PROVISIONAL
PASSING & OVERTAKING
GUIDELINES

for

Transit New Zealand's
Passing and Overtaking Policy

Draft for Consultation
Version 4

July 2008

Prepared by:	Submitted by:	Endorsed by:
Larry Cameron, Principal Transportation Planner, Transport Planning	David Silvester, National Development Manager	Wayne McDonald, GM Transport Planning on behalf of Transit General Management Team.

Guidelines Sponsor:	GM Transport Planning (Wayne MacDonald)
Guidelines Owner:	National Development Manager (David Silvester)
Key Contact (National Office):	Principal Transportation Planner (Larry Cameron)
Key Contact Regions:	Regional Transportation Manager or delegated staff member (Regional Manager, if no Regional Transportation Manager)

Note: For personal security reasons, electronic images of signatures are not provided.

Record of Amendments

Amendment No	Subject	Effective Date	Updated By
	Provisional PO Guidelines with Attachments	4 July 2008	L J Cameron

Preface

This document is a transitional version prepared for Transit staff and Transit's network consultants. It assumes that the reader has some technical knowledge and experience with development and operation of New Zealand's rural two-lane state highway network. It has not been written with the general public as its target readership.

These Provisional Passing and Overtaking Guidelines provide an indication of how Transit's Passing and Overtaking Policy could be implemented. They are intended to help with the development of projects in 2008/09 and beyond, while we complete consultation on these Guidelines.

As this is a provisional document, we welcome your feedback. Please forward your comments to larry.cameron@transit.govt.nz.

After 30 June 2008, Transit NZ will join with Land Transport New Zealand to become the New Zealand Transport Agency. The final version of the New Zealand Transport Agency's Passing and Overtaking Guidelines may vary from this document.

Table of Contents

Continued on next page

Table of Contents continued

Continued on next page

Table of Contents continued

A1. Introduction

Purpose

In October 2006, the Transit Board approved Transit's Passing and Overtaking (PO) Policy. The main purpose of these Guidelines is to ensure that the PO Policy is applied consistently throughout New Zealand and to assist with preparation and implementation of Regional Passing and Overtaking Plans (RPOPs) and individual projects.

Key Elements

The PO Policy and Provisional PO Guidelines apply to two-lane state highways in rural and peri-urban areas, until the point where four-laning is likely to be required. Transit is seeking to:

- Retain or enhance overtaking opportunities, both at low traffic flows and in conjunction with passing facilities.
- Optimise the use of existing and proposed passing facilities in terms of design and location.
- Provide an intermediate treatment (i.e. 2+1 lanes known as continuous alternating passing lanes) between passing lanes in series and four-laning.
- Apply supporting treatments and measures that enhance or provide alternatives to passing and overtaking treatments.

Differences from Previous Strategy

These Guidelines introduce key differences between Transit's previous Passing Lanes Strategy and the PO Policy.

- A more integrated approach, using multi-disciplinary input (i.e. engineering, education, enforcement and resource planning), means that as well as a wider range of infrastructure solutions, non-infrastructure solutions will now be provided to help manage driver behaviour and future demand.
- The PO Policy offers four different development strategies to cater for a wider range of road and traffic conditions up to a projected 25,000 vpd, rather than one general development strategy for road sections with currently 4,000-10,000 vpd.
- A long-term framework of recommended passing lengths and spacings is provided based on projected demand rather than a long-term objective of one passing lane (of unspecified length) every 5 km.
- Demand is now based mainly on projected AADT over the next 25-30 years and road gradient rather than current AADT.
- To manage the uncertainty of estimated projected traffic flows, road sections covered by the PO Policy will be developed in 10 year intervals towards a long-term 25-30 year layout so that projected traffic growth and hence demand can be more closely matched with actual traffic conditions.

Continued on next page

Differences from Previous Strategy continued

- The rural two-lane state highway network will now be more finely divided into road sections with similar road gradient and projected traffic flows. This finer division will ensure that road section strategies are more fit for purpose.
- Regional PO Plans will be prepared for all Transit Regions and will now include other scheduled Transit activities so that development is better co-ordinated.

General Layout

Parts B-E of these Guidelines deal with how to apply both the PO Policy's long-term layout and Land Transport NZ's EEM procedures, so that road section strategies can be developed.

Parts F-H address development, network management and monitoring issues to help ensure that the PO Policy works at an operational level.

At the beginning of Parts B-H, the content is summarised within an overview. An introduction is provided for sections within each Part.

The approach of these Guidelines is for standardised processes, such as EEM procedures and the PO Policy's layout framework, to deal with the majority of situations. Advice is given within these Guidelines on how to deal with common exceptions to these processes.

Provision is also made for one-off situations that will require surveyed levels of demand so that levels of infrastructure will match similar levels of demand on other parts of the network.

Description of Parts

Part A. Introduction describes these Guidelines' context relative to other Transit policy documents and the relevance of each Guideline Part.

Part B. Policy Overview outlines the Policy. It also clarifies any differences between Transit's NSHS and PO Policy, the types of strategy that can be applied and provides some worked examples.

Part C. Strategy Identification ensures that road section conditions are consistent and that the long-term PO strategy is appropriate. In some cases, either sub-division of the road section or another PO strategy may be required. Part C discusses the "Strategy identification procedure" section within EEM Appendix A7. These Guidelines use headings similar to the EEM to facilitate easy cross-referencing.

Part D. Strategy Refinement provides criteria for assessing whether individual sites are appropriate, in terms of safety, performance, driver perception and cost. Part D discusses the "Refinement of strategy" section within EEM Appendix A7.

Continued on next page

Description of Parts continued

Part E. Project Assessment helps to more accurately identify individual project benefits and costs. The Policy Hierarchy section covers other Transit requirements to be considered and where appropriate, added to the project scope. Part E discusses the "Assessment of individual passing lanes" and "Rural simulation for assessing passing lanes" sections within EEM Appendix A7.

Part F. Programme outlines how individual projects are prioritised with a view to developing an interim strategy for each road section. These interim strategies are then integrated into Transit's documents and systems.

Part G. Key Tasks provides advice on the project's life cycle and Transit's key activity areas from planning through to maintenance, including communications.

Part H. Monitoring highlights monitoring and feedback systems so that PO projects are continuously improved. **Part I. References** lists references noted in these Guidelines.

Attachments support these Guidelines and include:

- Glossary.
- Indicative maps showing how the PO Policy would apply to state highways.
- Differences for some state highways between the National State Highway Strategy (NSHS) and PO Policy.
- Comparison between PO Policy and international practice.
- Detailed technical notes on options, planning and design.

Diagram of Guideline Processes

Figure 1 is an outline of the steps within these Guidelines for developing both Regional PO Plans and individual PO projects. Figure 1 is shown on the next page.

Relevant Documents

These Guidelines are designed to be read in conjunction with:

- Transit's *National State Highway Strategy*.
- Transit's *Passing and Overtaking Policy*, appended to Transit's PPM (Transit, 2007).
- Sections within Transit's *PPM* relating to passing and overtaking. Refer to Attachment F Planning Notes Table F1.
- Transit's *Background Technical Report on PO Policy*.
- If available, Transit's *Regional Passing and Overtaking Plans* and any other Transit Regional plans.
- Land Transport NZ's *Economic Evaluation Manual (EEM) Vol. 1.*

Continued overleaf

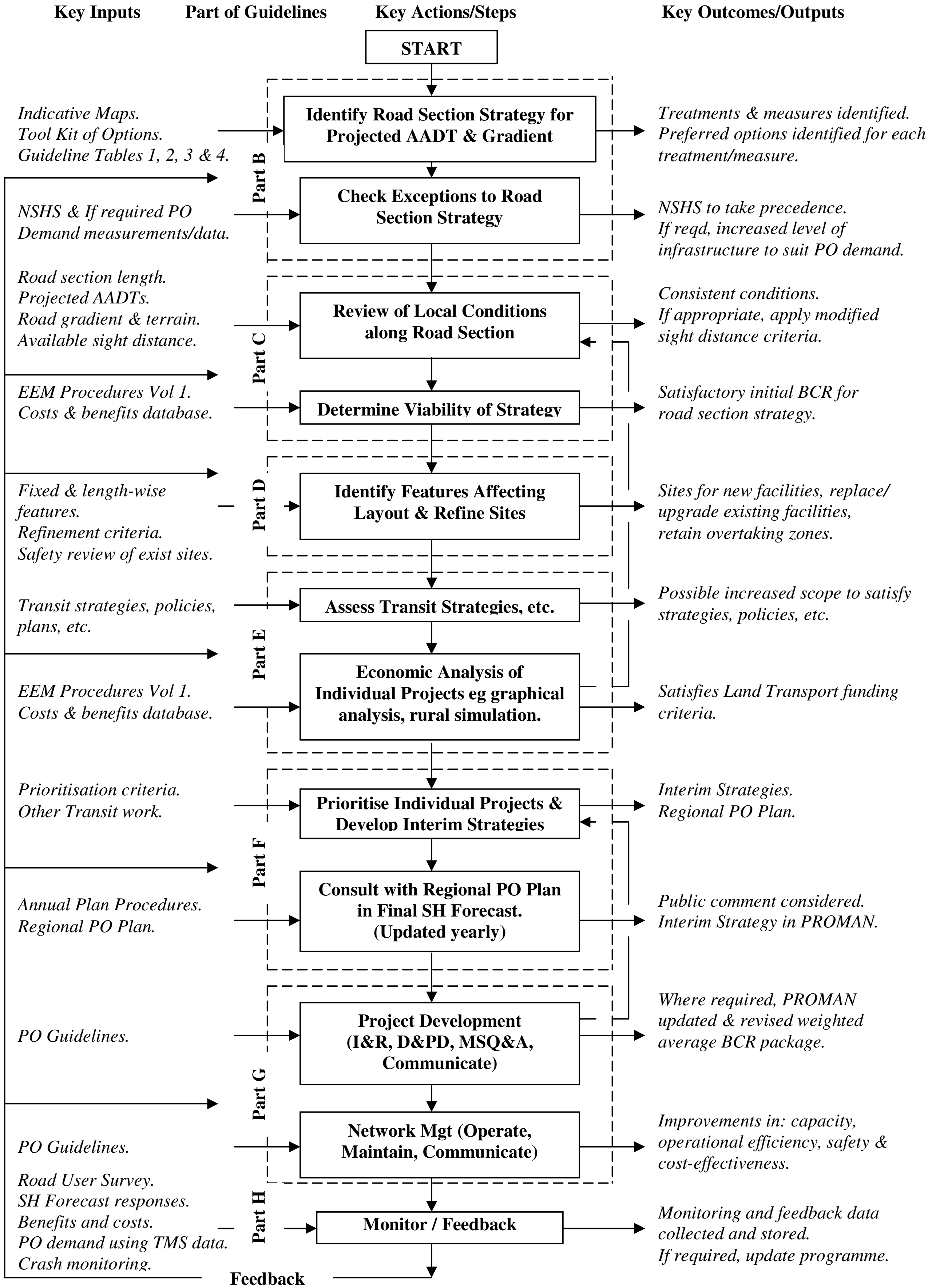

Figure 1. Implementation of Regional PO Plans & Individual Projects

Relevant Documents continued	• *Regional and district planning documents* (e.g. regional land transport strategies, if Transit's Regional Passing and Overtaking Plans and other Transit Regional plans are included).
Current Versions	All references to documents, guidelines and other supporting publications within these Guidelines and its attachments relate to current versions. If there is a New Zealand supplement for overseas guidelines, the supplement takes precedence.
Non-Exclusive Lists	Any lists of treatments, measures and options described within these Guidelines and its attachments are not complete or exclusive. Other influences have to be allowed for, such as new products, advances in technology, different management systems and opportunities for network development.

PART B. POLICY OVERVIEW

Overview

Four main types of 25-30 year long-term strategy are proposed, based on road gradient and projected AADTs (Table 1). Table 2 is an expansion of Table 1 and helps to define the long-term layout of passing and overtaking treatments under each type of strategy. Provision is made for exceptions to the framework.

In addition to both passing and overtaking treatments, Table 3 suggests which supporting treatments and measures should be applied under each type of strategy. Table 4 is an expansion of Table 3, outlining preferred options for each treatment and measure. Preferred options may change as PO demand level increases and hence road section strategies may change. Examples of each type of strategy are outlined for particular lengths of state highway.

B1. Types Of Strategy

Introduction

Table 1 shows long-term PO strategies for rural state highways, which are based on projected AADT and road gradient and fall into four different strategy types. Indicative maps have been prepared using these criteria (see Attachment B). These indicative maps will be affected by both higher level policy issues within the NSHS and local conditions.

Types of Strategy

Transit proposes four different long-term strategies, based on projected traffic flows and road gradient. Table 1 shows these long-term strategies and the circumstances where they apply.

Table 1. Summary of Passing and Overtaking Strategy Types

Strategy types	Summary of passing and overtaking treatments for each strategy type (A range of supporting treatments and measures are also applied, depending on strategy type)	Typical 25-30 year projected traffic flow where each strategy type applies (vpd)	
		Flat road gradient	Rolling or mountainous road gradient
Overtaking	• Sight distance improvements. • Overtaking enhancements. • Possibly, isolated short passing lanes, slow vehicle bays, shoulder widening or crawler shoulders.	Less than 4,000	Less than 2,000
Mainly overtaking	• Sight distance improvements. • Overtaking enhancements. • Possibly some "in series" (i.e. regular and frequent) short passing lanes, slow vehicle bays, shoulder widening or crawler shoulders.	4,000-5,000	2,000-4,000
Mixed [1] passing & overtaking	• In series passing lanes. • Overtaking enhancements. • Crawler lanes, where appropriate.	5,000-12,000	4,000-10,000
Passing	• 2+1 lanes on flat/rolling road gradients (subject to comparison with four-lanes). • Passing lanes in series on mountainous road gradients.	12,000-25,000	10,000-25,000

Note: "Mixed" added to distinguish from overall Passing and Overtaking Policy. Not in same table in Policy within PPM.

Indicative Maps

A series of indicative maps show generally where different types of long-term strategy would apply on the state highway network (see Attachment B). These indicative maps are working documents and may change with detailed evaluation for Transit's Regional Passing and Overtaking Plans.

Attachment C summarises differences between maps within the NSHS that indicate possible future state highway development and the indicative maps attached to these Guidelines (see Attachment B). These differences are due to both NSHS issues and further sub-division of road sections. The reader is advised to read Attachment C.

B2. Passing & Overtaking Treatments

Introduction

For each type of long-term strategy, Table 2 outlines a more detailed framework for passing and overtaking treatments. Under some circumstances, a different level of infrastructure may be more appropriate. Guidance is provided on both common exceptions and one-off situations.

Long-Term Framework

Passing and overtaking treatments are an important part of any road section strategy. Table 2 suggests the preferred length and spacing for facilities, depending on projected AADT and road gradient. Table 2 Notes are provided on the next page.

Table 2. Long-Term Framework for Passing and Overtaking Treatments

<table>
<tr><th rowspan="2">Projected AADT (vpd)[1]</th><th colspan="3">Road Gradient</th></tr>
<tr><th>Flat</th><th>Rolling</th><th>Mountainous</th></tr>
<tr><td>0-2,000 (Approx 0-115 vph one-way flow)</td><td colspan="3">Overtaking (OT) (OT sight distance improvements, OT enhancements, possible isolated shoulder widening/crawler shoulder/SVBs[2]/short PLs).</td></tr>
<tr><td>2,000-4,000 (Approx 115-230 vph one-way)</td><td>Overtaking (As above).</td><td colspan="2">Mainly OT, as above but possibly some SVBs[2] or short PLs @ 10 km.</td></tr>
<tr><td>4,000-5,000 (Approx 230-290 vph one-way. General transition to PLs)</td><td>Mainly OT, as above but possibly some SVBs[2] or short PLs @ 10 km.</td><td>PLs @ 10km 1.2 km + tapers & OT enhancements.</td><td rowspan="2">PLs @ 5 km 1 km + tapers & possible OT enhancements. Possibly crawler shoulders/lanes.[6]</td></tr>
<tr><td>5,000-7,000 (Approx 290-400 vph one-way)</td><td colspan="2">PLs[3] @ 5 or 10 km 1.2 km + tapers & OT enhancements.</td></tr>
<tr><td>7,000-10,000 (Approx 400-580 vph one-way)</td><td colspan="2">PLs[3] @ 5 or 10 km 1.5 km + tapers & OT enhancements.</td><td>PLs @ 5 km 1.2 km + tapers & possible OT enhancements. Possibly crawler lanes.[6]</td></tr>
<tr><td>10,000-12,000 (Approx 580-690 vpd one-way, General transition to 2+1 lanes)[4, 5]</td><td>PLs @ 5 km 1.5 km + tapers & possible OT enhancements</td><td>2+1 lanes (subject to four-lane comparison).</td><td rowspan="3">PLs @ 5 km 1.2-1.5 km + tapers. Where required, crawler lanes.[6]</td></tr>
<tr><td>12,000-20,000</td><td colspan="2" rowspan="2">2+1 lanes (subject to four-lane comparison).</td></tr>
<tr><td>20,000-25,000 Approx 1,150-1,450 vph one-way. General transition to 4 lanes)</td></tr>
</table>

Key – Strategy Type	Overtaking	Mainly overtaking	Mixed[7] passing & overtaking	Passing

Continued on next page

Notes:
1. In the PPM, the projected AADT is generally based on a ten year time frame. In the NSHS and Provisional PO Guidelines, the projected AADTs relate to a 25-30 year time frame. One-way flows in the treated direction are based on 55/45% directional split and 10.5% AADT for two-way peak hour flow. Assume 0-20% HV &LVT. (Added, not in same table in PO Policy within PPM).
2 Passing treatments at 10 km spacings will apply to two or possibly three facilities in series rather than along the full length of the road section (Added, not in same table in PO Policy within PPM). Where appropriate, a SVB (See Glossary) is able to be easily altered to a short PL or PL at a later date.
3. Along the same road section, a mixed layout with 5 km spacings in higher demand locations and 10 spacings in lower demand locations.
4. For flat or rolling road gradient, the combination of passing lane length and spacing may not be sufficient to dissipate vehicle queues and a more frequent provision of passing opportunities would be required. Therefore, passing treatments, such as 2+1 lanes (subject to comparison with four-lanes), are likely to be required for state highways with a flat or rolling gradient and projected 10,000-25,000 vpd.
5. 10,000-12,000 vpd represents a general upper limit for passing lanes in series with flat or rolling gradient. Above this threshold, treatments such as 2+1 lanes (subject to comparison with four-lanes), are likely to be required. Some locations may have a higher upper limit of about 14,000 vpd depending on other factors, such as the peak one-way hourly flow and traffic composition.
6. Consider crawler lanes/shoulder where PO demand is high and there are a high number of HCVs and other slow moving vehicles. (Added, not in same table in PO Policy within PPM but part of PO Policy's Tool Kit)
7. "Mixed" added not in same table in PO Policy within PPM.

Long-Term Framework continued

In some cases, passing length or layout spacing may have to be adjusted to accommodate the only available site or to take advantage of a localised steeper gradient.

If possible, avoid creating shorter or longer spacings between two passing facilities or overtaking zones, unless the passing or overtaking length is adjusted.

One–way hourly flow in the treated direction is a better parameter than AADT for determining passing lengths. The surveyed results apply for up to 20% combined light towing and heavy commercial vehicles.

Additional Influences on PO Demand

The Policy uses projected AADT (based on a 25-30 year time frame) and road gradient (vertical alignment) as primary influences of passing and overtaking demand. Other influences may include:

- Proportion of slow moving vehicles e.g. heavy commercial, recreational and light towing vehicles, buses, tour coaches.
- Initial platooning.
- Directional split of traffic flows.
- Vehicle speed distribution.
- Horizontal alignment.
- Available overtaking opportunities including sight distance.
- Passing facility length and frequency.

Due to the above-mentioned other influences, some flexibility is required when applying the long-term framework.

Common Exceptions

The general layout of the long-term framework has been confirmed by surveyed results from five existing passing lanes and one slow vehicle bay (Cenek & Lester, 2008). These results are discussed further within Attachment D Comparison with International Practice.

Continued on next page

Common Exceptions continued

Generally, the research agrees with the long-term framework but some layouts may have to be adjusted:

- Shorter passing lengths may be appropriate if the passing facility is on steeper gradients compared to downstream gradient conditions. As a general guide, from Table 2, there is generally a 20% reduction in passing length, as road gradient increases from 0 to 6%.
- At projected 2,000-4000 vpd on mountainous road gradients, SVBs @ 10 km would be under-provision. Short PLs are preferred but SVBs are acceptable if they able to be extended at a later date.
- At projected 4,000-5,000 vpd on flat road gradients, 600-800 m PLs @ 10 km may be slightly under-provision. Longer passing lanes are favoured if a layout of 10 km spacings is to be provided. If in series, passing facilities would not be provided along the entire length.
- At flows greater than projected 10,000 vpd on mountainous road gradients, 1.2-1.5 km PL @ 5 km spacings is likely to require closer spacings or alternatively crawler lanes at high demand locations. (Within the PO Policy Tool-Kit, crawler lanes can be considered and closer spaced PLs are an intermediate step towards crawler lanes).
- Where there is an increased demand due to horizontal sight restrictions as well as projected AADT and vertical road gradient (e.g. downstream rolling road gradient with tortuous horizontal alignments is classified as combined mountainous terrain), an increased level of infrastructure would seem appropriate but the facility length would still be dependent on the local road gradient and projected AADTs. See C3 Road Gradient and Terrain within these Guidelines for more detail.
- Similarly, for combined road gradient and projected AADT conditions that result in a reduced demand, a lesser level of infrastructure would be appropriate. See C3. Road Gradient and Terrain for more detail.
- If the directional split is even, low peak hourly one-way flow and/or the merge operating capacity is greater than 1,200-1,400 vph (one-way flow), the upper range of 20,000-25,000 vpd may be extended.

One-Off Situations

For one-off departures from the long-term framework, measurements/data of current and estimated projected PO demand will be required from Transit Regions. These measurements/data will take into account: projected AADT, percentage of traffic following, following speed, free speed and road section length. Measurements may require (but are not restricted to):

- EITHER surveying existing passing facilities/overtaking zones with downstream conditions that are similar to projected AADT and downstream demand conditions, OR
- Surveying the same road section under peak public holiday or similar conditions to simulate projected conditions, OR
- Using results from other surveys under similar projected conditions.

Continued on next page

One-Off Situations continued

Transportation Planning, National Office will approve situations where either a reduced or higher level of infrastructure is proposed that lies outside of the long-term framework.

B3. Treatments & Measures For Each Type Of Strategy

Introduction

For each type of strategy, Table 3 identifies specific categories of treatments and measures that should be applied. Progressively more categories are applied as traffic volumes and PO demand increases For each category, Table 4 outlines a tool kit of preferred options.

Selecting Treatments & Measures

Table 3 shows the treatments and measures to be **applied** for each strategy type. In some situations, other treatments and measures may be more appropriate and would be **considered** on a case-by-case basis.

Table 3. Integration of Treatments & Measures

Category of Treatment or Measure	Passing and Overtaking Strategy			
	Overtaking	Mainly Overtaking	Mixed [3] Passing & Overtaking	Passing
Overtaking Treatments				
OT sight distance improvements	C	C	C	-
OT enhancements	A [1]	A	A	-
Passing Treatments				
Low-volume treatments	A*	A*	-	-
Moderate-volume treatments	-	-	A	A
Supporting Treatments				
Centreline	A	A	A	A
Roadside and edgeline	A	A	A	A
Intersections	A*	A*	A	A
Supporting Measures				
Resource Planning	C [2]	C	A	A
Education	C	C	C	A
Enforcement	C	C	C	A
TDM	C	C	C	A
ITS	C	C	C	C

Notes: * means apply if overtaking is not viable. (For intersections, not shown in same table in PO Policy within PPM). 1. A means apply. 2. C means consider if potential or actual problem. 3. "Mixed" added not in same table in PO Policy within PPM.

Preferred Options Within Each Treatment and Measure

Using Table 3 to identify relevant treatments and measures, Table 4 outlines a detailed framework of preferred options for each treatment and measure.

For example, centreline treatments will be applied for each type of strategy. The preferred option for centreline treatments is line markings for overtaking, mainly overtaking and passing & overtaking strategies. For passing strategies, either central median cables or gap separation is the preferred option, depending on crash history or risk.

Continued on next page

Table 4. Tool Kit of Options

	Treatments and Measures	Passing and Overtaking Strategy Type			
		Overtaking	Mainly Overtaking	Mixed Passing & Overtaking	Passing
Overtaking treatments	**Overtaking sight improvements**				
	Vegetation control, batter relocation	C	C	C	-
	Pavement rehabilitation, realignment	C	C	C	-
	Overtaking enhancements				
	Seal widening	P	P	C	-
	Overtake at PLs or SVBs, configuration of PLs or SVBs	P [1]	P [1]	P [1]	-
Passing treatments	**Low-volume treatments [2]**				
	Shoulder widening or crawler shoulder	P [1]	C [1]	-	-
	SVB or short PL	C [1]	P [1]	-	-
	Moderate-volume treatments [3]				
	Wide shoulder (special use requirement)	-	-	C	-
	PLs in series	-	-	P	P [4]
	Crawler lanes	-	-	C	C
	2+1 lanes (subject to four-lane comparison)	-	-	-	P [5]
Supporting treatments	**Centreline treatments**				
	Line markings	P	P	P	C
	Gap separation	-	-	C	P
	Central median cables	-	-	C	P
	Roadside/edgeline treatments				
	Clear zone and shoulder run-off	P	P	P	P
	Increased signs and markings	P	P	P	P
	Wide profile markings	C	C	P	P
	Local shoulder widening and/or chip seal	C	C	P	P
	Cable or guard rails	C	C	C	C
	Intersection treatments				
	OT zones/PLs with respect to intersection	P [1]	P [1]	P	P
	Provision for through traffic	C	C	P	P
	Intersection rationalisation	-	-	P	P
Supporting measures	**Resource planning measures**				
	Control of direct access onto SH	C	C	P	P
	Submission (plan docs, RC application)	C	C	P	P
	Encourage alternative District networks	C	C	C	C
	New alignments	C	C	C	C
	Education Measures				
	Target audience	C	C	C	P
	General public	C	C	C	C
	Enforcement Measures				
	Problem locations	C	C	C	P
	General public	C	C	C	C
	TDM measures				
	Alternative hours, routes or modes	C	C	C	P
	ITS measures				
	Variable message signs with/without web camera	C	C	C	C
	Speed cameras	C	C	C	C

NOTES: Not an exclusive list, others may be added at a later date. If more than one preferred option for same treatment/measure, consider one or combination on a case-by-case basis. P = preferred option/s, C = consider if specific problem. 1 = only if overtaking strategy is not viable (For OT Zones/PLs not shown same table in PPM). 2 = low- volume is typically less than projected 5,000 vpd. 3 = moderate-volume is typically projected 4,000-25,000 vpd. 4 = preferred on mountainous terrain. 5 = preferred on flat/rolling terrain, subject to comparison with four-lanes. 6. “Mixed” added not in same table in PO Policy within PPM.

Preferred Options Within Each Treatment and Measure continued

Preferred options have been evaluated within the PO Policy's Background Technical Report (Transit 2006). Attachment E Option Notes provides a fuller description of each option and its characteristics.

B4. Examples of Road Section Strategies

Introduction

Long-term strategies have been examined for various road sections. These strategies were obtained from indicative maps. Table 2 Long-Term Framework and Table 4 Tool Kit of Options were used to help identify appropriate treatments and measures.

Combination of Overtaking and Mainly Overtaking

Table 5 shows rural sections of SH 94 Gore-Te Anau. Use Table 4 to identify treatments and measures.

Table 5. SH 94 Gore – Te Anau

State Highway Section	Length[1] (km)	Road Gradient	Current AADT (vpd)	Projected AADT (vpd)	Long-Term Strategy
Gore-Lumsden	62	Flat/rolling	2,300	3,700	Mainly OT
Lumsden-Mossburn	19	Flat	900	1,300	OT
Mossburn-Manapouri turn-off	43	Flat/rolling/hilly mountainous	1,500	2,500	Mainly OT
Manapouri turn-off-Te Anau	15	Flat/rolling	1,900	3,300	Mainly OT
NOTE: 1. Length of rural state highway excludes urban areas.					

Passing & overtaking treatments. Lumsden-Mossburn: review other scheduled Transit work, e.g. growth control, pavement rehabilitation. Remaining sections: either isolated shoulder widening or short passing lanes in only high demand locations.

Note: While a Mainly Overtaking Strategy has been identified for Mossburn-Manapouri turn-off, it may be more appropriate to sub-divide the road section into shorter sections based on terrain.

Supporting treatments & measures. Gore-Te Anau: Apply centreline and edgeline/roadside treatments.

Note: Parts of SH 94 carry large numbers of tourist buses so the passing demand may be higher than both current and projected AADTs suggest. Consider supporting measures such as education, enforcement, TDM and possibly ITS (long vehicle speed cameras) measures for bus drivers and tourist facility operators.

Mixed Passing & Overtaking

Table 6 shows rural sections of SH 1 Rangipo-Bulls.

Pass & overtaking treatments. All road sections: Increase passing lane frequency at areas of high passing demand. Also retain and enhance existing overtaking opportunities at locations with good sight distance. Crawler lanes or shoulders may be required for mountainous road gradient over sustained lengths.

Table 6. SH 1 Rangipo - Bulls

State Highway Section	Length[1] (km)	Road Gradient	Current AADT (vpd)	Projected AADT (vpd)	Long-Term Strategy
Rangipo-Transit Boundary -Waiouru	51	Flat/rolling	3,500	5,200	Mixed Pass & OT
Waiouru-Taihape	26	Rolling	5,000	7,500	Mixed Pass & OT
Taihape-Mangaweka	21	Mountainous	5,800	7,500	Mixed Pass & OT
Mangaweka -SH 54-Hunterville	23	Flat /mountainous[2]	5,100	6,200	Mixed Pass & OT
Hunterville-Bulls	31	Rolling	5,100	6,100	Mixed Pass & OT

NOTE: 1. Length of rural state highway excludes urban areas.
2. There are some short sections of hilly or mountainous gradient but there are no consistently steep road gradients over 10 km long.

Supporting treatments & measures. All of section: Apply centreline, edgeline/roadside, intersection and resource planning. Intersection rationalisation may be required for some intersections within close proximity to existing or proposed passing lanes.

Note: Because of the route's high traffic flows during holiday periods, any strategy should consider both peak weekly flows and 125th or similar highest design hour flows.

Passing with Mixed Passing & Overtaking

Table 7 shows rural sections of SH 3 New Plymouth to Hawera.

Table 7. SH 3 New Plymouth to Hawera

State Highway Section	Length[1] (km)	Road Gradient	Current AADT (vpd)	Projected AADT (vpd)	Long-Term Strategy
N. Plymouth-Inglewood	11	Rolling	9,200	14,100	Passing
Inglewood-Stratford	19	Rolling	8,300	13,000	Passing
Stratford-Etham	8	Rolling	8,000	11,000	Mixed or Passing
Etham-Normanby	12	Rolling	5,900	8,100	Mixed Pass & OT
Normanby-Hawera	2	Flat	8,400	11,600	Mixed Pass & OT

NOTE: 1. Length of rural state highway excludes urban areas.

Passing & overtaking treatments. New Plymouth-Eltham: Ensure 1.5 km long passing lanes (excluding tapers) in series with 5 km spacings as an interim strategy. Provide for a 2+1 lane, subject to four-lane comparison as a long-term layout. Consider effect of other scheduled works on proposed layout.

Note: For Inglewood-Stratford, consider developing part of the 19 km length as a 2+1 layout, and later infilling the reminder. Monitor demand on SH 3 Stratford-Etham, which is 8 km long and just slightly over the 10,000 vpd threshold for 2+1 layouts on rolling road gradient. .

Eltham-Hawera**:** Provide 1.5 km long passing lanes at 5 km spacings.

Note: Normanby-Hawera is 2 km long. Check if practical/safe to extend existing passing lanes or to retain shorter length passing lane.

Supporting treatments & measures. New Plymouth-Eltham**:** Apply all supporting all treatments and measures, except ITS. At relatively low projected traffic flows of 11,000-14,000 vpd, merging should not be a problem, so ITS assisted merging would not be required.

Note: Allow extra seal width for possible future gap separation central median cables but consider current crash history as traffic volumes are still relatively low i.e. projected <14,000 vpd.

Etham-Hawera: Apply centreline, edgeline/roadside, intersections and resource planning. Consider, education, enforcement, TDM and ITS.

Passing

Table 8 shows rural sections of SH 1 Hornby–Ashburton

Table 8. SH 1 Hornby-Ashburton

State Highway Section	Length[1] (km)	Road Gradient	Current AADT (vpd)	Projected AADT (vpd)	Long-Term Strategy
Hornby-Bankside	38	Flat	9,500	17,800	Passing
Bankside-Rakaia	9	Flat	10,700	20,400	Passing
Rakaia-Ashburton	85	Flat	9,200	17,300	Passing
NOTE: 1. Length of rural state highway excludes urban areas.					

Passing & overtaking treatments. All of section: Provide 2+1 lanes subject to comparison with four–lanes. Passing lanes in series should have been applied already at 5 km centres in both directions, if merging capacity is not a problem. Consider possible sub-division of SH 1 Rakaia - Ashburton, which is 85 km long.

Note: If this route was four-laned, it would also require the four-laning of the bridges crossing the Selwyn and Rakaia Rivers plus four-laning of small towns and rural centres. The ability of 2+1 lanes to transition to two lanes over bridges would avoid four-laning costs for bridges.

Continued on next page

Passing continued

Supporting treatments and measures. All of section: Apply centreline and roadside/edgeline treatments, resource planning, intersections, education, enforcement and TDM.

Consider ITS assisted merging (i.e. variable message signs preferably linked to a web camera) for high demand locations, especially if merging is difficult during peak flow periods.

PART C. STRATEGY IDENTIFICATION

Overview

The PO Policy estimates PO demand using projected AADT and road gradient. The EEM procedures use projected AADT and combined terrain. For many cases, there will be little difference between these two different approaches. Exceptional circumstances that will make a difference have been identified along with the recommended action.

Each type of strategy assumes a particular range of PO demand throughout the road section. To provide an approximately consistent level of PO demand, road sections are divided into appropriate lengths with similar levels of projected AADTs and road gradient. Using an initial graphical benefit cost ratio (BCR) analysis, the viability of proposed layouts is checked.

Part C supplements EEM Appendix 7.3 "Strategy identification procedure".

C1. Road Section Length

Introduction

The road section length has to be optimised between short lengths, which have a more uniform PO demand and long lengths, which provide greater consistency of layout and a better choice of sites.

Minimum Lengths

For long-term strategies, section lengths should be no shorter than:

- 10 km for 2+1 lanes.
- 10 km for passing lanes at 5 km spacings.
- 20 km for passing lanes at 10 km spacings.

These minimum section lengths will allow an effective interim strategy to be developed at lower traffic flows.

Adjacent sections with the same long-term strategy but less than the minimum 10 or 20 km length can be added together to form a section length at least as long as the lower limit for that long-term strategy.

Note: EEM procedures assume a maximum effective length of 10 km. If possible, minimum section lengths greater than 20 km are recommended for road sections with less than projected 7,000 vpd. At these lower flows, the effective length is longer than 10 km. Therefore, 10 km spacings between passing facilities will help to optimise the PL's effective length.

Short Sections

Short sections, that are under the 10 km or 20 km recommended minimum and isolated by adjoining lengths with different strategies, need to be considered on a case-by-case basis.

Continued on next page

Short Sections continued

Note: If the road section is either at the end of a state highway or adjoining sections on both sides have the same long-term PO strategy, apply the strategy from the adjoining section/s. In other cases, it may be better to include part of adjoining sections to form a minimum section length, e.g. flat/rolling sections either end of short gorge sections.

Long Sections

Where possible, break down state highway sections that are longer than 80 km into more manageable lengths.

C2. Projected AADTs

Introduction

Current and projected traffic flow data is available from Transit's PO web page. When applying current and projected flows to individual road sections, the PO Policy has made some assumptions relating to representative sites, extrapolation of traffic flows, HCV flows and rounding of flow values. These assumptions are discussed below.

Availability

A spreadsheet of estimated 2006 and 2031 AADTs is available from Transit's PO web page under Passing & Overtaking Road Section Details.

Projected Growth Rate

For estimating traffic growth along a road section, use the estimated representative growth rate based on projected 2006 and 2031 flows within Transit's above-mentioned spreadsheet. For flows after 2031, extrapolate at the same overall yearly rate.

For determining PL length based on projected flows, use the AADT value from the nearest available TMS count site or surveyed results for the site and apply the representative growth rate for the road section.

Note: To manage the uncertainty of estimated projected flows, road sections covered by the PO Policy will be developed in 10 year intervals towards a long-term 25-30 year layout so that projected traffic growth and hence demand can be more closely matched with actual traffic conditions.

HCV Flows

Unless there is specific data on regional growth on slow moving vehicles, assume that the proportion of heavy commercial, recreational and light towing vehicles is the same for both current and projected flows.

Rounding

For determining where a road section lies within the long-term framework, projected AADTs should be rounded as follows:

- Up to 5,500 vpd, round to the nearest 500 vpd.
- Above 5,500 vpd, round to the nearest 1,000 vpd.

Representative Sites

While selected count sites are assumed to have typical traffic flows for each road section, road sections may require further sub-division due to their localised differences in traffic volumes or have similar projected AADTs but different road gradient.

C3. Road Gradient & Terrain

Introduction

Transit's PO Policy uses road gradient (vertical terrain) rather than the EEM's combined terrain. Differences between these two approaches are discussed within this section.

The level of infrastructure for flat and rolling road gradients is similar except around transition points i.e. projected 4,000-5,000 vpd and projected 10,000-12,000 vpd.

Likewise, the provision of infrastructure on hilly and mountainous road gradients is similar but markedly different from flat and rolling terrain. Therefore, care has to be taken so that road sections are not classified incorrectly, as flat/rolling when they should be hilly/mountainous or vice versa.

Increased Flows

Where flows approach 600 - 700 vph peak one-way flow – (i.e. 10,000 - 12,000 vpd), the availability of gaps in opposing traffic that allow overtaking start to decrease. At this point, the difference between vertical and combined terrain starts to become less marked as traffic volumes start to dominate.

Under-Estimated Level of Infrastructure

Under-estimation can occur where:

- **Flat or rolling vertical alignment with tortuous horizontal alignment** should be classified respectively as combined hilly and mountainous terrain. (This generally occurs in rugged gorge or coastline sections where high use by HCVs, RVs and/or light towing vehicles will increase passing and overtaking demand).

- **Flat vertical alignment with winding or curved horizontal alignment** should be classified as combined rolling terrain. (This is only likely to be critical where projected AADTs fall between transitions i.e. 4,000 - 5,000 vpd and 10,000 – 12,000 vpd).

Note: The above under-estimations can be catered for by substituting the vertical gradient classification for combined terrain. Combined hilly terrain would be classified under vertical mountainous within the long-term framework. In some cases, instead of a shorter passing lane with closer spacing, a slightly longer passing lane may be sufficient.

Over-Estimated Level of Infrastructure

Over-estimation can occur where:

- **Mountainous vertical alignment with a straight horizontal alignment** should be classified as combined rolling terrain. (This type of terrain is generally uncommon).

Mixed Gradient

Assume the flatter road gradient for a whole road section if it makes up at least two-thirds of the section length. However, for road sections close to the 67/33 split, consider the following differences between vertical and combined terrain:

- **Mixed rolling and hilly vertical terrain with straight horizontal alignment** might be classified as either combined flat or rolling terrain.
- **Mixed rolling and hilly vertical terrain with curved horizontal alignment** might be classified as either combined rolling or hilly terrain.
- **Mixed hilly and mountainous vertical terrain with winding horizontal alignment** might be classified as either combined hilly or mountainous terrain.

For the first two cases, it is recommended that the section is **EITHER** further sub-divided into separate terrains **OR** undertake a more detailed BCR analysis. For the third case, the distinction between hilly or mountainous will not affect the level of infrastructure to be provided.

C4. Available Sight Distance

Introduction

For determining EEM benefits, the proportion of time gaps to allow overtaking was adjusted to match calibrated conditions. Therefore, the EEM benefit graphs are correct for a given combined terrain.

However, as an approximation for determining if an overtaking or mainly overtaking strategy is viable, the criteria of 450 m sight distance for 35% of road length can be used but there are some exceptions. These exceptions are discussed below.

EEM

Use EEM Table A7.6 for typical values of average percentage passing sight distance based on horizontal terrain (Land Transport NZ, 2006). **Note**: The EEM heading written as vertical terrain should read horizontal terrain.

Approximation

As a rule of thumb, if at least 35% of the road section length has 450 m or more clear sight distance, the road section is assumed to have adequate overtaking opportunities.

Exceptions to Approximation

However, there are some exceptions to this general assumption, namely:

- **Flat combined terrain with high traffic volumes and a high likelihood of long vehicles and timid drivers travelling in the same direction** will require regularly spaced maxima sight distance.
- **Flat combined terrain with high traffic volumes and a high likelihood of opposing traffic** would require a longer overtaking sight distance than 450 m.

Continued on next page

Exceptions to Approximation continued

- **Hilly or mountainous combined terrain**, the larger speed differential may require an overtaking sight distance less than 450 m.

See Transit National office for situations where the above-mentioned exceptions apply.

Modified Sight Distance Criteria

For the above-mentioned exceptions, Table 9 shows modified sight distances criteria that have been adapted from Swedish research (Bergh & Carlsson, 1995). The proportion of gaps is estimated from Canadian research (cited in Harwood & Hoban, 1986).

The following proportions of overtaking sight distance shown in Table 9 are provided as a general indicative guide only and have not been trialled under New Zealand conditions. Further work may be needed to compare these sight distance criteria against projected PO Demand.

Table 9. Indicative Overtaking Sight Distance Criteria For Exceptions to Sight Distance Approximation

Projected AADT (vpd)	Proportion of Gaps with At Least 25 Second (%)	Proportion of Sight Distance (%) @ Length [1, 2, 3] (m)	Max Sight Distance [1, 4] (m) @ Average Freq [5] (km)
3,000	75	35-45 @ > 300	680 @ 5 or 1,000 @ 10
5,000	62	50-65 @ > 300	1,000 @ 5
7,000	50	70-90 @ > 300	1,000 @ 2.5-3.5

NOTE: 1. Based on 110 km/hour. Lengths may vary depending on operating speed and speed differential.
2. 300 m in both vertical and horizontal alignments. If there are not yellow no-overtaking markings provided (minimum 330 m clear vertical sight distance), check the horizontal alignment. In NZ, vertical alignment restrictions are marked. (Transit NZ/Land Transport NZ, 2004).
3. The Swedish guidelines seem to assume 50 % overtaking opportunities. Therefore, the proportion of available 300 m clear sight distance under Swedish guidelines has been reduced by 70% to approximate 35% overtaking opportunities.
4. Upper limit overtaking sight distance for an operating speed of 110 km/hr is 1,000 m (AUSTROADS, 2003). Therefore, the Swedish maxima have been factored upwards.
5. Maxima frequency of 3-5 minutes (5.4-9 km) for an operating speed of 100 km/hour (AUSTROADS, 2003). So use 5-10 km.

Long-Term Strategies

For the above-mentioned exceptions, use Table 10 as an indicative guide when deciding on a long-term PO strategy.

Table 10. Indicative Long-Term Strategy For Exceptions to Sight Distance Approximation

Combined Terrain	Long-Term Strategy		
	OT	Mainly OT	Pass & OT
Flat or Rolling	Both modified proportions & modified maxima satisfied.	Same as for OT except some short sections of road will not satisfy OT criteria.	Both modified proportions & maxima not satisfied.
Hilly or Mountainous	Modified proportions satisfied but not maxima.		

C5. Graphs For Passing Lane Strategies

Introduction

EEM procedures provide graphs to help assess the feasibility of a passing lane strategy at 5, 10 and 20 km spacings. Limitations on these indicative BCR graphs are discussed below.

Transit Regions are expected to use the Policy's long-term framework rather than developing alternative layouts.

Accuracy of Series Curves

EEM BCR graphs for passing lanes in series are not as accurate as the BCR graphs for individual passing lanes. BCR analysis for passing lane strategies is therefore only a preliminary estimate of project BCR.

BCR Difference by Terrain

There is little difference in benefits between flat and rolling combined terrain and similarly between hilly and mountainous combined terrain. However there is a difference between flat/rolling versus hilly/mountainous terrain.

Comparing BCR graphs for flat combined terrain with rolling combined terrain shows a maximum BCR difference of about 10 - 20 % for 0 - 15 % available sight distance. Similarly, there is 10 – 15 % difference in BCR when comparing hilly with mountainous combined terrain for 0 to 15% of available sight distance.

Costs

EEM base costs do not itemise the work to be undertaken. Where possible, use Transit's Cost Database instead. EEM BCR graphs can be adjusted based on the difference between base costs and Transit's Cost Database values.

Slow Vehicle Bays

EEM graphs cannot be used for analysing SVBs in series.

Indicative BCRs for slow vehicle bays can be determined using a simple screening method, which is available on Transit's PO web page. **Note**: The Borel-Tanner method used in the screening tool is currently only suitable for screening not funding purposes.

PART D. STRATEGY REFINEMENT

Overview

Part D supplements EEM A7.3 "Refinement of strategy" Steps 6-8 and expands on EEM guidance for locating passing facilities and overtaking zones.

Guidance relates to 2+1 lanes, passing lanes and overtaking zones. Additional site requirements are outlined for other types of passing facility, such as slow vehicle bays, shoulder widening, crawler lanes and crawler shoulders.

Individual requirements are grouped under the main influences i.e. safety, performance, driver perception and cost. A site is not necessarily excluded if it cannot satisfy all requirements. Good design and mitigating measures may help to overcome site short-comings.

D1. Facilities In Series

Introduction

Some localised and lengthwise features will affect the location of passing facilities and overtaking zones. The remainder of the layout should be fitted around these essentially fixed features.

Localised Features

When developing passing facilities in series, it is important to determine the locations that are effectively 'fixed'. Consider the following:

- **High passing and overtaking demand**. Locate the sites along sections with high PO demand.
- **Available sight distance**. Determine if the available overtaking sight distance is adequate for the road section. See C4 Available Sight Distance. Locate facilities in areas that do not have adequate overtaking opportunities.
- **Existing facilities or overtaking zones** that are satisfactory or upgradeable. Include existing sites that meet the standards within any overall section layout. If appropriate, lengthen and upgrade any existing sub-standard facilities. Try to retain existing overtaking zones.
- **Crash-prone locations** (overtaking, rear end and head-on crashes only). Look for sites with these types of crashes.
- **Poor alignments**, e.g. steep gorges, winding coastline. **EITHER** locate new facilities downstream of poor alignments to maximise bunching before the facility **OR** locate facilities at least 4 km upstream of poor alignments to minimise increased operating speed and potential downstream safety problems.
- **Crawler lanes and crawler shoulders**. Identify sites where crawler lanes/shoulders are required.

Lengthwise Features

Some features occur along the majority of the road section and may affect the overall layout described in the long-term framework. Lengthwise features include:

- **Predominant grade**. PO demand needs to be reduced evenly along both sides of the road section. For terrain with a predominant gradient in one direction, the PO demand is likely to be higher in one direction and passing facilities in series may have to be spaced differently for each direction.
- **Access control**. Road sections should **EITHER** have an appropriate level of access control for both access crossings and District road intersections **OR** could be easily provided in the near future.

D2. 2+1 Lanes, Passing Lanes & Overtaking Zones

Introduction

Consider the following features, when locating 2+1 lanes and passing lanes. This section also includes overtaking zones that would become passing lanes, as part of a long-term PO strategy.

Safety

Merge taper length. Use MOTSAM Part II (Transit NZ Land Transport NZ, 2004) to determine the merge taper length for a site's operating speed. Allow for extra taper length if the taper occurs on slight curves. Refer to AUSTROADS Part 5 section 6.8.2.4 (ii) Merge taper (Tm) and merge tapers for more detail.

Crash history. For crash-by-crash analysis of passing lanes, consider overtaking, rear end, and head-on crashes along the proposed passing length and up to 10 km downstream. Use 5 km downstream for other crash analysis methods. For 2+1 lanes, analyse the entire highway section. Check that head-on crashes are due to overtaking not poor alignment on curves.

Road alignment. Identify any substandard curves (i.e. generally less than 500 m radius) for both upstream (up to 2 km in untreated direction) and downstream (up to 4 km both sides) of the passing facility. If appropriate, use roadside/edgeline treatments for loss of control crashes with decreasing emphasis as distance from the passing facility or overtaking zone increases.

Left turning curves. Avoid these for merge and diverge areas, where the design speed of the curve and the speed environment of the site are significantly different.

Adequate sight distance. For 110 km/hour, allow at least 300 m at the beginning and end of the passing lane. If there is a reduced operating speed use a reduced sight distance.

Continued on next page

Safety continued

Road and weather conditions. Avoid locations with regular adverse road or weather conditions, e.g. falling rocks, ice, fog and flooding.

Blind merges. Avoid vertical crests and horizontal curves that do not have a design speed consistent with the operating speed. See AUSTROADS Part 5 section 6.8.2.4 (ii) Merge taper (Tm) and merge tapers for more detail.

Intersections and access crossings. See Attachment F Planning Notes for detail on the location of passing facilities and overtaking zones relative to access crossings and intersections. Advice is also given on estimating future intersection size, as larger separation distances are required for larger capacity intersections.

Performance

Bunching (PLs & 2+1 Lanes). Locate where traffic has started to bunch, especially for headway distributions with a high proportion of less than 2 seconds headway. **Note:** As an indication of bunching (based on research by Cenek & Lester), high demand locations would be expected to have 50 % or more following vehicles for the 4 second headway with 35 % or more following vehicles for the 2 headway criterion.

Bunching (OT zones). Consider OT zones as part of a realignment. **Note:** as an indication of bunching (based on research by Cenek & Lester), the SVB headway distribution (and hence voluntary pulling-over behaviour) was about 30 % following vehicles at the 4 second headway criterion with about 20 % following vehicles for the 2 second headway criterion.

Upstream bunching. Ensure that upstream percentage following is steadily increasing over the last 2 km approx before the start of the passing facility. Steadily increasing percentage following, under all flow conditions, is important to the performance of the passing facility. Therefore, beware of locations too close to rural townships.

Speed differentials between vehicles. Sites with large differentials are preferred locations for passing facilities. Where possible, locate facilities downstream of urban areas and 50-70 kph speed zones. For sites upstream of urban areas and 50-70 kph speed zones, locate the facility to maximise its effective length.

Effects of alignment. Where possible, locate facilities upstream of road sections with good alignments. Vehicles are more likely to achieve free-flowing speeds.

Peak one – way traffic flows. *Without ITS assisted merging*, the one-way peak projected flow for a moderate-volume passing facility should be less than 1,200 - 1,400 vph with up to 5 % total HCVs, RVs and light towing vehicles. *With ITS assistance*, the one-way peak projected flow could be up to 1,700 - 1,800 vph with up to 5 % total HCVs, RVs and light towing vehicles (Beacher et al, 2003). **Note:** High proportions of longer vehicles require larger gaps to merge and hence reduce one-way flow capacity.

Continued on next page

Performance continued

Access controls. Look for sites where access controls for intersections and access crossings are applied or can easily be applied.

Road sections with few overtaking opportunities. First, ensure new facilities do not diminish existing overtaking opportunities. Second, choose sites where overtaking in the opposing direction is still viable.

Driver perception

Logical. The location of passing facilities should seem a logical place for vehicles to pass (treated direction) or overtake (untreated direction).

Cost

High cost items. Where possible, avoid the following: bridge widening, culvert extensions, deep ditches, retaining walls, cattle underpasses, geotechnical problems, utilities relocation, river scour, intersection improvements or requiring large amounts of guard rail and excessive earthworks.

Co-ordination of state highway works. Where possible, PO projects should occur at the same time as other scheduled Transit works, such as pavement rehabilitation, realignments and safety works.

State highway boundaries. If possible, ensure that proposed passing lane alignments are within state highway boundaries.

Proposed toll routes. Four-lanes are preferred over 2+1 lanes for proposed toll routes that cannot be developed with 2+1 lanes as an intermediate step. Usually toll legislation for the route would specify if staged development is able to be undertaken.

Structures with long service life. Where 2+1 lanes are proposed, only consider road sections where existing high-cost structures, such as overpasses and bridges, have a long service life. **Note:** 2+1 lanes can transition down to two-lane sections so that high cost items can be avoided.

Staged development. For 2+1 lanes, it is recommended that the middle of the road section is developed first, rather than the whole road section. **Note:** As the road section is probably bounded by higher volume intersections at both ends, mid-location of the 2+1 lanes will help to maximum downstream benefits. Initial development will also depend on the location of highest PO demand.

Future network development. Ensure that overtaking zones can be developed later into either short or longer length passing lanes. Also, the passing lane length and spacing would fit with both the road section's interim and long-term strategies.

Geotechnical reasons. It may be appropriate to undertake the earthworks as a four-lane formation and therefore total construction costs may be similar between 2+1 lanes and four-lanes, e.g. swampy ground, engineered embankments. However, this would have to extend over most of the road section length.

D3. Slow Vehicle Bays & Shoulder Widening

Introduction

For slow vehicle bays and shoulder widening, consider the features below in addition to those for 2+1 lanes, passing lanes & overtaking zones.

Safety

Merge location. Where possible, ensure the merge location has a differential speed of less than 15 km/hour between merging vehicles.

Diverge sight distance. It is recommended that drivers have clear sight distance before entering a facility (Nicholson, Brough & Meister, 2000). Clear sight distance is measured to the diverge taper's mid-point. Consider the same sight distance provided for merge sight distance, as shown in Table 13.4 (b) Merge Sight Distance at end of Climbing Lane for Cars Overtaking MCV's (AUSTROADS, 2003).

Merge sight distance. It is recommended that there is clear sight distance after the end of the merge taper. This can include the start of yellow line at the end of the sight distance. Consider Table 13.4 (b) Merge Sight Distance at end of Climbing Lane for Cars Overtaking MCV's (AUSTROADS, 2003).

Performance

Bunching. Unlike passing lanes, locate at a lower percentage following value. **Note:** As an indication, (based on research by Cenek & Lester), the headway distribution for the SVB was about 30 % following vehicles for the 4 second headway criterion and about 20 % for the 2 second headway criterion).

High differential speeds. Provide facilities in both uphill and downhill situations where differential speeds are high.

Platoon size and speed differential. It is recommended that both of these parameters are appropriate for slow vehicle bay. A 300 m length is adequate for 60 km/hour mean traffic speed, 50 km/hour slow vehicles with 1 following. See Koorey et al, 1999 for detailed information.

Long-term growth and high proportion slow vehicles. Long-term growth is more desirable as opposed to short-term growth, such as forest harvesting cycles.

Driver perception

Merge location. Where there are high numbers of slow moving vehicles, locate the merge on a relatively flat gradient if possible. **Note:** SVB users may find it easier to stop if unable to merge and therefore would be more likely to use the SVB on a regular basis.

Cost

Extension of SVB. It is recommended that slow vehicle bays can be extended at a later date if passing lanes are required for the road section's long-term strategy. The ability for future extension delivers a greater economic benefit.

D4. Crawler Lanes & Shoulders

Introduction

This section applies to crawler lanes and short sections of wide sealed shoulder where crawler lanes are not feasible. Consider the features below in addition to those for 2+1 lanes, passing lanes and overtaking zones.

Safety

Crash history. Use crawler lanes and shoulders where there is a significant crash history caused by slow moving vehicles.

Speed differential. Extend crawler lanes to a point where the speed differential is within 15 km/hour.

Merge sight distance. Consider Table 13.4 (b) Merge sight distance at end of Climbing Lane for Cars Overtaking MCV's (AUSTROADS, 2003).

Performance

Sustained gradients. It is recommended that long lengths of sustained gradient should be greater than 8 % gradient (AUSTROADS, 2003). There is a speed differential of at least 15 km/hour for at least 2 km (British Columbia guidelines).

Marked speed differentials. Crawler lanes are recommended where truck speeds are 40 km/hour or less, as shown in Table 13.4 (a) Grade/Distance Warrant (Lengths (m) to Reduce Truck Vehicle Speed to 40 km/h) and traffic volumes are equal to or greater than the current year design volumes shown in Table 13.3 Volume Guidelines for Partial Climbing Lanes (AUSTROADS, 2003).

HCV access. Consider locations where high volumes of HCVs access the state highway on either an upgrade or downgrade and therefore HCVs will take a long time to reach their normal travelling speed.

Upstream PO demand increases markedly. Consider sites where platooning is more closely bunched relative to the upgrade or downgrade approach.

Long-term growth and high proportion of slow moving vehicles. It is recommended that both of these site features are present.

For more detail on location to improve performance, see both AUSTROADS Rural Road Design, Section 13.4.2 and Ministry of Transportation and Highways, British Columbia, 1998. If there is any conflict, AUSTROADS will take precedence over British Columbia guidelines.

Driver Perception

Merge location. Where high numbers of heavy commercial, recreational and light towing vehicles are typical, if possible, site the merge on a relatively flat length of road.

Continued on next page

Driver Perception continued	**Note:** As with SVBs and shoulder widening, crawler lane or crawler shoulder users should find it easier to stop if unable to merge and therefore are more likely to use the facility on a regular basis.
Cost	**Minimum lengths of sustained grade**. See EEM Table A7.8 Limiting Lengths m for Consideration of Climbing Lanes for minimum lengths of sustained grade required to provide crawler lanes. These lengths should also provide an indication of economic viability.

PART E. PROJECT ASSESSMENT

Overview

PO projects are generally routine and should not vary greatly from higher level policy once Transit Regional PO Plans have been assessed against national and regional policy issues. At an individual project level, other Transit strategies, policies and plans may affect the scope and hence feasibility of PO projects.

Graphical Analysis supplements EEM A7.4 "Assessment of individual passing lanes" and Rural Simulation supplements EEM A7.5 "Rural simulation for assessing passing lanes".

BCR graphs are commonly used for analysing passing lanes and similarly rural simulation for analysing projects with significant costs, construction or pre-construction periods and slow vehicle bays. Limitations and recommended actions are discussed for both analysis methods.

E1. Policy Hierarchy

Introduction

Transit Regional PO Plans and individual PO projects will be assessed against:

- NZTS and Transit Goals.
- Regional Planning Objectives and Policy.
- Other Transit strategies, policies and plans.

NZTS &Transit Goals

Passing facilities that qualify for block funding are generally routine activities and have already been assessed against the New Zealand Transport Strategy issues and Transit goals.

Large projects, such as individual 2+1 lane projects, have to be considered on a case-by-case basis and follow the NLTP on-line requirements.

For more detail, see Attachment D: Policy Assessment of the PO Policy on the web page.

Regional Planning Objectives & Policy

Transit Regional PO Plans should not be inconsistent with regional territorial authority planning objectives and policy.

It is encouraged that Transit Regional PO Plans are incorporated into regional planning documents (i.e. regional growth strategies, regional land transport strategies, etc) through the submission process. This should assist with implementing future PO projects.

Measures, such as TDM, ITS, education and enforcement that are part of Transit Regional PO Plans, should be consistent with and incorporated into wider regional initiatives.

Other Transit Strategies, Policies and Plans

Consider the following:

- National State Highway Strategy.
- Environmental Policy Manual (including Environment Plan and Guidelines for Highway Landscaping).
- Walking and Cycling Policy.
- TDM Manual.
- ITS Strategy.
- Asset Management Plan.
- Safety Plan.
- Public Engagement Manual (currently under development).
- Consultation with Maori Policy.
- Branding Strategy.
- Other GMT or Board decisions.

Note: Transit's SM 030 scoping guidelines outline policy assessment criteria.

E2. Graphical Analysis

Introduction

This section provides advice on limitations within the EEM graphical method. Graphical Analysis supplements information in EEM Appendix A7.4 "Assessment of Individual Passing Lanes".

Consistency

EEM graphical procedures require consistent upstream and downstream conditions. Therefore, sub-divide state highway sections so that combined terrain and traffic flow conditions are consistent.

Use sites with upstream conditions that cause traffic bunching rather than sites with upstream conditions that dissipate traffic bunching and therefore have irregular platooning behaviour at the facility.

Costs

EEM base costs do not include a schedule of items.

Where possible use summarised passing lane costs on Transit's PO web page to help estimate project costs. For total project costs, include only items directly incurred as a result of the passing facility. Separate out other scheduled Transit work from the project BCR. And record within PROMAN as a separate linked project.

Note: If other scheduled work is included in individual project BCRs, these projects would compare unfavourably with other passing lane or slow vehicle bay projects.

Effective Length

The EEM procedures assume a downstream effective length of 5-10 km. Therefore, where possible, focus on providing facilities for road sections (or parts of road sections) with more than projected 7,000 vpd, as the road sections are more likely to have a similar downstream effective length.

For crash savings, the downstream effective length will vary by the analysis method. If using the crash-by-crash analysis method, use up to 10 km as a downstream effective length. For safety benefits under other methods, use a 5 km downstream effective length.

Available Passing Opportunities

Avoid sites where the EEM procedures tend to under-estimate available passing opportunities. See C3 Available Sight Distance within these Guidelines for more detail.

Length Factor

EEM graphical analysis is based on a passing lane length of 1 km. The benefits for different lengths of passing lane are reduced (if less than 1 km) or increased (if greater than 1 km) using a length factor.

For lower projected flows, a passing length less than 1 kilometre may not have reduced benefits as the facility may be adequate for that level of AADT. Low projected flows apply to:

- Rolling and mountainous road sections with less than 4,000 vpd.
- Flat road sections with less than 5,000 vpd.

Therefore, use the long-term framework for estimating passing lane length and spacing.

Crash-By-Crash Analysis

EEM graphical procedures provide a reduction rate for total crashes. In some cases, this method is too generalised and greater benefits can be obtained if a crash-by-crash analysis is warranted. Refer to EEM A6.2 "Choosing to undertake an accident analysis" to determine if a crash-by-crash analysis is required.

Where appropriate, use EEM section A6.5 procedures to undertake a crash-by-crash analysis.

Note: Crash reduction rates from EEM Table 6.18 (d), apply only to overtaking, head-on and rear end/obstruction crashes. Include these crashes within the project's BCR. For crash-by-crash analysis, loss of control type crashes need to be considered separately.

Loss of Control Type Crashes continued

Both EEM graphical procedures and crash-by-crash analysis do not include loss of control crashes. Additional benefits can be claimed for edgeline/roadside treatments that will reduce loss of control crashes along and downstream of the passing lane. Such treatments include:

Continued on next page

Loss of Control Type Crashes

- Clear zones.
- Shoulder widening.
- Guard railing.
- Resurfacing of curves.
- Reflective raised pavement markers.
- Edge marker posts.
- Edgelines.
- Audible edge lines.
- Speed advisory signs and chevrons, etc.

Identify the benefits of edgeline/roadside treatments, but keep them separate from the passing lane/slow vehicle bay project BCR.

Directional Benefits

EEM graphical procedures do not consider benefits in the opposite direction, which are assumed to be typically quite small and are therefore ignored.

US research showed that at 400 vph one-way flow (in the treated direction) about 20% of all overtaking movements were in the opposite direction. Similarly, at about 200 vph one-way flow (in the treated direction) about 30% of all overtaking movements were in the opposite direction. See Harwood, St John & Warren, 1985 for more detail.

Therefore, downstream benefits in the opposite direction should be considered when preparing interim strategies and long-term layouts but **not** for funding purposes. This behaviour tends to be site-specific. Refer to Attachment E Option Notes for more detail on overtaking in the opposite direction.

Existing Facilities

For location facilities in the same direction of traffic flow as existing facilities, ensure that there is sufficient distance so that their effective lengths do not overlap.

Additional Information

See Part C Strategy Identification within these Guidelines for more detail on:

- Road sections.
- Projected AADTs.
- Road gradient and terrain.
- Available sight distance.

E3. Rural Simulation

Introduction

This section provides advice on limitations within the EEM rural simulation method. Rural Simulation supplements information in EEM Appendix A7.5 "Rural simulation for assessing passing lanes".

Use of EEM Procedures

Under EEM procedures, computerised rural simulations are required for:

- Slow vehicle bays and crawling lanes at scheme assessment stage.
- Locations where there are a large proportion of slow vehicles.
- Passing lanes with significant costs or significant construction and pre-construction periods – (by default as graphical method cannot be used).

Calibration data

Surveyed research data is available through NZ research into PLs and SVBs or data can be surveyed separately.

Accuracy

For passing lanes, at one-way flows of about 150 vph, Table 11 shows that the accuracy is similar for graphical and simulation methods, assuming consistent conditions.

Table 11. Comparison between TRARR & EEM Graphs[1]

One–Way Hourly Traffic Volume (vph)	Travel Time Savings per Vehicle (Seconds)	
	TRAAR	EEM
50	3.9	2.5
150	20	21
Note: 1. Derived from research conducted on northbound section of SH 3 in Wanganui (Koorey & Gu, 2001).		

Simple SVB Screening Tool

If proposing slow vehicle bays, the Borel-Tanner method is recommended for calculating indicative BCRs for SVBs. See the SVB screening spreadsheet on Transit's PO web page.

Note: BCRs based on the Borel-Tanner method are indicative only and at this stage, cannot be used for funding purposes, without permission from Land Transport NZ.

Additional Information

For more detail on New Zealand rural road simulation, see Koorey, 2003.

PART F. PROGRAMME

Overview

Weighted average BCR packages of passing and overtaking treatments will be used to group favourably prioritised individual projects with less favourable projects that collectively provide a consistent layout along the road section. These packages form an important part of interim 10 year PO strategies.

Interim strategies include weighted average BCR packages for passing and overtaking projects, supporting treatments and measures, other scheduled Transit work, Regionally funded projects, safety works and other scheduled Transit work.

As well as project BCR, the prioritisation of weighted average BCR packages will consider PO demand, safety and network importance. NSHS issues will also be considered and would over-ride the weighting system, if some routes are to be developed in preference to other routes.

For each section of state highway, Transit planning documents (e.g. SH Forecast) and systems (e.g. PROMAN) will be used to co-ordinate work within an interim strategy. This co-ordination will ensure that development is considered on a road section basis rather than individual isolated sites.

F1. Interim Strategies

Introduction

An interim 10-year strategy for each road section shall include:

- Weighted average BCR package of passing and overtaking treatments.
- Roadside/edgeline treatments incurred as a direct result of the passing facility.
- Other scheduled Transit works that will be co-ordinated with PO projects.
- Crown or regionally funded projects that are part of the interim layout.
- Relevant supporting treatments and measures.

Weighted Average BCR Packages

Weighted average BCR packages allow Transit to develop an overall interim layout, rather than building individual projects in isolation. They can also be used for EEM funding requirements.

Once a 10 year interim strategy is identified, the passing and overtaking treatments for that state highway section can be grouped as a weighted average BCR package. To determine the weighted average BCR, the total benefits for all projects are divided by the total costs for all projects.

Continued on next page

Weighted Average BCR Packages continued

Transit Regions are responsible for developing the weighted average BCR package for each road section. Transportation Planning, National Office is responsible for approving the packages put forward by Transit Regions.

Generally, projects with the most favourable individual BCRs will be undertaken first. If the most favourable project BCRs are markedly reduced during project development, consider re-evaluating the weighted average BCR package to provide a reduced layout.

Roadside/Edgeline Treatments

Roadside and edgeline treatments should be itemised separately and not included within the weighted average BCR package of passing facilities (but linked to a weighted BCR package if associated with work on PLs/SVBs) where:

- Work is undertaken on new/existing PLs/SVBs.
- Overtaking zones that have a history of crashes, but which are unlikely to be developed as passing facilities.

Other Scheduled Transit Work

While it is more economical to co-ordinate highway works, this co-ordination should **not** be the primary driver behind site selection. Where various works occur at the same location or close to each other, try to ensure that passing and overtaking treatments occur at the same time as the other works.

Note: Other scheduled Transit work should be itemised separately and linked with a weighted average BCR package for scheduling purposes but funded separately.

Crown & Regional Funding

Territorial authorities use Crown or regional funding for:

- Passing and overtaking projects along a state highway section that will not attract national funding.
- Less feasible projects that enable remaining projects to form a favourable weighted average BCR package.

Such projects can be linked to the weighted average BCR packages for the scheduling of work but funded separately. Crown and Regional funded projects must be identified before the I&R stage.

Note: No projects can be identified for regional funding after 2013/2014, and Transit regions must complete construction on all regionally funded projects by 2013/2014, preferably earlier.

Supporting Treatments & Measures

Except for any roadside and edgeline treatments required as a direct result of the passing facility, supporting treatments and measures should be identified as part of the interim strategy but funded separately.

F2. Prioritisation

Introduction

Project BCRs are weighted based on passing demand, safety and network importance. This weighting helps to establish national priorities for individual projects.

Under the previous Passing Lanes Strategy, special priority routes were weighted using similar attributes but now a wider range of influences will have to be taken into account.

A 2006-2008 transition period will help to streamline the transition from old priorities under the Passing Lane Strategy to new priorities under the PO Policy.

Transition of Current Projects

State Highway Forecast projects scheduled for construction up to 2007/08 inclusive have priority over all other projects. This transition is to ensure continuity of work streams. However, the priority for these projects is subject to a satisfactory BCR, prior to approval of the design and construction phases.

Note: After 2007/08, all projects will be prioritised using the system outlined below.

Weighting Factors

For ranking, each project BCR is given weighting factors based on:

- Passing demand (currently projected AADT)
- Safety (number of fatal and serious injuries as opposed to fatal and serious crashes)
- Network Importance (NSHS classification categories).

PO Demand Factor

The passing and overtaking demand factor is currently based on projected AADT:

- 0.05 = Less than projected 4,000 vpd
- 0.1 = 4,000-4,999
- 0.2 = 5,000-6,999
- 0.5 = 7,000-9,999
- 1.0 = 10,000 projected vpd or more.

Safety Factor

Safety factors are:

- 0 = 0 number of fatal and serious injuries
- 0.1 = 1
- 0.2 = 2

Continued on next page

Safety Factor continued

- 0.5 = 3-5
- 1.0 = 6 or more.

Network Factor

The network importance of each road section is based on NSHS classification categories:

- 0.2 = Sub-Regional
- 0.5 = Regional
- 1.0 = National.

NSHS issues

No weighting factors apply for NSHS issues. Where one route is preferred over another, projects not on the preferred route are prioritised on a case-by-case basis. The prioritisation of projects on preferred routes is not altered.

Individual Projects

Individual project BCRs are multiplied by the sum of individual weighting factors. A large Prioritisation Number means higher prioritisation of the project.

Weighted Average BCR Packages

The Prioritisation Number for the weighted average package is used for administrative purposes to help rank packages and is calculated as:

$$\text{Overall Priorisation No.} = \frac{BCR^{A}(\sum W^{A}) + BCR^{B}(\sum W^{B}) + BCR^{C}(\sum W^{C})}{\sum (W^{A} + W^{B} + W^{C})}$$

where BCR = Benefit Cost Ratio
A,B,C = Site identifiers
$\sum$ = sum of
W = Weighting Factors.

National Ranking

Transportation Planning, National Office will allocate the priority ranking. The allocated national ranking will apply to all projects within the weighted average BCR package.

Previous Passing Lane Strategy Priorities

Transit's previous Passing Lanes Strategy identified a number of priority sections:

Priority 1

- SH 1 Greater than current 10,000 vpd (strategic)
- SH 1 Milton-Mosgiel (road safety)
- SH 1 Kaikoura-Blenheim (strategic)

Continued on next page

Previous Passing Lane Strategy Priorities continued

- SH 2 Featherston-Masterton (road safety)
- SH 1 Warkworth-Whangarei (road safety).

Priority 2

- SH 1 Less than current 10,000 vpd (strategic)
- SH 3 Awakino-Te Kuiti (strategic).

Priority 3 - state highways with AADTs 5,000-9,999 vpd

Priority 4 - state highways with AADTs 4,000-4,999 vpd.

Transit's new Passing and Overtaking Policy recognises that other state highway sections may have similar issues that deserve similar priority to those listed above. The PO Policy's prioritisation system will apply to the above-mentioned routes instead of the previous system.

F3. Transit Documents & Systems

Introduction

Interim strategies shall be incorporated into Transit planning documents and project scheduling systems, namely:

- Regional PO Plans.
- State Highway Forecast.
- PROMAN.

Regional PO Plan

The Regional PO Plan should have a interim 10 year PO strategy and a long-term 25-30 year PO strategy for each road section. Transit Regional Managers are responsible for ensuring that a Regional PO Plan is prepared and updated.

SH Forecast

The interim strategy for each road section will be included within the State Highway Forecast.

If not updated beforehand, interim strategies leading to long-term Overtaking, Mainly Overtaking and Mixed passing and Overtaking strategies should be updated at least every 3 years. Interim strategies leading to a long-term Passing strategy should be updated at least every 6 years.

Where appropriate, remove completed projects from the road section's interim strategy. PO projects that have become viable or other scheduled Transit work should be added.

PROMAN

Weighted average BCR packages and other works within a road section strategy will match the State Highway Forecast. Project information should be completed as per Transit's Annual Plan instructions.

Cross Boundary Issues

Where state highway sections cross Transit Regional boundaries, the road section will be considered as a whole. The interim strategy, including the weighted average BCR package, will cover the entire road section.

Each Transit Region will progress individual projects within their own Transit Regional boundaries but any layout should benefit the entire road section, regardless of Transit Regional boundaries.

PART G. KEY TASKS

Overview

The PO Policy offers a wide range of options for managing PO demand and requires a multi-disciplinary collaborative approach. This approach requires input from all Transit divisions, as well as Transit's roading partners.

Therefore, Key Tasks reflect Transit's key activity areas. Issues have been categorised under planning, design, construction, operations, maintenance and communications. The order of headings roughly follows a facility's life cycle.

G1. Planning

Introduction

Key transportation planning variables are discussed below. Planning Notes provide additional information on the application of resource planning measures and assessment of development applications (Attachment F).

Design Hour Flows

For passing treatments, assume a 125th design hour at 25 years from construction date. For estimating percentage growth, refer to the PO web page for projected 2006 and 2031 AADTs.

In the absence of any traffic flow data, for rural strategic state highways, assume a 55/45% direction split with a peak hour flow of 10.5% AADT. This flow should not be exceeded for 95% of hours during the design year.

For recreational routes, refer to EEM Table A7.2 Traffic Flow Profiles for percentage of hourly flow relative to AADT for routes with both low and high volumes of recreational traffic.

Merge Capacity

Without ITS assisted merging. Where merging occurs without ITS assistance, assume that the upper operating limit for projected flows is 1,200-1,400 vph (one-way).

With ITS assisted merging. Where ITS is used to assist merging, assume that the upper operating limit for projected flows is 1,700-1,800 vph (one–way).

Continued on next page

Merge Capacity continued

Note: Merge capacity can be affected by high proportions of HCV and LVTs in the traffic stream. These types of vehicles require larger gaps, which can disrupt traffic flow. Also, they are longer vehicles and therefore fewer vehicles would pass through in an hour. For the purpose of these Guidelines, assume that merge capacity is most likely to be critical during peak rural commuter periods when heavy traffic and light towing traffic volumes are expected to be a small proportion (5% approx) of the total flow. Care should also be taken on weekend recreational routes with high AADTs.

Operating Speed

2+1 Lanes & Passing Lanes. Where available, use surveyed data to determine operating speed. Otherwise, assume an operating speed of 10 km/hour above the posted speed limit within the diverge area, passing facility lane and merge area. On some steep gradients, the operating speed may be less than the posted speed limit.

SVBs. New Zealand research shows that 300 metre long slow vehicle bays will only be effective up to a slow vehicle operating speed of 40 km/hour (with mean traffic speed of 50 km/hour) for two following vehicles and 50 km/hour (with a mean traffic speed of 60 km/hour) for one following vehicle (Koorey & Gu, 2001).

Crawler Lanes & Shoulders. See AUSTROADS Rural Road Design Table 13.4 (a) Grade/Distance Warrant (Lengths (m) to Reduce Truck Vehicle Speed to 40 km/h) for the length of road gradient to consider a crawler lane or shoulder.

Planning Notes

For more detail, see Attachment F Planning Notes.

G2. Design

Introduction

General design standards are referenced. More specific issues relating to PO projects are included within Attachment G Design Notes.

Eventually, Transit's Draft Geometric Design Manual will be replaced with a NZ supplement for AUSTROADS Rural Road Design. Until development and release of that publication, Design Notes is a useful repository for design matters that affect PO projects.

Design Notes

For more detail, see Attachment G Design Notes.

G3. Construction

Introduction

While general construction issues are covered within Transit's specifications, manuals and guidelines, during the construction stage, there are various monitoring activities that are specific to PO facilities.

Before and After Surveys

Transportation Planning, National Office is responsible for surveying traffic performance. Survey parameters will usually cover traffic effects of bunching (i.e. platoon size, overtaking rate, distribution of headway) and speed (i.e. operating, free).

The Transit Project Manager is required to notify Transportation Planning six weeks before construction starts, and again when construction has finished, so that surveys can be scheduled, if appropriate.

This surveyed information will provide more accurate information on benefits that can be used to develop more robust weighted average BCR packages.

Out-Turn Costs

Monitoring out-turn costs will help to improve cost accuracy early within the development stages.

Immediately after project completion, the Transit Project Manager is to provide a summary of costs to the Block Projects Manager at Transit National Office. Use the sample Cost Database form that is available on the PO web page.

The Block Projects Manager at Transit National Office will co-ordinate the return of the completed forms and will refer them onto Transportation Planning for loading onto the PO Cost Database.

PROMAN Update

The Transit Project Manager is to arrange for PROMAN to be updated to reflect out-turn costs entered onto the PO Cost Database.

Post-Construction Safety Audit

Once the facility is in use, any post-construction safety audit should extend from 2 km upstream of the facility diverge to 4 km downstream of the facility merge.

G4. Operations

Introduction

While general operational issues are covered within Transit's operational specifications, manuals and guidelines, there are some operational aspects that are specific to PO facilities.

Lane Closure

Merging difficulties on 2+1 and passing lanes can occur when there are high one-way flows, such as during peak periods of public holidays. These difficulties translate upstream as following vehicles must also slow or stop. Where this slowing and stopping occurs, it is better to close the passing lane.

Consider temporary closure where one-way flows reach 1,200 vph. However, each site will have an initial trigger point based on experience with other similar locations and traffic conditions.

Continued on next page

Lane Closure continued

Generally, passing lanes will have higher capacity if there are low volumes of heavy commercial, recreational and light towing vehicles and sufficient queuing storage within the lane.

If temporary lane closures are necessary on a regular basis, a higher level of infrastructure should be considered.

Over-Dimension Vehicles

Bridge guard rails, central median barriers and roadside cables/guard rails may restrict access for over-dimension vehicles. Therefore, consider clearance tolerances on restraining cables when issuing over-dimension permits.

Emergency Services

Consider quick lock openings on central median cables at lane transitions to provide for emergency services. Also consider permanent emergency openings every 3-5 km (Bergh & Carlsson, 2000).

Weather Conditions

Edgelines must always be clearly visible. For snow removal around restraining cables and guard rails ensure at least 400 mm clear distance past the outer edge of road markings (Bergh & Carlsson, 2000).

For roadside/edgeline treatments, wide profile markings and RRPMs may not be appropriate for areas with regular snow clearing.

G5. Maintenance

Introduction

While general maintenance issues are covered within Transit's maintenance specifications, manuals and guidelines, there are some maintenance aspects that are specific to PO facilities.

Off-Peak Periods

To minimise disruption to traffic flows, undertake inspections and maintenance during off-peak periods, for the following locations:

- Near constriction points, such as merge tapers and bridges.
- One-lane sections that are close to traffic flow capacity.

Regular Inspections & Maintenance

Include checks of central and roadside restraining cables and their cable end barriers, as part of scheduled inspections and maintenance programmes.

Supporting Posts for Restraint Cables

Replace broken support posts as soon as practical rather than waiting for scheduled maintenance. Under night-time conditions, broken supporting delineator posts could seem like a break in the barrier, particularly if close to intersections.

Note: For scheduling purposes, maintenance work for central median cables such as washing and replacing supporting posts involves on average about two hours per week for a 33 km long section (Bergh & Carlsson, 2000).

Shoulder Maintenance

Where appropriate, provide extra shoulder width for both safety and cyclist purposes. Programme regular cleaning and maintenance checks so that the extra seal width is satisfactory for cyclist and/or pedestrian use. Include cleaning and checks within relevant network management contract responsibilities.

Pavement Maintenance

Where possible, try to minimise traffic disruption and construction costs by coordinating the construction of new passing facilities with pavement rehabilitation for the site.

This co-ordination applies to passing facilities within an interim strategy where funding of these facilities is likely over the next 10 years. However, as mentioned previously, co-ordination of pavement maintenance should not be the main driver in site selection.

G6. Communications

Introduction

Public awareness of PO facilities and their function within the state highway network will aid education and enforcement programmes. Liaison with Transit's roading partners is part of a wider collaborative approach with other organisations that have similar PO objectives within the transport sector or could be affected by PO activities.

Key National Office & Regional Contacts

Region Contacts:

- Regional contact for media enquiries - Regional Manager.
- Day-to-day regional contact - Regional Transportation Planner (Regional Manager, if no Regional Transportation Planner) or nominated Transit staff.

National Office Contacts:

- Network Operations - State Highway Safety and Operations Manager.
- Capital Projects - Block Projects Manager.
- Transportation Planning - National Development Manager.
- Strategic Support - Communications Manager.

Key Stakeholders

As part of Transit's collaborative approach, Ministry of Transport, Land Transport NZ and NZ Police representatives are to be informed of any significant changes or milestones regarding the PO Policy.

Consultation with Maori

Transit regional personnel need to be familiar with their Regional PO Plan and consider issues as they relate to Maori, particularly:

- Access to Iwi or Hapu held land.

Continued on next page

Consultation with Maori continued	• Access to archeologically significant sites. • Sites significant to Maori, including toanga and customary user rights.

PART H. MONITORING

Overview

Monitoring systems and feedback are important activities within the life-cycle of passing facilities and overtaking zones. These monitoring activities enable Regional PO Plans, project development and operational stages to be continuously improved.

H1. Monitoring Systems

Introduction

The monitoring programme enables a database of results to be established. Transit will use this quantitative information to continuously improve its existing systems and to identify possible areas of research.

Traffic Monitoring Systems

Transit is currently adapting its data collection procedures to accommodate the traffic performance parameters of percentage following and speed measures.

The specification of new equipment will allow for measurement of passing and overtaking demand parameters i.e. bunching and speed measures.

For new counter sites, consider what effect any nearby existing or proposed passing facilities would have on traffic count data. If data will be affected, relocate the counter site. Similarly, as previously mentioned, new passing facilities should consider existing traffic count sites.

Costs & Benefits Database

Transit is developing a separate costs and benefits database on new PO works. Costs and Benefits information will be available through the PO web-page.

Transit project managers are required to provide cost information on all PO projects. For additional information, see G3 Construction within these Guidelines.

Safety

Transit’s State Highway Safety and Operations Manager will monitor any updates on standards and specifications relating to passing facilities and develop a programme for any associated upgrade of existing facilities.

As part of developing any Regional PO Plan, existing facilities should be reviewed for safety, as described in Strategy Refinement of these Guidelines under Facilities in Series.

Safety reviews of passing facilities and overtaking zones should span 2 km upstream through to 4 km downstream. Use the same distance to monitor crash records. For sites with an adverse crash history, a higher level of centreline and/or roadside and edgeline treatments is recommended.

Research

Transportation Planning, National Office will monitor overseas practices and research. If necessary, these Guidelines will be updated.

H2. Feedback

Introduction

In addition to quantitative monitoring systems, Transit encourages informal feedback mechanisms particularly with the general public and at a Transit Regional level.

SH Forecast

Consultation responses on PO projects are currently referred through to Transportation Planning, Transit National Office.

Road User Survey

Transit Regional personnel should review road user surveys relating to PO issues within their Region. Responses are to be prepared in conjunction with the Transit Regional Manager.

After review by Transportation Planning, National Office, the responses are forwarded to road user survey staff within Transit's Strategic Support.

Within Regions

Transit Regions should seek feedback on PO issues from regional representatives of Ministry of Transport, Land Transport and NZ Police, as part of any current regional liaison meetings.

Regional Managers are to address problems and keep Transportation Planning National Office informed to ensure that systemic problems are not occurring.

Between Regions

Regional contacts are encouraged to communicate with other Transit Regions and National Office, particularly where similar projects have already been undertaken by other Transit Regions.

Suggestions for Improvement

Any suggestions for improvements to the PO Policy or these Guidelines can be directed through Larry Cameron, Transportation Planning, Transit National Office or Transit's PO web page.

PART I. REFERENCES

Introduction

The following publications are referred to within these Guidelines. The Attachments have been referenced separately.

1. AUSTROADS, 2003. Rural Road Design A Guide to the Geometric Design of Rural Roads, ISBN 0-85588-655-2, Eighth Edition, Sydney, Australia.

2. AUSTROADS, 2006. Guide to Traffic Engineering Practice Part 5 – Intersections at Grade, ISBN 0-85588-734-6, Sydney, Australia.

3. Beacher A. Fontaine M. & Garber N., 2004. "Evaluation of the Late Merge Zone Traffic Control Strategy". Transportation Research Board Final Report VTRC 05-R6, Charlottesville, Virginia USA, August, 2004.

4. Bergh T. & Carlsson A., 1995. "Design Criteria and Traffic Performance Research in New Swedish Guidelines on Rural Highways", International Symposium on Highway Geometric Design Practices, Transportation Research Board, Boston, USA, Aug. 30-Sept. 1 1995, pp.1-15.

5. Bergh T. & Carlsson A., 2000. "2+1 Roads With and Without Cable Barriers Speed Performance", Proceedings of the Fourth International Symposium on Highway Capacity, Transportation Research Board, Hawaii, USA, June 2000. pp.118-199.

6. Harwood D.W., St John A.D. & Warren D.L., 1985. "Operational and Safety Effectiveness of Passing Lanes on Two-Lane Highways", Transportation Research Board Record 1026, 1985, pp.31-39.

7. Koorey G.F., Farrelly P.M., Mitchell T.J. & Nicholson C.S., 1999. "Assessing Passing Opportunities – Stage 2", Transfund New Zealand Research Report No. 146, 1999.

8. Koorey G.F. & Gu J., 2001. "Assessing Passing Opportunities – Stage 3", Transfund New Zealand Research Report No.220, 2001.

9. Koorey G.F., 2003. "Assessment of Rural Road Simulation Modelling Tools", Transfund New Zealand Research Report No. 245, 2003.

10. Land Transport New Zealand, 2006. "Procedures for Evaluating Passing Lanes", Economic Evaluation Manual, Volume 1, ISBN 0-478-28983-9, First Edition. Oct. 1 2006.

11. Ministry of Transportation and Highways, British Columbia, 1998. "Passing Lane Warrants and Design", Technical Bulletin No. DS98003, May 1998.

Continued on next page

12. Nicholson C., Brough K. & Meister M., 2000. "SH 29 Kaimai Slow Vehicle Bays Safety Review", Opus International Consultants Report 29A012.00, prepared for Transit New Zealand, 2000.

13. Transit New Zealand / Land Transport New Zealand, 1998. Manual of Traffic Signs and Markings Part I Traffic Signs, 4th Edition, Wellington, New Zealand, Passing Lane Traffic Signs updated 1 March 2000, viewed 1 May 2006. <http://www.transit.govt.nz/technical/ manuals/MOTSAM-Part I: TRAFFIC SIGNS.

14. Transit New Zealand / Land Transport New Zealand, 2004. Manual of Traffic Signs and Markings Part II Markings, 3rd Edition, Wellington, New Zealand, Passing Lane Markings updated July 2004, viewed 1 May 2006. <http://www.transit.govt.nz/technical/manuals/ MOTSAM-Part II: MARKINGS.

15. Transit New Zealand, 2006. Background Technical Report for Transit New Zealand's Passing and Overtaking Policy, Unpublished report, May 2006.

16. Transit New Zealand, 2007. Planning Policy Manual, ISBN 978-04-478-10598-8, 2007.