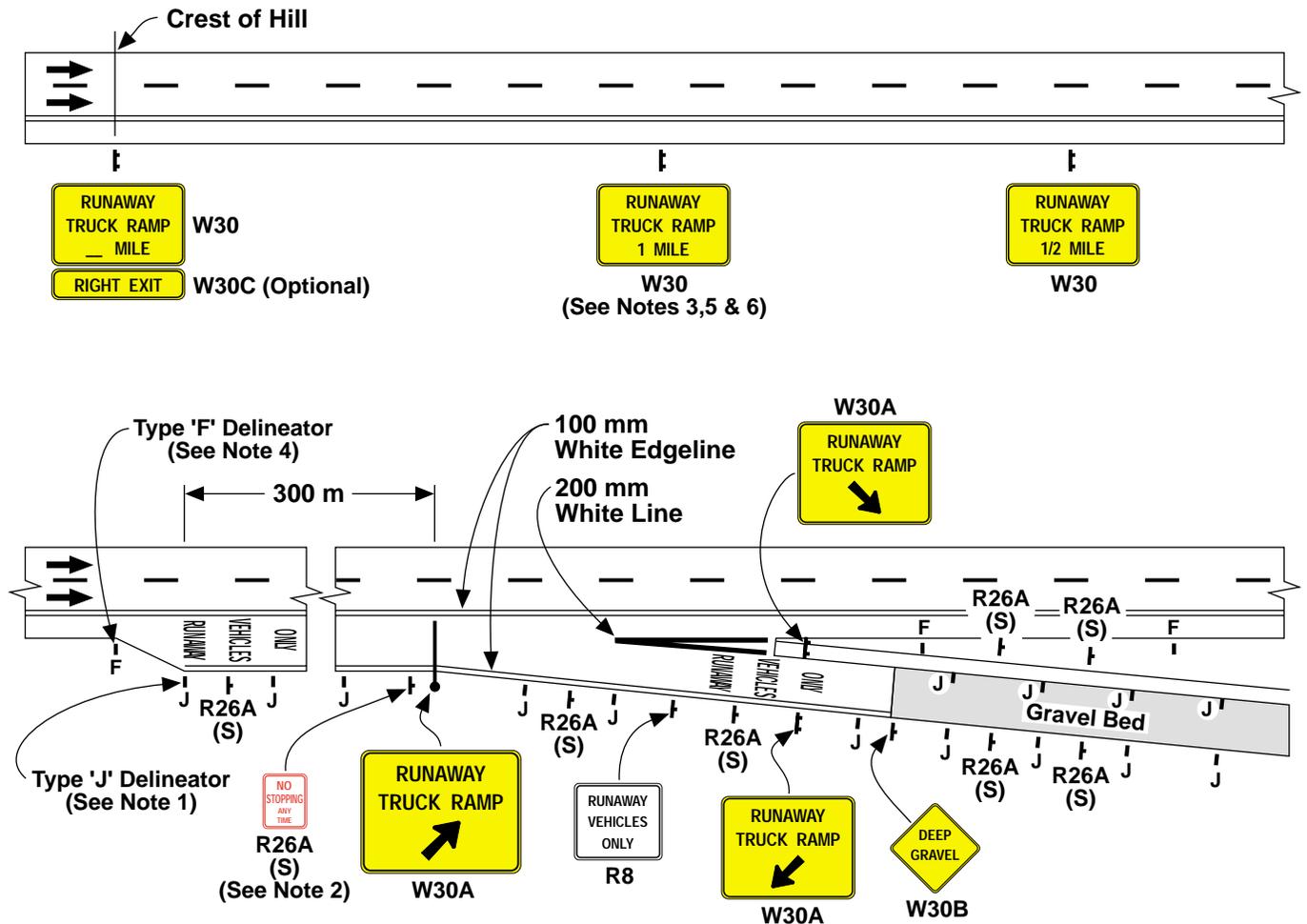


- Notes: 1. The Edgeline shall be continued across all bridges on State highways.  
 2. The NARROW BRIDGE (W23) sign should be erected on the right and in the median on a one-way roadway.  
 3. Delineators shall be continued across the bridge in Cases 2 and 3.

**LEGEND**

I = Type "P" Object Marker. See Figure 6-52. I = Delineators (Type "G" for One-Way Roadways and Type "I" for Two-Way Roadways). See Figure 6-45.  
 NOT TO SCALE

**Figure 6-49  
TYPICAL RUNAWAY TRUCK RAMP SIGNING AND MARKINGS**



**Notes:**

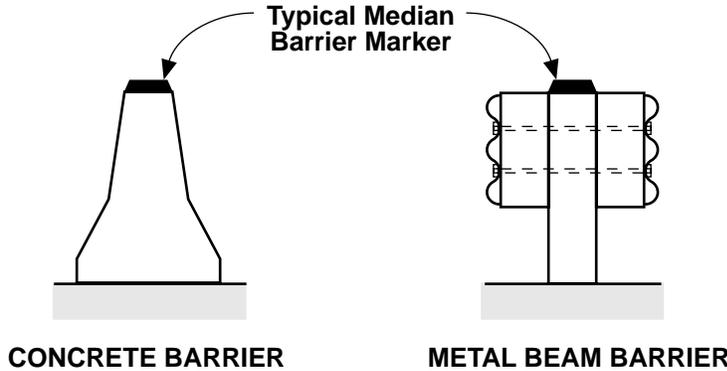
1. Place Type 'J' Delineators at 15 m centers. See Figure 6-45.
2. Place NO STOPPING ANY TIME, R26A(S) signs at 75 m centers.
3. Additional RUNAWAY TRUCK RAMP 1 MILE and RUNAWAY TRUCK RAMP 1/2 MILE, W30 signs may also be placed in the median on a one-way roadway.
4. Place 3 - Type 'F' Delineators at 150 m centers, preceding and following the Runaway Truck Ramp. See Figure 6-45.
5. Additional advance RUNAWAY TRUCK RAMP (2 MILES, 3 MILES, etc.) W30 signs may be added as necessary.
6. Overhead signs may be substituted for ground mounted signs.

**LEGEND**

← Direction of Travel

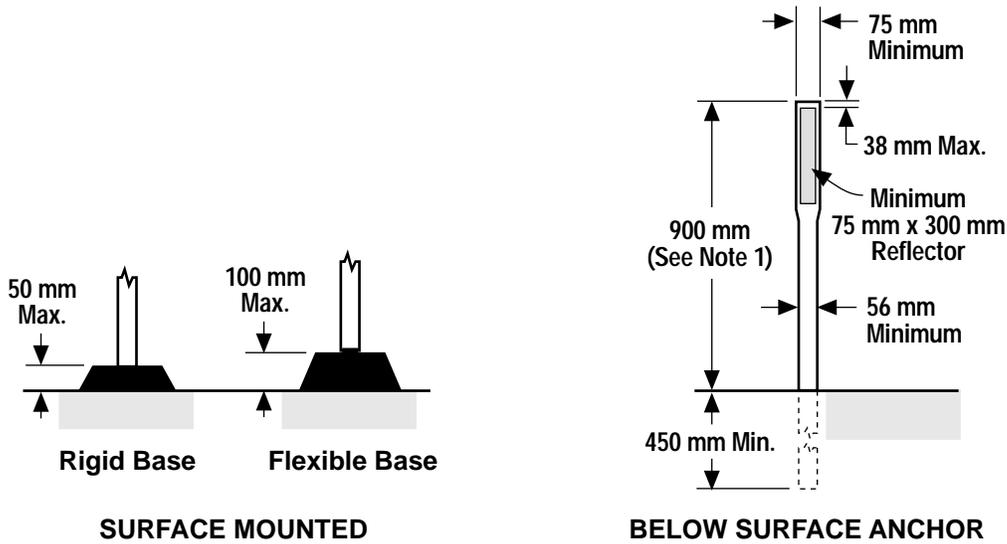
NOT TO SCALE

**Figure 6-50  
TYPICAL MEDIAN BARRIER DELINEATION AND CHANNELIZERS**



**MEDIAN BARRIER DELINEATION**

**NOTE:** The Median Barrier Marker spacing should correspond with the raised pavement marker spacing used on the left edgeline.



**CHANNELIZERS**

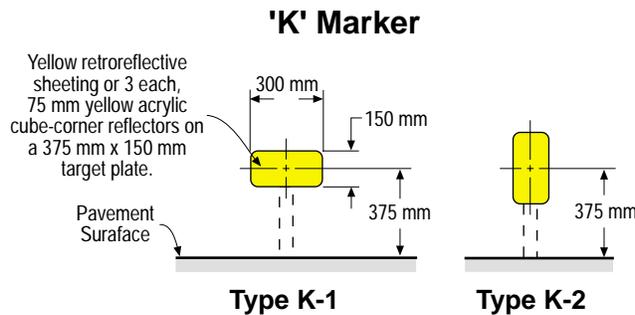
**CHANNELIZER NOTES:**

1. A minimum post height of 700 mm may be used at locations where speeds are 64 km/h or less.
2. Channelizer posts used in a construction or maintenance zone shall be orange with white reflectors. However, if the channelizers are to remain in place as a permanent roadway feature after the construction or maintenance period, the post shall be white and the color of the reflector shall conform to that of the pavement markings it supplements.

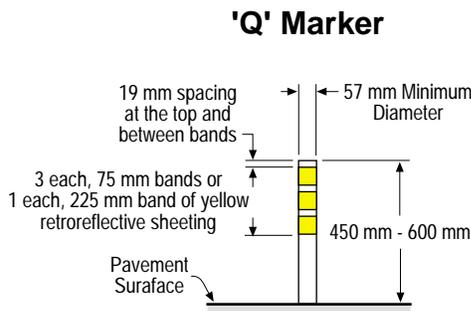
NOT TO SCALE

**Figure 6-51  
TYPICAL OBJECT MARKERS  
(Type K, Q and L)**

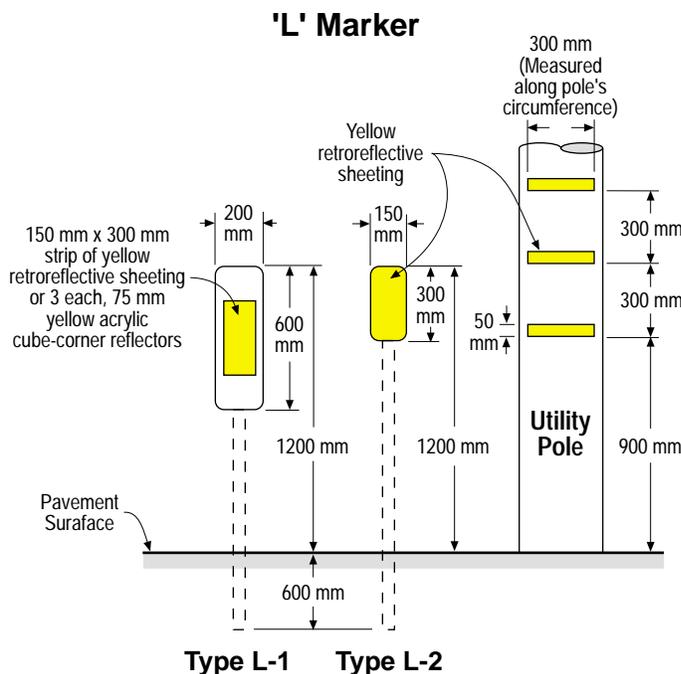
**POLICY**



Type 'K' Marker is used facing traffic to mark islands, curbs or neutral areas.



Type 'Q' Marker is used to mark islands, curbs or neutral areas where visibility is desired from all directions.



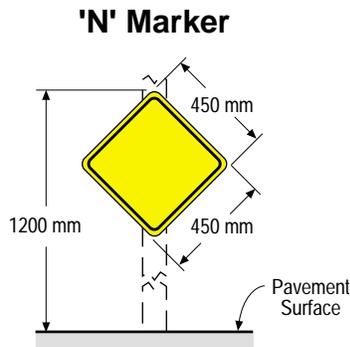
Type 'L' Marker is used to mark an object adjacent to the roadbed (outside of the paved shoulder) and within 3.66 m off the traveled way.

- The Type 'L-1' Marker with the 200 mm x 600 mm target plate shall be used on State Highways.
- Type 'L' Utility Pole Marker is used to mark a utility pole adjacent to the roadbed (outside of the paved shoulder). Installation and maintenance is the responsibility of the utility company.

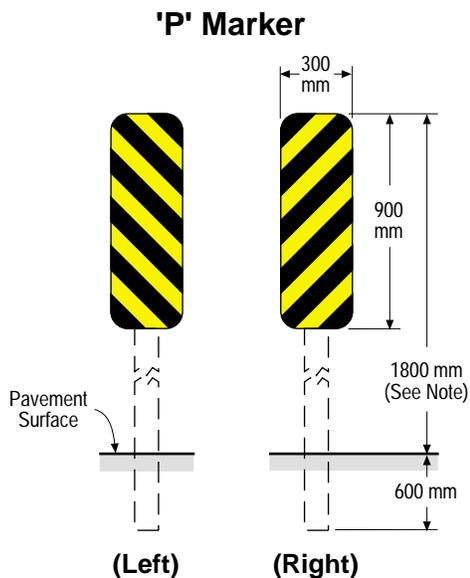
NOT TO SCALE

**Figure 6-52**  
**TYPICAL OBJECT MARKERS**  
(Type N, P and R)

**POLICY**



- 'N' Marker (Yellow) is used below and on the same post with a W56 or W57 Arrow sign to warn of an abrupt turn. Background may be either yellow retroreflective sheeting or yellow non-reflective background with 9 each, yellow acrylic cube-corner retroreflective elements.
- 'N' Marker (Red) is normally used below and on the same post with the W31 END sign to mark the end of a street or highway. Background may be either red retroreflective sheeting or red non-reflective background with 9 each, red acrylic cube-corner retroreflective elements.
- 'N' Marker (Orange) is used in a construction zone in the same manner as the Yellow - 'N' Marker. Background shall be orange retroreflective sheeting.

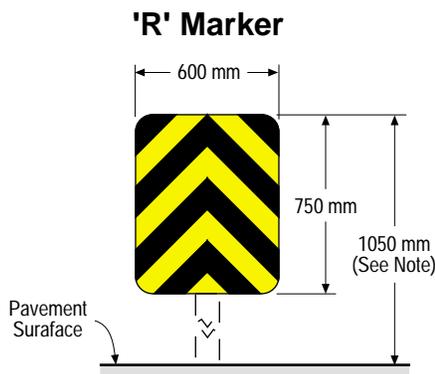


'P' Marker is used to mark an object in a paved area, within 2.44 m of the traveled way, where traffic may pass on only one side of a fixed object. Background shall be yellow retroreflective sheeting with alternating black opaque stripes.

In a construction zone, this marker has a white retroreflective background with alternating orange retroreflective stripes.

**Note:**

When placed on, or in front of, a crash cushion, this height should be approximately the same height as the crash cushion.



'R' Marker is used to mark an object within the roadbed where traffic may pass on either side of a fixed object. Background shall be yellow retroreflective sheeting with alternating black opaque stripes.

In a construction zone, this marker has a white retroreflective background with orange retroreflective stripes.

**Note:**

The bottom of the marker is normally mounted 0.3 m above the pavement surface.

NOT TO SCALE