Guidelines for rural road marking and delineation

RTS 5

Disclaimer

While this document is believed to be correct at the time of publication, Transit New Zealand and its employees or agents involved in preparation and publication cannot accept any liability for its contents or for any consequences arising from its use. People using the contents of the document should apply, and rely upon, their own skill and judgement. They should not rely on its contents in isolation from other sources of advice and information.

October 1992 (reprinted January 2002)

Transit New Zealand
PO Box 5084
Wellington
Telephone 04 499 6600
Fascimile 04 496 6666

Land Transport Safety Authority
PO Box 2840
Wellington
Telephone 04 494 8600
Fascimile 04 494 8601

ISSN: 1170-5337
ISBN: 0-477-05288-6

Preface

In recent years the highway system in New Zealand has made great advances in road marking and delineation and I believe that the thrust toward this has come from the need to create much safer roads for the users. It has been of great interest to me that many black spot investigations have revealed that inadequate road marking or delineation has contributed significantly to a number of road accidents. Both the National Roads Board and Transit New Zealand have placed a very high priority on improving road marking and delineation on our state highways and main arterials, and I believe it is very appropriate that we are now addressing Standards for rural roads. It is important that all rural roading authorities use these guidelines for two reasons – firstly, there is no doubt that good marking and delineation does contribute greatly to the reduction of accidents and secondly, that we put in place uniformity of marking and delineation nationwide.

I would like also to take this opportunity to congratulate and thank those who have been involved in the putting together of the guideline and trust that the outcome from this document sees a reduction in the number of accidents we have right across the country.

G. J. Geering, Q.S.O.

President
New Zealand Local Government Association

Contents

Preface 3

1. Introduction 6

2. Existing references 7

3. Driver expectation 8

4. Road hierarchy 9

5. Summary tables 10

5.1 Summary of road markings and delineation devices 10

5.2 Summary of requirements by road type 10

5.3 Very low volume road 10

6. Guidelines 13

6.1 Road markings 13

6.2 Delineation Devices 22

6.3 Signs 25

7. Implementation 29

7.1 Suggested practical procedures 29

8. Maintenance 32

8.1 Loss rates 32

9. References 33

10. Acknowledgements 34

Appendices

Appendix 1: Accident analysis 35

Appendix 2: Economic analysis 37

Appendix 3: Marking and delineation costs (1991) 39

Appendix 4: Edge marker post spacing 41

Appendix 5: Guide for rural roading - geometric standards 47

Figures

Figure 1: Edge line markings at kerbed/unkerbed transitions 18

Figure 2: Intersection markings 20

Figure 3: Sight rail construction details 28

Figure A1: Accident movement types - rural reported injury accidents 35

Figure A2: Accidents in darkness - rural reported injury accidents 36

Figure A3: Lost control on curves - rural reported injury accidents 36

Tables

5.1: Summary of road markings and delineation devices 11

5.2: Summary of requirements by road type 12

7.1: Unsealed rural roads 30

7.2: Sealed rural roads 31

A1: Expected accident reductions and benefit cost ratios 38

A2: Cost of rural remedial works (April 1991) 40

1. Introduction

These guidelines are for road controlling authorities requiring technical guidance and further information when determining the road marking and delineation requirements for rural roads (i.e. speed limit greater than 70km/h).

The standard of road marking and delineation on New Zealand's state highway network has been improved in recent years with the introduction of reflective raised pavement markers and new edge marker posts.

There can, however, be a large difference between the standards on rural state highways and local rural roads (i.e. non state highway rural roads). While there has been some improvement on local rural roads, there are still many sections of local roads carrying similar volumes of traffic to state highways but with a lower standard of road marking and delineation.

A Working Group comprising people from local and central government, government agencies and the traffic engineering profession with experience in rural road marking and delineation was formed to prepare this document (refer Section 10).

Analysis of accident data for rural roads (refer Appendix 1) indicates that the following accident types are over represented on local rural roads compared to rural state highways:

- lost control accidents, curved roads
- head on accidents, curved roads
- accidents occurring in darkness.

These guidelines are intended to reduce this disparity between rural state highways and local rural roads by ensuring that motorists receive consistent and appropriate visual guidance to achieve an improved level of safety.

It should be noted that good delineation will not overcome fundamental deficiencies in the road (e.g. insufficient carriageway width or worn road surface).

These guidelines are an amalgam of the following inputs:

- results of a questionnaire sent to 65 local authorities (i.e. those with rural roads) and Transit New Zealand on current and anticipated practice
- good overseas practice, as interpreted from references
- the opinion of the Working Group
- feedback on drafts of the guideline from users
- Transit New Zealand Signs Advisory Group.

2. Existing references

The road markings and delineation devices referred to in this guideline appear in the National Roads Board (NRB) *Manual of Traffic Signs and Markings,* 1975, and the Transit NZ/Ministry of Transport Land Transport Division *Manual of Traffic Signs and Markings* (edition 3, 1992) as appropriate.

Reference is also made to:

- National Roads Board, *Guide to Geometric Standards for Rural Roads*, 1985
- Transit New Zealand, *Planning for a Safe and Efficient Highway Network under the Resource Management Act,* June 1992.

3. Driver expectations

A driver's prior expectations about the standard of road markings and delineation are a major factor in his or her ability to negotiate the road environment safely. While it is important to ensure that a road is designed to a consistent standard there are times when, due to physical or financial constraints, this is not possible. When this happens roading engineers must rely on road markings and delineation devices to advise drivers of changes in the road environment.

If these road markings or delineation devices are not provided, or not used in a consistent manner, driver expectations are not met and the chances of a motorist entering a hazard at too great a speed increase. The inconsistent use of markings or devices may also result in the driver misinterpreting the visual message intended.

4. Road hierarchy

The importance of the routes and their traffic volumes are the main factors which should determine the level of road markings and delineation devices in rural areas. However, for markings and devices fixed to the road surface the actual sealed road width must also be considered.

In an attempt to achieve national consistency this guideline has used road width and traffic volumes as the main criteria and has endeavoured to use volume cut-offs consistent with those used in Table 3: Guide for rural roading - geometric standards, from the *Guide to Geometric Standards for Rural Roads,* NRB 1985 (refer Appendix 5) and the *Manual of Traffic Signs and Markings*.

5. Summary tables

5.1 Summary of road markings and delineation devices

Table 5.1 shows in summary form the road marking and delineation devices recommended for rural roads. The table summarises detailed explanations which are developed in Section 6.

While most of the categories are self-explanatory several need amplification:

Treatment type:
A code letter used for convenience in this document to represent various combinations of road markings or delineation devices (e.g. painted edge lines) with respect to particular road characteristics (e.g. 6.6m wide seal, 750 or more vehicles per day).

Minimum traffic volume:
The minimum traffic volume in vehicles per day (VPD) above which the marking or device should normally be applied.

5.2 Summary of requirements by road type

Table 5.2 lists for convenient use treatment types applicable to roads by surface type, traffic volume and seal width (for sealed roads).

5.3 Very low volume roads

Road markings and delineation devices are not generally recommended for roads with a traffic volume less than 100 VPD. Advising drivers of sudden changes in the road environment on these roads can be achieved by the use of warning signs (refer to Section 6.3 for information on the use of warning signs).

There may, however, be special circumstances where road marking and or delineation devices are desirable on roads with a traffic volume below 100 VPD:

- where there are frequent horizontal and/or vertical curves
- at sub-standard curves
- over sections where the accident record indicates a need, (i.e. where the proportion of lost control, head on or accidents in darkness are well above the national average)
- where continuity on a route or with an adjacent road is desirable
- through areas commonly subject to fog, mist or steam
- where there is a high proportion of night traffic flows
- where there is a high proportion of tourist traffic flows.

Table 5.1: Summary of road markings and delineation devices

Treatment type*	Road marking or delineation device	Desirable minimum sealed width (m)	Absolute minimum sealed width (m)	Minimum traffic volume VPD	Comment
	ROAD MARKINGS				
A	Dashed centreline (total route)	5.5	5.0	250	
B	Dashed centreline (isolated sections)	5.5	5.0	100	
C	Edge lines (total route)	6.6	6.0	750	
D	Edge lines (isolated sections)	6.6	6.0	250	
E	Intersection markings solid centreline only	5.5	5.0	250	
F	Intersection markings solid centreline, edge line and continuity line	6.6	6.0	750	
	DELINEATION DEVICES				
	Unsealed roads				
G	Edge marker posts (total route)	-	-	500	Spacing A (**) (old SH standard)
H	Edge marker posts (isolated sections)	-	-	100	Spacing A (**) (old SH standard
	Sealed roads				
I	Edge marker posts (total route)	-	-	1,500	Spacing B (**) (new SH standard)
J	Edge marker posts (total route)	-	-	500	Spacing A (**) (old SH standard)
K	Edge marker posts (isolated sections)	-	-	100	Spacing A (**) (old SH standard)
L	Reflective raised pavement markers (total route)	6.0	-	1,000	20m centres
M	Reflective raised pavement markers (isolated sections)	6.0	-	500	20m centres

* Treatment type refers to the required treatment column in Table 5.2 (refer Section 6.1-6.2 for detailed description of each treatment type).

** Refer Appendix 4 for details of spacing.

Table 5.2: Summary of requirements by road type

Traffic volume (VPD)	Sealed width (metres)	Required treatment type*
Unsealed roads		
000-099	N/A	Nil
100-499	N/A	H
500->	N/A	G
Sealed roads		
000-099	N/A	Nil
100-249	< 5.5	K
	5.5->	B and K
250-499	< 5.5	K
	5.5-6.5	A, E and K
	6.6->	A, D, E and K
500-749	< 5.5	J
	5.5-5.9	A, E and J
	6.0-6.5	A, E, J and M
	6.6->	A, D, E, J and M
750-999	< 5.5	J
	5.5-5.9	A, E and J
	6.0-6.5	A, E, J and M
	6.6->	A, C, F, J and M
1,000-1,499	< 5.5	J
	5.5-5.9	A, E and J
	6.0-6.5	A, E, J and L
	6.6->	A, C, F, J and L
1,500->	< 5.5	I
	5.5-5.9	A, E and I
	6.0-6.5	A, E, I and L
	6.6->	A, C, F, I and L

* Refer Table 5.1 for description of road marking or delineation device.

6. Guidelines

6.1 Road markings

The following section provides information on the different road markings recommended for rural roads. The following details are provided:

Dimensions:
The colour, width and length of stripe and/or gap if applicable.

Requirements:
The desirable minimum width and absolute minimum width of sealed road required to provide the marking. The minimum traffic volume (VPD) above which the marking should normally be applied.

Special conditions:
Any special conditions which apply, which would make it desirable to provide markings on roads below the recommended requirements.

Accident reduction:
The reduction in accidents expected from the installation of the marking and typical benefit cost ratio (BCR), where known, together with the reference. Obviously the BCR for specific projects can be calculated from the road's accident history and the expected accident reductions (refer Appendix 2). The typical BCR is shown for indicative reasons only.

Note: While the recommended values for seal width should be followed, local road controlling authorities can use lower minimum traffic volume thresholds. If this occurs it is essential that the lower criteria be applied in a consistent manner and special care be taken on roads that cross into adjacent authorities. It is also essential that a consistent treatment be provided along a road whose width varies. Generally the minimum width sections will dictate the standard of marking which should be applied.

6.1.1 Centrelines

A centreline is used to define the portion of a two way sealed roadway available for travelling in each direction. It also provides a simple and continuous form of delineation, however its effectiveness can be reduced at night and in wet weather. Overseas research (see section 9, reference 1) has also shown that marking centrelines on very narrow roads may increase accident numbers.

Dimensions:

The centreline shall be a dashed line marked as follows:

Colour:	White
Width:	100mm
Stripe:	3m
Gap:	7m

Note: The visibility of centreline markings at night can be improved by using reflectorised paint. The use of reflectorised centreline markings is recommended on roads with a high proportion of night time accidents. The average percentage of night time accidents is as follows:

Rural state highways	37%
Local rural roads	42%

Reflectorised markings may not be necessary if reflective raised pavement markers are installed.

Requirements:

Dashed centreline: (total route) [Type A*]

These are recommended for all sealed roads meeting the following criteria:

Desirable minimum width	5.5m
Absolute minimum width	5.0m
Minimum volume	250 VPD

Note: Marking centrelines on narrow roads with a high proportion of heavy motor vehicles may result in maintenance problems such as edge break. Consideration would need to be given to widening such roads.

Dashed centreline: (isolated sections) [Type B*]

Total route marking of dashed centrelines on lower volume roads is not normally necessary, however special circumstances may exist where the marking of isolated sections of centreline is desirable:

- where there are frequent horizontal and/or vertical curves
- at sub-standard curves
- over sections where the accident record indicates a need
- to maintain continuity on a route or with an adjacent road.

It is recommended that centrelines be marked on isolated sections of roads meeting the following criteria:

Desirable minimum width	5.5m
Absolute minimum width	5.0m
Minimum volume	100 VPD

Special conditions:

Irrespective of the above guidelines, marking of other continuous or isolated sections may be desirable where special conditions apply. These may be:

- through areas commonly subject to fog, mist or steam
- where there are heavy night traffic flows
- where there are heavy tourist traffic flows.

Accident reduction:

Centrelines can address lost control and/or head-on accidents by defining the centre of the roadway. No references to the expected accident reduction or BCR have been found.

** Refers to Table 5.1.*

6.1.2 No overtaking lines

No overtaking lines are used at vertical and, on rare occasions, horizontal curves where overtaking must be prohibited because of restricted visibility or other hazardous conditions. The lines also serve a similar function to centrelines in that they define the centre of the road and delineate the alignment.

Dimensions:

The no overtaking line shall be a continuous line marked as follows:

Colour:	Reflectorised Yellow
Width:	100mm
Stripe:	Continuous

Requirements:

No overtaking lines are recommended for all sealed roads meeting the following criteria:

Desirable minimum width	5.5m
Absolute minimum width	5.0m

Note: Details for the marking of no overtaking lines are provided in the *Manual of Traffic Signs and Markings* (Part II Markings). No minimum traffic volume is specified, however, no overtaking lines are generally only recommended on roads where the traffic volume criteria for centrelines apply and a centreline is marked (refer Section 6.1.1).

Accident reduction:

No overtaking lines are mainly used to reduce accidents relating to overtaking manoeuvres. No references to the expected accident reduction or BCR have been found for the New Zealand use of the lines which are predominantly limited to vertical curves. Overseas studies may not be relevant because of the extensive use of no overtaking lines on horizontal curves.

6.1.3 Edge lines

Edge lines delineate the edge of the traffic lane and, in situations where the shoulder is paved, edge lines separate the shoulder from the traffic lane. They provide a useful guide to motorists at night and in foggy or misty conditions. Where roadway shoulders are unsealed, the provision of edge lines not only enhances road safety but can reduce wear and maintenance of the shoulder.

Dimensions:

The edge line shall be a continuous line marked as follows:

Colour:	White
Width:	75mm
Stripe:	Continuous

Note: The visibility of edge line markings at night can be improved by using reflectorised paint. The use of reflectorised edge lines is recommended on roads with a high proportion of night time accidents. The average percentage of night time accidents is as follows:

Rural state highways	37%
Local rural roads	42%

Requirements:

Edge lines: (total route) [Type C*]

These are recommended for all sealed roads meeting the following criteria:

Desirable minimum width	6.6m
Absolute minimum width	6.0m
Minimum volume	750 VPD

Edge lines: (Isolated Sections) [Type D*]

Total route marking of edge lines on lower volume roads is not normally necessary. Special circumstances, however, may exist where marking of isolated sections of edge line is desirable:

- where there are frequent horizontal and/or vertical curves
- at sub-standard curves
- over sections where the accident record indicates a need
- on approaches to narrow bridges
- to maintain continuity on a route or with an adjacent road
- where road edge maintenance is a problem.

It is recommended that isolated sections of edge line be marked on both sides of roads meeting the following criteria:

Desirable minimum width	6.6m
Absolute minimum width	6.0m
Minimum volume	250 VPD

Special conditions:

Irrespective of the above guidelines, marking of other continuous or isolated sections with edge lines may be desirable where special conditions apply. These may be:

- through areas commonly subject to fog, mist or steam
- in high rainfall areas (greater than 1,000mm annual rainfall)
- where there are heavy night traffic flows
- where there are heavy tourist traffic flows.

Edge lines at kerbed/unkerbed transitions:

Special consideration should be given to the marking of edge lines between wide kerbed urban/ semi-rural roads and narrower unkerbed rural roads. Figure 1 illustrates the recommended markings. These markings are recommended at all such situations irrespective of road width or volume, however transition marking on short no exit rural roads are not usually necessary.

Note: These markings are not to be used at the approaches to one lane bridges or short sections of one lane road.

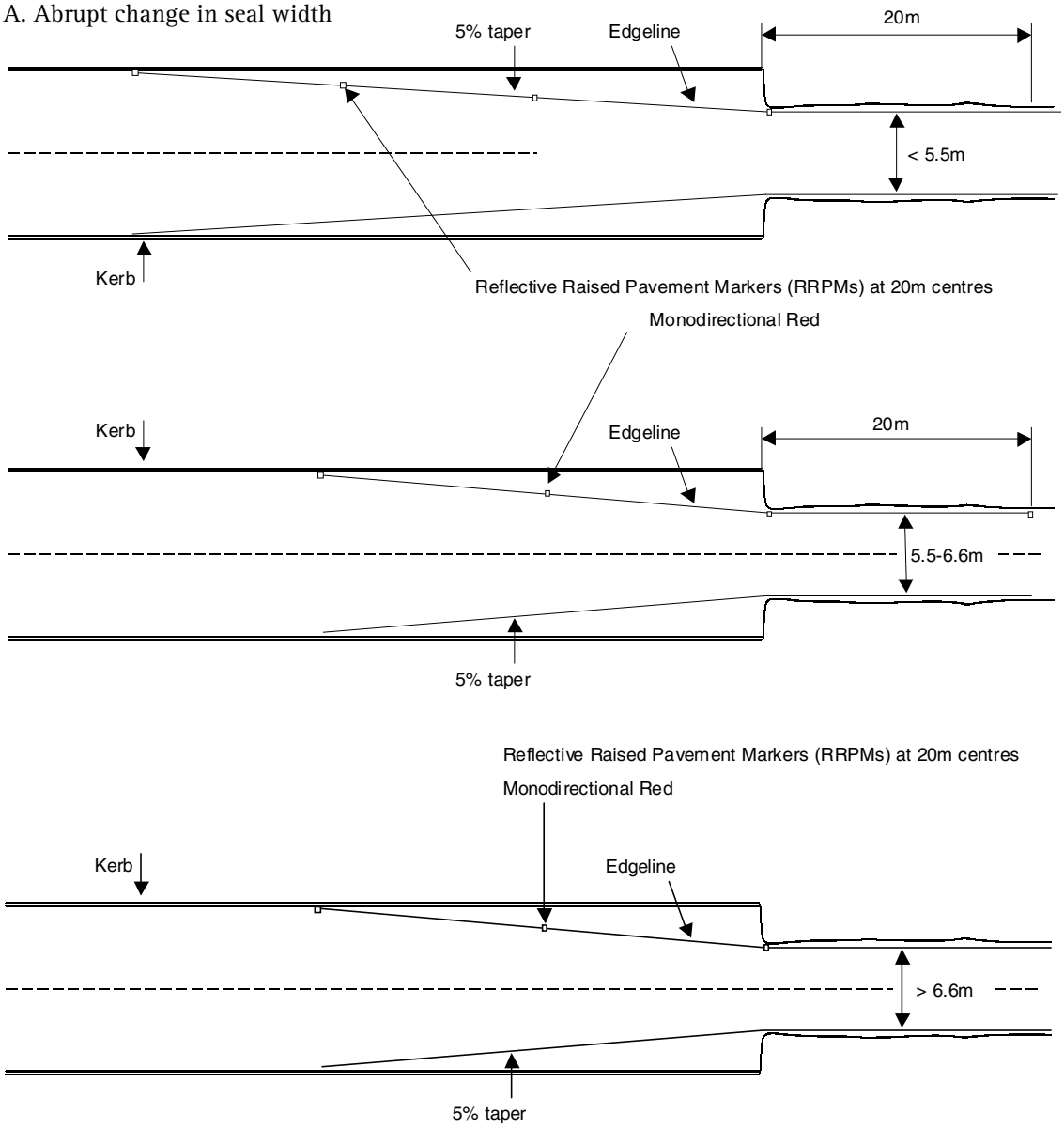
** Refers to Table 5.1.*

Accident reduction:

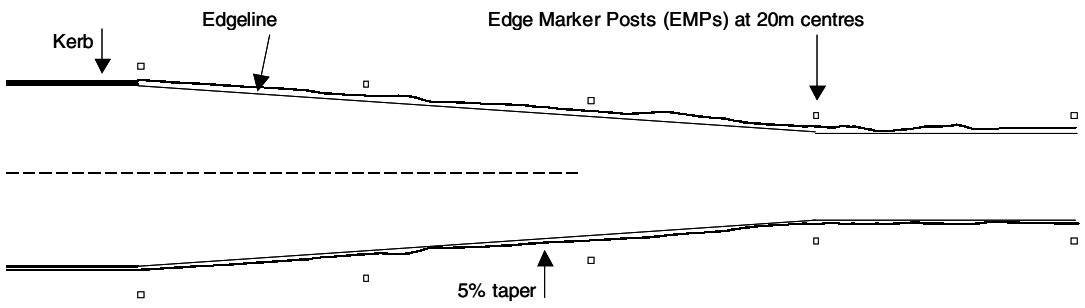
Edge lines can address lost control accidents by defining alignment and road edge. Accident reductions of between 0 percent and 62 percent have been reported (see section 9, reference 6). No references to the expected BCR have been found.

Figure 1: Edge line markings at kerbed/unkerbed transitions

A. Abrupt change in seal width



B. Tapered transition



6.1.4 Intersection markings

Highlighting the presence of side roads to main road traffic with the use of road markings serves two useful purposes. Firstly, the presence of the side road is easier to identify and motorists are therefore more likely to be aware of the possible hazards associated with an intersection, such as turning traffic. Secondly, the markings act as a useful guide for turning traffic.

Types of markings

Three types of markings can be used:

- continuous centreline
- edge line
- continuity line.

Details for line size and layout for rural side roads are shown in the *Manual of Traffic Signs and Markings* (Part II, Markings) and in Figure 2 of this guideline. An example of localised seal widening is shown in Transit New Zealand *Planning for a Safe and Efficient Highway Network under the Resource Management Act,* diagram 4, page 64 (June 1992). Although this diagram refers to a property access similar widening is considered appropriate for side roads.

Requirements:

Centrelines, edge lines and continuity lines: [Type F*]

The markings of centrelines, edge lines and continuity lines as shown in Figure 2 is recommended for roads meeting the following criteria:

Desirable minimum width	6.6m
Absolute minimum width	6.0m
Minimum volume	750 VPD

Centrelines: (only) [Type E*]

The marking of solid centrelines only on each approach is recommended on roads meeting the following criteria:

Desirable minimum width	5.5m
Absolute minimum width	5.0m
Minimum volume	250 VPD

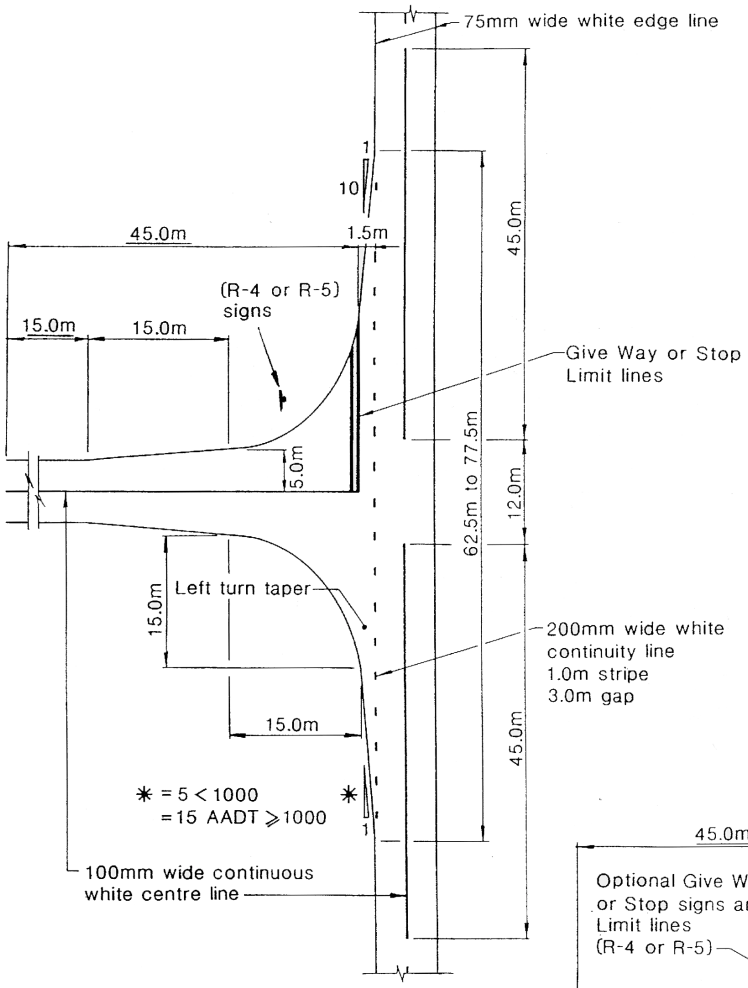
Accident reduction:

Intersection markings are intended to address intersection accidents, particularly turning versus same direction and overtaking turning vehicle accidents. No references to the expected accident reduction or BCR have been found.

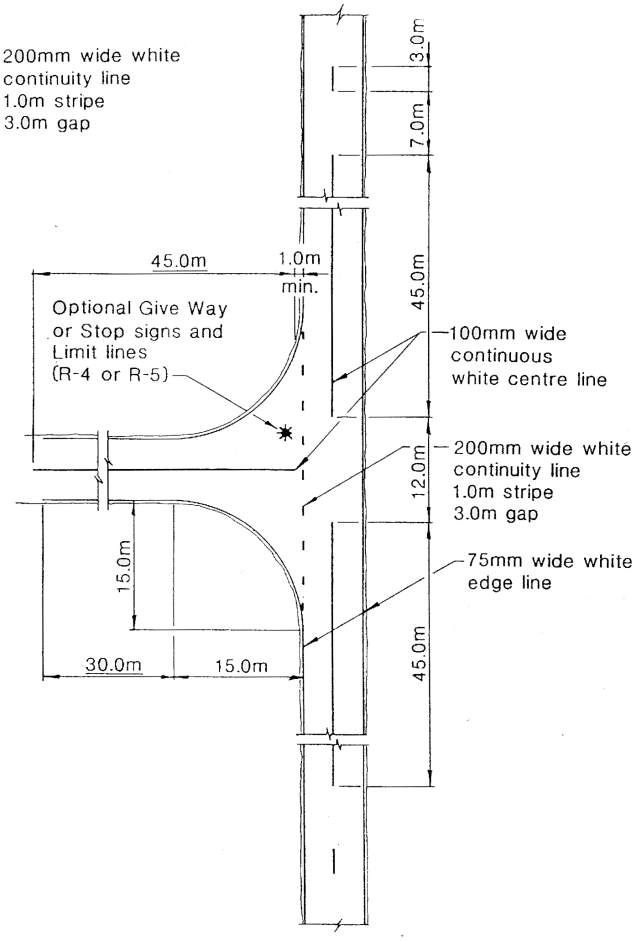
** Refers to Table 5.1.*

Figure 2: Intersection markings

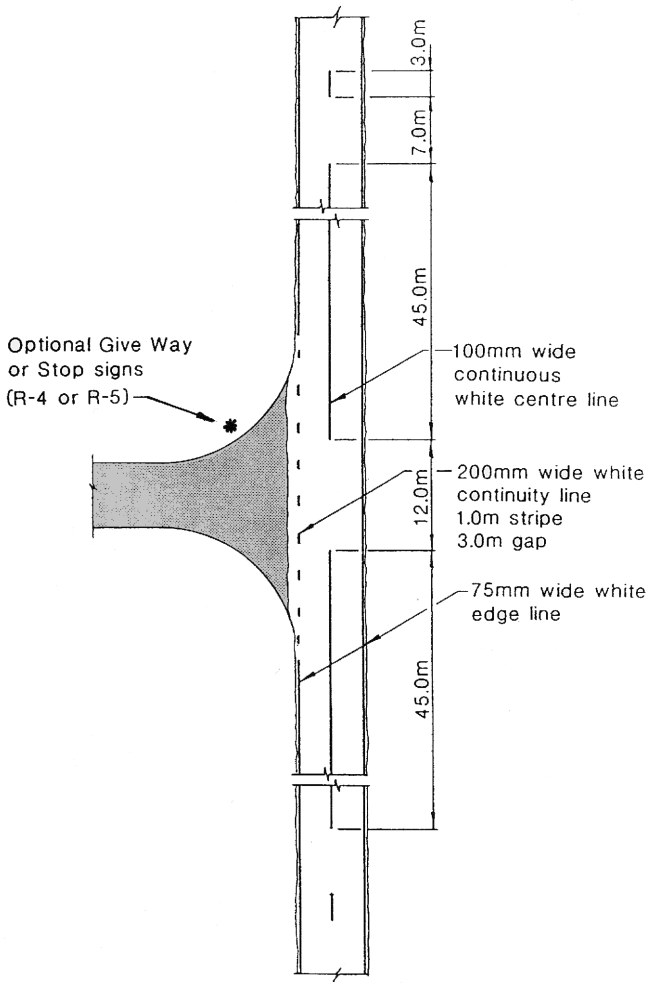
A. Sealed sideroad: desirable treatment (for roads with localised seal widening or wide sealed shoulders)



B. Sealed sideroad: minimum treatment



C. Unsealed sideroad:



Note: It is considered good practice to seal the approach of side roads as this helps prevent loose material from migrating on to the main road. Loose material on sealed roads can be hazardous, particularly if the intersection is located on a curve.

6.2 Delineation devices

The following section provides information on the different delineation devices recommended for rural roads. The following details are provided:

Dimensions:
Any reference to standards or specifications that apply to the device.

Requirements:
The desirable minimum width and absolute minimum width, where applicable, of sealed road required to provide the device. The minimum traffic volume (VPD) above which the device should normally be applied. The recommended spacing of devices is also provided.

Special conditions:
Any special conditions which apply, which would make it desirable to provide delineation devices on roads below the recommended requirements.

Accident reduction:
The reduction in accidents expected from the installation of the device and benefit cost ratio (BCR) where known, together with the reference. Obviously the BCR for specific projects can be calculated from the road's accident history and the expected accident reductions (refer Appendix 2). The typical BCR is shown for indicative reasons only.

Note: While the recommended values for seal width should be followed, local road controlling authorities can use lower minimum traffic volume thresholds. If this occurs it is essential that the lower criteria be applied in a consistent manner and special care be taken on roads that cross into adjacent authorities. It is also essential that a consistent treatment be provided along a road whose width varies. Generally the minimum width sections will dictate the standard of device which is applied.

6.2.1 Edge marker posts

Edge marker posts or post mounted delineators are used to delineate the alignment of the roadway ahead, especially at horizontal and vertical curves. They are primarily of use for night time guidance and have the following advantages:

- they can be detected far ahead, particularly in poor visibility conditions
- they can be detected even when the pavement has become invisible because of vertical or horizontal curves
- they are not subject to traffic wear
- they do not become covered by water, snow or sand which can cover pavement markings, although they do become dirty from road film and can be damaged by stock or vandals
- they are, on the near side of the road, located away from the glare of opposing vehicle headlights
- they can be used adjacent to unsealed roads.

Dimensions:

In 1990 the standard for edge marker posts was revised with a longer reflective strip being used (refer Transit New Zealand Specification M/14 1991). It is recommended that ***all new installations use this new post type*** to maintain consistency and for ease of supply. In these guidelines, two

standards for the placement of edge marker posts are referred to. Details of these are provided in Appendix 4:

- Spacing 'A' is the old state highway standard.
- Spacing 'B' is the new state highway standard.

Note: It is considered that the new state highway standard is too expensive for general application on all local rural roads. The safety benefits of the new standard are also unknown at this time. Should information on the expected accident reductions of the new standard become available the requirements in this guideline will be reviewed.

Road controlling authorities can use the new spacing standard on lower traffic volume roads than those recommended in this guideline if desired. However, if this occurs it is essential that the new criteria be applied in a consistent manner and special care be taken on roads that cross into adjacent authorities.

Requirements:

The installation of edge marker posts is recommended on the following road types at the stated spacing:

Road type	Treatment type**	Spacing type*	Minimum volume
Unsealed road (total route)	[Type G]	A	500 VPD
Unsealed road (isolated sections)	[Type H]	A	100 VPD
Sealed road (total route)	[Type I]	B	1,500 VPD
Sealed road (total route)	[Type J]	A	500 VPD
Sealed road (isolated sections)	[Type K]	A	100 VPD

* Refer to Appendix 4 for details of spacing.

** Refers to Table 5.1.

Special conditions:

The installation of edge marker posts on the total route is not normally necessary for roads carrying less than 500 VPD, however, circumstances may exist where the installation of either continuous or isolated sections of edge marker posts is desirable:

- where there are frequent horizontal and/or vertical curves
- at sub-standard curves
- over sections where the accident record indicates a need
- to maintain continuity on a route or with an adjacent road
- through areas commonly subject to fog, mist or steam
- through areas commonly subject to heavy rainfall (greater than 1,000mm annual rainfall)
- where there are heavy night traffic flows
- where there are heavy tourist traffic flows.

Accident reduction:

Edge marker posts can address lost control accidents particularly those at night and have been shown to reduce accidents on curves between 32-67 percent (see section 9, reference 3 and 4) and between 15-18 percent on total routes (see section 9, reference 5), with an expected BCR of 8 (see section 9, reference 2).

6.2.2 Reflective raised pavement markers

Reflective raised pavement markers (RRPMs) provide both 'near' and 'far' delineation at night. In wet weather RRPMs are particularly valuable since water enhances their reflectivity. RRPMs can also provide an audible and tactile signal when traversed by vehicle wheels.

Dimensions:

For details on product specification and marker placement refer to Transit New Zealand Specification M/12 *Reflective and Non-reflective Traffic Lane Markers* and *Manual of Traffic Signs and Markings* (Part II Markings).

The colour coding of RRPMs is as follows:

Centreline:	bi-directional white
No overtaking line:	bi-directional yellow
Left edge (special situations):	mono-directional red.

Requirements:

Reflective raised pavement markers: [Type L*] (total route)

The installation of RRPMs on centrelines and no overtaking lines is recommended for all sealed roads meeting the following criteria:

Desirable minimum width:	6.0m
Minimum volume:	1,000 VPD
Desirable spacing:	20m

Note: It is considered that the practice of installing RRPMs on state highways carrying flows as low as 500 VPD is too expensive for general application on all local rural roads. The safety benefits of this are also unknown at this time. Should information on the expected accident reduction of this become available the requirements in this guideline will be reviewed.

A desirable minimum width has been recommended as experience has shown that the loss rate of RRPMs increases with narrower widths, particularly on curves.

Reflective raised pavement markers: [Type M*] (isolated sections)

The installation of continuous RRPMs on lower volume roads is not normally necessary, however special circumstances may exist where the installation of isolated sections of markers is desirable:

- where there are frequent horizontal and/or vertical curves
- at sub-standard curves

** Refers to Table 5.1.*

- through sections where the night accident record indicates a need
- through sections where night traffic volumes are abnormally high.

Reflective raised pavement markers can be installed on centrelines and no overtaking lines on isolated sections of sealed roads meeting the following criteria:

Desirable minimum width	6.0m
Minimum volume	500 VPD
Desirable spacing	20m

Special conditions:

Irrespective of the above guidelines, the installation of RRPMs on other continuous or isolated sections may be desirable where special conditions apply. These may be:

- through areas commonly subject to fog, mist or steam
- to maintain continuity on a route or with an adjacent road
- areas subject to high rainfall (greater than 1,000mm annual rainfall).

Note: For those roads subject to ice and snow, that require snow clearance, careful consideration of the type of RRPM to be installed or the equipment used will be necessary to reduce loss.

Accident reduction:

Reflective raised pavement markers can address lost control and head-on accidents particularly at night and during wet weather and have been shown to reduce these type of accidents by 15-20 percent (see section 9, reference 2) with a BCR of 8 (see section 9, reference 2).

6.3 Signs

It is considered that the standards for sign posting in the Transit New Zealand/Ministry of Transport Land Transport Division *Manual of Traffic Signs and Markings* (edition 3, 1992) are appropriate for all road types and no recommendations as to minimum traffic flow are suggested.

It is, however, recommended that rather than treat the installation of warning signs on an ad hoc basis, as is common, road controlling authorities should identify all hazardous locations and treat them accordingly. To assist controlling authorities in this it is recommended that reference be made to the *Manual of Traffic Signs and Markings* Part 1: Traffic signs, Appendix 3 (edition 3, 1992).

It should be remembered that in this guideline road markings and delineation devices are not generally recommended for roads with a traffic volume less than **100 VPD.** Advising motorists of sudden changes in the road environment on these roads is therefore achieved by the use of warning signs alone.

Sections 6.3.1-6.3.3 of this guide refer users to the appropriate references and suggest expected accident reductions and benefit cost ratios (BCR), where known, together with the reference. Obviously the BCR for specific projects can be calculated from the road's accident history and the expected accident reductions (refer Appendix 2). The typical BCR is shown for indicative reasons only.

Section 6.3.4 refers to the construction and installation of sight rails.

6.3.1 Curve warning and advisory speed signs

Curve warning signs provide 'far' delineation in all weather conditions and can advise motorists of hidden changes in the horizontal alignment that would not have otherwise been defined by road markings or delineation devices. Advisory speed signs indicate to drivers the speed at which a curve may be negotiated without discomfort to the driver or passengers.

References: *Manual of Traffic Signs and Markings,* Part 1: Traffic signs (edition 3, 1992), Section 6 and Appendix 3.

Accident reduction:

Curve warning and advisory speed signs address lost control and head-on accidents by providing warning of the alignment of the road ahead and have been shown to reduce accidents as follows:

Sign type	% reduction	BCR	Source**
Curve warning (only)	36	400	(2)
Curve warning and advisory speed	20	125	(2)
Adding advisory speed	36	400	(2)

** Reference number refers to Section 9.

6.3.2 Chevrons (sight boards)

Chevrons (sight boards) and chevron curve indicators are used to help emphasise deceptive or dangerous curves and are generally erected at curves where advisory speed signs are present and a continuing record of curve accidents exist, or speeds are consistently higher than the posted advisory speed.

Chevrons are also used at Tee intersections where the background is either non-existent or so poor that other devices are failing to prevent over-run of the intersection.

References: *Manual of Traffic Signs and Markings* (Part II Markings), *Manual of Traffic Signs and Markings,* Part 1: Traffic signs (edition 3, 1992), Appendix 3.

Accident reduction:

Chevron boards address lost control on curve and over-run at intersection accidents and have been shown to reduce accidents by 30-70% (6). No references to the expected BCR have been found.

6.3.3 Hazard and bridge end markers

Hazard and bridge end markers are intended to highlight hazards, usually fixed solid objects, that are located close to the edge of the road, provided that the area between the road edge and object is traversible by vehicles.

Hazard markers should be used where it is not economic to provide guardrailing or remove the hazard.

Bridge end markers should be installed on all bridges where it is not economic to provide guardrailing.

Note: The use of bridge end markers where guardrailing has been provided is considered unnecessary as it can indicate a false width. Guardrail mounted edge marker posts are considered more appropriate.

Reference: *Manual of Traffic Signs and Markings* (Part II Markings).

Accident reduction:

Hazard and bridge end markers address collisions with roadside objects. No references to the expected accident reduction or BCR have been found.

6.3.4 Sight rails

Sight rails have been used to highlight hazards such as curves, bridges, culverts and intersections. They are usually constructed of light timber and are painted white.

The use of sight rails to protect dangerous roadside hazards such as bridge abutments and steep banks is strongly discouraged. It is recommended that road controlling authorities identify all such sites and implement a plan to replace such installations with guard rail or other recognised safety fencing.

It is considered that, in most situations, the use of correctly installed conventional delineation devices as explained previously would make the use of sight rails unnecessary.

For those situations where guard rails are uneconomic, or conventional delineation devices are not considered appropriate or do not provide the visual guidance expected, it is recommended that sight rails be constructed as indicated in Figure 3.

Examples of where sight rails may be appropriate are as follows:

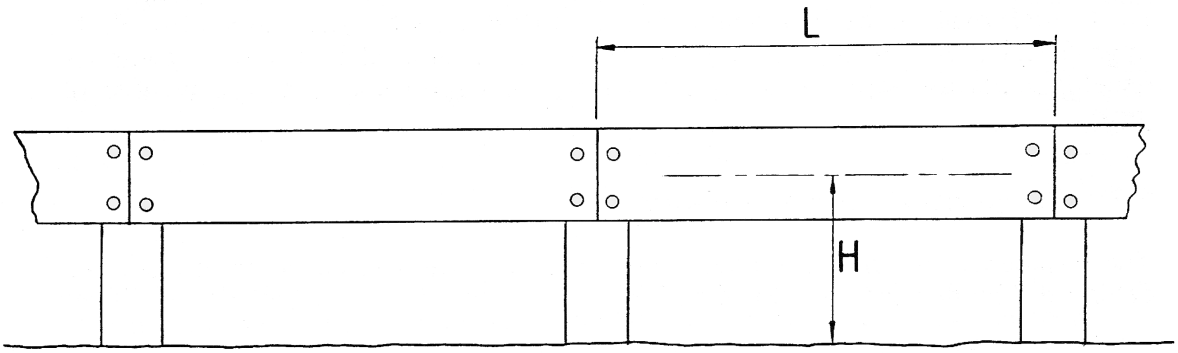
- to highlight the throat of intersections in flat level terrain, especially in areas commonly subject to fog, mist or steam
- to provide continual guidance through tight bends with limited visual background.

Note: Careful consideration of the end treatment of sight rails is required to ensure that the rail itself does not become a hazard. It is recommended that the ends be turned away from the roadway.

Accident reduction:

Sight rails can address accidents such as collisions with roadside objects, lost control and overshooting intersections. No references to the expected accident reduction or BCR have been found.

Figure 3: Sight rail construction details



Posts	Size (maximum): 100mm x 100mm or 10,000mm^2 Spacing: 1.5m
Rails	Size: 200-300mm x 25mm Maximum length (L): 1.5m (refer note below)
Mounting height	Height (H): refer note below
Materials	Tanalised timber or approved frangible material
Fixings	Galvanised bolts or coach screws
Finish	Painted white

Note: Length (L): This is the suggested maximum length of continuous solid members. Longer sections of material are more likely to impale vehicles in the event of an impact.

Height (H): Generally half driver eye height (i.e. similar to guard rail and edge marker posts). This will however depend on site layout. The sight rail should be clearly visible to approaching drivers and if possible be illuminated by vehicle head lights. Care also needs to be taken at intersections to ensure intervisibility is not reduced by the rail.

7. Implementation

It is realised that the implementation of these proposed road marking and delineation standards will result in an increase in current levels of traffic services budgets in most rural road controlling authorities. It would also be physically difficult to upgrade all roads in one year. It is therefore recommended that each authority develop a priority schedule for implementing the improvements over a number of years.

7.1 Suggested practical procedure

The installation of curve warning, advisory speed signs and chevrons can only be determined by detailed analysis of each road.

The following suggested procedure is intended to help road controlling authorities identify roads that require improvements to road markings, delineation devices, hazard markers and bridge end markers:

(a) identify roads that may require road marking or delineation (i.e. roads with a traffic volume greater than 100 VPD)

(b) record road details and what the current standard of road markings and delineation devices is (refer Tables 7.1 and 7.2 on following pages for suggested layout)

(c) sort roads by traffic volume and seal width (see note below)

(d) use the guideline to determine which roads require improvement

(e) determine which roads should be treated first. This could be based on any of the following:

- road hierarchy
- area (e.g. ward)
- volume
- accident rate
- benefit cost ratio (refer Appendix 2)

(f) arrange for the necessary Council approvals and budget adjustments

(g) publicise the reasons for the improvement, and where they will be installed

(h) co-ordinate the marking and delineation improvements so they are installed together.

Note: The tabulation in (c) above may also highlight sections of road where the seal width is inadequate for the traffic volume. This should be used to assess the need for a seal widening programme.

Table 7.1: Unsealed rural roads

Name	Section From - to	Traffic volume	Edge marker posts Total route	 Isolated	Hazard markers	Bridge end markers

Table 7.2: Sealed rural roads

Road name	Section From – to	Traffic volume	Seal width	Centreline		Edge line		Intersection markings	Edge marker posts		Hazard markers	Bridge end markers
				Total route	Isol-ated	Total route	Isol-ated		Total route	Isol-ated		

8. Maintenance

To ensure road markings, delineation devices and signs remain effective it is necessary to carry out regular checking and maintenance. It is recommended that road controlling authorities refer to the National Roads Board *State Highway Maintenance Standard* October 1985 and Transit New Zealand Specifications C18 *Maintenance of Edge Marker Posts* and C20 *Erection and Maintenance of Signs, Chevrons, Markers & Sight Rails 1992* for guidance on the level of maintenance required.

Note: It is important that regular inspections be carried out, including night visits, to ensure maintenance problems are corrected as soon as possible.

8.1 Loss rates

The maintenance costs for road markings are generally well known as markings are repainted on a regular basis.

The maintenance costs for edge marker posts and reflective raised pavement markers, apart from regular cleaning, are more difficult to calculate as the loss rate, due to such factors as vehicle collision, stock damage, snow clearance etc, is difficult to assess. Information gained from the questionnaire circulated to all rural road controlling authorities indicate the following expected annual loss rates:

Edge marker posts

Bends/curves:	12%
Straights:	12%
Total:	16%

Reflective raised pavement markers

Bends/curves:	18%
Straights:	9%
Total:	16%

9. References

The following documents have been referred to throughout this guideline, shown as a number in brackets (i.e. (1)).

(1) Glennon J C, (1985), *Accident Effects of Centreline Markings on Low Volume Rural Roads* 64th Annual Meeting, Transportation Research Board, Washington DC.

(2) Garrett A, (1990), *The Benefits of Low Cost Engineering Treatments* Road Hazards Conference and Introductory Training Course, Wollongong, 25-29 June 1990. Pak-Poy and Kneebone.

(3) Nicholas Clark and Associates, (February 1984), *Evaluation of the Effectiveness of Low Cost Traffic Engineering Projects,* Australian Federal Department of Transport, Office of Road Safety, Canberra.

(4) County Surveyors Society, (August 1989), Report 1/8 *Carriageway Definition,* United Kingdom.

(5) Hoque M M and Sanderson J T, (1988), *Road Safety Countermeasures for Rural Roads,* Report TS88/3 (Royal Automobile Club of Victoria, Melbourne).

(6) Travers Morgan (NZ) Ltd, (April 1992), *Accident Countermeasures: Literature Review* Transit New Zealand Research Report Number RR10.

10. Acknowledgements

This document was prepared by David Croft, Road and Traffic Standards Section, Land Transport Division, Ministry of Transport, Auckland, who gratefully acknowledges the assistance of the members of the Working Group:

Mr L Hutton	Transit New Zealand
Mr L Peters	Hauraki District Council
Mr R Coles	Rangitikei District Council
Mr W Caplin	NZ Roadmarkers Federation
Mr C Hitch	Road Safety Manufacturers Association

The assistance of those road controlling authority staff who completed the *Rural Road Marking and Delineation Questionnaire* and who provided comments on drafts is also gratefully acknowledged.

Appendix 1: Accident analysis

1. Introduction

Both local authority investigating teams and accident investigation teams have identified that the standard of road markings and delineation on many non-state highway rural roads, especially low volume roads, is poor. This can lead to an increase in lost-control and night-time accidents. In many cases the teams have recommended improvements to delineation and this has led to a number of differing standards being followed on rural roads in New Zealand.

2. Accidents

Analysis of national accident data for rural roads illustrates some of the problems. The data analysed is reported injury accident data for the period 1981-1990. Rural roads are those roads with a speed limit greater than 70 kilometres per hour.

A comparison was made between rural non-state highway and rural state highway accidents as it was considered that the standard of road marking and delineation is of a higher standard on state highways.

In Figure A1 a comparison between rural non-state highway and rural state highway accidents shows that the proportion of curved road-lost control and head-on accidents is higher for non-state highway roads.

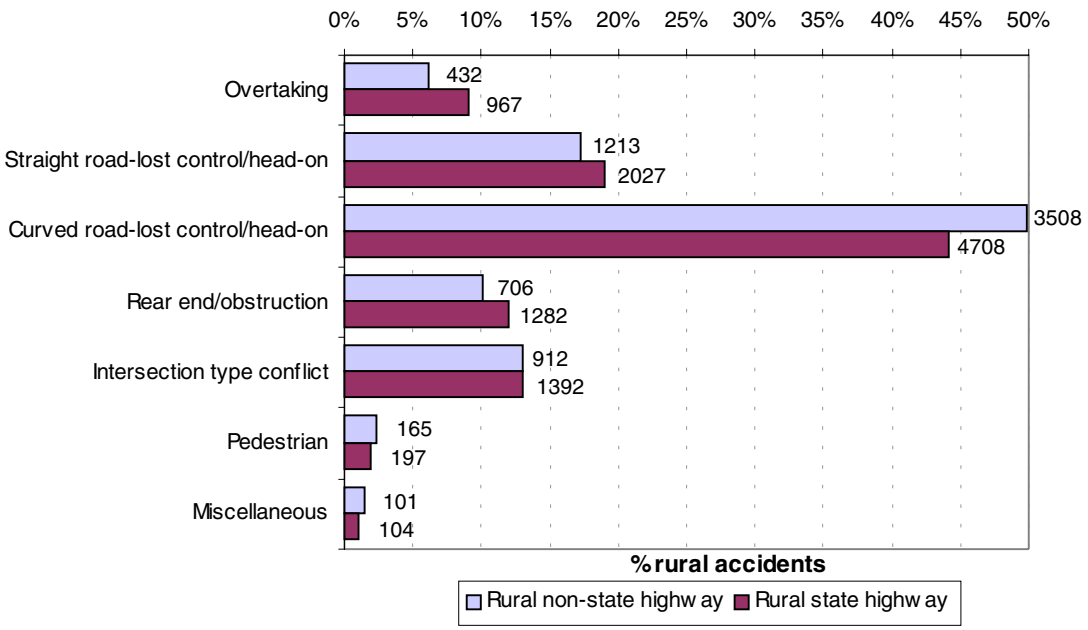


Figure A2 shows that the proportion of accidents occurring in darkness on rural non-state highways is above that for rural state highways.

Figure A2: Accidents in darkness – rural reported injury accidents

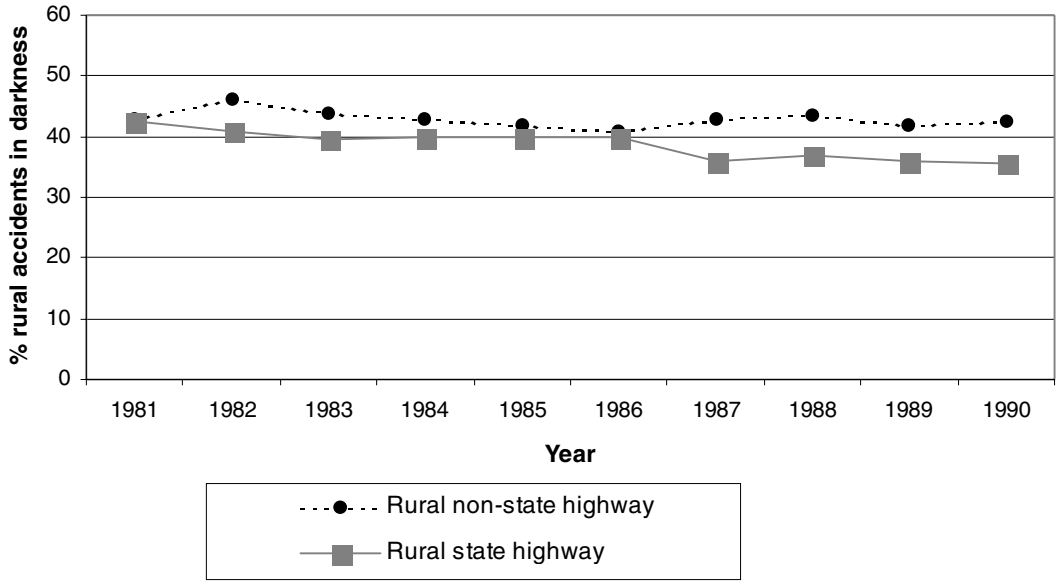
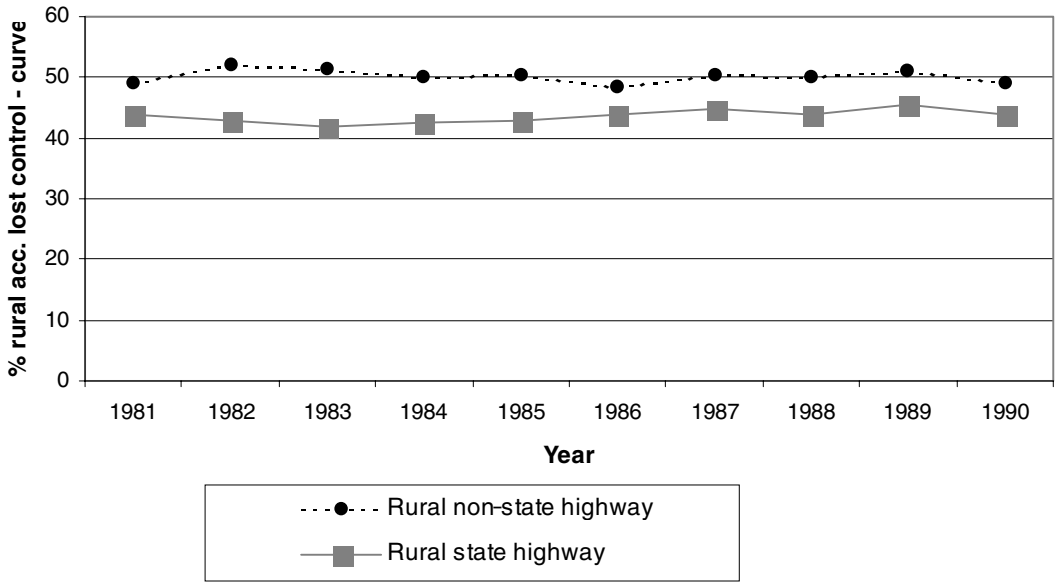


Figure A3 compares accidents on curves and once again shows that the proportion of lost control accidents on non-state highway roads is above that for rural state highways.

Figure A3: Lost control on curves – rural reported injury accidents



Appendix 2: Economic analysis

Details on the type of accidents addressed for each road marking and delineation device together with expected accident reductions and suggested benefit cost ratios have been supplied throughout this document where known. Obviously the BCR for specific projects can be calculated from the road's accident history and the expected accident reductions. Typical BCRs are shown for indicative reasons only. These are summarised in Table A1 (refer next page).

Note: There are some difficulties with the information shown in this Table:

- some of the values could not be found in research
- most of the values are from overseas research which may have dubious relevance to New Zealand conditions
- some research evaluated enhanced markings or devices, for example very wide edge lines
- often a number of devices are simultaneously installed, with a compounding effect masking their individual safety performance.

It is hoped that the monitoring of accident investigation studies carried out in New Zealand will allow this information to be updated with more relevant figures. This work is currently being done by the Ministry of Transport.

The Working Group suggests that rather than rely on overseas research local authorities should assume that over-represented accidents can be reduced in part or whole to the national average for either local rural roads or rural state highways.

The following shows national average expected percentages of over-represented accident types identified in Appendix 1 and the average expected night/day accident ratio, expressed as a fraction of day accidents.

Accident type	National average % of all accidents	National average expected number of night accidents
Rural state highways		
Curved road - lost control/ head-on	44	Number of day accidents x 0.64
Accidents in darkness	37	Number of day accidents x 0.59
Local rural roads		
Curved road - lost control/ head-on	50	Number of day accidents x 0.88
Accidents in darkness	42	Number of day accidents x 0.71

Table A1: Expected accident reductions and benefit cost ratios

Treatment	Accident reduction	Benefit cost ratio	Source*
Markings			
Centreline	-	-	-
No overtaking lines	-	-	-
Edge lines	0-62%	-	6
Intersection markings	-	-	-
Delineation devices			
Edge marker posts (isolated sections)	32-67%	-	3, 4
Edge marker posts (total route)	15-18%	8	2
Reflective raised pavement markers	15-20%	8	2
Signs			
Curve warning	36%	400	2
Curve warning and advisory speed	20%	125	2
Advisory speed	36%	400	2
Chevrons	30-70%	-	6
Hazard and bridge end markers	-	-	-
Sight rails	-	-	-

* Reference number refers to Section 9.

Note: The omission of a value implies a lack of known research into the device and is not an indication of its effectiveness.

Appendix 3: Marking and delineation costs 1991

To assist road controlling authorities in calculating the costs of improvements to road markings and delineation devices, the following table (Table A2) lists the average cost (exclusive of GST) for markings, devices and signs for April 1991. The data in this table comes from the questionnaire sent to all rural road controlling authorities and members of the Working Group. Authorities should first check their own contract prices.

Table A2: Cost of rural remedial works (April 1991)

	Cost item $ (average)	Installation cost $ (average)
Signs		
New Single Warning Sign (600x600)	75	75
New Single Warning Sign & Supplementary Plate	105	80
Change Warning Sign (600x600)	65	35
Add Supplementary Plate	45	20
New Full Chevron (2400x600) (HI)	145	95
New Half Chevron (1200x600) (HI)	90	80
New Full Chevron & Supplementary Plate	200	110
New Half Chevron & Supplementary Plate	160	85
Add Supplementary Plate	70	35
New Single Chevron (HI)	55	75
New Bridge End Marker (HI)	15	35
New Hazard Marker (HI)	5	30
Road markings		
Centreline White (100mm) Dashed	105 $/km	N/A
Centreline White (100mm) Dashed Reflectorised	150 $/km	N/A
Centreline White (100mm) Dashed Thermoplastic	550 $/km	N/A
Centreline White (100mm) Solid	260 $/km	N/A
Centreline White (100mm) Solid Reflectorised	395 $/km	N/A
Centreline White (100mm) Solid Thermoplastic	1050 $/km	N/A
Centreline Yellow (100mm) Solid	285 $/km	N/A
Centreline Yellow (100mm) Solid Reflectorised	380 $/km	N/A
Centreline Yellow (100mm) Solid Thermoplastic	1150 $/km	N/A
Edge line White (75mm)	190 $/km	NIA
Edge line White (75mm) Reflectorised	395 $/km	N/A
Edge line White (75mm) Thermoplastic	850 $/km	N/A
Continuity Line White (200mm)	660 $/km	N/A
Continuity Line White (200mm) Reflectorised	825 $/km	N/A
Continuity Line White (200mm) Thermoplastic	1550 $/km	N/A
Delineation		
Edge Marker Post (New) Wood (HI)	10 ea	11
Edge Marker Post (New) Plastic (HI)	10 ea	17
Raised Reflective Pavement Marker (Mono)	7 ea	9
Raised Reflective Pavement Marker (BI)	8 ea	9
Raised Reflective Pavement Marker (Mono) (Shank)	5 ea	?
Raised Reflective Pavement Marker (BI) (Shank)	9 ea	?

(HI) = High Intensity Reflective Sheeting

(Mono) = Mono Directional

(BI) = Bi Directional

(Shank) = RRPM has a shank

Appendix 4: Edge marker post spacing

Details of the two edge marker post spacing standards referred to in this guideline are as follows:

Spacing A: old state highway standard: Reproduced from National Roads Board, *Manual of Traffic Signs and Markings, 1975*.

Spacing B: new state highway standard: Reproduced from Transit New Zealand, General Circular 91/3 *Revised Standard for Edge Marker Post Delineation,* January 1991.

Spacing A: Old state highway standard

3.05 Edge marker posts

Edge marker posts with retro-reflective devices aid night driving particularly on curves. They should be used on all rural highways, should be considered as guide markers and never substituted for a proper warning sign. Edge marker posts shall take the form specified in NRB Specification M/14 "Edge marker posts" (see also Fig. 3.7). Reflectors installed on the left side of the road shall reflect white light. Reflectors installed on the right side of the road shall reflect yellow light.

3.05.01 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.

3.05.02 Location

Posts shall be placed vertically so that the top of the post is 900mm above the adjacent edge of the traffic lane. Posts must be located clear of any trafficable portion of the roadway shoulders but shall not be further than 3m from the side of the adjacent traffic lane. Where no shoulders exist a lateral clearance of at least 1.2m to the adjacent traffic lane shall be provided where practicable. In order to produce a smooth flowing pattern of delineation some variation in the lateral clearances specified may be necessary.

(a) Straights: On straights, posts shall be 100m apart, in straight lines both sides of the road, with pairs opposite.

(b) Horizontal curves: The arranging and spacing of posts shall be as indicated in figures 3.7 and 3.8. Note that posts shall not be located on the inside of horizontal curves with a radius of 600m or less.

(c) Passing lanes: Where passing lanes are marked the spacing of posts adjacent to the merge taper shall be 20m.

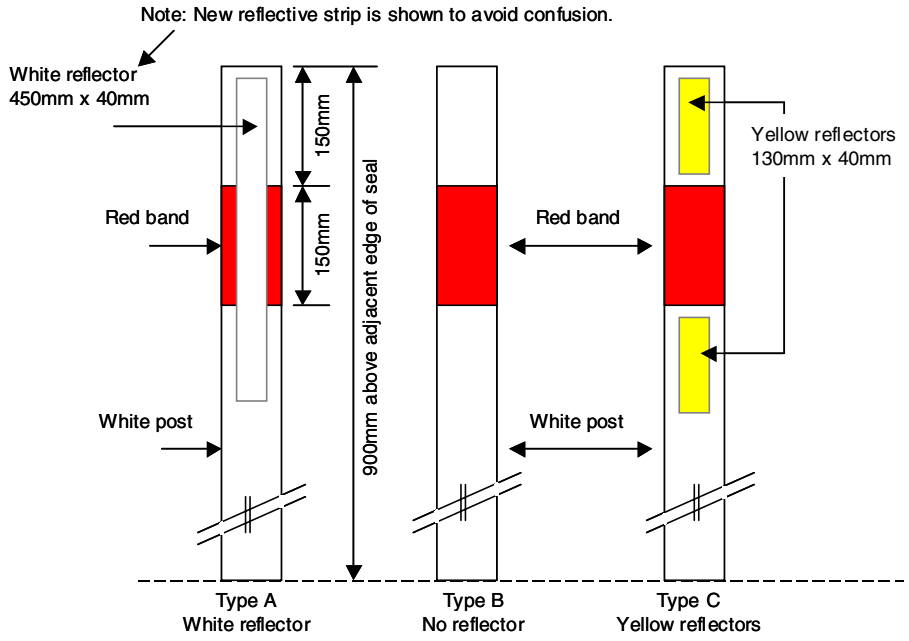
(d) Vertical curves: On substandard vertical curves spacing may be reduced so that the top 300mm of three posts is visible ahead.

3.05.03 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 reduced by up to 20 percent to clear driveways, side roads or other obstructions. Edge marker posts are generally unnecessary where 100mm continuous reflectorised white edge lines are provided i.e. on motorways and multi-lane divided highways.

Figure 3.7: Edge marker posts

Details of posts and reflectors (reflectors attached to widest face of rectangular posts)



Post spacing table

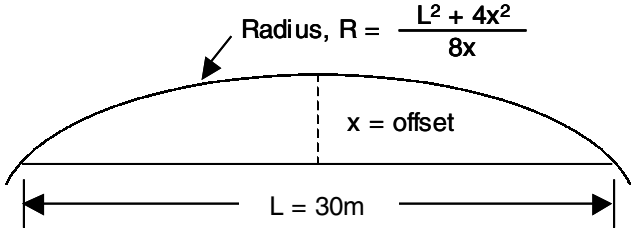
Horizontal alignment	Reflector type Left	Right	*Spacing (metres)		*Edge location
Straights	A	B	100		Pairs opp.
			Intermediate	Curve	
All curves R over 600m	A	B	100	100	Pairs opp.
LH curves R 600m or less	-	C	75	50	Right only
RH curves R 600m or less	A	-	75	50	Left only
LH curves R 140m or less	-	C	50	25	Right only
RH curves R 140m or less	A	-	50	25	Left only

* See also Fig. 3.8 for illustration of typical layouts.

Note:

1 At passing lane end taper, spacing shall be 20m.

2 At substandard horizontal curves, spacing throughout shall be such as to make at least three posts always visible.



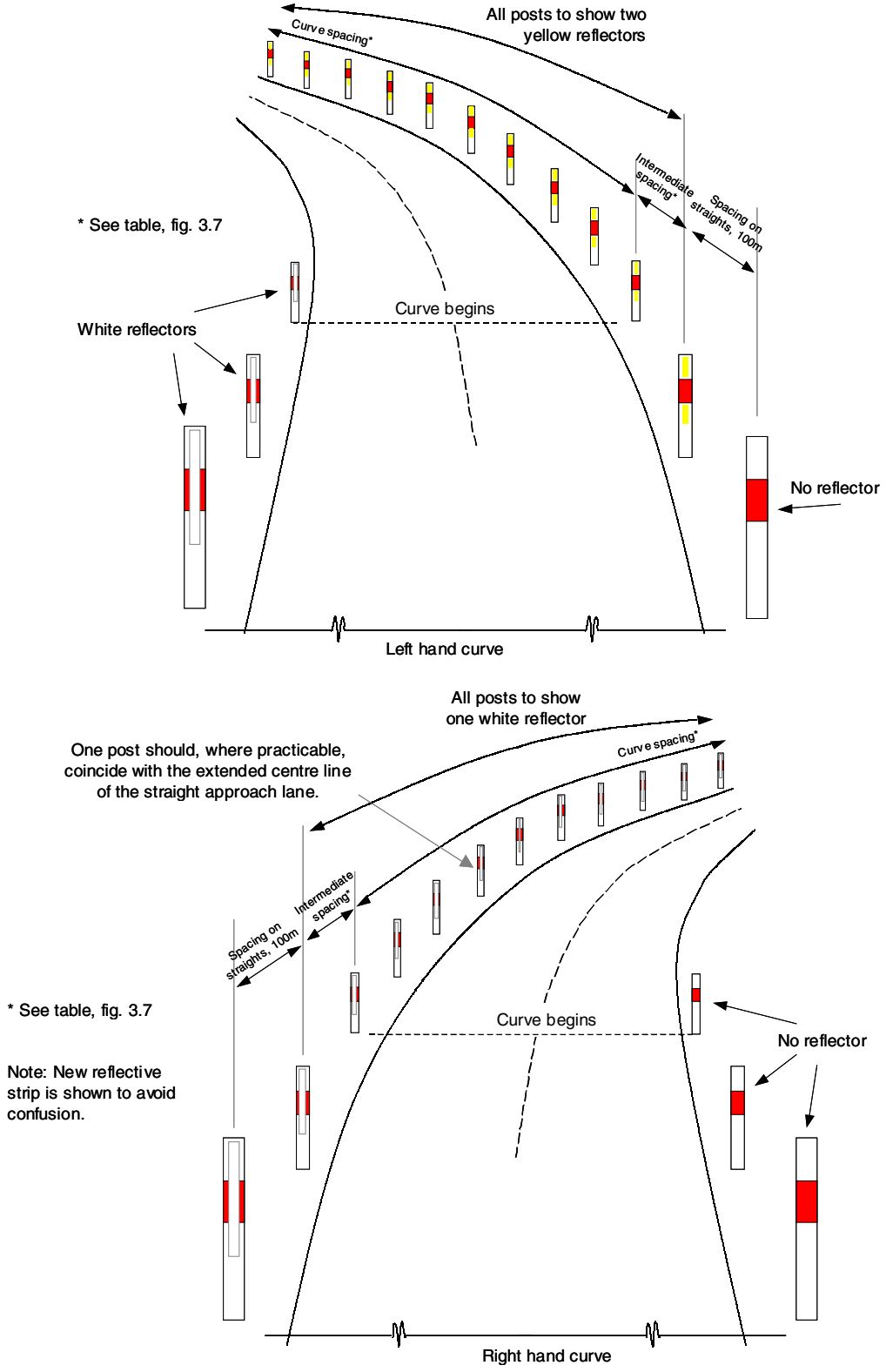
To find curve radius (R)

When x = 190mm, R = 600m

When x = 800mm, R = 140m

Reproduced from National Roads Board, Manual of Traffic Signs and Markings, 1975

Figure 3.8: Typical layout of edge marker posts at curves with radius 600m or less



Reproduced from National Roads Board, Manual of Traffic Signs and Markings, 1975

Spacing B: New state highway standard

3.05 Edge marker posts

Edge marker posts with retro-reflective devices aid night driving particularly on curves. They should be used on all rural highways, should be considered as guide markers and never substituted for a proper warning sign. Edge marker posts shall take the form specified in TNZ Specification M/14 "Edge marker posts" (see also Fig. 3.7). Reflectors installed on the left side of the road shall reflect white light. Reflectors installed on the right side of the road shall reflect yellow light.

3.05.01 Post 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 high intensity reflective material (see TNZ M/14).

3.05.02 Location

Posts shall be placed to produce a smooth flowing pattern of delineation which defines the edge of the trafficable portion of the carriageway. They shall not be further than 3m from the side of the adjacent traffic lane. Where no shoulders exist a lateral clearance of at least 1.2m to the adjacent traffic lane shall be provided where practicable. Posts shall be placed vertically so that the top of the post is 900mm above the adjacent edge of the traffic lane.

(a) Straights: On straights, posts shall be 100m apart, in straight lines both sides of the road, with pairs opposite.

(b) Horizontal curves: The arranging and spacing of posts shall be as indicated in figures 3.7 and 3.8.

(c) Passing lanes: Where passing lanes are marked the spacing of posts adjacent to the merge taper shall be 20m.

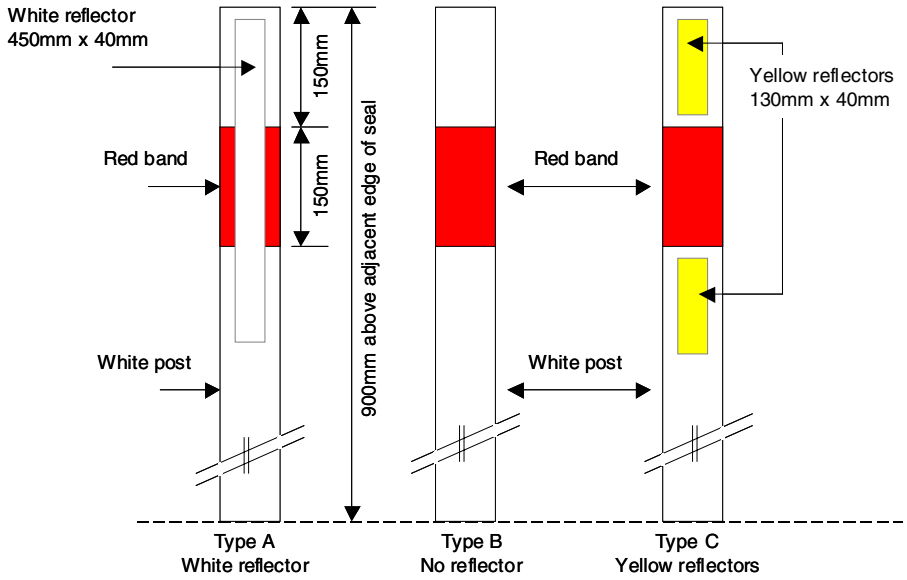
(d) Vertical curves: On substandard vertical curves spacing may be reduced so that the top 300mm of four posts is visible ahead when viewed from driver eye height (1.15m).

3.05.03 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. Post spacing may be reduced by up to 20 percent to clear driveways, side roads or other obstructions. Edge marker posts are generally unnecessary where 100mm continuous reflectorised white edge lines are provided, i.e. on motorways and multi-lane divided highways.

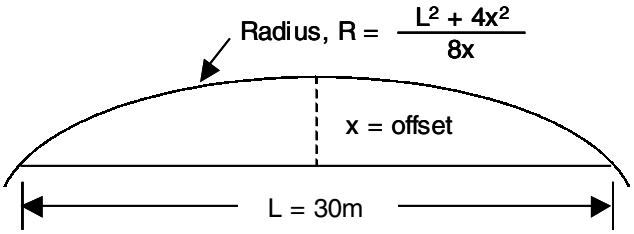
Figure 3.7: Edge marker posts

Details of posts and reflectors (reflectors attached to widest face of rectangular posts)



Post spacing table

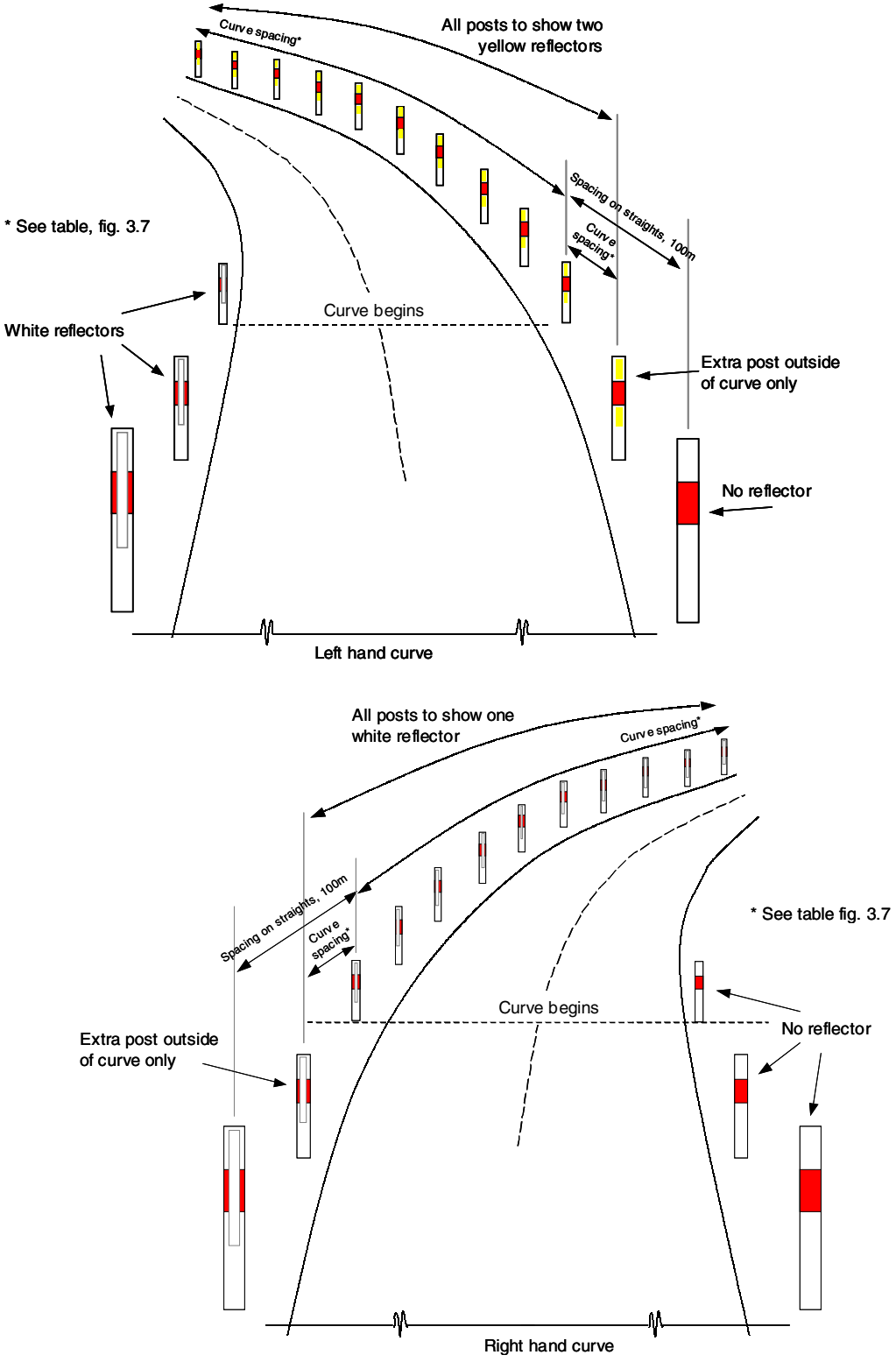
Horizontal alignment		Reflector type Left	Right	Edge location	
Straight		A	B	Pairs opposite	
LH curves		A	C	Equal curve spacing	
RH curves		A	B	Equal curve spacing	
Radius (m)	**Spacing (m)**			**Radius (m)**	**Spacing (m)**
20-30	10			200-300	28
30-40	12.5			300-400	31
40-60	15			400-600	35
60-80	17.5			600-800	40
80-100	19			800-1200	45
100-150	21			Over 1200	50
150-200	25				



To find curve radius (R)

Reproduced from Transit New Zealand, General Circular 91/3 Revised Standard for Edge Marker Post Delineation, January 1991

Figure 3.8: Typical layout of edge marker posts



Reproduced from Transit New Zealand, General Circular 91/3 Revised Standard for Edge Marker Post Delineation, January 1991

Group	1			2			3			4			5		
Traffic volume (AADT) Annual average daily vehicles Annual average heavy vehicles	Under - 30 Under - 10			30 - 100 10 - 40			100 - 250 40 - 80			250 - 500 80 - 150			500 - 2500 Over 150		
Topography: L=level, R=rolling, M=mountainous	L	R	M	L	R	M	L	R	M	L	R	M	L	R	M
Number of traffic lanes	1	1	1+	2	1 or 2	1+	2	2	2	2	2	2	2	2	2
Design speed (km/h)	As practicable			As practicable			80	70	50*	80	70	50*	80/100	80	50*
Desirable gradient	-	5.0%	6.5%	-	5.0%	6.5%	-	5.0%	6.5%	-	5.0%	6.5%	-	5.0%	6.5%
Maximum gradient	-	12.5%	12.5%	-	10.0%	12.5%	-	8.5%	12.5%	-	6.5%	10.0%	-	6.5%	10.0%
Sight distance - minimum (m)	Refer to Table 1 in Section 7 above														
Traffic lane(s) width (m)	3.5	3.5	3.5+	6	3.5+/6	3.5+	6	6	6	6.8	6.8	6.8	7.5	7.5	7.5
Carriageway width (m)	5	5	5+	7.5	5+/7.5	5+	7.5	7.5	7.5	8.5	8.5	8.5	9.5	9.5	9.5
Road reserve width (m)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Bridge widths (m) under 6m long	3.7	3.7	3.7	8	8	8	8	8	8	8	8	8	8	8	8
Bridge widths (m) 6m - 30m long	3.7	3.7	3.7	3.7	3.7	3.7	8	8	8	8	8	8	8	8	8
Bridge widths (m) over 30m long	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	8	8	8	8	8	8
Bridge design standards	Ministry of Works Design Brief 1972														
Type of surfacing (Metal, Seal)	M	M	M	S or M	S or M	S or M	S	S	S	S	S	S	S	S	S

* Or as practicable.

Notes: Bridge width is minimum between kerbs.
For AADT exceeding 2,500, refer to the National Roads Boards's State Highway Policy and Procedure Manual.

Reproduced from National Roads Board, Guide to Geometric Standards for Rural Roads, 1985, Table 3.

Road and Traffic Guideline publications

The following Road and Traffic Guidelines are available:

RTS I	Guidelines for the implementation of traffic controls at crossroads (1990)
RTS 2	Guidelines for street name signs (1990)
RTS 3	Guidelines for establishing rural selling places (1992)
RTS 4	Guidelines for flush medians (1991)
RTS 5	Guidelines for rural road marking and delineation (1992)
RTS 6	Guidelines for visibility at driveways (1993)
RTS 7	Advertising signs and road safety: design and location guidelines (1993)
RTS 8	Guidelines for safe kerbline protection (1993)
RTS 9	Guidelines for the signing and layout of slip lanes (1994)
RTS 11	Urban roadside barriers and alternative treatments (1995)
RTS 13	Guidelines for service stations (1995)
RTS 14	Guidelines for installing pedestrian facilities for people with visual impairment (1997)
RTS 17	Guidelines for setting speed limits (1995)

The Guidelines may be purchased from:

Land Transport Safety Authority, Head Office (PO Box 2840, Wellington) or Regional Offices in: Auckland, (Private Bag 92-515), Wellington (PO Box 27-249) and Christchurch (PO Box 13-364).