SM012 State Highway Controls and Operations Manual

Part 8 - Consolidated Projects Sections

Index

1.0 Procurement Policy and Contracts

1.1 Policy

With the exception of events listed in section 1.4 Exemptions below, no payments shall be made by NZTA for State highway physical works or professional services unless the payment relates to an approved project the price of which has been determined by an agreed Procurement Procedure (PP).

1.2 Rationale

The LTMA section 95 requires contestability to achieve the efficient application of the State Highway Account.

1.3 Procedures

The LTMA also requires the NZTA to approve a PP for each project or class of project.

Details of the procedures to be followed for State highways are contained in the current NZTA issues of the following:

- Procurement Manual, NZTA: and
- Contract Procedures Manual, NZTA.

1.4 Exemptions

The following types of physical works and professional services are exempt from the PP requirements:

1. Payment for works or services not partly or wholly funded by the NZTA.
2. Payment that is necessary in the urgent interests of public safety.
3. Payment that is necessary for the immediate or temporary repair of damage caused by a sudden and unexpected event.
4. Payment for an approved project of administration.
5. Cost payable by the NZTA as a consequence of a lawfully authorised agency controlling a structure on a State highway.
6. Payment for any other activities exempted by subsequent changes in legislation.

1.5 Payment to Local Authorities for Unique Services

The LTMA section 95 prohibits any payment direct to a TLA.

Where a TLA is the only provider of a unique service, that service must be included as an approved output of a capital project, the price of which has been determined by a competitively priced contract.

Payment can then be made to the contract provider who will reimburse the TLA.

An example of this is the maintenance of drainage pumping facilities by a TLA where the State highway bears part of the cost.

A formal agreement should be executed. The Cost Sharing Contract in Appendix G17 gives the wording of the agreement.

1.6 Tendering of Services and Purchasing Procedures

The administrative procedures to be followed and form of contracts to be used for the tendering of all works and services shall be specified in *Contract Procedures Manual,* NZTA.

2.0 Design Details for Highways and Motorways

2.1 Introduction

This section points to guidelines to be used for new or reconstructed highways. These guidelines should not be applied as rigid standards and variations may be approved by the National Manager Maintenance and Operations, as appropriate, to take account of local engineering and economic considerations. This approval shall be adequately documented.

2.2 Motorway Design

These are guidelines to be used for new or reconstructed highways. These guidelines should not be applied as rigid standards and variations may be approved by the National Manager Programme and Standards, as appropriate, to take account of local engineering and economic considerations. This approval shall be adequately documented.

Motorways shall be designed for a minimum design speed of 110 km/h.

Any exception to this policy must have the approval of the National Manager System Design.

Ramps on or off a motorway may have lower design speed values provided they are safe and appropriate speed limits are properly posted.

2.3 Geometric Design

Vertical and horizontal alignment should be in accordance with the latest editions of the following publications:

1. *State Highway Geometric Design Manual* (SHGDM) –New Zealand Transport Agency
2. *Guide to Road Design (in particular Parts 2 and 3)*, Austroads.
3. *Guide Policy for Geometric Design of Freeways and Expressways*, NAASRA.
4. *Guide to the Geometric Design of Major Urban Roads*, Austroads

2.4 Intersection Design

Intersection design should be in accordance with the latest editions of the following publications:

1. *Guide to Road Design*, in particular Parts 4, 4A, 4B and 4C, from Austroads.
2. The NZTA *Traffic Control Devices Manual*, Part 4: Traffic Control Devices for General Use – for Intersections.

2.5 Private, Commercial Access and Minor Side Road Intersections

The layout design for accesses and intersections not requiring any special facilities for traffic management should be in accordance with *Planning Policy Manual (PPM)*.

Minor side rods should be in accordance with Diagram 4 of the *PPM*.

Private and commercial accesses and intersections should be in accordance with Diagrams 1, 2, 3, 4, and 7 of the *PPM*.

2.6 Cross Sectional Width

Guidelines for widths of rural State highways are given in the Austroads *Guide to Road Design* Part 3, the *Specification for Design, Construction and Maintenance of Walking and Cycling Facilities* and the safety guidelines in section 3.0 below.

Guidelines for widths of urban State highways are given in the Austroads *Guide to Road Design* Part 3 and with further information in *NZS 4404: Code of Practice for Urban Land Subdivision,* SNZ.

2.7 Parking

Parking design should be in accordance with the appropriate parts of the Austroads *Guide to Road Design*.

2.8 Traffic Flow and Capacity

Considerations of traffic flow and capacity should be in accordance with the Austroads Guide to Traffic Management.

2.9 Cycle Facilities

Guidelines for the design and use of cycle facilities are detailed in the various parts of Austroads *Guide to Road Design*. These guidelines are also summarised in the *Cycling Aspects of Austroads Guides.*

Further advice for practitioners is given in the Cycling Network Guidance and the *Specification for Design, Construction and Maintenance of Walking and Cycling Facilities*.

2.10 Footpaths

Guidelines for the design and detailing of pedestrian footpaths are given in *NZS 4404: Code of Practice for Urban Land Subdivision,* SNZ.

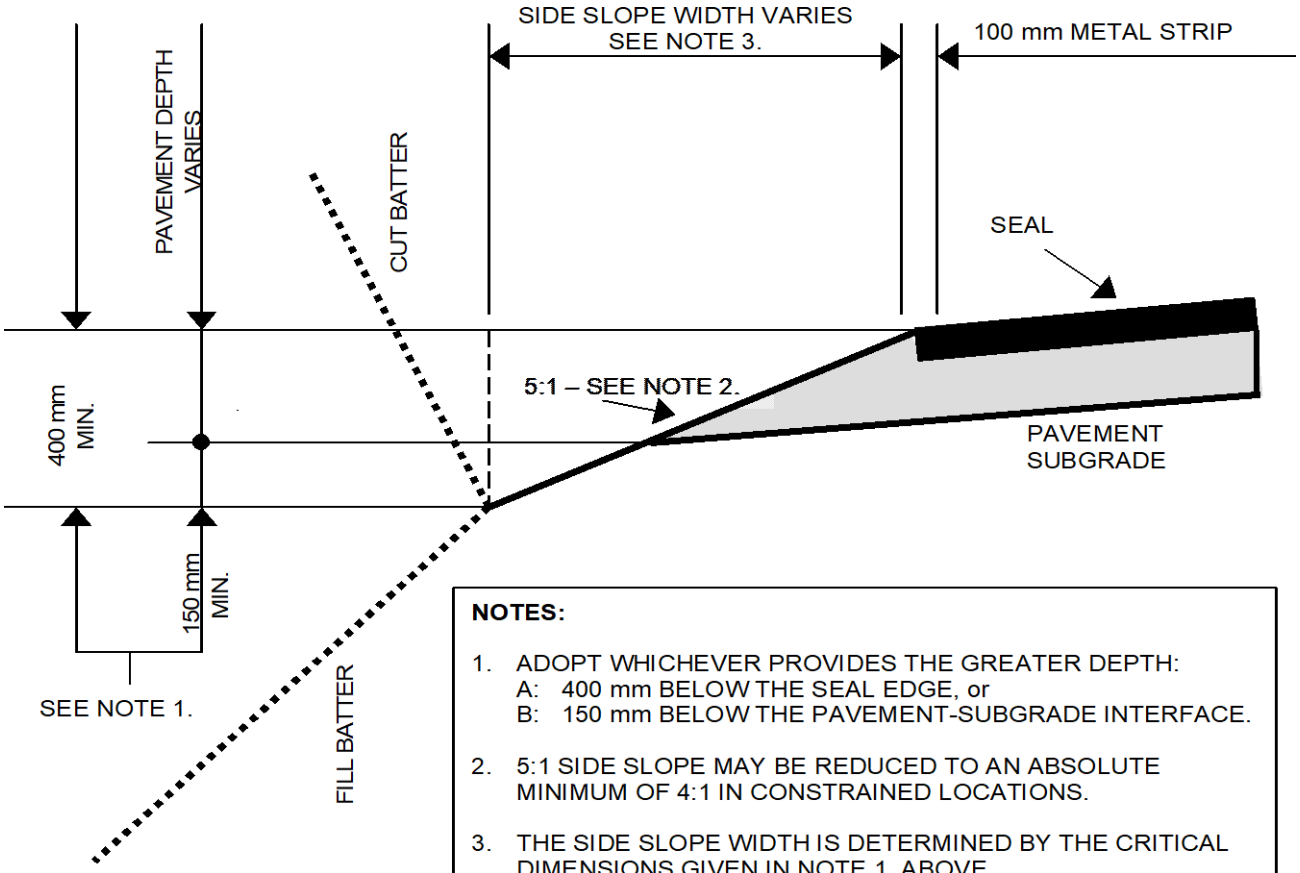
2.11 Drainage Design Details

Adequate drainage shall be provided for both surface and subsurface water. Guidance on the design of surface drainage systems is found in:

1. *Highway Surface Drainage: a Design Guide for Highways with a Positive Collection System*, developed by the National Roads Board.
2. *Guide to Road Design*, in particular Part 5, from Austroads.

In general, if a positive stormwater collection system is not used, a slope not flatter than 5H: 1V should be provided from the edge of seal. Typical side slope details are shown in Figure 1 below.

Figure 1: Cross-section Guidelines for Two-lane Rural Roads: Side Slope Details



NOTES:

1. ADOPT WHICHEVER PROVIDES THE GREATER DEPTH:
   A: 400 mm BELOW THE SEAL EDGE, or
   B: 150 mm BELOW THE PAVEMENT-SUBGRADE INTERFACE.
2. 5:1 SIDE SLOPE MAY BE REDUCED TO AN ABSOLUTE MINIMUM OF 4:1 IN CONSTRAINED LOCATIONS.
3. THE SIDE SLOPE WIDTH IS DETERMINED BY THE CRITICAL DIMENSIONS GIVEN IN NOTE 1. ABOVE.
4. SEE FIGURE A3A.1 FOR CROSS SECTION WIDTH DETAILS.

3.0 Cross Section Guidelines for Two-lane Rural State Highways

3.1 Background

This guideline has been developed from a review of cross section guidelines for two-lane rural roads from a motorist safety perspective and are not a definitive requirement for shoulder width. The review was undertaken to look at the safety performance of the State highway network and consider optimal widths to address safety only. Additional consideration for cyclist safety is required and suggested widths are included in the *Specification for Design, Construction and Maintenance of Walking and Cycling Facilities*. Additional width should also be considered adjacent to passing lanes and for sections with central median barriers due to errant vehicle tracking affecting vulnerable road users.

The guideline is to be used by NZTA offices as a first-cut assessment for the setting of cross-section widths over State highway links. Refer to section 3.5 *Links*, below, for the definition of a road link. On both State highways and local roads, road controlling authorities are recommended to use the guidelines given in the Austroads *Guide to Road Design* Part 3: Geometric Design, in particular see table 4.5 in that Guide, and to consider the needs of all road users.

In developing the guidelines, source data was drawn from the VicRoads *Draft Width Study Report*. This was later published as *Optimum Traffic Lane, Seal and Pavement Widths for Non-urban Roads,* by John McLean for the Australian Road Research Board, 1990.

Expected motorist accident rate reductions were used to determine safety cross section configurations on a national basis to ensure that they are considered as part of the assessment process. An integrated approach will then be used to determine what cross section configurations would best apply to varying multi-traffic volume ranges.

3.2 Procedure

Each NZTA office is to establish appropriate cross section standards for defined roading links over its State highway network. Details of the safety assessment procedure are given in the body of this report as the first step of this process.

3.3 The Cross-Section Review

The emphasis of the review of cross section guidelines for two lane rural roads was, in terms of safety, to establish the best safety layouts. The review findings were as follows.

(a) Widening lane widths to 3.5 metres provides the best benefit in terms of reductions in motorist accident rates. There was little saving for increasing lane widths above 3.5 metres.

(b) For sealed roadways up to 7.0 metres wide, it is desirable to allocate available seal width into traffic lane rather than sealed shoulder.

(c) Sealed shoulders provide better utilisation of space in safety terms compared with metal shoulders and provide some separation for cyclists and pedestrians.

(d) Where possible, it is preferable to use available cross section width for wider shoulders rather than for side slopes flatter than the recommended to provide better safety for other road users.

Analysis of varying cross-section configurations for varying traffic volumes resulted in the ideal cross sections being selected for given traffic volumes (see Figure 2).

The recommended seal widths to be applied on a link-by-link basis are as follows:

(a) Up to 500 vehicles per day : 7.0 metres seal width
(b) 2000 to 4000 vehicles per day: 8.5 metres seal width
or 10.0 metres seal width if benefit/cost ratio >1*
(c) Over 4000 vehicles per day: 10.0 metres seal width
or 11.0 metres or 12.0 metres seal width if the link benefit/cost ratio exceeds cut-off value*

* NOTE: A benefit/cost ratio of 1 is to be used when determining a standard for a link, but it is not to be regarded as the funding cut off on a project-by-project basis. Refer to section 3.7 *Application* below.

Intermediate cross-section widths are not to be adopted when establishing link cross-section widths, so if the widths recommended for other purposes are less, these should be the target. If the widths recommended overall are greater, then they should be the targets adopted.

3.4 Accident Savings Tables

Average accident rates per 100 million vehicle kilometres ($Ax/10^8$ veh-kms) can be obtained from Table 1 below.

The accident rates have been calculated using New Zealand average accident rates applied to the formula obtained in the VicRoads width study report. The data is admittedly coarse and only indicative of the expected accident savings that can be achieved.

Table 1 and the method set out below can be used to estimate an annual accident rate (A) for a section of road.

(a) Establish an annual reported non-intersection injury accident rate** for the section of road (R).
(b) Use Table 1 to determine the estimated accident rate for the section of road based on its existing cross section configuration (E).
(c) Use Table 1 to determine the estimated accident rate for the two or three possible options for the cross-section configuration (P) (see Figure 2).
(d) Establish an expected annual accident rate using the following formula.

$$A = R \times \frac{P}{E}$$

** NOTE: Non-intersection injury accident rate also includes fatal accidents.

3.4.1 Example

An existing two-lane rural road has an existing cross section consisting of two 3.25 metre-wide lanes, 0.25 metres of metal shoulder and 0.25 metres of sealed shoulder on each side. Ten non-intersection injury accidents were reported over its two kilometre length over the last five years. The road is carrying 3,000 vehicles per day.

What is the estimated accident savings if the road cross section was to be upgraded to 3.5m lanes and 750mm sealed shoulders?

(a) Calculate the reported accident rate for section of road. (R)

$$AxRate(R) = \frac{10}{5 \times 3000 \times 365 \times 2} Ax$$
$$= 91.32\ Ax/10^8\ veh\,km$$

(b) Establish the estimated accident rate for existing cross section. (E)

Using values taken from Table 1: 3.25 metre lanes, 0.5 metre shoulders each side, 0.25 metres of which is sealed = 22.97 Ax/10^8 veh-km.

(c) Establish the estimated accident rate for proposed cross section. (P)

Using Table 1: 3.5 metre lanes, 0.75 metre shoulders each side, totally sealed = 19.57 Ax/10^8 veh-km.

(d) Calculate the expected annual accident rate per year. (A)

$$A = 91.32 \times \frac{19.57}{22.97}$$
$$A = 77.80\ Ax/10^8\ veh\,km$$

3.5 Links

Cross sections should not vary arbitrarily along a road length. They should only vary at points where the reason is obvious to road users as follows:

(a) At points where there are major intersections that change traffic flows significantly, or
(b) Points where there are terrain changes that impose significant changes in construction cost.

A link is defined as the road length between the points as defined above.

Link lengths should not be related to features that are not perceived by a driver. An example of this would be where extra construction costs are incurred where a road travelling across flat open country then crosses a swamp. To the driver there is no visible change to the driving environment.

Desirably a link should be as long as possible. It may be over 50 kilometres in length where there is no substantial change to the road environment. Conversely there are practical situations where a link may be only three to five kilometres long.

3.6 Side Slopes

The side slope of the road cross-section is that slope which applies from the shoulder edge to the base of the adjacent drainage channel or to the top of a fill batter. It incorporates that section over which the metal pavement layer is tapered out. This section provides lateral support to the pavement layers.

The side slope is not intended for normal use by vehicles. It does not play a part in the recovery of vehicles which may stray from the traffic lane in the same way that a shoulder does. Nevertheless, it should be flat enough not to worsen the consequences of an accident when a vehicle runs off the road. Beyond this there is no documented safety benefit to be derived from flatter side slopes.

At the same time, the side slope must be steep enough to drain water from the surface and pavement layers into the drainage channel.

International literature recommends side slopes in the range 4:1 to 6:1 for safety reasons.

Refer to the paragraphs below and to Figure 1 above for recommended side slope details. A side slope of 5:1 is adopted for normal use. A maximum side slope of 4:1 may be acceptable in constrained situations where, for safety reasons, it is preferable to invest available space into shoulder width rather than side slope width.

Existing side slopes flatter than 5:1 should remain unless there is evidence of inadequate drainage.

The side slope shall fall from the metal strip outside the seal edge for a distance that enables the greater of the following two criteria to be obtained before either a drainage channel, a cut batter, or a fill batter.

The side slope shall terminate at either:

(a) 400 millimetres below the seal edge, or
(b) 150 millimetres below the pavement/subgrade interface.

3.7 Application

The appropriate cross-section standard from Figure 2 is to be determined for road links along rural State highways in conformity with the processes established in this guideline.

To establish the appropriate cross section the following methodology is recommended:

(a) Determine the bounds of the road link under consideration as defined in section 3.5. *Links,* above.
(b) Determine the traffic volume representative of the link.
(c) Obtain the number of reported non-intersection injury accidents for the link, using the most recent five-year record of reported injury accidents. Calculate the existing accident rate and consider wide centrelines as well for very high-risk links.
(d) Obtain representative data of the existing cross-section configuration over the link to establish a calculated accident rate. Also obtain details on the length of highway and width of seal below each of the cross section options for costing purposes.
(e) Calculate expected accident savings for the link using the method given in section 3.4 *Accident Savings Tables,* above, and using Table 1.
(f) Determine the rough order cost for seal widening to the proposed cross section standard over the link. The cost may have to be calculated for more than one cross-section option to establish the optimum.
(g) Carry out benefit/cost ratio analysis for seal width options.
(h) Select the appropriate minimum safety seal width assessed for the link on the basis of the widths recommended in section 3.3 *The Cross-Section Review*, above.

3.8 Implementation

Compare the recommended widths from the various treatment needs and select the appropriate seal width to meet all requirements. The selected cross-section standard shall be applied to all new works and to pavement rehabilitation works where widening can be achieved above the current funding cut-off and to area wide treatments where seal widening is specifically approved.

By exception, a lesser seal width may be approved where the target seal width cannot be realistically achieved over the full treatment length due to the presence of a significant impediment, such as a physical restriction like for example an isolated rock bluff) provided the width used will not create a varying driving environment.

System Manager approval is required for the use of any higher-than-existing cross section which is below the standard cross section for the link, except when the improvement to the cross section on a highway is being carried out and funded in conjunction with area wide treatment or pavement smoothing works. In those cases, approval is to be obtained from the Senior Manager, Practice Area, Maintenance and Operations.

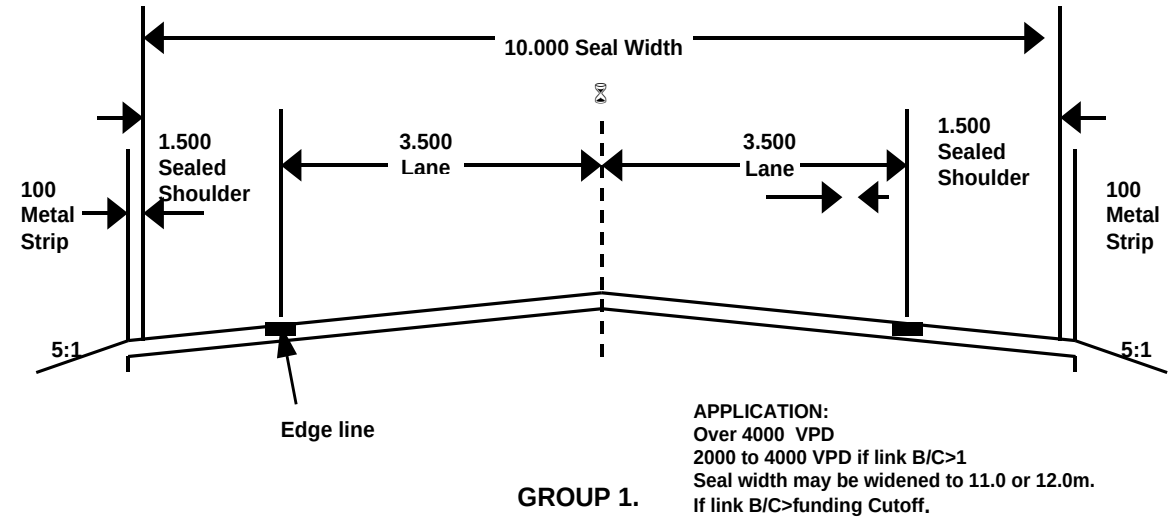
If funding for the new standard cross section cannot be justified for a length of highway, it shall remain at its existing width.

A section of road already above the proposed link standard is not to be narrowed to conform.

NZTA offices should have ensured that all rural State highways have undergone a cross-section review as per the methods described in this guideline by 1 July 2020 and should confirm to the Senior Manager, Practice Area, Maintenance and Operations at least two months before the next review is due. Further cross-section reviews will then be undertaken at five-year intervals.

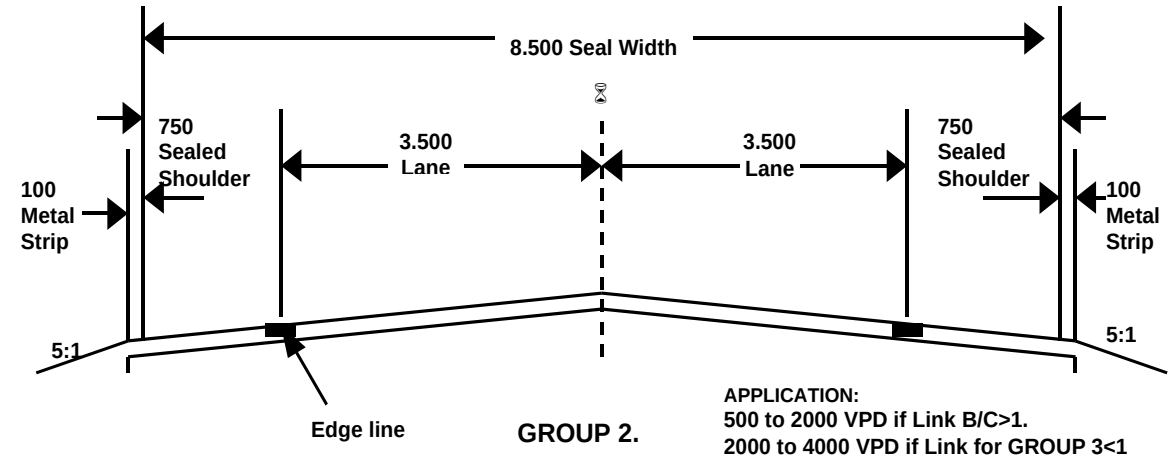
The cross-section review findings, including calculations shall be held by NZTA regional offices for review and update. For quick reference, the selected cross-section widths shall be recorded on the highway information sheets.

Figure 2: Cross-section Guideline for Two-lane Rural Road



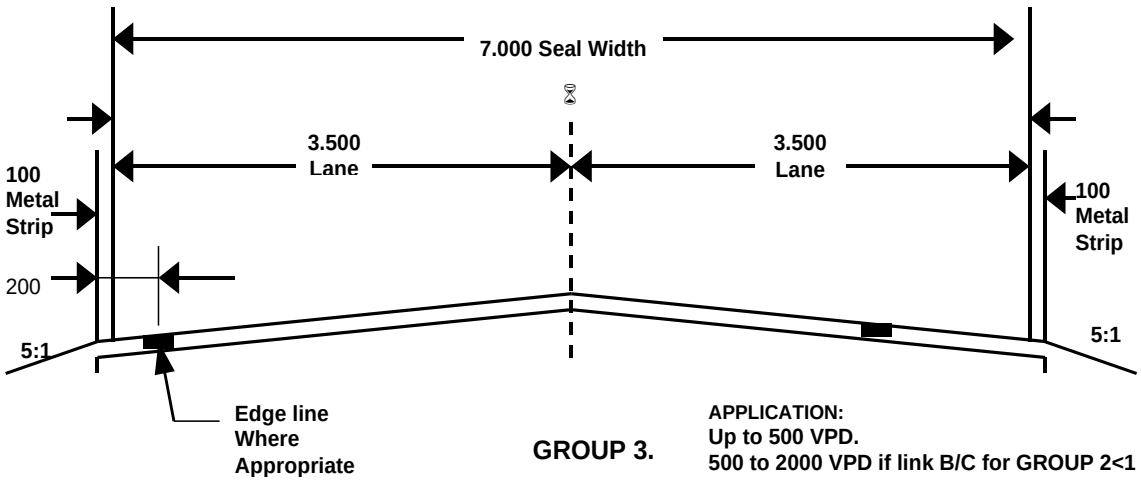
GROUP 1.

APPLICATION:
Over 4000 VPD
2000 to 4000 VPD if link B/C>1
Seal width may be widened to 11.0 or 12.0m.
If link B/C>funding Cutoff.



GROUP 2.

APPLICATION:
500 to 2000 VPD if Link B/C>1.
2000 to 4000 VPD if Link for GROUP 3<1



GROUP 3.

APPLICATION:
Up to 500 VPD.
500 to 2000 VPD if link B/C for GROUP 2<1

NOTE: 5:1 side slopes may be reduced to a minimum of 4:1 in constrained areas.

Table 1: Accident Rates for Various Cross-section Configurations (Crashes/km/yr)

Total Shoulder Width	Sealed Shoulder Width	Lane Width (m)				
Total Width	Sealed Width	2.75	3.00	3.25	3.50	3.60
0.00	0.00	29.74	26.83	24.37	22.36	21.91
0.25	0.00	29.16	26.31	23.89	21.92	21.48
	0.25	28.60	25.80	23.44	21.50	21.07
0.50	0.00	28.57	25.78	23.42	21.48	21.05
	0.25	28.02	25.28	22.97	21.07	20.65
	0.50	27.45	24.77	22.50	20.64	20.23
0.75	0.00	27.41	24.73	22.46	20.61	20.19
	0.25	26.88	24.25	22.03	20.21	19.81
	0.50	26.33	23.76	21.58	19.80	19.40
	0.75	26.02	23.48	21.33	19.57	19.55
1.00	0.00	26.53	23.94	21.74	19.95	19.55
	0.25	26.02	23.48	21.33	19.57	19.17
	0.50	25.49	23.00	20.89	19.17	18.78
	0.75	25.19	22.73	20.65	18.94	18.56
	1.00	24.31	21.93	19.92	18.28	17.91
1.50	0.00	24.49	22.10	20.07	18.41	18.05
	0.50	23.53	21.23	19.28	17.69	17.34
	1.00	22.44	20.24	18.39	16.87	16.53
	1.50	20.87	18.83	17.11	15.70	15.38
2.00	0.00	22.45	20.26	18.40	16.88	16.54
	0.50	21.57	19.46	17.68	16.22	15.89
	1.00	20.57	18.56	16.86	15.46	15.15
	1.50	19.13	17.26	15.68	14.39	14.10
	2.00	17.44	15.74	14.30	13.12	12.85

4.0 Basic Design Criteria for Improvements to State Highways through National Parks, Reserves and Conservation Areas

4.1 General

In all aspects of planning, design and construction of State highways through public conservation land, NZTA's State Highway Professional Services Contract Proforma Manual (SM030) and State Highway Construction Proforma Manual (SM031) should be complied with. The NZTA's environmental standards, guides and specifications will be used as the basis of management controls.

4.2 Pre-Works Project Liaison

The location of the State highway, its alignment and profile, the cross-section design and other related features shall avoid, remedy or mitigate any adverse effects on environmental values, including waterways, and on public use and public conservation land.

4.3 Design Speed

Special attention must also be given to the impact of the State highway on the natural character and landscape and to the highway's visual appearance. Where possible, multipurpose landscaping should be used, as identified in the NZTA landscape guides and specifications.

4.4 Alignment

Where proposed works are to be undertaken on public conservation land, NZTA and its consultant should meet with the appropriate DOC conservancy teams as part of business cases processes and preparation for authorisations when designs are considered and being developed. The purpose of these meetings is to identify any specific constraints, such as whether it is a sensitive ecological area which should be avoided altogether, or the works remedied or mitigated.

4.5 Native Vegetation

Prior to any construction activities being undertaken, a pre-works on site meeting between the DOC, the Contractor, the NZTA and/or the consultant should take place. The purpose of the meeting is to discuss construction practices and re-affirm specific issues discussed at the design stage that the contractor needs to be aware of in undertaking the work.

4.6 Structures

The design speed shall be carefully chosen, as it is the key element that directly fixes standards for the horizontal alignment and profile of the State highway. As a result, this can influence the manner in which the location of the State highway avoids environmental damage, including historic sites so that it blends into the landscape.

4.7 Stopping places

The general alignment and profile of the highway must fit the character of the area traversed, to ensure that excavation and embankment will be reduced to a minimum while meeting NZTA's statutory objective. Geometric design should follow a curvilinear horizontal alignment and have a gently rolling profile, which will result in a more pleasing appearance.