MWH now part of Stantec

OTAKI TO NORTH OF LEVIN RONS: INTERIM SAFETY IMPROVEMENTS

Prepared for the NZ Transport Agency

25 September 2017

QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
Jon England	Rob Partridge

PREPARED BY		
Dhimantha Ranatunga, Joe Southey	……....	…25/09/17…
CHECKED BY		
Rob Partridge		…25/09/17…
REVIEWED BY		
Rob Partridge		…25/09/17…
APPROVED FOR ISSUE BY		
Jon England	……....	…25/09/17…

WELLINGTON
Level 13, 80 The Terrace, Wellington 6011
PO Box 13-052, Armagh, Christchurch 8141
TEL +64 4 381 6700, FAX +64 4 473 1982

REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
1	21 Dec 2016	For Client Review	DR/JS	RP	RP	JE
2	25 Sept 2017	Final (include HDC Feedback)	DR/JS	RP	RP	JE

Executive Summary

The purpose of this study is to investigate the need for safety improvements on State Highway One (SH1), between Taylors Road and south Levin (Levin urban boundary) over the next 8 to 10 year timeframe. This study has been commissioned by the NZ Transport Agency in acknowledgement that this section of SH1 is classified as a High Risk Rural Road and that, until the design and construction of Otaki to north of Levin capital works are completed, there are expected to be a high number of high severity crashes on the existing route.

For this study, two key objectives have been agreed:

1. Provide an existing state highway that has a consistent level of road safety provision with a minimum KiwiRAP 3 star rating; and,
2. Reduce the number of deaths and serious injuries.

The focus of this study will therefore be on 'interim' safety measures that are variety of safety maintenance, safety management and safer corridor treatments including options such as signs and markings (delineation) improvements, wide centrelines, ATP, speed management, intersection improvements, reallocation of road space, skid resistance improvements, hazard removal and mitigation (safety barriers).

Within the most recent five year period, 2011-2015, there have been 19 high severity crashes which have resulted in 29 deaths or serious injuries (DSI) along the 15.8 kilometre (km) section of road investigated. This rate is extremely high, giving a collective risk at least three times higher than a road that would not be classified as a high risk.

The methodology adopted for this study is similar to a Crash Reduction Study (CRS) and involved identification of issues through a desktop review and day and night site visits.

From the desktop review the calculated KiwiRAP star rating for the entire section was 3.1. However, there is quite a variation along the route with 44 100m sections, or 4.4km of the 15.8km route, being classified as below 3 star. In addition it has been estimated that 25 DSIs could be expected to occur in the next five year period if no further improvements are undertaken.

The site visits identified numerous safety issues, both route wide and site specific, along with potential interventions and remedial treatments. The effectiveness of these potential interim safety measures were then discussed and assessed at two short workshops against high level criteria including route consistency, change in KiwiRAP star rating, potential reduction in DSI, cost/funding, barriers to implementation/timeframe and fitness for future form and function.

From the workshops a number of measures were discounted as being a low priority or not worth proceeding with; the remaining measures were divided up into categories or packages of work as set out below:

Package	Details
Maintenance	A small number of maintenance deficiencies that should be addressed under standard maintenance budgets except rectifying a retaining structure near 'The Shekinah' which will need additional investigation and potentially additional funding.
Quick Wins	Works that have few barriers to implementation, are low cost and can provide some immediate safety benefits. These works include such things as delineation improvements (chevrons on curves), line marking changes, 'Stop' control installation, new/upgraded signs and some hazard removal. Gains of up to 1 DSI per five year period could be achieved along with raising three 100m sections above 3 star. The estimated expenditure of $300k to $400k should funded from existing budgets, and ideally implemented through existing contracts, before the end of June 2018.

Package	Details
Block Funding/Safer Corridors	Works that will need to be put forward for separate funding but will provide improved route consistency and good DSI saved for the money spent (accounting for the short timeframe). These works include such things as wide centreline treatments, ATP and long-life high performance road marking, edge safety barriers, reallocation of space including passing lane removal, turning restrictions and a speed limit reduction. Gains of 3 to 4 DSI per five year period (excluding speed limit reduction) could be achieved along with raising approximately 17 100m sections above 3 star. An additional 1 to 2 DSI per five year period could be achieved with a speed limit reduction to 80km/h (excluding Taylors Rd to Pukehou Over Bridge). The cost of the current package is estimated to be between $4M and $5M, however the exact details of the package will need to be refined (along with the costs and benefits) to ensure a robust funding application is put forward for implementation in the 2017/18 & 18/19 financial years. The current resealing programme was briefly reviewed and there are three possible sites that could be timed in with the 'Block Funding/Safer Corridors' package to reduce costs.
RoNS/Other Funding	This consisted of three items of work. Two safety measures were addressing legacy issues from the Manakau an Ohau safety improvements project that should be undertaken as soon as possible (covered under existing budgets). The final measure involved the need for a roundabout at the intersection of SH1 and SH57. It was concluded that this will need to be revisited once a 'preferred' realignment option for SH1 has been chosen and if significant traffic was still likely to use this intersection then a roundabout should be constructed as part of early establishment works.

The combination of 'Quick Wins' and 'Block Funding/Safer Corridor' packages identified will ensure all sections of the route have an average KiwiRAP star rating greater than 3 and reduce the number of 100m sections below 3 star by nearly half. In addition DSIs saved are likely to be in the range of 5 to 7 (per five year period).

Even with this investment in interim safety measures it is still expected that the section of SH1 between Taylors Road and south of Levin will remain high risk until a safe system solution, such as that being considered as part of the wider Otaki to North of Levin options, is constructed.

NZ Transport Agency

Otaki to North of Levin RoNS: Interim Safety Improvements

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1 Introduction

1.1 Context

The Wellington Northern Corridor is one of seven Roads of National Significance (RoNS) within New Zealand. Otaki to north of Levin is the northernmost section of this corridor and is being progressively upgraded to create a 4 lane expressway (or 2+1) that will deliver travel time and safety improvements appropriate to the future demands.

The Wellington Northern Corridor is shown in Figure 1-1 below, with the Otaki to north of Levin segment coloured purple at the northern extent of the corridor.

Figure 1-1: Wellington Northern Corridor Road of National Significance

1.2 Objectives and Scope

The current draft objectives for the Otaki to north of Levin section are”

1. Contribute to enhanced movement of people and freight on the state highway network;
2. Enhance safety of travel on the state highway network;
3. Enhance the resilience of the state highway network; and
4. Provide appropriate connections that integrate the state highway and local road networks to serve urban areas.

The purpose of this report is to investigate the need for safety improvements on SH1, between Taylors Road and south Levin (Levin urban boundary), to meet the following objectives over the next 8 to 10 year timeframe, while the design and construction of Otaki to north of Levin capital works is undertaken:

1. Provide an existing state highway that has a consistent level of road safety provision with a minimum KiwiRAP 3 star rating; and,
2. Reduce the number of deaths and serious injuries.

The focus will therefore be on interim safety measures to provide an improved and more consistent level of safety along the route. Interim safety measures would be a variety of safety maintenance, safety management and safer corridor treatments which typically involve signs and markings (delineation) improvements, ATP, seal widening, speed management, intersection improvements, active warning signs, skid resistance improvements, safety barriers and hazard mitigation[1].

The study area, divided into seven sections based on route characteristics and recent works, is outlined in Figure 1-2 below. The current posted speed limit is shown on the right of Figure 1-2.

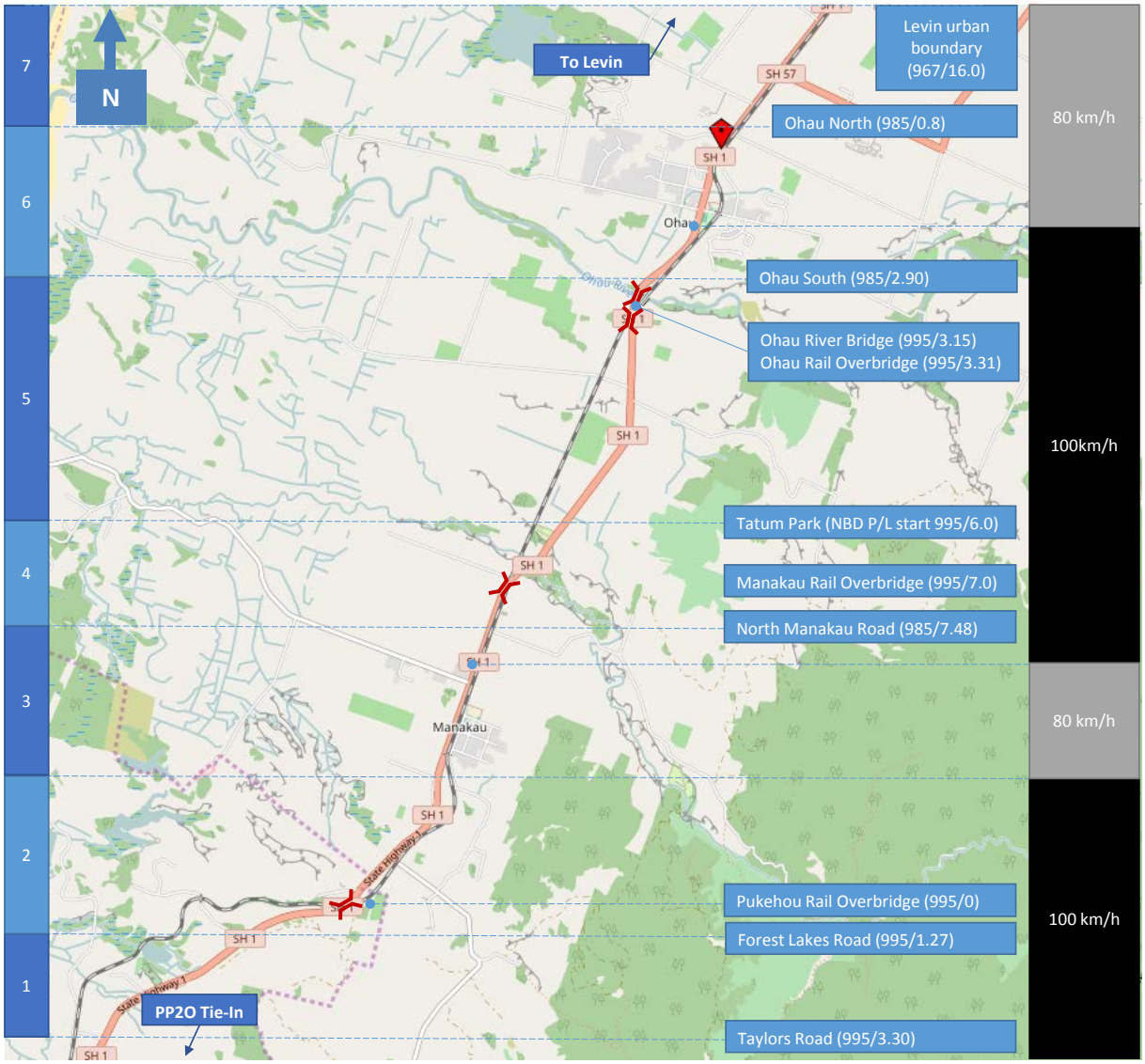


Figure 1-2: Taylors Road to Levin Interim Safety Measures Study Area

[1] Interim safety measures, in contrast to the wider Otaki to north of Levin RoNS capital works, are unlikely to change the status of SH1 from being a High Risk Rural road; rather, they will provide an immediate improved level of safety service, reducing the number of deaths and serious injuries.

1.3 Methodology

The methodology adopted, comparable to a Crash Reduction Study (CRS)[2], involved identification of issues through a desktop review and site visit. This was followed by optioneering of appropriate interventions and a multi-criteria assessment (MCA) of options in a workshop setting to determine preferred packages of countermeasures. The site visit was attended by Steve James and Dan Tate, both Senior Road Safety Engineers at the NZ Transport Agency, and Rob Partridge, Road Safety Discipline Leader and Joe Southey, Intermediate Road Safety Engineer, both from MWH, now part of Stantec (MWH).

Figure 1-3 below provides an outline of the process undertaken.

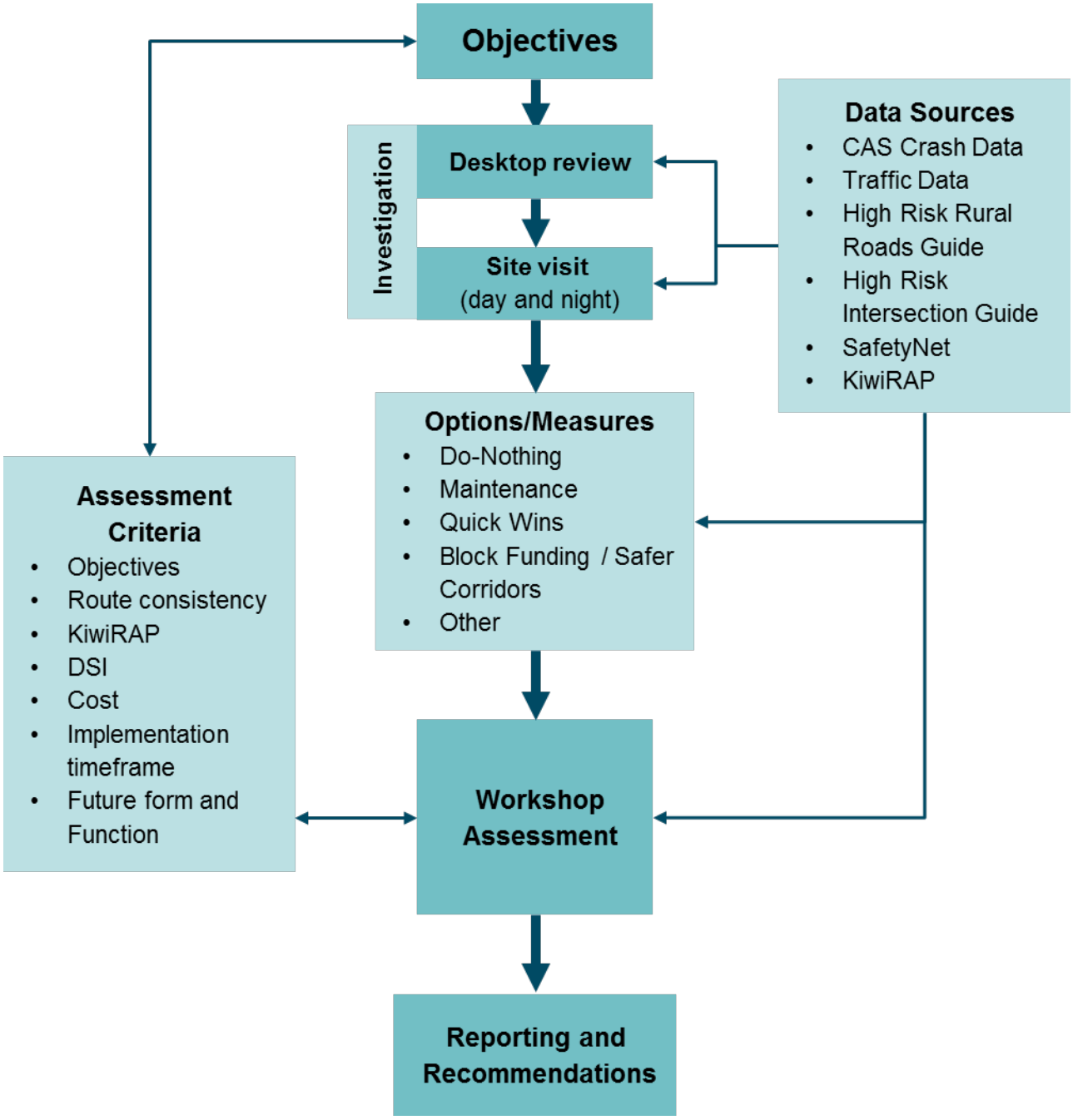


Figure 1-3: Interim Safety Measures Methodology

[2] Land Transport New Zealand, "A New Zealand Guide to the Treatment of Crash Locations", December 2004

2 Existing Safety Issues

2.1 Route Summary

2.1.1 Crash History and Trends

A review of NZ Transport Agency's CAS database over the five-year period 2011 to 2015, summarised in Figure 2-1 below, revealed a total of 133 crashes (19 high severity crashes resulting in 29 DSI[3]) along the approximately 16 km project length, from Taylors Road (RP 995/3.30) to the southern urban boundary of Levin (RP 967/16.0). Collision diagrams along with the crash listing are contained within Appendix A.

The five year crash history shows a general reduction in high severity crashes since 2012. However, the total number of crashes ranges from 20 to over 30 per year, reflecting the random nature of crashes.

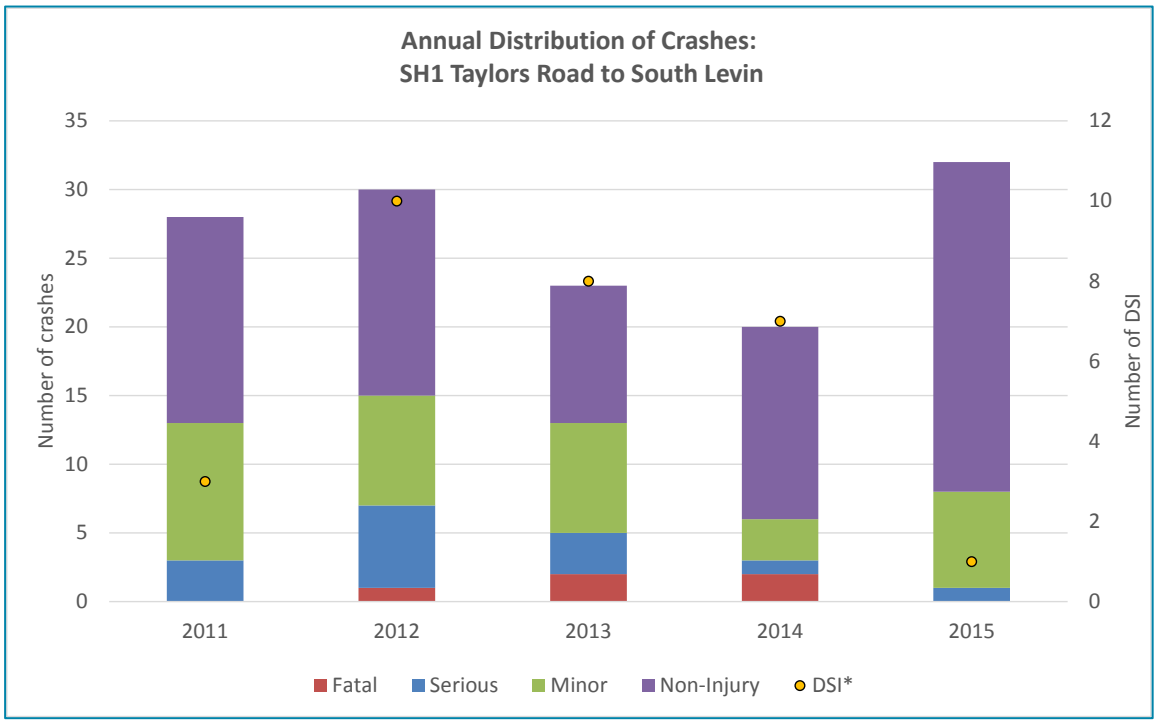


Figure 2-1: Annual Distribution of Crashes

Crash analysis highlights include:

- Run off road and head on crashes contributed to 42% of the reported crashes yet accounted for nearly 70% of the deaths and serious injuries along the route.
- Crashes that occurred in wet and dark conditions contributed to 13% of the reported crashes yet over 20% of the deaths and serious injuries along the route.
- Compared to national figures, this section of highway is over-represented in terms of:
  - Head on high severity crashes (26% vs 21% nationally);
  - Intersection high severity crashes (26% vs 13% nationally);
  - Heavy vehicle injury and high severity crashes (16% high severity vs 10% of traffic);and
  - Wet and icy high severity crashes (53% vs 28% regionally).

Section 2.3 explores details and likely causation factors by section.

[3] Noting that DSI is a measure of the total deaths and serious casualties rather than crashes. For example, a single recorded fatal crash could have had multiple fatalities, depending on the number of other vehicles and passengers involved.

2.1.2 Crash Risk

This section of SH1 has a high collective risk with 1.2 high severity crashes per kilometre within a five year period (or 0.24 high severity crashes per kilometre per year). This high collective risk classifies this section as a High Risk Rural Road[4], as shown in Figure 2-2 below. Figure 2-2 also shows that this route has a collective risk that is at least three times higher than a road that would not be classified as high risk.

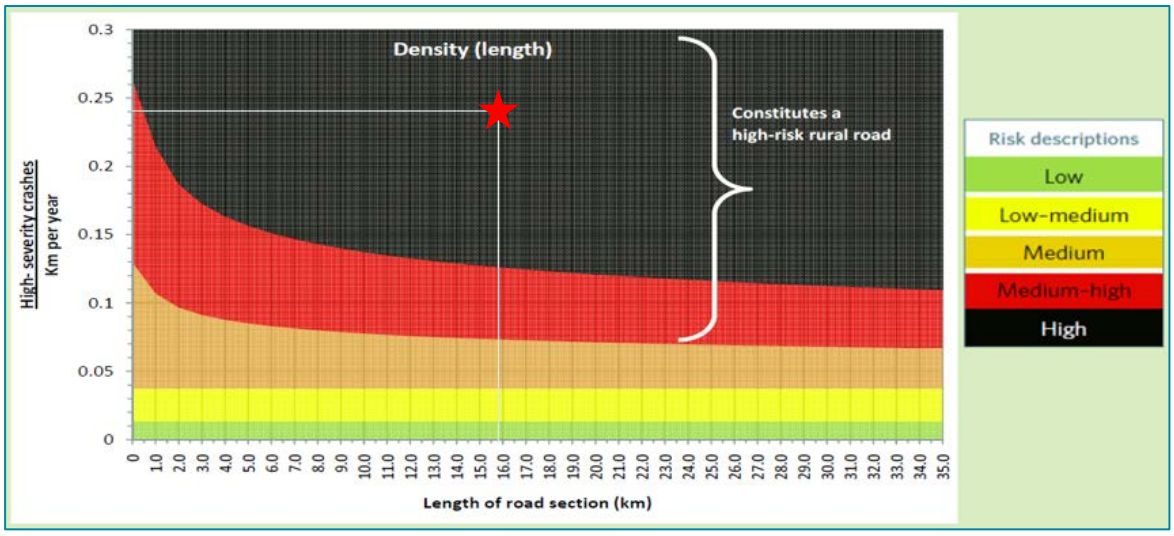


Figure 2-2: Collective Risk Graph showing the section of SH1 from Taylors Rd to south of Levin

In addition to collective risk, Figure 2-3 below, identifies a number of medium and high risk intersections[5]. The one high risk intersection on this route is located where SH1 meets SH57.

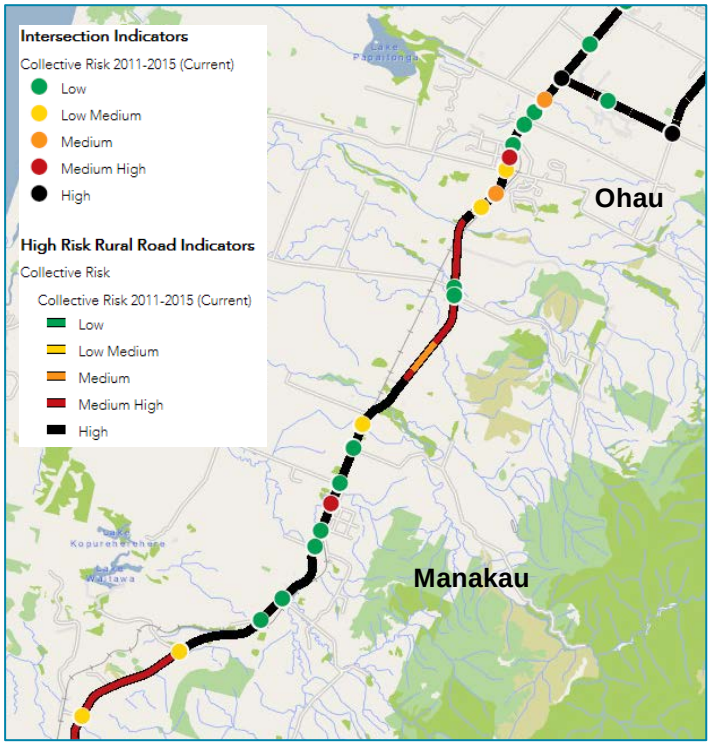


Figure 2-3: Collective Risk and Intersection Risk (Source: NZTA SafetyNET)

[4] The personal risk (high severity crashes per 100 million vehicles kilometres travelled) is low-medium.

[5] Note that the Medium High Risk intersections in Manakau and Ohau, Mokena Kohere St and Victoria Tce, have been addressed as part of the recent Manakau and Ohau Township Improvements.

The calculated KiwiRAP star rating for this section is 3.1, below the KiwiRAP 4-star One Network Road Classification (ONRC) Safety Customer Level of Service target for a National (High Volume) route. However, as outlined in Section 1.2, the interim objective is to ensure a minimum KiwiRAP 3-star rating is maintained. Figure 2-4 below presents the existing KiwiRAP star rating, both with and without the effect of intersections, highlighting key sections where the 100m star rating drops below 3 stars.

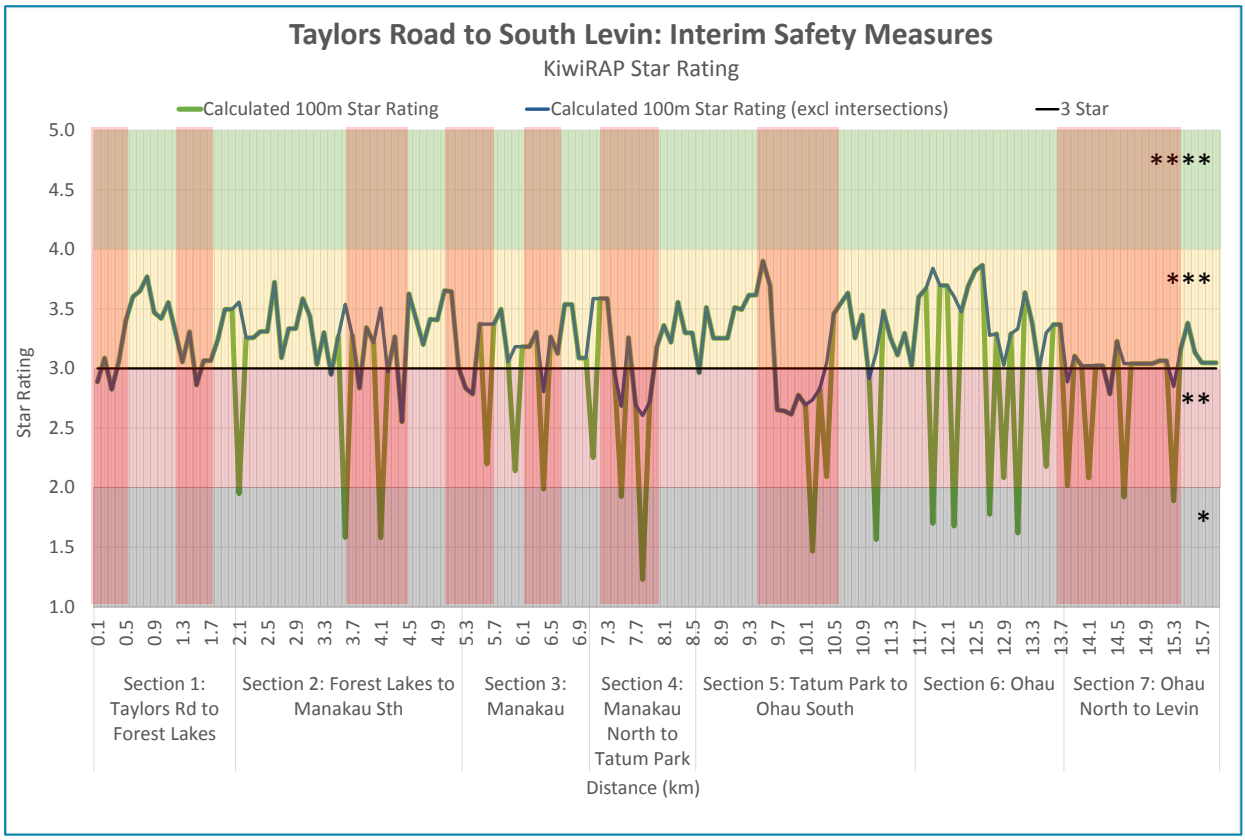


Figure 2-4: KiwiRAP Star Rating

2.1.3 Summary

There have been 19 high severity crashes resulting in 29 deaths and serious injuries within the last five year period along the route. Figure 2-6 overleaf provides an infographic road safety summary of the Taylors Rd to Levin route highlighting; crash statistics, key crash types (and where these are over-represented nationally), crash risk, traffic volumes and vehicle speeds for each of the seven sections.

Overall, the speed environment, high traffic volumes, poor horizontal and vertical alignment (out of context curves and bridges), roadside hazards, poor intersection form and narrow cross section all contribute to the high severity crashes experienced. This is evidenced by the high collective crash risk and the number of 100m sections of 2-star KiwiRAP rating for this length of highway.

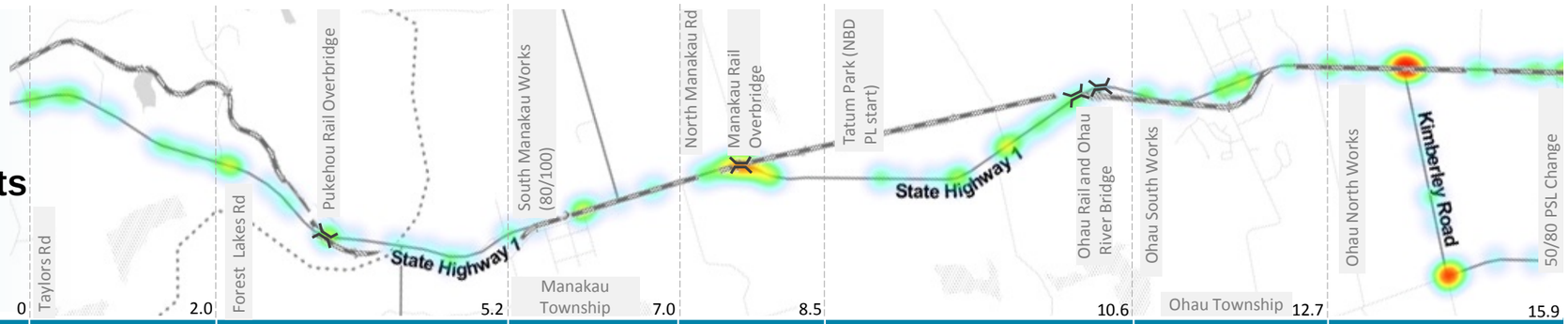
Figure 2-5 below shows the existing star rating by section, and although for the route average is 3.1, there are two sections that have a star rating less than 3.0. In addition, Figure 2-5 compares the actual DSI per five year period versus the KiwiRAP predicted DSI per five year period. This shows variance by section but a strong correlation on the route as a whole.

Both the actual and predicted data have been analysed to determine a 'do nothing' scenario for this route (shown on the right of Figure 2-5) and although a range of DSIs is provided, it is estimated that if nothing further is done we can expect an average of 25 DSIs per five year period. This number is slightly lower than the purely predicted value from KAT as it takes into account the recent improvements through both the Manakau and Ohau Townships and the resultant reduction in speed across the route as a whole.

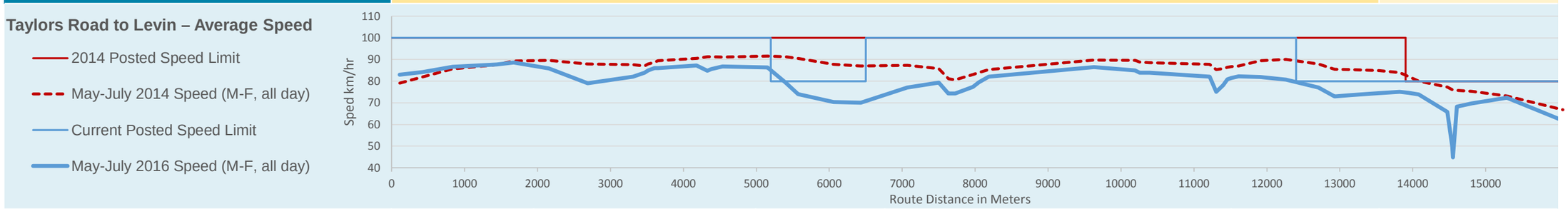
		Actual and KiwiRAP Predicted DSI / 5 yr Existing				Estimated DSI / 5 yr Do Nothing Scenario			
	Section	Star Rating	Actual DSI/5yr	Predicted DSI/5yr	Difference	Range	Min	Max	Average
1	SH1 Taylors Road to Forest Lakes Road Inc.	3.3	5.0	2.9	2.1	3-5	3	5	4.0
2	SH1 Forest Lakes Road Excl to Manakau South	3.1	2.0	5.3	-3.3	2-5	2	5	3.5
3	SH1 Manakau South to Makakau North	3.0	6.0	3.3	2.7	2-3	2	3	2.5
4	Manakau North to Tatum Park (start wide center line)	2.9	2.0	3.0	-1.0	2-3	2	3	2.5
5	Tatum Park start wide center line to Ohau South	3.1	0.0	5.3	-5.3	3-5	3	5	4.0
6	Ohau South to Ohau North	3.0	6.0	3.9	2.1	2-3	2	3	2.5
7	Ohau North to Levin Urban Boundary	2.9	8.0	3.8	4.2	4-8	4	8	6.0
SH1 Taylors Road to South Levin		**3.1**	**29.0**	**27.4**	1.6	**18-32**	**18**	**32**	**25**

Figure 2-5: KiwiRAP Star Rating by section. Actual and KiwiRAP Predicted DSI / 5 Year period (Existing scenario) and Estimated DSI / 5 Year Period (Do nothing scenario)

OTAKI TO LEVIN RONS:
Interim Safety Improvements



Section	1	2	3	4	5	6	7
Length (km)	2.0	3.2	1.8	1.5	3.1	2.1	2.2
AADT	15,000 – 15,700 vpd						12,700 vpd



Injury crashes		6	8	4	8	7	8	14
Deaths and Serious Injuries (DSI)		5	2	6	2	-	6	8
DSI per km		2.5	0.6	3.4	1.4	-	2.9	3.7
KiwiRAP Star Rating 2016 (2012)		3.3 (3.3)	3.1 (3.0)	3.0 (2.9)	2.9 (2.8)	3.1 (2.9)	3.0 (2.8)	2.9 (2.9)
Length below KiwiRAP 3 Stars (%)		0.3km (15%)	0.7km (23%)	0.5km (28%)	0.6km (40%)	1.1km (35%)	0.7km 33%	0.5km (23%)
Collective Risk Band *(Crash Density)*		HIGH	MEDIUM-HIGH	HIGH		LOW	HIGH	
Personal Risk Band *(Crash Rate)*		MEDIUM	LOW-MEDIUM	MEDIUM		LOW	MEDIUM-HIGH	
Key Movement Types *Injury Crashes* ■ Above national average □ Below national average	Head On	33%	25%	25%	25%	0%	13%	0%
	Run Off Road	33%	50%	50%	63%	43%	38%	21%
	Intersection	17%	0%	25%	0%	14%	50%	64%
	Other	17%	25%	0%	13%	43%	0%	14%
Environmental Factors *Injury Crashes*	Wet	17%	25%	50%	50%	29%	25%	36%
	Dark	17%	13%	50%	38%	0%	50%	21%
Modes *Injury Crashes*	Vulnerable Road Users	0%	0%	0%	0%	0%	0%	7%
	HV	0%	25%	0%	0%	43%	0%	14%
	Motorcyclist	17%	13%	0%	13%	0%	25%	7%

Figure 2-6: Safety Summary

2.2 Route Wide Issues

2.2.1 Safe and Appropriate Speed

An assessment of the section of SH1 from Taylors Road to South of Levin against the draft Speed Management Guide[6] was undertaken and this shows that, as a National High Volume route (Class 1) with a high collective risk, the 'safe and appropriate speed' is 80km/h (refer Figure 2-7 below). This is in contrast to the current speed limit of 100km/h on Sections 1, 2, 4, 5 and part of 6 (The remaining sections have a speed limit of 80km/h already).

Table 4.2 Proposed Safe and Appropriate Speeds classification method – Rural Roads (incl rural towns)

Function / Feature	Road Safety Metric	Infrastructure Risk Rating	Safe and Appropriate Speed (km/h)
• **ONRC** is Class 1 • **Median Divided** • **No direct property access** • **Grade separated intersections**	• **Road Network** Personal Risk ≤ Low-Medium; • **Road Network** Collective Risk ≤ Medium-High;	• **'Low'**	• **110**[12]
• **ONRC** is Class 1 – 3	• **Road Network** Personal Risk ≤ Medium; • **Road Network** Collective Risk ≤ Medium-High;	• **'Low' or 'Low-Medium'**	• **100**
• **Any ONRC**	• **Road Network** Personal Risk ≤ Medium-High;	• **'Low' to 'Medium'**	• **80**

Figure 2-7: Draft speed management guide - safe and appropriate speeds

Speed data from TomTom has been obtained as part of the recent Manakau and Ohau Township safety improvement work. This shows that although the speed limit is 100km/h in the aforementioned sections, the actual average speed is generally between 80km/h and 90km/h.

2.2.2 Maintenance

From site investigations it was observed that the road marking south of the Pukehou Rail Overbridge consists of 150mm wide long-life high reflective road marking with red Raised Reflective Pavement markers (RRPM's) adjacent to each edgeline. However north of the Pukehou Rail Overbridge the markings consist of 100mm wide paint marking with no red RRPM's. It is understood that this difference in marking is down to historic maintenance contract boundaries.

This difference in marking was particularly obvious at night and was compounded by the fact that the painted marking had severely faded in many locations to the point that it couldn't t be seen. Ironically, during the night site visit road marking vehicles were on site refreshing the paint; however, it was felt that the marking should never have got to this poor state before it was renewed. A more frequent remarking regime is required north of Pukehou Rail Overbridge or an upgrade to high reflective long-life markings with red RRPM's in unlit areas.

In addition, there appeared to be more issues with reflectivity of signs north of Pukehou Rail Overbridge which could suggest a wider maintenance issue between old maintenance boundaries.

Due to the high percentage of high severity crashes occurring during wet and icy conditions, MWH have undertaken a brief review of latest skid resistance information compared to injury crashes that occurred in wet or icy conditions (refer Appendix B for comparison graph). While lengths of highway fall between the SCRIM Investigatory Level (IL) and Threshold level (IL) along the route, there only appeared to be correlation with wet injury crashes in Section 7 (Buller Road to Levin urban boundary). This section is the highest risk section along the route (refer Figure 2-6) and hence further investigation should be undertaken into whether improved skid resistance is required.

Horowhenua District Council (HDC) raised that surface flooding does occur along the route associated with roadside drainage; it is unsure if this is lack of maintenance or a capacity issues. HDC also raised concerns around lack of safe cycle facilities and pinch points particularly at the bridges.

[6] NZTA, The Draft Speed Management Guide aims to give effect to the significant new direction and framework for speed management in NZ. It is currently in draft form while a demonstration project is carried out in the Waikato region. https://www.pikb.co.nz/assets/Uploads/Documents/Speed-Management-Guide-final-draft-1-September-2015-2.pdf

2.3 Specific Issues

This section outlines the key issues and comments, specific to each section, and combines the results of the crash analysis with the findings from the day and night time site inspections. Site visit notes are contained within Appendix C.

2.3.1 Section 1: Taylors Rd to Forest Lakes Rd

This section has a **High Collective Risk** due to the high number (five) of DSIs between 2011 and 2015. This equates to 2.5 DSIs/km. This is operating worse than predicted from its KiwiRAP star rating and with no significant change occurring on this section during the last five years, we could expect between **three and five** DSIs to occur within the next five year period.

The percentage of head on, intersection and motorcyclist injury crashes is above the national average and there are three 100m sections where the KiwiRAP star rating falls below 3 stars (excl intersections); the average star rating for the section is 3.3.

Numerous roadside hazards exist throughout this section including:

- Power poles north of Taylors Rd (western side)
- Trees and drop-offs adjacent to southbound rest area (both sides)
- Trees and drainage channel northbound near the start of the northbound passing lane
- Trees and a drop-off southbound, south of Forest Lakes Rd.

Neither Taylors Rd nor Forest Lakes Rd have right turn bays for southbound traffic increasing the risk of crashes. Forest Lakes Rd has limited visibility for exiting vehicles and despite signage the intersection is still inconspicuous to approaching state highway traffic. In addition there are a number of high risk accesses along this section including those for the 'Loco' attraction and southbound rest area.

Some delineation was difficult to see during the night site inspection, although this was better than sections north of Pukehou Rail Overbridge.

Figure 2-8: Power Poles north of Taylors Road

Figure 2-9: Trees and drop-off south of Forest Lakes Road

2.3.2 Section 2: Forest Lakes Rd to Manakau

This section has a **Medium-High Collective Risk** due to the two DSIs recorded between 2011 and 2015. This equates to 0.6 DSI /km.

There was a realignment completed at the northern end of this section between South Manakau Rd and Gleesons Rd in January 2011, which has increased the KiwiRAP star rating over this 700m length to approximately 3.5 stars. Despite the realignment there are seven 100m sections where the KiwiRAP star rating falls below 3 stars (excluding intersections); the average star rating for this section is 3.1.

Looking at the risk on this section in a 'do nothing' scenario we could expect between **two and five** DSIs to occur per five year period.

The crash data also identified that the percentage of head on and motorcyclist injury crashes is above the national average, with the heavy vehicle injury crashes also over-represented.

Key roadside hazards along this section include:

- Trees and drop-offs (both sides) between Forest Lakes Rd and Pukehou Overbridge;
- Power poles and drop-offs between Pukehou Overbridge and the southern end of the realignment.

The site inspection identified poor maintenance on this section which included:

- Faded road markings (in some cases completely invisible - since been remarked).
- Missing street light pole luminare at Gleeson's Rd (since been reinstated through maintenance).
- Overgrown vegetation limiting visibility out of Aitkins Rd.
- Chevron signs on the Pukehou Overbridge were dirty/faded and not level.

In addition to the above it was generally felt that the level of delineation could be improved substantially through this section.

Figure 2-10: Faded line marking

Figure 2-11: Trees and drop-offs south of Pukehou Overbridge

2.3.3 Section 3: Manakau Township

This section has a **High Collective Risk** due to the high number (six) of DSIs between 2011 and 2015. This equates to 3.4 DSIs/km.

Significant improvements have been made through the township of Manakau along with a reduction in speed limit which has resulted in an average speed reduction of approximately 15-20km/h. Although this work appears to have only increased the KiwiRAP star rating from 2.9 to 3.0, with the reduction in speeds there will be a reduction in the number of DSIs occurring in the future. Given this it is expected that in a 'do nothing' scenario we could expect between **two and three** DSIs to occur per five year period.

The crash data also identified that the percentage of head on and intersection injury crashes and injury crashes occurring in wet and dark conditions is above the national average.

There were still five 100m sections where the KiwiRAP star rating fell below 3 stars (excluding intersections). This is likely to be a result of a number of unprotected power poles and hazards that were seen on the site visit.

HDC have identified a number of safety issues through the Manakau area including unprotected hazards, improvements required to pedestrian refuges and vegetation encroaching onto the cycle lanes.

Figure 2-12: Power poles through Manakau Township

2.3.4 Section 4: Manakau to Tatum Park

This section has a **High Collective Risk** due to the two DSIs between 2011 and 2015. This equates to 1.4 DSIs /km. Minor improvements have been made along this section, including new barrier on the western side of Manakau Rail Overbridge. Looking at the risk on this section in a 'do nothing' scenario we could expect between **2 and 3** DSIs to occur per five year period.

The crash data identified that the percentage of head on, run off road and motorcyclist injury crashes and crashes occurring in wet and dark conditions is above the national average.

There are six 100m sections where the KiwiRAP star rating falls below 3 stars (excl intersections) which is over 40% of the section.

Key issues identified from the site visit included:

- The level of delineation could be improved, particularly from (and including) the Manakau Rail Overbridge to Tatum Park.
- Unprotected power poles and trees are present near the side of the highway.
- There is very poor sight distance when turning out of Whakahoro Rd, especially the turn out. This is also at a very dangerous location to the south of the Manakau Rail overbridge.
- An excessively bright 'No Vacancy' sign is present at Tatum Park that was a distraction to motorists at night.

In addition it was identified that events held at the Ngati Wehi Marae result in a large number of parked vehicles adjacent to the highway as well as a people crossing the road. This was not observed on the site visit, however this is known to occur.

Figure 2-13: Poor sight distance from Whakahoro Rd

Figure 2-14: Unprotected power poles south of Manakau Rail Overbridge

2.3.5 Section 5: Tatum Park to Ohau

This section has a **Low Collective Risk** as there have been no death or serious injuries from the seven injury crashes between 2011 and 2015. There have been some improvement works undertaken on this section including new barriers at Kuku Stream and ATP at the passing lanes.

There are eleven 100m sections where the KiwiRAP star rating falls below 3 stars (excl. intersections), or 35% or the section; the actual star rating for the section is 3.1. At least one of these 100m sections will have been addressed by the new barriers at Kuku Stream.

Looking at the risk on this section in a 'do nothing' scenario we could expect between **three and five** DSIs to occur per five year period.

Heavy vehicles are over represented along the route, accounting for 10% of overall traffic but involved in over 40% of the injury crashes.

As this section is 3.1km long there were a number of issues identified. The key ones included:

- The existing bridge side protection on the Ohau River Bridge and Rail Overbridge is not compliant with modern standards (NZTA M23).
- The delineation appeared poor in sections and poorly maintained.
- Sealed shoulders were narrow in places.
- A number of unprotected power poles.
- Some of the side road intersections had been poorly maintained and could have improved signage.
- The passing lane for southbound traffic terminates with a right turn bay at Kuku Beach Rd. The passing lane also complicates entry into the Te Iwi o Ngati Tukorehe Marae which is located near the end of the passing lane.
- The sight rails opposite St Stephen's Church are a hazard to errant vehicles. The unsealed turning area at this location does not provide good traction for turning vehicles and loose gravel has entered the carriageway.
- The retaining for the deep stream/drain north of St Stephen's Church appears to be failing and the road shoulder is collapsing. In addition vehicles are only protected from the drain hazard by a sight rail.

Figure 2-15: Narrow sealed shoulder and non-compliant bridge barrier, Ohau Rail Overbridge

Figure 2-16: Passing lane termination at Te Iwi o Ngati Tukorehe Marae

Figure 2-17: Hazardous sight rail opposite St Stephens Church

Figure 2-18: Deep drain and failing retaining south of St Stephens Church

2.3.6 Section 6: Ohau Township

This section has a **High Collective Risk** due to the high number (six) of DSIs between 2011 and 2015. This equates to 2.9 DSIs/km.

Significant improvements have been made through the township of Ohau along with a reduction in speed limit which has resulted in an average speed reduction of between 10 and 15km/h. Although this work appears to have only increased the KiwiRAP star rating from 2.8 to 3.0, with the reduction in speeds there will be a reduction in the number of DSIs occurring in the future. Given this it is expected that in a 'do nothing' scenario we could expect between **two and three** DSIs to occur per five year period.

The crash data also identified that the percentage of head on, intersection and motorcyclist injury crashes and injury crashes occurring in dark conditions is above the national average.

There are seven 100m sections where the KiwiRAP star rating falls below 3 stars (excl. intersections).

Despite the recent works through the Ohau Township there were still a number of issues identified from the site visit including:

- The existing road marking is fading and old road markings are coming through the chipseal to the south of Ohau. This is extremely confusing and a poor look for the Agency.
- There are unprotected trees, power poles and drop-offs particularly at the curve north of Ohau, just before the curve south of Ohau and an area within Ohau.
- The speed limit change at the southern end of Ohau may not be obvious enough.
- The curve just south of Ohau is not well delineated.
- Poor visibility/difficulty for vehicles getting out of Marsden Terrace (raised by HDC)

Figure 2-19: Poorly delineated curve and roadside hazards south of Ohau. Old line marking visible

Figure 2-20: Poorly delineated curve and roadside hazards north of Ohau

2.3.7 Section 7: Ohau North to Levin

This section has a **High Collective Risk** due to the high number (eight) of DSIs between 2011 and 2015. This equates to 3.7 DSIs /km.

Only minor improvements have occurred on this section in recent times including, including new islands at the intersection of SH1 and SH57.

Looking at the risk on this section in a 'do nothing' scenario we could expect between **four and eight** DSIs to occur per five year period.

The crash data identifies that the percentage of intersection injury crashes and injury crashes occurring in the wet is above the national average. In addition, heavy vehicles and vulnerable road user injury crashes are over represented.

The KiwiRAP star rating for this section is 2.9 and there are five 100m sections where the KiwiRAP star rating fell below 3 stars (excl intersections).

There were a large number of issues identified along this section, which reflects the low KiwiRAP star rating. The key issues identified include

- Numerous roadside hazards including power pole and culverts between Vista Rd and the SH1/SH57 intersection.
- Buller Rd had hazards on both corners, was difficult to get out of and vehicles cut the corner when turning in.
- The 'Major Intersection Ahead' signage needed updating to be reflective at night.
- Outside lit areas, markings and delineation needed to be to a higher level.
- Trees posed a hazard on the eastern side between Levin and SH1/SH57 (although it was noted that if they were taken away speed might increase along this length).
- Gravel from the unsealed parking area opposite the Motel south of Levin tracked across the highway.
- The sealed shoulder on the eastern side, south of Levin is very narrow (between 'Major Intersection Ahead' sign and SH57).
- The SH1/SH57 intersection contained a number of issues, but the form of this intersection (priority controlled), given the traffic volumes and level rail crossing, poses a significant crash risk. Other issues included:
    - The conspicuity of the intersection could be improved, particularly from SH57, to help vehicles slow earlier
    - The left turn acceleration lane (southbound onto SH1) has an unusual curve in the geometry and ends where a right turn bay starts
    - The intersection lighting could be reviewed and potentially upgraded
    - There are non-compliant safety barriers around the railway barrier arms that create a spearing hazard.
    - Vehicle accesses opposite the intersection
- The 50/80 km/h change point at Levin was hard to see and needed to be a more prominent threshold.
- Power Poles on the western side of SH1 from SH57 to the 50/80 change point
- Drainage issues north of the 50/80 change point – East side (raised by HDC)

Figure 2-21: Buller Rd Culvert (hazards on both sides of SH1 and Buller Road)

Figure 2-22: Narrow shoulder, trees & old sign north of SH57

Figure 2-23: Non-compliant safety barrier at SH57 intersection

Figure 2-24: Inconspicuous speed limit signs

3 Options / Interim Safety Measures

3.1 Introduction

Following the desktop safety review and the day and night site visits, MWH drafted a number of potential interim safety measures and options that could help address the identified issues over the next 8 to 10 year period. These measures included a variety of safety maintenance, safety management and safer corridor treatments which involved signs and markings (delineation) improvements, wide centrelines, ATP, speed management, intersection improvements, reallocation of road space, skid resistance improvements, hazard removal and mitigation (safety barriers).

The various measures considered, both route wide and for each section, are contained in the 'Potential Measures/Options Table' in Appendix D.1.

3.2 Assessment of Potential Measures / Optioneering

In order to identify the likely effectiveness of the potential safety improvements MWH developed various criteria with which to assess measures against (a high level multi-criteria analysis) which also tied back to the objectives of this particular exercise. The key measures considered were:

1. Route consistency;
2. Change in KiwiRAP star rating;
3. Death and serious injury (DSI) reduction potential;
4. Cost / Funding requirements;
5. Barriers to implementation (including timeframe); and,
6. Fitness for future form and function of the route.

Two short workshops were then held with the NZ Transport Agency to:

- Confirm the objectives;
- Confirm the issues;
- Run through the potential measures and assess these against the criteria above (measures were also refined and added as part of the workshop exercises); and,
- Discuss likely packages of works.

The workshop dates and attendees are contained in Table 3-1 below.

Table 3-1: Workshop Attendees

Workshop 1 Attendees - 16 November 2016
Steve James, Senior Road Safety Engineer, NZ Transport Agency Rob Partridge, Road Safety Discipline Leader, MWH, now part of Stantec Joe Southey, Intermediate Road Safety Engineer, MWH, now part of Stantec
Workshop 2 Attendees - 22 November 2016
Greg Lee, Principal Planner, NZ Transport Agency Dan Tate, Senior Road Safety Engineer, NZ Transport Agency Mike Pilgrim, Principal Safety Engineer, Towards Zero Consulting Rob Partridge, Road Safety Discipline Leader, MWH, now part of Stantec Joe Southey, Intermediate Road Safety Engineer, MWH, now part of Stantec

From the workshops a number of measures were discounted as being a low priority or not worth proceeding with, due various criteria not being met (particularly options with significant barriers to implementation) and that the benefit of that measure was limited. In some cases measures were deemed a low priority as there have been recent improvements that may have mitigated the issue. The remaining measures were then divided up into potential categories or packages, namely:

1. Maintenance;
2. Quick Wins;
3. Block Funding / Safer Corridors; and
4. RoNS / Other Funding.

The 'Potential Measures/Options Table' contained in Appendix D.1 shows the outcome of the workshop assessments in terms of both the multi-criteria analysis and categorisation into potential packages. A further table contained in Appendix D.2 entitled 'Package Development' displays the measures within each package against some of the key road safety metrics.

A 'do nothing' option was also discussed at the workshops along with the impact of this in terms of the expected 25 DSIs within a five year period (as outlined in Section 2 of this report). It was concluded that 'doing nothing' was not an option on this route as the collective risk is at least three times higher than a road that would not be classified as high risk.

3.3 Packages of Work

3.3.1 Maintenance

This package contains a small number of works that were identified as maintenance deficiencies from the day and night site visits. These works should be addressed through existing maintenance budgets, or through separate maintenance funding in relation to the failing retaining structure opposite 'The Shekinah'. Measures also include increasing the frequency of marking renewal along with sign and delineation cleaning, north of Pukehou Rail Overbridge.

3.3.2 Quick Wins

One of the assessment criteria for safety measures included barriers to implementation and if there are few barriers, and if measures are low cost, then there is opportunity to achieve 'Quick Wins' through existing budgets before the end of the 2017/18 financial year.

A number of measures have been identified in this category particularly on Sections 2, 4, 5 and 7, such as delineation improvements (chevrons on curves), line marking changes, 'Stop' control installation, new/upgraded signs and some hazard removal.

The 'Quick Wins' package developed, and shown in Appendix D.2, is estimated to cost in the order of $300k to $400k. MWH estimate that this package could have an overall reduction in injury crashes along the route of up to 5% with potential gains of up to 1 DSI saved in a five year period. In addition these measures should raise three 100m sections of highway from a 2 star KiwiRAP rating to a 3 star rating.

3.3.3 Block Funding / Safer Corridors

It was identified as part of the workshops that the bulk of the interim safety measures could not be funded under existing budgets, such as minor safety, and would need to be put forward for separate block funding.

The measures that make up the 'Block Funding /Safer Corridors' package are contained within the tables in Appendices D.1 and D.2 and include options such as wide centreline treatments, ATP and long-life high performance road marking, edge safety barriers, reallocation of space (including passing lane removal), turning restrictions and a speed limit reduction.

MWH have undertaken a very high level assessment of the likely benefits of the package of works using the KiwiRAP Assessment Tool (KAT). Initially looking at the measures proposed, without any change in speed limit, it was identified that a saving of 3 to 4 DSI per 5-year period could be achieved. In addition all seven sections would achieve an average star rating of 3 or more and approximately 17 100m sections of highway would be raised from a 2 star KiwiRAP rating to a 3 star rating.

A safety assessment was then undertaken of reducing the speed limit to 80km/h on Sections 2, 4, 5 and part of 6 (Section 3, part of 6 and 7 already have an 80km/h speed limit). This assessment, using the Elvik speed and crash relationship power model, showed a further 1 to 2 DSI could be saved per five year period over and above these other measures. This saving is slightly lower than expected as the current average speeds within the 100km/h speed limit sections are generally between 80km/h and 90km/h (as identified in Section 2.2.1 of this report) .

MWH estimate that the Block Funding / Safer Corridor package, as identified in Appendices D.1 and D.2, would cost between $4M and $5M to implement. The costs and benefits currently calculated are very high level and further work is required to refine this package. This will be important to ensure a robust funding application that achieves the objectives, and provides a good level of DSIs saved for the money spent (accounting for the short timeframe), is produced.

MWH has also identified that savings can be made by combining safety measures with the reseal programme; sites within Sections 1, 2 and 4 are programmed for resealing in 2017/18 or 2018/19.

3.3.4 RoNS / Other Funding

There were two safety issues identified that will be addressed as part of completion of the Manakau and Ohau Safety improvements works. These include:

- Sealing part of the turning area opposite St Stephan's Church; and,
- Resolving road marking issues south of Ohau with the application of the 2nd coat chip.

The intersection of SH1 and SH57 was identified within this report as the only high risk intersection along the route. Although minor improvements have been suggested as part of the 'Block Funding / Safer Corridors' package, the safe system solution is to convert this intersection to a roundabout. It is acknowledged that this would be expensive (at least $3M), require land take and could take at least two years to complete and hence this is not likely to be a worthwhile for a short period of time (depending on the chosen SH1 realignment route). Therefore it is suggested that the need for a roundabout at this intersection is revisited once a 'preferred' realignment option has been chosen for SH1. Should significant traffic still be predicted to use the SH1/SH57 intersection with the 'preferred' realignment option then a roundabout should be constructed as part of early establishment works.

3.4 Summary

The packages of measures discussed above are all aimed at meeting the objectives identified in Section 1 of this report; namely:

1. Provide an existing state highway that has a consistent level of road safety provision with a minimum KiwiRAP 3 star rating; and,
2. Reduce the number in deaths and serious injuries (DSIs).

The combination 'Quick Wins' and 'Block Funding/Safer Corridor' packages will ensure all sections of the route have an average KiwiRAP star rating greater than 3 and reduce the number of 100m sections below 3 star by nearly half. In addition DSIs saved are likely to be in the range of 5 to 7 (per five year period).

Even with this investment it is expected that there will still be 18 to 20 DSIs per five year period on SH1 between Taylors Road and south of Levin. In order to truly address the safety issues along the existing route a safe system solution is required, such as that being considered as part of the wider Otaki to North of Levin options.

4 Recommendations

Recommendations have been made in relation to the four packages of work that have been identified to address safety issues on SH1, between Taylors Road and south Levin (Levin urban boundary), over the next 8 to 10 year timeframe while the design and construction of Otaki to North of Levin realignment work is undertaken.

The interim safety measures identified within the packages will provide a more consistent level of road safety provision, improve the KiwiRAP star rating and reduce deaths and serious injuries. These measures will not however prevent this section of SH1 from being a High Risk Rural Road, as in order to do this a safe system realignment solution is required.

4.1 Maintenance

The following recommendations are made in relation to the maintenance package:

1. Address all basic maintenance items (identified within the Package Development Sheet) within a three month timeframe.
2. Further investigate the potential maintenance issue at the retaining wall opposite 'The Shekinah' and look to apply for maintenance funding to address this (if this is not deemed a maintenance issue then the culvert hazard should be addressed as part of the Block Funding / Safer Corridors package).
3. Increase the frequency of road marking renewal (unless long-life high reflective marking is installed) along with cleaning of signs and delineators, north of Pukehou Rail Overbridge.

4.2 Quick Wins

The following recommendations are made in relation to the 'Quick Wins' package:

1. Secure funding of approximately $300k to $400k from existing budgets (including minor safety, maintenance, capital) to complete the 'Quick Wins' package.
2. Confirm details of the 'Quick Wins' measures, based on available funding, and ideally complete these through existing Maintenance/Capital contracts – preparing a separate contract is possible, however this would push construction close to the end of the financial year.

4.3 Block Funding / Safer Corridors

The following recommendations are made in relation to the Block Funding / Safer Corridors package:

1. Undertake further analysis of costs and benefits of the measures before the end of 2017.
2. Submit a funding proposal that demonstrates a good reduction in deaths and serious injuries for the money spent (accounting for the short timeframe).
3. Implement the Block Funding / Safer Corridors package of interim safety measures in the 2017/18 & 18/19 financial year.
4. Work with maintenance teams to combine safety measures with the resealing programme where possible; this may involve bringing some resealing sites forward a year (At least three opportunities have been identified along this route).

4.4 RoNS / Other Funding

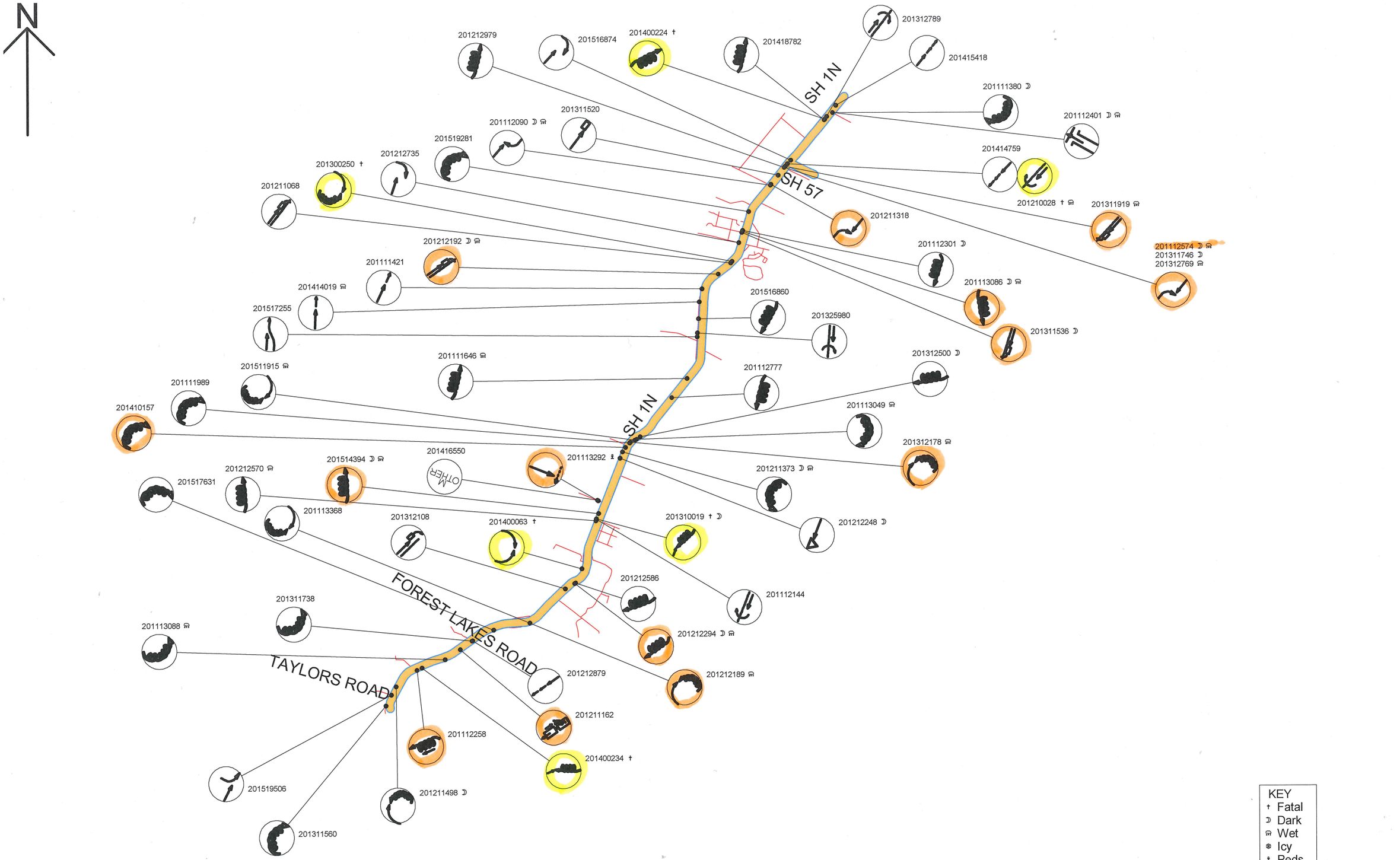
The following recommendations are made in relation to other identified works:

1. Seal part of the turning area opposite St Stephan's Church as soon as possible (M & O funding).
2. Reseal and resolve road marking issues south of Ohau as soon as possible (M & O funding).
3. Revisit the need for a roundabout at the intersection of SH1/SH57 once a 'preferred' realignment option for SH1 has been chosen. Should the chosen option still require significant traffic to use this intersection then a roundabout should be constructed as part of early establishment works.

Appendices

Appendix A Crash Data

A.1 Collision Diagrams



2 0 2 4Km 6Km

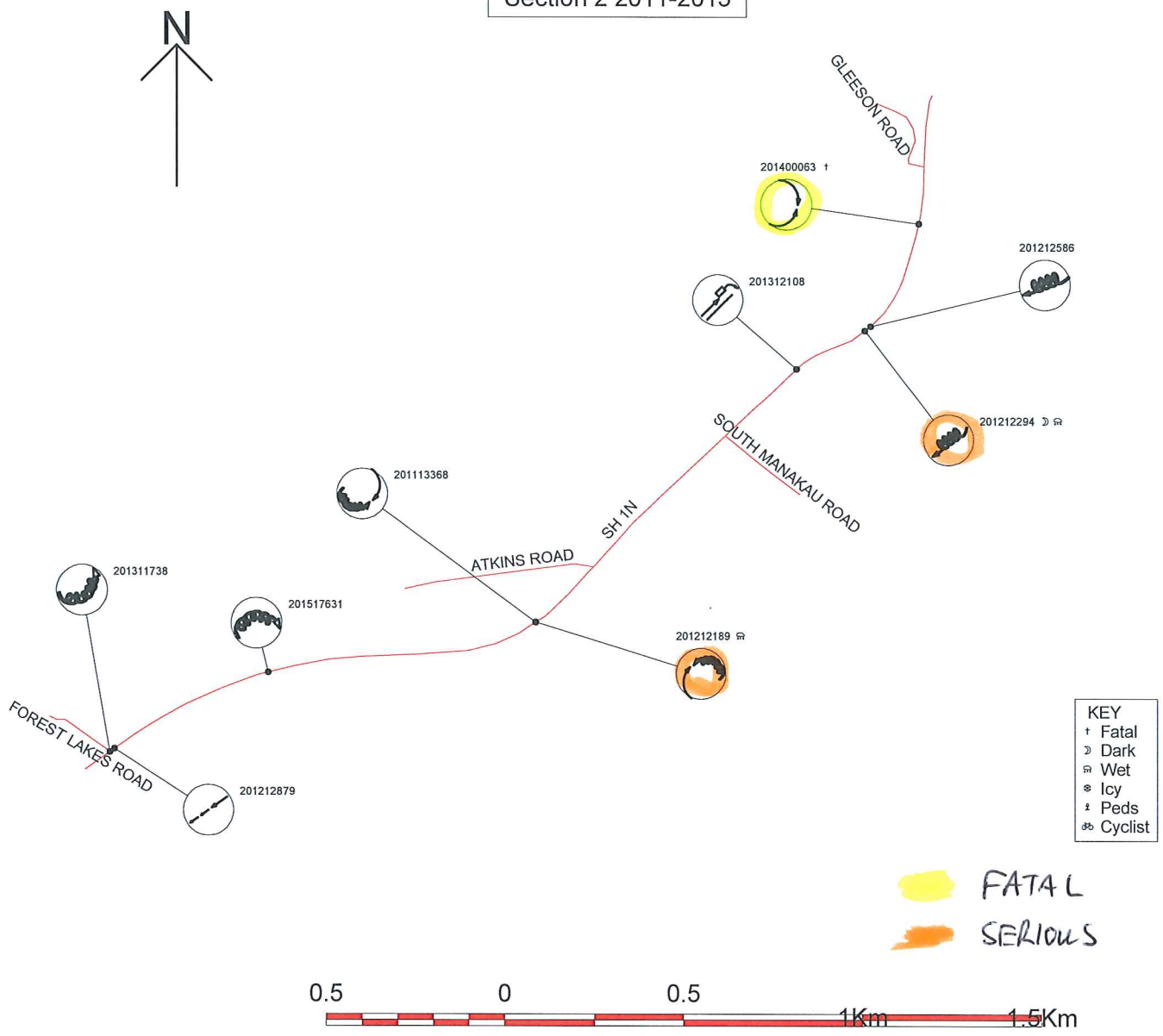
30 September 2016

KEY
† Fatal
☽ Dark
☔ Wet
❄ Icy
🚶 Peds
🚲 Cyclist

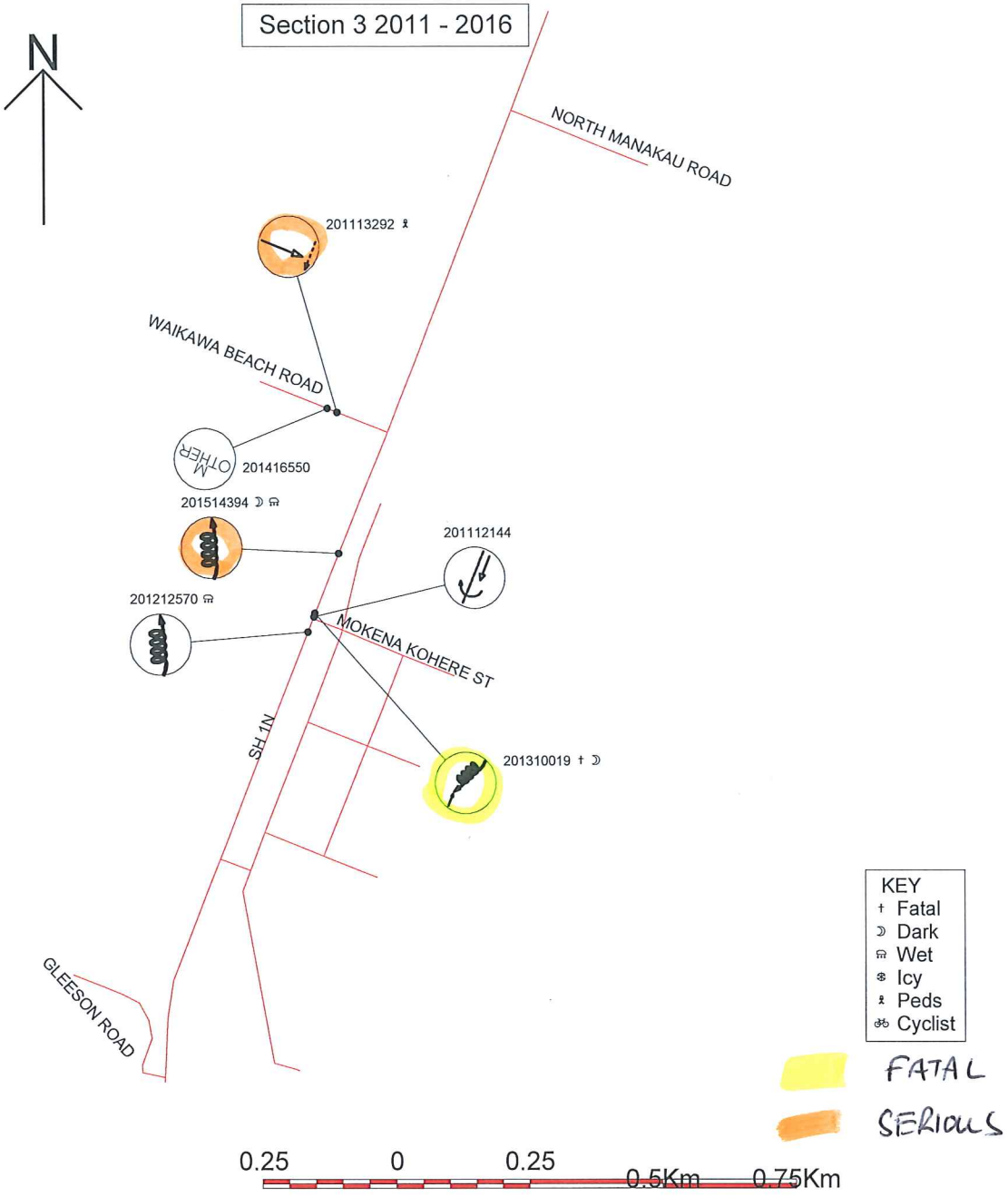
FATAL +
SERIOUS

SH1 Forest Lakes Road Excl to Manakau South - Injury Only

Section 2 2011-2015

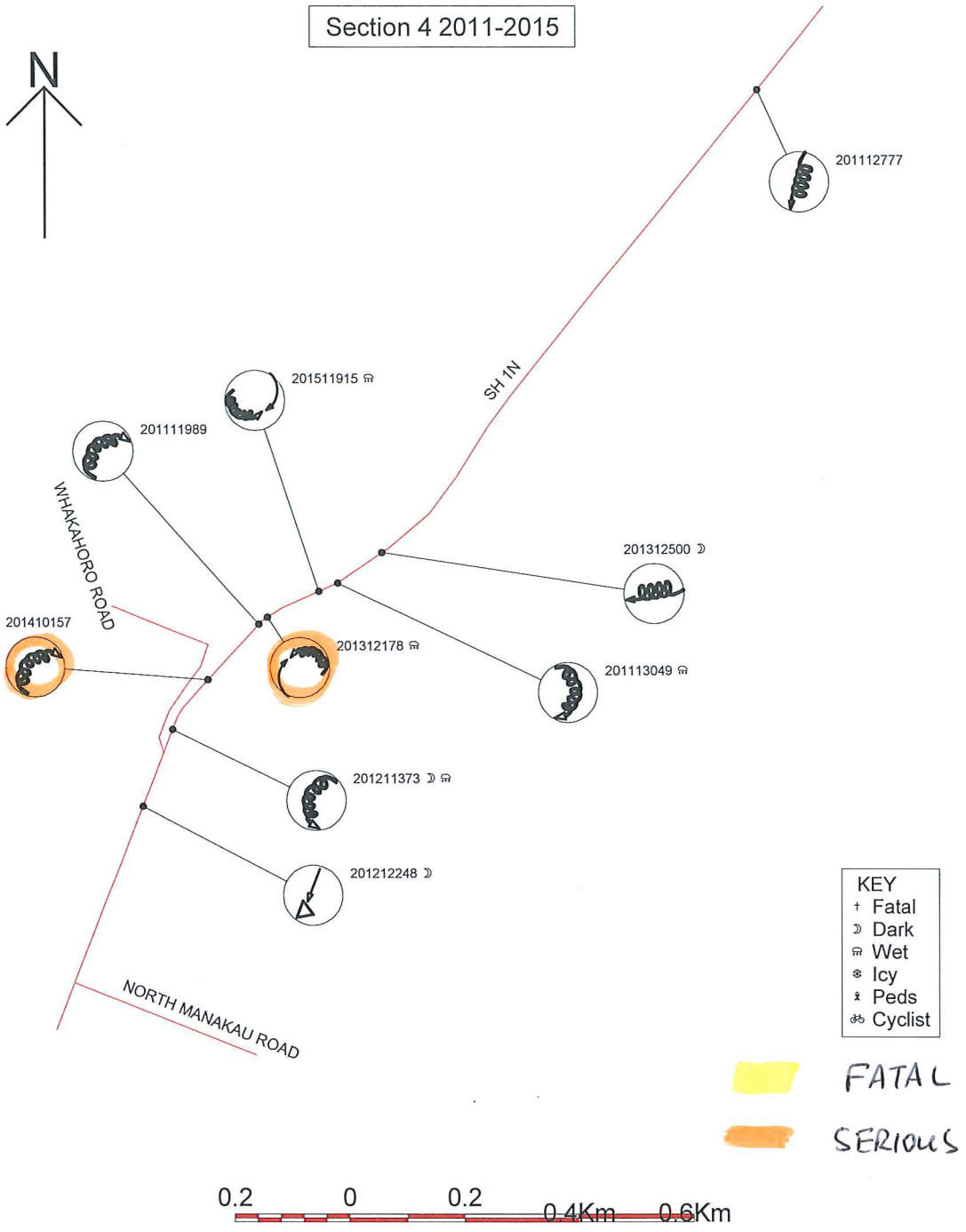


SH1 Manakau South to Makakau North, Injury Only



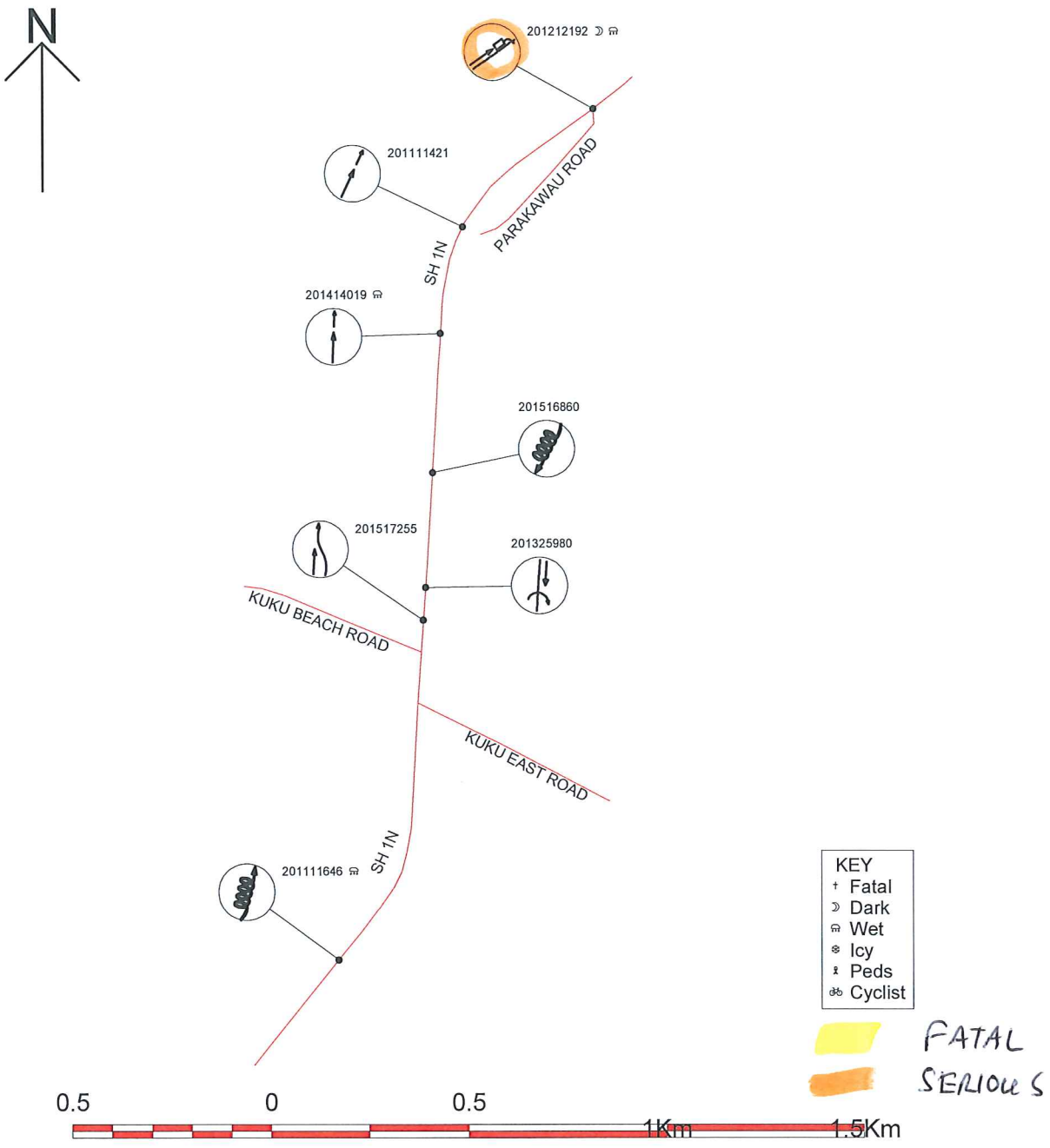
Manakau North to Tatum Park (start wide center line), Injury Only

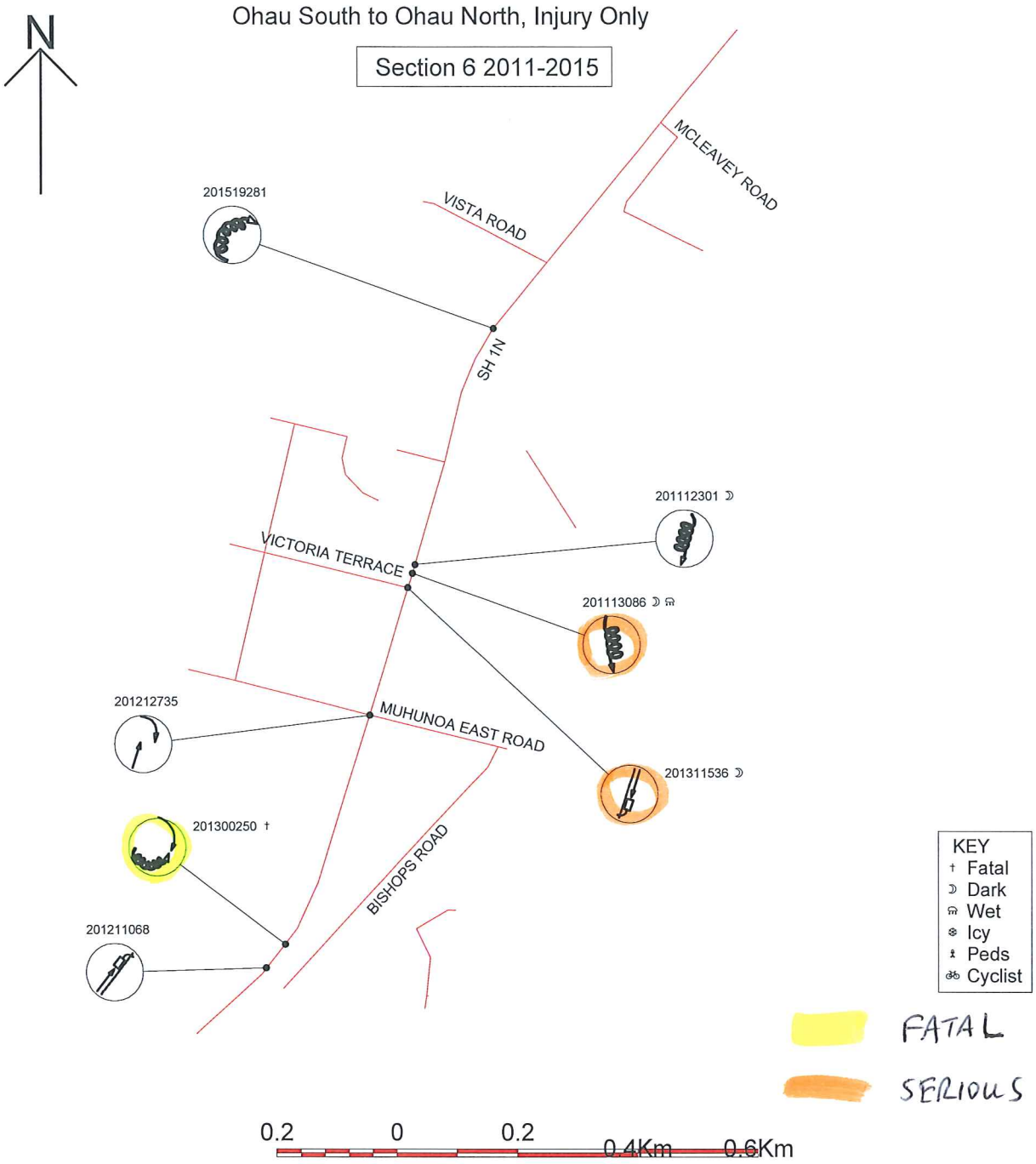
Section 4 2011-2015



Tatum Park start wide center line to Ohau South, Injury Only

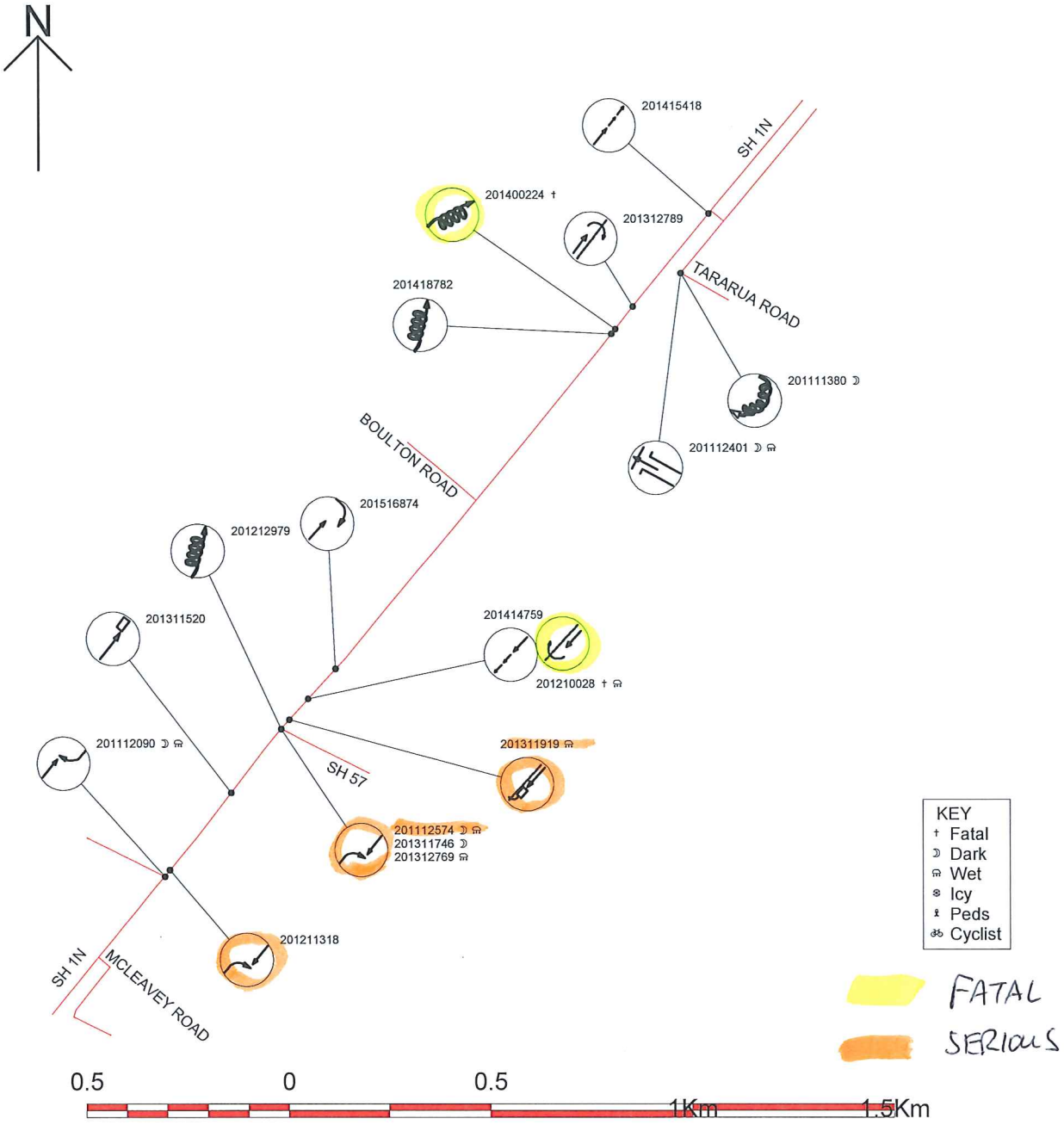
Section 5 2011-2015




N
Ohau South to Ohau North, Injury Only
Section 6 2011-2015
MCLEAVEY ROAD
VISTA ROAD
201519281
SH 1N
201112301 ☽
VICTORIA TERRACE
201113086 ☽ ☔
201212735
MUHUNOA EAST ROAD
201311536 ☽
201300250 †
BISHOPS ROAD
201211068
KEY
† Fatal
☽ Dark
☔ Wet
❄ Icy
Peds
Cyclist
FATAL
SERIOUS
0.2
0
0.2
0.4Km
0.6Km

Ohau North to Levin Urban Boundary, Injury Only

Section 7 2011-2015



A.2 Crash Listing

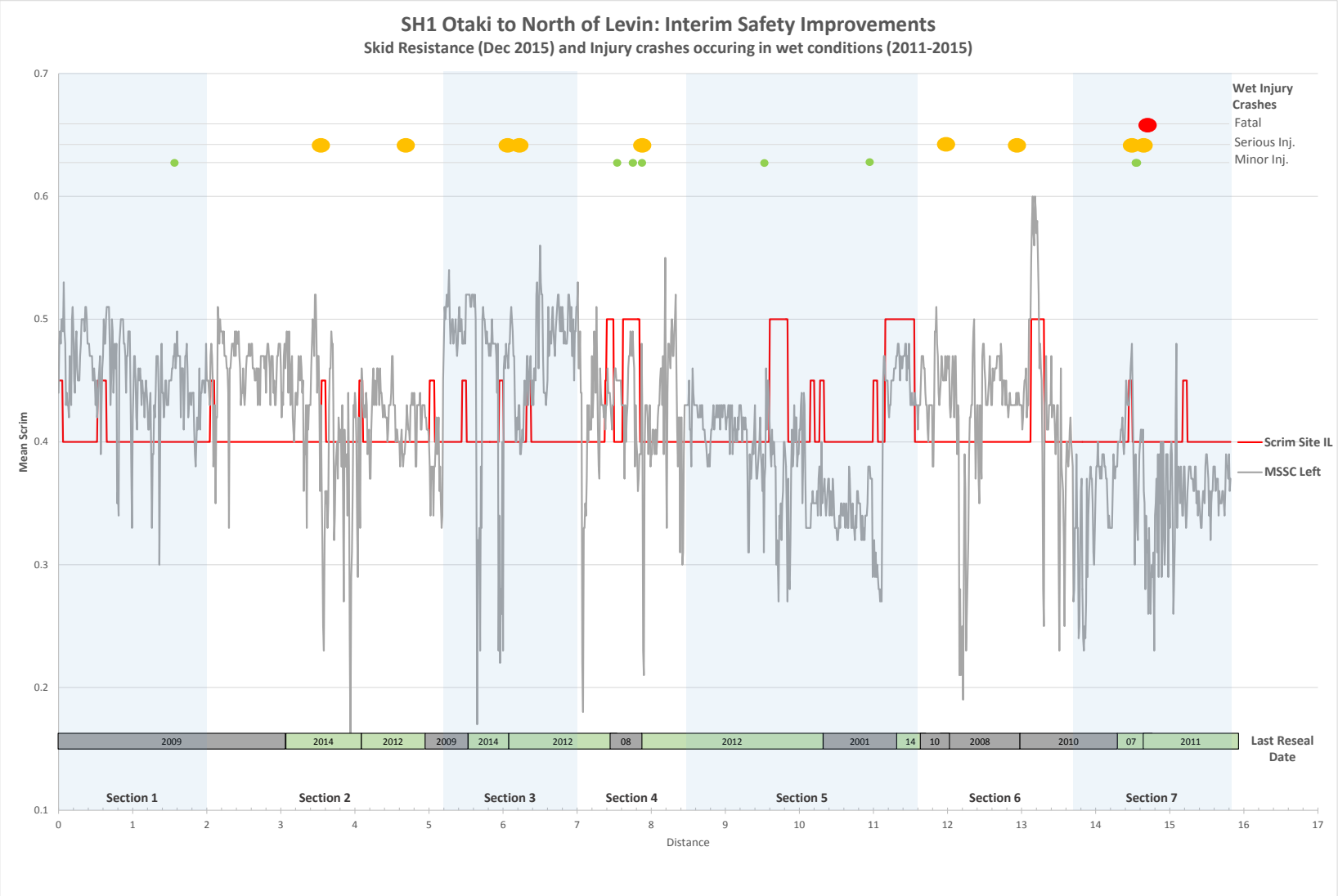
CRASH ROAD	CRASH DIST	CRASH DIRN	INTSN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT	VEHICLES	CAUSES	OBJECTS STRUCK	MVMT DESCR	CAUSES	ROAD CURVE	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	ROAD MARK	SPD LIM	CRASH FATAL CNT	CRASH SEV CNT	CRASH MIN CNT	PERS AGE1	PERS AGE2	EASTING	NORTHING	SECTION
Section 7, Ohau North to Levin Urban Boundary 50km/hr Sign																															
1N/967/16.063	750	S		HOKIO BEACH ROAD	201312789	13/11/2013	Wed	1205	MC	VN1C	371B 671B		VAN1 NBD on SH 1N hit CAR2 U-turning from same direction of travel	CAR2 Did not check / notice another party behind, blind spot	R	D	B	F		N	C	50	0	0	1			1791986	5498901	7
1N/967/16.133	820	S		HOKIO BEACH ROAD	201400224	3/11/2014	Mon	1700	CC	CN1	106A 120A 130A	P	CAR1 NBD on SH 1N lost control; went off road to right, CAR1 hit Post Or Pole	CAR1 alcohol not suspected, tested and -ve (MoT use only), failed to keep left, lost control	R	D	O	F		N	L	80	1	2	0			1791942	5498846	7
1N/967/16.149	530	N		BOULTON ROAD	201418782	29/12/2014	Mon	1404	CB	CN1E	410A	P	CAR1 NBD on SH 1N lost control; went off road to left, CAR1 hit Post Or Pole	CAR1 fatigue (drowsy, tired, fell asleep)	R	D	B	F			C	80	0	0	4	28		1791932	5498834	7
1N/967/16.299	380	N		BOULTON ROAD	201150925	23/01/2011	Sun	1620	GC	VS1C	330B 371B 404B 801 927		VAN1 SBD on SH 1N hit rear of CAR2 turning right from left side	CAR2 inattentive, Did not check / notice another party behind, overseas/migrant driver failed to adjust to NZ road rules and road conditions ENV: road slippery (rain), entering or leaving other commercial	R	W	O	L	D	N	C	100	0	0	0			1791838	5498718	7
1N/967/16.579	100	N		BOULTON ROAD	201534318	18/03/2015	Wed	1600	FD	CS1T	110A 331A 423A 507A		CAR1 SBD on SH 1N hit rear end of TRUCK2 stop/slow for queue	CAR1 Inappropriate speed, failed to notice car slowing, wrong pedal / foot slipped, impared ability due to old age	R	D	B	F			L	80	0	0	0			1791659	5498502	7
1N/967/16.719	40	S		BOULTON ROAD	201152990	22/07/2011	Fri	1700	AD	CN1	110A 357A	FST	CAR1 NBD on SH 1N lost control while overtaking, CAR1 hit Fence, Traffic Sign, Tree	CAR1 Inappropriate speed, emotionally upset/road rage	R	D	TO	F		N	C	100	0	0	0			1791569	5498395	7
1N/967/16.729	50	S		BOULTON ROAD	201551465	19/12/2015	Sat	2355	FA	4S1V	112A 331A		SUV1 SBD on SH 1N hit rear end of VAN2 stopped/moving slowly	SUV1 too fast on straight, failed to notice car slowing	R	D	DO	F			L	80	0	0	0			1791563	5498387	7
1N/967/17.221	200	N		SH 57	201516874	26/08/2015	Wed	1308	JA	VN1C	308B 501B 926		VAN1 NBD on SH 1N hit CAR2 turning right onto SH 1N from the left	CAR2 failed to give way at driveway, Sudden Illness ENV: entering or leaving car parking building / area	R	D	B	F	D	N	C	80	0	0	2			1791246	5498011	7
1N/967/17.311	110	N		KIMBERLEY ROAD	201546704	22/09/2015	Tue	2109	CC	CS1	404A 901	S	CAR1 SBD on SH 1N lost control; went off road to right, CAR1 hit Traffic Sign	CAR1 overseas/migrant driver failed to adjust to NZ road rules and road conditions ENV: heavy rain	R	W	DO	H		N	C	80	0	0	0			1791185	5497945	7
1N/967/17.321	100	N		KIMBERLEY ROAD	201210028	14/05/2012	Mon	1310	MC	TS1V	371B		TRUCK1 SBD on SH 1N hit VAN2 U-turning from same direction of travel	VAN2 Did not check / notice another party behind	R	W	O	L			C	80	1	1	0			1791178	5497937	7
1N/967/17.321	100	N		SH 57	201414759	5/04/2014	Sat	930	FD	4S1CC	191A 331A 191B 331B		SUV1 SBD on SH 1N hit rear end of CAR2 stop/slow for queue	SUV1 Suddenly Braked, failed to notice car slowing CAR2 Suddenly Braked, failed to notice car slowing	R	D	B	F			L	80	0	0	1			1791178	5497937	7
1N/967/17.321	100	N		SH 57	201531508	9/03/2015	Mon	1045	CB	CN1	112A 132A 927	K	CAR1 NBD on SH 1N lost control; went off road to left, CAR1 hit Kerb	CAR1 too fast on straight, Lost control Under Braking ENV: entering or leaving other commercial	R	D	B	F	D	N	L	100	0	0	0			1791178	5497937	7
1N/967/17.321	100	N		SH 57	201352499	21/05/2013	Tue	1700	MC	CN1V	330B 371B		CAR1 NBD on SH 1N hit VAN2 U-turning from same direction of travel	VAN2 inattentive, Did not check / notice another party behind	R	D	TF	F		N	C	80	0	0	0			1791178	5497937	7
1N/967/17.391	30	N		KIMBERLEY ROAD	201311919	21/04/2013	Sun	1420	GD	VS1C	132A 181A 333A 801 927		VAN1 SBD on SH 1N hit rear of CAR2 turning right from centre line	VAN1 Lost control Under Braking, following too closely, failed to notice indication of vehicle in front ENV: road slippery (rain), entering or leaving other commercial	R	W	O	L	D	N	P	80	0	1	0			1791131	5497886	7
1N/985/0			I	KIMBERLEY ROAD	201311746	15/04/2013	Mon	1848	LB	4S1V	303B 404B		VAN2 turning right hit by oncoming SUV1 SBD on SH 1N	VAN2 failed to give way when turning to non-turning traffic, overseas/migrant driver failed to adjust to NZ road rules and road conditions	R	D	DO	F	T	G	C	80	0	0	2			1791111	5497863	7
1N/985/0			I	KIMBERLEY ROAD	201212979	24/10/2012	Wed	1440	CB	CN1	130A 410A	P	CAR1 NBD on SH 1N lost control; went off road to left, CAR1 hit Post Or Pole	CAR1 lost control, fatigue (drowsy, tired, fell asleep)	R	D	B	F	T	G	C	80	0	0	2			1791111	5497863	7
1N/985/0			I	SH 57	201312769	23/10/2013	Wed	610	LB	MS14	303B 375B		SUV2 turning right hit by oncoming MOTOR CYCLE1 SBD on SH 1N	SUV2 failed to give way when turning to non-turning traffic, Did not check / notice another party	R	W	O	F	T	G	R	80	0	0	1			1791111	5497863	7
1N/985/0			I	SH 57	201432253	7/02/2014	Fri	1223	BE	TS1V	129A 130A 407A	I	TRUCK1 SBD on SH 1N lost control on straight and hit VAN2 head on, TRUCK1 hit Traffic Island	TRUCK1 too far left/right, lost control, driver over-reacted	R	D	B	F	T	G	R	80	0	0	0			1791111	5497863	7
1N/985/0			I	SH 57	201150408	10/02/2011	Thu	45	CB	CN1	410A	S	CAR1 NBD on SH 1N lost control; went off road to left, CAR1 hit Traffic Sign	CAR1 fatigue (drowsy, tired, fell asleep)	R	D	DO	F	T	G	L	100	0	0	0			1791111	5497863	7
1N/985/0			I	SH 57	201152869	16/06/2011	Thu	1819	LB	CS1T	692A 303B		TRUCK2 turning right hit by oncoming CAR1 SBD on SH 1N	CAR1 vehicle caught fire TRUCK2 failed to give way when turning to non-turning traffic	R	D	TO	F	T	G	R	80	0	0	0			1791111	5497863	7
1N/985/0			I	SH 57	201154853	7/11/2011	Mon	1405	LB	CS1C	303B 381B		CAR2 turning right hit by oncoming CAR1 SBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic, another vehicle	R	D	B	F	T	G	C	80	0	0	0			1791111	5497863	7
1N/985/0			I	SH 57 KIMBERLEY	201112574	11/09/2011	Sun	1930	LB	4S1C	303B 386B 404B	S	CAR2 turning right hit by oncoming SUV1 SBD on SH 1N SUV1 hit Traffic Sign	CAR2 failed to give way when turning to non-turning traffic, misjudged speed of own vehicle, overseas/migrant driver failed to adjust to NZ road rules and road conditions	R	W	DO	L	T	G	C	100	0	1	2			1791111	5497863	7
1N/985/0.11	110	S		SH 57	201150180	22/01/2011	Sat	1340	GD	CS1CC	331A 353A 402A 921		CAR1 SBD on SH 1N hit rear of CAR2 turning right from centre line	CAR1 failed to notice car slowing, attention diverted by other traffic, new driver / under instruction ENV: entering or leaving roadside stall	R	D	O	F	D	N	L	100	0	0	0			1791042	5497778	7
1N/985/0.2	200	S		KIMBERLEY ROAD	201311520	15/03/2013	Fri	1341	EA	CN14	129A 350A 402A	Q	CAR1 NBD on SH 1N hit parked veh, CAR1 hit Vehicle	CAR1 too far left/right, attention diverted, new driver / under instruction	R	D	B	F		N	C	80	0	0	1			1790987	5497706	7
1N/985/0.443	20	N		BULLER ROAD	201211318	10/01/2012	Tue	1215	LB	CS1CT	371A 386A 158B 303B 386B		CAR2 turning right hit by oncoming CAR1 SBD on SH 1N	CAR1 Did not check / notice another party behind, misjudged speed of own vehicle CAR2 overtaking on left, failed to give way when turning to non-turning traffic, misjudged speed of own vehicle	R	D	B	F	T	G	P	80	0	1	1			1790836	5497516	7
1N/985/0.463			I	BULLER ROAD	201112090	25/04/2011	Mon	1740	LB	CN1C	303B 381B		CAR2 turning right hit by oncoming CAR1 NBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic, another vehicle	R	W	DN	H	T	G	C	100	0	0	1			1790824	5497500	7
1N/985/0.721			I	MCLEAVEY ROAD	201450909	19/12/2014	Fri	100	CB	CS1	112A 130A	S	CAR1 SBD on SH 1N lost control; went off road to left, CAR1 hit Traffic Sign	CAR1 too fast on straight, lost control	R	D	DN	F	T	G	C	100	0	0	0			1790659	5497302	7
1N/985/0.721			I	MCLEAVEY ROAD	201539868	3/06/2015	Wed	820	JA	TS1C	301B		TRUCK1 SBD on SH 1N hit CAR2 turning right onto SH 1N from the left	CAR2 Failed to give way At a priority traffic control	R	D	BN	F	T	G	C	80	0	0	0			1790659	5497302	7
1N/985/0.721			I	MCLEAVEY ROAD	201252169	5/06/2012	Tue	1636	LB	4S1C	303B 334B 355B 801 901		CAR2 turning right hit by oncoming SUV1 SBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic, failed to notice control, attention diverted while trying to find intersection ENV: road slippery (rain), heavy rain	E	W	TF	H	T	G	L	100	0	0	0			1790659	5497302	7

CRASH ROAD	CRASH DIST	CRASH DIRN	INTSN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT	VEHICLES	CAUSES	OBJECTS STRUCK	MVMT DESCR	CAUSES	ROAD CURVE	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	ROAD MARK	SPD LIM	CRASH FATAL CNT	CRASH SEV CNT	CRASH MIN CNT	PERS AGE1	PERS AGE2	EASTING	NORTHING	SECTION
Section 6, Ohau South to Ohau North																															
1N/985/1.096	300	N		MARSDEN TERRACE	201252359	17/07/2012	Tue	1900	QG	VS1C	668A	D	load or trailer from VAN1 SBD on SH 1N hit CAR2 CAR2 hit Debris	VAN1 wheel off	E	D	DN	F		N	L	100	0	0	0			1790420	5497013	6
1N/985/1.16	140	S		VISTA ROAD	201519281	11/12/2015	Fri	1226	DA	MN1	131A 662A	CFK	MOTOR CYCLE1 NBD on SH 1N lost control turning right, MOTOR CYCLE1 hit Cliff Bank, Fence, Kerb on right hand bend	MOTOR CYCLE1 lost control when turning, suspension failure	E	D	B	F			L	80	0	0	1			1790380	5496963	6
1N/985/1.572	40	N		VICTORIA TERRACE	201112301	31/07/2011	Sun	610	CA	MS1	135A 363A 601A		MOTOR CYCLE1 SBD on SH 1N lost control but did not leave the road	MOTOR CYCLE1 lost control due to road conditions, attention diverted by driver dazzled by sun/lights, dazzling headlights	R	D	DN	FF		N	C	100	0	0	1			1790250	5496574	6
1N/985/1.587	25	N		VICTORIA TERRACE	201113086	8/11/2011	Tue	1919	CB	CS1	358A 801	CV	CAR1 SBD on SH 1N lost control; went off road to left, CAR1 hit Cliff Bank, Ditch	CAR1 attention diverted by cigarette etc ENV: road slippery (rain)	R	W	TN	F		N	C	100	0	1	0			1790246	5496560	6
1N/985/1.612			I	VICTORIA TERRACE	201311536	16/03/2013	Sat	2108	GD	CS14	181A 333A		CAR1 SBD on SH 1N hit rear of SUV2 turning right from centre line	CAR1 following too closely, failed to notice indication of vehicle in front	R	D	DN	F	T	N	L	100	0	1	1			1790238	5496536	6
1N/985/1.662	50	S		VICTORIA TERRACE	201533683	29/03/2015	Sun	1727	FD	TN1C	181A 817		TRUCK1 NBD on SH 1N hit rear end of CAR2 stop/slow for queue	TRUCK1 following too closely ENV: road surface under construction or maintenance	R	W	O	L			C	100	0	0	0			1790224	5496488	6
1N/985/1.831			I	MUHUNOA EAST ROAD	201154851	12/11/2011	Sat	1240	LB	CN1C	301B 352B 377B		CAR2 turning right hit by oncoming CAR1 NBD on SH 1N	CAR2 Failed to give way At a priority traffic control, attention diverted by scenery or persons outside vehicle, didnt see/look when visibility obstructed by other vehicles	R	D	O	F	X	S	C	100	0	0	0			1790174	5496326	6
1N/985/1.831			I	MUHUNOA EAST ROAD	201251656	21/05/2012	Mon	837	JA	CN1C	301B 375B		CAR1 NBD on SH 1N hit CAR2 turning right onto SH 1N from the left	CAR2 Failed to give way At a priority traffic control, Did not check / notice another party	R	D	B	F	X	S	C	100	0	0	0			1790174	5496326	6
1N/985/1.831			I	MUHUNOA WEST ROAD	201212735	1/10/2012	Mon	1545	JA	CN1CC	137A 197A 301B 375B 507B		CAR1 NBD on SH 1N hit CAR2 turning right onto SH 1N from the left	CAR1 Lost control avoiding another party, suddenly swerved to avoid vehicle CAR2 Failed to give way At a priority traffic control, Did not check / notice another party, impared ability due to old age	R	D	O	F	X	S	C	100	0	0	1			1790174	5496326	6
1N/985/2.237	50	N		BISHOPS ROAD	201300250	29/11/2013	Fri	1417	BF	4N1CC	121A 350A 410A 106B		SUV1 NBD on SH 1N lost control on curve and hit CAR2 head on	SUV1 swung wide on bend, attention diverted, fatigue (drowsy, tired, fell asleep) CAR2 alcohol not suspected, tested and -ve (MoT use only)	E	D	B	F		N	L	100	1	1	1			1790033	5495948	6
1N/985/2.287			A	BISHOPS ROAD	201211068	14/01/2012	Sat	1600	GD	CN1C	331A 377A 830A		CAR1 NBD on SH 1N hit rear of CAR2 turning right from centre line	CAR1 failed to notice car slowing, didnt see/look when visibility obstructed by other vehicles, visibility limited	E	D	B	FS	T	N	C	100	0	0	2			1790002	5495909	6
1N/985/2.528	100	N		PARAKAWAU ROAD	201354113	28/10/2013	Mon	20	CB	4S1	125A 351A 410A	G	SUV1 SBD on SH 1N lost control; went off road to left, SUV1 hit Guard Rail	SUV1 Too far right, attention diverted by passengers, fatigue (drowsy, tired, fell asleep)	R	D	DN	F		N	C	100	0	0	0			1789825	5495744	6
1N/985/2.628			I	PARAKAWAU ROAD	201532208	6/02/2015	Fri	1055	MC	4N1C	197A 330B 371B		SUV1 NBD on SH 1N hit CAR2 U-turning from same direction of travel	SUV1 suddenly swerved to avoid vehicle CAR2 inattentive, Did not check / notice another party behind	R	D	O	F	T	S	C	100	0	0	0			1789747	5495682	6
1N/985/2.628			I	PARAKAWAU ROAD	201212192	20/06/2012	Wed	653	GD	CN1CC	331A 387A		CAR1 NBD on SH 1N hit rear of CAR2 turning right from centre line	CAR1 failed to notice car slowing, misjudged intentions of another party	E	W	DF	L	T	S	C	100	0	2	2			1789747	5495682	6
Section 5, Tatum Park start wide center line to Ohau South																															
1N/985/3.078	450	S		PARAKAWAU ROAD	201111421	5/03/2011	Sat	1312	FA	4N1C	331A 503A		SUV1 NBD on SH 1N hit rear end of CAR2 stopped/moving slowly	SUV1 failed to notice car slowing, defective vision	E	D	B	F		N	L	100	0	0	3			1789415	5495386	5
1N/985/3.228	600	S		PARAKAWAU ROAD	201546134	30/09/2015	Wed	1030	FD	4S1C4	181A 330A 421C		SUV1 SBD on SH 1N hit rear end of CAR2 stop/slow for queue	SUV1 following too closely, inattentive SUV3 started in gear /stalled	E	D	B	F		N	C	100	0	0	0			1789370	5495244	5
1N/985/3.354	800	N		KUKU BEACH ROAD	201355541	8/11/2013	Fri	1501	FD	4N1CC	181A 350A		SUV1 NBD on SH 1N hit rear end of CAR2 stop/slow for queue	SUV1 following too closely, attention diverted	R	D	B	F		N	L	100	0	0	0			1789358	5495119	5
1N/985/3.354	800	N		KUKU BEACH ROAD	201414019	13/05/2014	Tue	1053	FA	TN14	331A 350A		TRUCK1 NBD on SH 1N hit rear end of SUV2 stopped/moving slowly	TRUCK1 failed to notice car slowing, attention diverted	R	W	O	L		N	L	100	0	0	1			1789358	5495119	5
1N/985/3.484	670	N		KUKU BEACH ROAD	201250514	2/03/2012	Fri	2141	CB	VS1	130A 801	FV	VAN1 SBD on SH 1N lost control; went off road to left, VAN1 hit Fence, Ditch	VAN1 lost control ENV: road slippery (rain)	R	W	DN	L		N	C	100	0	0	0			1789350	5494989	5
1N/985/3.554	600	N		KUKU BEACH ROAD	201254398	5/12/2012	Wed	1427	FD	CN1V	112A 181A 402A 181B 191B 801 901		CAR1 NBD on SH 1N hit rear end of VAN2 stop/slow for queue	CAR1 too fast on straight, following too closely, new driver / under instruction VAN2 following too closely, Suddenly Braked ENV: road slippery (rain), heavy rain	R	W	O	H		N	C	100	0	0	0			1789346	5494919	5
1N/985/3.704	450	N		KUKU BEACH ROAD	201516860	6/10/2015	Tue	953	CC	CS1	130A 504A	FGT	CAR1 SBD on SH 1N lost control; went off road to right, CAR1 hit Fence, Guard Rail, Tree	CAR1 lost control, medical illness (not sudden eg flu)	R	D	B	F		N	C	100	0	0	1			1789337	5494770	5
1N/985/3.754	400	N		KUKU BEACH ROAD	201353014	12/07/2013	Fri	1625	GD	CS1C	181A 929		CAR1 SBD on SH 1N hit rear of CAR2 turning right from centre line	CAR1 following too closely ENV: entering or leaving private house / farm	R	D	B	F	D	N	L	100	0	0	0			1789334	5494720	5
1N/985/3.854	300	N		KUKU BEACH ROAD	201438771	11/04/2014	Fri	1520	GD	CN1T	331A 358A 928		CAR1 NBD on SH 1N hit rear of TRUCK2 turning right from centre line	CAR1 failed to notice car slowing, attention diverted by cigarette etc ENV: entering or leaving industrial site	R	W	OF	L	D	N	C	100	0	0	0			1789328	5494620	5
1N/985/3.992	290	N		KUKU EAST ROAD	201325980	7/12/2013	Sat	1556	MB	CS1C	371B		CAR1 SBD on SH 1N hit CAR2 U-turning from opposite direction of travel	CAR2 Did not check / notice another party behind	R	D	BF	F		N	C	100	0	0	2			1789318	5494482	5
1N/985/4.074	80	N		KUKU BEACH ROAD	201517255	22/10/2015	Thu	1410	AC	CN1T	112A 371A 381A	F	CAR1 NBD on SH 1N changing lanes to left hit TRUCK2 CAR1 hit Fence	CAR1 too fast on straight, Did not check / notice another party behind, another vehicle	R	D	O	L			P	100	0	0	1			1789312	5494400	5
1N/985/4.154			I	KUKU BEACH ROAD	201432965	14/03/2014	Fri	1000	LB	CN1V	303B 375B		VAN2 turning right hit by oncoming CAR1 NBD on SH 1N	VAN2 failed to give way when turning to non-turning traffic, Did not check / notice another party	R	D	B	F	T	G	P	100	0	0	0			1789306	5494321	5
1N/985/4.154			I	KUKU BEACH ROAD	201436496	14/05/2014	Wed	1626	JA	CN1C	301B 375B		CAR1 NBD on SH 1N hit CAR2 turning right onto SH 1N from the left	CAR2 Failed to give way At a priority traffic control, Did not check / notice another party	R	W	OF	L	T	G	C	100	0	0	0			1789306	5494321	5
1N/985/4.154			I	KUKU BEACH ROAD	201254318	29/10/2012	Mon	1635	JA	CN14	303B 375B		CAR1 NBD on SH 1N hit SUV2 turning right onto SH 1N from the left	SUV2 failed to give way when turning to non-turning traffic, Did not check / notice another party	R	D	B	F	T	G	C	100	0	0	0			1789306	5494321	5
1N/985/4.232	50	N		KUKU EAST ROAD	201448026	6/11/2014	Thu	1200	AA	CS14	177A 184A		CAR1 SBD on SH 1N changing lanes/overtaking to right hit SUV2	CAR1 weaving or cut in on multi-lane road, incorrect merging/diverging manoeuvre	R	D	B	F			L	100	0	0	0			1789301	5494243	5
1N/985/4.682	400	S		KUKU EAST ROAD	201539939	6/06/2015	Sat	110	DA	CS1	103A 410A 801	FV	CAR1 SBD on SH 1N lost control turning right, CAR1 hit Fence, Ditch on right hand bend	CAR1 alcohol test above limit or test refused, fatigue (drowsy, tired, fell asleep) ENV: road slippery (rain)	E	W	DN	L			C	100	0	0	0			1789263	5493795	5
1N/985/4.682	400	S		KUKU EAST ROAD	201250333	22/01/2012	Sun	850	DB	CN1	137A 195A 911	T	CAR1 NBD on SH 1N lost control turning left, CAR1 hit Tree	CAR1 Lost control avoiding another party, suddenly swerved to avoid animal ENV: household pet rushed out or playing	M	D	O	F		N	C	100	0	0	0			1789263	5493795	5
1N/985/4.732	450	S		KUKU EAST ROAD	201350512	9/02/2013	Sat	1440	QG	CS1	665A 666A	FS	load or trailer from CAR1 SBD on SH 1N CAR1 hit Fence, Traffic Sign	CAR1 inadequate tow coupling, inadequate or no safety chain	R	D	B	F		N	C	100	0	0	0			1789246	5493748	5
1N/985/4.804	650	S		KUKU BEACH ROAD	201544512	16/07/2015	Thu	515	EC	TN1	912	W	TRUCK1 NBD on SH 1N hit obstruction, TRUCK1 hit Stray Animal	ENV: farm animal straying	R	D	DN	F			C	100	0	0	0			1789208	5493688	5
1N/985/4.982	700	S		KUKU EAST ROAD	201111646	16/04/2011	Sat	1400	CB	TN1B	132A 181A 800	T	TRUCK1 NBD on SH 1N lost control; went off road to left, TRUCK1 hit Tree	TRUCK1 Lost control Under Braking, following too closely ENV: slippery	R	W	O	L		N	L	100	0	0	2			1789098	5493548	5

CRASH ROAD	CRASH DIST	CRASH DIRN	INTSN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT	VEHICLES	CAUSES	OBJECTS STRUCK	MVMT DESCR	CAUSES	ROAD CURVE	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	ROAD MARK	SPD LIM	CRASH FATAL CNT	CRASH SEV CNT	CRASH MIN CNT	PERS AGE1	PERS AGE2	EASTING	NORTHING	SECTION
1N/985/5.282	1000	S		KUKU EAST ROAD	201544387	25/08/2015	Tue	1800	BC	CN1C	121A 410A		CAR1 NBD on SH 1N swinging wide hit CAR2 head on	CAR1 swung wide on bend, fatigue (drowsy, tired, fell asleep)	E	W	DN	L		N	L	100	0	0	0			1788908	5493315	5
1N/985/5.482	1200	S		KUKU EAST ROAD	201112777	3/11/2011	Thu	1115	CB	CS1	130A 412A	F	CAR1 SBD on SH 1N lost control; went off road to left, CAR1 hit Fence	CAR1 lost control, fatigue due to lack of sleep	R	D	B	F		N	L	100	0	0	1			1788783	5493159	5
1N/985/5.482	1200	S		KUKU EAST ROAD	201439574	4/07/2014	Fri	1357	LB	CS1C	303B 929		CAR2 turning right hit by oncoming CAR1 SBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic ENV: entering or leaving private house / farm	R	D	B	F	D	N	L	100	0	0	0			1788783	5493159	5
Section 4, Manakau North to Tatum Park (start wide center line)																															
1N/985/6.517	530	N		WHAKAHORO ROAD	201312500	14/09/2013	Sat	2019	CC	VS1	101A 410A		VAN1 SBD on SH 1N lost control; went off road to right	VAN1 alcohol suspected, fatigue (drowsy, tired, fell asleep)	R	D	DN	F		N	L	100	0	0	1			1788130	5492359	4
1N/985/6.547	500	N		WHAKAHORO ROAD	201550452	20/11/2015	Fri	2330	DA	CW1	631A	G	CAR1 WBD on SH 1N lost control turning right, CAR1 hit Guard Rail on right hand bend	CAR1 puncture or blowout	E	W	DN	L			C	100	0	0	0			1788106	5492342	4
1N/985/6.581	60	S		WAIKAWA BR	201150277	5/02/2011	Sat	852	DA	VN1	110A	T	VAN1 NBD on SH 1N lost control turning right, VAN1 hit Tree on right hand bend	VAN1 Inappropriate speed	M	W	O	L		N	L	100	0	0	0			1788078	5492323	4
1N/985/6.611	90	S		WAIKAWA BR	201113049	28/10/2011	Fri	1820	DA	CS1	131A 407A 811 901	V	CAR1 SBD on SH 1N lost control turning right, CAR1 hit Ditch on right hand bend	CAR1 lost control when turning, driver over-reacted ENV: road surface (potholed), heavy rain	E	W	O	H		N	C	100	0	0	2			1788053	5492306	4
1N/985/6.647	400	N		WHAKAHORO ROAD	201511915	26/03/2015	Thu	1728	BF	CN1C	131A 191A 402A		CAR1 NBD on SH 1N lost control on curve and hit CAR2 head on	CAR1 lost control when turning, Suddenly Braked, new driver / under instruction	M	W	O	L			L	100	0	0	1			1788020	5492292	4
1N/985/6.737	310	N		WHAKAHORO ROAD	201545914	22/10/2015	Thu	1615	FD	TN1C	132A 181A		TRUCK1 NBD on SH 1N hit rear end of CAR2 stop/slow for queue	TRUCK1 Lost control Under Braking, following too closely	E	W	O	F		N	L	100	0	0	0			1787939	5492253	4
1N/985/6.747	300	N		WHAKAHORO ROAD	201312178	4/06/2013	Tue	1538	BF	CS14	121A 201A		CAR1 SBD on SH 1N lost control on curve and hit SUV2 head on	CAR1 swung wide on bend, wrong way in one way street	M	W	B	L		N	L	100	0	1	0			1787930	5492247	4
1N/985/6.767	280	N		WHAKAHORO ROAD	201111989	27/06/2011	Mon	1357	DA	CN1	130A 410A	P	CAR1 NBD on SH 1N lost control turning right, CAR1 hit Post Or Pole on right hand bend	CAR1 lost control, fatigue (drowsy, tired, fell asleep)	M	D	B	F		N	C	100	0	0	1			1787915	5492235	4
1N/985/6.767	280	N		WHAKAHORO ROAD	201547461	16/10/2015	Fri	1035	DA	CN1	129A 410A	G	CAR1 NBD on SH 1N lost control turning right, CAR1 hit Guard Rail on right hand bend	CAR1 too far left/right, fatigue (drowsy, tired, fell asleep)	E	D	O	F		N	C	100	0	0	0			1787915	5492235	4
1N/985/6.872			A	MANAKAU N RLY OBR	201153450	15/08/2011	Mon	429	DA	VN1	135A 802 905	G	VAN1 NBD on SH 1N lost control turning right, VAN1 hit Guard Rail on right hand bend	VAN1 lost control due to road conditions ENV: road slippery (frost or ice), snow	E	I	DN	SF		N	C	100	0	0	0			1787844	5492157	4
1N/985/6.872			A	MANAKAU N RLY OBR	201151907	22/05/2011	Sun	1500	FA	CN1C	181A		CAR1 NBD on SH 1N hit rear end of CAR2 stopped/moving slowly	CAR1 following too closely	E	W	O	L		N	C	100	0	0	0			1787844	5492157	4
1N/985/6.872			A	MANAKAU N RLY OBR	201151985	22/05/2011	Sun	1600	FD	4N1CC	110A 331A		SUV1 NBD on SH 1N hit rear end of CAR2 stop/slow for queue	SUV1 Inappropriate speed, failed to notice car slowing	M	W	O	L		N	L	100	0	0	0			1787844	5492157	4
1N/985/6.872			A	MANAKAU N RLY OBR	201254439	17/11/2012	Sat	1913	DA	CN1	111A 131A 402A	FV	CAR1 NBD on SH 1N lost control turning right, CAR1 hit Fence, Ditch on right hand bend	CAR1 Entering / On curve, lost control when turning, new driver / under instruction	M	W	O	F		N	L	100	0	0	0			1787844	5492157	4
1N/985/6.897	150	N		WHAKAHORO ROAD	201410157	4/01/2014	Sat	1619	DA	MN1CB	131A	G	MOTOR CYCLE1 NBD on SH 1N lost control turning right, MOTOR CYCLE1 hit Guard Rail on right hand bend	MOTOR CYCLE1 lost control when turning	M	D	O	F			L	100	0	1	0			1787827	5492139	4
1N/985/6.947	100	N		WHAKAHORO ROAD	201436194	14/05/2014	Wed	1500	FD	CS1CC	331A 353A 402A		CAR1 SBD on SH 1N hit rear end of CAR2 stop/slow for queue	CAR1 failed to notice car slowing, attention diverted by other traffic, new driver / under instruction	M	W	O	L			C	100	0	0	0			1787794	5492102	4
1N/985/7.004	470	N		NORTH MANAKAU ROAD	201211373	2/03/2012	Fri	2125	DB	VS1	135A 806 901	FP	VAN1 SBD on SH 1N lost control turning left, VAN1 hit Fence, Post Or Pole	VAN1 lost control due to road conditions ENV: road slippery (oil/diesel/fuel), heavy rain	M	W	DN	H		N	L	100	0	0	1			1787766	5492053	4
1N/985/7.047			I	WHAKAHORO ROAD	201153451	24/08/2011	Wed	820	FD	CN1C	130A 181A 331A 800		CAR1 NBD on SH 1N hit rear end of CAR2 stop/slow for queue	CAR1 lost control, following too closely, failed to notice car slowing ENV: slippery	R	W	O	F	T	S	C	100	0	0	0			1787750	5492013	4
1N/985/7.047			I	WHAKAHORO ROAD	201535797	28/03/2015	Sat	1310	DB	CS1C	134A 358A 901	FM	CAR1 SBD on SH 1N lost control turning left, CAR1 hit Fence, Parked Vehicle	CAR1 lost control while returning to seal from unsealed shoulder, attention diverted by cigarette etc ENV: heavy rain	E	W	ON	H	T	N	C	100	0	0	0			1787750	5492013	4
1N/985/7.147	100	S		WHAKAHORO ROAD	201212248	26/07/2012	Thu	2140	EC	CS1	341A 912	W	CAR1 SBD on SH 1N hit obstruction, CAR1 hit Stray Animal	CAR1 obstruction on roadway ENV: farm animal straying	R	D	DN	F		N	C	100	0	0	1			1787714	5491920	4
1N/985/7.247	200	S		WHAKAHORO ROAD	201534973	2/04/2015	Thu	1725	EC	CN1T	682B	D	CAR1 NBD on SH 1N hit obstruction, CAR1 hit Debris	TRUCK2 load not well secured or moved	R	D	ON	F		N	C	100	0	0	0			1787678	5491827	4
1N/985/7.274	200	N		NORTH MANAKAU ROAD	201445721	23/10/2014	Thu	9	EC	CS1	912	W	CAR1 SBD on SH 1N hit obstruction, CAR1 hit Stray Animal	ENV: farm animal straying	R	D	DN	F		N	C	100	0	0	0			1787668	5491802	4
Section 3, SH1 Manakau South to Makakau North																															
1N/985/7.724	250	S		NORTH MANAKAU ROAD	201253270	8/09/2012	Sat	1620	CA	MN1	110A 132A		MOTOR CYCLE1 NBD on SH 1N lost control but did not leave the road	MOTOR CYCLE1 Inappropriate speed, Lost control Under Braking	R	W	O	H		N	C	100	0	0	0			1787505	5491382	3
1N/985/7.816	300	N		WAIKAWA BEACH ROAD	201251778	18/03/2012	Sun	1700	AA	TS1CC	177A 371A 191B 181C 331C		TRUCK1 SBD on SH 1N changing lanes/overtaking to right hit CAR2	TRUCK1 weaving or cut in on multi-lane road, Did not check / notice another party behind CAR2 Suddenly Braked CAR3 following too closely, failed to notice car slowing	R	D	B	F		N	C	100	0	0	0			1787471	5491296	3
1N/985/8.116			I	WAIKAWA BEACH ROAD	201546135	11/09/2015	Fri	2140	AD	CS1C	103A 112A 157A		CAR1 SBD on SH 1N lost control while overtaking	CAR1 alcohol test above limit or test refused, too fast on straight, overtaking at an intersection	R	D	DO	F	T	N	C	100	0	0	0			1787362	5491016	3
1N/985/8.36	130	N		MOKENA KOHERE ST	201514394	11/06/2015	Thu	15	CB	CN1	129A 410A	P	CAR1 NBD on SH 1N lost control; went off road to left, CAR1 hit Post Or Pole	CAR1 too far left/right, fatigue (drowsy, tired, fell asleep)	R	W	DN	L		N	C	50	0	1	0			1787271	5490791	3
1N/985/8.48	10	N		MOKENA KOHERE ST	201310019	4/05/2013	Sat	2240	BE	CS1C	106A 125A 106B		CAR1 SBD on SH 1N lost control on straight and hit CAR2 head on	CAR1 alcohol not suspected, tested and -ve (MoT use only), Too far right CAR2 alcohol not suspected, tested and -ve (MoT use only)	R	D	DO	F	T	N	C	100	2	1	0			1787226	5490680	3
1N/985/8.486	370	S		WAIKAWA BEACH ROAD	201112144	23/05/2011	Mon	1240	MC	CS14	371B 381B 642B		CAR1 SBD on SH 1N hit SUV2 U-turning from same direction of travel	SUV2 Did not check / notice another party behind, another vehicle, vehicle windows/helmet visors/goggles/glasses/misted dirty/windscreen wipers	R	D	O	F		N	C	100	0	0	1			1787224	5490673	3
1N/985/8.49			I	MOKENA KOHERE ST	201254109	27/10/2012	Sat	2350	GD	CN1C	112A 150A		CAR1 NBD on SH 1N hit rear of CAR2 turning right from centre line	CAR1 too fast on straight, overtaking	R	D	DO	F	T	G	C	100	0	0	0			1787222	5490670	3
1N/985/8.516	400	S		WAIKAWA BEACH ROAD	201212570	8/09/2012	Sat	1522	CB	CN1	101A 129A 801 901	P	CAR1 NBD on SH 1N lost control; went off road to left, CAR1 hit Post Or Pole	CAR1 alcohol suspected, too far left/right ENV: road slippery (rain), heavy rain	R	W	O	H		N	C	100	0	2	1			1787213	5490645	3
MANAKAU RAIL UNDERPASS			I	1N/985/8.971	201449370	14/12/2014	Sun	1537	MO	4E1C	357A 512A		SUV1 EBD on MANAKAU RAIL UNDERPASS hit CAR2 manoeuvring	SUV1 emotionally upset/road rage, intentional collision	R	D	B	F	T	S	L	50	0	0	0			1787047	5490223	3
1N/985/9.214	180	N		GLEESON ROAD	201532870	18/03/2015	Wed	944	DA	CN1	131A 504A	FT	CAR1 NBD on SH 1N lost control turning right, CAR1 hit Fence, Tree on right hand bend	CAR1 lost control when turning, medical illness (not sudden eg flu)	E	D	B	F			C	100	0	0	0			1786958	5489996	3
1N/985/9.274	120	N		GLEESON ROAD	201252166	30/06/2012	Sat	500	CC	CS1	125A 410A	FT	CAR1 SBD on SH 1N lost control; went off road to right, CAR1 hit Fence, Tree	CAR1 Too far right, fatigue (drowsy, tired, fell asleep)	R	D	DN	F		N	C	100	0	0	0			1786949	5489936	3

CRASH ROAD	CRASH DIST	CRASH DIRN	INTSN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT	VEHICLES	CAUSES	OBJECTS STRUCK	MVMT DESCR	CAUSES	ROAD CURVE	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	ROAD MARK	SPD LIM	CRASH FATAL CNT	CRASH SEV CNT	CRASH MIN CNT	PERS AGE1	PERS AGE2	EASTING	NORTHING	SECTION
Section 2, SH1 Forest Lakes Road Excl to Manakau South																															
1N/985/9.694	300	S		GLEESON ROAD	201533696	26/03/2015	Thu	2115	FO	TN1C	181A 197B		TRUCK1 NBD on SH 1N hit rear end of CAR2 stop/slow for obstruction	TRUCK1 following too closely CAR2 suddenly swerved to avoid vehicle	E	D	DO	F			C	100	0	0	0			1786890	5489523	2
1N/985/9.875	510	N		SOUTH MANAKAU ROAD	201212586	22/09/2012	Sat	1735	CC	CS1	103A 120A	FV	CAR1 SBD on SH 1N lost control; went off road to right, CAR1 hit Fence, Ditch	CAR1 alcohol test above limit or test refused, failed to keep left	R	D	B	F		N	C	100	0	0	1			1786793	5489373	2
1N/985/9.894	500	S		GLEESON ROAD	201212294	30/07/2012	Mon	1700	CA	MS1	137A 197A		MOTOR CYCLE1 SBD on SH 1N lost control but did not leave the road	MOTOR CYCLE1 Lost control avoiding another party, suddenly swerved to avoid vehicle	R	W	TO	LS		N	C	100	0	1	0			1786778	5489361	2
1N/985/10.116	270	N		SOUTH MANAKAU ROAD	201312108	11/05/2013	Sat	935	GC	4N1C	387A 174B 371B 929		SUV1 NBD on SH 1N hit rear of CAR2 turning right from left side	SUV1 misjudged intentions of another party CAR2 Turned from incorrect position on road, Did not check / notice another party behind ENV: entering or leaving private house / farm	R	D	O	F	D	N	L	100	0	0	1			1786587	5489254	2
1N/985/10.326	60	N		SOUTH MANAKAU ROAD	201537766	19/06/2015	Fri	2220	EA	VN1V	363A	M	VAN1 NBD on SH 1N hit parked veh, VAN1 hit Parked Vehicle	VAN1 attention diverted by driver dazzled by sun/lights	R	D	DO	H		N	C	100	0	0	0			1786434	5489110	2
1N/985/10.463	70	S		SOUTH MANAKAU ROAD	201352465	6/06/2013	Thu	1110	FD	CN1C	112A 181A		CAR1 NBD on SH 1N hit rear end of CAR2 stop/slow for queue	CAR1 too fast on straight, following too closely	R	D	B	F		N	C	100	0	0	0			1786339	5489022	2
1N/985/10.872	40	N		ATKINS ROAD	201150181	23/01/2011	Sun	1632	FD	CS1CC	112A 181A 112C 181C		CAR1 SBD on SH 1N hit rear end of CAR2 stop/slow for queue	CAR1 too fast on straight, following too closely CAR3 too fast on straight, following too closely	R	W	O	H		N	C	100	0	0	0			1786047	5488735	2
1N/985/11.072	160	S		ATKINS ROAD	201152179	16/04/2011	Sat	1540	DB	CN1	800	F	CAR1 NBD on SH 1N lost control turning left, CAR1 hit Fence	ENV: slippery	M	W	O	L		N	C	100	0	0	0			1785909	5488590	2
1N/985/11.135			A	PUKEHOU RLY OBR	201252002	20/05/2012	Sun	1715	FA	CN1C	331A 350A 817		CAR1 NBD on SH 1N hit rear end of CAR2 stopped/moving slowly	CAR1 failed to notice car slowing, attention diverted ENV: road surface under construction or maintenance	E	D	TN	F		N	C	80	0	0	0			1785860	5488551	2
1N/985/11.135			A	PUKEHOU RLY OBR	201212189	16/07/2012	Mon	1329	BF	CS1T	101A 132A 339A 801 817	B	CAR1 SBD on SH 1N lost control on curve and hit TRUCK2 head on, CAR1 hit Bridge	CAR1 alcohol suspected, Lost control Under Braking, failed to notice roadworks signs ENV: road slippery (rain), road surface under construction or maintenance	E	W	O	F		N	C	100	0	1	2			1785860	5488551	2
1N/985/11.135			A	PUKEHOU RLY OBR	201113368	22/12/2011	Thu	710	BF	VE1V	131A 501A	B	VAN1 EBD on SH 1N lost control on curve and hit VAN2 head on, VAN1 hit Bridge	VAN1 lost control when turning, Sudden Illness	E	D	B	F		N	C	100	0	0	1			1785860	5488551	2
1N/995/0.439	1200	S		SOUTH MANAKAU ROAD	201152830	28/07/2011	Thu	1300	DA	TS1	136A 631A	V	TRUCK1 SBD on SH 1N lost control turning right, TRUCK1 hit Ditch on right hand bend	TRUCK1 lost control due to vehicle fault, puncture or blowout	E	D	B	F		N	C	100	0	0	0			1785421	5488457	2
1N/995/0.559	800	S		ATKINS ROAD	201359037	29/11/2013	Fri	1830	FD	CN1C	181A		CAR1 NBD on SH 1N hit rear end of CAR2 stop/slow for queue	CAR1 following too closely	E	D	OF	F		N	L	100	0	0	0			1785302	5488448	2
1N/995/0.749	500	E		FOREST LAKES ROAD	201517631	7/10/2015	Wed	1745	DA	CN1	130A 631A	CT	CAR1 NBD on SH 1N lost control turning right, CAR1 hit Cliff Bank, Tree on right hand bend	CAR1 lost control, puncture or blowout	E	D	B	F			C	100	0	0	1			1785115	5488411	2
1N/995/1.099	150	E		FOREST LAKES ROAD	201534365	5/03/2015	Thu	1823	MC	CE14	371B		CAR1 EBD on SH 1N hit SUV2 U-turning from same direction of travel	SUV2 Did not check / notice another party behind	R	D	B	F			L	100	0	0	0			1784795	5488272	2
1N/995/1.149	100	N		FOREST LAKES ROAD	201352942	20/07/2013	Sat	1830	FA	CN1C	331A		CAR1 NBD on SH 1N hit rear end of CAR2 stopped/moving slowly	CAR1 failed to notice car slowing	M	D	DN	F		N	L	100	0	0	0			1784753	5488246	2
1N/995/1.169	80	N		FOREST LAKES ROAD	201354281	24/10/2013	Thu	515	EC	TN1	912	W	TRUCK1 NBD on SH 1N hit obstruction, TRUCK1 hit Stray Animal	ENV: farm animal straying	R	W	DN	H		N	C	100	0	0	0			1784736	5488235	2
1N/995/1.234	15	N		FOREST LAKES ROAD	201212879	1/11/2012	Thu	1120	FD	TS1CC	181A 330A		TRUCK1 SBD on SH 1N hit rear end of CAR2 stop/slow for queue	TRUCK1 following too closely, inattentive	E	D	B	F	T	S	L	100	0	0	1			1784683	5488198	2
1N/995/1.249			I	FOREST LAKES ROAD	201311738	1/05/2013	Wed	930	DB	CN1	111A 355A 361A	C	CAR1 NBD on SH 1N lost control turning left, CAR1 hit Cliff Bank	CAR1 Entering / On curve, attention diverted while trying to find intersection, attention diverted by navigation device	E	D	B	F	T	S	C	100	0	0	1			1784670	5488189	2
Section 1, SH1 Taylors Road to Forest Lakes Road Inc																															
1N/995/1.399	150	W		FOREST LAKES ROAD	201434768	4/03/2014	Tue	2105	GD	TN1C	387A 929		TRUCK1 NBD on SH 1N hit rear of CAR2 turning right from centre line	TRUCK1 misjudged intentions of another party ENV: entering or leaving private house / farm	E	W	DO	H	D	N	L	100	0	0	0			1784547	5488103	1
1N/995/1.549	300	S		FOREST LAKES ROAD	201211162	28/01/2012	Sat	1230	QG	4S1	130A 661A 682A	E	load or trailer from SUV1 SBD on SH 1N SUV1 went Over Bank	SUV1 lost control, body or frame failure, load not well secured or moved	R	D	B	F		N	L	100	0	1	3			1784425	5488017	1
1N/995/1.599	350	W		FOREST LAKES ROAD	201538338	26/04/2015	Sun	1202	FA	4W1C	110A 331A 402A		SUV1 WBD on SH 1N hit rear end of CAR2 stopped/moving slowly	SUV1 Inappropriate speed, failed to notice car slowing, new driver / under instruction	R	D	B	F			L	100	0	0	0			1784384	5487988	1
1N/995/1.749	500	S		FOREST LAKES ROAD	201251299	20/04/2012	Fri	1730	EC	CS1	130A 341A	D	CAR1 SBD on SH 1N hit obstruction, CAR1 hit Debris	CAR1 lost control, obstruction on roadway	E	D	TN	F		N	C	100	0	0	0			1784261	5487902	1
1N/995/1.849	600	S		FOREST LAKES ROAD	201441639	15/08/2014	Fri	2000	CB	CS1	112A 130A	FV	CAR1 SBD on SH 1N lost control; went off road to left, CAR1 hit Fence, Ditch	CAR1 too fast on straight, lost control	R	W	DN	L			L	100	0	0	0			1784179	5487845	1
1N/995/1.919	670	S		FOREST LAKES ROAD	201113088	21/11/2011	Mon	1040	DB	CN1	111A 131A 402A 800	V	CAR1 NBD on SH 1N lost control turning left, CAR1 hit Ditch	CAR1 Entering / On curve, lost control when turning, new driver / under instruction ENV: slippery	E	W	O	L		N	C	100	0	0	1			1784118	5487810	1
1N/995/2.427	150	E		LAWLORS ROAD	201400234	10/11/2014	Mon	1326	BE	CW1C	101A 112A 132A 926		CAR1 WBD on SH 1N lost control on straight and hit CAR2 head on	CAR1 alcohol suspected, too fast on straight, Lost control Under Braking ENV: entering or leaving car parking building / area	R	D	O	F	D	N	L	100	1	2	0			1783641	5487638	1
1N/995/2.543	760	N		TAYLORS ROAD	201112258	2/06/2011	Thu	840	AD	CS1C	130A 150A 407A	C	CAR1 SBD on SH 1N lost control while overtaking, CAR1 hit Cliff Bank	CAR1 lost control, overtaking, driver over-reacted	R	D	B	F		N	L	100	0	1	1			1783534	5487594	1
1N/995/2.803	500	N		TAYLORS ROAD	201537806	7/06/2015	Sun	1800	EC	CN1	911	W	CAR1 NBD on SH 1N hit obstruction, CAR1 hit Stray Animal	ENV: household pet rushed out or playing	E	D	B	F		N	C	100	0	0	0			1783298	5487486	1
1N/995/2.903	400	N		TAYLORS ROAD	201253029	24/08/2012	Fri	2055	DA	CN1	101A 111A	G	CAR1 NBD on SH 1N lost control turning right, CAR1 hit Guard Rail on right hand bend	CAR1 alcohol suspected, Entering / On curve	E	D	DN	F		N	C	100	0	0	0			1783218	5487427	1
1N/995/2.903	400	N		TAYLORS ROAD	201444017	2/01/2014	Thu	1523	FD	CW1CC	331A 832		CAR1 WBD on SH 1N hit rear end of CAR2 stop/slow for queue	CAR1 failed to notice car slowing ENV: visibility limited by crest or dip	R	D	ON	F		N	L	100	0	0	0			1783218	5487427	1
1N/995/3.003	300	N		TAYLORS ROAD	201445153	7/09/2014	Sun	810	DB	CS1	131A 407A	F	CAR1 SBD on SH 1N lost control turning left, CAR1 hit Fence	CAR1 lost control when turning, driver over-reacted	E	D	B	F			L	100	0	0	0			1783154	5487350	1
1N/995/3.103	200	N		TAYLORS ROAD	201211498	22/03/2012	Thu	2155	BF	4S1C	108A 131A	T	SUV1 SBD on SH 1N lost control on curve and hit CAR2 head on, SUV1 hit Tree	SUV1 drugs suspected, lost control when turning	E	D	DN	F		N	L	100	0	0	1			1783105	5487262	1
1N/995/3.253	50	N		TAYLORS ROAD	201543386	19/08/2015	Wed	1400	MC	CN1C	371B		CAR1 NBD on SH 1N hit CAR2 U-turning from same direction of travel	CAR2 Did not check / notice another party behind	R	W	O	L		N	L	100	0	0	0			1783032	5487131	1
1N/995/3.303			I	TAYLORS ROAD	201519506	5/11/2015	Thu	1344	KA	CN1M	301B 375B		CAR1 NBD on SH 1N hit MOTOR CYCLE2 merging from the left	MOTOR CYCLE2 Failed to give way At a priority traffic control, Did not check / notice another party	R	D	B	F	T	G	L	100	0	0	1			1783008	5487088	1
1N/995/3.303			I	TAYLORS ROAD	201357892	17/12/2013	Tue	1355	MC	CS1V	371B		CAR1 SBD on SH 1N hit VAN2 U-turning from same direction of travel	VAN2 Did not check / notice another party behind	R	D	BF	F	T	N	C	100	0	0	0			1783008	5487088	1

Appendix B Skid Resistance vs Wet Injury Crashes



Appendix C Site Visit Notes

The following site notes were recorded during the site visit on 13 October 2016. The notes are a combination of observations made during the hours of daylight and hours of darkness, on the same day.

Route Works

- Line marking for Sections 2-7 should be renewed more often, or marked in high-performance long-life material. Red RRPM's didn't exist north of Pukehou Rail Overbridge.
- There were gaps in ATP edge lines and this this be installed in other locations where possible (away from residences).
- Existing delineation needed better maintenance including cleaning, replacing and realigning existing delineators as required. Any obsolete materials, such as sign with Engineering Grade reflectors, should be upgraded to a higher grade. Particular attention should be paid to the following areas:
  - All bridges.
  - All curves with existing chevron delineators.
  - All curves with missing or poorly-performing EMPs.

Section 1

- Numerous roadside hazards exist throughout this section including:
  - Power poles north of Taylors Rd (western side).
  - Trees and drop-offs adjacent to southbound rest area (both sides).
  - Trees and drainage channel northbound near the start of the northbound passing lane.
  - Trees and a drop-off southbound, south of Forest Lakes Road.
  - Non-frangible sign posts at the rest area (RP 995/0.76).
- Neither Taylors Road nor Forest Lakes Road have right turn bays for southbound traffic increasing the risk crashes.
- Forest Lakes Road has limited visibility for exiting vehicles and despite signage the intersection is still inconspicuous to approaching state highway traffic.
- Here are a number of high risk accesses along this section including those for the 'Loco' attraction and southbound rest area.
- Some delineation was difficult to see during the night site inspection although this was better than sections north of Pukehou Bridge.

Section 2

- Some of the existing delineation on the curves either side of Gleeson Road is difficult to see or missing. This reduces drivers' ability to interpret the curving alignment of the road.
- A luminaire near Gleeson Road is missing. This reduces the amount of light available in dark conditions which reduce driver's ability to interpret the alignment of the road ahead.
- The existing delineation either side of South Manakau Road is poor which makes the environment relatively dark at night, especially compared to the lighting provided at the intersection.
- There are unprotected drops-offs and power poles close to the highway either side of Atkins Road.
- The sight distance when turning out of Atkins Road is poor/marginal. Overgrown vegetation reduces this further.
- The existing delineation on Pukehou Rail Overbridge looks dirty, hard to see and is not level.

Section 3

- Unprotected service poles are present near the sides of the highway.

Section 4

- An excessively bright 'No Vacancy' sign is present at Tatum Park.
- Delineation at the curves between MOB and Tatum Park is poor.
- Delineation is poor around the curves and bridges etc. between Waikawa Stream and Whakahoro Rd.
- The existing delineation on Manakau rail overbridge is in some cases dirty, missing.
- Unprotected power poles and trees are present near the side of the highway near Manakau Rail Overbridge.
- There is poor sight distance when turning out of Whakahoro Road, especially right turn out.
- There is heavy parking and road crossing (by vehicles and pedestrians) near Ngati Wehi Marae when events are being held there.

Section 5

- The existing bridge side protection on the Ohau River Bridge and rail overbridge is not compliant with modern standards (NZTA M23). If a vehicle was to collide with the bridge serious injury or worse is possible especially as the barrier may 'gate' and allow the vehicle to pass over the side of the bridge.
- The existing delineation over the Ohau River Bridge and rail over bridge is dirty and hard to see.
- The sealed shoulder on the northbound side near the Ohau River Bridge and rail overbridge is very narrow.
- The unnamed side road south of the Ohau River Bridge has poor sight distance when existing onto the highway and may meet the warrant for a stop sign.
- The delineation south of Ohau, leading up to the Kuku passing lane, is poor.
- The sealed shoulder between Kuku and the Ohau rail overbridge is narrow, particularly on the northbound side. This shoulder is used for parking when there are events at the nearby Marae and cemetery.
- Unprotected power poles are present near the side of the highway on both sides of Kuku Beach road.
- The passing lane for southbound traffic terminates just north of Kuku Beach Road. Southbound vehicles turning right into Kuku Beach Road use the passing lane in order to enter the right turn bay, however they tend to be travelling slower than vehicles that are using the lane to pass slower vehicles. They may also decelerate significantly towards the end of the passing lane which could result in conflict with a vehicle behind them which is attempting to pass.
- The passing lane also complicates entry into the Te Iwi o Ngati Tukorehe Marae which is located near the end of the passing lane.
- Kuku Beach Road has potholes near the intersection with SH1.
- The chevron board at the head of the Kuku Beach Road T-intersection is the old black and white type.
- An existing power pole can obscure the give way sign on Kuku East Road, depending on the position of the vehicle approaching the intersection.
- There is no chevron board at the head of the Kuku East Road T-intersection.

- The existing sight rails opposite St Stephen's Church are a hazard for errant vehicles and poor delineators.
- The unsealed turning area opposite St Stephen's Church does not provide good traction for turning vehicles, particularly when re-joining the highway. The loose gravel may migrate onto the highway and create a new hazard, particularly for cyclists.
- The straight north of Tatum Park has poor delineation with some EMPs missing.
- An unprotected deep stream close to the side of the highway is present north of St Stephen's Church. A sight rail is present around the stream, however this is hazard itself.
- The retaining for the deep stream north of St Stephen's Church appears to be failing and the road shoulder is collapsing. If this is not rectified it may eventually result in a loss of shoulder material and potentially the southbound lane.
- Unprotected power poles are present near the western side of the highway between St Stephen's Church and Tatum Park.
- The sealed shoulder alongside the passing lane north of Tatum Park is very narrow.

Section 6

- Unprotected power poles are present near the western side of the highway north of Ohau.
- The existing delineation on the curve north of Ohau is hard to see.
- The northern Ohau threshold signs may suggest that there has been a change in speed limit (as this is often the case when these are used), despite the fact there hasn't.
- A corner north of Ohau has unprotected hazards including a drop off and trees.
- The speed limit change at the southern end of Ohau may not be obvious enough.
- The curve just south of Ohau is not well lit or delineated.
- The road surface between Ohau and Bishops Road is flushed and the redundant markings can be seen.
- A curve just south of Ohau is not well delineated/a chevron is missing.

Section 7

- The existing 50/80 km/h signs are not very obvious/too small in this environment.
- The existing lighting does not extend from within the 50 km/h zone to the 50/80 km/h sign location.
- There are unprotected non-frangible trees close to the highway on the eastern side between the 50/80 speed limit change and the SH1/57 intersection.
- The unsealed parking area opposite Motel does not provide good traction particularly when re-joining the highway. The loose gravel may migrate onto the highway and create a new hazard, particularly for cyclists.
- The existing 'Major Intersection' signs are in poor condition and are hard to read at night.
- There is a narrow sealed shoulder on the eastern side, south of Levin.
- The highway is relatively dark where it is not lit, in between Ohau and Levin.
    - A number of issues exist ant the SH1/SH57 intersection:
    - Raised concrete kerbs are not painted white and may be hard to see, especially at night.
    - The layout of the intersection, and the need to significantly reduce speed, may not be obvious to some drivers.
    - The left slip lane (southbound onto SH1) has unusual curved geometry.
    - The left slip lane (southbound onto SH1) is not well lit at night.

  - The intersection lighting is poor.
  - The 80 km/h signs on the westbound (SH57) approach to the intersection are inconspicuous, partly due to the high number of other signs in the vicinity.
  - There are non-compliant safety barriers around the railway barrier arms.
  - The railway line crosses SH57 near to the intersection with SH1.
- The lighting between SH1/57 intersection and Ohau is inconsistent.
- The SH1/57 intersection guide sign (south of the intersection, for northbound traffic) is mounted too low.
- The 'Levin' threshold signs are located too far away from Levin (and too close to Ohau).
- Unprotected service poles are present near the western side of the highway.
- A large unprotected culvert is present near the sides of the highway at Buller Road intersection.
- There is poor sight distance when turning out of Buller Road, especially right turn out.
- Southbound vehicles turning into Buller Road may cut the corner which could result in conflict with vehicles waiting to turn right out.
- The northbound merge out of Buller Road is short.

Appendix D Options & Package Development Tables

D.1 Potential Measures/Options Assessment Table

Otaki to North of Levin: SH1 Interim Safety Measures - Potential Measures/Options

Potential Measures	Route Consistency	Change in KiwiRAP Star Rating	DSI Reduction	Cost/ Funding	Barriers to Implementation/ Timeframe	Fitness for Future Form & Function	Potential Packages (Outsome of Workshops)	Comments
Route-wide measures								
More frequent remarking required Sections 2-7 (unless longlife high reflective marking is installed).	3	1	2	3	3	3	Maintenance	
Improved level of cleaning of signs and delineators required across whole of section	3	1	2	3	3	3	Maintenance	
Upgrade line marking from 100 mm paint to 150 mm longlife high reflective marking Sections 2-7	3	1	2	3	3	2	Block Funding / Safer Corridors	Tie with wide centreline & resealing where possible
Install ATP is areas it has not been installed (check property proximity)	3	1	2	3	2	2	Block Funding / Safer Corridors	Tie with wide centreline & resealing where possible
Install red RRPM's from Sections 2 to 7 (excl lit areas)	3	1	2	3	3	2	Block Funding / Safer Corridors	Tie with wide centreline & resealing where possible
Speed limit reduction along the entire section - Speed Management Review	3	1	3	2	1	2	Block Funding / Safer Corridors	Being looked at independently
Increase wide centrelines across route (could involve removing passing lanes)	2	3	3	2	1	2	Block Funding / Safer Corridors	Tie with HP marking & resealing where possible
Check skid resistance/resurfacing programme along route and improve areas of low SR	3	1	2	3	2	2	Maintenance	
Improve signage at cycle pinch points e.g. bridges (including active signage)	2	1	2	2	3	2	Block Funding / Safer Corridors	
Improved maintenance of roadside drainage to avoid surface flooding (rasied by HDC)	3	1	1	3	3	2	Maintenance	Liaise with HDC for locations
Section 1 (995/3.3-1.27)								
Taylors Rd - Install Right Turn Bay	3	2	3	2	1	2	Not Proceed / Low Priority	Check Demand
Nth of Taylors Rd - Underground power poles or install safety barrier	3	3	2	2	2	2	Not Proceed / Low Priority	On straight => lower benefit
Nth of Taylors Rd - Improve delineation around curve including chevron signs	3	1	1	3	3	3	Quick Wins	
SBD Rest Area - Remove trees and regrade southbound	3	2	2	2	2	3	Block Funding / Safer Corridors	
SBD Rest Area - Install barrier southbound	3	2	1	2	1	2	Block Funding / Safer Corridors	
SBD Rest Area - Install barrier northbound	3	2	1	2	1	2	Block Funding / Safer Corridors	
SBD Rest Area - Remove signage promoting this rest area (and potentially remove facilities)	2	1	3	3	1	2	Not Proceed / Low Priority	Right turn signage already removed
Remove southbound passing lane with wide centreline & barriers	2	3	3	2	1	2	Block Funding / Safer Corridors	Include as option noting barriers to implementation
Between SBD Rest Area and Forest Lakes Road - Remove drainage hazard northbound	3	2	3	2	2	3	Block Funding / Safer Corridors	
Between SBD Rest Area & Forest Lakes Road - Install barrier to protect vehicles from trees/drop-off NBD	3	2	3	2	2	3	Block Funding / Safer Corridors	
Between SBD Rest Area and Forest Lakes Road - Install barrier to protect vehicles from trees/drop-off SBD	3	2	3	2	2	3	Block Funding / Safer Corridors	
Forest Lakes Rd - Right Turn Bay	3	2	3	1	1	2	Not Proceed / Low Priority	Very difficult to construct without major works
Forest Lakes Rd - Improve conspicuity of intersection (especially NBD) - incl signage & improved lighting	3	1	2	3	3	3	Quick Wins	
Section 2 (995/1.27 - 985/9.25)								
Forest Lakes Rd to NBD Rest Area - Remove Trees NBD or install safety barrier	3	2	2	2	2	3	Block Funding / Safer Corridors	
Forest Lakes Rd to NBD Rest Area - Install barrier to protect vehicles from trees and drop-off SBD	3	2	2	2	2	3	Block Funding / Safer Corridors	
NBD Rest Area - Improve delineation/markings in and around the rest area including hatch markings	3	1	1	3	3	3	Quick Wins	
NBD Rest Area - Remove hazardous sign posts from rest area	2	1	1	3	3	3	Quick Wins	
NBD Rest Area - Remove signage promoting this as a formal rest area	2	1	2	3	3	2	Not Proceed / Low Priority	Right turn signage already removed
NBD Rest Area to Pukehou Bridge - Install barrier to protect vehicles from trees and drop-off both sides	3	2	2	2	2	3	Block Funding / Safer Corridors	
Pukehou Rail Overbridge - Level and clean chevrons. Also ensure sign reflectivity grades are the same	3	1	1	3	3	3	Maintenance	
Atkins Rd - Trim vegetation to south to improve sight distance, consider installing stop sign and markings	3	1	2	3	3	3	Quick Wins	
Nth & Sth of Atkins Rd - Install safety barrier both sides, protect vehicles from trees/power poles/drop-offs	3	3	2	2	2	3	Block Funding / Safer Corridors	
Pukehou Bridge to Gleeson Rd - Install wide centreline	3	3	3	2	2	2	Block Funding / Safer Corridors	
Gleeson Rd to Waiauti Stream - Install ATP on edge line	3	1	2	3	1	2	Block Funding / Safer Corridors	
Gleeson Rd to Waiauti Stream - Improve delineation outside of curve possibly with chevrons	3	1	1	3	3	3	Quick Wins	
Waiauti Stream - Extend Barriers slightly south to improve hazard protection	3	3	2	3	3	3	Quick Wins	
Gleeson Rd - Replace missing luminaire	3	N/A	N/A	3	3	3	Maintenance	
Section 3 (985/9.25-7.48)								
Manakau - Install isolated sections of safety barrier to protect vehicles from power poles/drains/drop-offs	3	1	1	2	1	3	Not Proceed / Low Priority	Speed has reduced with recent safety measures
Gleeson Rd Speed Threshold - Vegetation requires maintenance to prevent encroachment into cycle lane	3	1	1	3	3	3	Maintenance	
Manakau Store - Improve pedestrian refuge facilities/improve traffic calming	2	1	1	3	3	3	Not Proceed / Low Priority	
Section 4 (9857.48-6)								
North Manakau Rd to Manakau OB - Wide Centreline	3	2	3	2	2	2	Block Funding / Safer Corridors	
North Manakau Rd to Manakau OB - Underground Poles	3	2	3	2	1	3	Not Proceed / Low Priority	Too difficult to barrier with accesses
Ngati Wehi Wehi Marae - Upskill Marae staff to 'self provide' TTM for events or variable message sign	2	N/A	2	3	2	3	Quick Wins	
Whakahoro Rd - Ban right turn out	2	2	3	3	1	2	Block Funding / Safer Corridors	Include as option noting barriers to implementation
Manakau OB to Tatum Park - Review & improve delineation	3	1	1	3	3	3	Quick Wins	
Manakau OB to Tatum Park - Remove trees or install barrier to protect vehicles from trees and drop-off	3	3	2	2	2	3	Block Funding / Safer Corridors	
Tatum Park - Get owner to remove bright 'vacancy' sign	3	N/A	1	3	2	3	Quick Wins	Planning issue?

Otaki to North of Levin: SH1 Interim Safety Measures - Potential Measures/Options

Potential Measures	Route Consistency	Change in KiwiRAP Star Rating	DSI Reduction	Cost/ Funding	Barriers to Implementation/ Timeframe	Fitness for Future Form & Function	Potential Packages (Outsome of Workshops)	Comments
Section 5 (985/6-2.9)								
Tatum Park to Nth Curve - Install safety barrier or underground power poles	3	2	2	2	2	3	Not Proceed / Low Priority	On straight => lower benefit
Tatum Park to Nth Curve - Widen sealed shoulder adjacent to passing lane	3	2	1	1	2	2	Not Proceed / Low Priority	Low number of cyclists
The Shekinah - rectify failing retaining, pipe culvert or install safety barrier	3	2	2	2	2	3	Maintenance	Might need emergency works funding
Kuku turning area/Opposite St Stephen's Church - seal part of turning area	3	N/A	2	3	3	3	RoNS (M & O)	
Kuku turning area/Opposite St Stephen's Church - replace sight rails with chevrons	3	2	2	3	3	3	Quick Wins	
Kuku East Rd - relocate give way sign, install new PW68 chevron board	2	N/A	1	3	3	3	Quick Wins	
Kuku East Rd to Ohau Bridge - Install barrier to protect vehicles from power poles	3	2	2	2	2	3	Quick Wins	
Kuku Beach Rd - fix potholes, install new PW68 chevron board	3	N/A	1	3	3	3	Quick Wins	Potential maintenance to fix potholes
Kuku Beach Rd - safety barrier on straight and around corner	3	2	3	3	2	3	Block Funding / Safer Corridors	
Te Iwi o Ngati Tukorehe & Kuku Beach Rd - Redo marking to allow for better access to Marae	3	1	2	3	2	3	Not Proceed / Low Priority	Replaced by another option
Kuku Beach Rd to Ohau Rail OB - Remove passing lane and install wide centreline & flush area to make access to Te Iwi o Ngati Tukorehe safer	2	2	2	2	1	2	Block Funding / Safer Corridors	Minor Safety / Maintenance
South of Ohau Rail OB - Make shoulder wider (adjacent to passing lane)	3	2	1	2	2	3	Not Proceed / Low Priority	Replaced by another option
Unnamed side road - install stop sign and markings	3	N/A	2	3	3	3	Quick Wins	
Unnamed side road - remove left slip lane	3	1	1	2	2	2	Not Proceed / Low Priority	
Ohau Rail OB and Ohau River Bridge - review & improve delineation	3	1	2	3	3	3	Quick Wins	
Ohau Bridges - upgrade side protection to thrie-beam	3	1	2	1	2	2	Not Proceed / Low Priority	Very costly for the benefit over a short period
Section 6 (985/2.9-0.8)								
Ohau & Bishops Rd - reseal and improve road markings	3	N/A	N/A	3	3	3	RoNS (M & O)	Part of seconf coat works
Curve south of Ohau (weigh station) - Improve delineation inch chevrons	3	1	2	3	3	3	Quick Wins	
Curve south of Ohau (weigh station) - Install barrier on SBD approach to curve	3	1	2	2	2	3	Block Funding / Safer Corridors	
Remove weigh station on curve south of Ohau	3	1	1	2	1	3	Block Funding / Safer Corridors	
South of Ohau - Install NBD advance warning speed signs	2	N/A	1	3	3	3	Not Proceed / Low Priority	
Ohau - Safety Barrier southbound (within recent works)	3	1	1	2	2	3	Not Proceed / Low Priority	Speed has reduced with recent safety measures
Marsden Tce - Close intersection and re-route traffic via Wairiri St	3	3	2	2	1	3	Block Funding / Safer Corridors	Liaise with HDC will need consultation
Curve north end of Ohau to Vista Rd - Install safety barrier on outside of curve	3	2	2	2	2	3	Not Proceed / Low Priority	Speed has reduced with recent safety measures
Curve north of Ohau - review & improve delineation	3	1	2	3	3	3	Quick Wins	
North of Ohau (SB) - review signage, potentially move 80 km/h signs elsewhere - More Repeater 80's	2	N/A	1	2	1	3	Not Proceed / Low Priority	
McLeavy Rd to Buller Rd - Install barrier northbound to protect vehicles from power poles	3	3	3	2	2	3	Block Funding / Safer Corridors	
Section 7 (985/0.8-967/16.03)								
North of Ohau to Levin 50/80 - Convert to similar as Ohau - Mountable kerbs & islands/gardens	3	3	3	1	1	2	Not Proceed / Low Priority	
Improve skid resistance between Buller Road and Levin Urban boundary	3	N/A	2	2	2	3	Maintenance	Further analysis required
Upgrade delineation between lit sections	3	1	1	3	3	3	Block Funding / Safer Corridors	
Buller Rd - Install stop control and install a raised traffic island. Revise markings if needed.	3	1	2	3	3	3	Quick Wins	
Buller Rd - Install safety barrier or cover drain on corner	3	2	2	2	2	3	Block Funding / Safer Corridors	
Opposite Buller Rd - Install barrier to protect vehicles from culvert	3	2	2	2	2	3	Block Funding / Safer Corridors	
North of Buller Rd - Install safety barrier for power pole	3	3	2	2	2	3	Block Funding / Safer Corridors	
North of Buller Rd & North of of SH1/SH57 -- Upgrade sign 'Major Intersection Ahead' sign	3	N/A	1	3	3	3	Quick Wins	
Levin Threshold signs - Revise threshold location	2	N/A	N/A	2	1	3	Not Proceed / Low Priority	
South of SH1/57 - Raise guide sign to the correct height	3	N/A	N/A	3	3	3	Quick Wins	
South of SH1/57 - Extend lighting to Ohau	3	1	1	2	2	2	Not Proceed / Low Priority	
South of SH1/SH57 - Adjust markings and alignment of left acceleration lane	3	N/A	1	3	2	3	Block Funding / Safer Corridors	
South of SH1/SH57 - Repeater 80km/h speed limit sign	3	1	1	3	3	3	Quick Wins	
SH1/SH57 intersection - Improve non-compliant barriers around level crossing bells/arms	3	1	2	2	2	3	Block Funding / Safer Corridors	
SH1/SH57 intersection - SH57 approach - add advance warning of speed limit change	2	N/A	1	3	3	3	Not Proceed / Low Priority	
SH1/SH57 intersection - Review and improve lighting	3	N/A	1	2	2	3	Block Funding / Safer Corridors	
SH1/SH57 intersection - Install audible road warning device on SH57 approach to intersection	1	N/A	1	3	1	2	Not Proceed / Low Priority	
SH1/SH57 intersection - Paint concrete kerbs	2	N/A	N/A	3	3	3	Maintenance	
SH1/SH57 intersection - Replace standard kerb with mountable kerb either side of vehicle accesses to enable to help vehicles exit carriageway	2	N/A	1	3	3	2	Quick Wins	
SH1/SH57 intersection - Convert intersection to a roundabout	1	3	3	1	1	2	RoNS	Construct early depending on realignment route.
SH1/SH57 - Ban right turn from SH57 to SH1	1	1	2	2	1	2	Not Proceed / Low Priority	

Otaki to North of Levin: SH1 Interim Safety Measures - Potential Measures/Options								
Potential Measures	Route Consistency	Change in KiwiRAP Star Rating	DSI Reduction	Cost/ Funding	Barriers to Implementation/ Timeframe	Fitness for Future Form & Function	Potential Packages (Outsome of Workshops)	Comments
SH1/SH57 to 'Major Intersection Ahead' sign - Reallocate road space, reduce flush median and provide shoulder on eastern side	3	2	2	2	2	3	Quick Wins	
SH1/SH57 to 50/80 - Install lighting	3	1	1	1	2	2	Not Proceed / Low Priority	
SH1/SH57 to 50/80 - Remove trees (need to replace with some frangible vertical element)	3	2	2	3	3	3	Quick Wins	
SH1/SH57 to 50/80 - Relocate/protect power poles west side	3	2	2	1	1	2	Not Proceed / Low Priority	On Straight/80km/h => less benefit
Bolton Rd Intersection - Replace old style chevron board at intersection with new style	3	N/A	1	3	3	3	Maintenance	Identify for replacement
Car park opposite motel - Seal shoulder/carpark area	2	N/A	2	3	3	3	Quick Wins	
North of 50/80 Change Point east side - Improve drainage issue at shoulder	2	N/A	1	3	2	3	Maintenance	Liaise with HDC
50/80 Change point - Enhance threshold at existing RG-1 signs	3	N/A	1	3	3	3	Block Funding / Safer Corridors	
50/80 Change point - Install lighting up to 50/80 threshold	3	Urban	1	2	2	3	Block Funding / Safer Corridors	

D.2 Package Development Table

Otaki to North of Levin: SH1 Interim Safety Measures - Package Development

Section	1	2	3	4	5	6	7
Length (km)	2	3.2	1.8	1.5	3.1	2.1	2.2
Injury crashes	6	8	4	8	7	8	14
Deaths and Serious Injuries (DSI)	5	2	6	2	-	6	8
DSI per km	2.5	0.6	3.4	1.4	-	2.9	3.7
KiwiRAP Star Rating 2016 (2012)	3.3 (3.3)	3.1 (3.0)	3.0 (2.9)	2.9 (2.8)	3.1 (2.9)	3.0 (2.8)	2.9 (2.9)
Length below KiwiRAP 3 Stars (%)	0.3km (15%)	0.7km (23%)	0.5km (28%)	0.6km (40%)	1.1km (35%)	0.7km 33%	0.5km (23%)
Collective Risk Band *(Crash Density)*	HIGH	MEDIUM-HIGH	HIGH		LOW	HIGH	
Personal Risk Band *(Crash Rate)*	MEDIUM	LOW-MEDIUM	MEDIUM		LOW	MEDIUM-HIGH	

Package

Maintenance	1	2	3	4	5	6	7
More frequent remarking required on Sections 2-7 (unless longlife high reflective marking is installed).		Level and clean chevrons on Pukehou Rail OB	Gleeson Rd Speed Threshold - Vegetation requires maintenance to prevent encroachment into cycle lane		The Shekinah - rectify failing retaining/carriageway. Also pipe culvert or install safety barrier		SH1/SH57 intersection - Paint concrete kerbs
Improved level of cleaning on signs and delineators required on Sections 2-7		Replace missing luminaire at Gleeson Road (Completed)			Kuku Beach Rd - fix potholes		Improve skid resistance btw Buller Road and Levin Urban boundary - Further analysis required
Improved maintenance of roadside drainage to avoid surface flooding (rasied by HDC)							Bolton Rd Intersection - Replace old style chevron board at intersection with new style
							North of 50/80 Change Point east side - Improve drainage issue at shoulder

Quick Wins	1	2	3	4	5	6	7
	Nth of Taylors Rd - Improve delineation around curve potentially with chevrons	Remove hazardous sign posts from NBD rest area	Nil	Manakau OB to Tatum Park - Review & improve delineation	Kuku turning area/Opposite St Stephen's Church - replace sight rails with chevrons	Curve south of Ohau (weigh station) - Improve delineation including chevrons	Buller Rd - Install stop control and install a raised traffic island. Revise markings if needed
	Improve conspicuity of Forest Lakes Rd, especially NBD with upgraded signage	Improve delineation and install hatch marking around rest area		Ngati Wehi Wehi Marae - Upskill Marae staff to 'self provide' TTM for events or variable message sign	Kuku East Rd - relocate give way sign, install new PW68 chevron board	Curve north of Ohau - review & improve delineation including chevrons	South of SH1/57 - Raise guide sign to the correct height
		Atkins Rd - Trim vegetation to south to improve sight distance and install stop signs and markings		Get owner of Tatum Park to remove bright 'vacancy' light	Kuku Beach Rd - Install new PW68 chevron board		Upgrade ' Major Intersection Ahead' signage on both approaches to SH57
		Install chevron signs on curve south of Gleeson Rd			Unnamed side road - install stop sign and markings		Install repeater 80km/h sign for traffic turning south onto SH1 from SH57
		Waiauti Stream - Extend Barriers slightly south to improve hazard protection			Ohau Rail OB and Ohau River Bridge - review & improve delineation		SH1/SH57 to 'Major Intersection Ahead' sign - Reallocate road space, reduce flush median and provide shoulder on eastern side
							SH1/SH57 to 50/80 - Remove trees (need to replace with some frangible vertical element)
							Car park opposite motel - Seal shoulder/carpark area
							SH1/SH57 intersection - Replace standard kerb with mountable kerb either side of vehicle accesses to enable to help vehicles exit carriageway

Block Funding / Safer Corridors	1	2	3	4	5	6	7
Improve signage at cycle pinch points e.g. bridges (including active signage)	Around the SBD rest area - Install barriers both sides	Install Wide Centreline along most of section including 150mm wide longlife high reflective markings and red RRPM's for whole section. Include ATP where appropriate.	Install 150mm wide long-life high reflective markings and red RRPM's at northern end of section outside lit area.	North Manakau Rd to Manakau OB - install Wide Centreline including 150mm wide longlife high reflective markings and red RRPM's. Include ATP where appropriate.	Kuku turning area/Opposite St Stephen's Church to Kuku Beach Road - Install Wide Centreline	Install 150mm wide long-life high reflective markings and red RRPM's at southern end outside lit area	Install 150mm wide long-life high reflective markings and red RRPM's outside lit areas.
	Remove southbound passing lane and reallocate road space with wide centreline	North and South of Atkins Road - Install safety barriers	Option - Extend 80km/h Speed Limit into north section	Install 150mm wide long-life high reflective markings and red RRPM's. Include ATP where appropriate.	Install 150mm wide long-life high reflective markings and red RRPM's. Include ATP where appropriate.	Remove weigh station on curve south of Ohau	Buller Rd - Install safety barrier or cover drain on corner
	SBD rest area to Forest Lakes, remove hazards (drainage channel & trees) and install safety barriers both sides	Forest Lakes to Pukehou O/B - Remove trees/install safety barriers		Manakau OB to Tatum Park - Remove trees/install barrier	Kuku East Rd to Ohau Bridge - Install barrier to protect vehicles from power poles	Curve south of Ohau (weigh station) - Install barrier on SBD approach to curve to protect vehicles from trees.	Opposite Buller Rd - Install barrier to protect vehicles from culvert
	Tie in works with reseal planned 17/18	Option - Speed Limit Reduction to 80km/h		Ban right turn out of Whakahoro Road	Kuku Beach Rd - safety barrier on straight and around corner	McLeavy Rd to Buller Rd - Install barrier northbound to protect vehicles from power poles	North of Buller Rd - install safety barrier around power poles
				Option - Speed Limit Reduction to 80km/h	Kuku Beach Rd to Ohau Rail OB - Remove passing lane and install wide centreline & flush area to make access to Te Iwi o Ngati Tukorehe safer, remark so nbd shoulder is wider	Option - Extend 80km/h Speed Limit into south section	South of SH1/SH57 - Adjust markings and alignment of left acceleration lane
					Option - Speed Limit Reduction to 80km/h	Marsden Tce - Close intersection and re-route traffic via Wairiri St	SH1/SH57 intersection - Improve non-compliant barriers around level crossing bells/arms
							SH1/SH57 intersection - Review and improve lighting
							50/80 Change point -Enhance threshold at existing RG-1 signs

Otaki to North of Levin: SH1 Interim Safety Measures - Package Development

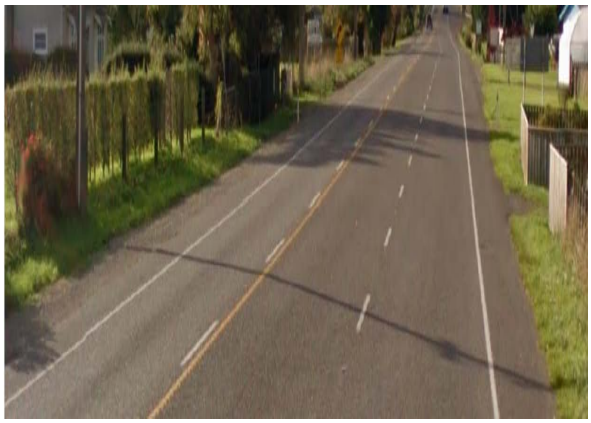
Section	1	2	3	4	5	6	7
Length (km)	2	3.2	1.8	1.5	3.1	2.1	2.2
Injury crashes	6	8	4	8	7	8	14
Deaths and Serious Injuries (DSI)	5	2	6	2	-	6	8
DSI per km	2.5	0.6	3.4	1.4	-	2.9	3.7
KiwiRAP Star Rating 2016 (2012)	3.3 (3.3)	3.1 (3.0)	3.0 (2.9)	2.9 (2.8)	3.1 (2.9)	3.0 (2.8)	2.9 (2.9)
Length below KiwiRAP 3 Stars (%)	0.3km (15%)	0.7km (23%)	0.5km (28%)	0.6km (40%)	1.1km (35%)	0.7km 33%	0.5km (23%)
Collective Risk Band *(Crash Density)*	HIGH	MEDIUM-HIGH	HIGH		LOW	HIGH	
Personal Risk Band *(Crash Rate)*	MEDIUM	LOW-MEDIUM	MEDIUM		LOW	MEDIUM-HIGH	
Package							
	Tie in works with reseal planned 17/18	*Bring reseals forward from 18/19 to 17/18 (Atkins Rd and South of Pukehou) - tie in with wide centreline*		*Bring reseals forward from 18/19 to 17/18 (Nth Waikawa Bridge) - tie in with longlife marking.*			50/80 Change point - Install lighting up to 50/80 threshold
RoNS Funding/other	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	Nil	Nil	Nil	Nil	Kuku turning area/Opposite St Stephen's Church - seal part of turning area (covered under M&O)	Ohau & Bishops Rd - reseal and improve road markings	SH1/SH57 intersection - Construct roundabout early in construction depending on realignment route

Appendix E Safety Issues Identified by HDC

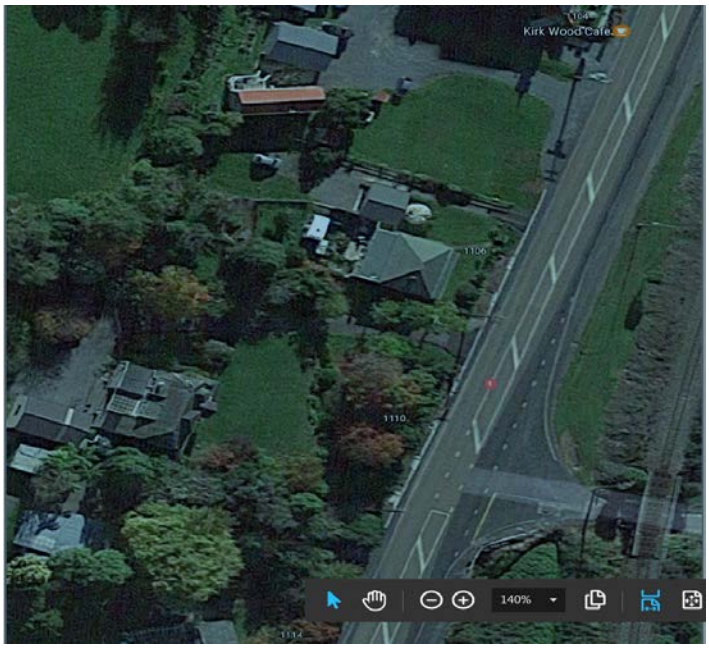
Horowhenua District Council Safety Issues – SH1 Adkins Rd to South of Levin	**MWH/Stantec comments**
1. <u>Route Wide issues</u> 1.1. Roadside drainage is an issue throughout this site, with surface flooding occurring regularly. 1.2. Power poles are in close proximity to the carriageway in many sections of the route. 1.3. Lack of safe cycle facilities.	1.1 Unsure if this is due to a lack of maintenance or capacity, however this has been added as a maintenance item. 1.2 These have already been identified within the sections in question, although added point 3.1 1.3 Have added under route wide section, although addressing this is likely to be with a number of other safety measures, including wider shoulders. Pinch points could be addressed with better signage (including active signage).
2. <u>Section 7 – South of Cambridge Rd Intersection</u> 2.1. Flooding on east side shoulder. 	2.1 Added as maintenance item.
3. <u>Section 7 Cambridge Road – Boulton Road</u> 3.1. Power poles too close to carriageway – consider underground lines. 	3.1 Added to section and table of potential measures/options

4. <u>Section 7 – Bolton Road Intersection</u> 4.1. Power pole too close to intersection – consider underground lines. 	4.1 Added to section and table of potential measures/options as per 3.1
4.2. Cabbage tree opposite intersection – remove 	4.2 Already covered in report although added note that these are on the eastern side.
4.3. Chevron sign opposite intersection – replace to current standard 	4.3 Added as maintenance item.

5. <u>Section 7 – SH57 Intersection</u> 5.1. Vehicle entrances opposite intersection are unsafe – increase shoulder width. 	5.1 Added although this would involve removing the footpath. One possible option is to convert the standard kerb and channel to a mountable type closer to the driveways enabling vehicles to get off the carriageway more easily.
6. <u>Marsden Terrace. Intersection</u> 6.1. Intersection is unsafe, poor visibility – consider closing intersection and providing access via Wairiri St. 	6.1 Added but would need quite a bit of consultation.
7. <u>Section 5 – Ohau River Bridge</u> 7.1. Consider ATP treatment in edgelines to prevent hitting kerb. 7.2. Provision for cyclists. Clip on cycleway? Separate bridge?	7.1 Already covered under route wide measures in report, but have added specific mention of this site under Section 5 notes. 7.2 Added note under route wide measures relating to better signage (incl active signage) around cycling pinch points. Clip-on for bridge would be very uneconomic for cycling numbers.

	
8. <u>Section 5 – Ohau River Bridge – Kuku Beach Road</u> 8.1. Shoulder too narrow or unsealed on both sides – consider sealing min 1.5m. 	8.1. Already covered in report
9. <u>Section 5 – Kuku Beach Road Intersection</u> 9.1. Right turn bay directly after passing lane, with high use vehicle entrance to Marae opposite – consider removing or reducing passing lane. 	9.1. Already covered in report

10. <u>Section 4 – 694 State Highway (outside KY Gardens)</u> 10.1. Pole in dangerous position – consider relocating or running line underground 	10.1. Already covered in report as part of unprotected power poles and trees within this section.
11. <u>Section 3 – The Manakau Store</u> 11.1. Guard Rail terminal is directly adjacent to a power pole on west side of road, if the terminal is hit, the pole will also be hit – extend guard rail or relocate pole. 11.2. Pedestrian Refuge, no TGSIs refuge has been built below minimum width and slanted at an angle – consider redesign of pedestrian crossing point, consider further traffic calming treatments at both approaches to the crossing. 	11.1. Acknowledged that this is not an ideal situation however the barrier cannot be extended due to the access directly adjacent to the driveway. Also it is unlikely the pole can be relocated. The reduction in vehicle speeds through this section will lower both the likelihood and severity of an incident. 11.2 Added although lower priority given recent works in area and the effective reduction in speed that has occurred.

12. <u>Gleeson Road Speed Threshold</u> 12.1. Cycle lane below minimum width, vegetation also encroaching – consider widening cycle land and remove or maintain vegetation. 12.2. Power poles in hazardous position North West of threshold – consider removal, relocation or protection. 	12.1 Added comment about vegetation/maintenance 12.2 Already covered in report
13. <u>Section 3 – South of Kirkwood Café</u> 13.1. Narrow shoulder on west side – consider removing kerb and channel, piping drain and filling shoulder. 	13.1 Adjusted PP comment to include other hazards.

Wellington

Level 13, 80 The Terrace
Wellington 6011
PO Box 13-052, Armagh
Christchurch 8141
Tel +64 4 381 6700
Fax +64 4 473 1982

www.mwhglobal.com