

# State Highway 1: Piarere to Taupō

NZ Transport Agency

September 2016

VERSION 0.3

Programme Business Case



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## SUPPORTING DOCUMENTS

The supporting documents for the programme business case include:

- Strategic Case - SH1 Hamilton to Waiouru – Case for Future Investment (NZ Transport Agency) July 2014
- SH1 Piarere to Desert Road Summit Corridor Strategy (Beca Ltd) May 2013
- National Freight Demand Study (MOT) March 2014
- Future Freight Scenarios Study (MOT) November 2014

## GLOSSARY OF TERMS

TERM	DEFINITION
AA	Automobile Association
AADT	Average Annual Daily Traffic
CAS	Crash Analysis System (NZ Transport Agency/Police crash database)
CLOS	Customer Level of Service
DBC	Detailed Business Case
DSI	Deaths and Serious Injuries
EEM	Economic Evaluation Manual
FAR	Funding Assistance Rate
GPS	Government Policy Statement on Land Transport Funding
HCV	Heavy Commercial Vehicle
HPMV	High Productivity Motor Vehicle
HRRRG	High Risk Rural Roads Guide
IBC	Indicative Business Case
ILM	Investment Logic Map
KAT	KiwiRAP Analysis Tool
KPI	Key Performance Indicator
KiwiRAP	New Zealand Road Assessment Programme
LOS	Level of Service
LTMA	Land Transport Management Act 2003
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NOF	Network Operating Framework
NSRRP	National Safer Roads and Roadsides Programme Business Case

TERM	DEFINITION
NZ	New Zealand
NZTA	NZ Transport Agency ("the Transport Agency" or "the Agency")
ONRC	One Network Road Classification
PBC	Programme Business Case
RLTP	Regional Land Transport Plan
RoNS	Roads of National Significance
RTA	Road Transport Association
SC	Strategic Case
SH(#)	State Highway (number)
SHAMP	State Highway Activity Management Plan
SinA	Strategy in Action – NZ Transport Agency database of completed projects providing high level costs and benefits
SMART (objectives)	Specific, measurable, assignable, realistic and time-related
SRA	Safe Roads Alliance
SWDC	South Waikato District Council
TDC	Taupō District Council
TREIS	Traffic Road Event Information System – NZ Transport Agency incident database that records reported events that disrupt highway traffic
VPD	Vehicles per day
VPH	Vehicles per hour

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## EXECUTIVE SUMMARY

### CONTEXT

State Highway 1 is New Zealand's national north-south highway linking Auckland with Wellington and the South Island. In the Waikato Region, it contributes to the social and economic wellbeing of New Zealand by connecting major population centres as well as providing the first journey experienced by more than 2 million international visitors and 4 million domestic tourists every year.

This programme business case considers the section of SH1 between Piarere and Taupō, which is classified as a National High Volume Highway. It joins the recently upgraded four lane Waikato Expressway (Cambridge Section) and planned improvements from Cambridge to Piarere) with the high quality two lane lower volume sections around Taupō (East Taupō Arterial). This business case considers the transition between these very different sections in a regional and national context.

The study area is 100km long and extends from the Piarere junction with SH29, through the townships of Tirau, Putaruru and Tokoroa to the Eastern Taupō Arterial. It intersects with a number of other state highways including SH27 to Matamata, SH5, SH28 and SH30 to Rotorua, and SH32 to the eastern side of Lake Taupō. SH1 services other settlements including Lichfield (with its major dairy factory), Kinleith (with its nationally important timber processing plants and SH30), Atiamuri (with its power generation, SH30 and small community) and Wairakei Village (SH5), as well as smaller clusters of rural housing, farms and forestry sites.

The North Island Main Trunk Line parallels the length of the corridor moving goods from the top of the north to the Manawatu, Wellington and the South Island. The Kinleith branch line also runs to the Port of Tauranga, taking the vast majority of locally produced timber and milk to the export market.



Figure 0-1: Corridor Freight Context

## PROBLEMS AND BENEFITS

The key stakeholders have identified the problems for this corridor length as:

1. An inconsistent and unforgiving road environment between Piarere and Taupō, combined with road user mistakes, lead to a high number of crashes with a severe outcome (70%).
2. Closures on the SH1 north-south spine result in unreliable movement of people and goods, resulting in economic loss to NZ (15%).
3. The social and economic aspirations of communities between Piarere and Taupō conflict with the through traffic on State Highway 1 (15%).

Travel time was not considered to be a particular problem for this corridor and even with forecast traffic growth, including residential and visitor growth in and around Taupō. This is not likely to be a problem for at least the next 30 years.

The significant evidence supporting the problems is as follows:

- There have been 307 crashes in the last 5 years, with a total of 56 deaths and serious injuries, with many crashes occurring at sub-standard curves.
- Approximately 45% of the corridor has a KiwiRAP Star rating below 3 Star (out of 5) which coincides with areas with sub-standard curves and unsafe roadsides.
- The highway has been completely closed 22 times over the past 5 years. On average, every return journey will be delayed to some degree because of a crash or maintenance activity.
- There is currently only limited evidence in regards to amenity concerns in the townships; further customer surveys and pedestrian crossing data needs to be gathered. Further investigation is needed with South Waikato District Council and the NZ Transport Agency.

The investment objectives for this corridor were agreed and discussed with the investment partners and key stakeholders. They are:

1. Improve safety of SH1 between Piarere and Taupō by reducing the number of deaths and serious injuries every 5 years from 56 to 20 by 2040.
2. Improve the quality of infrastructure of SH1 between Piarere and Taupō by increasing the length of corridor with KiwiRap Star Rating of 4 from 0% to 40% by 2030, but with no sections below 3 Star. By 2040 the whole corridor should be 4 Star.
3. Increase availability of SH1 between Piarere and Taupō by reducing the number of journeys impacted by closures and delays by 2040.
4. Improve amenity values within towns on SH1 between Piarere and Taupō by improving access to services and reducing the effect of severance by 2040.

## OPTIONS AND PROGRAMMES

A total of 114 options were suggested by stakeholders and investment partners during a facilitated workshop session. These were consolidated and compiled into programmes by the project team. After analysis and discussion with stakeholders and investors, the Broad Response Programme was agreed as the recommended programme.

The recommended programme includes investment of \$730 to \$1,050 million in infrastructure and non-infrastructure options including:

- Improved emergency management and response, to reduce length of closures due to crashes and natural events, including rapid response teams.
- Improved maintenance programme, to reduce the number of closures for maintenance, including better co-ordination of maintenance activities.
- Improved traveller information and communications, to provide road users with improved information and to ensure road users can call emergency services. This includes improved warning signage and better mobile phone coverage.
- Improved amenities for travellers and communities to help improve the townships, including promotion of towns as service centres, traffic calming and alternate freight routes.

- Staged roading upgrades based on triggers for traffic volume and safety risk, targeting a future KiwiRAP Star rating of 4. The median divided 4 Star upgrade works would prevent overtaking; therefore, passing lanes would be required as part of the safety upgrades. Due to the high traffic volumes, it might be most effective to construct 2+1 which would also future proof the corridor, but this would need to be determined in the IBC phase.

The overall outcomes of the recommended programme are:

- Deaths and serious injuries every 5 years will be reduced from around 56 to 20 by 2040, this will be achieved incrementally over the development of the corridor.
- The safety of the corridor will be increased, with it achieving a KiwiRAP 4 Star rating between Piarere and Kinleith by 2030 and for the balance of the corridor by 2040, depending on traffic growth.
- The number and duration of full and partial closures will be reduced by at least half by 2040.
- The amenity values through the town centres will be increased through improved facilities by 2040. Further improvement could be facilitated through bypasses in the longer term (i.e. beyond 40 years)

The other programmes either do not provide a balance across the investment objectives, or they are considered to be an oversupply of infrastructure that may never be needed. The current PBC between Taupō and Waipoua has investigated and rejected the possibility of diversion of SH 1 to the west of Lake Taupō, which in essence would have diverted north-south traffic at Tokoroa.

## OVERVIEW

In summary, this programme business case identifies a recommended programme that focuses principally on safety problems and improving reliability of the freight journey. At a local level, it also contributes to addressing journey versus place conflicts through townships along the corridor.

The recommended programme includes investment of \$730—\$1,050 million in infrastructure and non-infrastructure measures that can be delivered in a staged manner, with initial investment focused on reducing deaths and serious injuries and journey improvements, and the long term vision being a 4 Star median divided highway with adequate passing opportunities. This would be staged in relation to traffic demand<sup>1</sup> and safety risk.

The overall programme meets the investment objectives and significantly closes the gap between the current and expected level of service in the One Network Road Classification.

## NEXT STEPS

The figure below summarises the implementation of the recommended programme:

	Short	Medium	Long
Piarere to Wairakei Short Term Safety Improvements	Pre-Implementation Implementation		
Piarere to Wairakei Journey & Operational Improvements (incl Emergency Responsiveness & Communications)	Pre-Implementation Implementation		
Piarere to Kinleith 4 Star Corridor Transformation (incl Community Enhancement)	IBC/DBC & Pre-Implementation	Implementation	
Kinleith to Wairakei 4 Star Corridor Transformation		IBC/DBC & Pre-Implementation	Implementation

**Figure 0-2: Implementation Programme**

<sup>1</sup> Where traffic volumes exceed 8,000 vpd, a divided median is considered necessary in the Safe System Philosophy.

## PART A – THE STRATEGIC CASE

### 1. INTRODUCTION

#### 1.1. STRATEGIC CASE

The 2014 Hamilton to Waipoua Strategic Case identified three overarching problems relating to high crash severity due to fatigued drivers, closures, and towns impeding freight efficiency on State Highway 1.

Since the Strategic Case was approved, the wider corridor was split into three Programme Business Cases, reflecting the different form, function and use of the parts. For this Piarere to Taupō section, evidence has been further analysed to a much greater level of detail, which is explained in Sections 2 & 3.

A workshop was held with key stakeholders to gain a better understanding of the current issues to discuss the current problem statements. The stakeholder panel refined and agreed three key problems which are presented in Table 1-1 below.

**Table 1-1: Strategic Case Conclusions**

Original Problem Statement	Key findings	Refined Problem Statement	Conclusions
<b>Problem 1:</b> <b>Driver fatigue in long haul traffic results in a greater than average number and rate of high speed crashes with a high probability of a 'severe outcome' (50%)</b>	Although crashes are the major problem, the evidence suggests different causes. The main crash type is loss of control (run off road) with a major cause being inattention or distraction.  Whilst fatigue is a high contributory factor in crashes, it is not the main one.  Around 16% of the corridor is identified as having out-of-context curves. 45% of the corridor is below a KiwiRAP rating of 3 Stars. The corridor has been improved at discrete locations over its life which has resulted in an inconsistent highway.	<b>Problem 1:</b> <b>An inconsistent and unforgiving road environment between Piarere and Taupō, combined with road user mistakes, leads to a high number of crashes with a severe outcome (70%)</b>	There is a need to reduce the 56 deaths and serious injuries that are occurring every five years. This was considered to be the biggest single issue on the corridor by stakeholders.
<b>Problem 2:</b> <b>Closures of the long haul SH1 north-south spine will result in material loss due to delay of getting goods to market (30%)</b>	The evidence supports this statement although the primary cause of full closures is now better understood as being crashes and partial closures due to maintenance and unplanned events.	<b>Problem 2:</b> <b>Closures on the SH1 north-south spine results in unreliable movement of people and goods resulting in economic loss to NZ (15%)</b>	There is a need to reduce number of closures and the duration of each closure. Doing nothing will mean maintenance activities will continue and crashes increase (due to increasing traffic) resulting in increasing closures and delays.

Original Problem Statement	Key findings	Refined Problem Statement	Conclusions
<b>Problem 3:</b> <b>The small towns on the route impede traffic flow and increase journey times (20%)</b>	A fundamental Stakeholder requirement is a predictable and reliable journey. Whilst the evidence does not suggest that the towns are a significant impediment to through traffic, there are conflicting demands in terms of throughput and accessibility within the towns which impact on their social and economic wellbeing.	<b>Problem 3:</b> <b>The social and economic aspirations of small town communities between Piarere and Taupō conflict with the function of the state highway (15%)</b>	There is a need to improve social and economic cohesiveness within towns and address the conflict between through traffic and local movements.

These problems are likely to get worse with time, due to increasing traffic volumes. Both South Waikato District Council and Taupō District Council recognise that large population or economic growth within the region is unlikely. However, through traffic volumes are forecast to increase by 30% over the next 30 years, with road freight increasing 50%.

## 1.2. PARTNERS AND KEY STAKEHOLDERS

Developing and implementing the right programme of improvements along this corridor would not be possible without the full involvement of the investment partners and stakeholders. Investment partners involved in the PBC process are:

- The NZ Transport Agency; and
- South Waikato District Council.

There are also a number of key stakeholders who have interests in the SH1 corridor and the outcomes of the PBC. These are:

- Waikato Regional Council;
- Taupō District Council
- NZ Police;
- Automobile Association;
- Road Transport Association NZ;
- Freight Logistics Action Group;
- KiwiRail; and
- Iwi.

The majority of stakeholders<sup>2</sup> have been involved closely with the project team through workshops to:

- Define and agree problems, benefits and investment objectives
- Identify alternatives and options
- Select and refine the recommended programme

<sup>2</sup> KiwiRail chose not to attend the workshops.

Through the workshops, the stakeholders have taken ownership of the outcomes and worked hard to challenge the status quo to drive positive change along this corridor. They have actively engaged and sought an understanding the problems and their underlying causes, identify a wide range of potential solutions and embraced the challenge of developing an appropriate programme in response to the problems.

As a group and in the context of this business case they have a passion for safety and supporting economic activity while preserving the unique character of the region. They also have a strong drive to arrive at an appropriate outcome and were fully supportive of the process taken to arrive at the recommended programme.

Further information about stakeholders and consultation is included in Appendix D.

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## 2. PROGRAMME CONTEXT

This chapter outlines the geographic, environmental, social, economic, and transport context to the SH1 Programme Business Case, presented in a series of maps.

## 2.1. NATIONAL CONTEXT

## 2.1.1 North - South Journey

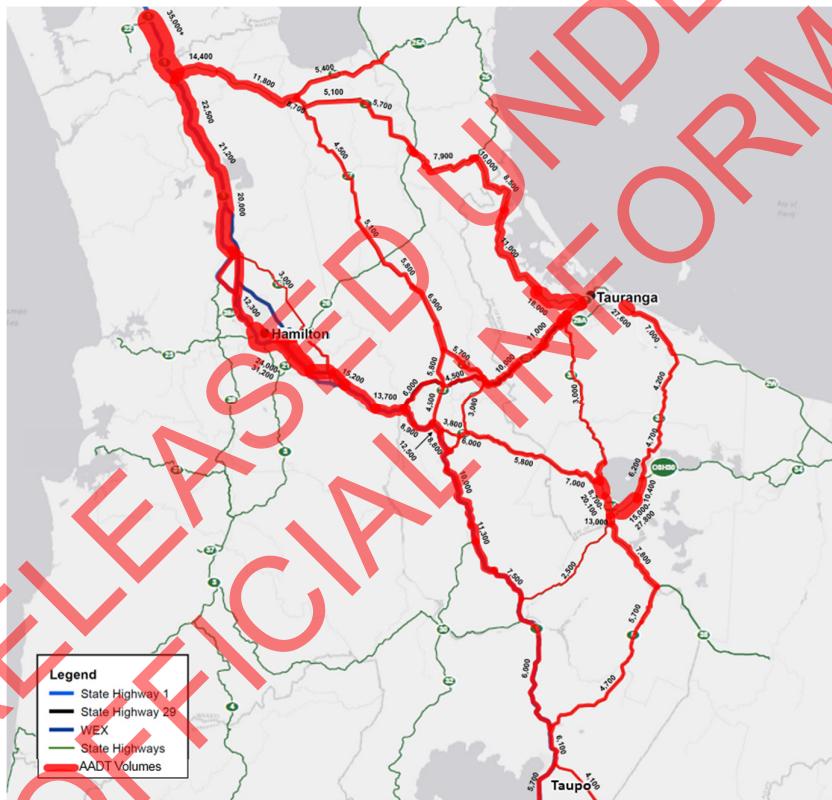
State Highway 1 is the principal route for the length of New Zealand. This section forms a vital part of the route between Auckland and Wellington. This is the economic spine of New Zealand for people and freight movements and is a key tourist route, as outlined below.

The section of the State highway from Piarere to Taupō is a key link in the overall SH1 route and needs to reflect the overall status of this major highway.

To the north of this section, SH1 is the Waikato Expressway. The corridor provides strategic connections to the Bay of Plenty via SH29 which in turn is a key freight route to the Port of Tauranga. It links to Rotorua via SH5, just south of Tirau, which takes a significant flow of tourists annually (approx. 4M visitors). To the south it connects to Taupō, another major tourist destination (around 3M visitors) and on to the remainder of the central and lower North Island. The importance of this corridor to these journeys is expected to increase with time.

The current PBC for the corridor between Taupō and Waiouru has examined and rejected the possibility of diversion of SH 1 to the west of Lake Taupō, which would have diverted north-south traffic at Tokoroa, reducing the significance of the remainder of the corridor.

Accordingly, the current SH1 corridor is expected to remain the main road link between Auckland and Wellington into the future. Regional and national growth is expected to result in an increase in traffic equitant to 30% of current volumes over the next three decade.



**Figure 2-1: Regional Traffic Volumes (AADT)**

## 2.1.2 Road Freight

This section of SH1 links freight from the central North Island to the Port of Tauranga and other major cities in the Waikato and Bay of Plenty Regions including Hamilton, Rotorua and Taupō.

Around 1,500 heavy vehicles use this route every day. This is approximately 15% of the total traffic flow and is considered to be a very high demand based on the ONRC criteria<sup>3</sup>. The majority of this (70%) is associated with local industry, with the remainder being inter-regional and long distance.

Road freight is expected to continue to increase by 50% over the next 30 years in line with national predictions, (increase to around 2,000 vpd). It is important that this corridor is capable of carrying these vehicles safely and effectively.

### 2.1.3 Rail Freight

Half of the corridor is paralleled by the Kinleith Branch Railway line which takes a high proportion (90%) of products from the region to the Port of Tauranga for export. This would have a significant impact on the demands of the highway if the branch line were unavailable for a lengthy period of time, however, KiwiRail are investing to protect the resilience and durability of this line into the future.

The main trunk line south of Auckland also plays a significant role as it moves approximately 20% of consumer goods south from Auckland to distribution centres in the lower North Island and Christchurch. There is a local distribution hub growing from Tokoroa; however, this is not expected to be anything more than a nominal volume in the future compared to current freight volume on the road network.

Current rail freight operations are expected to continue and therefore are unlikely to result in significant change to the use of the state highway.

### 2.1.4 Tourism

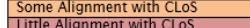
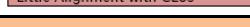
The corridor is the primary route for tourists travelling between the international airports and New Zealand's top tourist destinations of Rotorua and Taupō. Almost 6 million international and local tourist trips are made annually from Piarere to the SH5 link to Rotorua, where 4 million divert along SH5 and 2 million continue along SH1 to the south.

Accordingly, as this route is regularly being driven by people unfamiliar with the road or the environment it is therefore important that it is safe, attractive and legible.

### 2.1.5 One Network Road Classification

The role of this route, as identified above, is to move freight, facilitate tourism and link population centres. Accordingly, it is defined as a National High Volume highway under the One Network Road Classification (ONRC). The ONRC has a range of customer levels of service to which National High Volume routes should aim to achieve. These, and how Piarere to Taupō reflects these, are shown in the table below.

**Table 2-1: ONRC Customer Level of Service Assessment**

	National HV benchmark		Corridor Assessment
	Travel time reliability	Resilience	  
Mobility	Consistent travel times for most road users.		Reliability is inconsistent primarily due to crashes and road works.
		Route or viable alternative always available – advance warning of network issues.	Suitable alternative routes are available although some are longer and unable to carry larger HPMV vehicles. Advance warning and information at decision points limited. Inconsistent radio and cell phone coverage.
	Optimal Speeds	High speeds on 4 Star roads. Lower or variable elsewhere.	Not a 4 Star road. Speed environment is good at an average of between 80 and 90 km/h except through townships.

<sup>3</sup> The highest classification in the ONRC is National Strategic High Volume which has >1,200 heavy vehicles per day.

	National HV benchmark	Corridor Assessment
Safety	4 Star standard. Remove or mitigate hazards including head on. Active users separated.	Mostly 3 Star or below. Significant roadside hazards present. No median separation. No separation of pedestrians or cyclists
Amenity	High comfort, low roughness, appropriate road environment for traffic volume and backdrop.	Many out of context curves and emerging issues on ride quality. Route is generally part of landscape.
Accessibility	Unimpeded traffic flows with limited access, separated vulnerable road users, quality information.	No differentiation between long distance and local routes. Corridor passes through three towns and has numerous side roads and property accesses. Driver information limited to direction signage or on-line information.

The table above shows that there are significant gaps between the aspirational customer level of service benchmarks and the level of service offered by the current highway.

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## 2.2. CORRIDOR CONTEXT

This section outlines the geographic, environmental, social, economic, and transport context to the SH1 Programme Business Case, presented in a series of maps.

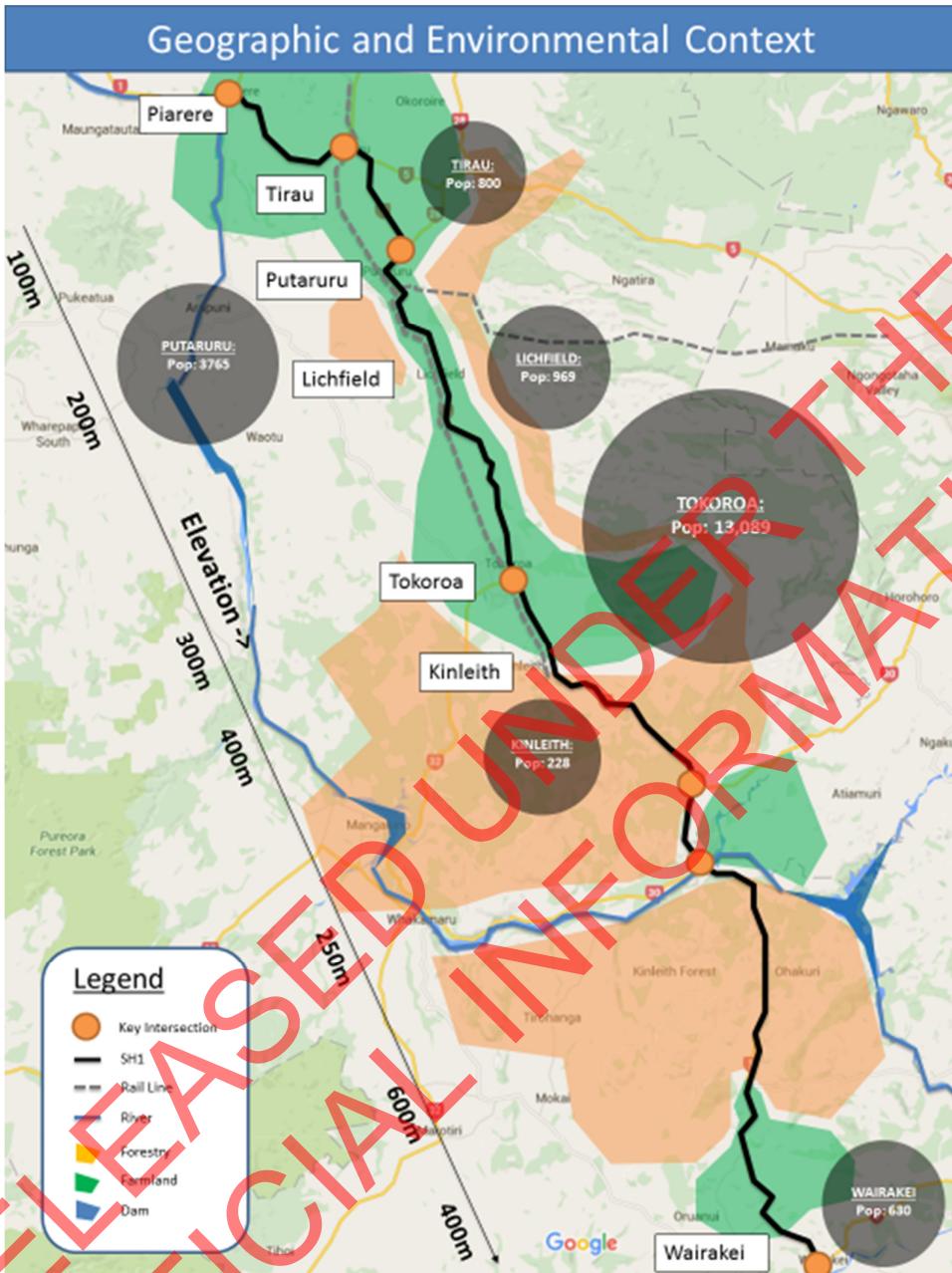


Figure 2-2: Geographic & Environmental Context

The route is largely through rural (pasture and forest) land. The geography along the corridor varies from relatively flat rolling countryside in the north with a predominance of dairy farms to a more hilly terrain in the south with forest plantations serving the timber industry. The three main settlements within the corridor are Tirau and Putaruru, with SH1 effectively functioning as a 'main street' and Tokoroa with the main area of development to the west of SH1.

SH1 through the study area therefore operates as a facilitator for local movements connecting the rural communities to the townships and markets.

This highway is not highly susceptible to earthquakes, major storms or other high impact events.

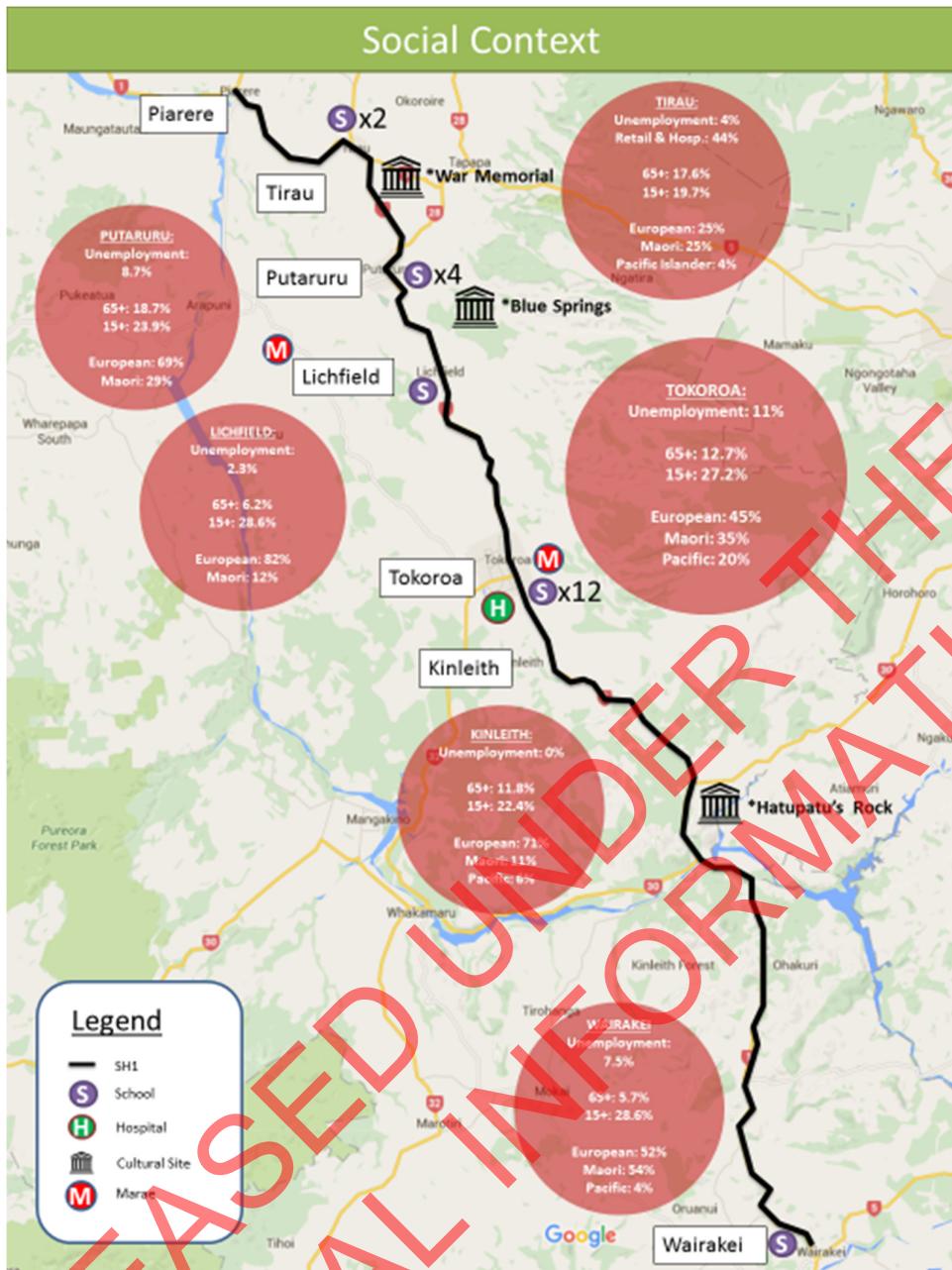


Figure 2-3: Social Context

The social context of the corridor is focussed around the main towns, of which Tokoroa is the largest. It has a population of 13,000 people and with a hospital, courthouse, police station, council offices, range of schools (primary through to secondary) businesses and other facilities, it has many of the facilities that support the wider South Waikato district. Putaruru is the second largest of the towns with 3,800 people. Putaruru has grown around SH1 and the Kinleith Branch rail line and offers a wide range of retail banks and services and has one of the three secondary schools located along the corridor. Tirau has a population of around 800 is now well known as a stopping place for passing tourists due to its cafés boutiques and antique shops.

The dominance of farming and forestry in the area has had an impact on the social context of this section. The top three employment sectors in the South Waikato District (2013 Census) are agricultural, forestry & fishing, followed by manufacturing, education and training, retail, health care and social assistance.

There has been a decline in the population in Tokoroa in particular which is linked to the downscaling of operations at the Kinleith Mill over the past three decades; however, through traffic continues to increase.

SH1 has a very important function in connecting rural communities to local services with the townships, and as operating as the main street for Tirau.

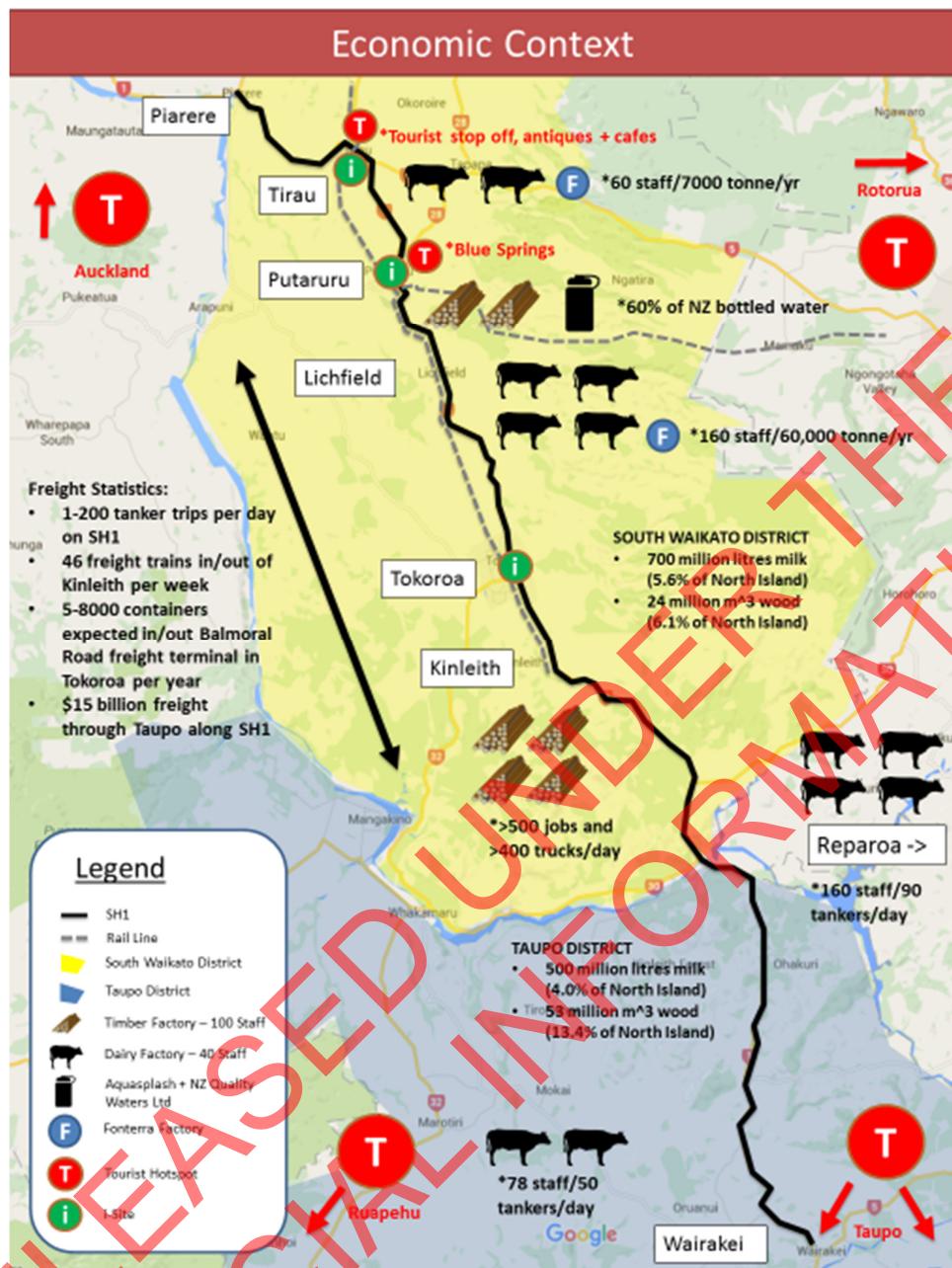


Figure 2-4: Economic Context

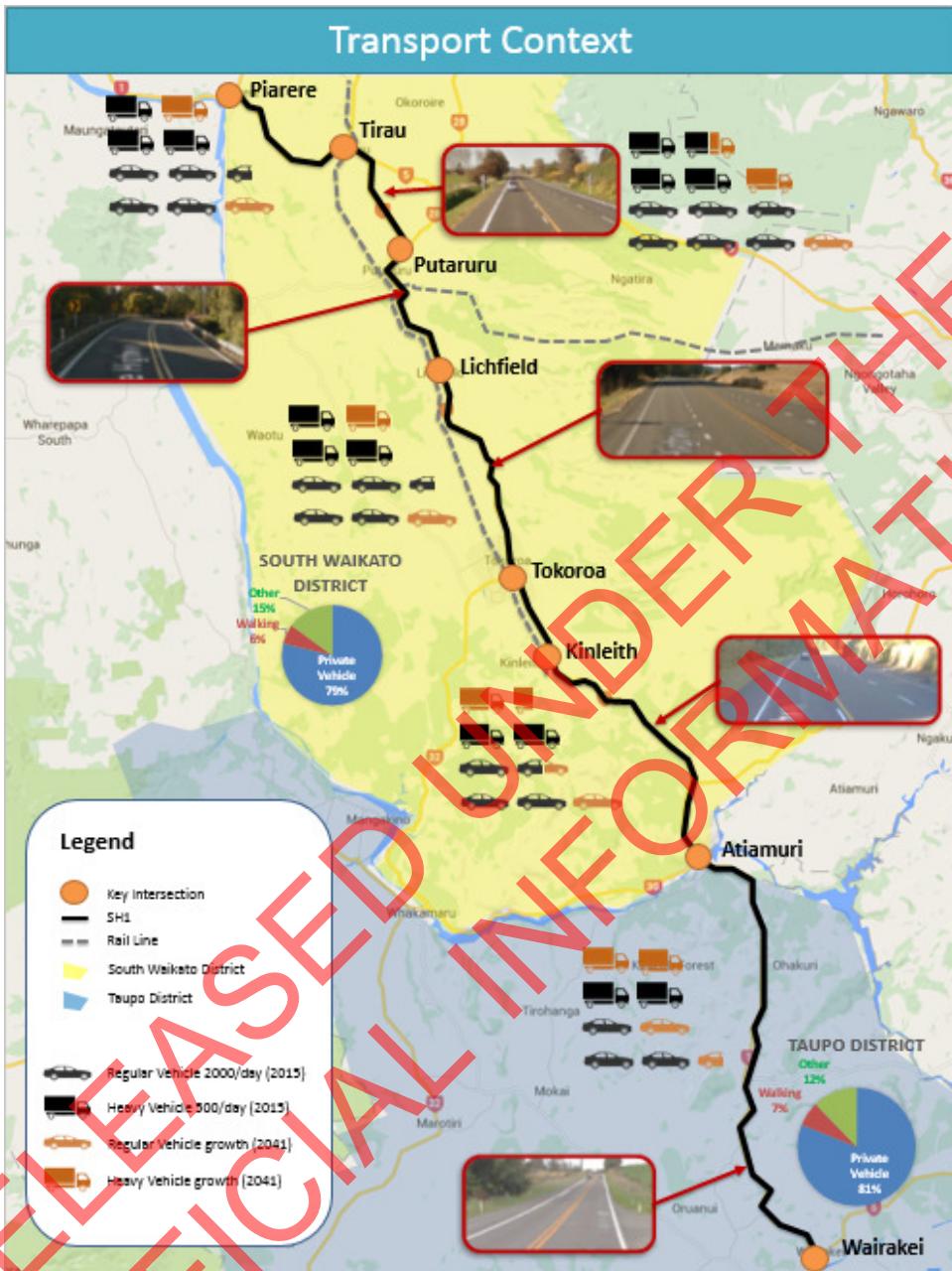
Significant industries along the corridor include dairy farming, forestry and engineering and these industries generate a high volume of export products, with almost 90% of product being shipped via the Port of Tauranga. Raw materials and domestic market goods are transported to and from factories by road.

Links by road and rail to the Port of Tauranga have helped a number of businesses in the district develop export potential in new or emerging industries. Tourism is identified as an emerging industry for South Waikato. The presence of an export quality water supply is also seen as another economic advantage and tourist attraction (e.g. Blue Springs).

The District is located on a major tourist route with thousands of domestic and international visitors passing along the route each day. Tirau is a tourist destination in its own right with other local attractions being marketed. New tourist attractions are developing based on adventure activities related to the Waikato River and

the success of movies such as Lord of the Rings with 'Hobbiton' nearby and the cycling and walking Waikato River Trails that cover about 100km of previously inaccessible Southern Waikato from Atiamuri to Karapiro.

Along with the Kinleith branch line, SH1 is the economic lifeline that connects the local industries with the domestic and export markets and, tourist connection from Auckland to the tourist centres of Rotorua and Taupō.



**Figure 2-5: Transport Context**

This corridor carries on average 9,000 vehicles per day with peaks of almost 12,000 in Tirau. It carries 1,500 trucks a day (around 15-20% of all traffic) servicing the regional industries but also on long haul routes.

Future traffic growth is strongest with HCVs and in the northern part of the corridor. The regional transport model shows a 30% increase in all traffic by 2045 is anticipated, but a 50% increase in trucks.

Current speeds outside of towns are typically 85km/h for trucks and 95km/h for cars. With the increase in traffic over time, it is expected that average travel speeds over the length of the route will erode slightly, due to the larger slower vehicles and fewer gaps in the traffic stream to enable overtaking.

Over 90% of product originating from the major factories is transported by rail to the Port of Tauranga. The Kinleith Branch Line runs parallel with SH1 between Tirau and Kinleith, primarily serving the timber and dairy industries; it carries 46 freight trains per week, which takes at least 300 trucks a day off the road network. Rail freight growth is dependent on the Oji and Carter Holt Harvey factories at Kinleith and Fonterra's operations at Lichfield but production or mode of transport is not expected to change significantly in the future.

The North Island Main Trunk Line runs 30 – 70km to the west of SH1 (outside of the map area above) and carries around 20% of the north-south long haul freight.

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### 3. STRATEGIC ASSESSMENTS – OUTLINING THE NEED FOR INVESTMENT

#### 3.1. DEFINING THE PROBLEM

##### 3.1.1 Problem 1: An inconsistent and unforgiving road environment between Piarere and Taupō, combined with road user mistakes leads to a high number of crashes with a severe outcome (70%)

Cause: Inconsistent and unforgiving road environment and road user mistakes

Effect: High number of crashes

Consequence: High number of deaths and serious injuries

#### Cause

Over the past three decades or more, SH 1 has been continually improved with realignments, intersections, passing lanes and widening works. However, these good sections are interspersed with lower standard older sections which make the highway inconsistent. This is demonstrated by the KiwiRAP Star ratings for the corridor where 45% remains below 3 Star when 4 Star is suggested as a minimum benchmark for a National High Volume State Highway.

The following figures show that the crash risk is significantly higher on the northern half of the corridor. The data also shows that about half of all crashes occur on out of context curves. An out of context curve is one where a driver cannot easily read the road and will need to brake to achieve a speed that is safe. 16% of the corridor is considered to be out of context.

It is important to recognise that the scale of crash risk is linked to the level of exposure and will increase over time as traffic volumes grow.

Drivers make mistakes along this corridor. The biggest single cause of crashes is distraction due to a number of reasons including:

- Fatigue
- Impairment (drug/alcohol)
- Inattention to changes in road conditions
- Inexperience
- Use of cell phones etc

These crashes can lead to severe outcomes when vehicles leave the road and hit roadside hazards, which is one of the aspects reflected in the KiwiRAP rating. The combination of the high number of distraction crashes coupled with the low KiwiRAP rating therefore leads to a high number of deaths and serious injuries.

*The single biggest cause of crashes is drivers distracted from the driving task.*

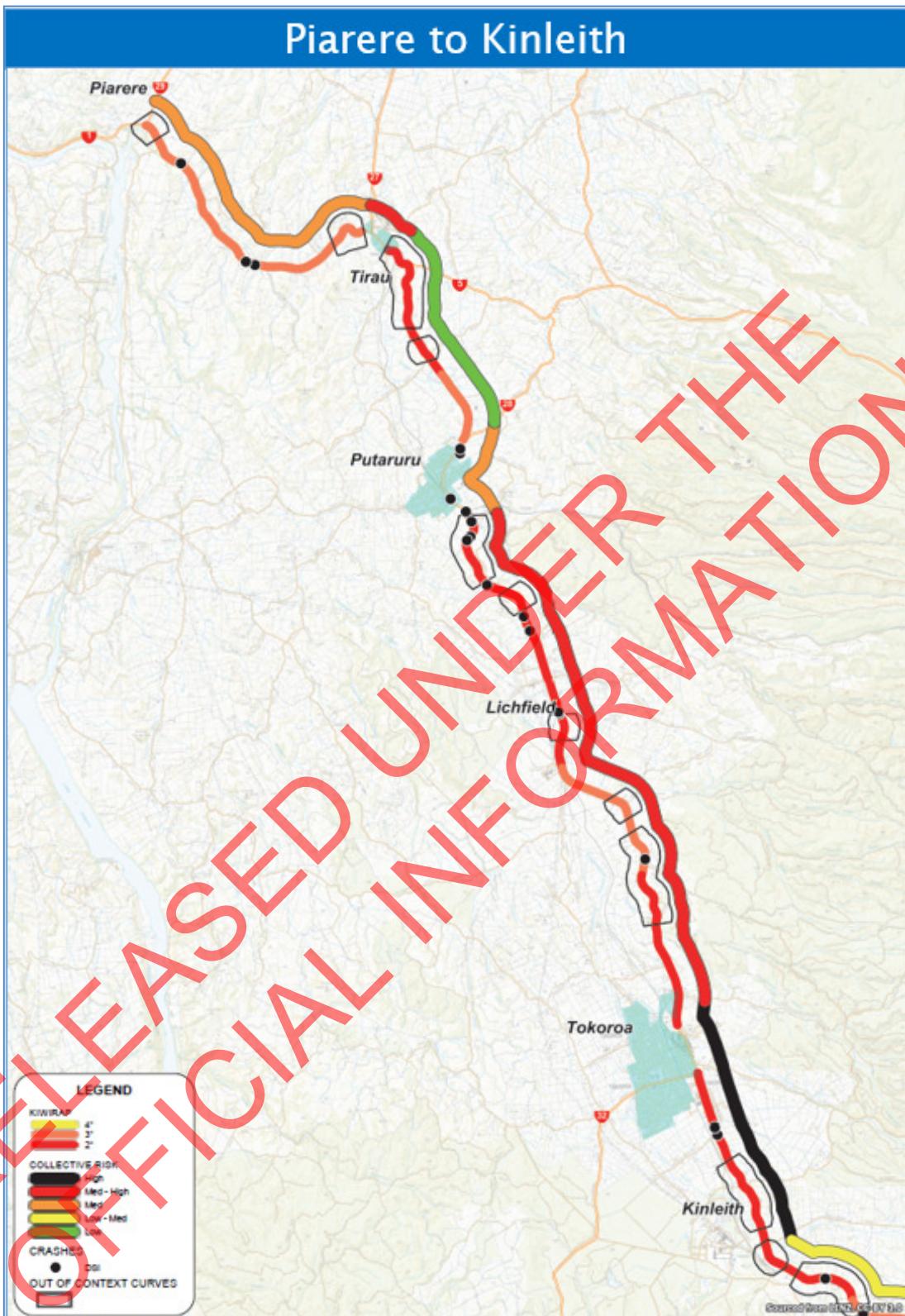


Figure 3-1: Crash Risk and Out of Context Curves Piarere to Kinleith

## Kinleith to Wairakei

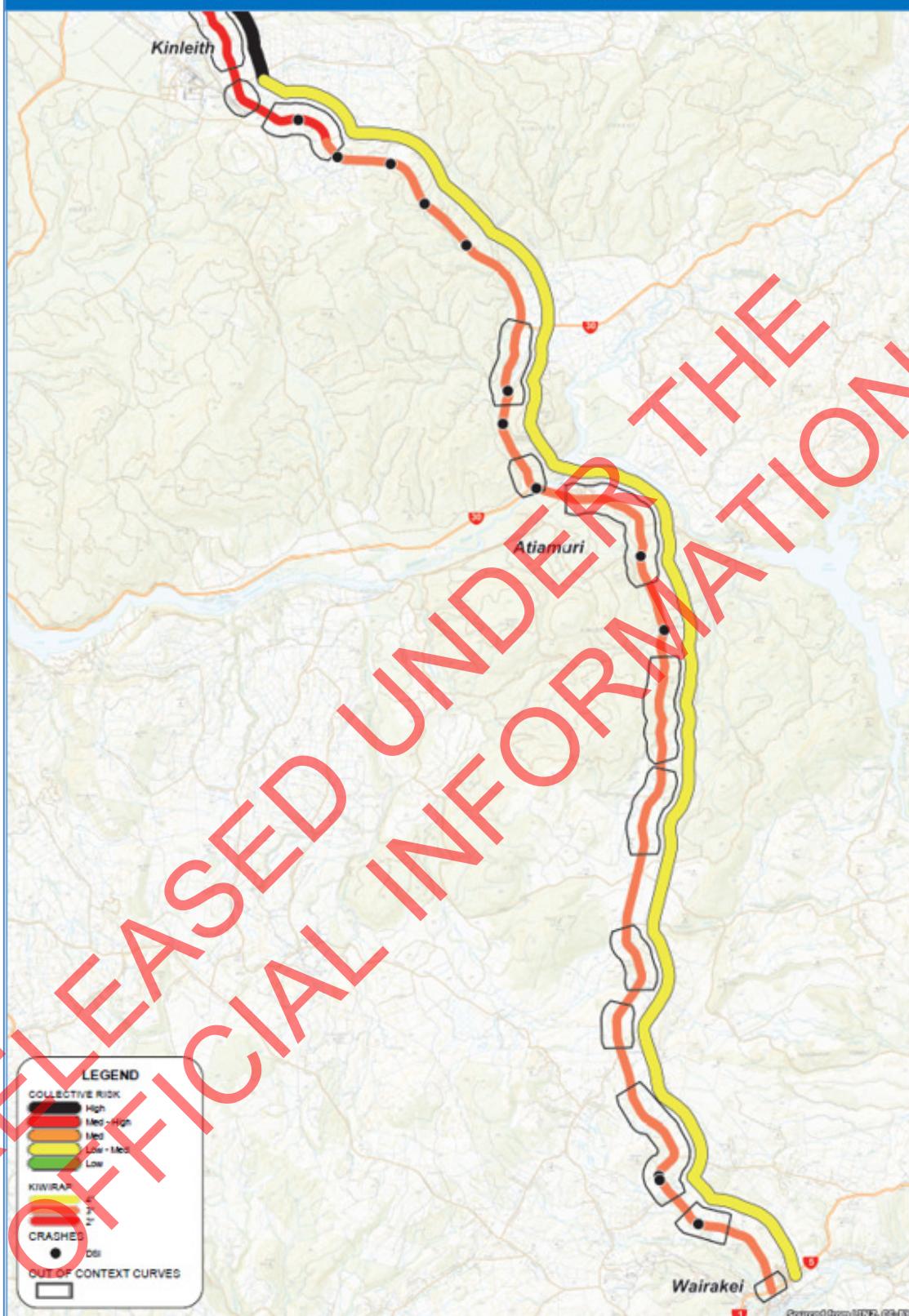


Figure 3-2: Crash Risk and Out of Context Curves Kinleith to Wairakei

**Effect**

There have been 307 crashes over the 2010 to 2014 period resulting in 56 deaths and serious injuries (DSIs). In 2015 there was an additional 50 crashes and 13 DSIs.

Figure 3-2 on the following page outlines where these crashes are occurring and the types of crash. There are a high number of low-severity crashes in the townships, due to the high traffic volumes and conflict points. The run off road and head on high severity crashes typically occur in the rural sections and are primarily due to loss of control.

The predicted increase in traffic volumes, including heavy vehicles, over the next 30 years, will result in the numbers of crashes increasing along the entire highway and the Star rating of the highway decreasing if left unaltered.

The overall result is likely to be an increase in deaths and serious injuries.

*Loss of control and head on crashes are significant in the corridor with four sections significantly above the national average for this crash type.*

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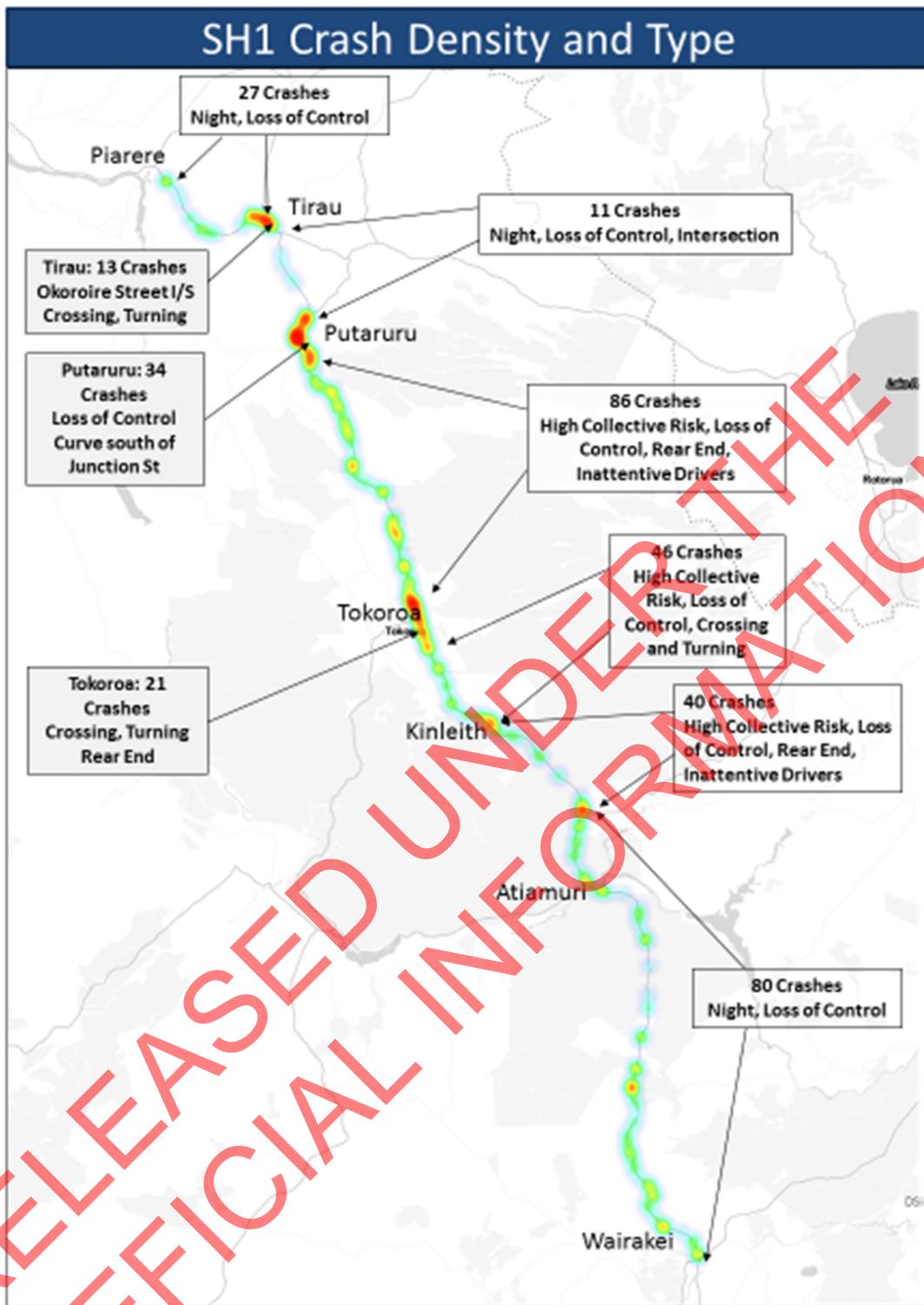


Figure 3-3: Crash Density and Type

### 3.1.2 Problem 2: Closures on the SH1 north-south spine result in unreliable movement of people and goods resulting in an economic loss (15%)

Cause: Crashes and other events

Effect: Closures of SH1

Consequence: Delays moving people and goods and therefore economic impact<sup>4</sup>.

#### Cause

Closures are either planned or unplanned. Unplanned events often create short term problems, and planned events such as maintenance also reduce travel time reliability and increase frustration.

TREIS is the NZ Transport Agency database which records unplanned events and this shows two levels of impact:

- Full closures, which prevent the movement of all traffic for a period of time, and
- Partial closures, which restrict traffic to a single lane.

Full closures have occurred on 22 occasions over the past 5 years with crashes being the reason behind all but one of them.

Partial closures are due to a variety of reasons as outlined in the figure below.



Figure 3-4: Unplanned Events by Year

Since 2013, unplanned events have doubled; this appears to be due to increase in reporting of unplanned reactive maintenance activities. These unplanned events appear to be located all along the corridor; the data is not specific enough to determine any commonality in location.

There is limited information available for planned maintenance activities. It is understood that temporary traffic management has been on site for part of the corridor for at least the past 12 months in various locations and durations either for reseal works or to reduce traffic speed on road sections with pavement failures. Recent information suggests that this is a symptom of a higher degree of maintenance activity to improve the CLoS, although further evidence is required to demonstrate the effects and extent of this action.

<sup>4</sup> The stakeholder group did not consider travel time to be a particular problem for this corridor and the evidence suggests that even with forecast traffic growth, this is not likely to be a problem for at least the next 30 years. Stakeholder inputs and evidence also shows that the vast majority of travel time reliability issues are caused by full and partial closures.

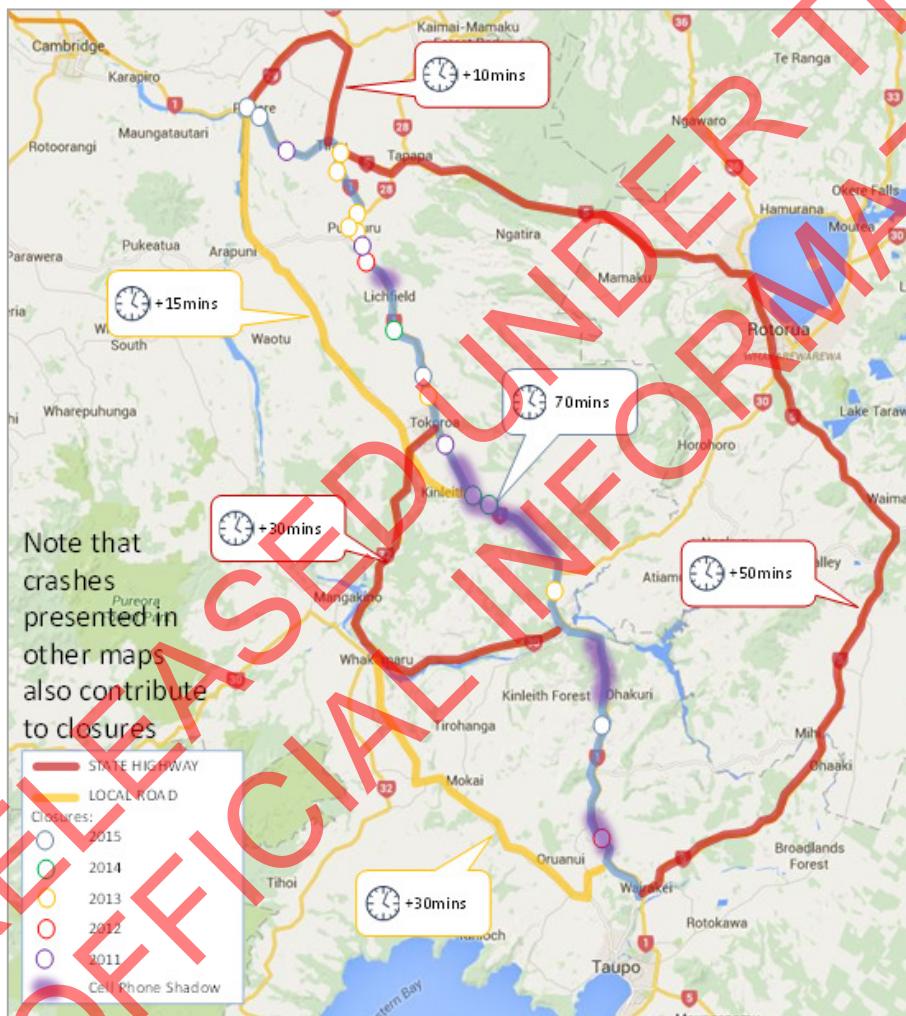
## Effect

*The average closure on this corridor lasts approximately 6 hours compared with the regional average of 3 hours.*

The average full closure on this corridor lasts around 6 hours. This is double the regional average, meaning that more journeys are impacted for a longer period of time. The cause of this closure time is unclear; it may be due to the remoteness of some of the areas and the inability to get the right equipment to the site in a timely manner.

Another major factor in delays and reaction times is the ability to communicate. There are several areas between Tokoroa and Wairakei that have restricted or no coverage for any cell phone or radio network, meaning that it is difficult to report incidents or contact people already on route.

In addition, when there is a closure, there are few diversion routes available, and these can add up to 50 minutes to the journey. Currently only around 10% of the diversion routes are able to be used by large HPMV vehicles<sup>5</sup> so often these trucks have to wait until the road is reopened. At around 30% of the truck fleet this could result in around 100 trucks being unable to continue their journey for up to 6 hours.



**Figure 3-5: Diversion Routes and Travel Times**

<sup>5</sup> There are published local emergency diversion routes used by the Police and Network Contractor, analysis of these shows that the majority are on local roads with structures that have insufficient load carrying capability.

*There are few alternative routes for HPMV vehicles meaning up to 100 trucks could have delayed journeys of up to 6 hours when full closures occur.*

On average, there are around 150 unplanned events which do not fully close the road each year.

Planned closures or restrictions for maintenance activities are not recorded. However, analysis of a typical future maintenance programme suggests that, over the summer period, drivers on SH1 will encounter road works between 50% and 80% of the time.

Anecdotal evidence for planned activities suggests that this can impact on journey times by up to 10 minutes or more per vehicle during the summer construction season. Other sections with poor surface condition have had temporary speed limits for safety reasons prior to resealing being undertaken.

When considering all of the above, a driver undertaking a return journey from Piarere to Taupō will, on average, be delayed by a full or partial closure every time.

### 3.1.3 Problem 3: The social and economic aspirations of small town communities between Piarere and Taupō conflict with the function of the state highway (15%)

**Cause:** High traffic volumes on SH1 and local demands within townships

**Effect:** Impacts on the operation of the towns

**Consequence:** Impacts on road user amenity and community amenity

#### Cause

Traffic volumes within towns are higher than in the rural sections due to the services within the towns and connections to other highways.



**Figure 3-6: Corridor Traffic Volumes**

These traffic volumes are expected to increase in the future with a 30% increase in all traffic and a 50% increase in heavy vehicles over the next 30 years.

Increasing the number of people travelling through the towns can be beneficial to the townships. If 2.5% of through traffic stops in a town the local revenue generated is estimated in the region of \$1.5m per year. This means that annually up to \$12m revenue is captured in the region as a result of visitors stopping at Tirau, Putaruru and Tokoroa.

*The number of people stopping in a town has a direct, measurable link to the revenue reported by local retailers and tourist industries. Annually up to \$12m revenue is captured in the region as a result of visitors stopping at Tirau, Putaruru and Tokoroa.*

However, the current form of the highway and the increasing traffic volumes is not conducive to people stopping and also creates severance for locals accessing goods and services.

The concentration of activities and traffic movements within towns increases the safety risk as well as reducing reliability for through movement, particularly for trucks. Manoeuvring vehicles and crossing pedestrians result in a slowing of traffic to a crawl in peak tourist season.

SWDC are currently planning improvements within Tirau, Putaruru and Tokoroa to improve amenity and create stronger social and economic centres. As part of this work they are measuring pedestrian activity, perceived risks from road users, car park utilisation and intersection delay. These measures will be monitored as they are good indicators of severance and accessibility.

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## Effect

The main impact of increasing vehicle volumes and, in particular, increasing numbers of heavy vehicles is on the social and economic operation of the towns.

Daily community access can be difficult and it also impacts local events. Businesses are also constrained as the function of the highway is focussed on through traffic rather than access to shops.

*Daily community access is affected by traffic volumes and types of vehicles, and local events are affected by difficulty of turning movements given increased traffic volumes. Businesses are also constrained by requirements driven by the function of the highway as a means of allowing traffic to pass through efficiently with minimal distraction to drivers.*

**Table 3-1: Overview of impacts on local amenity**

Impacts	Function / amenity affected
Through traffic (volumes and types of vehicles) has an impact on local movement. Particularly affects safe pedestrian movement from one side of SH1 to the other.	Daily access to schools, doctors, shops, community facilities and businesses. Local events related to community or sporting activities or economic development initiatives at local facilities.
Right turning movements between SH1 and local roads is difficult due to the volume of traffic.	
Access to businesses or advertising of businesses may be restricted because of the road being a State Highway.	Viability and function of businesses.

If these impacts are not addressed then the vision for the townships would not be realised. The highway would therefore not be enabling the economic growth opportunity, or social connectivity / quality of life experience sought by the community.

Specifically, visitors would not have safe and easy access to the townships, to find parking or to have quality rest facilities. Visitor experience would be negative and this is likely to have a direct and negative economic impact over time.

Local users would not have a safe local road network that allows easy access by any mode to goods and services throughout the townships.

Doing nothing will also result in highway through these townships being significantly different from the form expected of a National High Volume highway.

### 3.2. THE BENEFITS OF INVESTMENT

The benefits of addressing the problems were developed during a workshop with the key stakeholders and investment partners. The benefits were agreed to be:

- Improve safety: 60% weighting
- Efficient movement of people and goods: 40% weighting

The efficient movement of people and goods was considered to specifically relate to delays experienced due to full and partial closures (as defined by the problem statement). The stakeholder group did not consider travel time to be a particular problem for this corridor and the evidence suggests that even with forecast traffic growth, this is not likely to be a problem for at least the next 30 years. Journey reliability is expected to be eroded from its current values as traffic volumes, and in particular, truck volumes increase. In the future, higher numbers of slow moving vehicles and a reduction in overtaking opportunities, due to opposing traffic flow, will result in a reduction in journey time reliability.

### 3.3. INVESTMENT OBJECTIVES

The investment objectives have been developed from the problem and benefit statements and are as follows:

1. Improve safety of SH1 between Piarere and Taupō by reducing the number of deaths and serious injuries from 56 to 20 by 2040.
2. Improve the quality of infrastructure of SH1 between Piarere and Taupō by increasing the length of corridor with KiwiRap Star Rating of 4 from 0% to 40% by 2030, but with no sections below 3 Star. By 2040 the whole corridor should be 4 Star.
3. Increase availability of SH1 between Piarere and Taupō by reducing the number of journeys impacted by closures and delays by 2040.
4. Improving amenity values within towns on SH1 between Piarere and Taupō by improving access to services and reducing the effect of severance by 2040.

No investment objective has been developed in terms of travel time reliability as this was not determined to be a problem, except in relation to closures.

These investment objectives were discussed and agreed with the stakeholders during the facilitated workshops.

The following map outlines the progression from the problems and benefits to the investment objectives, showing that they are directly related.

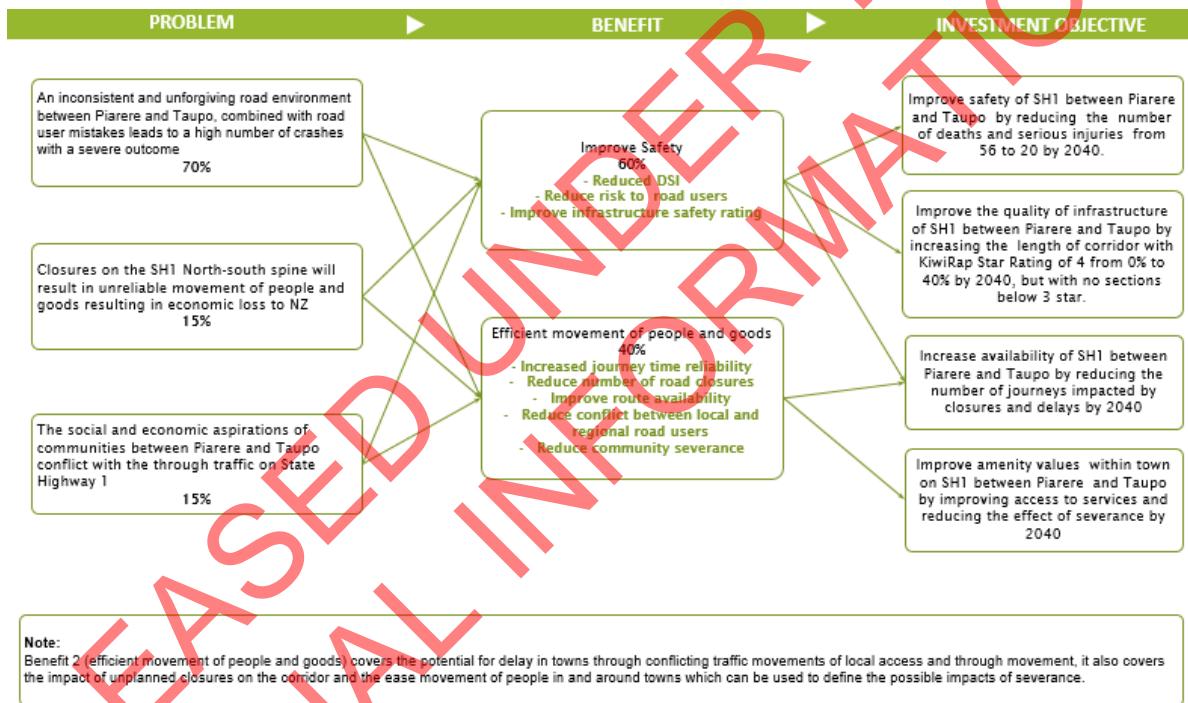


Figure 3-6: Benefit Map

**Note:**  
 Benefit 2 (efficient movement of people and goods) covers the potential for delay in towns through conflicting traffic movements of local access and through movement, it also covers the impact of unplanned closures on the corridor and the ease movement of people in and around towns which can be used to define the possible impacts of severance.

### 3.4. UNCERTAINTY LOG

A number of issues, constraints and key uncertainties which may impact the programme of works have been identified and a full uncertainty log has been developed (see Appendix E).

The uncertainties that may have significant impact on the future needs along this corridor are outlined below:

- Population or industrial increase in South Waikato exceeding SWDC forecast: SWDC have a modest growth forecast based on historic growth rates, industrial land uptake and population migration. The risk of this increasing significantly is low but may result in earlier interventions.
- Population and tourist increases above predicted volumes in Taupō: Current changes in population demographics and the desirability of Taupō as both a destination and place to live have been evaluated up to 2030. However, if the trend changes significantly, it may increase the scale of the current problems on the corridor and may accelerate the need for intervention.
- Expansion of operations at Kinleith timber processing works: Current understanding of Oji and Carter Holt Harvey operations is that production is focussed on consistency of output in the short term; growth will be governed by international markets and are hard to predict. It is unlikely that there will be a large increase in on-road logging trucks within the near future, but this should continue to be monitored.
- Reduction in rail freight: A reduction in rail operations on the Kinleith Branch Line would significantly increase road freight on the corridor, almost 90% of export goods are shipped to the port by rail (approx. 7 per day). The removal of a single train could increase road freight by up to 10 % (approx. 75 trucks) between Kinleith and Putaruru. Kiwi Rail is currently looking to increase train frequency and improve rail accessibility, so this risk is also low.

All the above uncertainties would increase the number of vehicles, and particularly heavy vehicles on the highway. This would have a flow on effect to all three of the problems by increasing safety risk, potentially having more freight delayed by closures and additional impacts in townships.

There are some lower impact and higher probability events identified in the uncertainty log. These have been considered but are not significant enough to change programme considerations materially at this stage. These include:

- Significant growth at the road/rail hub at Tokoroa
- Increase in electric vehicles
- Changes in fuel prices
- Changes in the road maintenance regime

All the above uncertainties were considered by the project team during the development and assessment of options and programmes.

## PART B – DEVELOPING THE PROGRAMME

### 4. ALTERNATIVES AND OPTIONS

Stakeholders identified 114 options specifically related to the problem statements. These options were grouped into themes, reviewed by the project team and consolidated where there were obvious duplications or where one option could be described as a sub-set of a wider option. This process reduced the list of options to 64.

The options were categorised into the following broad categories:

- Physical works to the road
- Road management & operation
- Behaviour Change
- Ancillary infrastructure
- Land use changes
- Public transport/alternative transport
- Information and technology
- Emergency management
- Traffic management

The options were assessed against a number of criteria to determine:

- How well they contributed to the investment objectives
- What impacts they would have on safety, economy, social & environmental
- The implementability and risks of the option

This assessment was qualitative, although based on industry best practice and the professional judgement of the wider team.

## 5. PROGRAMME OPTIONS

### 5.1. PROGRAMME GENERATION

It is unlikely that any option will be progressed on its own (and many are dependent on other options) and a programme of options will be needed to address the current problems. Programme themes were developed with the wider project team by considering how investment in certain areas would address the problems and achieve the investment objectives.

It is noted that there are almost limitless programme combinations; therefore, the programme themes outlined below were circulated to stakeholders as part of a PBC progress update, for comment prior to the Programme Assessment Workshop (Workshop 3). Workshop 3 would also provide opportunities to add or amend programmes. Appendix B contains the list of options that are included in each programmes.

**Table 5-1: Programme Themes**

Title		Description
1	Business As usual	Status quo, no additional investment.
2	Maintenance and Operations	Investment in road maintenance and improvements in effectiveness of road management and traffic operation.
3	Targeted Safety	Priority safety works, limited to evidenced problem areas. Limited lifespan of improvements and only targets known high risk sites.
4	Corridor Wide Safety Transformation	Corridor safety improvements to gain a baseline improvement in Star rating to 3.5. No improvements to Journey, management or communities. Does not account for maintaining current levels of service or community values.
5	Broad Response	Corridor wide infrastructure and non-infrastructure improvements including: <ul style="list-style-type: none"> <li>• Improved emergency management</li> <li>• Enhanced maintenance programme</li> <li>• Consistent traveller information</li> <li>• Improved town amenity, including diversion of through truck movements in towns.</li> <li>• Staged roading upgrades to achieve a Star rating of 4</li> </ul>
5A	Broad Response plus Journey Enhancements	All the benefits of Programme 5 plus features to improve and enhance the journey experience and amenity values of local community, such as: <ul style="list-style-type: none"> <li>• Rest areas/truck stops and additional facilities for all road users</li> <li>• More comprehensive traveller information and better communications</li> <li>• Improved ride quality/maintenance</li> <li>• Reduced impact of severance in towns through improving the amenities and environment</li> <li>• Enhanced local community and economy through promotion of towns and facilitating more accessible facilities</li> </ul>
6	Infrastructure Focussed	Up front Infrastructure improvement to give the best possible alignment and function. Based on a gap analysis between the current state and the draft customer LOS from One Network Road Classification for the National High Volume category, this programme is aimed to achieve the best possible alignment and cross section with a minimum Star rating of 4.

6A	<b>Infrastructure Focussed plus Journey Enhancements</b>	<p>All the benefits of Programme 6 plus features to improve and enhance the journey experience and amenity values of local community, such as:</p> <ul style="list-style-type: none"> <li>• Rest areas/truck stops and additional facilities for all road users</li> <li>• More comprehensive traveller information and better communications</li> <li>• Improved ride quality/maintenance</li> <li>• Reduced impact of severance in towns through improving the amenities and environment</li> <li>• Enhanced local community and economy through promotion of towns and facilitating more accessible facilities.</li> </ul>
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### 5.1.1 Options Not Considered

The PBC for the corridor between Taupō and Waiouru has examined and rejected the possibility of diversion of SH 1 to the west of Lake Taupō, which would have diverted north-south traffic at Tokoroa, reducing the significance of the remainder of the corridor. Therefore the current route will continue to operate as SH1 into the future.

An off line expressway programme was not considered as the current corridor provides the optimum route between Piarere and Wairakei, whilst still servicing the towns of Tirau, Putaruru and Tokoroa. It also links SH27, SH5, SH30 and SH32 along its length and provides access to significant industries. Diversion of SH1 away from its current corridor would reduce the journey efficiency for the majority of trips.

## 5.2. PROGRAMME EVALUATION AND SHORTLISTING

The programmes were assessed against a number of criteria consistent with the Options Assessment:

- Performance against each of the five investment objectives;
- Implementability Risks;
- MCA (Safety, Economy, Social and Environmental);
- Indicative Cost;
- IAF (Strategic Fit, Effectiveness, Efficiency); and
- Risks and Dependencies.

Assessments were carried out by the project team using local knowledge, industry best practice, and predicted project impacts. These assessments have undergone review and moderation by stakeholders and other professionals.

A summary of the evaluation is presented in the following table.

**Table 5-2: Programme Assessment Summary**

	SIGNIFICANT ALIGNMENT
	GOOD ALIGNMENT
	MINOR ALIGNMENT
	NEUTRAL
	MINOR MISALIGNMENT
	DISBENEFIT
	SIGNIFICANT DISBENEFIT

		2016 Baseline
Investment Objectives	Reduce DSIs	10 DSIs
	Improve quality of infrastructure (Kiwi RAP)	55% 3★
	Increase Availability	5 closures
	Improve amenity values in towns	3 min delay <sup>#</sup>

MCA	Safety
	Economy
	Social and Environmental
Implementability	

IAF	Strategic Fit
	Effectiveness
	BCA

Cost Range (\$m)	High
	Low
BCR	High
	Low

Timeframe (years) to attain full benefits	

Programme								
1	2	3	4	5	5a	6	6a	
Business as Usual	Maintenance and Operation	Targeted Safety	Corridor Wide Safety Transformation (3.5*)	Broad Response (4* target)	Broad Response Plus Journey Experience	Infrastructure Focussed	Infrastructure Focussed plus Journey Experience	
10	9	8.5	7	3.5	3.5	<3	<3	
55% 3★	55% 3★	80% 3★	All 3.5★	All 4★	All 4★	All 4★	All 4★	
5	5	5	4	2.5	2.5	1	1	
3.0	2.5	3.0	2.5	1.5	0.3	0.6	0.0	
4	3	2	1	1	1	1	1	
4	3	3	3	1	1	1	1	
3	4	4	2	4	2	6	4	
N/A	M	H	M	M	M	L	L	
H	H	H	H	H	H	H	H	
L	M	M	H	H	H	M	H	
L	L	L	L	L	L	L	L	
110	230	200	650	980	1,050	1,600	1,650	
70	130	90	400	710	730	1,210	1,230	
1.0	1.1	1.6	1.5	1.3	1.3	1.3	1.3	
0.6	0.6	0.4	0.8	0.5	0.5	0.5	0.5	
ongoing	0-20	5-10	5-30	5-40	5-40	5-20	5-20	

<sup>#</sup> This is an estimated proxy value for severance based on pedestrian delay in crossing the road in Tirau, derived from SWDC observations.

The programmes and the above assessment were discussed in a workshop with stakeholders, who helped to decide which programmes should not be considered further as well the recommended programme.

Programme 1 (Business as Usual) and Programme 2 (Maintenance and Operation) do not meet the Investment Objectives and score poorly in the MCA. These were therefore not considered further. However, elements of both of these programmes are included in programmes 4, 5, 5A, 6 and 6A.

Programme 3 addressed the immediate safety problem but took no account of what might happen in the future with traffic growth and did not significantly contribute to investment objectives 2 or 4. Therefore it was not considered further.

Three programmes and two sub-programmes were shortlisted which best met the investment objectives:

- 4 Corridor Safety Transformation
- 5 Broad Response
- 5A Broad Response plus Journey Enhancement
- 6 Infrastructure Focussed
- 6A Infrastructure Focussed plus Journey Enhancement

The consensus of opinion from the workshop was that Programme 5A, with suitable modifications would offer the best solution as it:

- includes a range of infrastructure and non-infrastructure measures to address the problems;
- deals with immediate safety problems;
- provides a staged approach to long term investment to meet demand; and
- contributes to the overall improvement of social and economic wellbeing within the townships.

The other shortlisted programmes were considered unsuitable for the following reasons:

- **Programme 4 – Corridor Safety Transformation:** Whilst this programme scores reasonably well in terms of improving safety (anticipated 40% improvement), it only focusses on current risks and does not consider the long term form and function required of the highway as a National High Volume route. The programme does not offer the same scale of DS1 prevention as other more extensive interventions and does not account for the need to maintain trip reliability. It is likely that some interventions of a purely safety nature will actually create an impediment to journey efficiency. There is a high probability of early redundancy in this type of investment as further works are likely to be required in the future as traffic volumes increase. Furthermore, the programme takes no account of the needs of the local communities in improving amenity values of the towns.
- **Programme 5 – Broad Response:** Significantly, this programme delivers a 60% improvement in DS1 casualty prevention now and in the future, so investment is only needed once to deliver a robust and enduring solution as it is needed. This programme delivers well on all aspects of the investment objectives apart from improving amenity values, which was considered fundamental by the stakeholder group.
- **Programme 6 – Infrastructure Focussed:** This programme delivers all the potential benefits and some significant gains in terms of future proofing. However, it is an oversupply of infrastructure, without providing significant additional benefits over Programme 5. The need for significant investment in infrastructure is not necessary for a number of years as traffic growth is anticipated to be modest.
- **Programme 6A – Infrastructure Focussed with Improved Amenity:** This is an enhanced version of Programme 6, and whilst it significantly contributes to the overall improvement of social and economic wellbeing within the district, it is still considered to be a significant oversupply of infrastructure.

The weighting of problems, benefits and investment benefits, as determined by the stakeholders during engagement at workshops was considered during the assessment. The overarching priority for all was safety which is reflected in the prioritisation of options within programmes to deliver on this outcome.

While Programme 4 would be cheaper and meets 60% of the safety and closure benefits, it fails to fulfil two key aspects; those being the needs of the local communities (i.e. severance and amenity) and the overall alignment

with the ONRC (i.e. star rating and reliability). For these reasons programme 5A is recommended as it fully meets all the targets and is likely to exceed the safety and reliability KPIs.

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## 6. RECOMMENDED PROGRAMME

### 6.1. PROGRAMME OVERVIEW

The recommended programme “Broad Response plus Journey Enhancement” (5A), is a mix of short, medium and long term interventions intended to be implemented in line with demand.

It includes investment of \$730 to \$1,050 million in infrastructure and non-infrastructure options to address the problems including:

- Improved emergency management and response to reduce length of closures due to crashes and natural events, including rapid response teams.
- Improved maintenance programme to reduce the number of closures for maintenance, including better co-ordination of maintenance activities.
- Improved traveller information and communications to provide road users with improved information and to ensure road users can call emergency services. This includes improved warning signage and better mobile phone coverage.
- Improved amenities for travellers and communities to help improve the townships including promotion of towns as service centres, traffic calming and alternate freight routes.
- Staged roading upgrades based on triggers for traffic volume and safety risk, targeting a future KiwiRAP Star rating of 4. The median divided 4 Star upgrade works would prevent overtaking; therefore, passing lanes would be required as part of the safety upgrades. Due to the high traffic volumes it may be most effective to construct 2+1, which would also future proof the corridor, but this would need to be determined in the IBC phase.

The list of projects included in the recommended programme is presented in the table below.

- **Core** activities that are expected from the programme: these reflect the essential elements that must be successfully delivered.
- **Desirable** requirements to be met: these are the requirements that would add value and bring about additional benefits but are not essential to successful delivery.
- **Optional** requirements: those things that might be delivered if sufficient budget were available.

**Table 6-1: Programme Overview**

Activity	Status
<b>Physical Works to Road</b>	
Out of context curve realignment Putaruru to Tokoroa	Core
Wide centre line Tirau to Kinleith	Core
Shoulder widening Tirau to Kinleith	Core
Roadside hazard protection Piarere to Kinleith	Core
Rural intersection improvement	Core
Urban intersection rationalisation/improvement	Desirable
Out of context curve realignment Tirau to Putaruru and Kinleith to Wairakei	Core
Increase passing lane length Atiamuri to Wairakei	Desirable
Median divided 4 Star upgrade Piarere to Tokoroa	Core
Wide centre line treatment Kinleith to Wairakei	Core
Roundabouts at SH27 and SH32	Desirable
Alternate freight routes through Tirau and Putaruru	Desirable
Roadside hazard removal/protection Kinleith to Wairakei	Core
Traffic calming in Tirau and Putaruru	Core
Median divided 4 Star upgrade transformation Tokoroa to Wairakei	Core
Rural intersection rationalisation	Core
Full bypass of towns (future)	Optional

Activity	Status
<b>Other Infrastructure</b>	
Improve direction signage and way finding	Core
Enforcement and emergency management facilities	Core
Improve/rationalise warning signage	Core
Improve mobile phone coverage	Desirable
Rest areas & truck stops Piarere to Tokoroa	Core
Improved traveller information systems	Core
Service roads to remove direct access Piarere to Tokoroa	Core
Stock effluent disposal sites	Desirable
Rest areas & truck stops Tokoroa to Wairakei	Core
Service roads to remove direct access Tokoroa to Wairakei	Core
<b>Cycling and Walking</b>	
Pedestrian crossing facilities in towns	Core
Cycle infrastructure in towns	Desirable
<b>Corridor Management</b>	
Production of a Network Operating Framework*	Core
Promotion of local towns as traveller service centres	Core
Land use controls to protect future corridor	Core
Rapid response teams for emergency management	Core
Centralised emergency management and traffic management services	Core
Secure land to future proof corridor	Core
Enhancement of operations technology to reduce closure duration	Desirable
<b>Traffic Management</b>	
Rationalisation of speed limits	Core
Urban parking management and enhancement	Core
<b>Maintenance</b>	
Improved maintenance regime Piarere to Wairakei	Core
Coordination of maintenance activities between providers and cross boundary	Desirable
Rapid response teams for maintenance issues	Desirable
<b>Behaviour</b>	
Safety education programme	Core
Enhanced public transport provision	Optional

\* A Network Operating Framework (NOF) is proposed to help further understand the independencies and conflict between modes, specifically in the townships. It is recommended that this expands upon the current work being done by SWDC measuring amenity in the townships. This will help inform the types of solutions that can be considered to improve the operation of the townships now and in the future.

A NOF an approach for managing competing demands placed upon limited road space reflective of current best practice. The framework aims to make the best use of the transport network by assigning priority to different modes of transport, at particular times of the day, on key routes in relation to land use types. The framework uses a tool that visually demonstrates the overarching affect and any detailed trade-offs being made in order to deliver strategic goals that result from a defined intervention. It informs decision makers and helps establish agreements, partnerships and allows understanding of the network wide effects of interventions as the basis for wider consultation and network or project development. Within the context of this corridor, the transport demands on the rural sections are well defined and simple to manage. The towns are more complex with competing demands and diverse flows. NOFs will be developed for the towns of Tokoroa, Putaruru and Tirau to help investors better understand the effects of change and the benefits of investment.



This programme will incrementally transform the corridor over the next 30 years to achieve a 4 star alignment, whilst being enhanced through ongoing and sustained improvements to maintenance, inter-organisational cooperation, and education to provide a holistic package of measures including:

- Safety problems addressed in the short term, minimum 3 star alignment.
- Freight bypasses in the medium term to reduce severance.
- Improved passing opportunities in the medium to long term to maintain reliability as traffic volumes increase.
- 4 star highway in the long term to provide enduring benefits and future proofing.
- Works to town centres will help improve amenity.
- Overall the programme will provide a consistent, reliable alignment from Piarere to Wairakei consistent with how New Zealand's premier highway (SH1) should look and feel.
- Ongoing progression in changing road user behaviour.

#### Assessment

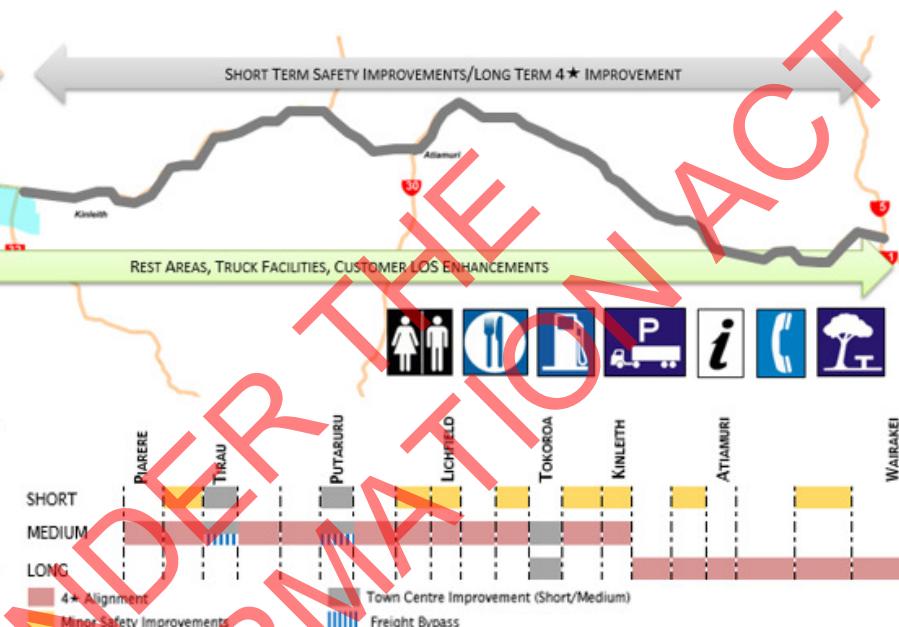
Investment Objectives			
Reduce DSi	Improve quality of infrastructure (Kiwi RAP)	Increase Availability	Improve amenity values in towns
<4 per year	All 4★	<3 per year	Half pedestrian delay

MCA			
Safety	Economy	Social and Environmental	Feasibility
1	1	2	M

Contribution to Objectives or Benefits Achieved (7 point scale)

1	Significant alignment or benefit
2	Good alignment or benefit
3	Minor alignment or benefit
4	Neutral
5	Slight dis-benefit or detriment
6	Major dis-benefit or detriment
7	Significant dis-benefit or detriment
N/A	Not measurable or irrelevant

- Scores very highly in terms of safety and efficiency.
- Social and environmental impacts are minor and in some cases could be enhanced through better access to services and destinations.
- Feasibility is Medium due to the need to acquire property when widening the highway and realigning curves.



#### Benefits of Investment

- Reduce DSi casualties by 36 (every 5 years) and increase KiwiRAP Star Rating to 4 for the first 40km of corridor,
- Reduce the number and duration of closures by at least half. The future form of the highway will result in fewer crashes which reduces the likelihood of closures.
- Improve the amenity values through:
  - Freight bypasses will reduce impacts of traffic on towns in the medium term. Full bypasses of Tirau and Putaruru would improve throughput efficiency when this is required in the long term.
  - Good benefits to local towns through enhancing visitor experience through improved parking, accessibility and quality urban design promoted by SWDC, as well as reducing the impact of severance.
  - Enhancing the journey experience by improving rest areas; truck stops; direction and visitor signage; promotion of township facilities; increased cell phone coverage & more real time information signs.
- Improve the quality of the journey through enhanced maintenance (better ride and less road works) and facilities for travellers of all modes.
- The programme is staged, making it more affordable and scalable depending on actual need. It will require additional land and some changes to property access which will impact on social, cultural and environmental considerations.

#### Dependencies

- SWDC investment
- Traffic growth
- Tourist growth
- Industrial growth
- Rail freight continuity
- Ongoing collaboration with stakeholders

#### Risks

- Consenting
- Property
- Economic uncertainty
- Urban congestion
- Cultural sensitivity
- Environmental sensitivity

Cost range: \$750m to \$1,050m

BCR Range: 0.5 to 1.3

**Figure 6-1: Programme Summary**

## 6.2. PROGRAMME IMPLEMENTATION STRATEGY AND TRIGGER POINTS

### 6.2.1 Implementation strategy

All of the proposed improvements would contribute towards the achievement of the objectives. However, it is not cost effective or necessary to implement all options immediately.

The implementation strategy presented below is based on the following:

- Improvements are staged with high risk corners, intersections and roadsides targeted first, followed by corridor wide improvements such as wide centre lines and passing lane extensions, with the long term vision a median divided 4 Star highway.
- The median divided 4 Star upgrade works are prioritised based on current crash risk and traffic volumes. As this would prevent overtaking, passing lanes would be required as part of the safety upgrades. Due to the high traffic volumes, it may be most effective to construct 2+1, which would also future proof the corridor.
- Safety improvements and changes to maintenance regimes are needed to reduce the number and duration of closures as soon as possible.
- A staged approach is needed to improve amenity within the townships. The short term includes better signage and promotion of the facilities within the townships. In the medium term physical improvements such as better crossing facilities and freight bypasses will be progressed. The long term vision is for a state highway bypass of each town, dependant on traffic volumes and community desires.
- Emergency management, journey improvements and other non-infrastructure measures are less reliant on staging and can be made throughout the investment period. However, it is anticipated that major improvements can be made for a relatively small investment, so this should be started as soon as possible.

### 6.2.2 Triggers for improvement

Triggers for improvement can be based on traffic volumes, safety risk and amenity.

#### Traffic volumes

Traffic volumes along the entire corridor are approaching or over 6,000vpd where the risk of head on crashes starts to exceed the risk of loss of control crashes. Based on this and the current crash risk, some immediate improvements are needed now.

Once traffic volumes exceed 8,000vpd some form of median treatment is recommended and for traffic volumes over 12,000vpd, this should be a median separation (which will also require improved passing opportunities and potentially 2+1). On hilly sections (3-6% grade) this threshold reduces to 10,000vpd.

In the townships, the high traffic volumes mean that severance is already an issue. However, due to the many contributing factors, a Network Operating Plan is proposed to identify triggers for improvements.

On this basis, the northern half of the corridor (between Piarere and Kinleith) is in need of improvement now, however, implementation of the improved alignment would take at least three years to commence and a further three to complete. Therefore, implementation of minor safety works within the corridor is necessary within the short term.

#### Safety Risk

The KiwiRAP star rating for the entire stretch is 2 or 3 Star which, for a National High Volume highway, warrants improvements now.

If crashes increase to result in sections having a medium-high or high collective risk, large scale safety improvement works should be implemented. The section of highway between Putaruru and Kinleith already triggers meets this criteria.

## Township Amenity

Once a monitoring framework has been set up with SWDC as part of the NOF, the changing amenity of the townships can be used to trigger the timing of activities that are needed within or around the townships.

### 6.2.3 Implementation

In terms of a staged corridor intervention, this translates as follows:

#### Short Term (1-5 years)

The evidence above highlights that there is an immediate need to tackle the current safety problem. The short term corridor wide infrastructure works will focus on out-of-context curves, hazard protection and intersection upgrades.

Business cases for the development of the 4 Star corridor improvement will be undertaken to confirm the timing and costs for the implementation stages.

Investigations into the improvements of the townships will commence together with a programme to address immediate needs such as better crossing facilities, access management and parking improvements in Tirau and Putaruru.

Journey and management improvements will be investigated and implemented such as improved rest areas, truck stops, and better traveller information systems.

There is also a need to better co-ordinate maintenance activities which, along with crashes, result in the vast majority of partial closures along this highway.

Other short term measures include safety education, speed limit changes, signage and promotion of townships to improve safety and access.

#### Medium Term (6-10 years)

Due to the forecast growth in local industry and through traffic between Piarere and Kinleith, this section of highway will require a more substantial upgrade to reduce the chance of high severity crashes. Accordingly, a 4 Star median divided highway upgrade with passing opportunities is proposed. Safety upgrades along the remainder of the highway include wide centrelines curve realignments and improved passing opportunities.

Further improvements of the townships will be undertaken, including alternate freight routes through Tirau and Putaruru. In addition, roundabouts are proposed at SH27 and SH32 to manage turning traffic in Tirau and Tokoroa.

There will also be continued implementation of journey and management improvements such as stock effluent disposal facilities, increased mobile phone coverage, and enforcement and emergency management facilities.

#### Long Term (11-15 years)

Depending on traffic growth, the 4 Star median divided highway upgrade will be extended between Kinleith and Wairakei.

#### Beyond 15 years – Future Trends

The timing of further investment will be based on growth in road transport, population demographics and future technologies such as autonomous vehicles.

If the status quo applies in terms of traffic growth, then small towns will need bypassing to maintain both amenity within the townships and an appropriate level of service for through traffic.

**Table 6-2: Programme Implementation**

Timeframe	Road Infrastructure	Maintenance & Management	Other Infrastructure
<b>Short (1-5 years)</b>	<ul style="list-style-type: none"> <li>Safety works Piarere to Wairakei:           <ul style="list-style-type: none"> <li>Out of context curve treatment</li> <li>Wide centre line</li> <li>Widen Shoulder</li> <li>roadside hazard protection</li> <li>Rural intersection improvement</li> </ul> </li> <li>Urban intersection rationalisation/improvement</li> <li>Pedestrian crossing facilities</li> </ul>	<ul style="list-style-type: none"> <li>Network Operating Framework</li> <li>Improved maintenance regime Piarere to Wairakei</li> <li>Coordination of maintenance activities between providers and cross boundary</li> <li>Urban parking management and enhancement</li> <li>Safety education programme</li> <li>Rationalisation of speed limits</li> <li>Promotion of local towns as traveller service centres</li> </ul>	<ul style="list-style-type: none"> <li>Improve direction signage and way finding</li> <li>Enforcement and emergency management facilities</li> <li>Improve warning signage</li> </ul>
<b>Medium (6-10 years)</b>	<ul style="list-style-type: none"> <li>Increase passing lane length Atiamuri to Wairakei</li> <li>Median divided transformation Piarere to Kinleith</li> <li>Roundabouts at SH27 and SH32</li> <li>Alternate freight routes through Tirau and Putaruru</li> <li>Traffic calming in Tirau and Putaruru</li> </ul>	<ul style="list-style-type: none"> <li>As short term plus:</li> <li>Land use controls to protect future corridor</li> <li>Centralised emergency management and traffic management services</li> <li>Rapid response teams for maintenance issues</li> </ul>	<ul style="list-style-type: none"> <li>Secure land to future proof corridor</li> <li>Rest areas &amp; truck stops Piarere to Tokoroa</li> <li>Improved traveller information systems</li> <li>Service roads to remove direct access Piarere to Tokoroa</li> <li>Enforcement and emergency management facilities</li> <li>Cycle infrastructure in towns</li> <li>Stock effluent disposal sites</li> </ul>
<b>Long (11-15 years)</b>	<ul style="list-style-type: none"> <li>Median divided transformation Kinleith to Wairakei</li> <li>Rural intersection rationalisation</li> </ul>	<ul style="list-style-type: none"> <li>As short term plus</li> <li>Enhancement of operations technology to reduce closure duration</li> </ul>	<ul style="list-style-type: none"> <li>Improve mobile phone coverage</li> <li>Rest areas &amp; truck stops Tokoroa to Wairakei</li> <li>Create alternative HPMV Route on SH 5</li> <li>Service roads to remove direct access Tokoroa to Wairakei</li> <li>Rest areas &amp; truck stops Tokoroa to Wairakei</li> </ul>
<b>Future (beyond 16 years)</b>	<ul style="list-style-type: none"> <li>Full bypasses of Tirau, Tokoroa and Putaruru</li> </ul>		

### 6.3. PROGRAMME OUTCOMES

The recommended programme alleviates the problems by:

- Making the road environment more consistent and forgiving and undertaking further education to reduce the number of crashes.
- Doing the above in conjunction with an improved maintenance regime will reduce the number and duration of closures.
- Preparing a NOF and investing in the townships will significantly improve amenity.

The achievement of these problems are measured by the investment objectives and the assessment of these are outlined in the table below.

**Table 6-3: Programme Outcomes**

Investment objective	KPI	Baseline	Improvement
Improve safety of SH1 between Piarere and Taupō by reducing the number of deaths and serious injuries from 56 to 20 by 2040	Number of deaths and serious injuries	56 DSi casualties (2010-2014)	Targeted improvements will reduce casualties by an estimated 20% within 5 years. 4 Star upgrades will reduce casualties by at least 60% over the next 15 years.
Improve the quality of infrastructure of SH1 between Piarere and Taupō by increasing the length of corridor with KiwiRap Star Rating of 4 from 0km to 40km by 2030, but with no sections below 3 Star	KiwiRAP Star rating (Road Assessment Programme for state highways)	45% of corridor below 3 Star (2016)	Safe system works are expected to provide a minimum of 3 star. Corridor transformation will provide at least 4.0 Star.
Increase availability of SH1 between Piarere and Taupō by reducing the number of journeys impacted by closures and delays by 2040	Number and length of closures and unplanned events recorded in TREIS	22 closures between 2011 and 2015 Average duration 6 hours	Closures reduced by half and average time to reopen reduced to 3 hours in line with the rest of the region. The majority of full closures are related to crashes, therefore closures will reduce as crashes reduce. Lower severity crashes will also reduce the time necessary to reopen the road. Improved maintenance regime can also contribute to fewer closures.
		154 unplanned events per year with average duration of 3 hours	A higher quality of infrastructure will reduce minor blockages and wandering stock. Improved maintenance will reduce the number of ad hoc or emergency repairs.

Investment objective	KPI	Baseline	Improvement
Improve amenity values within town on SH1 between Piarere and Taupō by improving access to services and reducing the effect of severance by 2040 #	Road user amenity value	To be agreed and measured with SWDC	Initially a Network Operating Framework will be produced to steer this objective. The improvement of crossing facilities will improve the ability for people to cross the road.  Alternate freight routes could remove around 10 to 15% of through traffic and extend the life of the corridor in the urban area by around 10 years if state highway growth continues.
	Community amenity value	To be agreed and measured with SWDC	To be further discussed with SWDC  Although, in terms of severance, pedestrian crossing delay would be reduced significantly through a combination of providing better facilities and reducing freight throughput on the main streets

Additional benefits of investment, not specifically targeted in the investment objectives, are:

- A 5 minute reduction in average travel time along the corridor between Piarere and Wairakei.
- Travel time variability (difference between 85<sup>th</sup> percentile and mean travel times) along the whole corridor reduced from 12 minutes to 6 minutes.
- A corridor look and feel which is consistent with the vision for a National High Volume highway.

#### 6.4. PROGRAMME RISKS AND INTERDEPENDENCIES

The primary transport network between Piarere and Taupō is SH 1, its continued effectiveness is dependent on a number of factors, some of which come from the uncertainty log presented earlier. A range of other risks have also been identified. These include:

##### Technical

- Generally the proposed future alignment follows the existing State highway corridor, however, there are a number of locations where short diversions will be necessary to realign particularly sharp corners and alter intersection form. This will necessitate construction within areas of, as yet, unknown geotechnical complexity.

##### Operational

- A number of activities and interventions proposed within the programme are dependent on the continued cooperation and financial commitment of third party organisations, some may challenge or alter existing contractual arrangements such as increasing the level of maintenance intervention or response times for emergencies.
- There will be a need to rationalise intersections and accesses as the programme progresses, this will increase journey length for some local trips and will need specific investigation and consultation during future phases.

##### Financial

- The current assessment of costs is at a high level at the current feasibility stage and there is a risk that these costs increase.
- The full programme is dependent on the financial commitment from a number of partners, notably SWDC who are investing heavily within the local communities. There is a risk that some of these partners may not be able to fund the works in the timeframes specified.

## Stakeholder/Public

- No public consultation has taken place to date, this will need to be undertaken at the next level of investigations for each element.
- Limited iwi engagement has occurred at this stage, although early indications are that there is support for the programme at least in terms of its intent and timing.

## Environmental and social responsibility

- Environmental effects during construction have only been examined at a high level. There are a number of rivers, watercourses and reserve areas that may be impacted on which are near to the current corridor.
- There are a number of historic and cultural sites along the length of the corridor and in the absence of design it is not possible to determine the level of impact at this stage. Further assessment and evaluation will be necessary to ensure that effects are properly avoided or mitigated.

## Safety

- The proposed programme is staged which means that the short to medium term investments do not provide the same reduction in deaths and serious injuries as the long term solution.

## Economy

- The economic effectiveness of the programme is not accurate as BCR calculations have only been undertaken at a high level. Costs are indicative and no discounting has been applied.
- Actual BCR for the programme may be lower when costs and benefits have been further developed.

## Interdependencies

- Although not a risk – this programme needs to continue to co-ordinate with adjacent business cases; i.e. the SH29 Piarere to Tauriko Business Case includes a Service Centre at SH1/SH29. Also a DBC is being developed for safety improvements on the East Taupō Arterial.

Refer to Appendix B for the full risk register. All risks will be monitored via the monitoring regime presented in Part C below.

### 6.2.4 Value for money

The recommended programme achieves a BCR in the range of 0.5 to 1.3. This is based on a sum of the activities within the programme. The relatively low BCR is one of the reasons for staging investment so that costs are incurred when benefits are higher.

The economic analysis carried out is indicative only and has been used as a basis for comparison of separate projects using consistent base data. No formal evaluation, discounting or contingent assessment has been applied due to the uncertainty in terms of individual project form. Evaluation has been determined from a simple rationale of high level total benefit divided by the rough order cost of implementation.

### 6.2.5 Sensitivity analysis

No formal sensitivity analysis has taken place other than a high level evaluation of the upper and lower bound of cost and benefit. These are reported in the Programme Summary Table 5-2.

### 6.2.6 Assessment profile

An assessment profile of HHL has been determined for the programme using the NZ Transport Agency's Investment Assessment Framework as detailed below:

Strategic Fit	High
---------------	------

The strategic fit of the problem is high as it involves:

- Journeys for employment, tourism and freight;
- A demonstrated gap in the customer level of service for travel time reliability due to closures and delays;

- A demonstrated gap in the customer level of service for resilience due to the number of closures and the length and unsuitability of alternate routes for HPMVs; and
- A high crash risk as around 70% of the corridor is classified as High or Medium-High Collective Risk when assessed against the criteria in the HRRRG.

Effectiveness	High
---------------	------

The effectiveness of the programme is considered high due to the following criteria:

- **Outcomes Focused** – Programme 5A responds to all problems. The programme would result in a tangible change in addressing the safety and reliability problems identified. It benefits road safety through reduction in crash severity as well as crash prevention. It contributes highly to productivity and economic growth through supporting freight logistics by improving corridor reliability thereby improving freight efficiency.
- **Integrated** – Programme 5A includes a range of interventions covering, land use, education, travel demand, information and infrastructure. The programme is considered fit for purpose as it meets current demands and problems whilst providing a high degree of future proofing. It is consistent with the underlying need to protect the primary north-south spine road and road freight corridor. It will also meet projected demands for growth and accessibility within the region in the long term, and has been developed with consideration of all modes, particularly rail. The programme is supported by all investment partners.
- **Correctly Scoped** – the programme is consistent with the problems, benefits and outcomes defined through collaborative working in the Strategic case and throughout this PBC. Being a staged approach, it follows the hierarchy of intervention over a 30 year investment horizon integrating all types of solution from education through to major infrastructure which is scaled to meet the triggers for investment. The programme is designed to provide a transitional environment linking the 4 lane Waikato expressway north of Piarere with the high quality two lane highway at Taupō.
- **Affordable** – the programme is considered affordable. Each element will be further examined for affordability during subsequent investigation stages. Furthermore, being a staged approach it can be planned and implemented to coincide with the need as well as scaled back if that need does not arise.
- **Timely** – there is a compelling need to improve safety in the short term, with instant realisation of safety benefits. Other interventions are timed over a 30 year period to ensure that the appropriate investment is made when it is needed. This will provide enduring benefits and future proofing.
- **Confidence** – Current assessments indicate that the recommended programme will meet the needs of the corridor, community and economy for the foreseeable future. Further work in assessment of risk and sensitivity testing will be part of the ongoing business case process.

Benefit and Cost Appraisal	Low
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An indicative assessment of comparing high level whole life costs and benefits has been carried out to determine a BCR range. During subsequent business case stages, this will be refined and tested as a clearer picture of the proposed investment is developed.

The BCR range is between 0.5 and 1.3.

## 6.5. PROGRAMME FINANCIAL CASE

This section highlights the affordability of the programme, and what elements are to be funded by the partnering organisations.

### 6.5.1 Indicative cost

Corridor improvement costs 100% funded by NZTA      \$750m to \$1,050 million

Town Centre improvements funded in part by SWDC      \$36m to \$62 million

These costs<sup>6</sup> are indicative only and will be refined during later stages of the business case as actual treatments and alignments are developed. SWDC contribution is conservative “upper end” of estimation range and assumes a high level of infrastructure requirement for freight bypasses.

In addition, there will be costs associated with education and enforcement and emergency management which will fall to the Waikato Regional Council and NZ Police. These have not yet been fully quantified.

Costs<sup>7</sup> by RLTP period are summarised below:

Period	Cost (\$M)
2015-18	\$55.1M
2018-21	\$203.0M
2021-24	\$318.2M
2024-27	\$383.8M
2027-30	\$100.0M
2030 +	\$10.3M

### 6.5.2 Funding arrangements

The programme will primarily be funded through the NLTF by its inclusion in future NLTPs.

The following sections have safety funding allocated in the 2015/18 RLTP:

- Putaruru to Tokoroa
- Upper Atiamuri to Wairakei

However, the scope will be amended based on the findings of this PBC.

SWDC works and activities will be part funded through Council rates contribution with some activities part funded through the NLTF FAR.

Enforcement and emergency management activities undertaken by the Police are funded by the NLTF.

### 6.5.3 Affordability

Overall, it is considered that the programme is affordable, as it stages investment over a long period of time.

Two safety improvement programmes are currently included in the NLTP (SH1 Putaruru to Tokoroa and SH1 Upper Atiamuri to Wairakei); however, the scope of these will change as a result of the PBC and other short term measures may need to be added into the NLTP to attract funding over the next few years.

<sup>6</sup> **Headline Costs** are based on current values of similar works or initiatives based on SinA data and database of project out turn costings. Values include implementation, physical works and land but not investigation, consultant hours, fees, or staff time.

<sup>7</sup> **Tabulated Costs** include estimates of investigation, design and staff time.

## PART C – DELIVERING AND MONITORING THE PROGRAMME

### 7. MANAGEMENT CASE

The following section provides a roadmap for the development and implementation of the different aspects of the recommended programme.

#### 7.1. INVESTMENT TO BE PROGRESSED NOW

If the PBC is ultimately approved, the recommended next key steps will be the development of a number of Indicative Business Cases as shown below. These include all of the activities identified in the recommended programme:

1. **Network Operating Framework.** For Tirau, Putaruru and Tokoroa to inform IBC/DBC #3. Further information on this is outlined below in Table 7-1.
2. **Pre-implementation for minor safety projects.** Short term signs, markings, guardrail etc that can be delivered immediately along the entire corridor.
3. **IBC #1 Piarere to Kinleith corridor transformation.** Identification of the ultimate solution to be delivered in the medium term, the works that can be undertaken in the short term to get early safety benefits in line with the ultimate solution will be developed in parallel with the minor safety pre-implementation.
4. **IBC #2 Kinleith to Wairakei corridor transformation.** Identification of the ultimate solution to be delivered in the long term, and the works that can be undertaken in the short and medium term to get earlier safety benefits in line with the ultimate solution will be developed in parallel with the minor safety pre-implementation.
5. **IBC/DBC #3 Local Community Transformation.** Activities that will assist in improving amenity within the townships.
6. **IBC/DBC #4 Journey and Corridor Management.** Activities that will improve the journey experience and corridor activities to improve emergency management.
7. **IBC/DBC #5 Improved Maintenance.** Activities to reduce the amount of planned and unplanned maintenance along the route.

The timeframes for implementation are:

Short	0 to 5 years
Medium	6 to 10 years
Long	11 to 15 years
Future	Beyond 15 years
Continuous	Activity that endures throughout programme lifecycle (i.e. maintenance)

**Table 7-1: Indicative Delivery Programme**

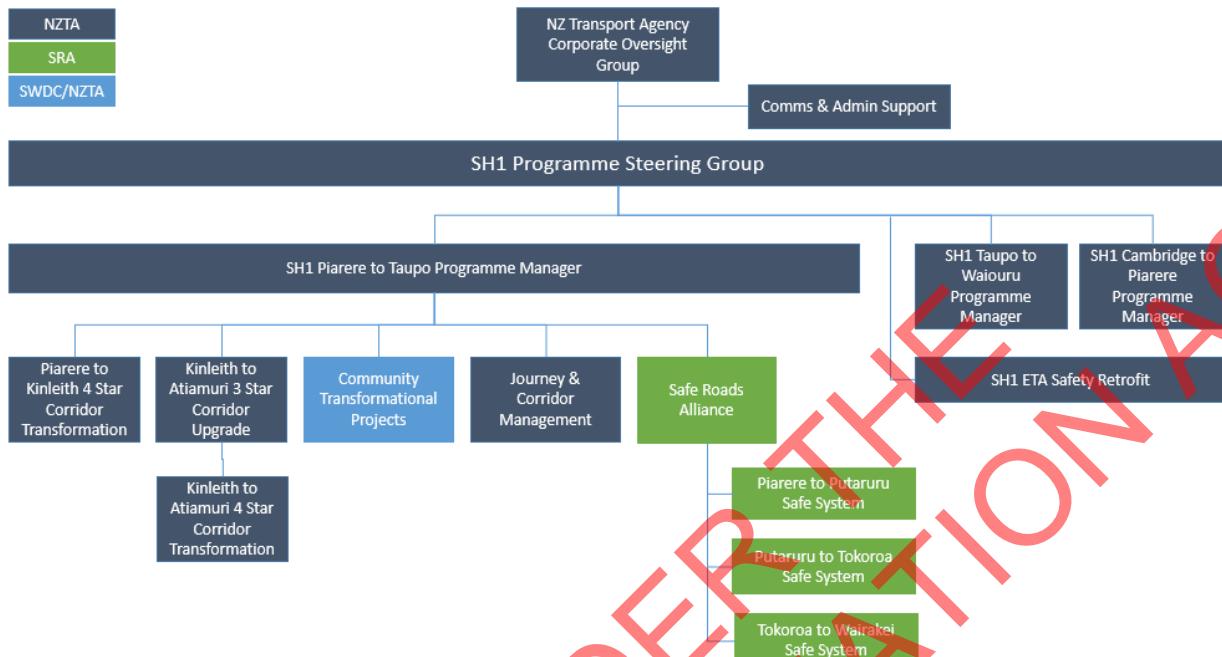
Activity	Status	Implementation Timing	Next Step Timing	Owner
<b>Network Operating Framework</b>				
Network Operating Framework	Core	Short	1-3 years	NZTA/SWDC/WRC
<b>Pre-implementation of minor safety projects</b>				
Piarere to Putaruru e.g. signs, markings, hazard protection, rural intersection warning, targeted safety improvements.	Core	Short	0-1 years	NZTA
Putaruru to Tokoroa e.g. signs, markings, hazard protection, rural intersection warning, targeted safety improvements	Core	Short		

Activity	Status	Implementation Timing	Next Step Timing	Owner
<b>Tokoroa to Wairakei</b> e.g. signs, markings, hazard protection, rural intersection warning, targeted safety improvements.	Core	Short		
<b>IBC #1 Piarere to Kinleith corridor transformation</b>				
<b>Determination of ultimate highway form</b> e.g. 2+1 transformation, median division, service roads, passing lanes, intersection rationalisation, full bypass of towns (future), out-of context curve realignments	Core	Medium	1-3 years	NZTA
<b>IBC #2 Kinleith to Wairakei corridor transformation</b>				
<b>Determination of ultimate highway form</b> e.g. 2+1 transformation, median division, service roads, passing lanes, intersection rationalisation, full bypass of towns (future), out-of context curve realignments	Core	Long	3-5 years	NZTA
<b>IBC/DBC #3 Local Community Transformational Programmes</b>				
<b>Core activities:</b> e.g. pedestrian crossing facilities, parking management and enhancement, traffic calming	Core	Short		NZTA/SWDC
<b>Desirable activities:</b> e.g. cycle infrastructure, intersection rationalisation and improvement, alternative freight routes, town promotion.	Desirable	Medium	1-3 years	NZTA/SWDC
<b>IBC/DBC #4 Journey &amp; Corridor Management</b>				
<b>Core activities:</b> e.g. future corridor protection, rationalise speed limits, safety education.	Core	Medium		NZTA/SWDC/ TDC
<b>Desirable activities:</b> e.g. emergency management, enhanced operations technology, improved mobile phone coverage, improved traveller information systems	Desirable	Medium	3-5 years	NZTA/SWDC/ TDC
<b>IBC/DBC #5 Improved Maintenance</b>				
Improved maintenance regime	Core	Continuous	1-3 years	NZTA
Coordination of maintenance activities between providers and cross boundary	Desirable	Continuous		NZTA/ SWDC/ TDC/ Utility providers
Rapid response teams for maintenance issues	Desirable	Medium		NZTA
<b>IBC/DBC #6 SH5 HPMV</b>				
Create alternative HPMV Route on SH 5	Desirable	Long	5-8 years	NZTA

## 7.2. PROGRAMME GOVERNANCE AND REPORTING

Overarching programme governance lies with NZ Transport Agency as principal funding organisation and asset owner, although some investment will also lie with South Waikato District Council as an Investment Partner, particularly for works within the town centres. Taupō District Council may become an investment partner if the IBCs result in off highway initiatives within the district, similarly Waikato Regional Council will be central to education programmes and NZ Police with enforcement.

The governance structure will be developed during the set-up of the next stage of the business case. The diagram below shows an indicative arrangement of the organisation and interrelationship between different business cases and project teams.



**Figure 7-1: Proposed Governance Structure**

Roles and responsibilities are summarised below, it is acknowledged that this may change as the business case progresses and more stakeholders are engaged as the level of detail of the programme is better developed.

**Table 7-2: Roles and Responsibilities**

Who	Role	Responsibility
NZ Transport Agency	Programme Lead	Manage business case process and programme, work with partner organisations and stakeholders to ensure diverse needs are catered for at the appropriate time in the appropriate manner through providing a future proofed corridor that meets CLOS.
South Waikato District Council	Investment Partner	Assessment and development of KPIs for amenity improvements. Co-funding of works and initiatives within towns and communities.
NOC Contractor	Maintenance Management	Develop programme of improved maintenance and emergency management in collaboration with the NZ Transport Agency and other stakeholders to meet future demands and CLOS.
NZ Police	Emergency management and road policing	Assist in the development and management of emergency management protocols. Support education and road improvement programme through targeted and sustained enforcement as appropriate.

Who	Role	Responsibility
Safe Roads Alliance	Delivery of short term safe system interventions	Identify, assess and develop designs for short term safety interventions at highest risk locations.
Waikato Regional Council	Investment partner	Management of road safety education programme through the Regional Road Safety Education Group.

### 7.3. STAKEHOLDER ENGAGEMENT AND COMMUNICATIONS PLAN

A stakeholder engagement and consultation plan will be developed at the commencement of the IBC stages to map out who will be contacted, by what means and for what purpose. The key objectives of this are:

- To ensure that the focus of investment remains appropriate
- To define and reinforce partner roles and responsibilities within the delivery of the programme
- To keep stakeholders informed of development of the programme and seek agreement of the staging and scope of the investment
- To actively engage with iwi and the local community to understand concerns and issues and explain how these are resolved through the proposed programme
- To inform the public of the benefits of the programme, its timing and the impacts of construction.

The IBC will include two stakeholder workshops: the **Options Workshop** where stakeholders are asked to brainstorm a long list of measures which will achieve the preferred outcome, and the **Preferred Options Workshop** where stakeholders will be asked to collaborate in the filtering of the long list into a shortlist for more detailed assessment. Ideally, the same stakeholders will be present who took part in the development of the PBC.

**Table 7-3: Key Stakeholder Contacts from PBC**

Name	Organisation	Status
Anuradha Fitzwalter		
Jo Carling		
Liam Ryan		
Rob Campbell		
Bevan Percival		
David Greig		
Michelle te Wharau	NZ Transport Agency	Investment Partner
Keryn Zimmerman		
Gordon Naidoo	South Waikato District Council	Investment Partner
Bill McMaster	Waikato Regional Council	Investment Partner
Andrew Tester		
Clare Sharland	Taupō District Council	Stakeholder and possible IP
Brent Crowe	NZ Police	Stakeholder and possible IP
Tom Cloke	Road Traffic Association	Stakeholder
Gary Masters	Automobile Association	Stakeholder
John Galbraith	Freight Logistics Action Group	Stakeholder

The following stakeholders and interested parties will be consulted throughout the development of the IBC; this list is not comprehensive and will be refined as the business case progresses.

**Table 7-4: Future Stakeholder Contacts**

Name	Organisation	Status
Jessica Samuels	Ngāti Hauā	Iwi Community Stakeholder and Landowner
Lisa Gardiner		
Poto Davies	Ngāti Koroki Kahukura	Iwi Community Stakeholder and Landowner
Diana Vaimoso	Ngāti Hinerangi	Iwi Community Stakeholder and Landowner
Grant Kettle	Raukawa	Iwi Community Stakeholder and Landowner
Celia ?		
Evelyn ?	Ngāti Tahu-Ngati Whaoa	Iwi Community Stakeholder and Landowner
Alice Barnett	Tūwharetoa	Iwi Community Stakeholder and Landowner
Hollei Gabrielsen	Ngāti Rangi	Iwi Community Stakeholder and Landowner
David Milner		
Alan Piper	KiwiRail	Stakeholder and landowner
tbc	DOC	Environmental Stakeholder and Landowner
tbc	St Johns Ambulance	Stakeholder – emergency response
tbc	NZ Fire	Stakeholder – emergency response
tbc	ACC	Stakeholder – emergency response & health
tbc	Fonterra	Major employer and landowner
tbc	OJI Fibre Solutions	Major employer and landowner
tbc	Carter Holt Harvey	Major employer and landowner
tbc	Spark	Telecommunications provider
tbc	Vodafone	Telecommunications provider
tbc	Mercury Energy (MRP – Atiamuri Hydro Dam)	Local power generator/employer & landowner

#### 7.4. PROGRAMME MONITORING, PERFORMANCE AND REVIEW

Monitoring of the network forms a critical element of determining the timing of implementation of activities, and once implemented, the effectiveness of the improvements against the investment objectives.

A key aspect of implementation timing is the rate of traffic growth. The trigger point approach allows the long term activities to be monitored and activated via the Regional Land Transport Plan (RLTP) once the relevant trigger points are met. If activity trigger points are not met, data related to these activities will continue to be monitored with potential activity promotion for the next RLTP. The monitoring of the network needs to include:

- Traffic volumes
- Crash Risk
- Amenity (via the NOF)
- Items in the uncertainty log and risk register; specifically:
  - Population or industrial increase in South Waikato
  - Expansion of operations at Kinleith timber processing works
  - Transfer of rail freight to road

A monitoring programme will need to be established to track the progress of the programme towards achieving the investment objectives. Monitoring of the programme will be managed by the NZ Transport Agency, but could involve reporting through to the Regional Advisory Group and Regional Land Transport Committee. The overall programme outcomes that need to be measured are outlined in the table below.

The monitoring programme should also consider how the SMART investment objectives will be reviewed after delivery of each activity in the programme. There may be no need to pursue parts of the programme if after review, a few of the activities have delivered the majority of the outcomes and benefits. This could also then result in a change in the trigger points for when further activities in the programme may be required.

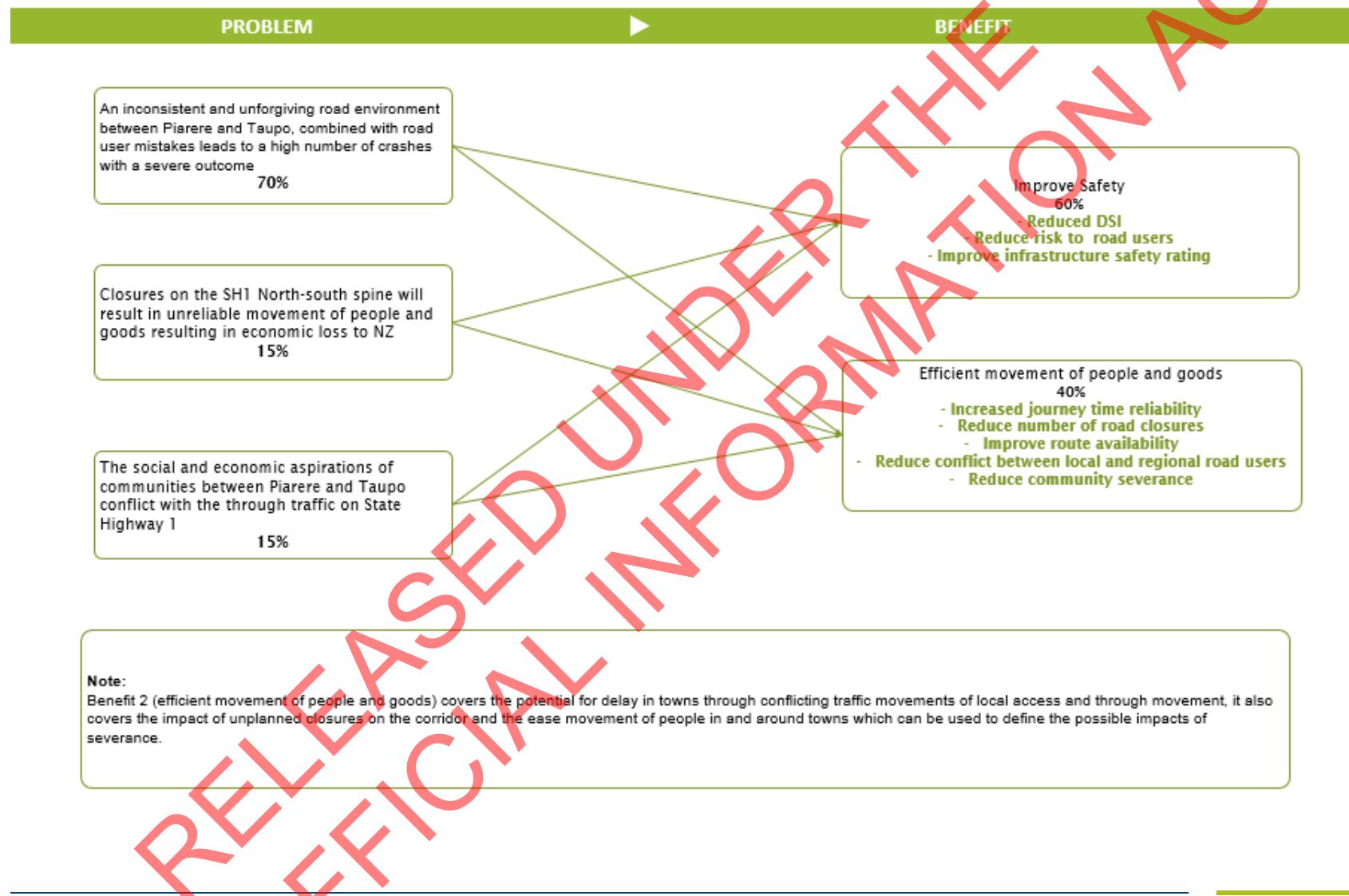
**Table 7-5: Performance measures and values**

Investment Objective	Indicator	Values
Improve Safety	Deaths and Serious Injuries	Currently 56 DSIs occur within a 5 year period and the target is 20 by 2040
	KiwiRAP	Currently 45% of the corridor is below 3 Star and the target is 40% being 4 Star with no sections below 3 Star.
Increase Availability	Number and duration of closures	Currently 22 with an average duration of 6 hours. Target is 10 or fewer with an average duration of 3 hours or less.
	Travel time	Current travel time is 73 minutes with a 95%ile journey time of 92 minutes. Target is to maintain these.
Improve Amenity	Various	To be determined by NOP. Current measures include average crossing delay <sup>8</sup> and number of visitor car parks <sup>9</sup> .

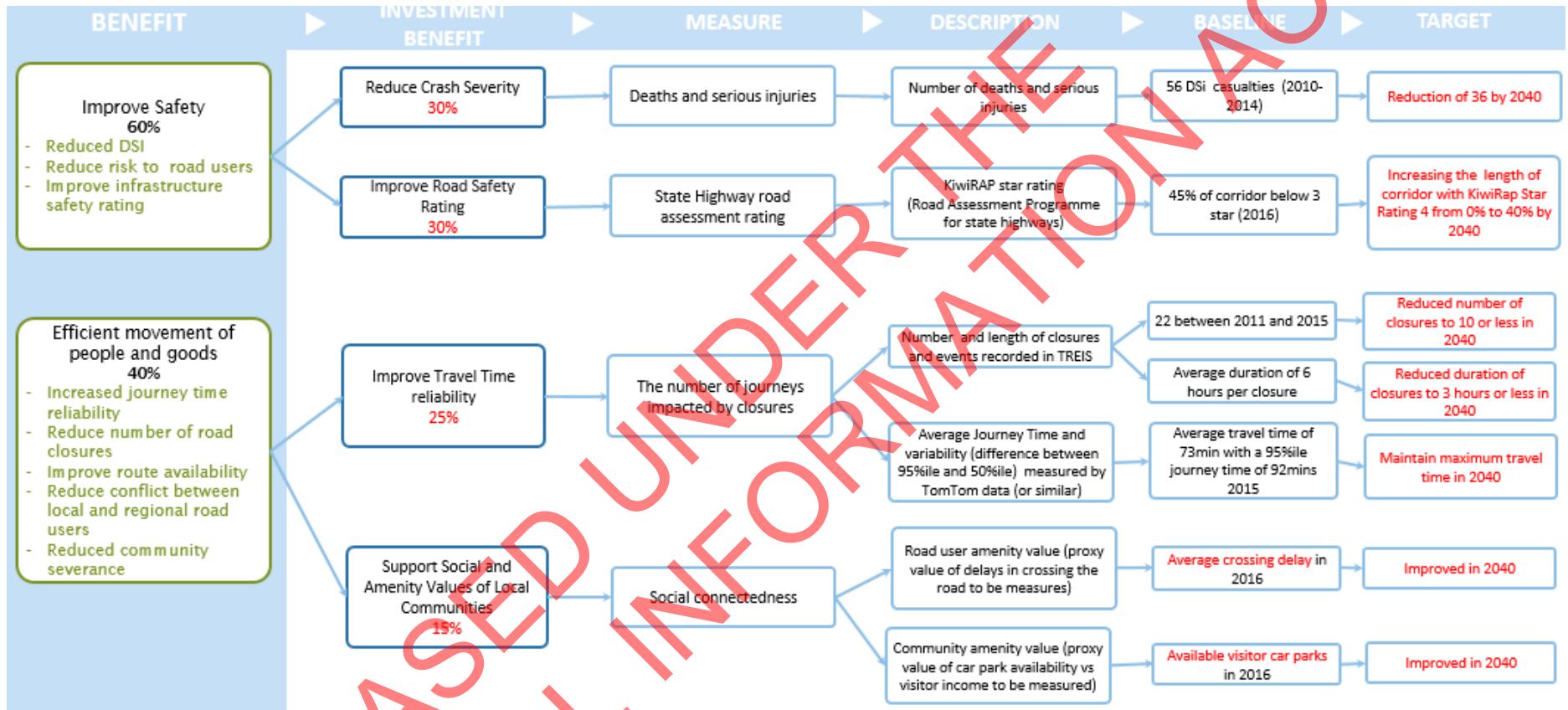
<sup>8</sup> Severity can be assessed through the measurement of average time delay for pedestrians crossing the road to reach essential services, this will be a reasonable facsimile of the negative effect of through traffic on the community

<sup>9</sup> SWDC have analysed tourist spend data in Tokoroa and compared it against available visitor car parking, it has a correlation between the two which can be used as a proxy for the economic value of through traffic to towns. Annual analysis of both car parking and retail spend should be collated to track the changes. Current research in Tokoroa suggests that a capture of 2.5% of the daily traffic flow would generate revenue of \$1.5M with a daily traffic volume in the region of 10,000 vehicles this equates to 250 visiting vehicles stopping each day. Assuming a typical dwell time of approximately 2 hours, there should be at least 30 car parks easily available at all times and any increase in this provision can be directly related to annual visitor income and therefore economic wellbeing of the community.

## APPENDIX A – INVESTMENT LOGIC MAP

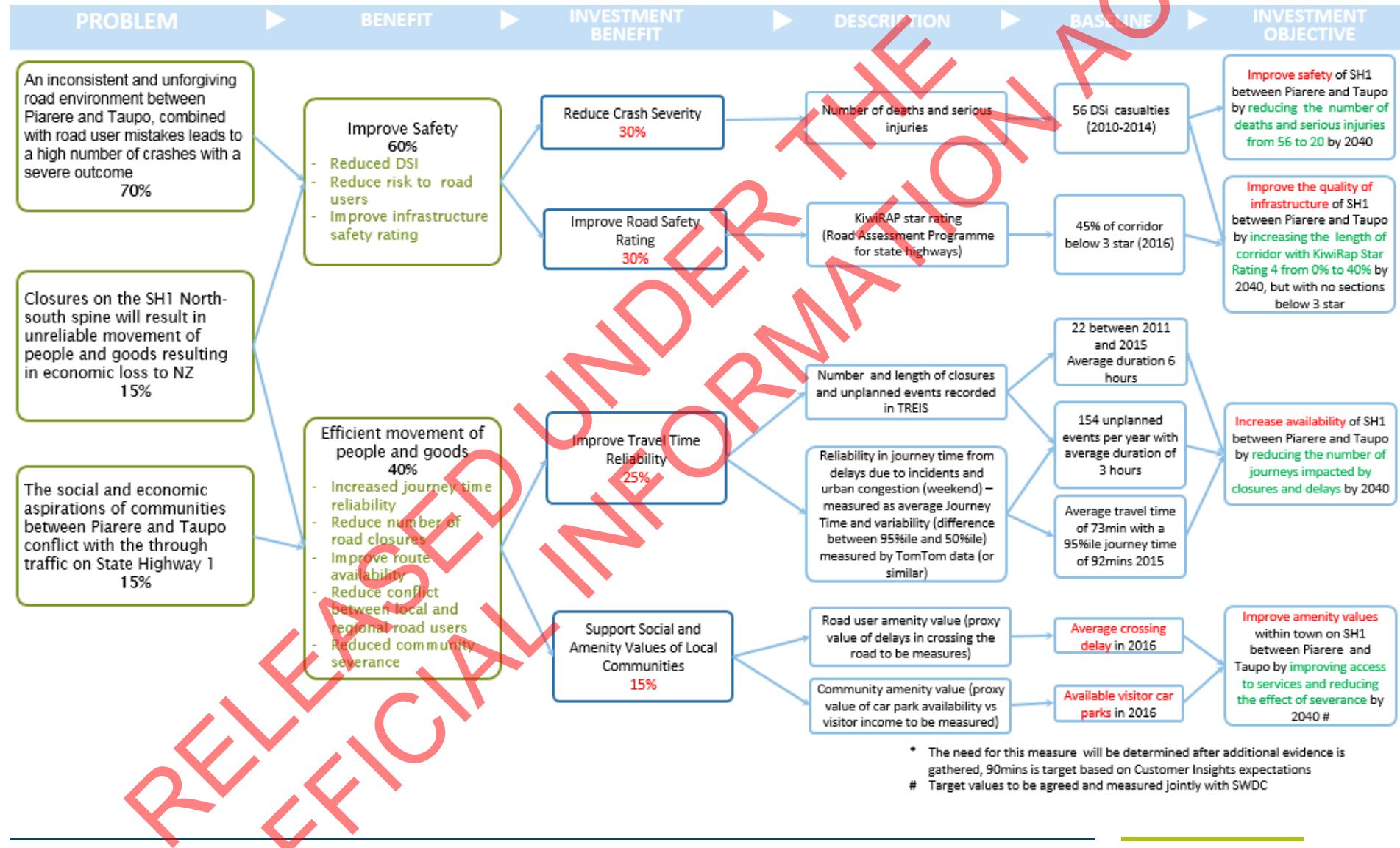


## APPENDIX B – BENEFIT MAP



Note: The targets and measures for amenity values are under development with SWDC, the baselines shown above are proxy values which represent different elements of accessibility for community and visiting road users.

## APPENDIX C – DEVELOPING THE INVESTMENT OBJECTIVES



## APPENDIX D – CONSULTATION SUMMARY

Developing and implementing the right programme of improvements along this corridor would not be possible without the full involvement of the investment partners and stakeholders. Investment partners involved in the PBC process are outlined in Table D-1 below.

**Table D-1: Investment Partners**

Investment Partner	Interest
NZ Transport Agency	<p>As the leader of this business case the NZ Transport Agency is concerned with the safety, efficiency and ongoing operation of the State Highway 1 corridor.</p> <p>The Agency has the wider remit of providing an effective and responsive transport system through:</p> <ul style="list-style-type: none"> <li>• Efficient movement of people and goods</li> <li>• More efficient and reliable movement of freight</li> <li>• Optimal range of transport choices</li> <li>• Safe speeds</li> <li>• Safe &amp; efficient vehicles</li> <li>• Safe journeys</li> <li>• Social and environmental responsibility</li> </ul>
South Waikato District Council	<p>The SWDC is the local road controlling authority responsible for managing the local road network, and is responsible for the communities of Tirau, Putaruru and Tokoroa and their aspirations.</p> <p>Investment by the South Waikato District Council could be needed to improve the townships and the local road network.</p> <p>There are three wards, with local councillors Tokoroa (6), Putaruru (3) and one in Tirau. Tirau also has a Community Board.</p>

There are a number of key stakeholders who have interests in the SH1 corridor and the outcomes of the PBC. These are outlined in Table D-2 below.

**Table D-2: Partners and Key Stakeholders**

Stakeholders	Focus areas
Waikato Regional Council	<p>In the context of this corridor, Waikato Regional Council is responsible for public transport, walking and cycling, road safety promotion and transport planning in the region. WRC identified the need for improvement of SH1 from Tirau to Taupō in its Regional Land Transport Plan.</p> <p>WRC are also the overarching consenting authority for the region's water, soil, air, geothermal areas and coastlines.</p>
Taupō District Council	<p>Taupō District Council is the local road controlling authority responsible for fully managing the local road network that forms, with the state highway, the land transport network connecting from Atiamuri to Wairakei and is responsible for the community at Wairakei Village.</p>
NZ Police	<p>The NZ Police have a strong interest in safe use of roads and vehicles through enforcing speed limits, checking vehicle compliance, managing traffic /congestion associated with accidents and other unplanned stoppages.</p> <p>They are a potential co-investor with regards to enforcement or incident management.</p>
Automobile Association	<p>Motor transport advocacy.</p> <p>The AA is a national organisation that offers motoring advice, insurance, finance, maps and travel guides. It is a leading advocate for New Zealand motorists and their interests. The AA has a long standing relationship with the NZ Transport Agency to deliver a range of vehicle and driver licensing services.</p>

Stakeholders	Focus areas
Road Transport Association NZ	<p>Freight movement advocacy.</p> <p>RTANZ is a national association which represents the interests of Road Transport Operators providing resources, commercial benefits, assistance, support, advocacy and education for its members.</p>
Freight Logistics Action Group	<p>Freight movement advocacy.</p> <p>FLAG aims to create world-class freight logistics primarily within the wider Bay of Plenty region and lift New Zealand's rankings in logistics performance by providing strong commercial leadership and advocacy.</p> <p>Their strategy takes an inter-regional and multi-sector, multi-modal overview, encompassing road, rail, sea and air.</p>
Kiwi Rail	<p>Kiwi Rail is the Government-owned Enterprise which owns and operates New Zealand's rail transportation network and the between-Island ferry service.</p> <p>Kiwi Rail move 18 million tonnes of freight and provide 13 million passenger trips per year; operate, maintain and improve 4,000 km of track; and transport 30% of New Zealand's exports.</p> <p>Their principle interest in this corridor is the Kinleith Branch Line (line operation and designation) and Rotorua Branch Line (designation only as rail line removed).</p>
Iwi	<p>The role of iwi is the sustained physical, cultural and spiritual well-being of the people. In particular the protection of land, water and resources as they relate to the origin, history and tribal affiliations and are a statement of identity.</p> <p>This covers a wide remit and differs between groups and therefore cannot be generalised. However, advocacy for local issues, protecting culture &amp; tradition, and investment in the future of the environment and people is an underlying theme.</p>

## CONSULTATION

The key stakeholders and investment partners have been consulted and informed at all stages of the development of the PBC. Wider interest groups and management teams from the NZ Transport Agency have been informed of progress and asked for opinions and input to various stages. For example, early in the process 'drop-in' sessions were held in regional NZ Transport Agency offices to allow a range of their input. Regular briefings were arranged with key decision-makers as the Programme Business Case progressed. The team has worked hard to establish an environment of no surprises throughout the process for all Stakeholders.

Iwi consultation is at an early stage with a collective information session held in Tokoroa with representatives of Ngāti Hauā, Ngāti Koroki Kahukura, Ngāti Hinerangi, Raukawa, Ngāti Tahu-Ngati Whaoa, Tūwharetoa, and Ngāti Rangi where the problems, objectives and programmes were introduced and comment invited. Follow up discussion and engagement will be on a one on one basis with individual groups to capture details of local issues, needs and opinions.

No public consultation has been carried out to date, although public opinion has been gauged from representations of Council and user advocacy groups such as the AA, RTA and FLAG. Consultation will be addressed in later stages of the business case once a preferred way forward is confirmed.

## CUSTOMER INSIGHTS

A significant amount of research through one-to-one engagement with customers in the Waikato Region has been carried out by the NZ Transport Agency. Whilst this has not been officially published, the key insights into the needs and expectations of actual road users can be drawn.

The research has identified 5 key customer types whose interview results have been collated to give the following conclusions on how and why they make the travel decisions that they do:

**Table D-3: Customer Insights by road user group**

Customer Group	Route Choice Priorities	Issues/Concerns	Needs/Values
Truck Drivers	Safety HPMV has no route choice Consistency in travel – less roundabouts, avoiding congestion Vary routes to maintain interest Tradition and availability of truck friendly services	Congestion in urban areas Risks caused by other drivers Narrow bridges Farm vehicles Cyclists No advance warning of problems	Places to stop a truck Roadside facilities (cafes, toilets etc) Reliability is more important than speed The ability for other road users to overtake safely
Leisure/Travel	Scenic Tradition (we always go this way) Variety Stops such as cafes, viewpoints, attractions and toilets	Safety Road condition and road works Slow or dangerous drivers Lack of passing provision Rest stops shared with trucks Poor advance warning of problems	Feel safe Tradition Viewpoints/stopping places Predictable and reliable journeys Good quality roads Better advance warning Better signage
Small – Medium Business	Quickest and shortest route Routes with less traffic	Slow drivers Inconsistent travel speeds Lack of warning of delays or closures	Shortest possible travel time Overtaking provision Advance warning of problems
Retiree/Domestic	GPS routing Tradition (we always go this way) or routine (taking children to school going to shops) Time of day (to avoid congestion) Attractive or convenient stopping places for recreation, food and toilets etc	Safety Slow or speeding drivers Lack of safe passing places Intimidated by large trucks Inconsistent speed environment	Technology reliance Landmarks and sites of interest to break the monotony Journey experience More frequent and better stopping places Consistent, reliable journeys
Commuter/Business Traveller	Reliability, congestion, time of day Routine GPS routing	Safety Reliability and congestion Unexpected closures and delays Road works	More reliable journeys Safer journeys Safe passing Better information or warning

Overall, the main theme for the majority of road users is a **safe and reliable journey** with adequate provision for passing slow vehicles, enhanced signage and advance warning of problems and convenient stopping places. This philosophy has been used when examining the mix of options within a programme.

## APPENDIX E – UNCERTAINTY LOG

Probability	Status
<b>Near certain:</b> The outcome will happen or there is a high probability that it will happen	Policy or funding approval Tenders let Under construction
<b>More than likely:</b> The outcome is likely to happen but there is some uncertainty	Submission of planning consent application imminent Adopted plans*
<b>Reasonably foreseeable:</b> The outcome may happen, but there is significant uncertainty	Adopted plans* Draft plans Development conditional upon interventions going ahead
<b>Hypothetical:</b> There is considerable uncertainty whether the outcome will ever happen	A policy aspiration

Table E-1: SH1 Piarere to Taupō Uncertainty Log

Factor	Time	Probability/ Uncertainty	Impact	Comment
<b>Demand for Transport</b>				
Population increase in South Waikato exceeding SWDC forecast	2045	Unlikely	High	SWDC have a modest growth forecast based on historic growth rates, industrial land uptake and population migration, there is no foreseeable reason for this to change.
Population increase in Taupō exceeding TDC forecast	2045	Hypothetical	Medium	TDC growth predictions are based on the current trends and change in population demographic as Taupō become more accessible and desirable. Current growth predictions are moderate and will need review if a significant change in this trend emerges in the future. WRTM has accounted for forecast growth in future scenarios.
Expansion of Fonterra Factory at Lichfield	2016/17	Committed (in progress)	Medium	Milk drier will increase transport demand for factory, whilst almost 90% of product leaves by rail, further understanding of impact in terms of truck movements is needed – ongoing discussions with Fonterra have improved the understanding of the impact in terms of truck movement, which has been included in the traffic growth forecast used in the PBC.

Factor	Time	Probability/ Uncertainty	Impact	Comment
Expansion of operations at Kinleith timber processing works	2025	Hypothetical	High	Current understanding of Oji and Carter Holt Harvey operations is that production is focussed on consistency of output in the short term; growth will be governed by international markets and are hard to predict. It is unlikely that there will be a large increase in on-road logging trucks within the near future. The potential increase in operations and ensuing traffic effects are captured within the overriding 50% increase in freight movement accounted for in the traffic growth scenario.
Tourist travel	2045	Reasonably Foreseeable	Medium	Current tourist numbers (domestic and international) for the region are high as people pass along the corridor to reach destinations in Rotorua and Taupō, it is anticipated that this growth will be sustained into the future aligned with government predictions; it is assumed that the WRTM includes this growth. Therefore this is accounted for in the future growth predictions used within the PBC. It is noted that the Taupō to Waipoua PBC has recorded an increase in tourism traffic south of Taupō.
Land Use change	2025	Hypothetical	Medium	Land use change would result in change to type, volume and potentially direction of vehicles. Potential impact is probably higher on local roads than State Highway corridor. Discussions with SWDC, TDC and industry representatives give a clear indication of the predicted growth forecasts and land uses. Variance is allowed for in the future model scenario for traffic predictions. Uncertainties within the commodities markets have seen a slowdown of the conversion from forestry to dairy and even to other emerging industries such as sheep milk. The overall impact is relatively neutral in traffic terms as reduction in trucks from one sector is replaced by growth in demand from an alternative.
Additional processing plants	2025	Hypothetical	Medium	This could be linked to both land use change and market forces where more companies may build processing plant to compete with existing organisations, such as Fonterra, Silver Fern and Carter Holt. Potential impact is probably higher on local roads than State Highway corridor.  At this stage (and for the foreseeable future) there is sufficient capacity for growth within the existing operations and no significant expansion is planned within the next 30 years.
Expansion of water bottling plants	2016/17	Reasonably foreseeable	Low	It is noted that the aquifer at Putaruru has greater capacity than currently utilises and further expansion can occur.  The net result will be unlikely to impact on corridor capacity as the output volumes are not anticipated to be significant proportion of vehicle movements
Change in vehicle legislation and regulation	2045	Hypothetical	Medium	Changes to vehicle load configuration and vehicle dimension requirements and axle weights to enable increased productivity may lead to changes required in the highways. Introduction of electric and autonomous vehicles over the next 20 to 50 years may require additional infrastructure and changed geometry requirements.  Currently there is no appetite for increasing the vehicle size used on NZ roads (i.e road trains). It is not reasonable to assume that this will change in the future and define and solve problems that do not exist, such as needing larger diameter roundabouts and longer right turn bays.

Factor	Time	Probability/ Uncertainty	Impact	Comment
<b>Supply of Transport</b>				
Increase in road freight transport	2045	Reasonably foreseeable	High	<p>Current government freight forecasts show an increase in road freight demand generally by 50% or more within the next 30 years, it is assumed at this stage that the WRTM has accounted for this.</p> <p>A greater uptake of HPMV is likely as transporters seek to improve efficiencies, however, with the introduction of HPMV there has been no reciprocal reduction in the heavy vehicle fleet (actual growth has been 2% over preceding 5 year period)</p>
Reduction in rail freight	2045	Hypothetical	High	<p>A reduction in rail operations on the Kinleith Branch Line will significantly increase road freight on the corridor, almost 90% of export goods are shipped to the port by rail (approx. 7 per day). The removal of a single train could increase road freight by up to 10% (approx. 75 trucks) between Kinleith and Putaruru. Kiwi Rail is currently looking to increase train frequency and improve rail accessibility.</p> <p>The Tokoroa multi modal terminal has been assessed and its impact on road freight is minimal, growth predictions are dependent on business growth in the area and has been accounted for in the traffic growth and freight predictions used in assessing this PBC.</p> <p>There is no indication that rail use on this line will decrease or cease in the future, consideration of line closure for extended periods of time is considered low risk by KiwiRail, this will be further examined in the subsequent business case stages to determine if short term closure risks are likely to be an issue in the future (i.e. road/rail incursion), although there is no history of this problem to date.</p>
Other business Cases	2015/18	More than likely	low	<p>The NZ Transport Agency's business cases in parallel with this one could impact on the outcomes and influence the way in which the corridor is used.</p> <p>Ongoing consultation and collaboration across project delivery teams and departments has ensured that issues and opportunities have been captured and addressed within the PBC. Any significant developments will be addressed within subsequent business case stages.</p>
HPMV route availability	2025	Reasonably foreseeable	High	<p>Availability of alternative HPMV routes in the event of a closure on the corridor is limited, less than a quarter of the official diversions are suitable. With the increase in HPMV trucks and increasing demand for them, any closure of the corridor will impact on freight efficiency.</p> <p>This has been addressed within the recommended programme.</p>

Factor	Time	Probability/ Uncertainty	Impact	Comment
Increase in Electric Vehicles	2020 +	Reasonably foreseeable	Medium	<p>The widespread roll out of electric vehicles may change the fuel source but not significantly the number of trips. If it suddenly becomes cheaper to travel long distance then actual trips could increase impacting on corridor capacity.</p> <p>Assessment of this possibility is in its infancy, however, it is considered more likely that the need for roadside facilities specifically tailored to EVs and the potential safety risks derived from them will be more apparent. This will be captured within later stages of the business case.</p> <p>It is considered more likely that EVs will replace traditional fuel vehicles within urban areas which will not impact on the overall traffic growth scenarios used.</p>
<b>Cost of Transport</b>				
Fuel prices	2045	Hypothetical	medium	Fluctuation in global fuel costs had an impact on travel demand in the 2008/9; a similar change in markets will reduce private travel and slow growth for a period of time. Similarly a sustained decline in cost could have the converse effect. There is no real way of accurately forecasting this.
Maintenance of Roads	2025	Hypothetical	medium	<p>A long term reduction in LOS for road condition “sweating the asset” will result in reduced ride and surface quality with an increase in temporary speed restrictions and sections undergoing maintenance, this could impact on the efficiency of freight transport, travel time reliability and possibly increased safety risk.</p> <p>This is an issue that is of concern to the majority of road users and stakeholders and is addressed in the recommended programme.</p>