ŌTAKI TO NORTH OF LEVIN PFRs

Report 2: Manakau Settlement Project Feasibility Report

Prepared for NZ Transport Agency

February 2013

This document has been prepared for the benefit of NZ Transport Agency. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval to fulfil a legal requirement.

This document has been prepared for the benefit of NZ Transport Agency. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval to fulfil a legal requirement.

QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
Tracy Couchman	Phil Peet

PREPARED BY		
Ian Robertson	……..	……/……/……
CHECKED BY		
Phil Peet	……..	……/……/……
REVIEWED BY		
Marten Oppenuis	……..	……/……/……
APPROVED FOR ISSUE BY		
Phil Peet	……..	……/……/……

WELLINGTON
Level 1, 123 Taranaki Street, Wellington 6011
PO Box 9624, Te Aro, Wellington 6141
TEL +64 4 381 6700, FAX +64 4 381 6739

REVISION SCHEDULE

Rev No	Date	Description	Signature or Typed Name (documentation on file).			
			Prepared by	Checked by	Reviewed by	Approved by
A		Draft	BD & MO	PP	MO	PP

Executive Summary

This Project Feasibility Report (PFR) is one of a number of reports being undertaken to determine the package of improvements that should be implemented in the short to medium term to improve the safety and efficiency of the highway between Otaki and north of Levin as part of the Wellington Northern Corridor Road of National Significance (RoNS).

The main purpose of this report is to determine the feasibility of improving road safety and traffic management of State Highway 1 through Manakau settlement.

A variety of road safety and traffic management improvement options were considered, for which benefits and costs were determined. The options considered included;

- reducing the speed limit through Manakau settlement to 80 km/h,
- installing threshold treatments at either end of the settlement,
- widening the highway to install a flush median and wider shoulders,
- removing the southbound passing lane to the north of the settlement,
- closing one intersection, redirecting traffic to one safer, more efficient T junction,

A summary of the economic analysis is shown below.

Table 1-1: Option Summary

Option Description	Capital Costs	NPV Benefits	Benefit Cost Ratio
Option 2-1: All Safety and Traffic Management Improvements	$1.95M	$17.4M	**0.9**

The rough order cost to achieve all of these improvements is $1.95M. Indicative BCRs were derived from predicted crash cost savings (with travel time and vehicle operating cost deemed neutral at this PFR stage) and calculated to be 0.9 (5 year crash history) or 2.7 (10 year crash history).

Options are such that each can also be considered as standalone, but a BCR for each is not credible to derive at this PFR level of detail. This could be progressed at SAR stage, however.

This report should be read in conjunction with the wider Otaki to north of Levin PFRs, which includes an option in Report No. 12 for a potential re-routing of SH 1 around Manakau settlement to the west, when four laning eventuates. This would have many positive benefits for Manakau (highway traffic essentially removed). Four laning by widening the existing highway is still potentially viable, but is contingent on a protected building on the west side being able to be shifted back or relocated. A war memorial on the eastern side, near Mokena Kohere St, if able to be relocated would open up the possibility of the rail being shifted east and hence some widening of the highway on the eastern side becomes a possibility. This should be investigated further during the scheme assessment report (SAR) stage to establish how viable it is to proceed with short to medium term improvements along the existing highway, and their compatibility with eventual four laning, versus re-routing the highway to the west of the settlement (i.e. identify redundant investment).

The economic result indicates that the All Improvements package of work is viable based on the 10 year underlying crash history; and this is recommended to be taken forward into the SAR phase.

NZ Transport Agency

Report 2: Manakau Settlement

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1 Introduction

Using the outcomes of the Otaki to north of Levin Scoping Report and Addendum, the NZTA decided that the most appropriate strategy for the highway between Ōtaki and north of Levin is to upgrade the existing highways as the first stage of a long term strategy. This allows the NZTA to realise important safety benefits in the short to medium term whilst deferring the need to construct four lanes for the time being.

This Project Feasibility Report (PFR) is one of a number of reports being undertaken to determine the package of improvements that should be implemented to improve the safety and efficiency of the highway between Otaki to Levin as part of the Wellington Northern Corridor Road of National Significance (RoNS).

The objectives of the Wellington Northern Corridor RoNS, which runs from Wellington Airport to north of Levin, are:

- To enhance inter regional and national economic growth and productivity;
- To improve access to Wellington's CBD, key industrial and employment centres, port, airport and hospital;
- To provide relief from severe congestion on the state highway and local road networks;
- To improve the journey time reliability of travel on the section of SH1 between Levin and the Wellington Airport; and
- To improve the safety of travel on state highways.

For the Otaki to north of Levin section; the objectives are:

- To provide best value solutions which will progressively meet (via a staged approach) the long term RoNS goals for this corridor of achieving a high quality four lane route;
- To provide better Levels of Service, particularly for journey time and safety, between north of Otaki and north of Levin;
- To remove or improve at grade intersections between north of Otaki and north of Levin;
- To engage effectively with key stakeholders; and
- To lodge Notices of Requirement and resource consents as appropriate with the relevant consent authorities for the first individual project by the 2013/14 financial year.

The projects that are being developed to help meet these objectives are presented in Section 2.

The purpose of this report is to determine the feasibility of undertaking safety improvements on the section of State Highway 1 through the settlement of Manakau.

The geographical extent of this project is for approximately 1 km of State Highway 1 (SH1), from south of Honi Taipua Street to north of Waikawa Beach Road.

The outcome of this PFR will be considered alongside the outcomes of the other PFRs and used to determine the best package of works to progress as the first stage towards the long term strategy.

2 Projects Currently Being Investigated

The projects that are currently being investigated to meet the short to medium term objectives of the Otaki to north of Levin RoNS project are presented in the figure below.

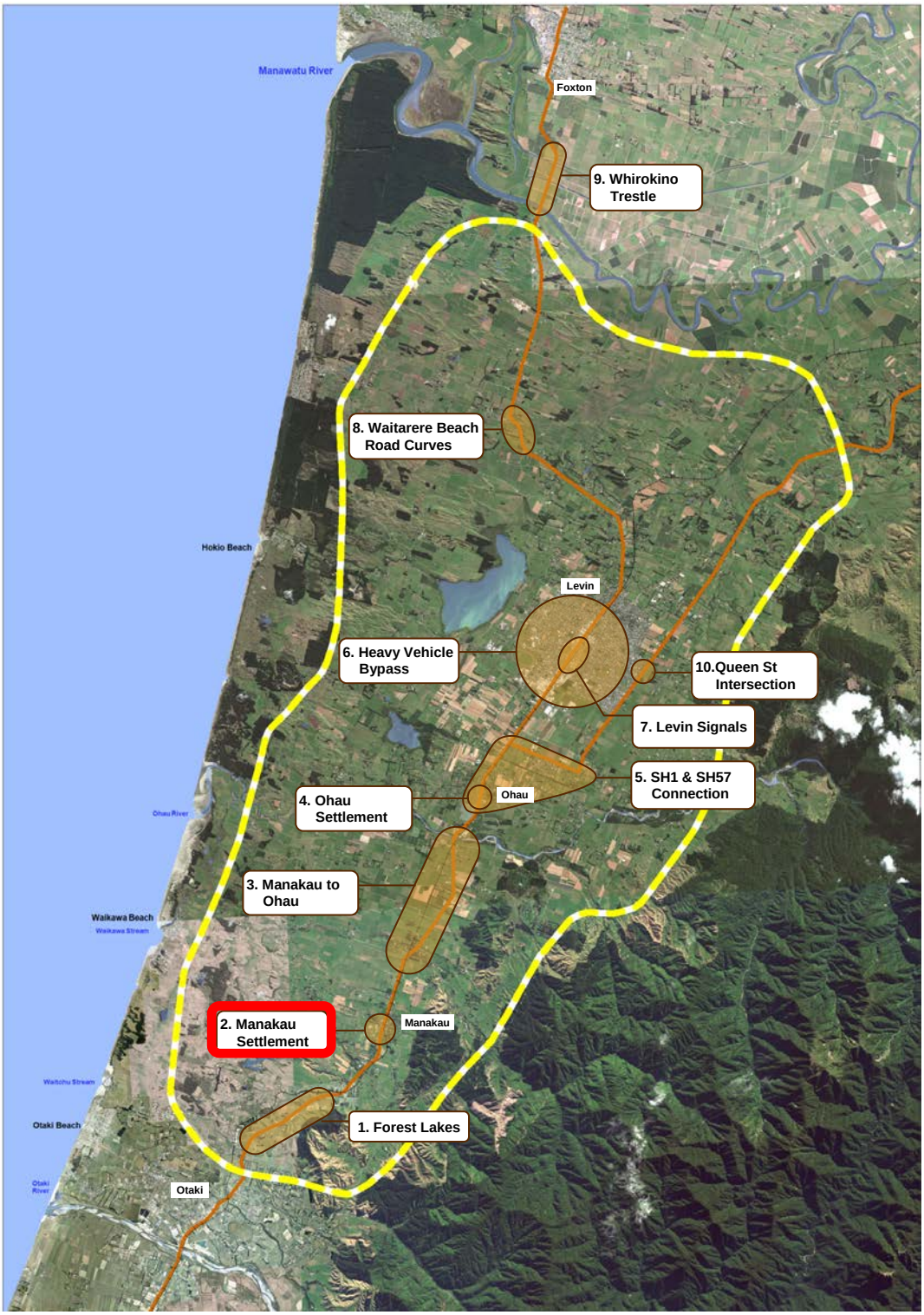


Figure 2-1: Projects Currently Being Investigated

In addition to the above PFRs, reports are also being undertaken on Route Improvements (i.e. edge treatment, passing lanes, walking and cycling, side friction etc; Report No. 11) and on Four Lane Alignments (Report No. 12).

3 Description of Problem

3.1 Ōtaki to North of Levin

State Highway 1 and State Highway 57 through the study area have a number of deficiencies, resulting in a poor crash history and a number of locations where the free flow of vehicles is restricted by the physical characteristics of the highway.

State Highway 1 currently follows the historic route established in the late 19th and early 20th centuries. As a consequence it is constrained by a now substandard alignment, towns and settlements, narrow curved bridges and significant side friction caused by local roads, commercial frontages and property accesses for the entire stretch.

3.2 Manakau Township

The section of highway under consideration in this PFR is approximately 1km in length, from south of Honi Taipua Street railway underpass link to north of Waikawa Beach Road, running through Manakau.

The key issues to be addressed by improvement works relate mostly to the safety and comfort of the community of Manakau and local area traffic. The key factors and constraints considered in this PFR are:

- Posted speed limit, 100 km/h limit through the township, and the incompatibility of the end of the southbound passing lane with the north end of the settlement.
- Vehicle speed problems exacerbated by the southbound passing lane terminating shortly before the settlement.
- Pedestrians and cyclists – no facilities at present.
- Side roads.
- Side friction.
- Nature of commercial development (separated from township, see following point) and off road parking availability.
- Movements across the highway from the settlement to the shops, particularly the dairy.
- Increasing heavy vehicle volumes.
- Deficient level crossing separation - railway to limit line distance on Mokena Kohere Street (currently 16 m).
- No storage for vehicles turning left onto Mokena Kohere Street when rail crossing barriers are down, leaving them exposed to traffic having just merged at the end of the passing lane. Also HCVs exiting will overhang the railway line.
- Cross Section (turning movements and ped/cycle provision).
- Waikawa Beach Rd intersection 125 m before the end of the passing lane.
- Steep shoulder to the south of and opposite Honi Taipua Street.
- Power poles close to the road, particularly opposite Honi Taipua Street on steep shoulder.

4 Site Description

The project area consists of a 1 km length of SH 1 from south of the Honi Taipua Street railway underpass link to north of Waikawa Beach Road (RP 985/8.00-9.00 approx.).

- Of the approximately 1 km project length, approx. 600 m is within the more built up part of Manakau.
- The speed limit through the entire project area is 100 km/h.

- The road is a two way undivided carriageway with 3.4 m lanes and generally a varying 0.6 to 1.7 m LH shoulder and a varying 0.6 to 1.7 m RH shoulder; with further variation at the passing lane merge taper.
- The road widens for a right turn bay into Mokena Kohere Street, and the southbound passing lane extends into the project area 125 m beyond Waikawa Beach Road.

Figure 4-1, following, shows the study area.

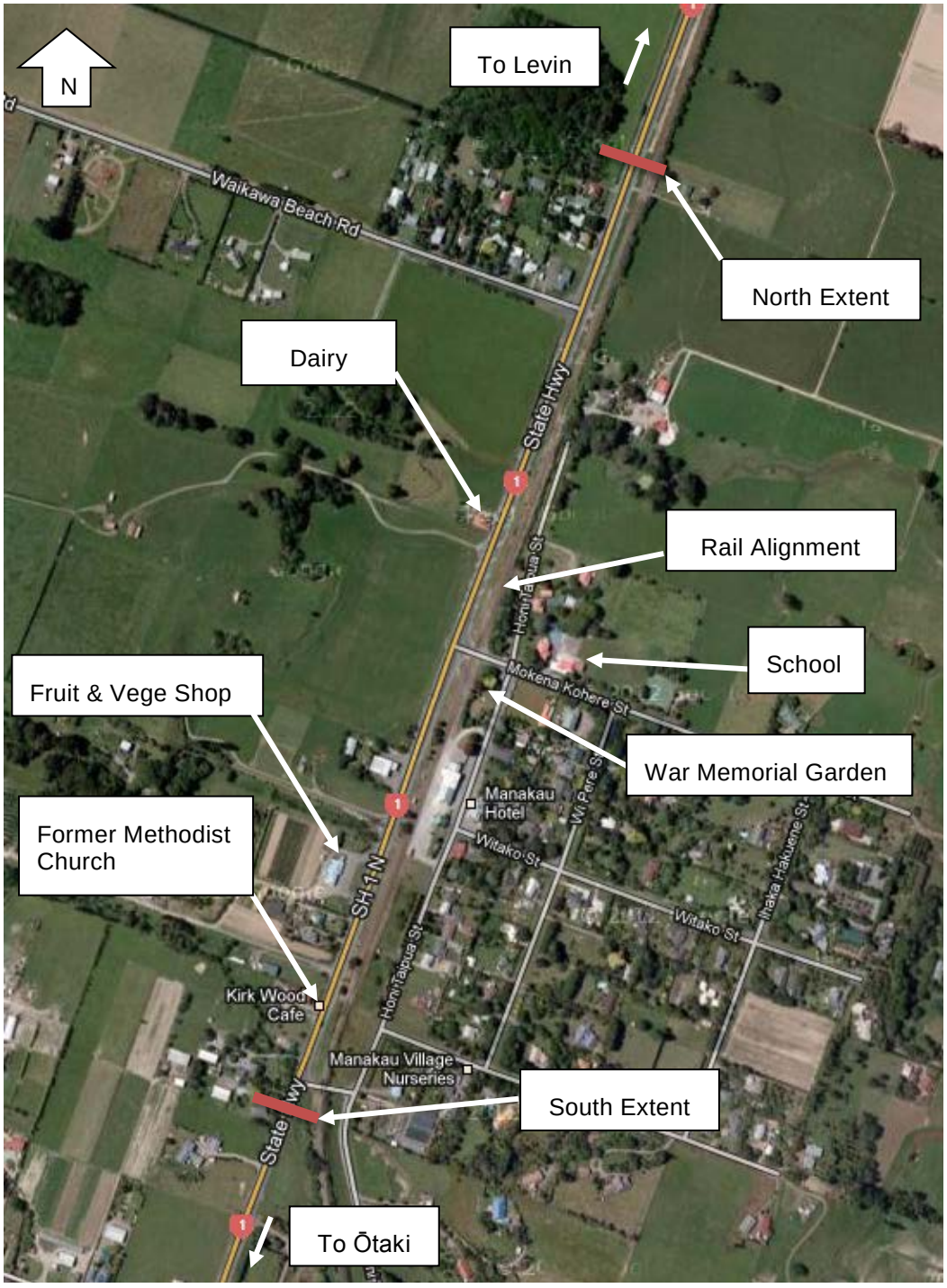


Figure 4-1: Study Area Location Plan

There are three side roads within the study area (south to north):

- Honi Taipua Street link (RP 985/8.98), serving Manakau Settlement, with access via a deficient one way rail underpass (height and width restricted). RHS.
- Mokena Kohere Street (RP 985/8.49), serving Manakau Settlement (the majority of the residential property is on the east side), including a school and some industry, with access via a barrier-protected level crossing immediately adjacent to the highway. RHS.
- Waikawa Beach Road (RP 985/8.12), serving the Waikawa Beach settlement and rural farmland. LHS.

State Highway 1 is bounded by the railway reserve to the east, beyond which are the main residential streets of Manakau along with the school and some retail/commercial. The settlement road network accesses the highway at two locations; the bells and barrier protected level crossing at Mokena Kohere Street at the north end and the short railway underpass connection to Honi Taipua Street at the south end. On the eastern side of the railway is a siding and fertiliser depot, but it appears that the siding is no longer used to offload and onload from the depot. To the west is a mixture of farm land, with a number of residential dwellings and several retail/commercial businesses.

There are no horizontal curves in the project area and the vertical geometry is relatively flat.

There are no dedicated cycling or walking facilities provided along or across State Highway 1.

It is noted that the Waiauti Stream Realignment has been recently completed just south of the settlement. The new alignment, whilst of a reasonable standard, does not meet RoNS guidelines and hence when four laning proceeds, redundancy of this recent investment (including a stream bridge) will potentially result.

5 Traffic Statistics

The Annual Average Daily Traffic (AADT) flow at the NZTA telemetry count site at Ohau (Count Site ID: 01N00988) was 14,600 vehicles per day (vpd), 2011, with the proportion of Heavy Commercial Vehicles (HCVs) at 10%. The traffic volume within the Manakau settlement will likely be slightly higher than this on account of the school, residential dwellings and retail/commercial businesses; however further traffic counts would be required to determine the actual volumes.

The traffic growth rate at the count site is calculated to be 1.3%, using data from 1992 to 2011. Volumes typically increased from 1992 to 2005; however since then volumes have remained generally stable.

Annual average daily side road traffic volumes, as far as the data from Horowhenua DC reveals, are as follows (south to north);

- Honi Taipua Street link (RHS): Unknown, considered to be significantly less than Mohena Kohere Street.
- Mohena Kohere Street (RHS): 580 vpd
- Waikawa Beach Road (LHS): 1000 vpd

6 Crash History

6.1 Crash Data

A review of NZTA's CAS database over the five year period from 2007 to 2011 revealed a total of 16 crashes along the approx.1 km section of highway (SH1 RP 985/9.00 – RP 985/8.00). The extended 1 km length was chosen to include crashes which would be influenced by the intersections and at either end of the site.

The following tables provide a summary of the CAS output data.

Table 6-1: Annual Distribution of Crashes, 2007-2011

Year	Fatal	Serious	Minor	Non-Injury	Total	DSi*
2007	-	-	4	2	**6**	-
2008	-	-	-	2	**2**	-
2009	-	-	-	3	**3**	-
2010	-	-	-	4	**4**	-
2011	-	-	1	-	**1**	-
Total	**-**	**-**	**5**	**11**	**16**	**-**

* Death and serious injury casualties

Table 6-2: CAS Crash Type

Crash Type	Number of Reported Crashes	Percentage of Reported Crashes
Overtaking Crashes	1	6%
Straight Road Lost Control/Head On	2	13%
Bend – Lost Control/Head On	1	6%
Rear End / Obstruction	7	44%
Crossing / Turning	4	25%
Pedestrian Crashes	-	0%
Miscellaneous Crashes	1	6%
Total	**16**	**100%**

Table 6-3: HRRRG[1] Crash Type

Crash Type	Number of Reported Crashes	DSi	Percentage of Reported Crashes
Head on	1	-	6
Run off Road	3	-	19
Intersection Crashes	5	-	31
Other	7	-	44
Total	**16**	**-**	**100%**

[1] High Risk Rural Roads Guide (HRRRG), NZTA, September 2011

Table 6-4: Crash Causation Factors of Reported Injury Crashes

Causation	Number of Reported Injury Crash Causation Factors
Alcohol	2
Too fast	1
Failed give way/stop	2
Overtaking	1
Incorrect lane/position	3
Poor handling	2
Poor observation	9
Poor judgement	2
Fatigue	2
Disabled/old/ill	1
Vehicle factors	4
Other	3

Table 6-5: Environmental Factors

	Wet	Dry		Night	Day		Weekend (Fri 6:00PM to Monday 5:59AM)	Weekday
No.	3	13		4	12		8	8
%	19	81		25	75		50	50

- Of the 16 reported crashes over the five year period analysed, five were minor injury and 11 were non-injury.
- Poor observation was the single highest crash causation factor towards injury crashes, being attributed to nine of the 32 crash causation factors.
- Three crashes involved hitting a post or pole.

A further five year period between 2002 and 2006 was also analysed. During this period there were three serious injury crashes: A car U-turning just north of Waikawa Beach Road was hit by a vehicle travelling in the same direction in 2002. A motorcyclist was hit in 2004 when overtaking a vehicle that was turning right into the fruit and vegetable shop. A car lost control and went off the road, hitting a car parked near the dairy in 2004.

There was a fatality involving a right turn across opposing traffic into the fruit and vegetable shop in 2000, and a further serious injury following loss of control and hitting a pole near Mokena Kohere Street in 2012, which though neither are included in the analysis periods, reinforces the ongoing high risk of this site. The crashes from the 5 year period from 2002-2006 are summarised in Table 6-6:

Table 6-6: Annual Distribution of Crashes, 2002-2006

Year	Fatal	Serious	Minor	Non-Injury	Total	DSi*
2002	-	1	-	3	**4**	1
2003	-	-	-	3	**3**	-
2004	-	2	-	-	**2**	2
2005	-	-	2	1	**3**	-
2006	-	-	-	-	**-**	-
Total	**-**	**3**	**2**	**7**	**12**	**3**

* Death and serious injury casualties

6.2 Crash Risk

The section of SH1 was analysed according to the High-Risk Rural Roads Guide (HRRRG) which identifies that crash risk can be generally defined in two ways:

- Actual Crash Risk; which is based on crashes reported in the last 5 years. This is separated into collective risk, which is also known as crash density, and personal risk, which is also known as crash rate.
- Predicted Crash Risk; which is based on KiwiRAP road protection score (RPS) and the KiwiRAP star rating.

In terms of crash risk this 1 km section of SH 1 has:

- A collective and personal risk of zero as there has been no fatal or serious injury crashes within the last 5 year period.
- An average KiwiRAP star rating of 2.5, giving a published KiwiRAP rating of 2 stars, together with an RPS of 19.4.

Based purely on the KiwiRAP star rating and the RPS, this length of SH1 is classified as a high risk rural road.

Therefore, in Order to better measure the collective and personal crash risk, crashes were analysed over the past 10 years. Following this;

- A personal risk value of 5.61 equates to the highway having a medium risk, and
- A collective risk value of 0.30 equates to a high risk,

Therefore from the past 10 years' crash data this length of SH 1 is classified as a high risk rural road.

Further crash data can be found in Appendix C.

7 Alternatives and Options Considered

The alternatives and options available should be seen as all individually and collectively contributing to road safety and traffic management improvement. They are such that a number can be standalone or they can be considered in clusters or as a total package. There is also overlap with other PFRs, so decision-making on how to proceed can be influenced by their outcomes.

The above needs to be considered when assessing the alternatives and options, particularly from a short/medium term versus long term investment perspective.

Report No. 12 includes a potential re-routing of SH 1 around Manakau Settlement to the west, when four laning eventuates. This would have many positive benefits for Manakau Settlement (highway traffic essentially removed). Four laning by widening the existing highway is also still potentially viable, but is contingent on a protected building on the west side being able to be shifted back or relocated. A war memorial on the eastern side, near Mokena Kohere Street, if able to be relocated would open up the

possibility of the rail being shifted east and hence some widening of the highway on the eastern side becomes a possibility. This should be investigated further during the SAR stage to establish how viable it is to proceed with short to medium term improvements along the existing highway, and their compatibility with eventual four laning, versus re-routing the highway to the west of the settlement (i.e. identify redundant investment). See Appendix D for an options layout.

7.1.1 Southbound Passing Lane

Report No. 11 addresses route improvement consistency, with passing lanes one of the features considered. The report recommends the removal of the northbound passing lane in favour of a better package of longer, more evenly distributed passing lanes. For the Manakau settlement PFR the removal of the southbound passing lane is noted as having a positive effect on the settlement (i.e. less aggressive speeds at the end of the passing lane, which is close to the settlement main residential activity (directly or indirectly)). The southbound passing lane would certainly not be compatible with an 80 km/h speed limit and compromises also the location of the northern threshold. Cost and economic benefits have been factored into the route improvements report.

7.1.2 Posted Speed Limit

The introduction of an 80 km/h zone allows the opportunity to consider a flush median, which together with threshold treatments at both ends will give the town an identity (see Section 8 for threshold treatment examples). There is an opportunity for the community to participate in the design of the threshold signs as indicated in one of the example signs.

A warrant survey was conducted following a field visit in December 2012, with the results analysed in accordance with Speed Limits New Zealand (SLNZ). Following this, the average rating for the section of SH1 through Manakau Settlement was found to be 4.8, which supports an 80 km/h speed limit through Manakau Settlement (Table SLNZ12). The speed limit warrant data has been included in Appendix G.

7.1.3 Pedestrian and Cycle Facilities

Main pedestrian movements are across the highway in a random pattern, but the extent will need to be measured as part of the SAR stage. Pedestrians should be encouraged to use the local road network and avoid crossing the railway. To facilitate this, a safety footpath should be considered at the SAR stage on both sides of the highway (noting Mokena Kohere St is not ideally placed for pedestrians to access retail/commercial on the west side). Consideration can also be given to physical refuges in the flush median.

Cyclists on the highway are currently not well catered for due to non uniform sealed shoulder widths and the proposal is to increase the sealed shoulder width to a uniform 2.0 m (See Section 7.1.9) which will provide an improved level of service standard for cyclists. Cyclists will also value the flush median when turning right into properties or side roads.

7.1.4 Side Friction

The frequency of properties, and access to them, results in significant side friction, often resulting in delays to following vehicles as they adjust speeds to avoid turning vehicles. This conflict can also lead to crashes at accessways. Provision of a wider cross section, particularly sealed shoulders and a flush median, will allow turning vehicles to move more smoothly out of the traffic stream, hence avoiding much of the conflict. In addition, it is proposed to provide enhanced access out to the highway boundary, in conjunction with the seal widening, to further facilitate conflict reduction. For the commercial/retail properties on the western side, application of the Planning Policy Manual (PPM) principles is proposed. More controlled entries/exits avoid random movements to/from SH 1.

Off highway parking provision should be reviewed, at the SAR stage, with Horowhenua DC, to ensure that retail/commercial businesses meet District Plan requirements.

7.1.5 Side Roads

7.1.5.1 Honi Taipua Street Link

This intersection is very substandard with the rail underpass restricted to one lane (an exiting HCV would block the underpass for any highway traffic turning left or right). The intersection also has sub-standard visibility to the south, but this can be improved by vegetation control.

Given the sub-standard nature of the rail underpass and low volumes which use the intersection it is recommended that the intersection be closed.

In concluding ii) above it is assumed that KiwiRail have no plans or interest in upgrading the rail underpass, but this needs to be confirmed with them at the SAR stage. On the very small possibility that the underpass was upgraded, a review of side road connections to the highway on the east side should be revisited.

7.1.5.2 Mokena Kohere Street

The existing layout is functional and would be improved further by removal of the southbound passing lane and increasing the rail limit line offset to 23 m. If the shift west to provide this separation is pursued headlight conflict will need to be carefully considered.

7.1.5.3 Waikawa Beach Road

This intersection services the beach community and a number of rural properties. Layout is also functional and would benefit from the removal of the southbound passing lane.

At the SAR stage review the intersection layout as part of the package of work.

7.1.6 Cross Movements

See Section 7.1.3 above, particularly noting the likely random pedestrian crossing pattern and the need to better control this behaviour. There will also be vehicle cross movements as residents on the east side make use of the retail/commercial facilities on the west side of the highway. A small number of cyclist cross movements is also likely. No information has been gathered to quantify the local cross movements and this should be further investigated at the next stage.

There are also those cross movements which result from southbound drivers parking on the east side of the highway and vehicle occupants walking across the highway to the retail/commercial businesses. With the traffic volume in the order of 15,000 vpd (2013) this is very dangerous and some of those crossing may get caught on the centreline. A number of the alternatives/options will assist to make this much safer (80 km/h zone, flush median, etc) also see Section 7.1.3 above. Whilst considered dangerous, it is noted that there are no recorded pedestrian crashes in the 10 year crash history.

7.1.7 Heavy Vehicle Volumes

The predicted increase in on road freight movement will inevitably result in more, heavier and potentially longer HCVs in the future. This puts more strain on other road users. Hence this adds weight to the argument to widen the cross section and install a flush median as safeguards against a reducing road safety and traffic management performance.

7.1.8 Rail Seperation on Mokena Kohere Street

The NIMT railway has a separation from the limit line on SH1 of 16 m. See Section 7.1.5.2 above for possible treatment to increase the rail and limit line separation to at least 23 m. The HCV number exiting the intersection will be largely those associated with the fertiliser depot and those who have a range of business on the eastern side. It is anticipated that turns out of Mokena Kohere St will be both left and right, with no dominant movement (to be substantiated at the SAR stage). If shifting the highway to the west proves difficult, a back-up part option is to provide sufficient width beyond the left hand radius to allow a HCV driver to pull off onto a sealed area along the highway (not an acceleration lane, but a protection width).

7.1.9 Cross Section and Shoulder Width

There is reference in the sections above to a consistent cross section. The current cross section nominally consists of two 3.4 m wide lanes and sealed shoulders which vary from 0.6 m to 1.7 m. The proposal is to provide a consistent cross section - 2 x 3.5 m lanes, 2 x 2.0 m sealed shoulders and a 2.0 m flush median between the threshold treatments. If road reserve width is tight, kerb and channel can be introduced to ensure widening stays as close to current road reserve width as possible (to be investigated). At intersections, particularly Mokena Kohere St and Waikawa Beach Rd, the seal width is determined by turning lanes, both left and right or by the requirements of the PPM. The cross section finally provided should be consistent with ultimate four laning (if it is constructed within the settlement) which will likely see widening occur on the western side (noting the constraints).

7.1.10 Proximity of Lighting and Power Poles to Carraigeway

The lighting through Manakau is provided almost entirely by lighting arms retro-fitted to the power poles on the northbound side of the road, whilst there are also several frangible lighting poles on the southbound side around the Mokena Kohere Street intersection. All are within the road reserve. Consideration should be given to undergrounding the overhead power as a preference, hence eliminating power poles. Or as a minimum, relocating poles out to the road reserve boundary. Lighting may then be provided by frangible light poles, which can also be located as far back as practicable as part of the seal widening proposal. This reduces hazards which figure prominently in objects hit in the crash history. Alternatively, crash cushions are available that will reduce the severity of impacts, however models that will provide the appropriate level of protection for this level of road are generally of a size that would constrict access to any nearby properties.

7.1.11 North Island Main Trunk Railway

The railway runs parallel with the highway on its eastern side for the entire approx. 1 km length, with an offset of approximately 16 m. It does deviate away at the southern end just after the underpass. Consideration was given to the possibility of shifting the railway to the east (to increase current intersection separation and to allow ultimate 4 laning), but this is compromised by the war memorial and related garden (between the fertiliser depot and Mokena Kohere St). Relocation would be required and this should be considered at the SAR stage. For this PFR and PFR 12, four laning Solution, it has been assumed that relocation of the war memorial and garden is most unlikely. Any rail/ highway improvements have been covered in the items above.

KiwiRail will need to be consulted at the SAR stage for any Alternatives/Options which impact their asset. It is noted that Kiwirail's railway corridor will be planning for double track, which in turn may impact highway Alternatives/Options.

8 Design Statement

This project is at a feasibility stage, and therefore several assumptions have been made in the design, particularly in relation to the seal widening aspects.

The design assumptions include the following:

- The cost estimate has been based on the judgement of an engineer who has knowledge of the site.
- The cost estimate has been based on the assumption that the project can be built using proven technology.
- No adverse ground conditions are encountered (e.g. contaminated material or large areas of peat).
- Regrading the carriageway would not be required but new surfacing would be laid across the entire width and length of the project.
- Earthwork batter slopes are assumed to be 6H:1V for fills and 3H:1V for cuts. Earthwork extents have been estimated as no topographical survey data is available.

Whilst the overall project length studied is 1.0 km, the section over which the general improvements such as seal widening would take place is 0.86km, between Waikawa Beach Road (RP 8.12) and Honi Taipua Street (RP 8.98). Therefore, while the economics of the option are considered only for this 0.86 km length, the full 1 km has been considered in the crash analysis in order to ensure that all crashes influenced by the Waikawa Beach and Honi Taipua Street intersections have been included in the analysis.

It has been assumed that the existing carriageway will largely be retained, with a seal widening formed on the railway reserve to the east of the existing formation to achieve the design road width. In lieu of geotechnical testing the depth of pavement construction has been based on local knowledge and typical sections provided for RoNS projects to the south. This allows for 350 mm of sub-base and 150 mm of M4 base course with a chip seal surface.

The 80 km/h speed restriction is recommended because of the clear safety gains and the appropriateness of an 80 km/h speed limit through a rural township. A threshold treatment at either end of the township is a relatively inexpensive way of reinforcing this.

Thresholds can be installed in accordance with Guidelines for Urban-Rural Speed Thresholds RTS 15 (LTSA, 2002), such as the examples in Figure 8-1 and Figure 8-2, below. The threshold signs may include a symbol or message designed by the local community (Figure 8-3).

A flush median and widened shoulders will address some of the safety issues caused by turning traffic, and improve the safety of pedestrians. The flush median, along with kerb and channel in parts of the settlement, will create a road environment that reflects the 80 km/h speed limit. A typical cross section is shown in Figure 8-4. As part of the widening, the private property accesses can be improved to a safer standard.

The passing lane north of Manakau will be removed in accordance with PFR 11 Route Improvements (Passing Lanes), and to reduce vehicle speeds entering the township and improve the safety at Waikawa Beach Road.

SH 1 N will be realigned and the intersection improved at Mokena Kohere Street, to allow for the storage of a 23 m design vehicle between the railway tracks and the limit line at SH 1. The railway underpass on Honi Taipua Street may also be closed as there is insufficient room to provide a safe intersection layout for right-turning traffic.

Retail/commercial development along the highway through Manakau Settlement needs to be considered, as it is currently creating issues with cross movements from the residential centre to some commercial properties, i.e. the dairy. The dairy could be relocated to the same side of SH 1 as the township to alleviate this problem.

Where the existing roadside environment restricts road widening and the batter slopes are non-traversable, safety barriers will be installed. Infrangible objects such as lighting and power poles may be placed underground, relocated or protected by safety barriers or crash cushions. This is particularyly relivant around Honi Taipua Street.

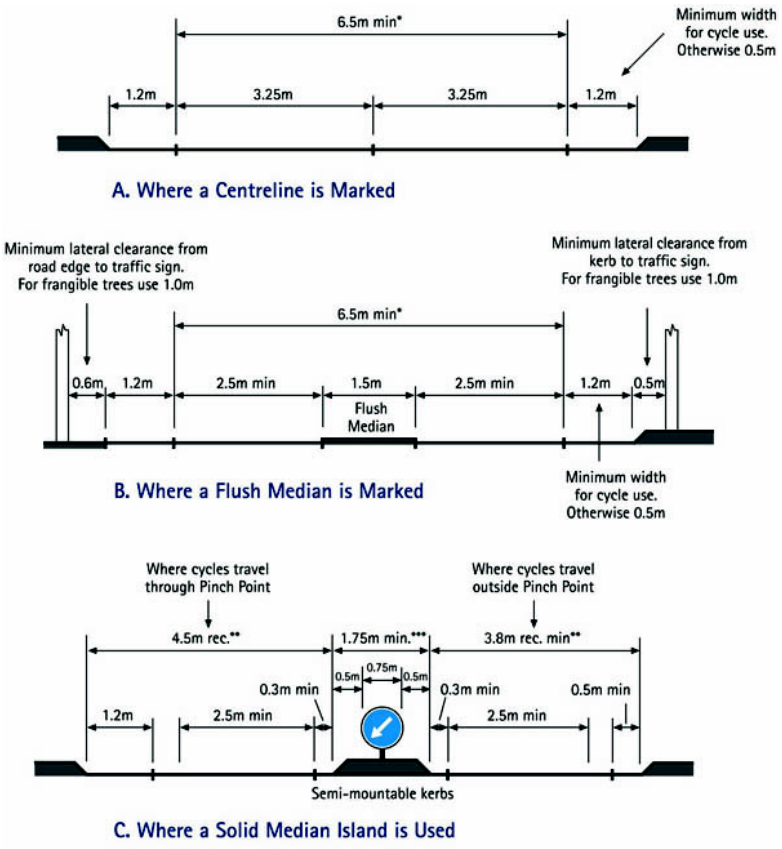


Figure 8-1: Threshold treatment cross-sections

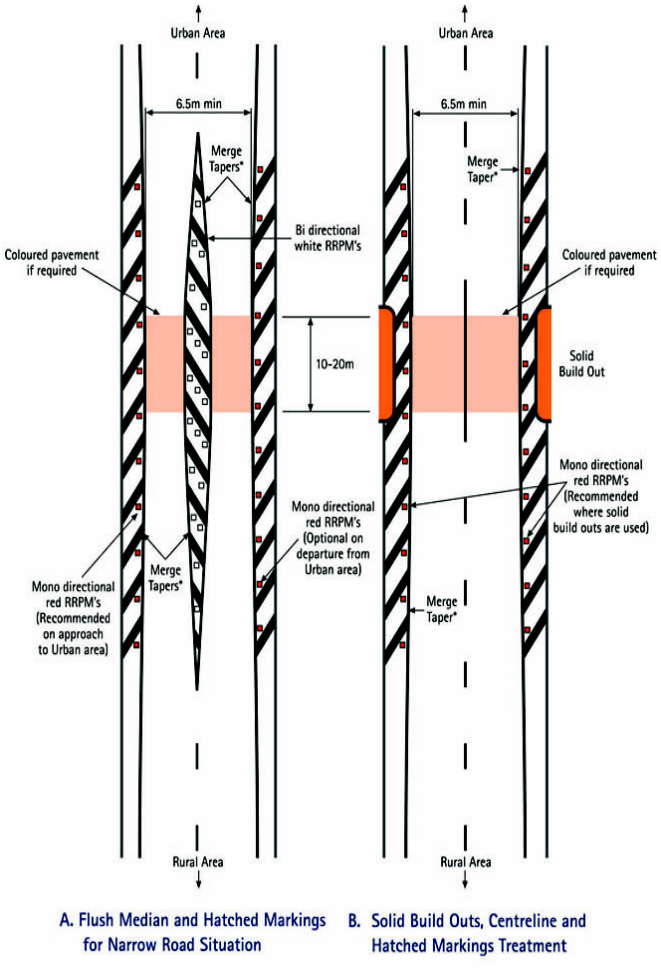


Figure 8-2: Threshold treatment plan views

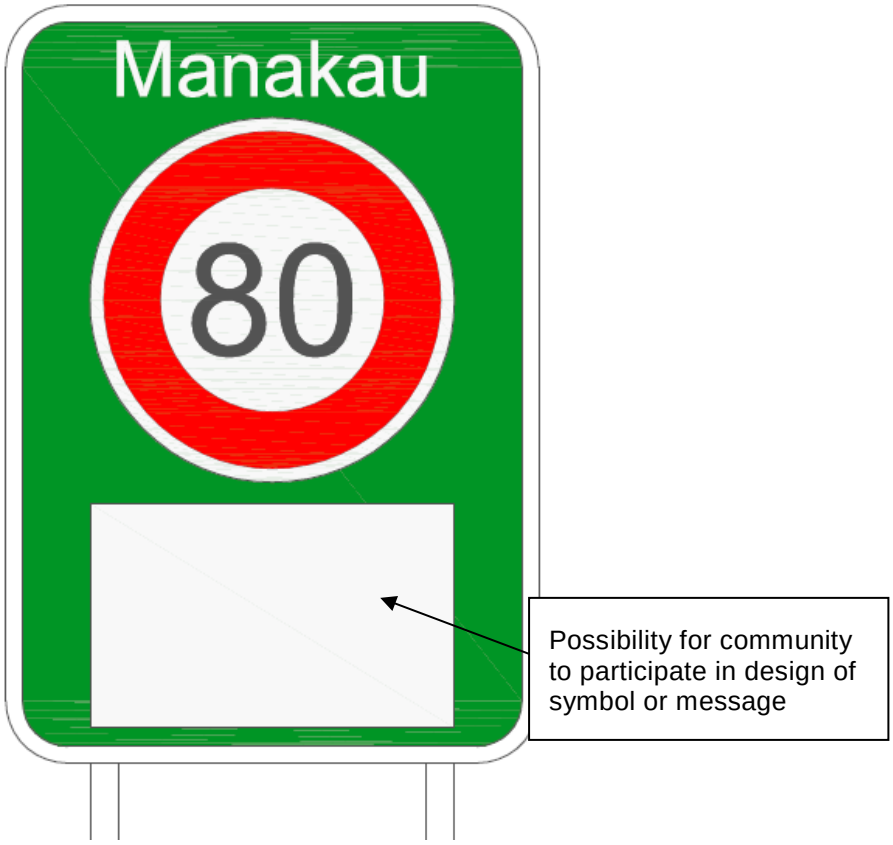


Figure 8-3: Threshold sign concept

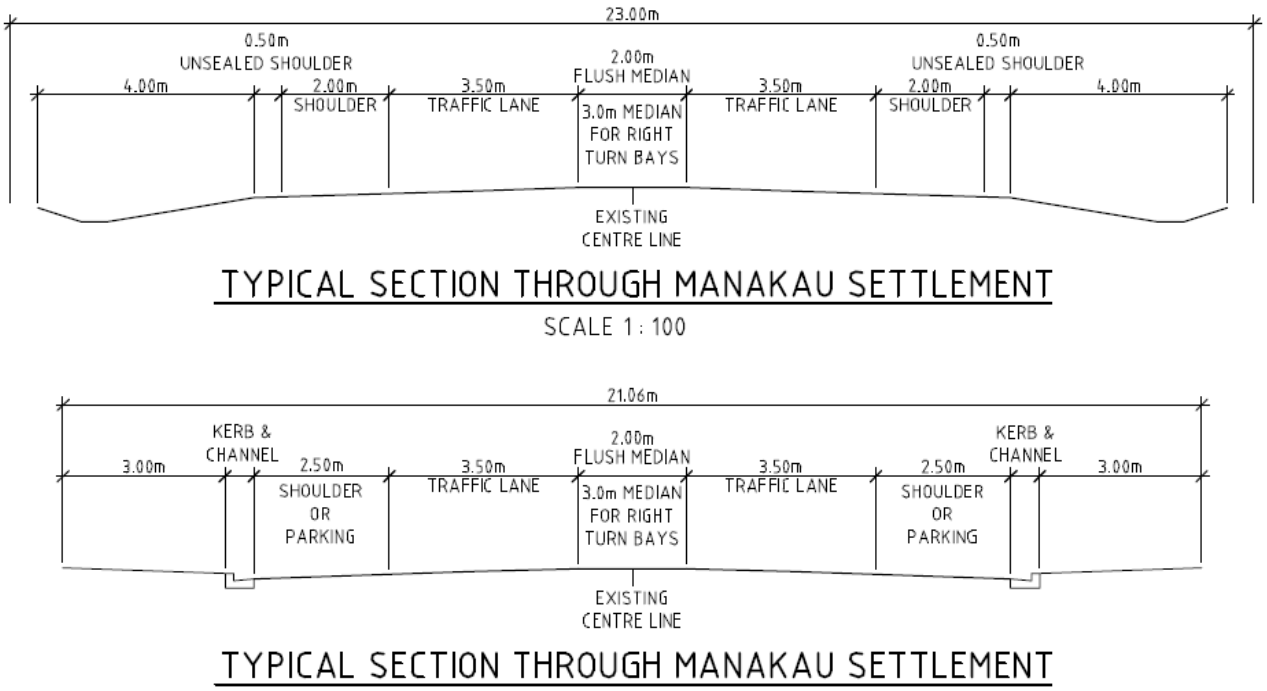


Figure 8-4: Typical cross sections

9 Cost Estimates

Feasibilty estimates have been prepared and should be seen as very rough order costs, noting the level of data and information available at this PFR stage.

Table 9-1: Cost Estimate (undiscounted)

Option Description	Expected Estimate	95th Percentile Estimate
All improvements	$1,950,150	$2,486,550

More detail of the cost estimates for the options are given in Appendix E.

10 Economic Assessment and Risk Assessment

Speed limit warrants tend to be a balanced consideration of the comfort/relieved anxiety of a community and a level of service for highway users which they will see as satisfactory (and hence will generally observe the speed limit). The introduction of a changed speed limit does therefore not go through an economic evaluation. With that in mind the introduction of an 80 km/h zone has not been economically tested for travel time and vehicle operating cost disbenefits. The economics is purely based on the crash reduction predicted as a result of the package of improvements identified – hence this sways in the direction of the balance being in favour of the community and that is considered a defendable position. Therefore; the main economic comparison for this PFR is to assess the level of safety benefit that can be derived from the package of improvements outlined. The Do Minimum is deemed to be maintenance of the existing asset.

10.1 Crash Benefits

Both 5 year and 10 year crash histories have been extracted (to understand the underlying risk) and a crash by crash analysis undertaken to derive the annual crash cost. Given the diverse nature of the improvements proposed, an experienced Principal Safety Engineer/Economic Analyst has judged the likely crash saving for the two BCRs.

Only those crashes which the improvement work is deemed to have a positive influence on have been counted towards the crash savings of the improvements. These, as a percentage of all crashes over the study periods, form the expected crash reductions used in the economic analysis. These have been noted as such in the crash list report in Appendix C.

Benefits have then been calculated based on the most optimistic, pessimistic and median crash reductions expected. The optimistic scenario is that all of the crashes theoretically preventable by the improvements will in fact be achieved. The pessimistic scenario is that only half of them will be achieved. The median crash reduction, that 75% of the theoretical reductions will be achieved, has taken forward for economic analysis. These are shown in Appendix F.

10.2 Benefit Cost Ratio Results

Table 10-1: Benefits - crash costs annual and discounted (30 years @ 8%)

Option Description	Annual Benefits	Discounted Benefits
All improvements (5 yr. crash history)	$165,000	$1,810,000
All improvements (10 yr. crash history)	$477,000	$5,240,000

Table 10-2: BCRs

Option Description	5 Year Crash History	10 Year Crash History
All improvements	0.9	2.7

A comparison of BCRs for the range of crash reductions between the pessimistic and optimistic scenarios has been included as a sensitivity analysis.

Table 10-3: Sensitivity Analysis of BCRs

Option Description	5 Year Crash History	10 Year Crash History
All improvements	0.7 – 1.2	1.9 – 3.6

10.3 Intangible benefits

Community comfort (or discomfort) is often under-estimated. For now this can be viewed as an intangible benefit, but in the SAR will be quantified. Communities will definitely respond in a positive manner to initiatives that make their environment safer. It remains to be seen if road closures will be endorsed by the community as a safer solution. Research does back this up as factual with two similar side roads having some 60% greater crash risk compared to one consolidated side road.

10.4 Risk Assessment

The risks to the project have been assessed using the General Approach as determined in the NZTA Risk Management Process Manual (AC/Man/1).

The major potential risks associated with the Manakau Township improvement project are considered to be:

- Project unable to get funded due to constrained funding environment.
- Local opposition to the project primarily due to the closure of Honi Taipua Street and the relocation of businesses and their accesses.
- Inaccurate cost estimate due to level of available data at this feasibility state, including utility information and assumptions in regards to passing lanes, turn around areas and seal type.
- Traffic delays during construction.
- Environmental effects during construction.
- Impacts on existing services
- Land acquisition difficulties
- Difficulties in obtaining resource consents and/or alteration to designation
- Opposition from local iwi
- Additional landowner accommodation works required
- Railway land is unable to be used for the widening, necessitating the purchase of private land on the western side

11 Assessment Profile

The Government Policy Statement on Land Transport Funding (GPS) requires the NZTA to consider a number of matters when evaluating projects. To assist in understanding how projects perform against these matters and hence what investment decisions to make, the NZTA utilises an assessment profile process.

The assessment profile is a three-part rating for an activity, rated as high, medium or low e.g. HMM, and representing the assessment for Strategic Fit, Effectiveness and Efficiency respectively. It is considered that the assessment profile[2] for Manakau Township is **HHM**. The following paragraphs outline how this profile has been created.

[2] NZTA Planning and Investment Knowledge Base, www.pikb.co.nz/assessment-framework

It should be noted that if this project in its entirety is not deemed economic or efficient, all or several of the improvements can be considered in isolation for the minor improvement programme.

11.1 Strategic Fit

The strategic fit factor is a measure of how an identified problem, issue or opportunity that is addressed by a proposed activity or combination of activities, aligns with the NZTA's strategic investment direction.

As this project is part of a Road of National Significance and is classified as a High Risk Rural Road, the Strategic Fit is **High**.

11.2 Effectiveness

The effectiveness factor considers the contribution that the proposed solution makes to achieving the potential identified in the strategic fit assessment and to the purpose of the Land Transport Management Act (LTMA).

A wide range of assessment factors are available for use in this effectiveness rating and these draw from the five LTMA areas of:

- Economic Development
- Safety and Personal Security
- Access and Mobility
- Public Health
- Environmental Sustainability

A number of other key criteria need to be considered including integration, consideration of options and responsiveness.

As this project is part of the Roads of National Significance programme, it is recommended that the effectiveness factor for RoNS projects of **High** is adopted.

This is considered appropriate as the project will contribute positively to safety and is consistent with NZTA's strategies and plans.

11.3 Efficiency

The economic efficiency assessment considers how well the proposed solution maximises the value of what is produced from the resources used. This is primarily undertaken by the Benefit Cost Ratio.

As this project has a BCR of 0.9 for the 5 year crash history and 2.7 for the 10 year crash history, the efficiency rating is **Medium**.

12 Social and Environmental Assessment

The Scoping Report phase of the Otaki to Levin RoNS identified a number of social and environmental factors relating to the Manakau PFR which will need to be assessed during the scheme assessment phase. The main issues relate to:

- historic building in the proximity of SH1 (Former Methodist Church)
- proposed deviation of the highway opposite the War Memorial Garden to achieve separation between the railway crossing and the highway (intersection of SH1 and Mokena Kohere Street)

Consultation has been carried out on a high level under the scoping phase of the Otaki to north of Levin RoNS and on-going consultation will continue with stakeholders throughout the planning and design process. The area is identified as being of cultural importance to the iwi of Rangitane o te Whanganui a Tara, Ngati Raukawa ki te Tonga and Ngati Toa Rangitira.

A Consultation Plan for the project area and consultation will be undertaken in accordance with the plan. The purpose of the plan is to:

- Provide a documented process for intended engagement with the community, including the project context, the parties involved, and desired outcomes;
- Maximise effective and efficient engagement of community within generally tight time constraints;
- Provide the specifics of consultation to be undertaken, including timeframes;
- Help the project team to proactively manage risks to the project/project future from inappropriate or inadequate community engagement; and
- Help the project team to constructively manage community expectations.

13 Geotechnical Requirements

A preliminary geotechnical appraisal report was prepared by MWH in 2011. This report outlined that the majority of the stretch of the highway is underlain by beach deposits (Otaki Sandstone). To investigate the subsurface conditions along the alignment which includes the Manakau Township study area, MWH recommended field investigations consisting of hand-auger bores, boreholes and test pits.

The preliminary geotechnical appraisal report for the Otaki to Levin RoNS noted the following aspects in regards to the subject study area:

- It has moderate settlement potential;
- It has a seismic potential due to the proximity of the active Northern Ohariu Fault;
- It has moderate susceptibility to liquefaction; and
- It is not located within a tsunami influence zone.

14 Land Requirements

The realignment of the Mokena Kohere St / SH 1 intersection will require approx. 1000 m^2 of land. These land requirements may require the relocation of the War Memorial Park and dairy.

Generally the widening, with flush median, will increase the existing road reserve width from just over 20 m, to 23 m, or 21 m if kerb and channel is used (in constrained locations). As discussed in the risk assessment, it is assumed that the road widening can be accommodated within the rail reserve, thus not requiring the purchase of any land. The SAR investigation will determine the extent of any land required. Land to provide off road parking for retail/commercial businesses will need to be discussed with Horowhenua DC during the SAR stage.

15 Resource Management Issues

The project must meet all statutory requirements. There are a number of documents (both statutory and non-statutory) that must be considered when planning for the state highway improvements. In particular, the requirements of the Resource Management Act, the operative Horowhenua District Plan and the Horizons Regional Plan (proposed One Plan) will be assessed to ensure that the proposed project meets the plan provisions and follows the statutory process.

15.1 District Plan Provisions

15.1.1 Designations

SH1 is designated under the operative Horowhenua District Plan for “state highway purposes” (D2) (Map 27). The existing designation is narrow in places and may need to be altered to accommodate the road improvements. The proposed deviation of the highway to accommodate an acceptable separation from the railway crossing will require an alteration to the designation. Accordingly, it is recommended that the

designation boundaries be altered to accommodate these works under s181 RMA. NZTA will be required to give notice to the Council of its requirement to alter the designation (NOR). An outline plan will also be required to indicate the scale of the prosed works within the designation.

Sections of SH1 run alongside the railway line. The railway corridor is designated as D1 under the District Plan.

15.1.2 Heritage Issues

Schedule 2 – Heritage Features of the District Plan identifies the Former Methodist Church (H25) (Map 29) located on SH1 in the vicinity of the proposed works.

The War Memorial Sarcophagus is identified as H20 (Map 29) located in Honi Taipua Street. This heritage site is close to the improvements proposed at the intersection of SH1 and Mokena Kohere Street.

15.2 Regional Plan Provisions

The final designs and construction plans will determine what regional consents are required. But given that there are no water courses or substantial earthworks in the immediate vicinity of the proposed works, it is unlikely that any consents will be required.

15.3 Other Provisions

Given that the proposed works may involve minor earthworks around the proposed deviation, there is the potential to unearth Maori artefacts. Current information does not identify any known sites but an archaeological authority may be required should a site be discovered.

16 Maintenance Issues

Routine maintenance costs can be considered to be neutral. A full-width reseal will be carried out as part of the improvements. This has been included in the comparison in costs between the improvements and the Do Minimum.

The current proposals would result in two specific changes to the maintenance regime:

- maintenance and repair of the w-section road safety barriers; and
- maintenance of a wider seal width.

Both these aspects have been included in the economic evaluations of the options.

17 Conclusions and Recommendations

A variety of road safety and traffic management improvement options were considered, for which benefits and costs were determined. The expected cost estimate to achieve all of the improvements considered is $1.95M.

Indicative BCRs were derived from predicted crash cost savings alone. For all improvements being carried out, the BCR is 0.9 (5 year crash history) or 2.7 (10 year crash history). The options are such that many can also be considered as standalone, but a BCR for each is not credible to derive.

The economic result indicates that all improvements are viable as a package, underpinned by an 80 km/h speed limit, and this is recommended to be taken forward into the SAR phase.

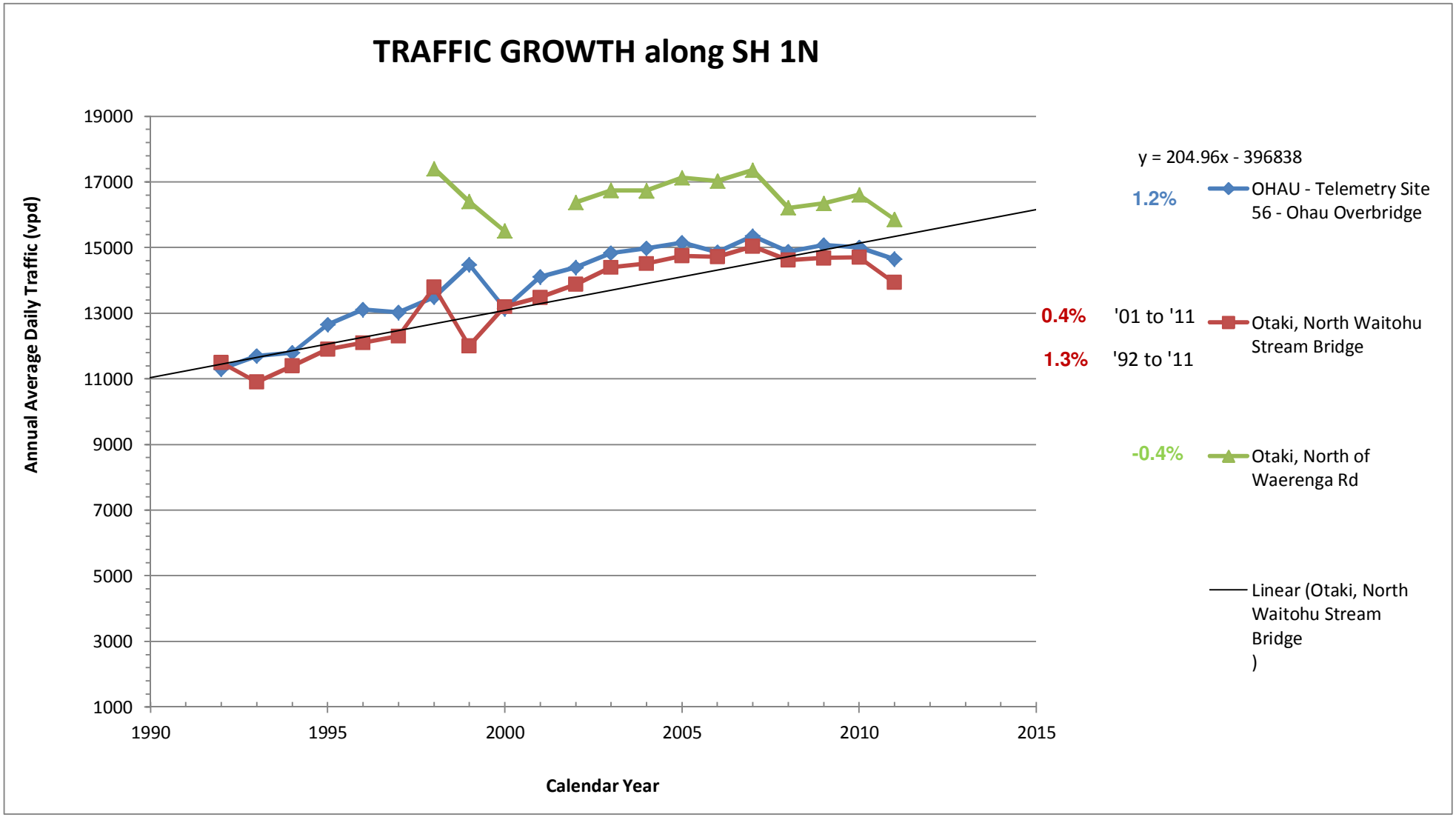
This report should be read in conjunction with the wider Otaki to North of Levin PFRs, which includes an option in Report No. 12, Four Lane Alignments, for a potential re-routing of SH 1 around Manakau settlement to the west, as well as keeping widening the existing highway to the west, if a historic building can be relocated, as an option to be further considered.

Appendix A Photographs

Looking South from Waikawa Beach Road

Looking North from Honi Taipua Street

Appendix B Traffic Data


TRAFFIC GROWTH along SH 1N
Annual Average Daily Traffic (vpd)
19000
17000
15000
13000
11000
9000
7000
5000
3000
1000
1990
1995
2000
2005
2010
2015
Calendar Year
y = 204.96x - 396838
1.2%
OHAU - Telemetry Site 56 - Ohau Overbridge
0.4%
'01 to '11
1.3%
'92 to '11
Otaki, North Waitohu Stream Bridge
-0.4%
Otaki, North of Waerenga Rd
Linear (Otaki, North Waitohu Stream Bridge)

Appendix C Crash Data

CRASH LIST DETAIL REPORT

Run on: 22 Nov 2012

Crash List: Manakau Township 2007 to 2011 (16 crashes)

Total Injury Crashes:	5
Total Non-Injury Crashes:	11
	16

Crash Type	Number	%
Overtaking Crashes:	1	6
Straight Road Lost Control/Head On:	2	13
Bend - Lost Control/Head On:	1	6
Rear End/Obstruction:	7	44
Crossing/Turning:	4	25
Pedestrian Crashes:	0	0
Miscellaneous Crashes:	1	6
TOTAL:	16	100 %

Location	Local road	%	St.Highway	%	Total	%
Urban	0	0	1	6	1	6
Open road	0	0	15	94	15	94
TOTAL:	0	0	16	100	16	100 %

Intersection/Midblock	Number	%
Intersection:	4	25
MidBlock:	12	75
TOTAL:	16	100 %

Environmental Factors	Number	%
Light/Overcast Crashes:	12	75
Dark/Twilight Crashes:	4	25
TOTAL:	16	100 %
Wet/Ice:	3	19
Dry:	13	81
TOTAL:	16	100 %

Day/Period	Number	%
Weekday	8	50
Weekend	8	50
TOTAL:	16	100 %

Vehicles	Number	%
Car	20	88
Van/Ute	2	13
Truck	3	13
Bus	0	0
Motorcycle	1	6
Bicycle	0	0
TOTAL:	26	120 %

Note: Percentages represent the % of crashes in which the vehicle, cause or object appears.

Crash factors (*)	Number	%
Alcohol	2	13
Too fast	1	6
Failed Giveway/Stop	2	13
Overtaking	1	6
Incorrect Lane/posn	3	19
Poor handling	2	13
Poor Observation	9	56
Poor judgement	2	13
Fatigue	2	13
Disabled/old/ill	1	6
Vehicle factors	4	25
Other	3	19
TOTAL:	32	202 %
Crashes with a:		
Driver factor	25	158 %
Environmental factor	0	0

(*) factors are counted once against a crash - ie two fatigued drivers count as one fatigue crash factor.

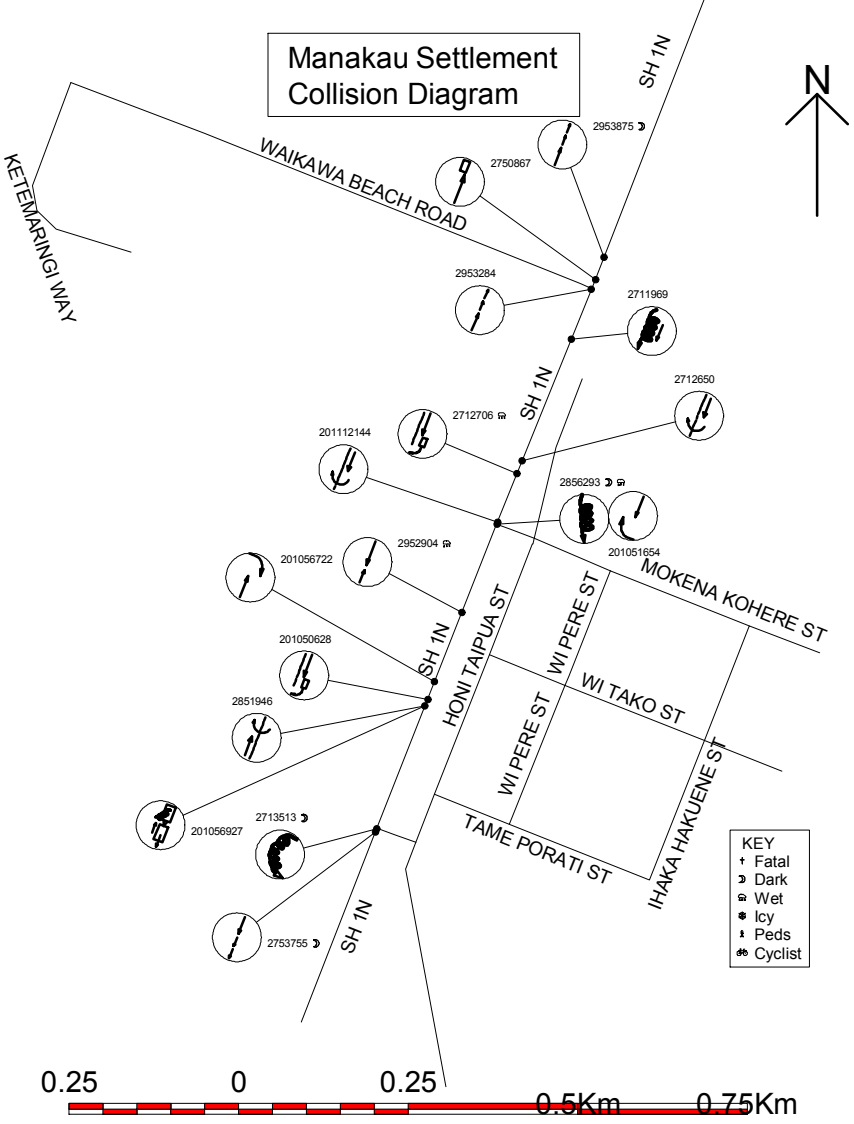
Note: Driver/vehicle factors are not available for non-injury crashes for Northland, Auckland, Waikato and Bay of Plenty before 2007. This will influence numbers and percentages.

Crashes with objects(s) struck	5	31 %

Object Struck	Number	%
Cliff Bank	1	6
Fence	2	13
Kerb	1	6
Parked Vehicle	1	6
Post Or Pole	3	19
Roadworks	1	6
Traffic Sign	1	6
TOTAL:	10	62 %

Crash Numbers

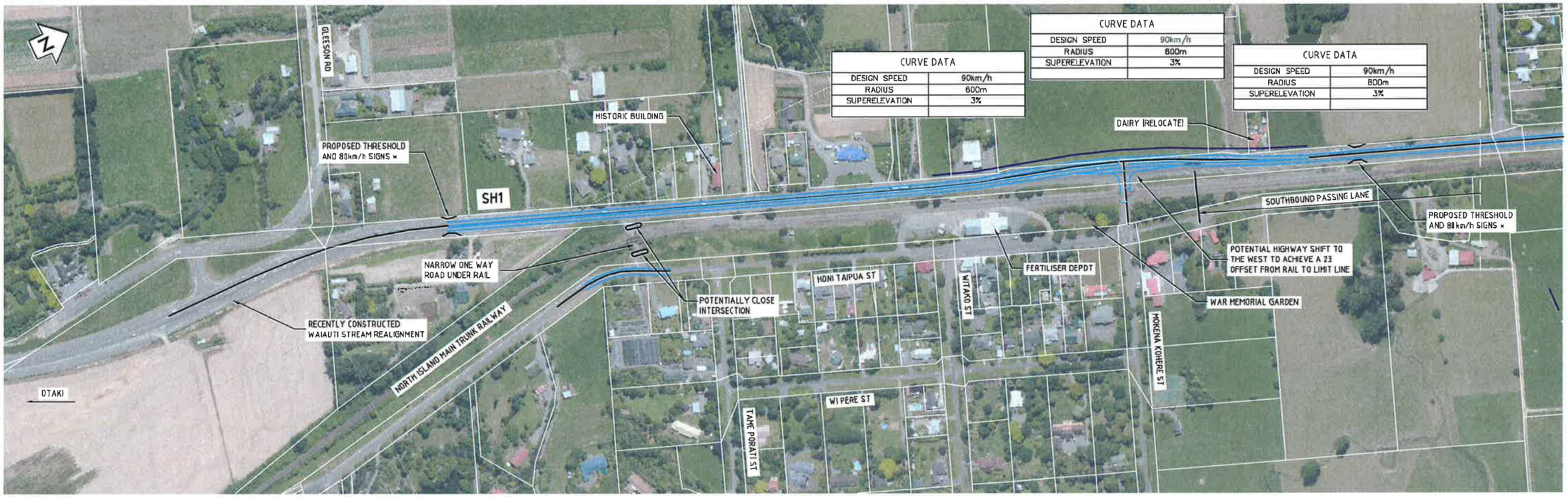
Year	Fatal	Serious	Minor	Non-Inj
2007	0	0	4	2
2008	0	0	0	2
2009	0	0	0	3
2010	0	0	0	4
2011	0	0	1	0
TOTAL:	0	0	5	11


Manakau Settlement
Collision Diagram
N
SH 1N
WAIKAWA BEACH ROAD
KETEMARINGI WAY
2953875
2750867
2953284
2711969
2712650
2712706
201112144
2856293
201051654
MOKENA KOHERE ST
2952904
201056722
201050628
2851946
HONI TAIPUA ST
WI PERE ST
WI TAKO ST
WI PERE ST
IHAKA HAKUENE ST
TAME PORATI ST
201056927
2713513
2753755
KEY
Fatal
Dark
Wet
Icy
Peds
Cyclist
0.25
0
0.25
0.5Km
0.75Km

CRASH ROAD	CRASH DIST	CRASH DIRN	INTSN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT	TYPE	VEHICLES	CAUSES	OBJECTS STRUCK	ROAD CURVE	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	ROAD MARK	SPD LIM	CRASH FATAL (	CRASH SEV CNT	CRASH MIN CNT
1N/985/8.101	15	N		WAIKAWA WAIKAWA	2750867	4/03/2007	Sun	1919	EA	OTHER	CN1C	129A 358A 134A 151A	FMP	R	D	B	F		N	C	100	0	0	0
1N/985/8.196	80	S		BEACH ROAD MOKENA	2711969	24/03/2007	Sat	1653	AD	RUNOFF	CS1TT	153A 351B 370B		R	D	B	F		N	C	100	0	0	1
1N/985/8.41	80	N		KOHERE ST	2712706	1/07/2007	Sun	1145	GC	OTHER	CS1C	640B 921		R	W	OF	L	D	N	L	100	0	0	2
1N/985/8.979	300	N		GLEESON ROAD MOKENA	2753755	8/07/2007	Sun	1800	FD	OTHER	CS1C	331A		R	D	DO	F		N	C	100	0	0	0
1N/985/8.39	100	N		KOHERE ST MANAKAU RAIL	2712650	27/07/2007	Fri	1124	MC	INTERSECTION	VS1C	372B 103A 111A		R	D	B	F		N	C	100	0	0	1
1N/985/8.973			I	UNDERPASS	2713513	12/10/2007	Fri	2330	DB	RUNOFF	CS1	692A 103B 372B	CP	R	D	DN	F	T	G	C	50	0	0	1
1N/985/8.779	500	N		GLEESON ROAD	2851946	27/04/2008	Sun	1530	MB	INTERSECTION	MN14	929		R	D	B	F	D	N	C	100	0	0	0
1N/985/8.49			I	MOKENA	2856293	25/11/2008	Tue	435	CB	RUNOFF	CS1	129A 410A	KP	R	W	DO	L	T	G	C	100	0	0	0
1N/985/8.116			I	WAIKAWA MOKENA	2953284	9/04/2009	Thu	1100	FD	OTHER	CN1CC	181A 191C 412A 137B		R	D	O	F	T	N	C	100	0	0	0
1N/985/8.633	140	S		KOHERE ST WAIKAWA	2952904	23/05/2009	Sat	1602	BA	HEADON	TS1C	197B 197A 331A	R	R	W	O	L		N	C	100	0	0	0
1N/985/8.066	50	N		BEACH ROAD	2953875	31/07/2009	Fri	1701	FD	OTHER	CN1C	358A		R	D	TF	F		N	C	100	0	0	0
1N/985/8.769	650	S		WAIKAWA MOKENA	201050628	7/02/2010	Sun	1538	GC	OTHER	CS14	372B 921 301B 375B		R	D	B	F	D	N	C	100	0	0	0
1N/985/8.49			I	KOHERE ST	201051654	11/04/2010	Sun	1650	JA	INTERSECTION	CS14	507B		R	D	B	F	T	S	C	100	0	0	0
1N/985/8.777	500	N		GLEESON ROAD MOKENA	201056927	8/12/2010	Wed	720	QG	OTHER	VS1	665A 308B 382B	FS	R	D	B	F		N	N	100	0	0	0
1N/985/8.74	250	S		KOHERE ST WAIKAWA	201056722	24/12/2010	Fri	1420	JA	INTERSECTION	CN14	921 372B 381B		R	D	B	F	D	N	L	100	0	0	0
1N/985/8.486	370	S		BEACH ROAD	201112144	23/05/2011	Mon	1240	MC	INTERSECTION	CS14	645B		R	D	O	F		N	C	100	0	0	1

Crashes										
Movement	#	%	F	S	M	N	Total			F+S Casualities (Dsi)
INTERSECTION	5	31%	0	0	1	4	5			0
HEADON	1	6%	0	0	0	1	1			0
RUNOFF	3	19%	0	0	2	1	3			0
OTHER	7	44%	0	0	2	5	7			0
total	**16**	**100%**	**0**	**0**	**5**	**11**	**16**			**0**

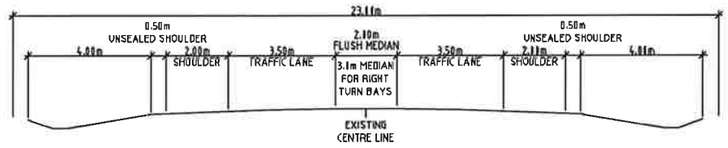
Appendix D Outline Plans



CURVE DATA	
DESIGN SPEED	90km/h
RADIUS	600m
SUPERELEVATION	3%

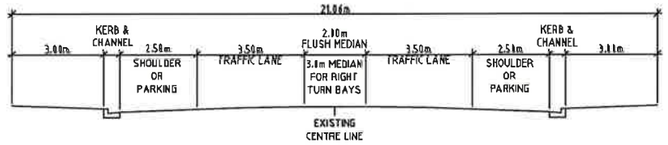
CURVE DATA	
DESIGN SPEED	90km/h
RADIUS	800m
SUPERELEVATION	3%

CURVE DATA	
DESIGN SPEED	90km/h
RADIUS	800m
SUPERELEVATION	3%



TYPICAL SECTION THROUGH MANAKAU SETTLEMENT

SCALE 1 : 100



TYPICAL SECTION THROUGH MANAKAU SETTLEMENT

SCALE 1 : 100

LEGEND

- ROAD CENTRELINE
- WIDENING OF EXISTING CARRIAGEWAY
- GREENFIELDS CARRIAGEWAY
- INDICATIVE GRADE SEPARATION
- INDICATIVE LAND REQUIREMENT
- LAND USE - RESIDENTIAL
- LAND USE - RETAIL/COMMERCIAL

NOTE: FOUR LANE WIDENING THROUGH MANAKAU IS ENVISAGED TO BE ON THE WESTERN SIDE, UNLESS A BYPASS OPTION IS PREFERRED. WIDENING TO THE WEST OF THE EXISTING HIGHWAY IS GOVERNED BY A HISTORIC BUILDING WHICH SHOULD BE CONSIDERED FOR RELOCATION.

× PROPOSED THRESHOLD TREATMENT SIGN DESIGN CAN POTENTIALLY BE DEVELOPED IN CONJUNCTION WITH THE MANAKAU COMMUNITY (I.E. SCHOOL COMPETITION) SEE REPORT FOR TYPICAL LAYOUTS.

NOT FOR CONSTRUCTION

REV	REVISIONS	BY DRN	PP CHK	PP APP	DATE
A	PRELIMINARY	BT	PP	PP	15.02.13

SURVEYED		
DESIGNED	B. Browne	11/12
DRAWN	B. TIMBLICK	11/12
CAD REVIEW		
DESIGN CHECK	P. Peet	11/12
DESIGN REVIEW	M. Oppenhuis	11/03
APPROVED	P. Peet	02/13
PROF REGISTRATION	-	

MWH

Clients: NZ TRANSPORT AGENCY

NZ TRANSPORT AGENCY
OTAKI TO LEVIN PFRs

OPTION 2-1 - MANAKAU SETTLEMENT SAFETY & TRAFFIC MANAGEMENT IMPROVEMENTS

Status Stamp: WORKING PLOT

Date Stamp: 15 FEB 2013

Scales: 1:2500, 1:100 A1

Drawing No.: 80500902-02-001-C001 Rev. A

Appendix E Cost Estimates

Project Estimate - Form A

Project Name: Otaki to Levin PFR Study
PFR 2 (Manakau Settlement)

FE
Feasibility Estimate

Item	Description	Base Estimate	Contingency	Funding Risk
A	**Nett Project Property Cost**	**0**	**0**	**0**
	Investigation and Reporting			
	- Consultancy Fees	**55,830**	**11,170**	**18,400**
	- NZTA-Managed Costs	**0**	**0**	**0**
B	**Total Investigation and Reporting**	**55,830**	**11,170**	**18,400**
	Design and Project Documentation			
	- Consultancy Fees	**120,000**	**24,000**	**39,600**
	- NZTA-Managed Costs	**0**	**0**	**0**
C	**Total Design and Project Documentation**	**120,000**	**24,000**	**39,600**
	Construction			
	MSQA			
	- Consultancy Fees	**120,000**	**24,000**	**39,600**
	- NZTA-Managed Costs	**0**	**0**	**0**
	- Consent Monitoring Fees	**0**	**0**	**0**
	Sub Total Base MSQA	**120,000**	**24,000**	**39,600**
	Physical Works			
D1	Widen road and install flush median	577,000	115,400	190,400
D2	Realign SH 1/Mokena Kohere St	443,500	88,700	146,400
D3	Threshold Treatments	40,000	8,000	13,200
D4	Honi Taipua Road Closure	25,000	5,000	8,300
D5	General Improvements	75,000	15,000	24,800
D6	Service Relocations	168,750	33,800	55,700
D7	Extraordinary Construction Costs	0	0	0
D8	(blank)			
D9	(blank)			
D10	(blank)			
D11	(blank)			
D12	(blank)			
D13	(blank)			
	Sub Total Base Physical Works	**1,329,250**	**265,900**	**438,800**
D	**Total Construction & MSQA**	**1,449,250**	**289,900**	**478,400**
E	**Project Base Estimate** (A+B+C+D)	**1,625,080**		
F	**Contingency** (Assessed / Analysed) (A+B+C+D)		**325,070**	
G	**Project Expected Estimate** (E+F)		**1,950,150**	
	Project Property Cost Expected Estimate		**0**	
	Investigation and Reporting Expected Estimate		**67,000**	
	Design and Project Documentation Expected Estimate		**144,000**	
	Construction Expected Estimate		**1,739,150**	
H	**Funding Risk** (Assessed / Analysed) (A+B+C+D)			**536,400**
I	**95th Percentile Project Estimate** (G+H)			**2,486,550**
	Project Property Cost 95th Percentile Estimate			**0**
	Investigation and Reporting 95th Percentile Estimate			**85,400**
	Design and Project Documentation 95th Percentile Estimate			**183,600**
	Construction 95th Percentile Estimate			**2,217,550**

Base Date of Estimate	**29 Nov 2012**	**Cost Index**
Estimate prepared by:	**Ben Dodgshun**	**Signed**
Estimate internal peer review by:	**Marten Oppenhuis**	**Signed**
Estimate external peer review by:		**Signed**
Estimate approved by NZTA Project Manager:		**Signed**

Note: (1) These estimates are exclusive of escalation and GST.

Appendix F Economic Analysis Worksheets

MWH

Simplified Procedure 3 - General Road Improvements

GENERAL ROADING IMPROVEMENT WORKS: 5 year crash history

EVALUATION SUMMARY — WORKSHEET 1

1 Evaluator(s) Ben Dodgshun
Reviewer(s) David Wanty

2 Project / Package Details

Approved Organisation Name	NZTA
Project / Package Name	Otaki to Levin: Manakau Township PFR
Your Reference	80500802
Project Description	Safety Improvements
Describe the problem to be addressed	Reduce crashes & improve community comfort

3 Location

Brief description of location: State Highway 1, north of Waikawa Beach Road to south of Honi Taipua Road, SH 1N-985/8.12 to 985/8.98

4 Alternatives and Options

Describe the Do Minimum	Scheduled maintenance
Summarise the options assessed	Shoulder widening and flush median installation; intersection closure and re-routing; intersection realignment; roadside hazard mitigation

5 Timing

Time Zero (assumed construction start date)	1 July 2013
Expected duration of construction (Months)	6

6 Economic Efficiency

Date economic evaluation completed (mm/yyyy)	30 November 2012
Base date for costs	1 July 2012
AADT at Time Zero	15000
Traffic Growth Rate at Time Zero (%)	1.2%

Existing Roughness	2.70	IRI or NAASRA	Existing Traffic Speed	100	km/hr	(est)
Predicted Roughness	2.70	IRI or NAASRA	Predicted Traffic Speed	80	km/hr	
Length of Job Before Improvements	0.86	km	Posted Speed Limit	100	km/hr	
Length of Job After Improvements	0.86	km	Road Type	Rural Strategic		
Length of new highway		km	Gradient Before Improvements	0 - 1%		
Length of existing highway used	0.86	km	Gradient After Improvements	0 - 1%		

7 PV Cost of Do Minimum — **Cost $** $94,162 — **A**

8 PV Cost of the preferred Option — **Cost $** $2,019,168 — **B**

9 Benefit values from Worksheet 4, 5 or 6

PV Travel Time Cost savings:	$ $0	**C**	x Update Factor^{TT}	1.33	= $	NIL	**W**
PV VOC & CO2 savings:	$ $0	**D**	x Update Factor^{VOC}	1.04	= $	NIL	**Y**
PV Accident Cost savings:	$ $1,549,351	**E**	x Update Factor^{AC}	1.17	= $	$1,812,741	**Z**
PV Passing Lane savings:	$ $0	**F**	x Update Factor^{AC}	1.00	= $	NIL	**X**

10 B/C Ratio = $\frac{W + Y + Z}{B - A}$ = $\frac{\text{BENEFITS}}{\text{COSTS}}$ = $\frac{0 + 0 + 1812741 + 0}{2019168 - 94162}$ = **0.9**

11 FYRR = $\frac{1^{st}\text{ Year BENEFITS}}{\text{COSTS}}$ = $\frac{[(0+0)/12.09+1812741/10.97] \times 0.9259}{2019168 - 94162}$ = **0.08**

ACCIDENT COST SAVINGS - 5 yr history

WORKSHEET 6

Movement Category:	All	**Posted Speed Limit:**	100	**Traffic Growth Rate (%):**	1.2%
Do Min Mean Speed:	100	**Option Mean Speed:**	80		

Includes crash types: all

		Injury Severity			Non-Injury
DO MINIMUM:		**Fatal**	**Serious**	**Minor**	
1	No of Years of typical accident records		5		
2	No of Reported Accidents over Period	0	0	5	11
3	Fatal / Serious Severity Adjustment (Tables A6.19 (a) to (c))	0.19	0.81		
4	No of Reported Accidents Adjusted by Severity (3 x 4)	0	0	5	11
5	Accidents per Year (4 / 1)	0	0	1	2.2
6	Adjustment Factor for accident trend (Table A6.1(a))		0.98		
7	Adjusted Accidents Per Year (5 x 6)	0.000	0.000	0.980	2.156
8	Under-Reporting Factors (Tables A6.20 (a) & (b))	1.0	1.9	4.5	18.5
9	Total Estimated Accidents per Year (7 x 8)	0	0	4.41	39.886
10	Accident Cost, 100 km/h Speed Limit (Table A6.21 (e) to (h))	3,800,000	405,000	24,000	2,400
11	Accident Cost, 50 km/h Speed Limit (Table A6.21 (a) to (d))	3,350,000	360,000	21,000	2,100
12	Mean Speed Adjustment = (Do Min Mean Speed - 50)/50		1.00		
13	Cost per Accident = 11 + (12 x (10 - 11))	3,800,000	405,000	24,000	2,400
14	Accident Cost per Year (9 x 13)	0	0	105,840	95,726
15	Total Cost of Accidents per Year		201,566		

OPTION:					
16	Percentage Accident Reduction	0.0%	0.0%	75.0%	61.4%
17	Percentage of accidents remaining [100- (16)]	100.0%	100.0%	25.0%	38.6%
18	Predicted Accidents per Year (9 x 17)	0.0000	0.0000	1.1025	15.4105
19	Accident Cost, 100 km/h Speed Limit (Table A6.21 (e) to (h))	3,800,000	405,000	24,000	2,400
20	Accident Cost, 50 km/h Speed Limit (Table A6.21 (a) to (d))	3,350,000	360,000	21,000	2,100
21	Mean Speed Adjustment = (Option Mean Speed - 50)/50		0.60		
22	Cost per Accident = 20 + (21 x (19 - 20))	3,620,000	387,000	22,800	2,280
23	Accident Cost per Year (18 x 22)	0	0	25,137	35,136
24	Total Cost of Accidents per Year		60,273		

0

25 Accident Cost Savings = (15 -24) x **DF** = $ 1,549,351 TOTAL E

Transfer TOTAL E to position $ E on Worksheet 1.

Note: Discount Factor, **DF** = 10.97

Discount Factors (**DF**) for different growth rates and speed limits for Years 1 to 30 inclusive

	Percent Traffic Growth Rate								
Speed Limit	**0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**
50 and 60 km/h	7.35	7.92	8.48	9.05	9.61	10.18	10.74	11.30	11.87
70km/h and above	9.61	10.18	10.74	11.30	11.87	12.43	13.00	13.56	14.13

MWH

Simplified Procedure 3 - General Road Improvements

GENERAL ROADING IMPROVEMENT WORKS: 10 year crash history

EVALUATION SUMMARY — WORKSHEET 1

1 Evaluator(s) Ben Dodgshun
Reviewer(s) David Wanty

2 Project / Package Details

Approved Organisation Name	NZTA
Project / Package Name	Otaki to Levin: Manakau Township PFR
Your Reference	80500802
Project Description	Safety Improvements
Describe the problem to be addressed	Reduce crashes & improve community comfort

3 Location

Brief description of location: State Highway 1, north of Waikawa Beach Road to south of Honi Taipua Road, SH 1N-985/8.12 to 985/8.98

4 Alternatives and Options

Describe the Do Minimum	Scheduled maintenance
Summarise the options assessed	Shoulder widening and flush median installation; intersection closure and re-routing; intersection realignment; roadside hazard mitigation

5 Timing

Time Zero (assumed construction start date)	1 July 2013
Expected duration of construction (Months)	6

6 Economic Efficiency

Date economic evaluation completed (mm/yyyy)	30 November 2012
Base date for costs	1 July 2012
AADT at Time Zero	15000
Traffic Growth Rate at Time Zero (%)	1.2%

Existing Roughness	2.70	IRI or NAASRA	Existing Traffic Speed	100	km/hr	(est)
Predicted Roughness	2.70	IRI or NAASRA	Predicted Traffic Speed	80	km/hr	
Length of Job Before Improvements	0.86	km	Posted Speed Limit	100	km/hr	
Length of Job After Improvements	0.86	km	Road Type	Rural Strategic		
Length of new highway		km	Gradient Before Improvements	0 - 1%		
Length of existing highway used	0.86	km	Gradient After Improvements	0 - 1%		

7 PV Cost of Do Minimum — **Cost $** $94,162 — **A**

8 PV Cost of the preferred Option — **Cost $** $2,019,168 — **B**

9 Benefit values from Worksheet 4, 5 or 6

PV Travel Time Cost savings:	$ $0	C	x Update Factor^{TT}	1.33	= $	NIL	W
PV VOC & CO2 savings:	$ $0	D	x Update Factor^{VOC}	1.04	= $	NIL	Y
PV Accident Cost savings:	$ $4,475,003	E	x Update Factor^{AC}	1.17	= $	$5,235,753	Z
PV Passing Lane savings:	$ $0	F	x Update Factor^{AC}	1.00	= $	NIL	X

10 B/C Ratio = $\frac{W + Y + Z}{B - A}$ = $\frac{\text{BENEFITS}}{\text{COSTS}}$ = $\frac{0 + 0 + 5235753 + 0}{2019168 - 94162}$ = **2.7**

11 FYRR = $\frac{1^{st}\text{ Year BENEFITS}}{\text{COSTS}}$ = $\frac{[(0+0)/12.09+5235753/10.97] \times 0.9259}{2019168 - 94162}$ = **0.23** (z)

ACCIDENT COST SAVINGS - 10 yr history

WORKSHEET 6

Movement Category:	All	**Posted Speed Limit:**	80	**Traffic Growth Rate (%):**	1.2%
Do Min Mean Speed:	100	**Option Mean Speed:**	80		

Includes crash types: all

		Injury Severity			Non-Injury
DO MINIMUM:		**Fatal**	**Serious**	**Minor**	
1	No of Years of typical accident records	10			
2	No of Reported Accidents over Period	0	3	7	18
3	Fatal / Serious Severity Adjustment (Tables A6.19 (a) to (c))	0.19	0.81		
4	No of Reported Accidents Adjusted by Severity (3 x 4)	0.57	2.43	7	18
5	Accidents per Year (4 / 1)	0.057	0.243	0.7	1.8
6	Adjustment Factor for accident trend (Table A6.1(a))	0.98			
7	Adjusted Accidents Per Year (5 x 6)	0.056	0.238	0.686	1.764
8	Under-Reporting Factors (Tables A6.20 (a) & (b))	1.0	1.9	4.5	18.5
9	Total Estimated Accidents per Year (7 x 8)	0.05586	0.452466	3.087	32.634
10	Accident Cost, 100 km/h Speed Limit (Table A6.21 (e) to (h))	3,800,000	405,000	24,000	2,400
11	Accident Cost, 50 km/h Speed Limit (Table A6.21 (a) to (d))	3,350,000	360,000	21,000	2,100
12	Mean Speed Adjustment = (Do Min Mean Speed - 50)/50	1.00			
13	Cost per Accident = 11 + (12 x (10 - 11))	3,800,000	405,000	24,000	2,400
14	Accident Cost per Year (9 x 13)	212,268	183,249	74,088	78,322
15	Total Cost of Accidents per Year	547,926			

OPTION:					
16	Percentage Accident Reduction	75.0%	75.0%	75.0%	62.5%
17	Percentage of accidents remaining [100- (16)]	25.0%	25.0%	25.0%	37.5%
18	Predicted Accidents per Year (9 x 17)	0.0140	0.1131	0.7718	12.2378
19	Accident Cost, 100 km/h Speed Limit (Table A6.21 (e) to (h))	3,800,000	405,000	24,000	2,400
20	Accident Cost, 50 km/h Speed Limit (Table A6.21 (a) to (d))	3,350,000	360,000	21,000	2,100
21	Mean Speed Adjustment = (Option Mean Speed - 50)/50	0.60			
22	Cost per Accident = 20 + (21 x (19 - 20))	3,620,000	387,000	22,800	2,280
23	Accident Cost per Year (18 x 22)	50,553	43,776	17,596	27,902
24	Total Cost of Accidents per Year	139,827			

0

25 Accident Cost Savings = (15 -24) x **DF** = $ 4,475,003 TOTAL E

Transfer TOTAL E to position $ E on Worksheet 1.

Note: Discount Factor, **DF** = 10.97

Discount Factors (**DF**) for different growth rates and speed limits for Years 1 to 30 inclusive

	Percent Traffic Growth Rate								
Speed Limit	**0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**
50 and 60 km/h	7.35	7.92	8.48	9.05	9.61	10.18	10.74	11.30	11.87
70km/h and above	9.61	10.18	10.74	11.30	11.87	12.43	13.00	13.56	14.13

Appendix G Speed Limit Warrant Survey

SPEED LIMIT SURVEY FORM (RATING DIAGRAM)

Road Controlling Authority N2TA **At** SH1

Road _____ **From** Gleeson Road **To** 300m past Waikawa Road

Surveyed by Nakita Steele **Date** 07 / 12 / 12

	DEVELOPMENT RATING			ROADWAY RATING								
	Frontage	Side Road	**Sub Total**	Peds	Cyclist	Parking	Geom-etry	Traffic Control	Use	**Sub Total**	**Total**	Notes
1.0	2	0	2	1	0	1	3	0	0	5	7	
0.9	0	2	2	1	0	1	3	0	0	5	7	* Manakau School assumbed 100
0.8	2	0	2	1	0	1	3	0	0	5	7	* Workshop Empty at the moment
0.7	3	0	3	1	0	1	3	0	0	5	8	
0.6	5	0	5	1	0	1	3	0	0	5	10	
0.5	6	3	9	1	0	1	3	0	0	5	14	
0.4	2	0	2	1	0	1	3	0	0	5	7	
0.3	1	0	1	1	0	1	3	0	0	5	6	
0.2	0	0	0	1	0	1	3	0	0	5	5	
0.1	0	2	2	1	0	1	3	0	0	5	7	
0.0												

TO

Gleeson Road

FROM

Average rating between _____ **and** _____ **equals** _____

GENERAL INFORMATION FORM

Instructions: Circle the answer, tick the box, describe or fill-in data as appropriate

Road Controlling Authority _____ **At** _____

Road _____ **From** _____ **To** _____

Surveyed by Nakita Steele **Date** ____/____/____

1. The surrounding land environment is: Fully developed urban ☐ Low density urban ☐
   Urban fringe ☐ Rural settlement ☐ Rural selling place ☐ Fully rural ☐
   Holiday resort ☐
2. The classification of this section of road is: Arterial ☑ Collector ☐ Local ☐
3. What is the length of road under consideration? 1300 m
4. What is the current speed limit on the road? 100 km/h
5. What are the speed limits on the adjoining road sections? _____ km/h, _____ km/h
6. Are there any features that would provide suitable change points between limits?
   Yes / No Describe: _____
7. Is the road divided by a solid or flush median? (Yes) / No Solid ☐ Flush ☑
   Note: a median should extend for at least 500 metres.
8. How wide is the median? 2 m
9. Does the median provide sufficient width and turn slots to provide adequate protection for turning and crossing vehicles? (Yes) / No
10. How many lanes? 2 What is the typical lane width? 3.5 m
    Note: count only the number of through lanes normally used by drivers.
11. Note any special lanes, e.g. cycle lanes: —
12. What is the setback of the through traffic lanes to the property boundary? 3-5 m
    Note: If the development is similar on both sides of the road, use the lower value. If development is not balanced, use the setback on the more developed site.
13. Is there a consistent standard of street lighting? (Yes) / No Frangible lightings
14. What is the mean speed _____ km/h and 85th percentile speed _____ km/h for free running vehicles on this section of road?
15. Examine crash data for the section of road for the previous two years. Note any changes that have occurred that may affect crashes. _____

    Number of injury crashes / 100 million vehicle km (two year average): _____

    List any special crash types _____
16. Are there any special traffic conditions or roadside developments that may affect speeds, or require special consideration? Describe: _____

SPEED LIMIT SURVEY FORM (RATING DIAGRAM)

Road Controlling Authority _____ **At** _____

Road _____ **From** _____ **To** _____

Surveyed by _____ **Date** ____/____/____

TO		DEVELOPMENT RATING			ROADWAY RATING								
		Frontage	Side Road	Sub Total	Peds	Cyclist	Parking	Geom-etry	Traffic Control	Use	Sub Total	Total	Notes
	1100 ~~1.0~~	0	0	0	1	0	1	3	0	0	5	5	
	1200 ~~0.9~~	0	0	0	1	0	1	3	0	0	5	5	
Waikawa Beach Road	1300 ~~0.8~~	0	2	2	1	0	1	3	0	0	5	7	
	1400 ~~0.7~~	4	0	4	1	0	1	3	0	0	5	9	
	1500 ~~0.6~~	2	0	2	1	0	1	3	0	0	5	7	
	0.5												
	0.4												
	0.3												
	0.2												
	0.1												
FROM	0.0												

Average rating between _____ **and** _____ **equals** _____

GENERAL INFORMATION FORM

Instructions: Circle the answer, tick the box, describe or fill-in data as appropriate

Road Controlling Authority _____ **At** _____

Road _____ **From** _____ **To** _____

Surveyed by _____ **Date** ____/____/____

1. The surrounding land environment is: Fully developed urban ☐ Low density urban ☐
   Urban fringe ☐ Rural settlement ☐ Rural selling place ☐ Fully rural ☐
   Holiday resort ☐
2. The classification of this section of road is: Arterial ☐ Collector ☐ Local ☐
3. What is the length of road under consideration? _____ m
4. What is the current speed limit on the road? _____ km/h
5. What are the speed limits on the adjoining road sections? _____ km/h, _____ km/h
6. Are there any features that would provide suitable change points between limits?
   Yes / No Describe: _____
7. Is the road divided by a solid or flush median? **Yes / No** Solid ☐ Flush ☐
   Note: a median should extend for at least 500 metres.
8. How wide is the median? _____ m
9. Does the median provide sufficient width and turn slots to provide adequate protection for turning and crossing vehicles? **Yes / No**
10. How many lanes? _____ What is the typical lane width? _____ m
    Note: count only the number of through lanes normally used by drivers.
11. Note any special lanes, e.g. cycle lanes: _____
12. What is the setback of the through traffic lanes to the property boundary? _____ m
    Note: If the development is similar on both sides of the road, use the lower value. If development is not balanced, use the setback on the more developed site.
13. Is there a consistent standard of street lighting? **Yes / No**
14. What is the mean speed _____ km/h and 85th percentile speed _____ km/h for free running vehicles on this section of road?
15. Examine crash data for the section of road for the previous two years. Note any changes that have occurred that may affect crashes. _____

    _____

    Number of injury crashes / 100 million vehicle km (two year average): _____

    List any special crash types _____
16. Are there any special traffic conditions or roadside developments that may affect speeds, or require special consideration? Describe: _____

    _____

MWH

BUILDING A BETTER WORLD

PROJECT Otaki - Levin PFR's PROJECT NO.

DESCRIPTION Manakau Township - speed limit warrant

PREPARED BY B. Dodgshun DATE 17/12/12

CHECKED BY DATE

REF/DWGS SHEET OF

SH 1N-98s/9.40 - 7.90 (1.5km)

Total development rating = 36

Total roadway rating = 75

However, roadway > development, so reduce roadway score to same as development: (SLNZ 4.3)

Total development rating = 36

Total roadway rating = 36 (adjusted)
72

⇒ over 15 × 100m sections

R (Average rating) = 72/15

= 4.8

From Table SLNZ 12, for 6 > R ≥ 3,
speed limit = 80 km/h for all road types.