

SECTION 5

DELINEATION AND HAZARD MARKERS

Update July 2010

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Note: For chevron sight boards refer to MOTSAM Part 1 Section 6: PW-66, PW-67, PW-68 & PW-69.
For motorway markings refer to MOTSAM part 3.

5.01 INTRODUCTION

5.01.01 GENERAL

Objects within and immediately adjacent to the road can constitute a hazard to traffic. Those that cannot reasonably be removed or protected require uniform methods of highlighting.

Hazard markers and signs ensure that drivers approaching such objects have adequate advance warning to allow proper precautions to be taken.

Devices approved for use to mark hazards on or near the road include reflectorised markers, painted markings and traffic signs.

5.01.02 POTENTIAL HAZARDS

Objects which may constitute a hazard to traffic include:

- bridge end posts, kerb ends, footpaths, etc,
- ends of sight rails, guardrails and handrails,
- piers and abutments at underpasses,
- ends of non-mountable kerbs,
- soffits of underpasses with less than 4.4 m vertical clearance,
- non-frangible service poles and lighting columns,
- ends of medians, safety zones, kerb extensions and kerb build-outs, and
- trees with a trunk diameter more than 150 mm.

5.02 HAZARDS ADJACENT TO THE ROADWAY

5.02.01 WIDTH MARKERS

AT GUARDRAILS, BRIDGES & OTHER WIDTH RESTRICTIONS

Width markers shall be installed on bridge guardrails, other guardrails, bridge end posts or other such width restrictions ONLY if they come within the clear or trafficable approach width of the highway.

(a) Width Marker Details:

Refer to Figure 5.1

Colour (left hand side)	:	Three white reflectorised diagonal stripes
Colour (right hand side)	:	Three yellow reflectorised diagonal stripes
Background	:	Matt black.
Height	:	900 mm
Width	:	150 mm (min.)

(b) Installation of Width Markers:

Refer to Figure 5.4

Width markers shall be attached:

- > On, or in front of, non-frangible width restrictions (eg. concrete bridge ends) in which case the front face of the restriction shall be painted white.
- > In the case of guardrails, on the guardrail post or on posts hard behind the guardrail.

The top of the marker should be a minimum of 1.0 m above the road surface.

The markers shall be erected on one or both sides of the road as applicable and facing oncoming traffic.

White markers shall be used on the left hand side of the road and yellow markers used on the right.

The diagonal stripes on the markers shall slope downward towards the road.

5.02.02 SERVICE POLES AND OTHER ISOLATED ROADSIDE HAZARDS

(a) Hazard Marker Details:

Hazard markers shall be as described below

Refer to Figure 5.3

Colour	:	Two 100 mm dia. reflectorised white discs
Background	:	Matt black.
Height	:	375 mm
Width	:	150 mm

(b) Hazard Marker Location:

Refer to Figure 5.4

Hazard markers shall be used to mark hidden objects (eg depressed culverts), and upright items if there is a reasonable probability of it being a hazard (eg isolated unexpected object on a curve.)

Hazard markers are only required if the object is within 4 - 6 metres of the relevant lane, the intervening area is traversible* by vehicles and it is not already shielded by something else (eg guardrail, kerb, longitudinal drain.)

* *Traversable means that the ground surface shape is such as to permit the driver of an errant vehicle to regain control, ie. the ground has a relatively smooth surface and a slope of $\leq 1:6$.*

They are not normally required in urban areas.

NOTE: Marking is not required for roadside hazards protected by approved road safety barriers or for frangible type service poles.

(c) Installation of Hazard Markers:

Refer to Figure 5.4.

The surface of a hazard does not normally need painting white unless its size, shape or position makes it particularly vulnerable.

A hazard marker shall be attached directly to the obstacle or erected on a timber post immediately in front of it. The marker should be positioned so that its lower edge is 1.2 m above ground level.

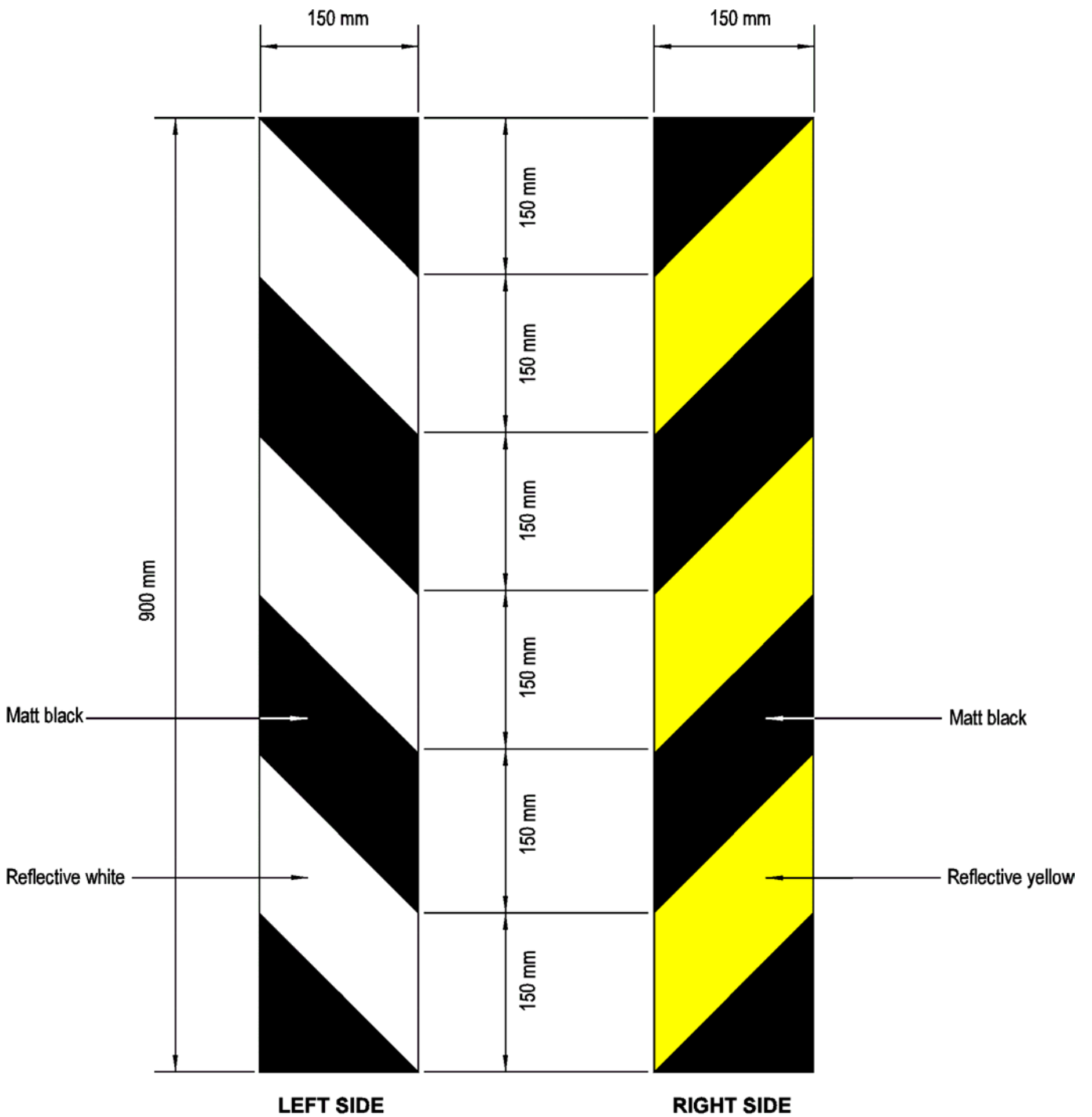
Hazards on both sides of the highway shall be marked as appropriate.

5.02.03 ONE-LANE BRIDGES

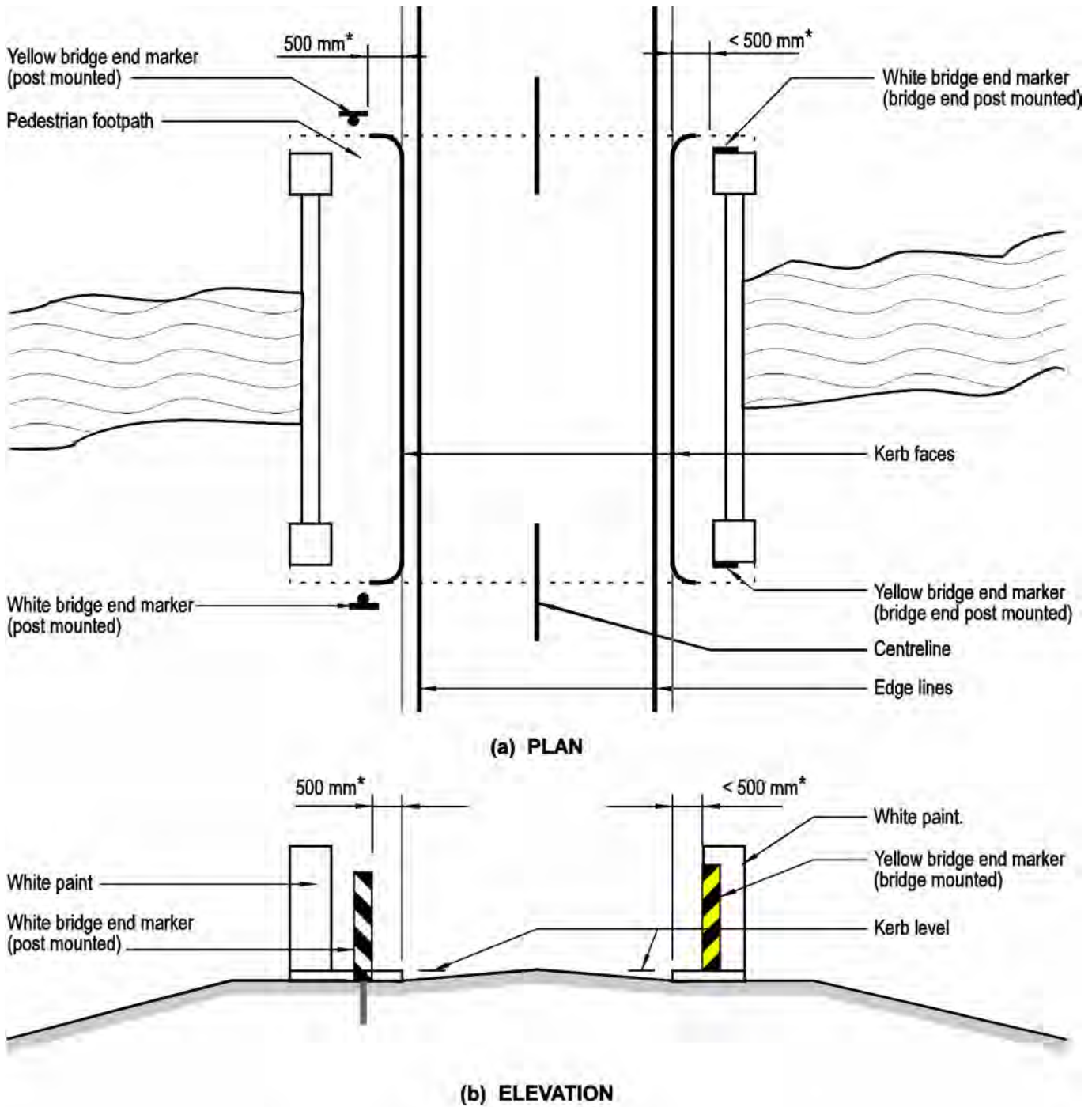
Refer to Figure 5.6

Special attention should be paid to one-lane bridges and one-lane sections of road. These require a combination of signs, markings and hazard markers to identify the particularly hazardous situations that occur when a two-lane road transitions into a one-lane section of road.

For markings on one-lane bridges refer to Section 4.05.



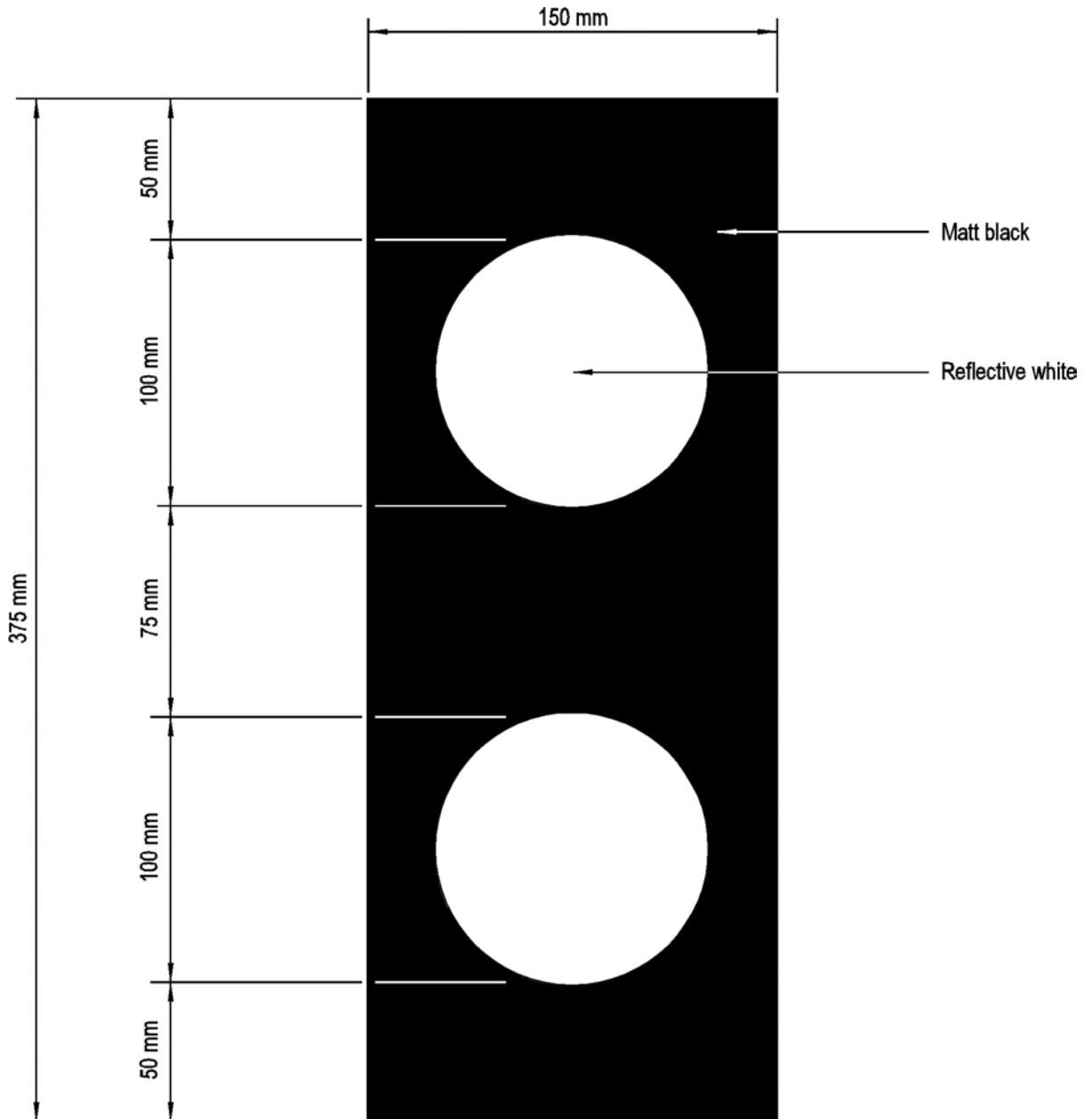
NOTE: Markers to be made of reflective material conforming to with the requirements of Section 1.12.3: Reflective Materials in Part 1 of this manual, and be mounted on an aluminium backing.



* Lateral offset of the marker from the kerb face to be 500 mm. Where the lateral offset of the hazard from the kerb face is less than 500 mm the inside edges of the marker and the hazard must coincide.

**WIDTH MARKER
INSTALLATION DETAILS**

FIGURE 5.2



NOTE: Markers to be made of reflective material conforming to with the requirements of Section 1.12.3: Reflective Materials in Part 1 of this manual, and be mounted on an aluminium backing.

EOS EL CL EL EOS

Hatch Shoulder if wider than 2.0m. (Refer Part 2 Fig 2.04).



HAZARD MARKER:

To mark **hidden** objects (e.g Depressed culverts) and **upright** items if there is reasonable probability of it being a hazard (e.g isolated, unexpected object on a curve). (refer part 5 fig. 5.3).

Only required if:

- Object is within 4-6m of the relevant lane, and
 - It is not already shielded by something else (e.g guardrail, kerb, longitudinal drain), and
 - The intervening area is traversible. Refer section 5.02.02(b).
- It is not normally necessary to paint the object white.

WIDTH MARKER:

Install at narrowest point, but only if within Trafficable Carriageway / Clear Approach width. Use on one or both sides as necessary. (Refer Part 5 Fig 5.1)

Use A Hazard Marker, on all guardrail end terminals unless it qualifies for a width marker, in which case use that instead. (Refer Part 5 Fig 5.3).

Narrowest point

Trafficable Carriageway or Clear Approach width if no shoulders

EMP

Typically 1.2m - 3.0m. (Refer Part 2 Fig 5.05)

EMP

FIGURE 5.4

WIDTH MARKERS & HAZARD MARKERS

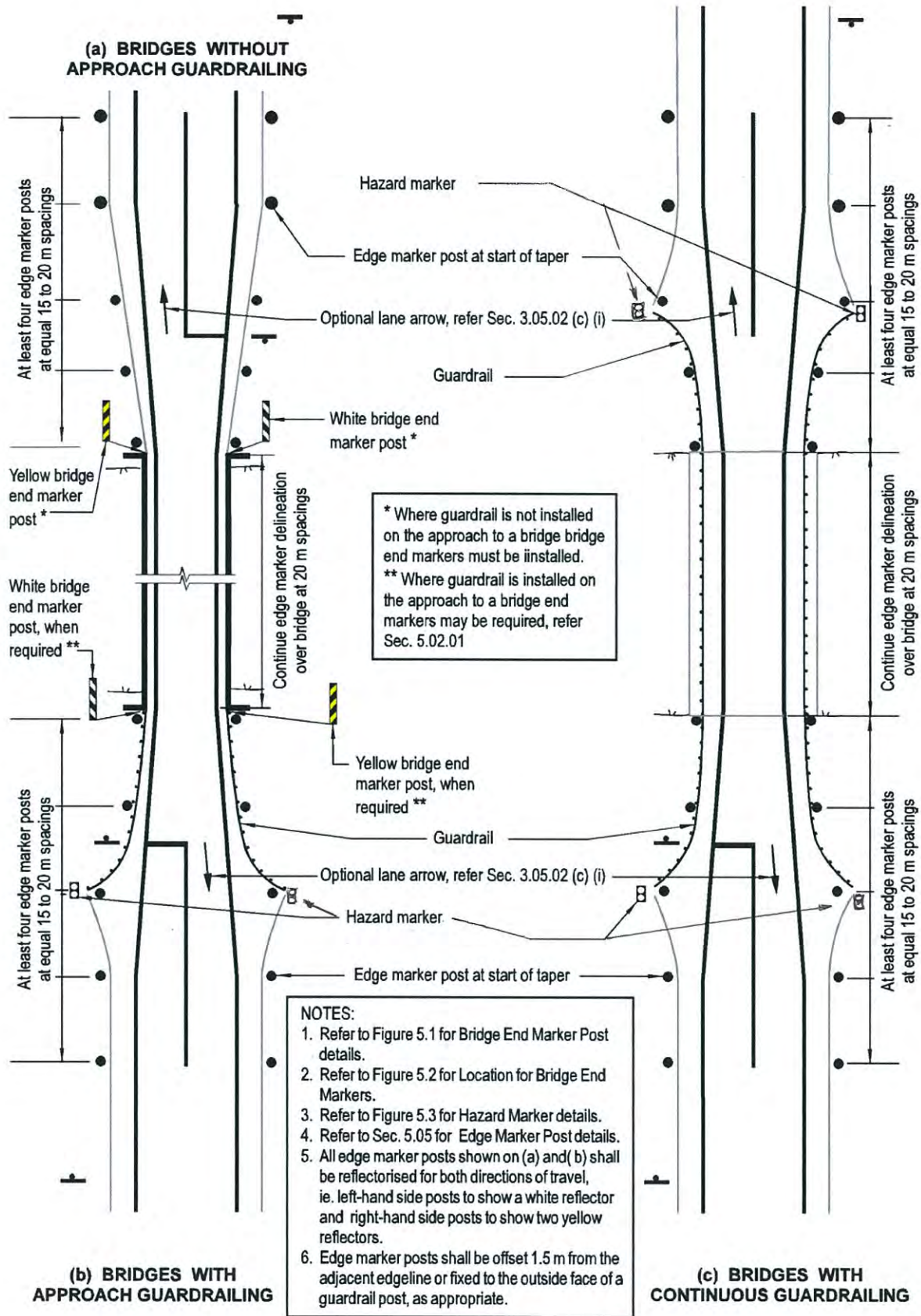


FIGURE 5.5 HAZARD MARKING AND DELINEATION AT ONE-LANE BRIDGES

5.02a DELINEATION OF SAFETY BARRIERS

5.02.04 MEDIAN BARRIERS

When median barriers are installed within 2.5 m of the right hand edgeline of the carriageway, they should be fitted with yellow reflectors or reflective tape mounted on top of the barrier.

This is not normally required where highway lighting is installed.

Size of reflectors	:	50 sq cm minimum.
Colour of reflectors	:	Yellow.
Spacing of reflectors	:	10 m +/- 2 m.

Note: In the case of wire rope barriers, the reflector should be mounted at the top of the post. Delineation is enhanced when the posts are powder-coated white.

5.02.05 EDGE BARRIERS

Edge marker posts as specified in section 5.05 are the standard road side delineation and these should be integrated with edge barriers in an appropriate manner so that route guidance is seamless.

It is important that the full length of the white and yellow reflectors, as applicable, be visible at all times. To ensure that this is true where marker posts are attached behind W-section or Thriebeam ribbons, it is necessary to install them higher than usual. An example is shown in Figure 5.5A.



Figure 5.5A

5.03 HAZARDS WITHIN THE ROADWAY

5.03.01 HAZARDS BETWEEN LANES CARRYING TRAFFIC IN THE SAME DIRECTION

A hazard which may be passed on either side by traffic travelling in the same direction shall be marked and signed unless traffic is protected from the hazard. Sometimes it may be necessary to mark protected hazards also.

Items of road furniture such as median barrier terminals can also be considered as potential hazards within the roadway and should be marked accordingly.

Refer to Sections 5.04.02 and 2.08.03 for marking details of approaches to hazards between lanes carrying traffic in the same direction.

The surface of the hazard which faces approaching traffic shall be white up to a height of 1.7 m above road level.

The PW - 5 DIVERGE traffic sign may be used, but due to their visibility obstruction, only if other cues fail.

5.03.02 HAZARDS BETWEEN LANES CARRYING OPPOSING TRAFFIC

A hazard which traffic must pass on the left, eg. an object located at the centre of the roadway of a conventional two-lane road, shall be marked as follows:

- regulatory RG - 17 KEEP LEFT signs as specified for traffic islands in Part I of this manual shall be provided,
- where the hazard is bordered by kerbing and the kerb face is less than 3 m from the hazard, or where the hazard is not bordered by kerbing, the hazard shall be marked with paint and hazard markers on the left hand edges,
- marking of the hazard is not required where barrier protection has been provided,
- surfaces of the hazard which face approaching traffic shall be white up to a height of 1.7 m above road level,
- hazard markers shall be applied to the left hand edges of the hazard, and
- where the object constitutes the right hand hazard of a pair of end hazards (e.g. an underpass or tunnel), bridge end markers shall be erected as described in Section 5.02.01.

Refer to Sections 2.08.02 and 5.04.03 for pavement markings on the approaches to hazards between lanes carrying opposing traffic.

5.03.03 STRUCTURES WITH LOW OVERHEAD CLEARANCE

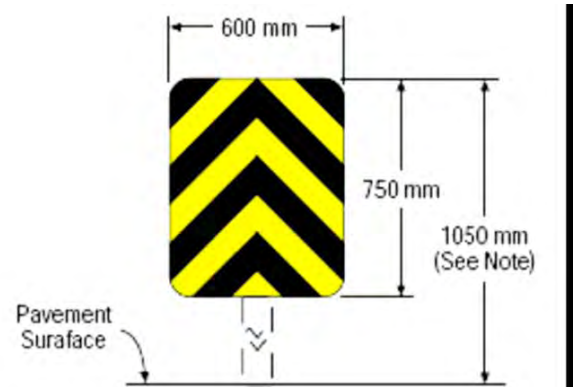
Refer to Figures 5.7 and 5.8

Where PW - 46 Low Clearance signs are erected on structures a 200 mm wide continuous yellow line shall be marked along the soffit line of the structure.

Where the soffit is of variable height such as at an arch structure, additional reflectorised white arrows shall indicate the points where clearance is a minimum. Refer also to Part I of this manual for details of the PW - 46 sign.

5.03.04 CRASH CUSHIONS

- Where a crash cushion is located on a median and approaching traffic must therefore keep to the left of it, a RG-17 Keep Left sign should be installed unless other installations negate the need for this.
- Where a crash cushion is located in a situation where approaching traffic may pass to either side of it, eg: at a motorway offramp, the nose cone or leading face must be marked with black and reflectorised yellow stripes 100mm wide as shown in figure 5.6 below.



Note: These dimensions may be adjusted to suit the crash cushion to which the marking is affixed.

Figure 5.6

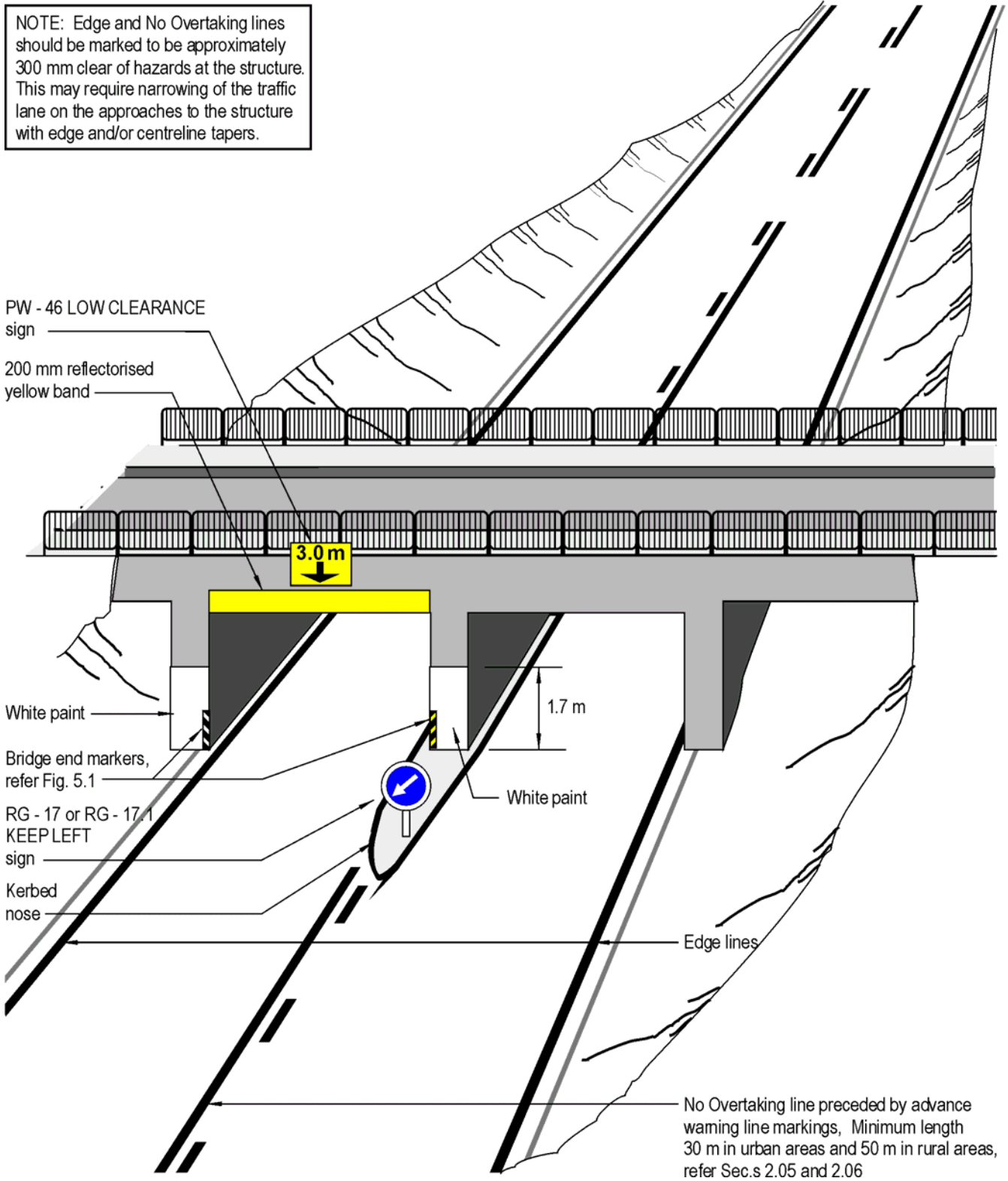
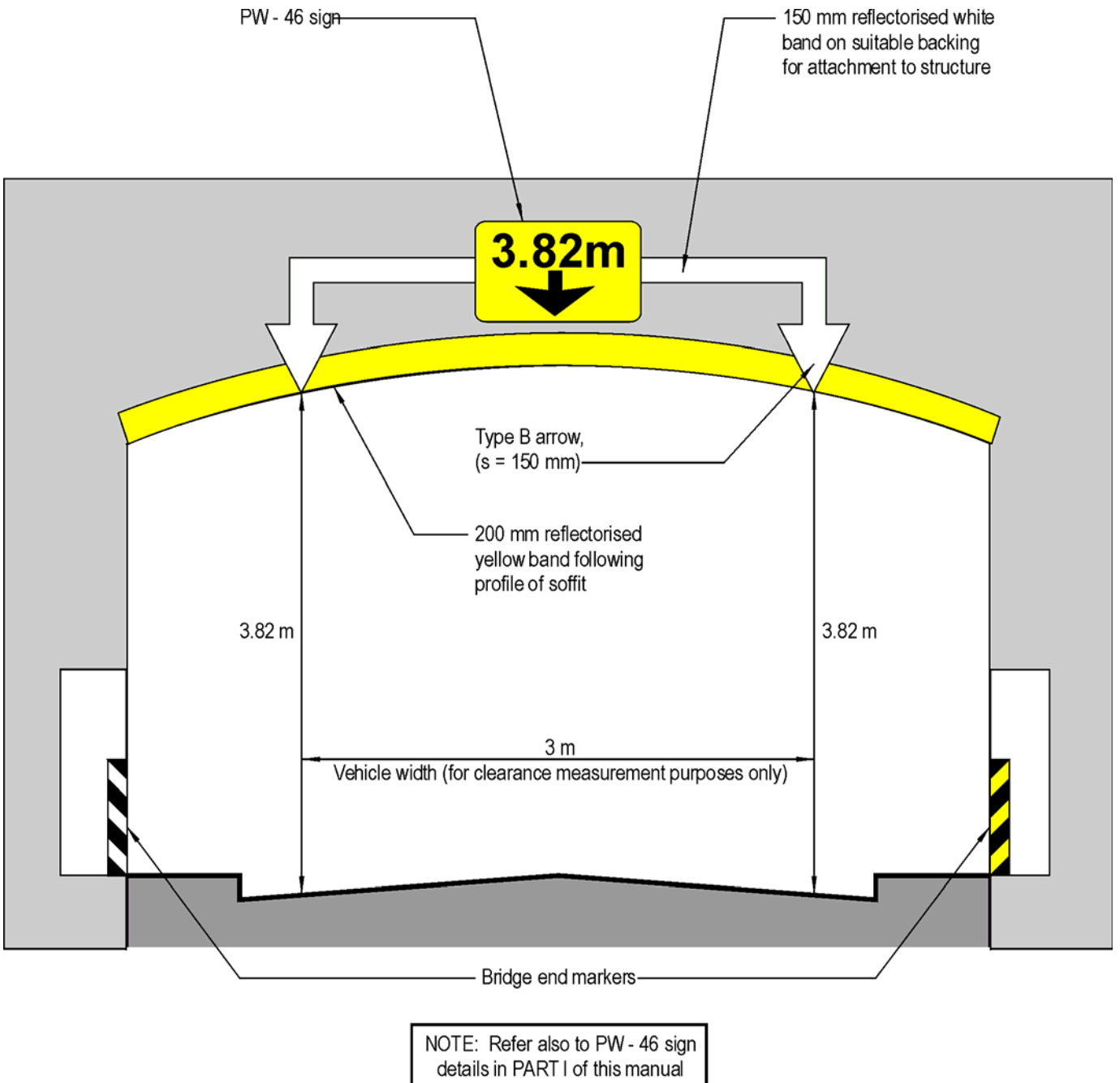


FIGURE 5.7 HAZARD MARKING AT HEIGHT AND/OR WIDTH RESTRICTED STRUCTURES



HAZARD MARKING AT STRUCTURES WITH VARYING SOFFIT HEIGHT

FIGURE 5.8

5.04 APPROACHES TO HAZARDS WITHIN THE ROADWAY

5.04.01 GENERAL

All objects located within the roadway and constituting a hazard to traffic require approach markings to guide traffic past the object.

The markings shall take the form of reflectorised white lines and stripes.

Approach markings for one way traffic situations should be marked differently from those where opposing traffic flows occur.

If approach speeds are high, the length of marking should be increased.

5.04.02 HAZARDS BETWEEN LANES CARRYING TRAFFIC IN THE SAME DIRECTION

The approach marking shall consist of two diverging reflectorised white lines enclosing a broad chevron pattern of reflectorised white bars (chevrons).

The pavement shall be marked in the same manner as markings ahead of traffic islands separating diverging traffic.

Refer to Section 2.08.03 and Figure 2.8.

(a) Rural

Colour :	Reflectorised white
Border Width :	200 mm
Bar Width :	900 mm
Bar Spacing :	10.0 m
Bar slope :	2:1
Length :	50 m minimum

(b) Urban

Colour :	Reflectorised white
Border Width :	100 mm
Bar Width :	600 mm
Bar Spacing :	6.0 m
Bar slope :	2:1
Length :	30 m minimum

5.04.03 HAZARDS BETWEEN LANES CARRYING OPPOSING TRAFFIC

For hazards which traffic must pass on the left approach marking shall be in the form of a no-overtaking line plus advance warning line or in the case of a multi lane highway a double reflectorised yellow centreline.

The pavement shall be marked in the same manner as for traffic islands separating opposing traffic.

Refer to Section 2.08.02 and Figure 2.7.

Colour :	Reflectorised white
Width :	100 mm, offset 100 mm from white or double yellow centreline
Stripe :	Continuous
Length :	50 m min, rural 30 m min, urban.

5.05 EDGE MARKER POSTS

5.05.01 GENERAL

Edge marker posts are used to delineate the alignment of the road ahead, especially horizontal and vertical curves. Edge marker posts fitted with retro-reflective devices which form a primary aid for night time driving.

Edge marker posts provide useful guidance for drivers and are not a substitute for standard warning signs.

Edge marker posts shall be installed on all rural state highways, as described in this section and in Transit New Zealand's specifications for edge marker posts and their installation and maintenance. Refer to <http://www.transit.govt.nz/technical/specifications.jsp>

Edge marker posts may be installed on rural local authority roads as per the recommendations given in MOT/TNZ "RTS 5 Guidelines for Rural Road Marking and Delineation" - Section 6.2.1, and as described in Section 5.05.05 below.

Edge marker posts shall take the form specified in TNZ Specification M/14 : 2002 - *Edge Marker Posts*. Post reflectors on the left side of the road shall be white, post reflectors on the right side of the road shall be yellow.

5.05.02 POSTS AND REFLECTORS

Posts may be timber, PVC or any similar type of permanent material which presents minimum hazard if struck by a vehicle and shall be white with a red band. Reflectors shall be fabricated from approved reflective material. Refer to TNZ Specification M/14.

5.05.03 LIMITATIONS AND VARIATIONS

Reflectors must only be attached to properly prepared posts. The reflectors must not be attached to poles, fence posts, sign posts, trees, abutments or the like, as doing so would destroy the desirable systematic spacing intended. However, post spacing may be adjusted by up to 20% to clear driveways, side roads or other obstructions.

5.05.04 LOCATION - GENERAL

Edge marker posts shall be placed to produce a smooth flowing pattern of delineation which defines the edge of the trafficable portion of the carriageway. Posts shall be placed at a uniform lateral distance no more than 3 m from the edge of the adjacent traffic lane. Where there are no shoulders a minimum lateral clearance of 1.2 m to the edge of the adjacent traffic lane shall be provided, where practicable.

Edge marker posts shall be placed vertically with the top of the post 900 mm above the adjacent edge of the traffic lane. This dimension should be increased when markers are attached behind a steel ribbon guardrail such that the full length of the reflector is clearly visible above it.

Edge marker posts should be installed on rural local authority roads as recommended in Table 5.1.

Road Type	Treatment	Post Spacing, refer to section	Min. AADT
Unsealed Road	Total Route	5.05.05	500
Sealed Road	Isolated Sections	5.05.05	100
Sealed Road	Total Route	5.05.05	500
Sealed Road	Total Route	5.05.06	1500

Table 5.1 Recommended Requirements for the Installation of Edge Marker Posts on Rural Roads

5.05.05 RURAL LOCAL AUTHORITY ROADS WITH AADT < 1500

Refer to Figure 5.9 for edge marker post details

Refer to Figure 5.10 for layout of edge marker posts on rural local authority roads.

Edge marker posts on these roads should be located as follows:

(a) Straights

Edge marker posts on straights shall be installed in straight lines at 100 m spacings and on both sides of the road on both sides of the road.

(b) Horizontal Curves

The arrangement and spacing of edge marker posts on horizontal shall be as indicated in Table 5.2 and as shown in Figure 5.10.

Posts should not be located on the inside of horizontal curves with radii ≤ 600 m.

At substandard horizontal curves post spacing should be adjusted to ensure that at least three posts are visible to approaching drivers.

(c) Vertical Curves

On substandard vertical curves post spacing may be reduced so that the top 300 mm of at least three posts will be visible to approaching drivers. A driver eye height of 1.05 m should be used to determine the appropriate post spacing.

(d) Passing Lanes

Where passing lanes are marked, the spacing of posts adjacent to the merge taper should be 20 m. Refer to Section 2.07, Passing Lanes.

Horizontal Alignment	Post Type Left / Right		Spacing (metres)		Edge Location
Straights	A	B	100		Pairs Opposite
	Straight — Curve				
All Curves R over 600 m	A	B	100	100	Pairs Opposite
LH Curves R ≤ 600 m	—	C	75	50	Pairs only
RH Curves R ≤ 600 m	A	—	75	50	Left only
LH Curves R ≤ 140 m	—	C	50	25	Right only
RH Curves R ≤ 140 m	A	—	50	25	Left only

Table 5.2 Edge Marker Post Spacing Table for Rural Local Authority Roads with AADT < 1500

5.05.06 ALL STATE HIGHWAYS AND RURAL ROADS WITH AADT > 1500

Edge marker post on rural state highways and rural local authority roads carrying over 1500 vpd shall be installed as described below.

Refer to Figure 5.9 for edge marker post details.

Refer to Figure 5.11 for layout of edge marker posts.

(a) Straights

On straights, edge marker posts shall be installed in straight lines on both sides of the road. Posts shall be spaced 100m apart with matching pairs on opposite sides of the road.

(b) Horizontal Curves

The location and spacing of posts shall be as indicated in the Tables 5.3 and 5.4 below and as shown in Figure 5.11.

(c) Vertical Curves

On substandard vertical curves spacing may be reduced so that the top 300 mm of four posts is visible to approaching drivers (driver eye height of 1.15 m).

(d) Passing Lanes

Where passing lanes are marked the spacing of posts adjacent to the merge taper shall be 20 m, as shown in Section 2.07.03, Delineation of Merge Area.

Horizontal Alignment	Reflector Type Left / Right		Post Location
Straight	A	B	Pairs Opposite
LH Curves	A	C	Equal Spacing
RH Curves	A	B	Equal Spacing

Table 5.3 Edge Marker Post Spacing Table for State Highway and Local Authority Rural Roads with AADT > 1500

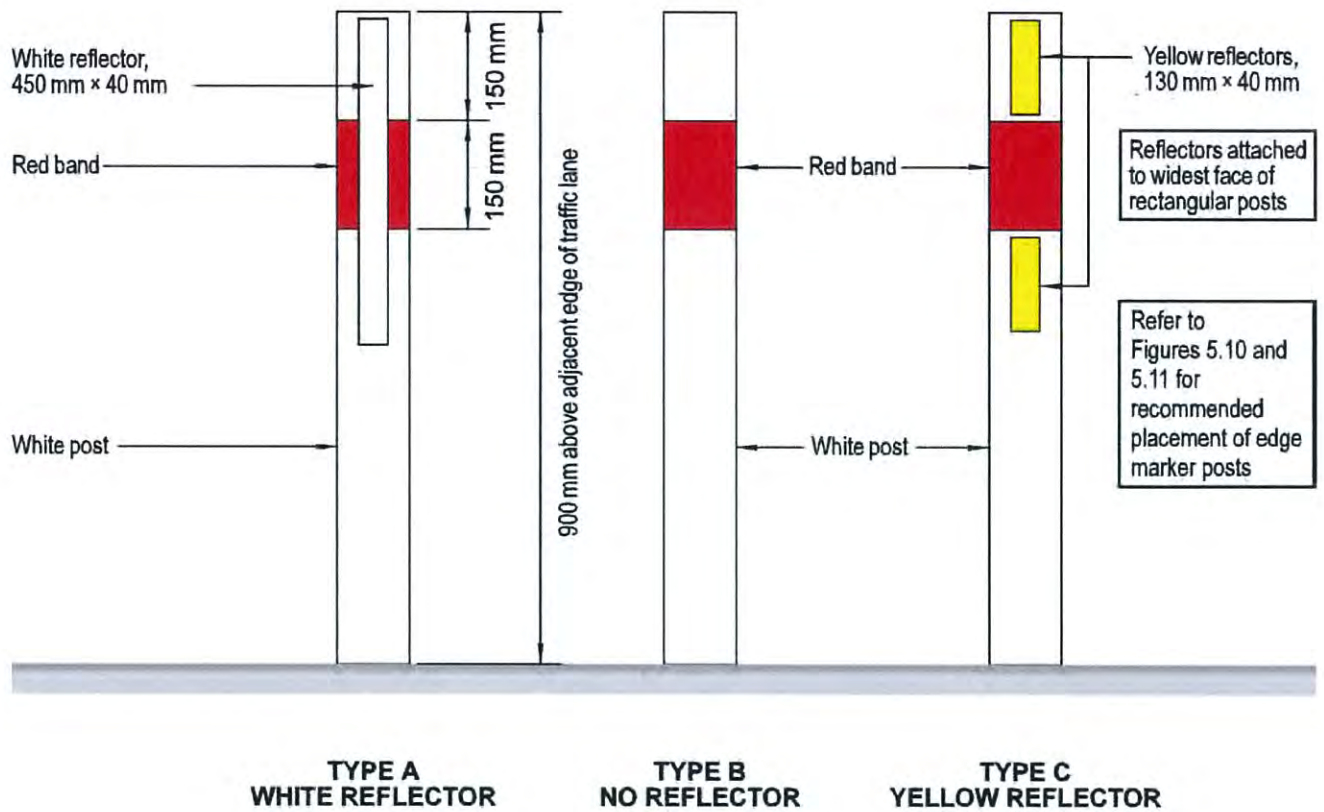
Curve Radius (metres)	Spacing (metres)
20 - 30	10.0
30 - 40	12.5
40 - 60	15.0
60 - 80	17.5
80 - 100	19.0
100 - 150	21.0
150 - 200	25.0
200 - 300	28.0
300 - 400	31.0
400 - 600	35.0
600 - 800	40.0
800 - 1200	45.0
over 1200	50.0

Table 5.4 Edge Marker Post Spacing Table - State Highways and Local Rural Roads with AADT > 1500

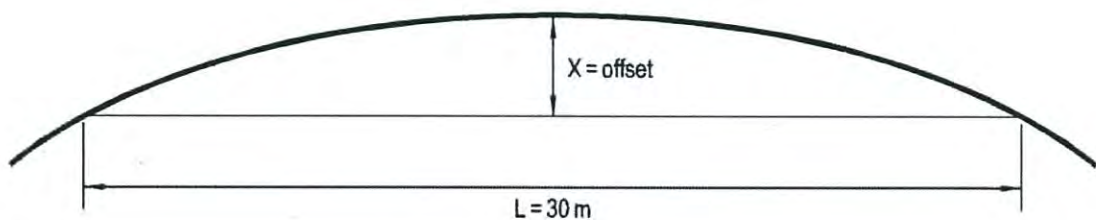
5.05.07 TEMPORARY USE

In locations where the road surface has to be left in a temporary unsealed condition for a long period and the maintenance burden of keeping traffic cones in position is too high, then orange coloured edge marker posts may be used in place of standard white ones. The spacing of the posts, and the reflectors and red bands shall be in accordance with the normal requirements for each side of the road.





(a) DETAILS OF POSTS AND REFLECTORS



$$\text{Radius (R)} = \frac{L^2 + 4X^2}{8X}$$

Examples:
 When $X = 190\text{ mm}$, $R = 600\text{ m}$
 When $X = 800\text{ mm}$, $R = 140\text{ m}$

(b) CALCULATION OF CURVE RADIUS (R)

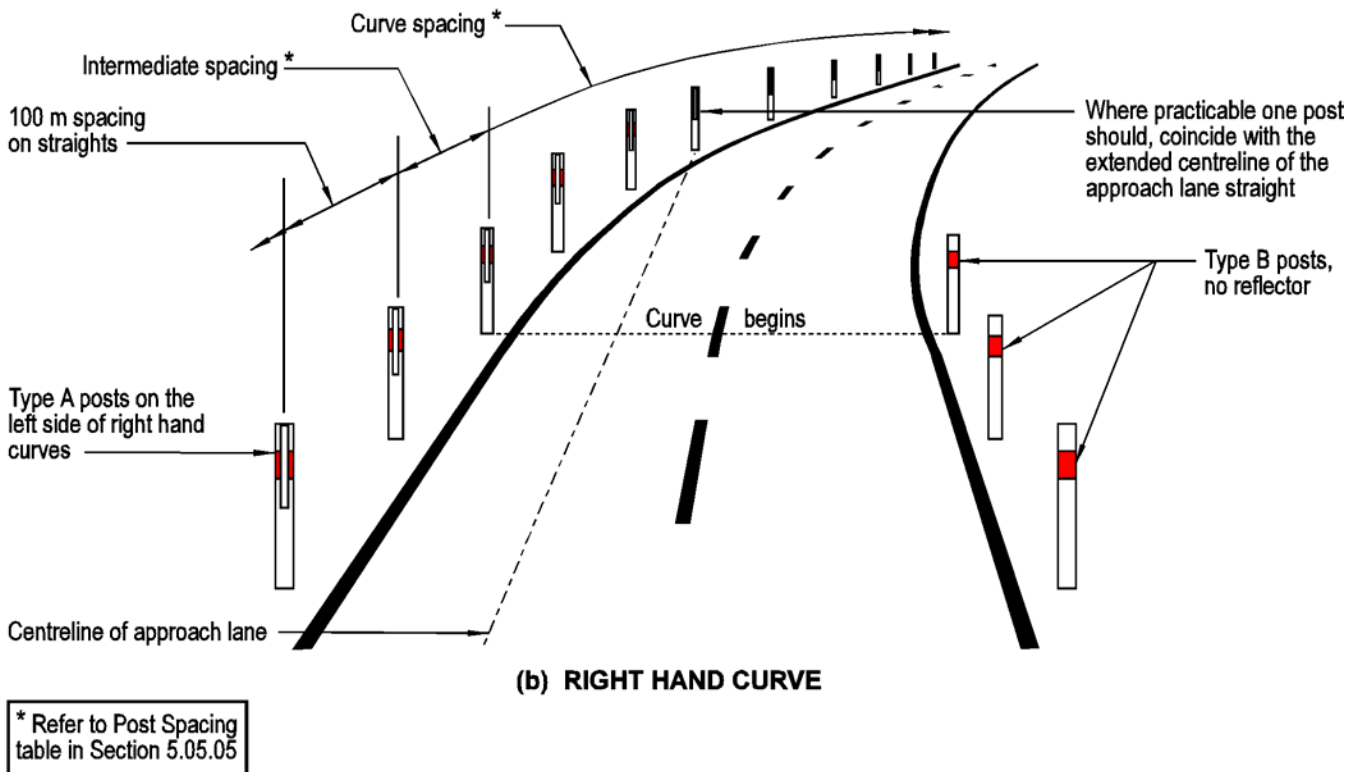
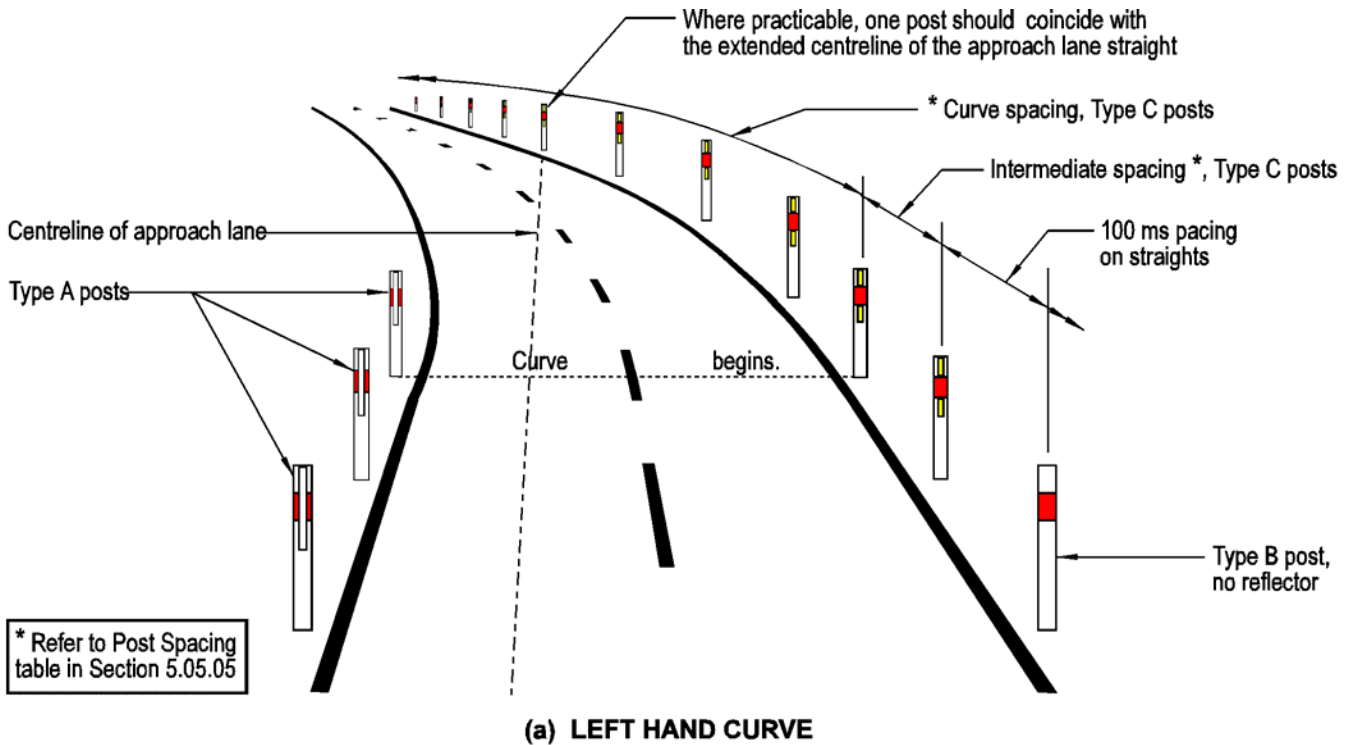
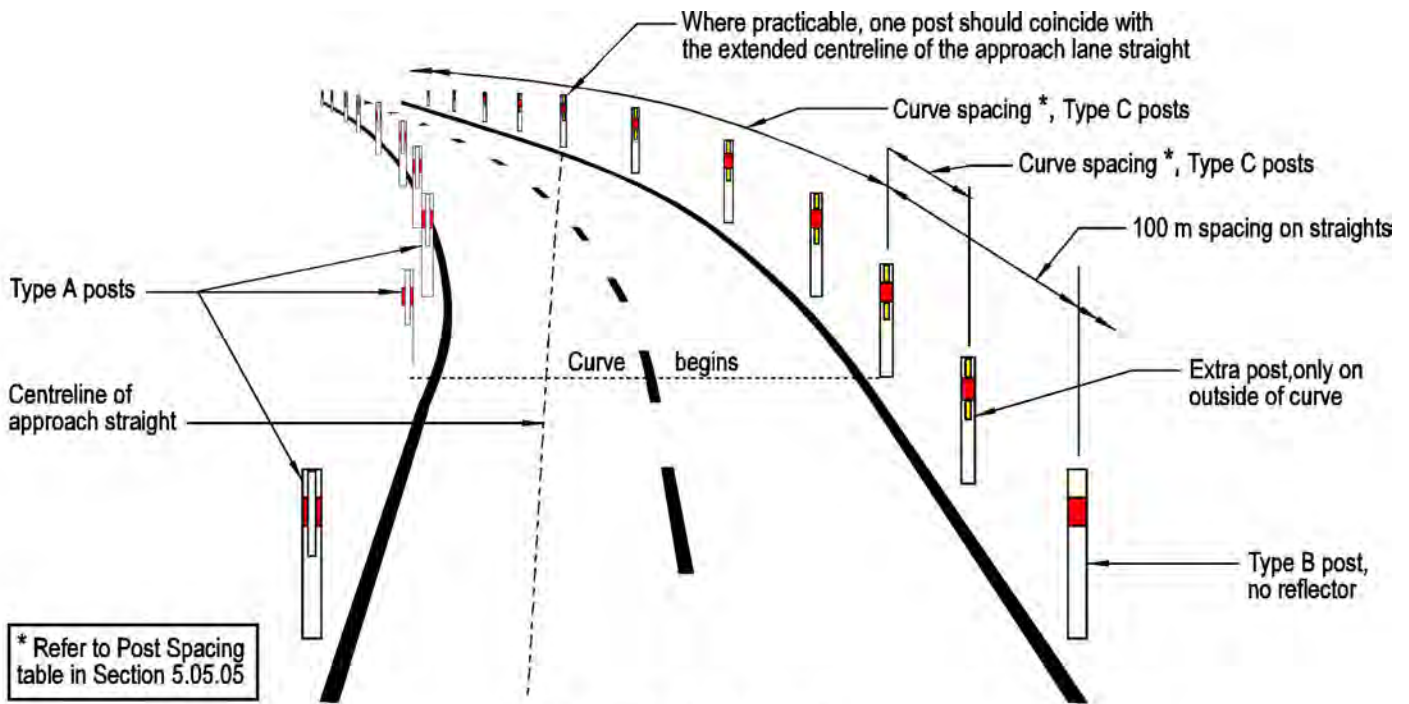
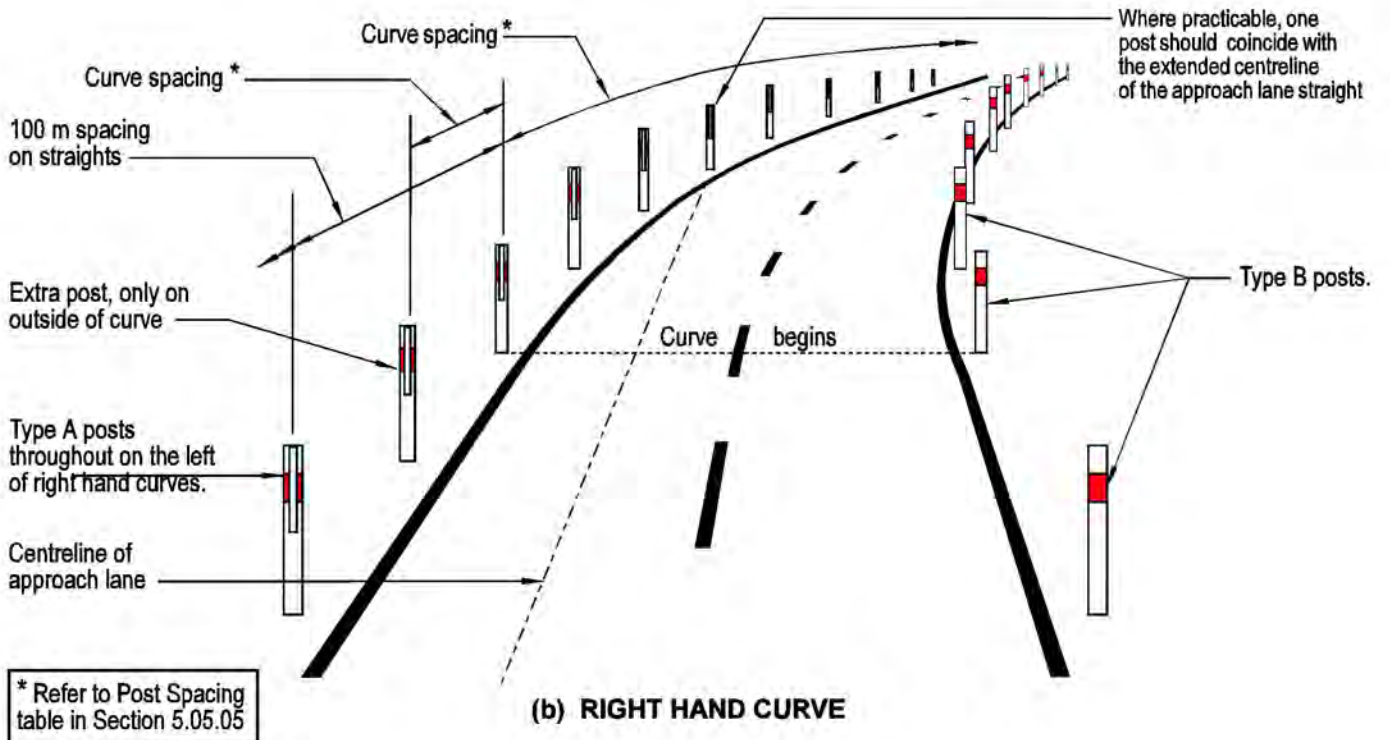


FIGURE 5.10 EDGE MARKER POST INSTALLATION ON RURAL ROADS WITH AADT < 1500



(a) LEFT HAND CURVE



(b) RIGHT HAND CURVE

**EDGE MARKER POST INSTALLATION ON
RURAL ROADS WITH AADT > 1500
and
ALL STATE HIGHWAYS**

FIGURE 5.11

5.06 LINEAR DELINEATION PANELS

Traffic Note 54



Date April 2005

Note:

These panels may be used as additional delineation in locations where all the normal systems are in place, but have proven insufficient. Only yellow panels may be used for permanent installation on state highways.



Linear delineation panels– Guidelines

1 Purpose

In 2002, four sites were treated with linear delineation panels in consultation and collaboration with the Land Transport Safety Authority (now Land Transport New Zealand) and road controlling authorities. This Traffic Note provides guidance arising from the trial sites and the feedback from road practitioners.

2 Delineation systems

Compared with road marking, delineation devices such as bridge-end markers, hazard markers, edge marker posts, chevron boards and chevron curve indicator boards are a point source of guidance. Some situations may require a linear or continuous device to better define geometric constraints in the roadway.

Examples of situations which might benefit from linear delineation include:

- short sections of winding, undulating road where standard point source delineators, road markings or retro-reflective pavement markers do not give a clear, unambiguous description of the mix of horizontal and vertical curves;
- curves on median divided roads where, because of difference in levels between the two sides, the headlights of opposing vehicles may mask the nature of the curve and reduce the effectiveness of other delineation devices.

The use of linear delineation may be considered for other situations such as isolated bends, bridges and tunnels where a decrease in vehicle speed or improvement to lateral placement is desirable.

3 Linear delineation panels

The linear delineation used in the trials comprised panels approximately 870mm long, 100mm wide with a repeating raised lateral ridge 8.6mm high approximately every 57mm. Each panel was constructed of retro-reflective material permanently bonded to an aluminium substrate. The shape provides retro-reflection across a wide range of entrance and observation angles.

The panels are designed for installation on rigid structures including W-section steel traffic barriers, concrete median barriers, movable lane barriers and sight rails and conform to the shape and orientation of these structures.

4 Spacing between adjacent delineation panels

In some countries linear delineation panels are installed with no gaps. The linear delineation panel trials indicated gaps are required between adjacent panels in order to give a good indication of the road alignment. A gap larger than half a panel length (440mm) and smaller than 2 panel lengths (1740mm) provided good visual cues. The radius of the curve will affected the spacing; where smaller radius curves will need smaller gaps and larger radius curves greater gaps.

5 Use of colours

Consultation with the industry and road controlling authorities provided the following consensus on the colours and use of the various linear delineation panels.

Panel colour	Use
white	sight boards
yellow fluorescent yellow	in association with other permanent warning devices (eg curve warning signs, chevron boards etc)
alternating white and fluorescent orange	work zone barrier delineation
alternating red and white	rail rolling stock

6 Installation issues

The panels provide an almost continuous indication of the road alignment and it is important the rigid structures on which they are installed substantially conform to the road alignment – both vertically and horizontally. This may require some realignment of existing structures.

Where used as curve delineation devices the linear delineation panels should be used to supplement other appropriately installed permanent warning signs. A careful review of other delineation devices along the treated length of road should then be carried out. Those that will remain must be compatible with the permanent warning signs and the linear delineation and the combination must provide a clear and unambiguous message to drivers.