Auckland to Levin

CORRIDOR MANAGEMENT PLAN

1 4 32 41 46 47 48 49 54

2018-2028

NZ TRANSPORT AGENCY
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New Zealand Government

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Executive summary

The Pokeno to Levin corridor is part of the spine of the North Island State Highway network and the key journey from Auckland to Wellington. It also includes the alternates: SH32 and SH41 around the western side of Lake Taupo, the SH46, SH47, SH4 and SH49 route around National Park between Rangipo and Waiouru, and, SH54 between Vinegar Hill and Palmerston North. Between Bulls and Sanson SH1 is part of the key SH3 east-west link between Whanganui and Palmerston North, providing access to the Palmerston North freight hub. The corridor passes through Hamilton City, and many small urban centres and townships.

The corridor is approximately 911 km long (8.0% of the state highway network). The total value of assets along the corridor is $1,561M (6.7% of the total national asset value).

State Highway 1 (SH1N) is New Zealand's premier and critical north-south highway linking Auckland with Wellington and the South Island (via Cook Strait ferry). It contributes to the economic and social wellbeing of New Zealand by connecting major population centres of Auckland, Hamilton and further south to Wellington. Over 10 million tonnes per annum of freight travel up and down the corridor and provides the first journey experienced by more than 2 million international visitors and 4 million domestic tourists every year. The corridor is the main route for tourists access key tourist area such as Rotorua and Taupo.

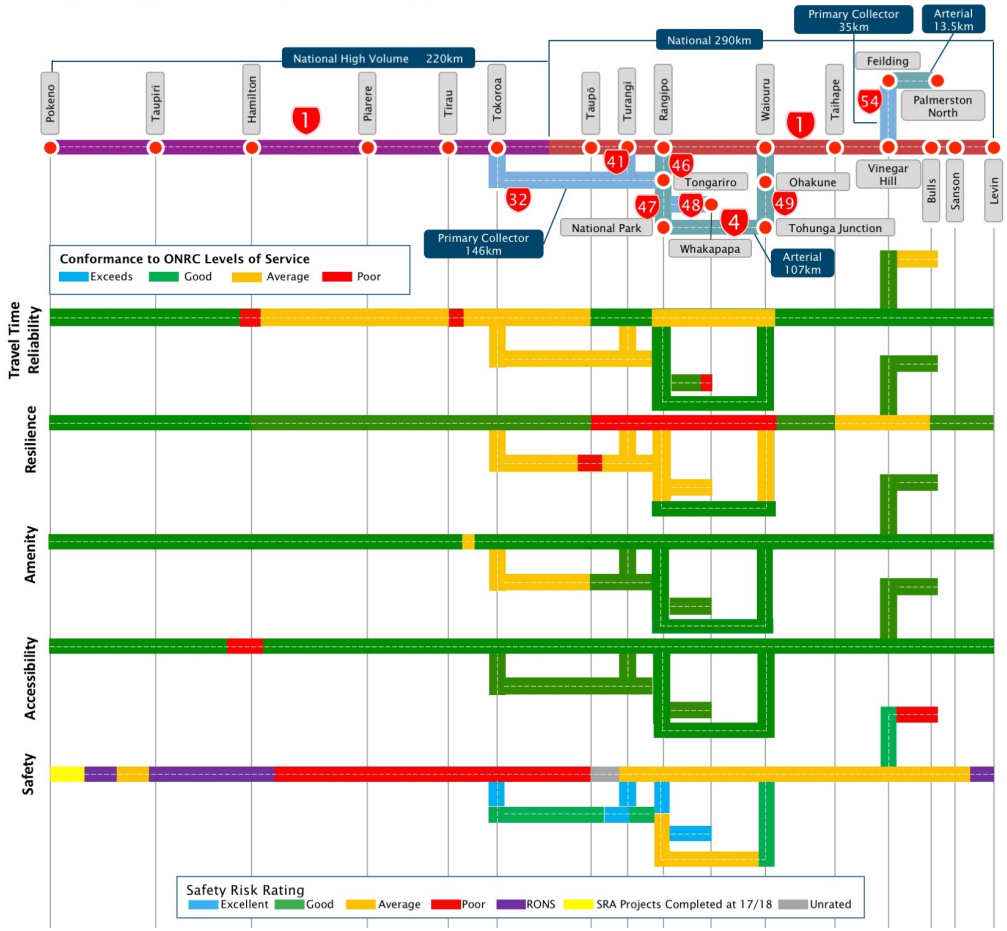
SH1N corridor is used by between 3,000 and 35,000 vehicles per day, with the alternative route around the volcanic plateau on SH46, SH47, SH4, and SH49 used by between 400 and 2,300 vehicles per day, including freight operators, commuters and tourists. It has varying levels of service along its length, with significant lengths out of keeping with its National – High Volume / National One Road Network Classification (ONRC) rating.

Investment over the past 10 years throughout the corridor has improved the level of service. However, the development of the Waikato Expressway has significantly improved the level of service along the northern section of the corridor. As such, there are now substantial inconsistencies in infrastructure level of service between the northern, middle and southern end of the corridor. This has a corresponding effect on maintenance and operations of the corridor.

Programme business cases that have been developed for the corridor set a clear vision and strategy for delivery of improvements that will improve the levels of service on the corridor over the next 30 years. The SH1 corridor is expected to remain the main road link between Auckland and Wellington into the future. Traffic growth of 30% above current volumes is expected over the next three decades. Investments will be targeted to pressures on the Desert Road, passing opportunities around urban areas, traveller information systems and communications, as well as maintenance planning changes to limit the impact of routine works.

Investments that reduce the response time to unplanned events and improve communication have the potential to improve the resilience along the route. Poor travel time reliability is experienced in the populous areas between Hamilton and Taupo. The Desert Road has some reliability issues that require addressing.

Figure 1 - Performance of the corridor against ONRC outcomes



Growth on the corridor will have some impact on the level of local access that is acceptable for a higher volume road. This will necessitate investment in initiatives that balance the requirement for more consistent travel speeds with local access that uses and crosses the corridor. Further capital investment in the corridor requires ongoing maintenance budgets in future years to adequately maintain and operate the asset.

Introduction

Purpose

What is the corridor management plan?

This Corridor Management Plan describes the customer service delivery story for the Auckland to Levin corridor, as measured against the One Road Network Classification performance framework. It is intended to describe the investment story, i.e. why invest in this corridor, in a context everyone can understand whether the activities are delivered through investment in the State Highways maintenance, operations, renewals and improvements programmes.

The corridor management plan considers a combination of:

- The **pressures** on the system that are resulting in increased demand or a reduction in levels of service
- The **current state** of the system and how it is performing
- The **response** the Agency is investing in to deliver the customer levels of service along the corridor.

It is important to note that this is a first-generation Corridor Management Plan, therefore, we expect it to be improved as we learn from this approach. It sets a firm foundation to improve from in the next 2-3 years, utilising a common framework and consistent data sets across the 30 corridors.

Why is it needed?

The corridor plan provides a link between the long-term planning outlook, the 10-year medium term investment programme and the 3-year land transport programmes for the next funding round.

Traditionally, the approach to investing in maintenance and renewals is to consider each asset activity in isolation, i.e. pavement, structures, drainage, and in isolation of capital expenditure. The Corridor Management Plan approach considers all assets within the corridor and takes a holistic view of the customer levels of service they provide throughout the corridor.

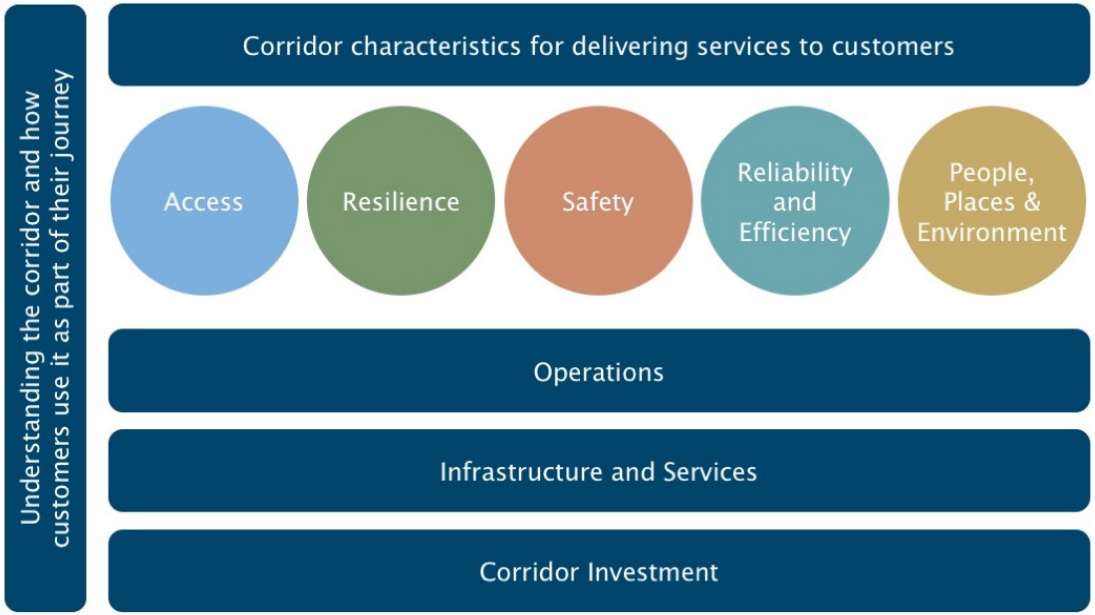
Planning is currently undertaken at the regional level, but typically significant journeys traverse more than one region. By considering the significant customer journeys and destinations, the corridor management plan is a vehicle to engage in regional and inter-regional conversations by focusing on the issues that are important and may extend beyond the state highways network.

How will we use it?

The Corridor Management Plan will provide the customer story and case for investment in maintenance, renewal and improvement on the corridor, based on targeting maintenance to achieve the appropriate customer levels of service within the context of providing value for money. The information presented in the corridor management plan helps to inform the business case for investment in State Highways for the subsequent triennial period.

In conjunction with the long-term view, the corridor management plan will provide for engagement with key stakeholders and partners to shape the future of the corridor. It responds to the needs of the users of the corridor to shape the future service levels.

Figure 2 - Corridor management plan framework



The corridor at a glance

Corridor overview

The Pokeno to Levin corridor is part of the spine of the North Island State Highway network and the key journey from Auckland to Wellington. It also includes the alternates: SH32 and SH41 around the western side of Lake Taupo, the SH46, SH47, SH4 and SH49 route around National Park between Rangipo and Waiouru, and, SH54 between Vinegar Hill and Palmerston North. Between Bulls and Sanson SH1 is part of the key SH3 east-west link between Whanganui and Palmerston North, providing access to the Palmerston North freight hub. The corridor passes through Hamilton City, and many small urban centres and townships.

The North Island Main Trunk (NIMT) line runs adjacent to the corridor at various locations with several rail overbridges and level crossings located throughout its length. The Kinleith branch line runs to the Port of Tauranga, taking locally produced timber and milk to the export market.

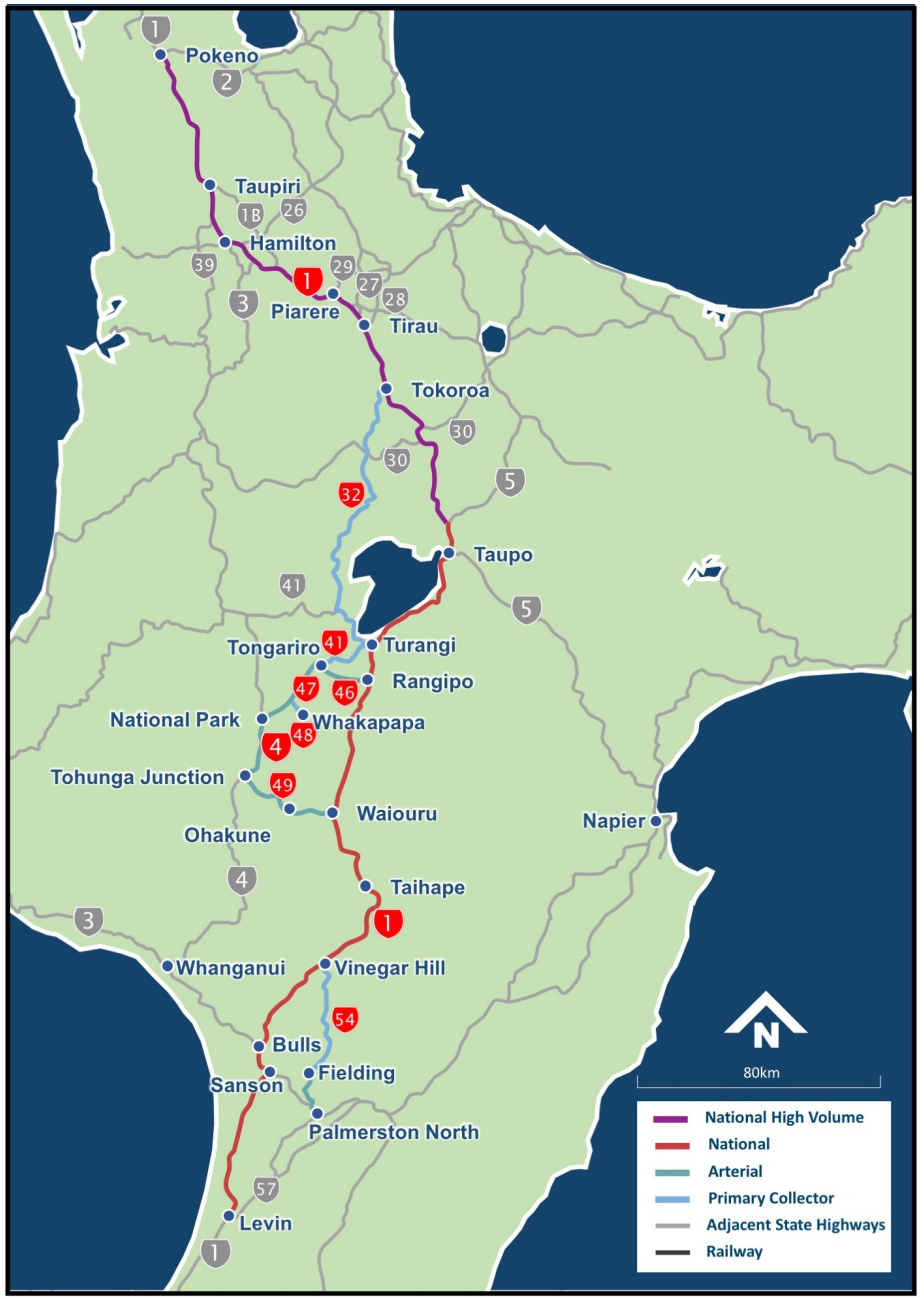
The regional economy

South Auckland (just north of the corridor) has an above average concentration of high-productivity employment in manufacturing, transport, wholesaling and logistics. It has important national infrastructure including the Auckland International Airport and rail links to Auckland. Over a third of Auckland's employment growth to 2040 is projected to be in South Auckland.

The Waikato region has a strong focus on primary production and associated manufacturing. The region contributes 9.0% of New Zealand's GDP and has 9.6% of the country's population resident. There is a strong Maori asset base (15% of total Maori assets). The region is home to iconic and culturally important natural assets including Lake Taupo and the Waikato River. Geothermal energy plays a major economic role particularly in the Taupo District.

The Manawatu – Whanganui region is the second largest land area in the North Island, with a diverse range of natural resources and economic activity. The region contributes 4% of New Zealand's GDP and has 5% of the country's population. In the southern part of the region growth in the dairy sector and horticulture industry has occurred. Palmerston North is the main campus for Massey University, hosts many central government departments, and is freight logistic hub for the lower North Island and access to the South Island via the Cook Strait.

Figure 3 – Corridor overview



Understanding our customers

Key customers

The key customers utilising the corridor are diverse, and utilise a range of transport modes. Different customers have different needs, expectations, and personal circumstances for using the transport system. Therefore, what customers value from the transport network needs to be understood in the context of who they are.

Daily commuter

The corridor provides for a range of commuter journeys. The key journeys are:

- North Waikato to Auckland
- Within Hamilton City, and Cambridge to Hamilton
- Rural Waikato to Taupo
- Whanganui to Palmerston North (through Bulls/Sanson)

Insights into daily commuter users:

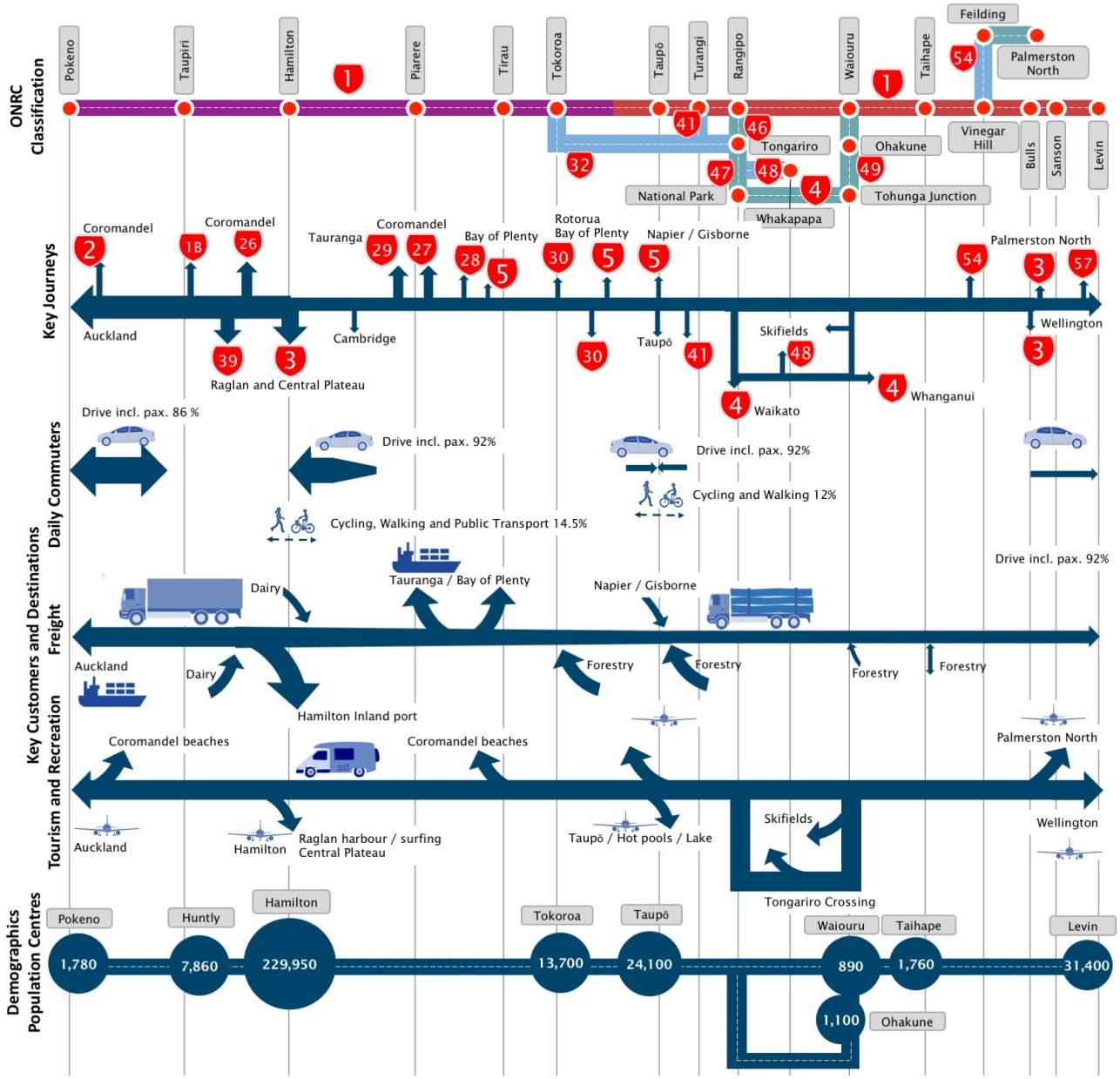
Road use: Commuters typically travel short sections of the corridor to reach a destination along the corridor or a major centre off it. Freight commuters regularly travel the length of the corridor.

Road knowledge: Commuters are familiar with the section of corridor they use. They expect seasonal variations in traffic volumes and weather patterns throughout the corridor and prepare accordingly.

Pain points: Bulls to Sanson traffic flows increase as two State highways combine for 5 km, reducing travel speeds. Cambridge to Hamilton has limited capacity which is being addressed as part of the Waikato Expressway. Access through and around Hamilton City at peak times is slowed by urban congestion.

Daily commuters expect: Reliable journey times with minimal unplanned events. Travel information on disruptions at the earliest opportunity to enable travel planning. Available alternate routes.

Figure 4 - Key customers, journeys, and destinations



Tourist and recreational users

The tourism industry is estimated to be worth $22bn to the New Zealand economy. There are four Regional Tourism Organisations (RTOs) along the corridor. Visitor expenditure for the Waikato is forecast to increase to $868 million in 2016. From 2009, expenditure has increased by 2.1% p.a. The RTOs for Lake Taupo and Ruapehu comprise around 3% of market share (2015) generating $600m in tourism expenditure. Visitor expenditure in the Manawatu RTO was forecast to be $453m in 2016, with a 1.8% increase per annum since 2009.

The corridor is part of the Thermal Explorer route. The MBIE tourism flows model shows that the corridor between Pokeno and Putaruru carries between 10-20 million journeys per year. From Putaruru to Lake Taupo there are 5-10 million journeys per year with this figure reducing to 1 to 5 million from Turangi south. Key destinations accessed from the corridor are Auckland, the Bay of Plenty via SH29, Rotorua via SH5, Lake Taupo and Tongariro National Park. Lake Taupo is a multi-sport hub with training by competitors taking place on the corridor up to six weeks prior to a major event. Some of these events use SH1 as part of their route e.g. Lake Taupo Cycle Challenge.

Insights into tourist and recreational users are as follows:

Road use: Seasonal variation on the corridor. High numbers of recreational users and tourists during long weekends in and around Taupo. Journeys from the north will utilise SH39 or SH3 to access the Central Plateau. Trips from the southern end of the corridor use SH1 to access the Central Plateau, then SH49. Long distance trips from Auckland and Wellington use the corridor to access destinations further afield.

Road knowledge: International visitors have limited knowledge of the road with many having arrived at Auckland airport, hired a vehicle, and headed south. They are frequently unaware of the topography along the corridor and that through the Desert Road in particular, they are travelling through sub-alpine conditions. International and domestic visitors can be unprepared for adverse weather conditions, particularly during winter.

Pain points: Bulls to Sanson has reduced speeds during long weekends and summer months. Delays during weekday peaks in Hamilton urban areas. Limited advance warning signs of delays / road closures on Desert Road.

Tourist and recreational users expect: Timely information about changing road conditions, distance to destination information, good directional signage, and journey time to destination, along with rest area facilities particularly where there are long stretches without towns to stop at.

Freight operator

The inland ports and freight hubs at Hamilton and Palmerston North, are key destinations for freight. Additionally, Taupo, Turangi and increasingly Waiouru are important change over points for drivers as part of an Auckland to Wellington journey. The northern section of SH1 links freight from the central North Island to the Port of Tauranga via SH2 for journeys from Auckland and SH29 for journeys from the south.

Between 800-3200 heavy vehicles use the route each day, representing up to 25% of total traffic flow. Inter-regional traffic is 30% of heavy vehicle use on the northern section. Road freight is forecast to increase by 50% over the next 30 years which creates a need to maintain and operate this section of the network safely and effectively.

The corridor is paralleled in part by the Kinleith branch railway line which takes 90% of wood and dairy products from the Waikato region to the Port of Tauranga for export. The NIMT line also parallels the route taking 20% of consumer goods south from Auckland to distribution centres in Palmerston North and further south.

Insights into freight operators are as follows:

Road use: Access to the inland ports in Hamilton and Palmerston North, and seaports in Auckland and Tauranga are important with 75% of national freight movements wholly within the Auckland-Hamilton-Tauranga triangle. The northern section of the corridor sees freight laden vehicles depart from Auckland and unload along the corridor, with a particularly high changeover of drivers at Turangi where the freight and logistics industry have supporting facilities and infrastructure located. Vehicles are typically empty travelling north on their return journey.

Road knowledge: Road knowledge is generally good, though more overseas drivers are being employed due to staff shortages. These drivers are not always prepared for the varied terrain of the corridor, the sudden changes in weather patterns, and consequently road conditions.

Pain points: Between Taupo and Turangi traffic turning into tourist and recreational areas requires heavy vehicles to reduce speed or stop due to the narrow carriageway. Delays on Cobham Drive in Hamilton creates variability in journey time. Ice on short inclines through the Desert Road during winter can slow or close the road for heavy vehicles. Higher traffic volumes between Bulls and Sanson on the two-lane opposing carriageway slows speeds. Sanson to Levin has limited overtaking opportunities.

Freight operators expect: Infrastructure that supports efficient commercial activity. Timely accurate road condition information in winter months and advanced warnings with alternative route options available. Layover and cab change facilities.

Daily users

The corridor has numerous towns and settlements along its length. These communities have developed along the state highway or around industrial sites for social and economic reasons. People living alongside the State highway utilise the corridor for daily journeys. Daily users from towns require access to essential services within their area by a variety of modes, with many requiring access across the corridor. Increasing use of the corridor by others provides positive and negative impacts on local communities.

Insights into communities are as follows:

Road use: Local communities interact with their section of the corridor every day through a variety of different modes. Local communities have movements along and across the State highway for social, employment and educational purposes. Users may meet and greet on the side of the corridor to engage in conversation, or may travel along or across to access retail, health, education or workplaces.

Road knowledge: Differing levels of experience and confidence in road use are held by individuals from the pre-schooler walking or cycling with parental supervision, or the elderly or disabled user on a mobility device, as well as able-bodied users. Most are likely to have detailed knowledge of their section of road.

Pain points: Access to, from and across the State highway between and at intersections in urban areas particularly Hamilton, Huntly, Taihape, Hunterville, Waiouru, Bulls, Sanson and Levin.

Communities expect: To be consulted when changes to the corridor are occurring, and to have local needs met by integrated planning. Local access to be provided for all modes through urban environments. Safe crossing locations with adequate facilities. Footpaths and cycle routes to be provided on State highway where local facilities are located or the corridor forms part of the route chosen by students.

Waikato expressway – Cambridge opening was attended by the community

How we deliver services along the corridor

Transport partners

The land transport system comprises more than State Highways. To provide customers with a reliable and safe journey usually requires the use of two or more transport infrastructure provider's networks. As such we work with other network providers to provide a one system approach. Along with other agencies, The NZ Transport Agency works closely with the TLAs and Regional Councils along the corridor shown in Figure 5.

The Government, along with many individuals and businesses, invests in the transport system and shapes the performance, costs and experiences of people using it. The NZ Transport Agency, KiwiRail, Councils and NZ Police work closely together to deliver a consistent, predictable experience for the customer.

Collaboration along the corridor

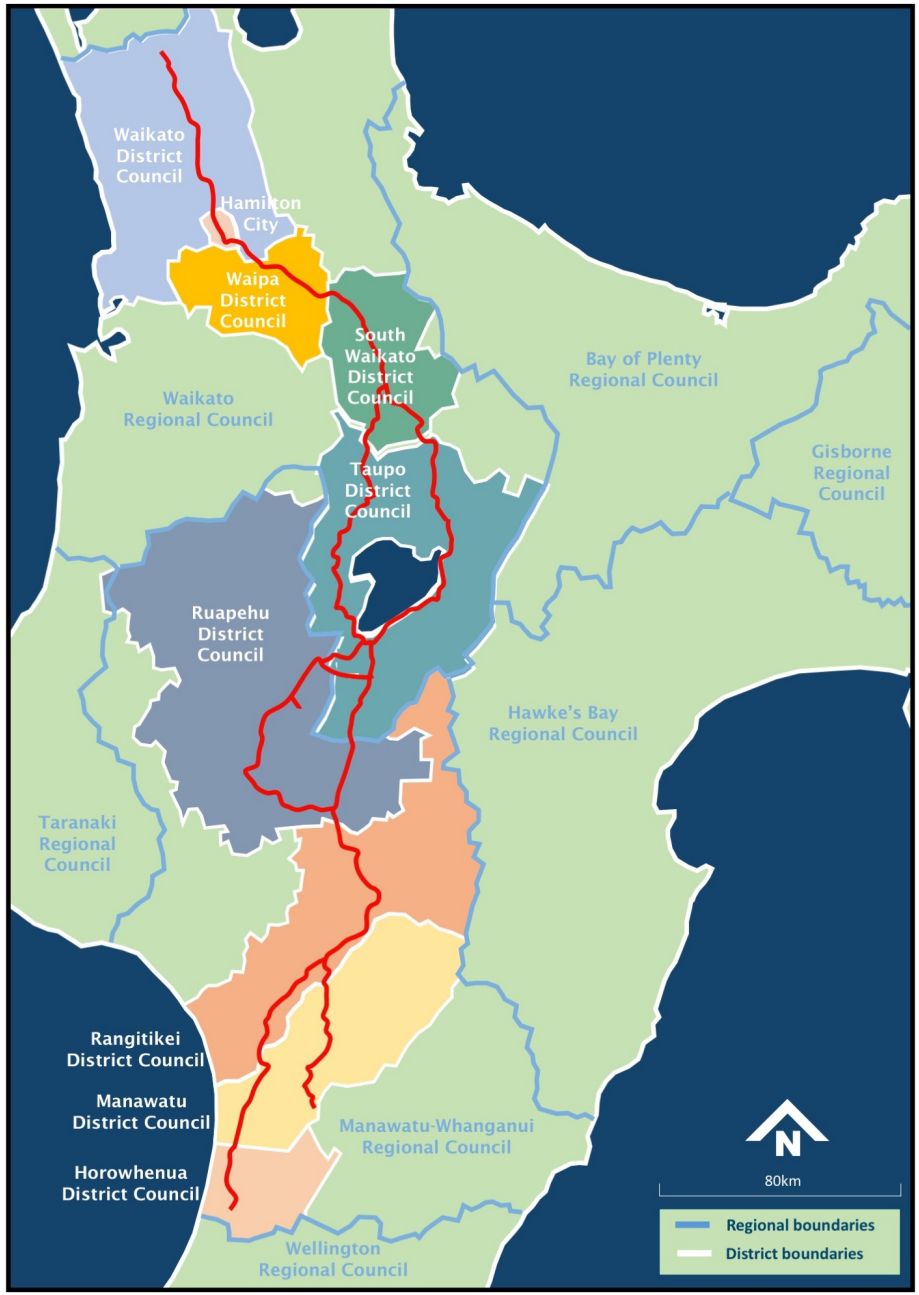
The Upper North Island Strategic Alliance (UNISA) formed between Auckland Council, Northland, Waikato and Bay of Plenty regional councils, Hamilton and Tauranga city councils and Whangarei District Council aims to manage and respond to inter-regional and inter-metropolitan issues. The remit of the alliance is wider than just transport matters, although transport has been the primary focus for several years. UNISA has worked with KiwiRail to develop the Upper North Island freight story which looked at critical issues limiting New Zealand's economic productivity.

The Waikato and Bay of Plenty regional transport committees have joined with their counterparts in Auckland and Northland to provide a shared statement for incorporation into their respective regional land transport plans, signalling the intent to continue to collaborate at an upper North Island scale to improve transport investment decision making and transport outcomes.

A shared focus in the Manawatu-Whanganui regional transport committees and industry is boosting economic growth through a collaborative effort to better connect the region. A strong focus is on improving connectivity between the road network and key rail and port links, making it easier and more efficient and resilient to bring people, goods and markets together.

The Safe Roads and Roadsides programme has projects planned and underway along the rural Waikato stretch of the corridor. This work is focused on older sections of the Waikato expressway that require installation of flexible barriers and rumble strips to bring the corridor to current National ONRC classification specifications. Further safety improvements along and adjacent to the corridor are also planned and underway through the Safer Roads Alliance

Figure 5 - Map of associated local authorities



Network Outcomes Contracts approach

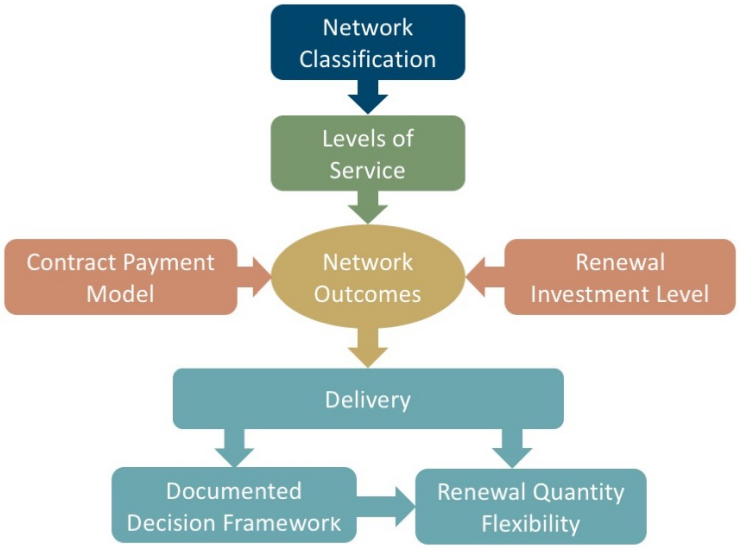
Network Outcome Contracts (NOC) are aimed at improving the effectiveness of service delivery for maintenance and operations of the state highway network. Elements of previous procurement methodologies (PSMC, Hybrid and Traditional models) have been integrated into the NOC contract model which delivers services through a primary supplier incorporating both professional services and physical works for all key maintenance activities.

To support this a central Governance and Management Group represents the interests of the Maintenance and Operations teams in the delivery of the NOCs. This group resolves issues, looks at opportunities for improvement, recommends changes to the national contact documentation, and ensures a consistent application, understanding and implementation of the NOC delivery model.

The core scope of work typically includes, but is not limited to maintenance, operations and renewals. The core scope of work typically excludes transport planning, ITS maintenance and management, capital works, emergency works reinstatement, Traffic Operation Centre activities, bridge and other structures management and repairs.

The contract process for the Network Outcomes Contracts is shown below:

Figure 6 - NOC process



Collaborative delivery of services

The Auckland to Levin corridor crosses three contract areas. The boundary of the North Waikato contract runs from Pokeno to the intersection of SH1 and SH29, south of Cambridge. The Central Waikato NOC commences at this location and ends just south of Waiouru and includes the volcanic plateau. The Manawatu NOC commences just south of Waiouru and runs to the end of the corridor at the intersection with SH57.

West Waikato Maintenance Contract (PSMC007)

This contract undertaken by Fulton Hogan covers SH1N, SH1B, 3, 21, 23, 26, 29 and 39 in West Waikato. The contract commenced on 18 July 2011 for a period of 9 years.

Central Waikato Network Outcomes Contract

This contract undertaken by Downer commenced on 3 November 2014 for a period of 7 years, with a possible extension depending on performance of 2 years. The two Waikato contracts are supported by the following specialist maintenance contracts:

- **Traffic signal maintenance** undertaken by Hamilton City Council
- **Traffic monitoring sites (NZTA 2/16-006/501)** awarded in September 2016 to Beca for a period of 2 years with three discretionary extensions of 1 year each.
- **Regional bridge and structures** awarded to Beca in October 2015, covering the wider Waikato and Bay of Plenty regions. It has a contract term of 3 years plus 2 years based on performance.

Manawatu Network Outcomes Contract

Manawatu NOC (contract MW-NOC15) is undertaken by Higgins. commencing on 1 July 2015 for a 7-year period with the option based on performance for a further 2 years. This contract is supported by the following specialist maintenance contracts:

- **Management of bridges and other structures Taranaki and Manawatu – Whanganui (PSWT25)** awarded to Opus and commenced on the 1 November 2014 for a 3-year period with the option based on performance for a further 1+1 years.
- **Traffic Monitoring Wellington region (859PN-T)** awarded to HTS Group Ltd and commenced on the 1 April 2016 for a 3-year period with the option based on performance for a further extension of 1+1 years.

Wellington Transport Operations Centre

Traffic signals on SH1 through Levin are operated by the NZ Transport Agency at the Wellington Transport Operations Centre. There is no Memorandum of Understanding between the Agency and Horowhenua District Council on how the signals operate. The Agency maintains a stakeholder relationship with the Council and other interested parties.

Drivers for change

The Transport Agency's long-term view identifies several key journeys, metro areas, and regional economic development areas considered either crucial for the continuing economic prosperity of the country, or in need of special attention, with transport often considered a key enabler of economic revival. The journeys, metro areas and Regional Growth Programmes associated with the corridor, and the long-term view of these are briefly described below.

Key journeys

The corridor is the critical link on the transport network supporting key journeys between Auckland, Hamilton and Tauranga, and Auckland to Wellington for freight and tourist and holiday destinations for tourists. The upper North Island freight task is forecast to increase 59% over the next 30 years. The corridor has the MNIT railway line running parallel to it for a significant length providing alternative transport choice for a limited number of journeys.

Impacts of growth on land use

The Provisional Regional Policy Statement for the Waikato Region sets out a future land use pattern to support the effective management of growth. This requires an understanding of transport needs and to plan a system that responds in an integrated manner.

Effective land use and urban design/settlement planning is one of three levers to help improve access, the remaining two being transport infrastructure and technology. This requires effective land use and transport integration. Waikato Means Business identifies the strategic priorities listed below.

- The impact of Auckland's southern growth on the northern Waikato area. Land use policy and planning in the north of Waikato District is facilitating residential and industrial growth. This is anticipated to increase the volume of traffic moving between the regions. This could impact on the longer-term efficiency and effectiveness of the Waikato Expressway.
- The Upper North Island Freight story concluded that the lack of strategic integrated land use and transport planning and investment is a key constraint in reducing the cost to do business. The Waikato region has a large proportion of the zoned and available industrial land supply in the upper North Island when compared to other regions, this will affect the movement of goods through the region.
- The growth corridor south of Hamilton (Peacockes, the Airport and surrounds and Tamahere), is likely to be developed over 15 years. This will be mixed use development which is reliant on key infrastructure and services including Southern Links.
- The development of the Ruakura Freight hub and inland port. This is a flagship development and expected to change freight patterns within the Waikato region.
- The Manawatu-Whanganui economic action plan includes the intensification of primary industries in the region. When successful, an increase in fright traffic could occur.
- Tourism opportunities are being actively explored and developed such as the Tongariro Crossing which could affect transport stopping patterns.
- Dairy conversions outside growth areas will influence transport decisions.

Population growth and changing demographics

The population is growing and ageing. It is also changing unevenly with growth occurring in some areas whilst rural districts face static or declining populations. The population in and around Hamilton is projected to grow by 1.3% per annum, and in the North Waikato villages of Tuakau, Pokeno and Te Kauwhata similar growth rates are also predicted. Alongside this there has been an increase in use of public transport, particularly by young people. Increased cycling activity is occurring across the region for transport and recreation. Within Hamilton the number of private vehicles is anticipated to increase by almost 50% over the next 20 years putting pressure on the capacity of the transport system.

It is expected that population growth will increase demand for infrastructure and exacerbate effects associated with a growing population, particularly congestion. In contrast areas with declining population will still require infrastructure though it will service fewer people. The ageing population is expected to result in increased access and mobility needs to access essential services.

Auckland

The corridor provides access to Auckland region. Auckland has a strong comparative advantage in wholesale trade. Auckland is expected to have sustained growth and to have a population by 2034 of two million people. This will put increasing pressure on physical infrastructure to enable the efficient management of the use of the asset.

Hamilton

The corridor currently runs through the centre of Hamilton. A bypass is being constructed as part of the Waikato Expressway and is expected to be completed by 2020.

The state highways are a major element of Hamilton city, with 36,000 people living and 18,000 people working within 500m of the state highway network. The highway network is used to access many amenities in Hamilton City with numerous educational, recreational, medical and commercial facilities within 1km of a state highway.

Manawatu-Whanganui region

More than 220,000 people live in the district and rely on the state highway network to travel to destinations. The corridor runs through many small towns and settlements, often bisecting them. These towns and settlements often depend on the business generated from the state highways. The population is not increasing but like many other regions is it aging.

Current levels of service performance

The One Network Road Classification (ONRC) is a framework that categorises roads throughout the country depending on what purpose they serve. Importantly it helps New Zealand to plan, invest in, maintain, and operate the road network in a more strategic, consistent and affordable way throughout the country.

Over time all roads in a category should offer an increasingly consistent and fit for purpose customer level of service (CLoS) for road users. With the knowledge of current CLoS experienced by customers, we can better target investment to meet future intended service levels.

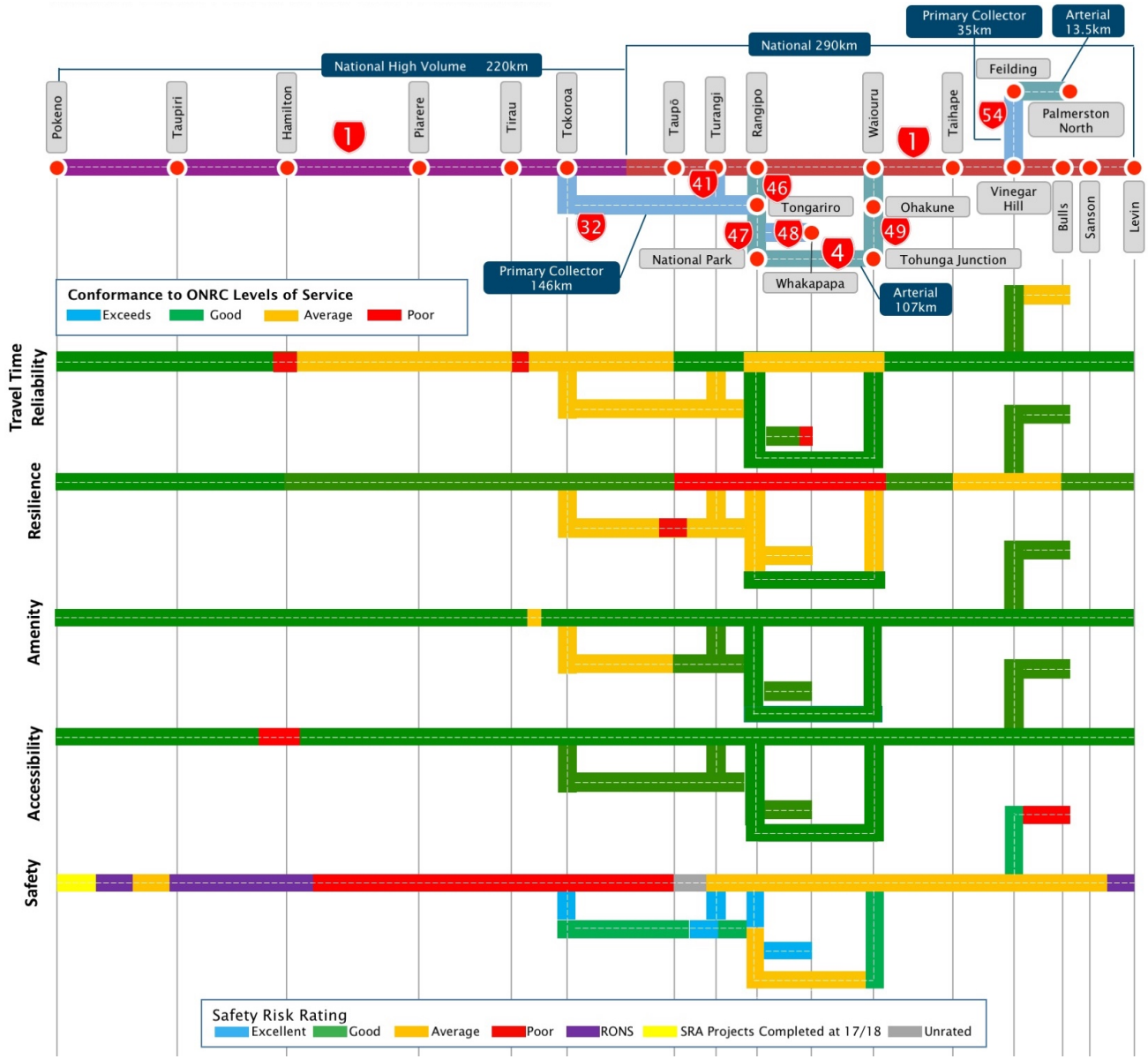
Overall, customers will be provided with the right level of road transport infrastructure where it is needed, determined by a robust, impartial, nationally consistent tool – the ONRC.

Road classification

The corridor is National High Volume from Pokeno to the intersection with SH5 north of Taupo, where it becomes a National classified state highway to the end of the corridor in Levin. The central plateau loop, and SH54 from Feilding to Palmerston North are classified as Arterial. The loop around the western side of lake Taupo along SH32 and SH41, SH48 to Whakapapa, and SH54 between Vinegar Hill and Feilding are classified as Primary Collector.

Overleaf provides additional context to explain the current levels of service along the corridor based on the road classification.

Figure 7 - Current ONRC levels of service performance



Summary of current performance

Figure 7 shows how the Auckland to Levin corridor is currently performing against the ONRC Levels of Service expected for the relevant classification of each section.

Levels of service performance has been determined by workshop participants in the development of this corridor plan and is therefore not solely based upon consolidated evidence from the ONRC technical measures.

A simple four-point assessment has been utilised as follows:

Exceeds	The level of service provided by the section of corridor for the activity under consideration exceeds what is required for a highway of that classification
Good	The section of corridor generally meets the LOS requirements for the activity and ONRC
Average	The section of corridor meets some but not all of the LOS requirements for the activity and ONRC classification
Poor	The section of corridor generally fails the LOS requirements for the activity and ONRC classification, or there is a significant gap in the LOS for some aspects of the activity.

Travel time reliability

Travel time reliability along the corridor is generally good. The exceptions to this are along the Desert Road where changes in weather conditions can impact safe travel speeds and therefore travel time. Around Hamilton travel times are impacted due to high traffic volumes in combination with at grade intersections. Future maintenance programmes between Piarere and Taupo indicate that there will be an increase in delays for customers on this section of the corridor. The combined SH1/SH3 between Bulls and Sanson has travel reliability pressures for a limited period of the year only.

Resilience

The corridor has high volumes of freight traffic and is an important strategic haulage route. From a national resilience perspective, the sections through the Desert Road and around Lake Taupo are vulnerable to extreme weather events, slips and unplanned closures. The central plateau loop provides an alternative route, though is often affected by the same natural events as the Desert Road, requiring some freight vehicles to wait for roads to reopen.

Amenity

The corridor has a high amenity value to tourists and locals with significant landmarks throughout its length. The corridor has high cultural and spiritual significance to Maori. Facilities for customers are provided through the smaller urban areas. On SH32 between Tokoroa and Turangi the road is average primarily due to geometry and surface cracking.

Accessibility

The corridor provides access to work, education and critical community amenities for smaller communities along its length as well as larger towns and cities. It enables freight movement to key distribution hubs and ports for onward distribution domestically and internationally. Within urban areas, accessibility for pedestrians and cyclists requires further integrated planning with communities.

Safety

Improvements between Pokeno and Cambridge have resulted in better safety outcomes on this corridor over the past decade, and the completion of the Waikato Expressway will see further improvements. Since KiwiRAP data was released there has been significant investment in this corridor. The high rating between Taupiri and Hamilton for Collective Risk is being addressed as part of the Waikato Expressway. The corridor north of Hamilton now has a 4-star rating as sections of the Waikato Expressway have since been completed.

Further south the route has a medium to high collective risk. The Desert Road section has the highest risk level and is within 3-5-hour drive-time of major origins such as Auckland and Wellington where fatigue begins to be a major factor. Low cost investments have been implemented incrementally over a period of years to address some of the high-risk sites. A longer-term plan to improve the alignment of these sites would be beneficial as growth impacts on traffic flows.

Key pressures along the corridor include the unforgiving nature of the road environment, out of context curves and increased urban growth in key sections. Between Piarere and Tirau half of all crashes occur on out of context curves. Distraction is the highest cause of accidents on the Piarere to Taupo section. On the Taupo to Waiouru section. run off road crashes and head on crashes are most of fatal and serious injury crashes. Fatigue is likely to be an underreported factor on this section of the corridor. An unforgiving road environment on SH4 and SH46 contribute to the high personal risk.

Improving the customer experience

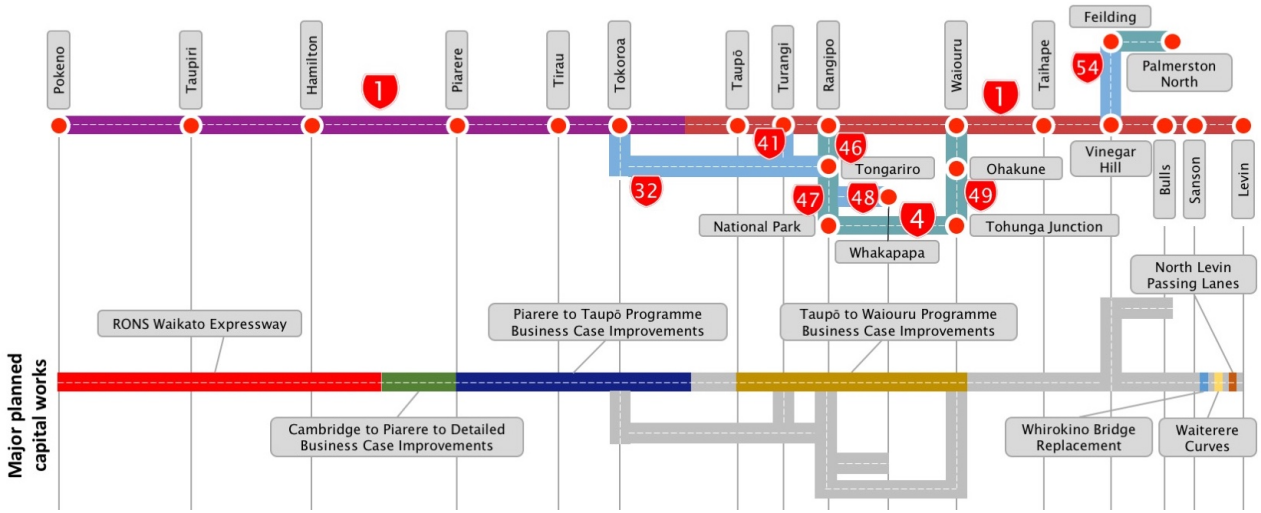
In responding to Customer Levels of Service it is important to acknowledge that significant investments are currently planned or underway as part of the Roads of National Significance and the NZ Transport Agency's State Highway capital works programme.

The Waikato Expressway will see a KiwiRAP 4-star highway from Pokeno to Piarere by 2020, with SH1B being revoked.

Two programme business cases have been prepared for the corridor between Piarere and Waiouru and preferred options for future works in these areas has been supported by the NZ Transport Agency Board. The outcomes that will be delivered are reliable journey times, improved safety, and enhanced resilience of the route.

Individual projects on the southern section of the corridor will improve resilience, address driver frustration, and challenging geometric layout.

Figure 8 – Significant corridor planned improvements



Waikato expressway – Karapiro Gully Viaduct

Access

Carriageway configuration

The corridor currently consists of a myriad of configurations. Construction works are currently underway throughout the section from Pokeno to Cambridge to upgrade to four lane divided carriageway. South of Cambridge the corridor consists of two lane opposing with passing lanes. There are divided sections between Tirau and Tokoroa, and in urban areas on the southern section. The volcanic plateau loop is two lane opposing with no passing lanes. There are frequent passing lanes on SH1 south of Waiouru.

Railway level crossings along the corridor have approaches at right angles to enable safe access across the tracks. Historically investment in SH47 has been higher than on roads of a similar ONRC classification in other areas.

Speed limits

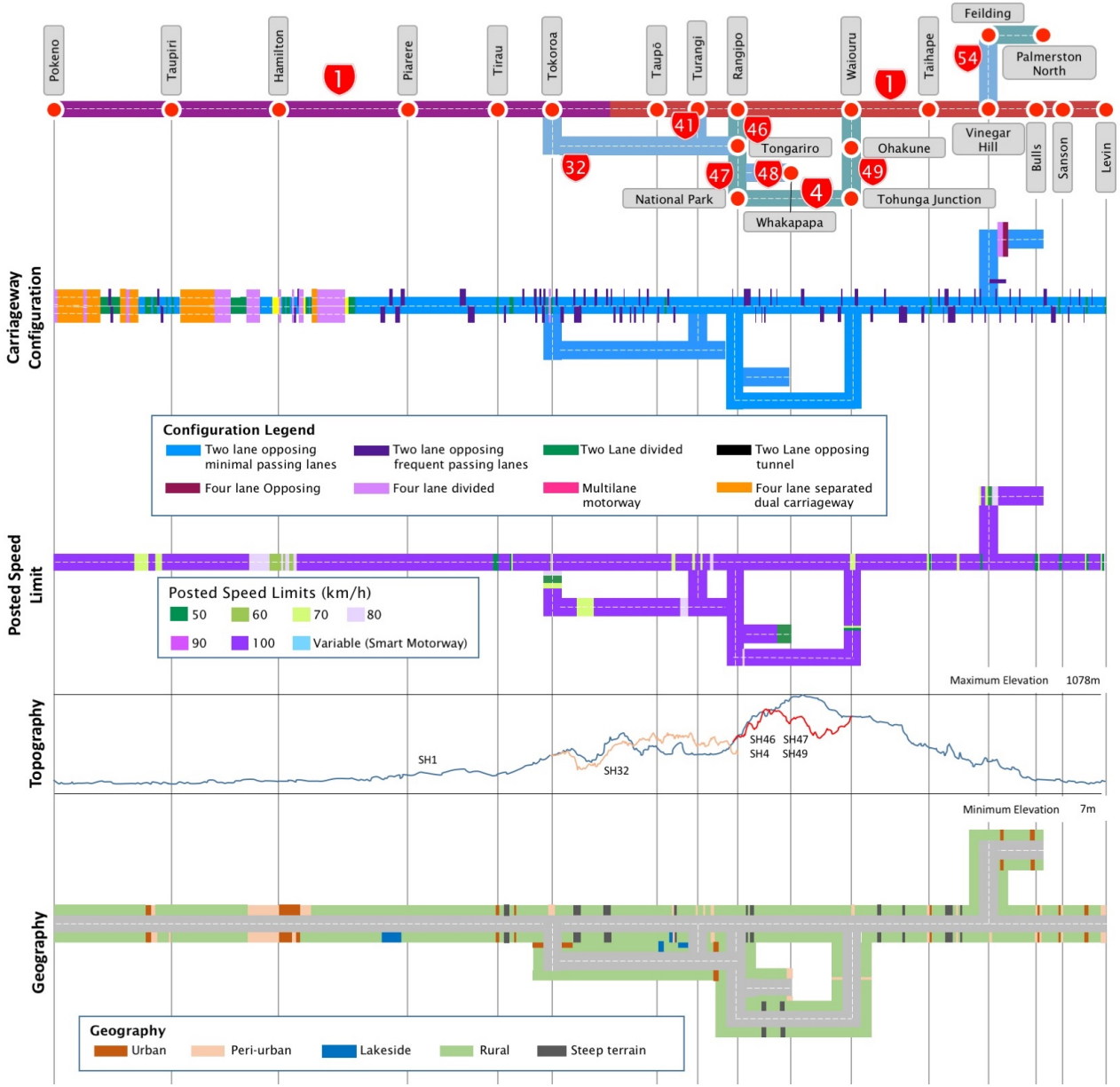
The corridor is predominantly 100 km/h, with reduced speed limits on the approach to and through urban areas. Sections of 50 km/h are through smaller settlements as well as Tirau, Bulls and Sanson. Speed limits between 60 km/h and 80 km/h are in place in all other urban and peri-urban areas along the corridor.

Topography/geography

The corridor is relatively flat from Pokeno to Piarere at which point it rises to the volcanic plateau where it is the highest State highway in New Zealand. It then descends to flatter terrain south of Bulls. The Tongariro National Park is acknowledged as both a cultural and natural World Heritage Site consisting of three active volcanic mountains, Ruapehu, Ngauruhoe, and Tongariro and with culturally significant Maori sites. The corridor runs adjacent to Lake Taupo and several other recreation and tourism areas of significance.

The corridor has a rural feel along most of its length, with several steep sections. Several large and many smaller communities are located on the corridor.

Figure 9 - Corridor characteristics

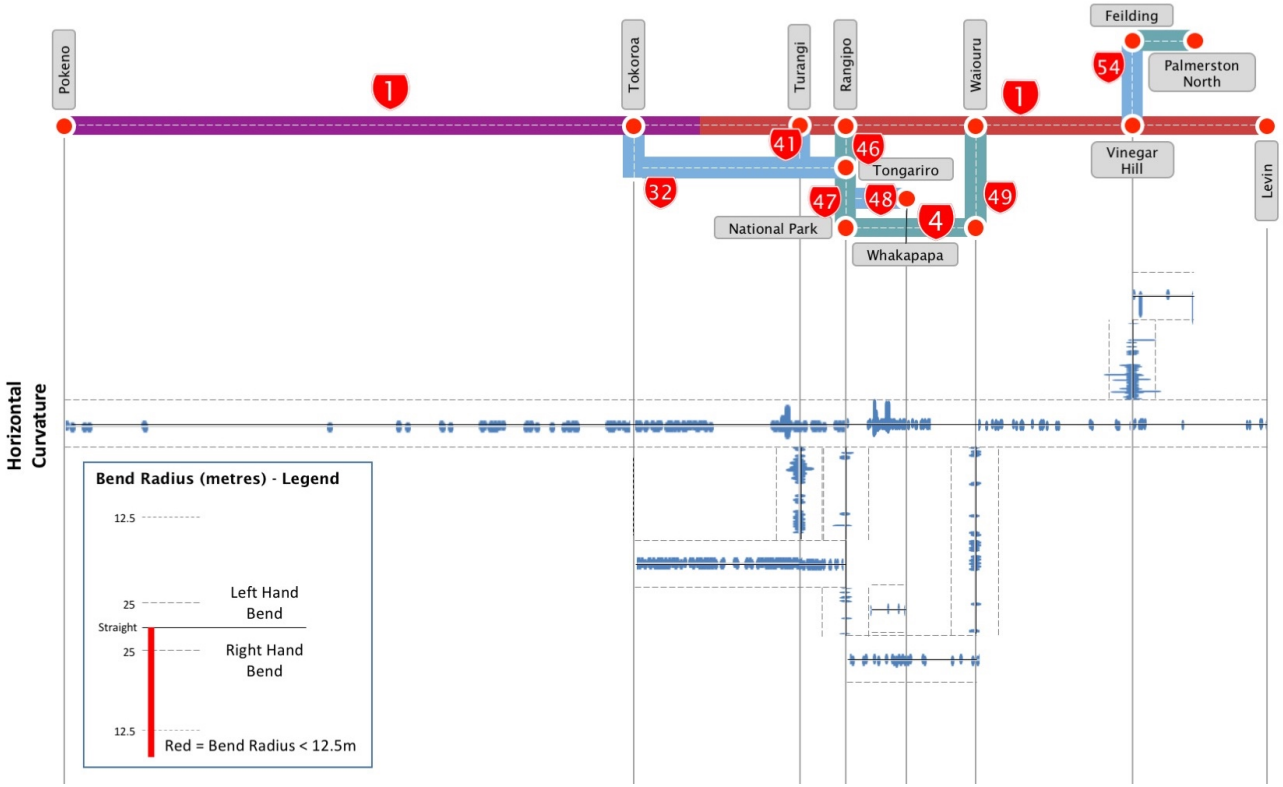


Horizontal alignment

The infographic shows the location and extent of the out of context curves along the corridor. The height of the bar is an indication of the severity of the curve calculated as $\frac{1}{radius^2}$, meaning the taller the bar, the smaller the radius of the curve. Note: Unlike other infographics, the horizontal alignment infographics are drawn in proportion to the length along the corridor. As such they are not shown in context with the intermediate points which have been excluded.

The corridor contains a regular occurrence of larger radius curves, except for the Waikato Expressway that has few out of context curves. Sharper bends with a radius below 25m only occur on SH54 between Vinegar Hill and Feilding.

Figure 10 – Horizontal alignment and traffic volumes



Volumes

The corridor has efficient use of the lanes with traffic volumes per lane below 11,000 vehicles per hour. The exception is south of Hamilton where capacity reduces to 2 lane opposing. The completion of the Waikato Expressway will increase capacity on this section. On the volcanic plateau loop, volumes range from 100 to 1,200 vehicles per lane, providing for efficient journeys.

Heavy vehicle volumes per lane are highest around Huntly and south of Hamilton. When Waikato Expressway is complete, the increase in capacity will reduce the heavy vehicle per lane figure to around 800 (without future traffic growth), similar to other sections around Tokoroa or Bulls. Heavy vehicle volumes are in the high range around Taupiri.

HPMV routes

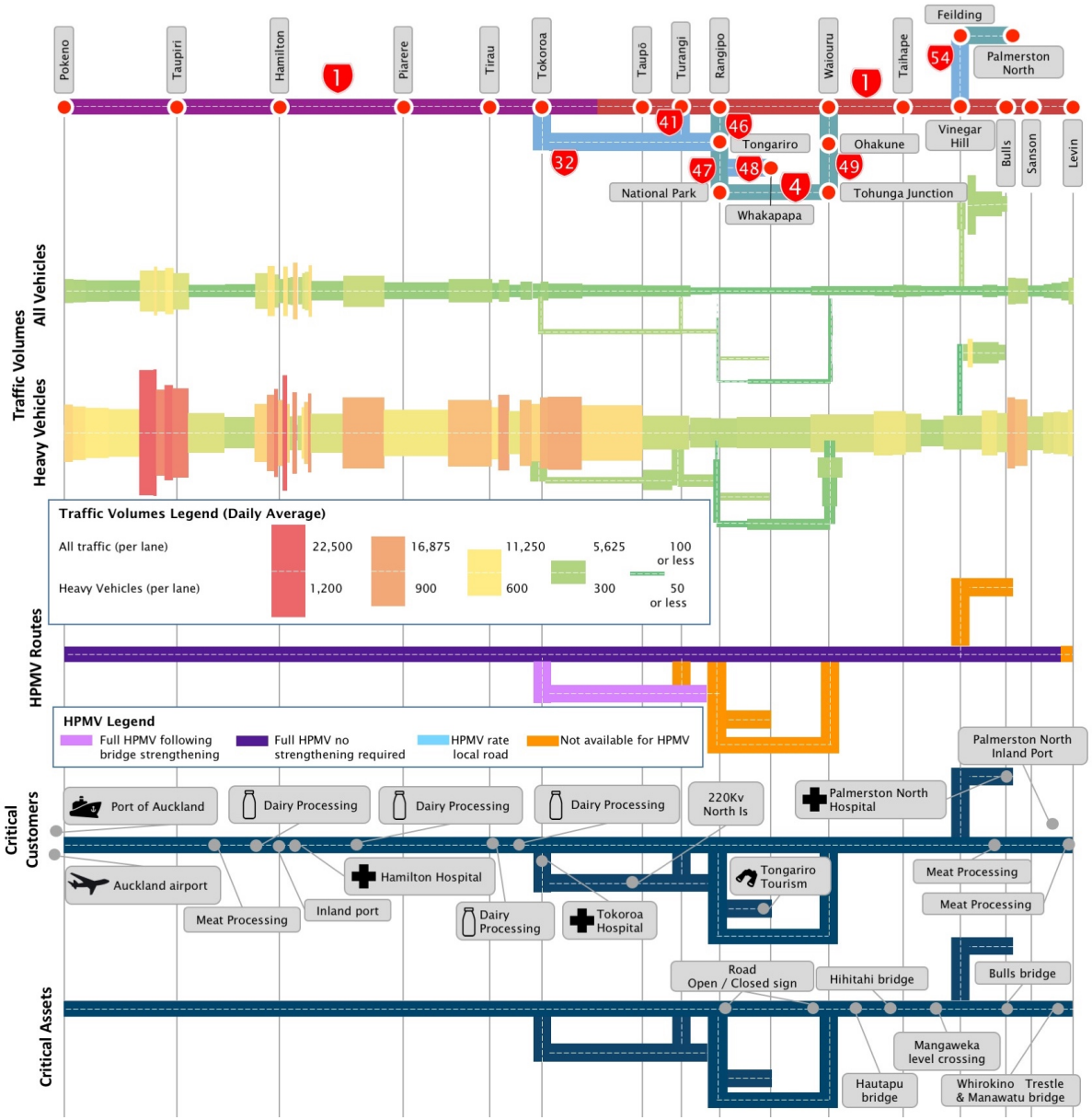
A significant length of the corridor is open to HPMV. SH1 from the Whirokino Trestle bridge south is not open to HPMV. A bridge replacement project has commenced and is due for completion by 2018, making the entire SH1 corridor suitable for HPMVs. SH4, SH46, SH47 and SH49 are not open to HPMVs. Oversized dimension vehicles are limited on the state highway corridor by rail overbridges at Marton and Tirau.

Critical customers and assets

The corridor has several time sensitive processing plants along its length and the inland ports at Hamilton and Palmerston North are two key distribution centres for the North Island. Further critical assets on the corridor are clustered at the southern end of the corridor. Five bridges are critical, two of which are currently being replaced - the Whirokino Trestle and Manawatu Bridge which carry fibre optic cable for the Wellington region. The Mangaweka level crossing on the NIMT railway line has had minor improvements in recent years.

Taupo lakeside between Hatepe and Turangi-Taupo is subject to reactive maintenance to ensure continued access. Variable message signs (VMS) and gates to close SH1 through the Desert Road are located between the intersection of SH46 and Waiouru.

Figure 11 - Corridor capacity



Pressures

The pressures on the corridor that are resulting in increased demand or a reduction in levels of service for Access are the following:

- **Population growth:** The population in and around Hamilton is projected to grow by 1.3% per annum, and in the North Waikato villages of Tuakau, Pokeno and Te Kauwhata similar growth rates are also predicted. This growth will put pressure on the capacity of the transport systems at the northern end and increase demand for access to the corridor.
- **Land use changes:** Land use intensification and change in use from forestry and dry stock to dairy throughout the corridor is bringing increased freight movement between farm, factory and ports, resulting in greater demand on the corridor.
- **Increase in freight demand:** As road freight across the North Island increases (forecast to increase by over 59% in the next 30 years), pressure will be placed on key road and rail journeys along the corridor, particularly links to the South Island and international gateways like the Ports of Napier, Tauranga, and Auckland, and inland ports.
- **Private accesses:** Industrial access points require appropriate maintenance and turning facilities to be provided to correspond with traffic volumes. Sites such as Fonterra at Tirau and Tangiwai Sawmill on SH49 have growth forecast and may require additional holding areas or improved accesses for deliveries.
- **At grade crossings:** Railway level crossing approaches are designed to allow crossing of the state highway by motorised vehicles at right angles to the track. This limits the visibility on the approach and the presence of the rail crossing requires hazardous cargo to stop before proceeding across the tracks. The provision of at grade crossings on a national / national high-volume corridor can create some delay and conflict between modes.
- **Tourism:** The Tongariro crossing is increasingly popular running between Mangatepopo, with 65 car parks, and Ketetahi, with 35. Ketetahi is generally the pick-up point and with only 35 carparks, vehicles are often parked on SH46. The Department of Conservation is reluctant to increase parking in a World Heritage area. Further tourism sites are being developed as tourism increases.
- **Aged asset life:** The Desert Road has several old timber deck bridges which require replacement. Failure of these structures would result in significant delays and lengthy closures.

Future considerations

The future considerations relating to corridor pressures, intervention triggers and appropriate levels of investment related to Access are as follows:

- **Integrated land use planning:** With increasing urban development along and in close proximity to sections of the corridor, the NZ Transport Agency will need to work closely with the relevant local authorities and monitor demand on the transport network and intervene as appropriate to maintain customer levels of service.
- **Whole of life capital investment:** The design and construction quality of new assets on the corridor as identified in the PBCs will impact on type, frequency and cost of future maintenance. Planned improvements on the corridor will result in growth of assets on the corridor. Provision for adequate maintenance and renewal investment should be considered as these projects are committed.
- **Improved maintenance and operations**: Develop the systems and process to reduce the duration of weather related incidents particularly through the Desert Road. would assist in minimising the impact to customers.
- **Level crossings strategy:** Develop a strategy for level crossings on National ONRC rated corridors, including determining whether it is appropriate to have level crossings on National corridors. Additional freight volumes on the corridor will continue to impact the level of service for all vehicles on the National route.
- **Improved asset age:** Review policies about asset age on National ONRC highways and align the desired ONRC rating with an investment strategy to improve overall asset age. This will ensure the corridor is more accessible and has a lower risk of closure.
- **Multi-Modal corridor provision:** As the urban population grows in Hamilton, the role of public transport, walking and cycling in maintaining Levels of Service on the corridor will become increasingly important. Investment and maintenance programmes and activities in the corridor should be planned and designed and explicitly detail how the needs of each user are provided for.
- **Tongariro Crossing Parking Management:** Working with the Department of Conservation and Ngā ti Hikairo to develop a strategy to manage parking associated with the Tongariro Crossing could reduce vehicles parking on SH46. This could include for example a parking booking system, and shuttles for walkers from Taupo, Whakapapa and National Park.

Resilience

Vulnerabilities

The corridor's vulnerabilities increase further south along the route. Vulnerabilities include natural events as well as vehicle events which impact traffic movements on the corridor. Hazards and incidents in the northern section to Cambridge reflect the current road alignment and will be resolved following the completion of the Waikato Expressway.

The Taupo to Waiouru section is compromised by weather events and geology (land slip, rock fall, lahar and drop outs). Temperatures in Waiouru are extreme, ranging from -8 to 26 degrees. This section is affected by snow and ice.

There are localised flooding sites around the volcanic plateau loop as well as shaded sections that result in ice during winter. Snow and ice, as well as wind, affect the Desert Road.

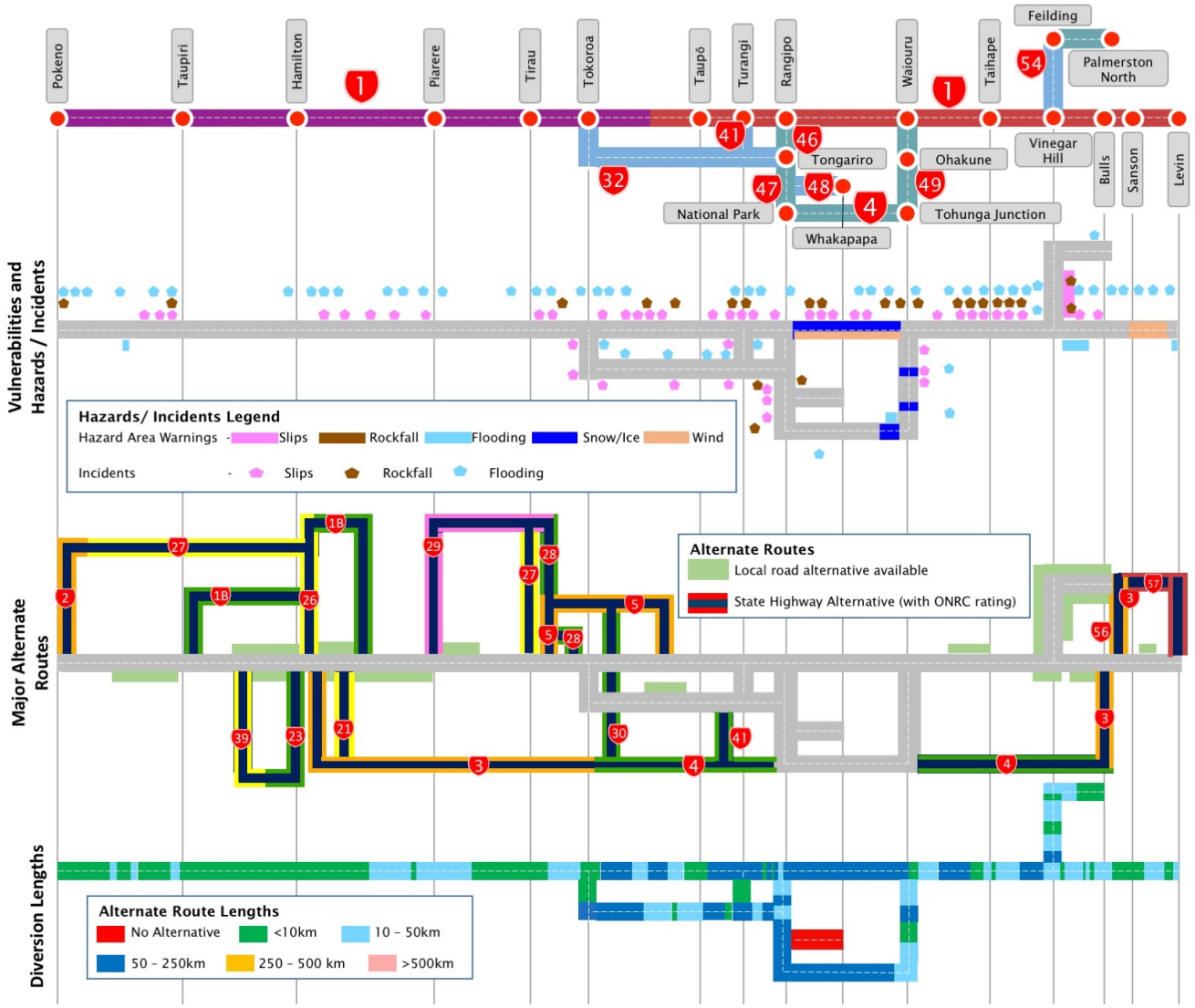
The southern end of the corridor experiences flooding and cross winds due to the flat plains between Bulls and Levin.

Alternative routes and diversion lengths

The northern section of the corridor has good alternative route choice. The central section between Taupo and Waiouru has no or limited alternative routes. Any diversion on this section due to planned or unplanned events adds considerably to journey time.

Between Waiouru and Hunterville there are limited alternative routes. For HMPVs the alternative detour route between Turangi and Bulls is via New Plymouth and Hamilton.

Figure 12 – Resilience



Closures and duration

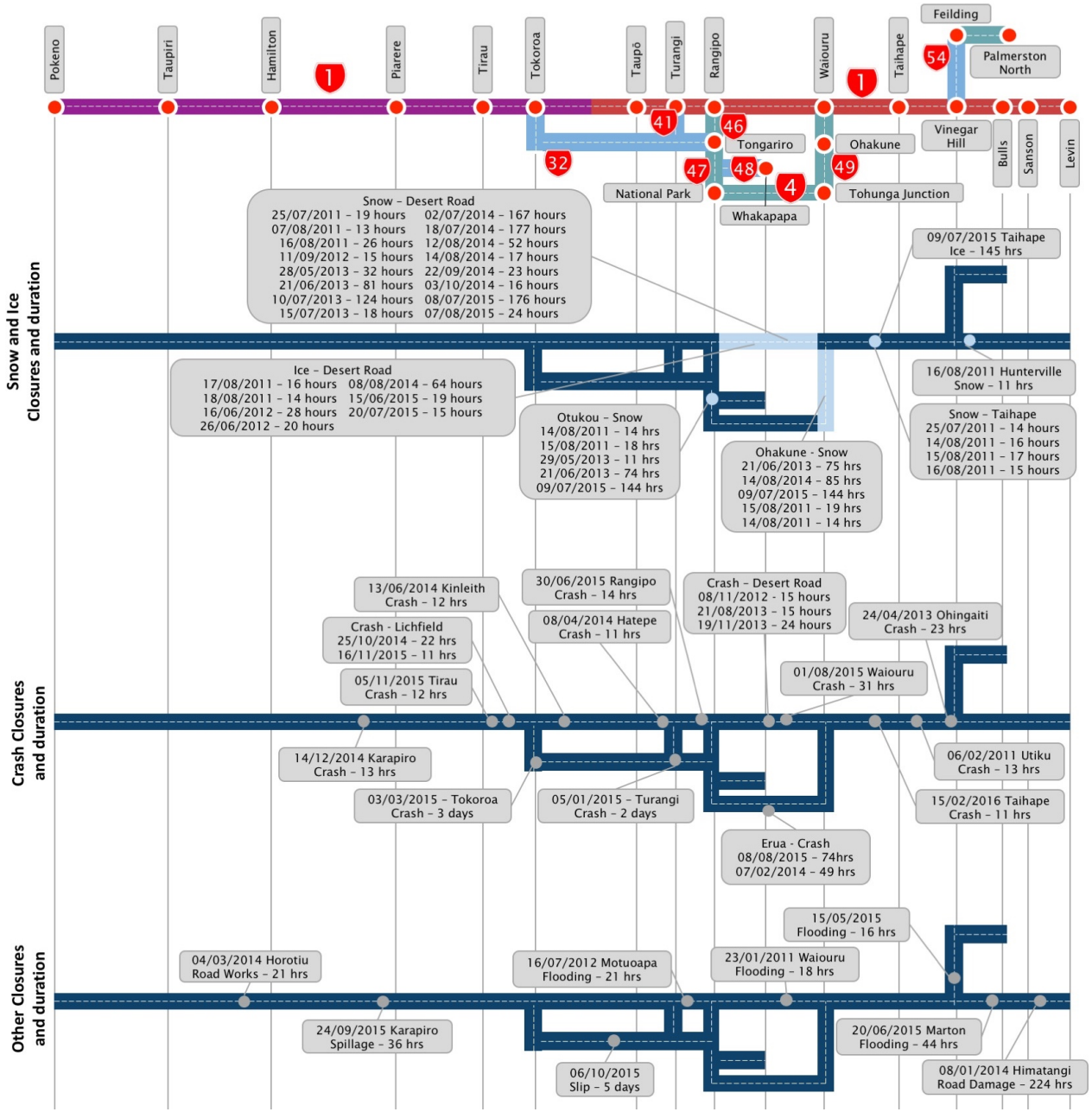
The major unplanned road closures and duration of interruption along the corridor in the last 5 years are shown in Figure 13.

For a national strategic route, sections of the corridor are closed more frequently than desirable. A comprehensive management plan is in place particularly around the Desert Road and the alternative highway to minimise disruption. This involves preventive and responsive management to weather events that could result in road closures. Further systems and processes are being developed to increase the availability of the Desert Road section.

The incidence of long periods of closure increases further south along the corridor where the likelihood of ice and snow is greater.

Weather events are the main cause of long periods of closure on the Desert Road, with closures north and south of this more likely due to crashes. SH49 is subject to lahar flows at the location of O Tangiwai Reserve. SH46 is typically shut at the same time as SH4 for snow.

Figure 13 – Resilience: closures



Pressures

The pressures on the corridor that are resulting in increased demand or a reduction in levels of service for Resilience are as follows:

- **Road closures:** Weather, other natural events, and crashes result in closures and delays. Some vehicle classes, particularly heavy vehicles and HPMV, are unable to turn around in sections of the corridor to take alternate routes when roads are closed at short notice. They are parked up on the roadside until the road reopens. The ability to recover as quickly as practicable from these events is necessary to keep business deliveries on schedule.
- **Roadside shading:** Shading from trees or rock formations adjacent to the roadside results in icy conditions on inclines on the volcanic plateau loop which are impassable for trucks. Improving the maintenance operation programme to target these areas for treatment when conditions are expected to deteriorate can improve resilience.
- **Under slips:** SH1 alongside Lake Taupo is subject to under slips. A sudden failure would result in road closure and disruption for a considerable length of time. There is a reactive approach at present to management of the asset. Similar issues are prevalent on SH4 around the Makatote River.

The Southern Links project aims to develop an effective transport network of state highway and urban arterial routes to support Hamilton's planned growth.

Future considerations

The future considerations relating to corridor pressures, intervention triggers and appropriate levels of investment related to Resilience are as follows:

- **Rapid response strategy:** Implementing a strategy to enable a more rapid response to incidents will have the corridor open quicker. This could include making better use of the data from weather stations to improve the ability to forecast and improve management of unplanned events. This would also assist with winter operational maintenance programme planning and pre-event management enabling a pro-active approach to events where possible. Equipment could be located in strategic areas facilitating faster response time for unplanned events. Focus on the teams and equipment on the volcanic plateau and Taupo Lakeside.
- **Improved mobile phone coverage:** Work with telecommunications stakeholders and the Ministry of Business, Innovation and Employment to improve mobile communications, particularly around the volcanic plateau. This will help provide real-time information to users and earlier information to first response teams.
- **Communication and information**: New and improved information warning measures including real time information allow for improved journey planning for all customers. Providing information before events and incidents to enable decisions is also important, such as understanding the location and nature of a closures. At times, it may be quicker to wait for works to be completed than to drive the detour. Improvements to the permanent detour guidance and traveller information systems along the length of the corridor will enable customers to make timely decisions about their journey. Focus on the Desert Road, volcanic plateau, and Bulls to Levin sections where delays and closures are more prevalent.
- **Monitoring of vulnerable areas**. Identification of high risk areas on the corridor, and monitor these more frequently, possibly in real-time. This would provide earlier warning of potential events, enabling proactive management measures to be considered, including maintenance responses and signage at appropriate locations to inform customers. For example, on the volcanic plateau loop road there is on-going slipping at Makatote stream, and around Lake Taupo.

Reliability and efficiency

Efficiency

Lower levels of service are experienced around nearer the urban centres and larger towns. Projects currently under construction will address this in Hamilton. Completion of the Waikato Expressway will significantly improve the level of service between Pokeno and Cambridge. South of Hamilton, the Cambridge bypass has addressed the lower levels of services shown since the data was collected.

The lower level of service on the Desert Road is due to poor road alignment at the Three Sisters. From Waiouru south the lower levels of service are associated with geographical features and urban environments.

Variability

Variability measures standard deviation of speed and mean speed for sections of the corridor on weekdays. There is low to very low variability along a significant length of the corridor. Very high variability is identified in Hamilton and Cambridge, the latter has been addressed with new infrastructure. Piarere to Tirau, and Taupo to the intersection with SH5 have medium levels of variability.

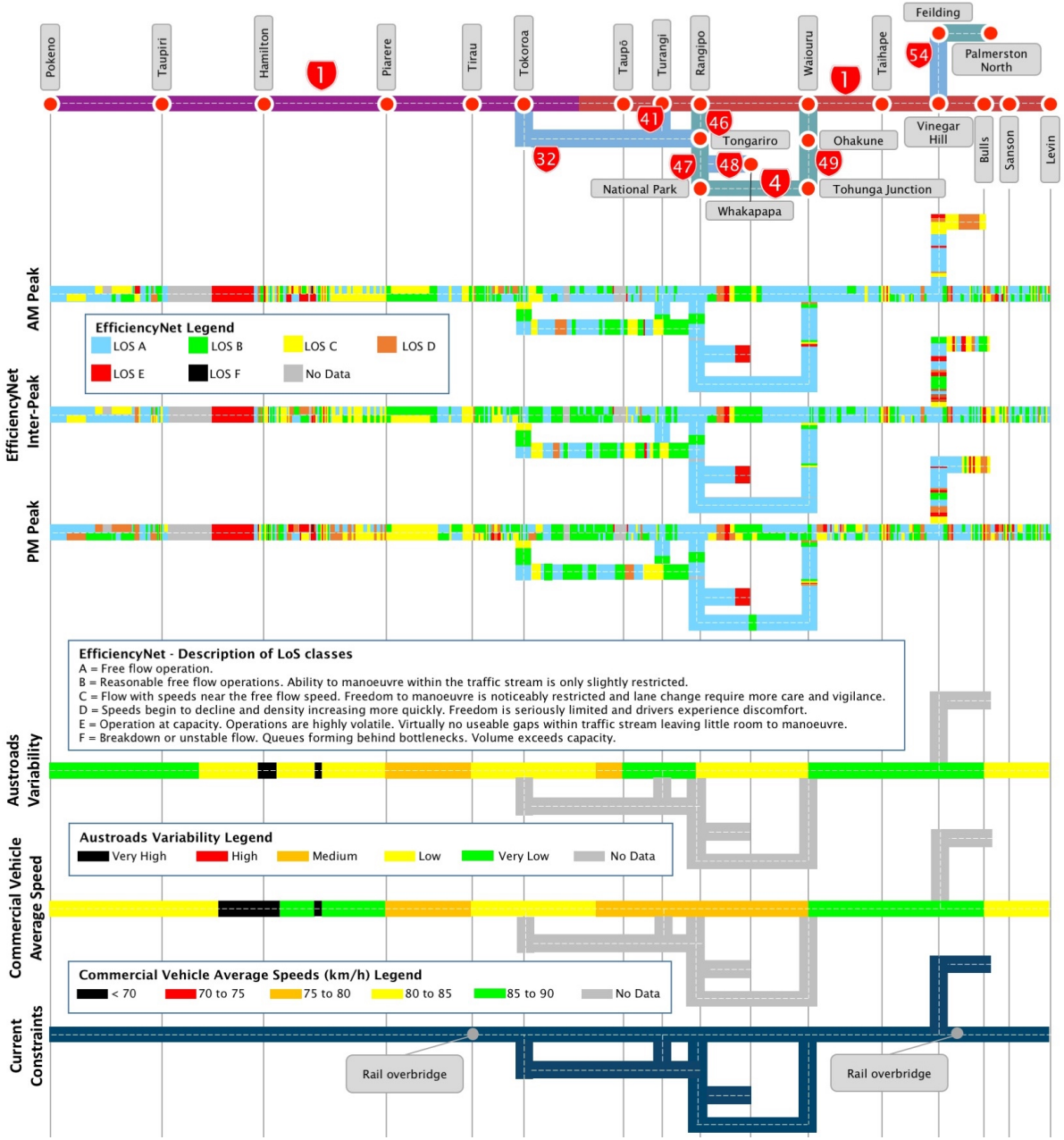
Commercial vehicle average speed

Average speeds through the Hamilton urban environment are below 70 km/h. The Cambridge section has been bypassed since this data was published. The corridor has good average speeds except for two sections around Hamilton, and from Taupo to Waiouru.

Current constraints

The major current constraints on the network affecting journey reliability and efficiency are shown in Figure 14. The only constraint is the rail bridge north of Marton which has a height restriction of 4.4 m. There is an alternative over dimension vehicle route provided on the local road network.

Figure 14 - Reliability and efficiency



Pressures

The pressures on the corridor that are resulting in increased demand or a reduction in levels of service for **Reliability and Efficiency** are as following:

- **Urban development:** High growth is currently occurring in the northern areas of the Waikato District around Pokeno, between Bombay and Mercer (the most northern extent of the corridor). This will put increasing volumes of traffic on the corridor, which will require maintenance activities to be carefully managed to ensure the efficiency gains of the expressway are maintained in the short and medium term.
- **Vehicle speed differential:** Travel speeds vary along the corridor significantly because of the geometry of the road, environmental factors and townships (where there are lower speeds). This is particularly prevalent on the exit from townships where differences in speed between vehicle classes exist (different acceleration rates for light and heavy vehicles). HPMV vehicles need to reduce speeds because of the condition of the road (gradients and corners), this then impacts other vehicle speeds.
- **Just in time deliveries:** There is an increased demand for freight to deliver 'just in time' deliveries. This requires the corridor or an alternate route to be available 24/7 to meet business needs, with equivalent journey times on the alternative provided if the corridor is closed.
- **Communication:** The need for prior warning when planned and unplanned road closures /delays occur affect the reliability of the route particularly between Taupo and Waiouru where 22 full closures occurred between 2011 and 2016.
- **Seasonal effects:** During holiday periods, there is a significant increase in traffic volume on the corridor, especially between Pokeno and Taupiri, and around Taupo traffic where volumes can increase by 30% or more during long weekends and during the summer. This brings the per lane volumes close to capacity (20-22,000). Similar increases on the Bulls to Sanson stretch are experienced and impact on pedestrian crossing movements particularly in the urban area.
- **Limited data:** There is poor understanding of traffic patterns within the Hamilton urban area during peak periods, and the impacts of this on the SH1 corridor. This makes the rationale of efficiency improvements difficult.
- **Competing user requirements:** There are several locations along the corridor and specifically by the Taupo lakeside (Waitahanui and Bulli Point) and the Tongariro Crossing that are used for recreational activity. Conflicts between parking, pedestrians, and through movement require management to maintain reliable journey times.

Future considerations

The future considerations relating to corridor pressures, intervention triggers and appropriate levels of investment related to **Reliability and Efficiency** are as follows:

- **Geometric improvements:** Increasing clearance for passing vehicles coupled with additional maintenance through the Three Sisters on the Desert Road will provide more reliable journeys. Realignments between Taupo to Waiouru will provide a more reliable and efficient corridor delivering significant benefits to the freight industry with greater journey time certainty.
- **Passing opportunities:** Improving passing opportunities on the exit of urban areas will allow slower vehicles to be passed, improving journey time reliability for customers and reducing driver frustration. Locations between Piarere and Taupo, and north of Levin would benefit from more passing lanes.
- **Maintenance programme co-ordination:** Coordinating routine and programmed maintenance activities would minimise the number of short term lane closures during peak and high trafficked hours without compromising safety.
- **Customer information:** Improving information available to customers on the corridor and through other media when unplanned and planned events occur would enable more proactive decision making. Increasing awareness of the tools available to customers to inform their journey planning is also necessary.

Oversize load on SH1 Waiouru

Safety

Collective risk

The collective risk rating for the corridor is varied and while it is predominantly low or medium-low, there are 11 segments of medium-high (particularly between Vinegar Hill and Levin) and one small section of high collective risk immediately before Taupiri.

Personal risk

The corridor is generally rated low for personal risk although the approach to Tongariro (SH46) and the National Park (SH47) are rated high risk. SH4 has a rating of medium and medium-high personal risk. SH54 from Vinegar Hill to Fielding is rated medium-high at the end of the route segment and low in the middle.

Star rating

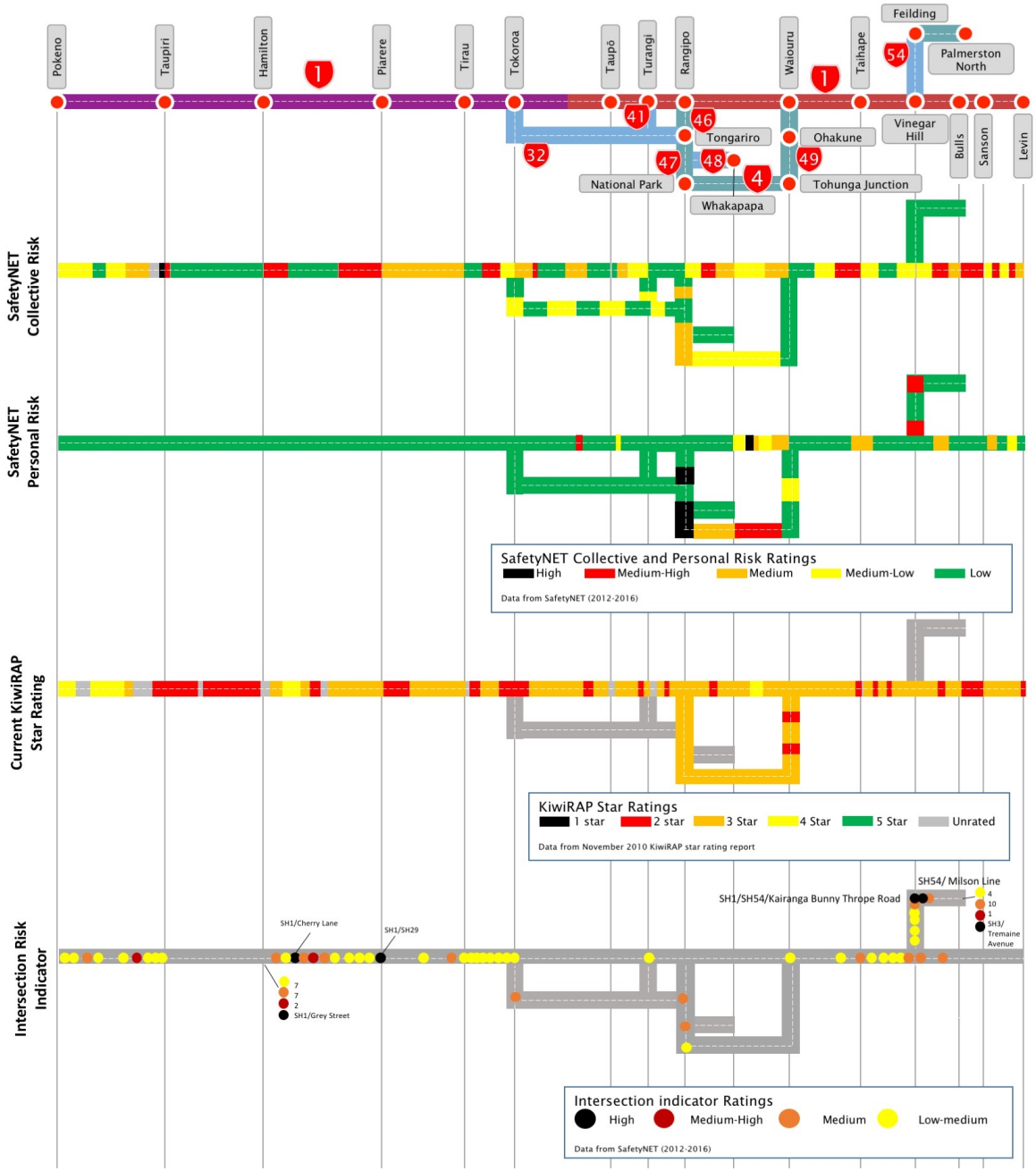
For a National High-volume road such as SH1 from Pokeno to Levin, the corridor has a target 4-star rating. Much of the corridor fails to meet the target rating and is rated either 2 or 3-star. Between Taupiri and Hamilton it is rated 2-star. Large sections of the corridor are unrated including SH32, SH41, and SH54.

Intersection risk indicators

There are six high risk intersections along the corridor. Three high risk intersections are located on SH1 from Hamilton to Piarere.

Three high risk intersections are located within the urban areas of Fielding and New Plymouth along SH54. There are large sections of the corridor with no intersection risk rating.

Figure 15 - Safety



Pressures

The pressures on the corridor that are resulting in increased demand or a reduction in levels of service for Safety are as follows:

- **Road environment:** The unforgiving nature of the corridor between Rangipo and Waiouru contributes to a high number of crashes from head on collisions and run-off road crashes (on sections with low star ratings typically 3-star – these coincide with out of context curves and unsafe roadsides). Further, narrow bridges on SH45 necessitate the slowing of heavy vehicles to navigate them.
- **Fatigue:** The central section of the corridor is within a 3-4 hour driving window from Auckland and Wellington, the time at which fatigue sets. Underreporting of fatigue as a crash cause is considered likely to be affecting the safety record for the corridor.
- **Waikato Expressway completion:** The opening of the expressway in 2020 will result in changing travel patterns. This may create flow on effects on local roads and the corridor at other locations, and resultant change in safety issues for the corridor.
- **Changing standards:** Older sections of the Waikato expressway and the Eastern Taupo Arterial were constructed to different engineering standards than current and planned improvements. This results in inconsistent intersection design in particular, which can result in higher risk locations with design speeds of slip roads not meeting driver expectations for the ONRC level.
- **Star rating reduces with traffic growth:** Traffic volumes form part of the KiwiRAP Star Rating process and increasing volumes and higher growth in the Waikato may result in the downgrading of star ratings unless there are accompanying infrastructure improvements.
- **Increased urban growth:** Increased urban growth in centres along the corridor increases trips by all modes increasing conflict between different road users, and requiring infrastructure to be adapted to cater for different users. For example, in Hamilton increased provision of crossing locations for pedestrians and cyclists within the urban area will be required.
- **Improving standards for road safety hardware:** There are assets on the corridor which do not meet current safety standards. For example, sight rails at bridges are common throughout the corridor such as at the Waiharuru Stream bridge on SH49.
- **SH29 intersection:** The existing configuration causes customer lane confusion

Future considerations

The future considerations relating to corridor pressures, intervention triggers and appropriate levels of investment related to Safety are as follows:

- **Short to medium term improvements along the Desert Road:** Safety measures including high skid resistance and/or achieving better compliance with advisory speed signage through the Three Sisters will improve short-term safety outcomes. Longer term realignment of the corridor between Taupo to Waiouru as described above in reliability and efficiency will provide significant benefits to the freight industry. This could include realignment at the Three Sisters and between Hatepe Hill and Motuoapa.
- **State highway intersection improvements:** Consider a plan to upgrade existing state highway intersections to current ONRC standard to improve safety and reduce crashes. This will require monitoring and review of geometrical design of all intersections with adjoining State highways.
- **Hazard protection:** Improved hazard protection at locations where poles create roadside hazards, especially on the volcanic plateau loop, will improve safety outcomes.
- **Advance signage:** Installation of advance warning of road conditions during winter on the volcanic plateau sections of the corridor and before Hatepe Hill will allow customers time to change their route or adapt their driving style to the conditions. Such tools can also assist drivers on the approach to intersections that are not at the current standard. Ensure signage on older slip roads is adequate to advise drivers of sudden changes in geometry and provide additional warnings or safety protection where possible.
- **Driver information and education:** Develop and deliver an education programme in partnership with other organisations to upskill all customers on the corridor on changing weather conditions, geography and fatigue, particularly in winter.
- **Eastern Taupo arterial improvements:** A median rope barrier on Eastern Taupo Arterial will improve safety outcomes on this section of the corridor.
- **Understand customer expectations:** Survey long distance and local customer use through townships to clearly determine expectations of each user, including pedestrians and cyclists. Implement outcomes of the work with a focus on safety issues.

People, places and environment

Natural environment

The corridor passes through a wide range of natural and rural landscapes creating an interesting and varied journey. Of significant note are the volcanic landforms in the central parts of the corridor and the steep incised valleys of the Rangitikei areas that represent significant geological and ecological values. Vegetation varies across the network with greater natural values through the central plateau requiring more focussed management for pest plants, and needs related to conservation land and agreements with stakeholders.

A variety of freshwater habitats are crossed by the network, the most sensitive being in the central volcanic plateau. Freshwater habitats have conservation values and cultural significance to Maori. The Waikato River and Taupo lake environments add to the journey experience.

Noise, vibration and air quality

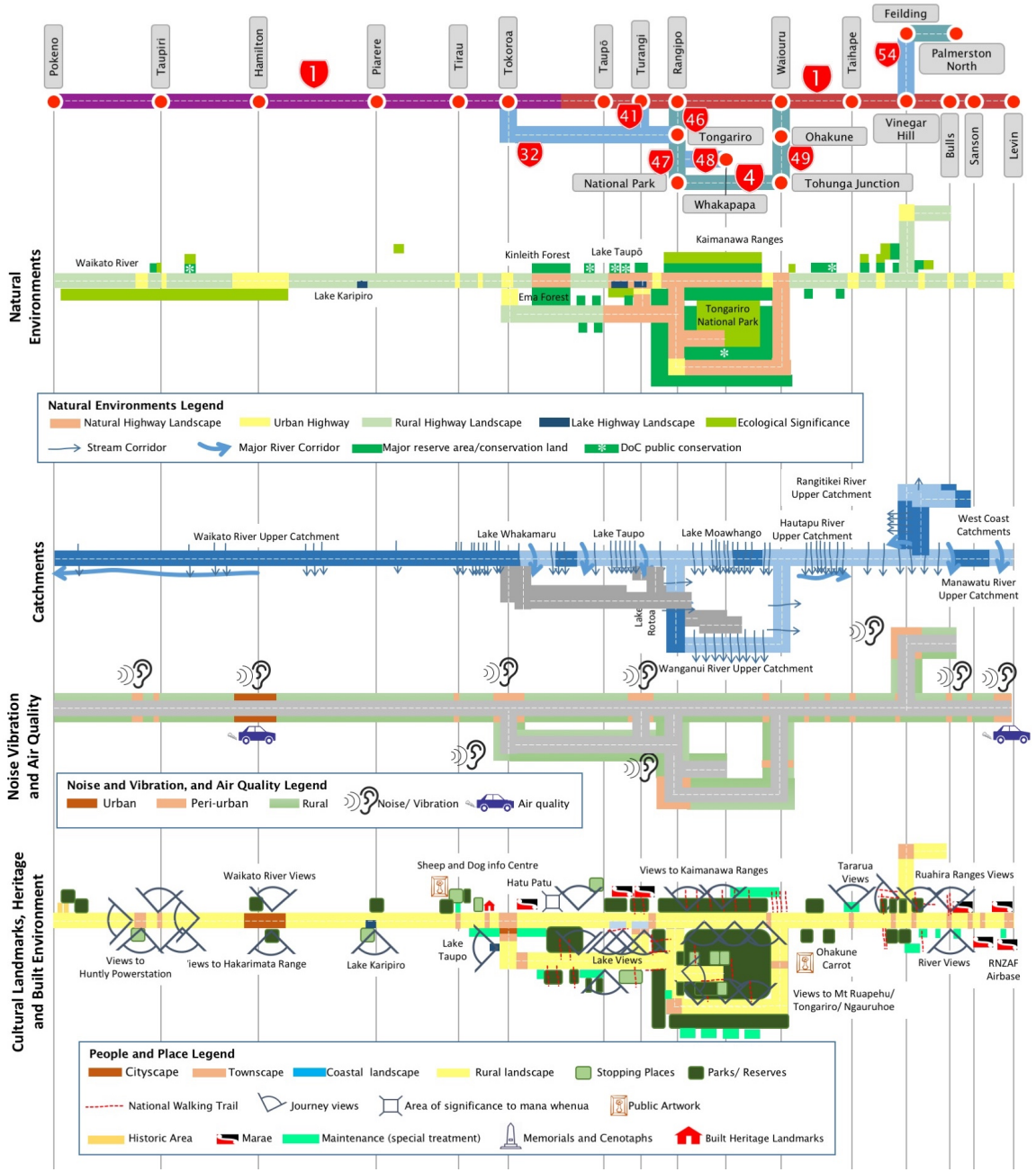
Noise and vibration issues have been identified through the urban areas along the corridor. The Waikato expressway has been designed to address noise issues at the northern end of the corridor. Air quality around Hamilton and between Bulls and Sanson at the southern end of the corridor are due to high traffic volumes and slow speeds through urban areas.

Cultural landmarks, heritage and built environment

The corridor has numerous viewing points that enhance the customer journey experience. There are structures in urban areas that provide visual landmarks to visitors. Existing urban communities provide the main facilities along the corridor for drivers to rest. During the skiing season in Ohakune there is high demand for on-street parking which can impact speeds of through traffic.

National walking trails run parallel to the corridor through the National Park and in Manawatu between Taihape and Bulls. There are no national cycle trails identified near the corridor.

Figure 16 – People, places and environment



Pressures

The pressures on the corridor that are resulting in increased demand or a reduction in levels of service for **People, Places and Environment** are as follows:

- **Vegetation Management:** Vegetation along and beside the corridor requires pest plant control, particularly in areas with high natural values such as conservation land managed by the Department of Conservation. In addition, new infrastructure has increased natural landscaping components which improves the customer experience. Some natural landscaping, such as grass which has regular mowing requirements, increases pressure on operational maintenance budgets.
- **Stormwater management:** Throughout the corridor there are a variety of sensitive freshwater environments which experience discharge and nutrient run off. Streams in the central plateau support sensitive native plants and aquatic animals as well as recreational fish such as trout which require specific maintenance practices.
- **Demand for stopping places:** There are numerous locations along Lake Taupo for traffic to stop, however the level of facilities provided at each site and the advance warning of sites is inconsistent. Maintenance of facilities is seasonal with additional resources required during summer months and after long weekends.
- **Pavement protection:** The water table between Motuoapa and Turangi is relatively high placing additional maintenance requirements on this section to keep water off the road, or to repair and replace pavement as necessary.
- **Material selection and maintenance standards:** Noise complaints from residents generally are a result of material selection or poor maintenance/construction (poor seal joins for example). Using chip sealing close to residential properties in rural areas, or through smaller townships increases noise from vehicles and subsequently complaints.
- **Speed:** through peri-urban areas. Speeds through Motuoapa at night time are high resulting in complaints from the local community.
- **Traffic growth and air quality:** Air quality around Hamilton and in Levin requires monitoring. As growth increases in urban areas, complaints from communities' increase. Accurate information to better quantify potential issues is necessary to develop effective management strategies.
- **Tourism:** There are sites along the corridor of cultural and spiritual significance which also provide tourism and historic value to the region and country. Additional tourism numbers require higher levels of maintenance of facilities and access.

Future considerations

The future considerations relating to corridor pressures, intervention triggers and appropriate levels of investment related to **People, Places and Environment** are as follows:

- **Understand and address noise and vibration impacts:** Data collection to better understand noise and air quality issues will provide information to more effectively work with communities to manage expectations, and meet consent conditions. Also consider speed management reviews in urban areas.
- **Stopping place strategy:** Appropriately located stopping points along the corridor will ensure visitors are provided with safe places to stop, take photos and learn more about sites of cultural and spiritual significance. Include an audit all facilities in areas and determine requirements for each site together with maintenance requirements and budgets. Consider how increasing tourist numbers can be catered for at sites.
- **Heavy vehicle stopping places:** Work with the freight industry, councils and other agencies to identify and develop well designed heavy vehicle stopping areas with good facilities. This will enable heavy vehicles to stop and drivers to swap over, rest, shower and get a good meal. Tirau and Turangi in particular could be considered. Tirau provides a connection to the SH5 corridor with links to other areas, and will help address changing travel patterns from investment upgrades that are enabling longer distances to be travelled before breaks are required. Review existing facilities along the corridor and implement a plan to provide agreed levels of service. This may include using urban centres or towns not directly on the corridor as service centres.
- **Improve maintenance practices:** Maintain or improve maintenance practices to improve the customer experience. In particular, focus on the quality of sensitive fresh water courses, ensuring all consent conditions are met or exceeded through continually improving maintenance practices of stormwater assets and the final finish of physical assets such as service covers, structure joints, pavement and reseal work to reduce noise and vibration impacts.
- **Landscaping management:** Identify alternatives to grass as lower cost whole-of-life solutions that meet Customer Levels of Service. Share learnings from the Waikato Expressway with capital works and project managers around the country on NZ projects as well as feeding learnings into policy reviews.

Understanding the infrastructure assets

The following sections contain information about the condition and performance of the state highway assets within the corridor. This information is necessarily complex and therefore challenging to communicate simply. Every effort has been made to explain the base data inputs and what the information is describing in as simple terms as possible, however full comprehension does require some technical knowledge of the terms used.

Corridor asset base

The state highway system is a significant national asset, made up of 11,563 km of roads and associated assets. This corridor contributes approximately 911 km of road network which reflects 8,0 % nationally. The total value of the assets along the corridor is $1,560M (excluding ITS, and, heritage and green assets).

The corridor assets have been divided into eight groups as shown in Figure 17 which directly support the access, reliability and efficiency, safety, resilience and people, places and environment outcomes on the network.

Asset condition and performance summary

The infographic shows the summary score the entire corridor achieves for each of the eight measures used in this document to assess the condition and performance of the assets. These measures are assessed in more detail along the corridor in the following sections of the document.

Figure 17 – Corridor asset base

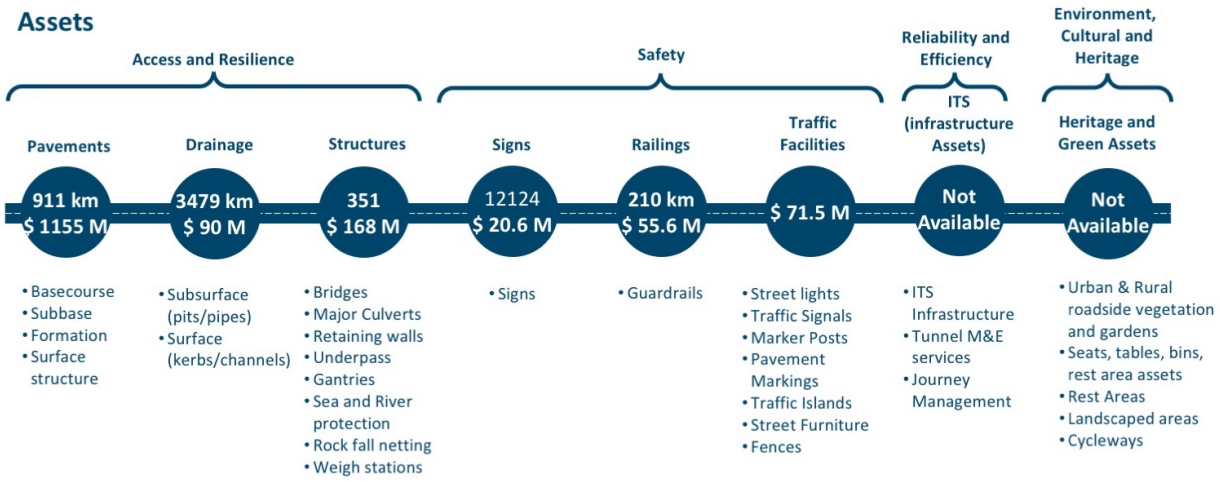


Figure 18 – Summary asset condition and performance

Asset condition and performance

Surface skid resistance

The infographic shows the proportion of the Route Section, as a percentage, that falls within the two levels of either threshold limit or investigation level. The change in Surface Skid Resistance infographic shows the change in the levels from the 2014 survey to the 2016 survey, as either an improvement or degradation.

The information is derived from inspection data that records a value every 10m in each direction. Each 10m length is rated as to whether it is within one of the bands: below threshold limit; within investigation limits; or above Investigation limits. The proportion is then the number of 10m lengths in that section as a percentage of all 10m lengths in that section.

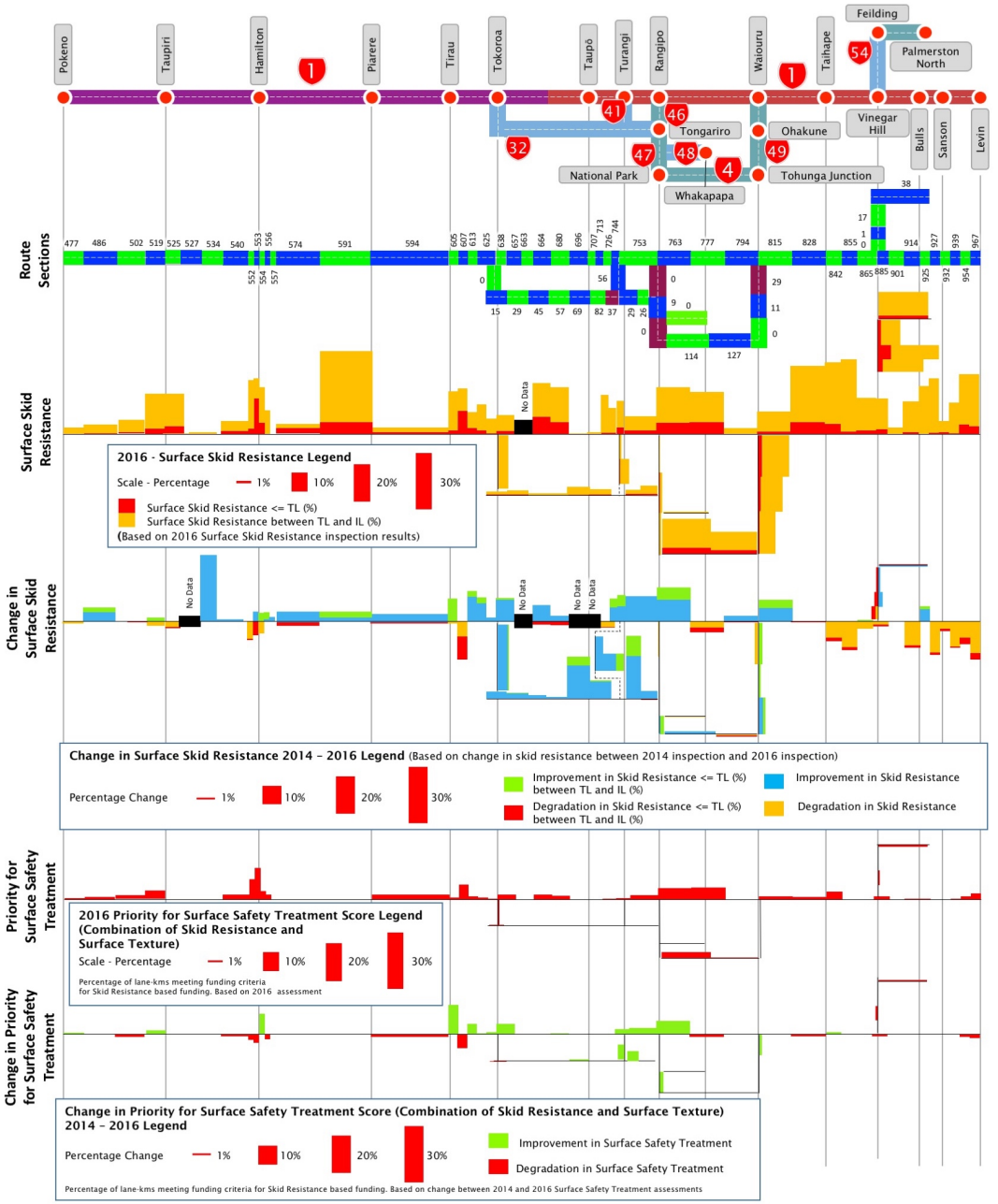
Surface skid resistance results have generally improved markedly along the corridor, north of Taihape. The exceptions are at SH1 RS525, RS552 to 554, RS607, RS664&680 and RS77, where surface skid resistance has degraded to below the Threshold Level, TL. Almost the entire southern end of the corridor, Taihape to Levin, shows an overall degradation in surface skid resistance with much of the length within the Investigation Levels, IL.

Priority for surface safety treatment

The infographics show the proportion of the Route Section that has a Priority for Surface Safety Treatment (Skid Assessment Length) that would qualify for funding, i.e. a score >140. The second infographic shows the change in these levels from the 2014 survey to the 2016 survey, as either an improvement or degradation.

Taken from inspection data that is normally recorded every 100m in each direction. Each 100m assessment length is rated and if it achieves a score over 140 it qualifies for funding. The proportion is then the length of route section that qualifies for funding as a percentage of the total length of that section.

Figure 19 – Asset condition



Skid Assessment Lengths that qualify for funding occurred across the corridor. The worst sites were: North of Hamilton, RS 540 to RS 554 and South of Tirau RS 607, where both areas have a high priority for surface safety treatment and a corresponding poor surface skid resistance. RS594 shows a degradation in priority for surface safety treatment, but an improved surface skid resistance.

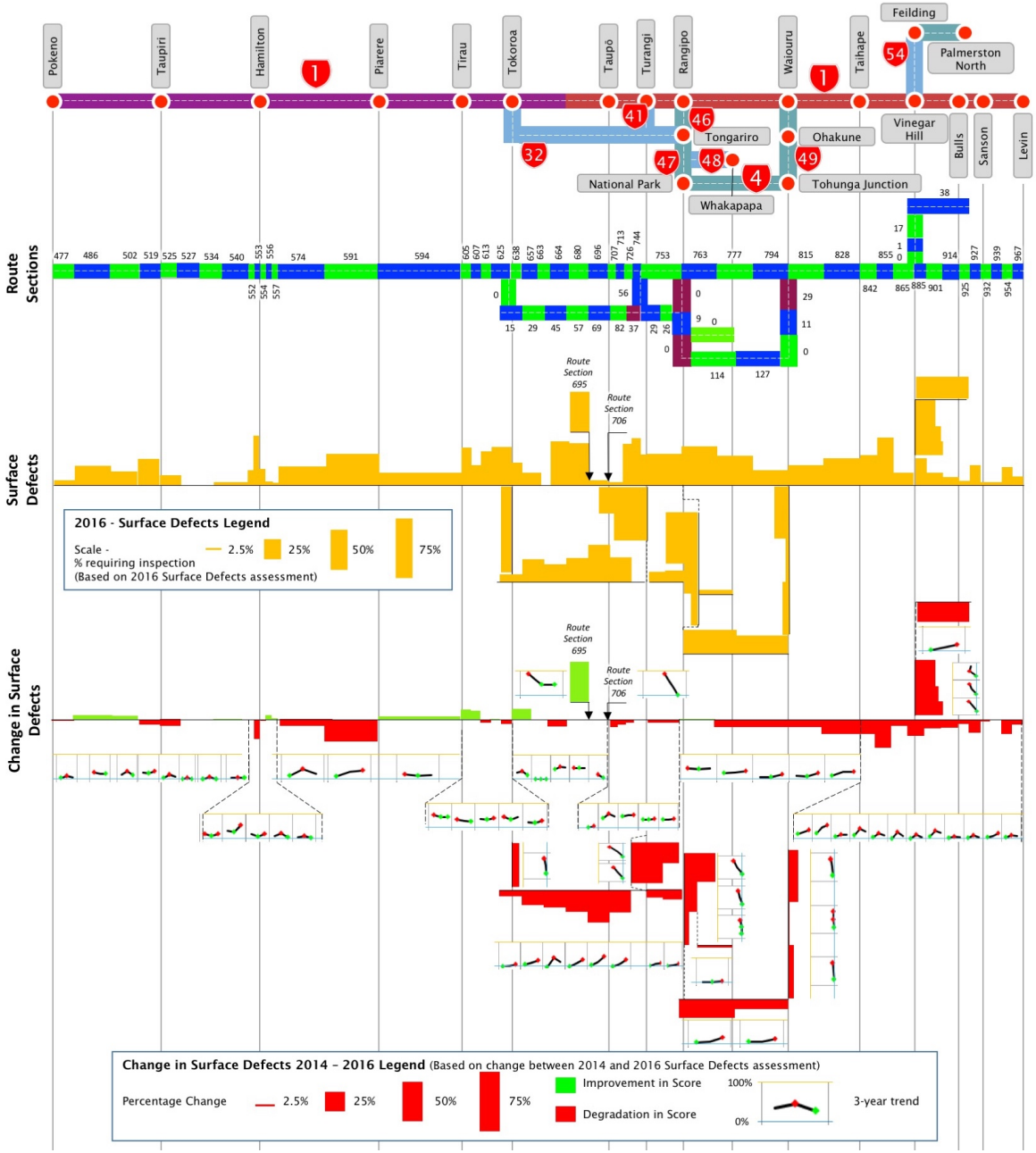
Surface defects

The infographics show the proportion of the Route Section that has a Surface Defects (100m Priority) score that would signal the need for further investigation, i.e. a score >20. The second infographic shows the change in these levels from the 2014 survey to the 2016 survey, as either an improvement or degradation, as well as the three-year trend.

The Surface Defects score is made up of a number of measures which all contribute to the overall score including: roughness, rutting, shoving, flushing, and design life. Any 100m section achieving a score over a total of 20 rates as flagged for inspection. The proportion is then the length of corridor that is flagged for inspection as a percentage of the total length of that section.

Overall, 24% of the corridor achieves a score above which inspection is required. Sections with significant lengths of surface requiring inspection include: 1N/553 Lorne Street in Hamilton, 1N/591 north of Piarere, 1N/885 south of Taihape, 46/0 Lake Rotoaira Road, and 4/114 south of National Park. These sections also show a significant level of degradation in score over the last three years.

Figure 20 – Asset condition 2



Surface age

The infographic shows the weighted average age of road surface, and the proportions of surface age that fall within the three age bands.

The base data is all the seal lengths and their age from RAMM. Then a weighted average is then calculated. Overall, all sections add up to 100%. The proportion is the length of corridor in a particular age band as a percentage of the total length of that section.

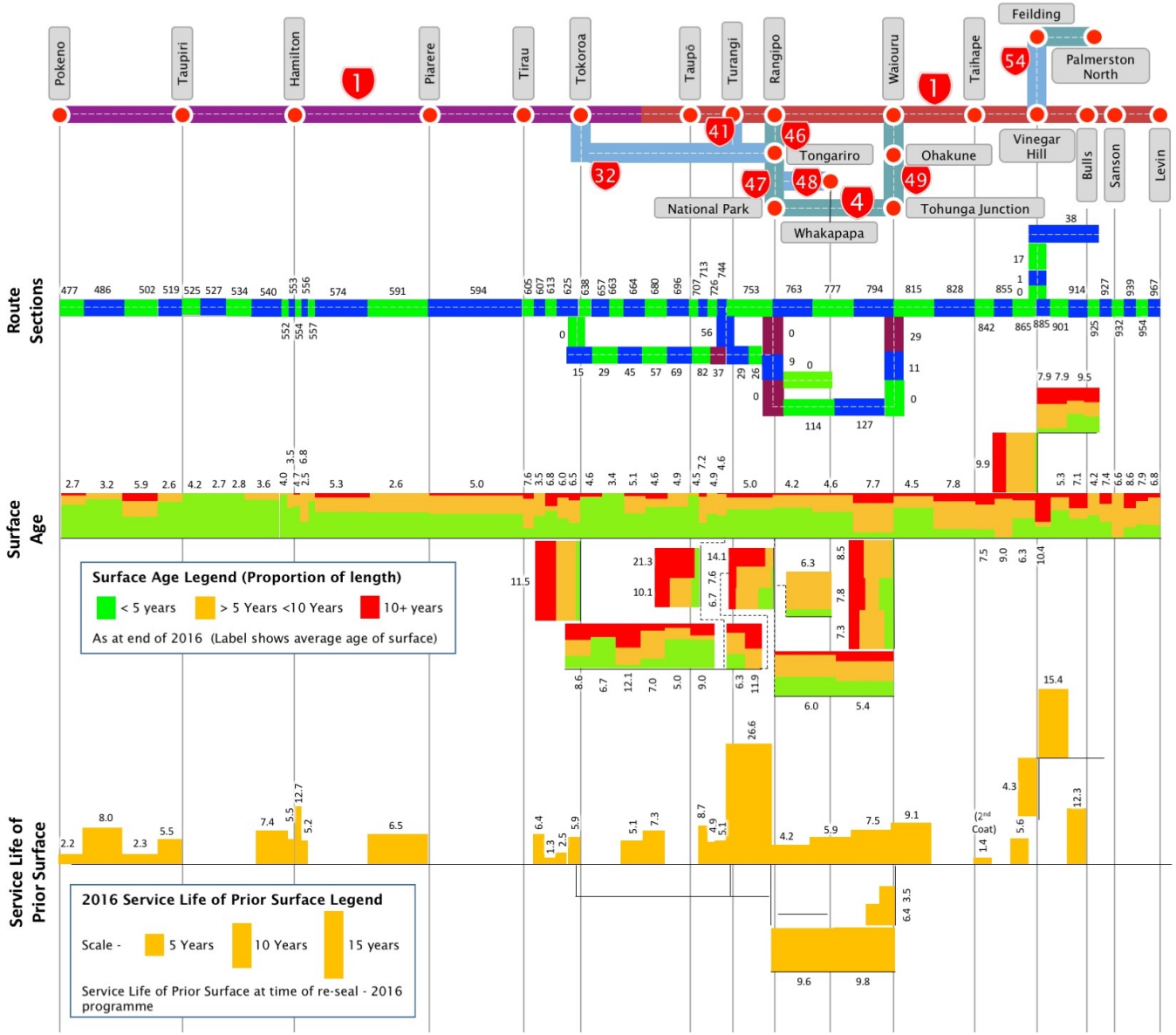
The sections of corridor with the oldest age profile are 1N/794 north of Waiouru, 46/0 Lake Rotoaira Road, 1N/828 north of Taihape, and 1N/885 between Utiku and Mangaweka.

Service life of prior surface

The infographic shows the weighted average age achieved for the sections of road surface that were resurfaced in the last financial year (2015-16). The infographic only shows sections where re-surfacing work was undertaken in the 2015/16 season. The value is derived from the weighted average age of the sections of seal that were overlaid by a new first coat seal. This is a standard ONRC measure.

Generally, an average service life of around 6 years or greater was achieved for most sections that were resealed in the last year. The section of corridor along SH4 achieved a service life of nearly 10 years.

Figure 21 – Asset condition 3



Resurfacing

The infographics show the proportion of Route Sections planned for resurfacing in the 2016/17 and 2017/18 approved annual plans, confirmed through the RAPT tour, as an indication of the response to the surface condition described previously, and current surface condition.

The major resurfacing works are planned for the section between Tirau and Tokoroa, and north of Wairakei, with significant works planned for South of Turangi, SH49 West of Waiouru, SH4 north of Tohanga Junction, and near Ohakea.

Proportion of travel on smooth roads

The infographic shows whether the route section passes the ONRC standard for Proportion of Travel on Smooth Roads (Smooth Travel Exposure). 97% is the ONRC target for proportion of travel on smooth roads. The infographic simply shows whether the route section achieves this level or not.

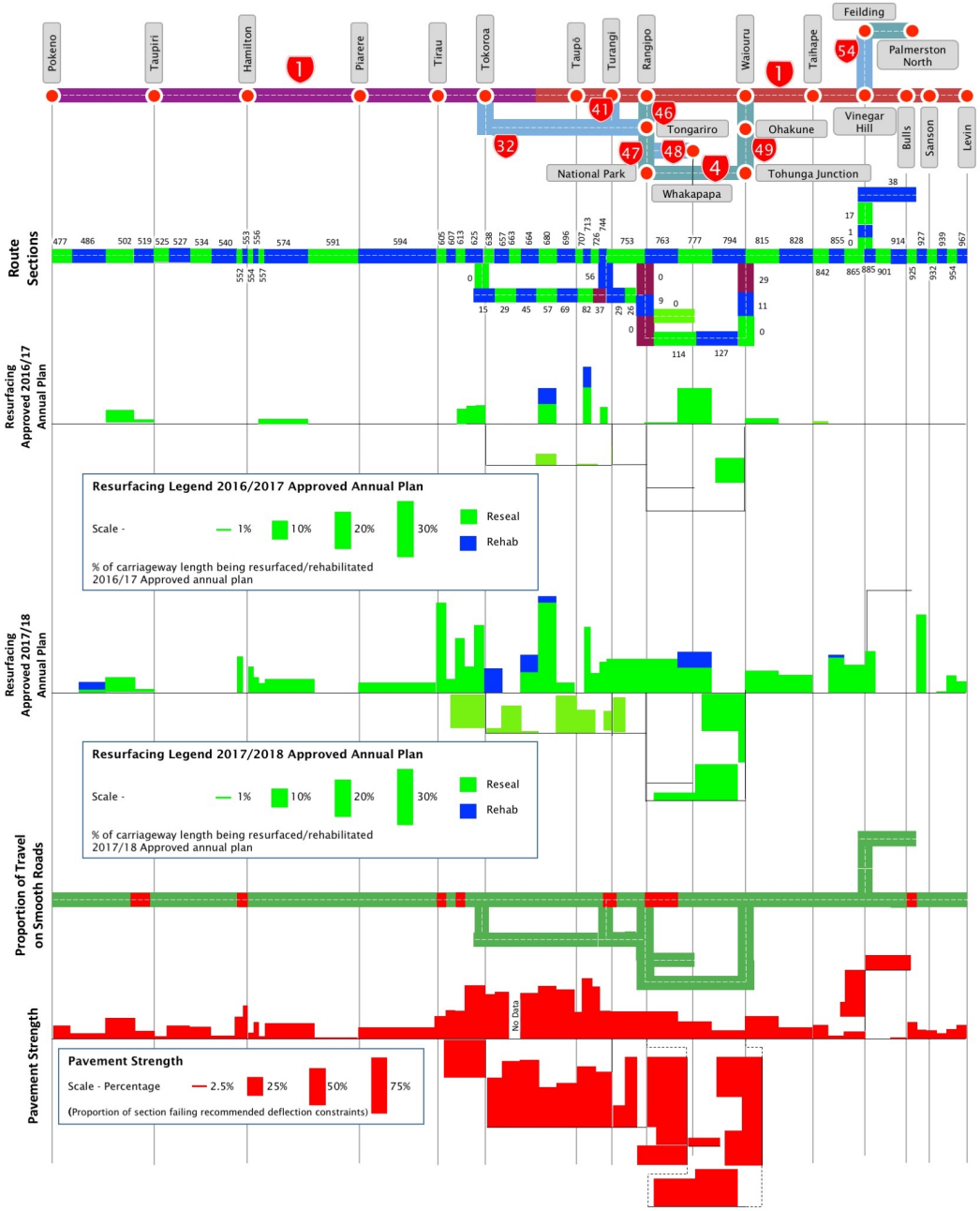
Sections of the corridor that fail to meet the standard for proportion of travel on smooth roads includes: SH1N/525 through Taupiri, SH1N/RS553 and 554 in Hamilton, SH1N/605 through Tirau, SH1N/613 south of Putaruru, S1N/726 in Turangi, SH1N/763 south of Rangipo, and SH1N/925 in Bulls.

Pavement strength

Recommended deflection constraints for thin asphaltic surfaces is used as a measure of pavement strength. The infographic shows the proportion of the Route Section that fails to achieve the recommended deflection constraint for the classification of road, based on lane-km.

The sections of corridor with the highest proportion of pavement failing to meet the deflection constraints occur predominantly around the Lake Taupo loop and the central plateau loop.

Figure 22 – Asset condition 4



Asset condition and performance pressures

The pressures on the corridor that are resulting in increased demand or a reduction in levels of service for **Asset Condition and Performance** are as follows:

- **Weather events:** During winter, snow is moved to the shoulders of the carriageway where it freezes and later melts. This results in pavement breakdown. Snow and ice on hills, including Hatepe Hill and Pete's Hill, are shaded by vegetation and rocks that can lead to heavy vehicles being unable to proceed and blocking the carriageway until the snow / ice is cleared. Flooding in the southern sections of the corridor can result in closures. Further south the corridor is located near the Manawatu flood overflow plains which can result in closures. The extreme weather events and ground temperatures on sections of the corridor impact on when maintenance activities can be undertaken.
- **Meremere to Hampton Downs SH1N/486:** The pavement in this section was poorly constructed and causes issues. Drainage is also a problem along this section.
- **Huntly:** The section through Huntly is in a holding pattern awaiting its revocation to Waikato District Council following completion of the Huntly section of the Waikato Expressway.
- **Ngaruawahia:** There are weak spots in the pavement due to poor materials and construction. To fix this issue will require a bypass of the road as requires all lanes to be closed.
- **Karapiro:** Heavy vehicles exciting the quarry are causing flushing issues around the Mobil station at Karapiro.
- **South of Tirau:** – There are high rates of surface degradation and flushing issues along this section fo the corridor.
- **Improve performance:** There is a need to improve performance to assume the quality for a high volume rural road, whilst minimising impact of works on travelling public.
- **Atiamuri (RS664 to Wairakei):** Dacite issue causing pavement to fail faster than expected. Continual densifying of subgrades is leading to higher than normal levels of rutting.
- **North of Wairakei to end of Desert Road:** The pavement is susceptible to early flushing caused by moisture coming to the surface.
- **Desert Road:** Has a challenging environment with extreme variations in temperature. This also narrows the window for maintenance. The pavement can also trap moisture.
- **Surface layer instability:** Increasing amount of old and stable pavements but with built up surface layers and surface layer instability. A significant rehabilitation programme will be required in 15-20 years.
- **Mangaweka deviation:** The left climbing lane is showing signs of high levels of stress and will need remediation in the near future.
- **Bulls:** The AC is broken and has been stretched over four years. Programming of maintenance has been tied in with Council planned underground utilities work

Asset condition and performance future considerations

The future considerations relating to corridor pressures, intervention triggers and appropriate levels of investment related to **Asset Condition and Performance** are as follows:

- **SH1/ SH3 Bulls intersection**: Design of this intersection needs future consideration. Currently due to the layout SH3 traffic has priority although volumes are higher on SH1.
- **Hamilton Bypass**: The Waikato Expressway bypass of Hamilton will have an impact on traffic volumes in and around Hamilton City, which may result in less maintenance on adjacent state highways.
- **Appropriate treatments:** Appropriate construction methods aligned with the classification of road are required. This means using higher cost, but more durable and longer lasting treatments.

Failed longitudinal & transverse joints on SH1 Porewa Stream (Rata Station) Bridge

Investing in the corridor

The **Customer Levels of Service** shapes our response to our investment in maintenance, renewals and improvements. The NZ Transport Agency must consider the impact we have on our customers, the environment, communities, iwi, and the NZ economy in everything we do.

Decisions must be evidence based, informed and transparent with investment targeted to the right treatment, in the right place, at the right time while considering a range of competing priorities for investment. This requires significant analysis of various alternatives and options and expertise in applying appropriate judgement in collaboration with our service delivery partners.

Right treatment, right place, right time

A range of factors have been considered to determine the best point at which to intervene with maintenance and/or renewal treatments and improvements along the corridor.

Intervention works will be programmed to ensure:

- The right treatment,
- At the right place, and,
- At the right time.

Interventions will:

- Be based on minimising whole of life, whole of system costs and be underpinned by facts derived from enhanced asset information and modelling
- Define the most appropriate approach to asset maintenance, inspection and renewal, supported by reliability, availability, maintainability and safety specifications
- Use a risk-based approach to determining intervention requirements to specified levels of reliability
- Use resilience requirements to a specified range of weather conditions, considering climate change
- Define how sustainable development requirements are to be addressed

Summary investment

The proposed investment in the corridor is as follows:

Table 1- Summary Corridor Investment ($000)

Outcome	Expenditure Category	2018-2021	2021-2024	2024-2028
Access and Resilience	Maintenance and Operations	$27,058	$30,255	$45,986
	Renewals	$53,378	$64,409	$108,363
	Improvements	$0	$0	$0
Reliability and Efficiency	Maintenance and Operations	$13,735	$14,890	$22,401
	Renewals	$906	$1,005	$1,633
	Improvements	$661,548	$558,892	$132,000
Safety	Maintenance and Operations	$29,196	$31,884	$48,606
	Renewals	$6,852	$7,825	$11,916
	Improvements	$142,938	$91,113	$2,600
People, places and Environment	Maintenance and Operations	$5,818	$6,325	$9,507
	Renewals	$777	$471	$707
	Improvements	$0	$0	$0
	Total	**$942,207**	**$807,070**	**$383,719**

Figure 23 – Corridor investment

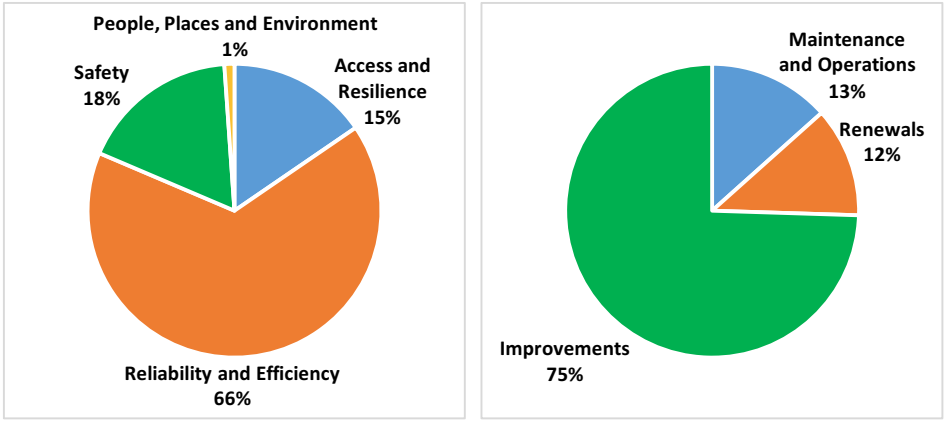


Table 2 - Summary investment by work category ($000)

Outcome	Work Category		2018-2021	2021-2024	2024-2028
Access and Resilience	111	Sealed Pavement Maintenance	$5,313	$6,288	$10,005
	112	Unsealed Roads	$9	$11	$16
	113	Drainage Maintenance	$2,998	$3,202	$4,908
	114	Structures Maintenance	$4,301	$4,670	$7,038
	121	Environmental Maintenance	$4,907	$5,385	$7,947
	122	Traffic Services Maintenance	$176	$300	$450
	124	Cycle Path Maintenance	$25	$30	$45
	151	Network & Asset Management	$7,487	$8,326	$12,506
	161	Property	$1,841	$2,045	$3,072
	211	Unsealed Road Metalling	$25	$30	$45
	212	Sealed Road Resurfacing (excl. surface skid resistance)	$31,251	$37,594	$68,901
	213	Drainage Renewals	$1,742	$1,403	$2,107
	214	Pavement Rehabilitation	$13,834	$18,631	$27,170
	215	Structures Component Replacements	$6,130	$6,405	$9,620
	222	Traffic Services Renewals	$395	$346	$520
	321 - 341	Improvements	$0	$0	$0
Reliability and Efficiency	121	Environmental Maintenance	$3,101	$3,368	$5,115
	123	Operational Traffic Management	$7,413	$8,111	$12,208
	151	Network & Asset Management	$2,885	$3,040	$4,521
	161	Property	$337	$371	$557
	222	Traffic Services Renewals	$906	$1,005	$1,633
	321 - 341	Improvements	$661,548	$558,892	$132,000
Safety	111	Sealed Pavement Maintenance	$6,319	$7,194	$11,365
	112	Unsealed Roads	$7	$9	$13
	113	Drainage Maintenance	$861	$836	$1,367
	114	Structures Maintenance	$1,821	$1,551	$2,199
	121	Environmental Maintenance	$1,661	$1,867	$2,804
	122	Traffic Services Maintenance	$12,670	$13,864	$21,009
	124	Cycle Path Maintenance	$0	$0	$0
	151	Network & Asset Management	$5,067	$5,667	$8,503
	161	Property	$788	$896	$1,346
	212	Surface Skid Resistance	$4,272	$4,744	$7,125
	214	Pavement Rehabilitation	$61	$130	$195
	215	Structures Component Replacements	$494	$750	$1,127
	222	Traffic Services Renewals	$2,025	$2,201	$3,469
	321 - 341	Improvements	$142,938	$91,113	$2,600
People, places and Environment	111	Sealed Pavement Maintenance	$1,184	$1,273	$1,912
	121	Environmental Maintenance	$3,637	$3,948	$5,938
	151	Network & Asset Management	$800	$885	$1,329
	161	Property	$197	$218	$327
	221	Environmental Renewals	$777	$471	$707
	321 - 341	Improvements	$0	$0	$0
		Total	**$942,207**	**$807,070**	**$383,719**

To be confirmed through the RLTP

Investing in access and resilience

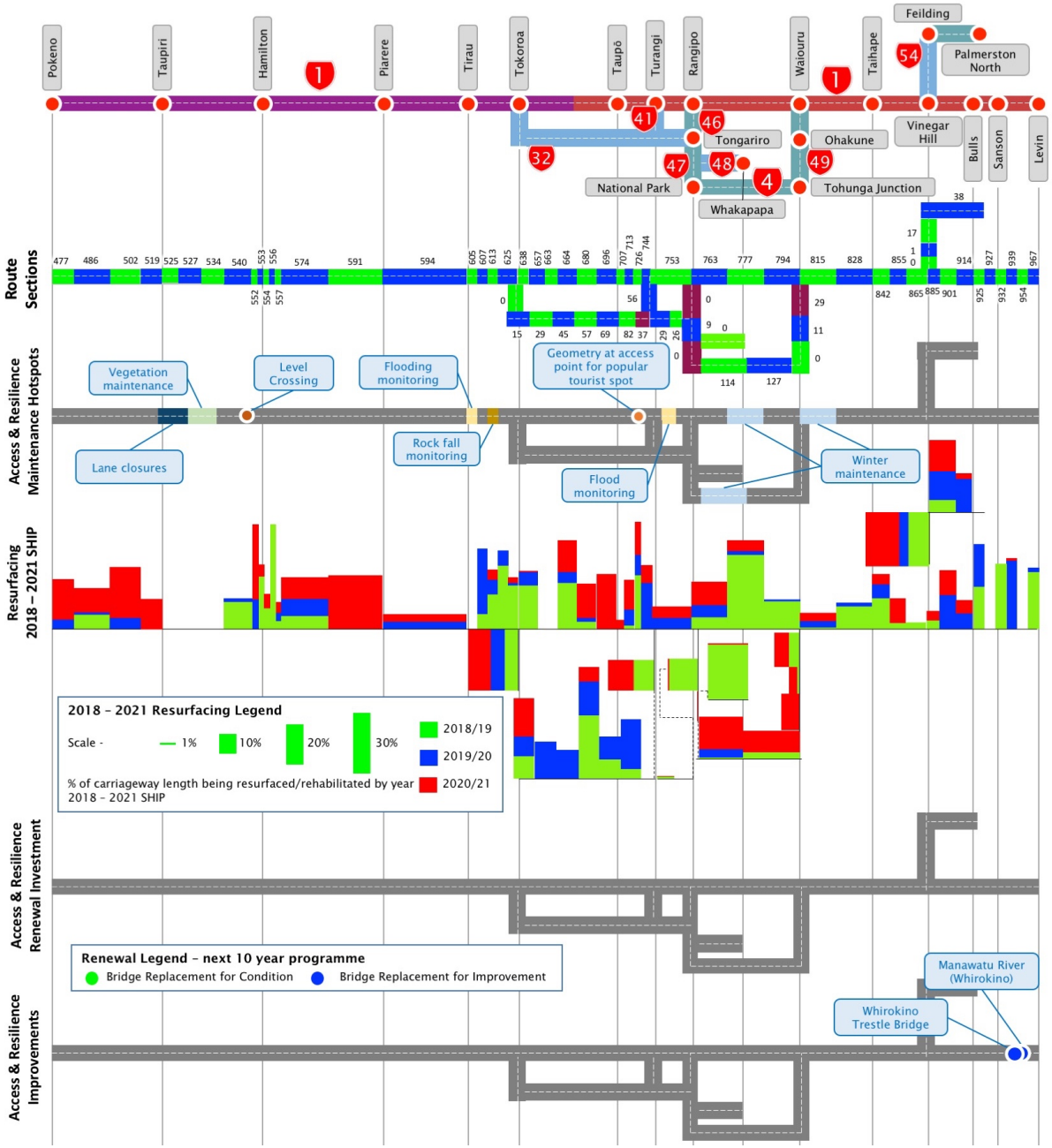
Operations and maintenance

The main areas of investment to provide and preserve access and resilience are drainage maintenance, sealed road surfacing and structural component replacements and vegetation control. A key focus is to realign the base preservation quantities toward increased preventative maintenance and to slow pavement deterioration specially through improved drainage.

Maintenance hot spots

- **Ngaruawahia:** On the Ngaruawahia section of Waikato Expressway, there is an inability to close one lane to do works.
- **Kahikatea Drive, Hamilton:** There is a level crossing on Kahikatea Drive in Hamilton which is incongruous with a National High Volume classified highway.
- **Putaruru:** Flooding regularly occurs and is monitored north of Putaruru.
- **Litchfield:** Rockfall is an issue on the highway at Litchfield in the south Waikato.
- **Bully Point - SH1N/726:** Poor geometry at the access point for popular tourist spot causes an issue for motorists leaving and joining the highway.
- **Turangi SH1N/744:** Surface water is a problem here due to the low level of road compared to the lake.
- **Winter maintenance:** Winter maintenance is necessary at the following locations: 3 sisters (Ice), Desert Road (Snow), Peters Hill (Ice), Makatote Viaduct SH4/114 (Ice)
- **SH49:** Flooding around SH49 causes a particular culvert to fill with pumice

Figure 24 – Access and resilience investment



Renewals

Resurfacing

The infographic shows the proportion of route section by carriageway length planned for resurfacing within the period 2018/19 to 2020/21, the three-year span of the SHIP. This is also broken down in to the individual years to indicate the timing of expenditure over the three-year period.

Significant investment in resurfacing is planned for sections: 1N/552 and 1N/556 in urban Hamilton, 1N/664 near Atiamuri, 1N726 along Lake Taupo, 1N/777 south of Turangi, and between Bulls and Levin.

Waikato expressway –The community taking part in the Cambridge open day

Improvements

Planned

The following projects are planned and underway. Details of the project progress can be found on the Transport Agency website at: https://www.nzta.govt.nz/projects/

SH1 – Whirokino Trestle and Manawatu River Bridge

Description: The primary purpose of the project is to improve safety, efficiency and resilience. Neither Whirokino Trestle nor Manawatu River bridges currently allow high productivity motor vehicle (HPMV) loads and Whirokino Trestle is approaching the end of its structural and economic life.

Waikato expressway- Grahams Valley Huntly

Investing in reliability and efficiency

Operations and maintenance

The main areas of investment to provide and preserve reliability and efficiency are environmental maintenance through keeping potential obstructions clear of the highway, wayfinding signage, and operational traffic management.

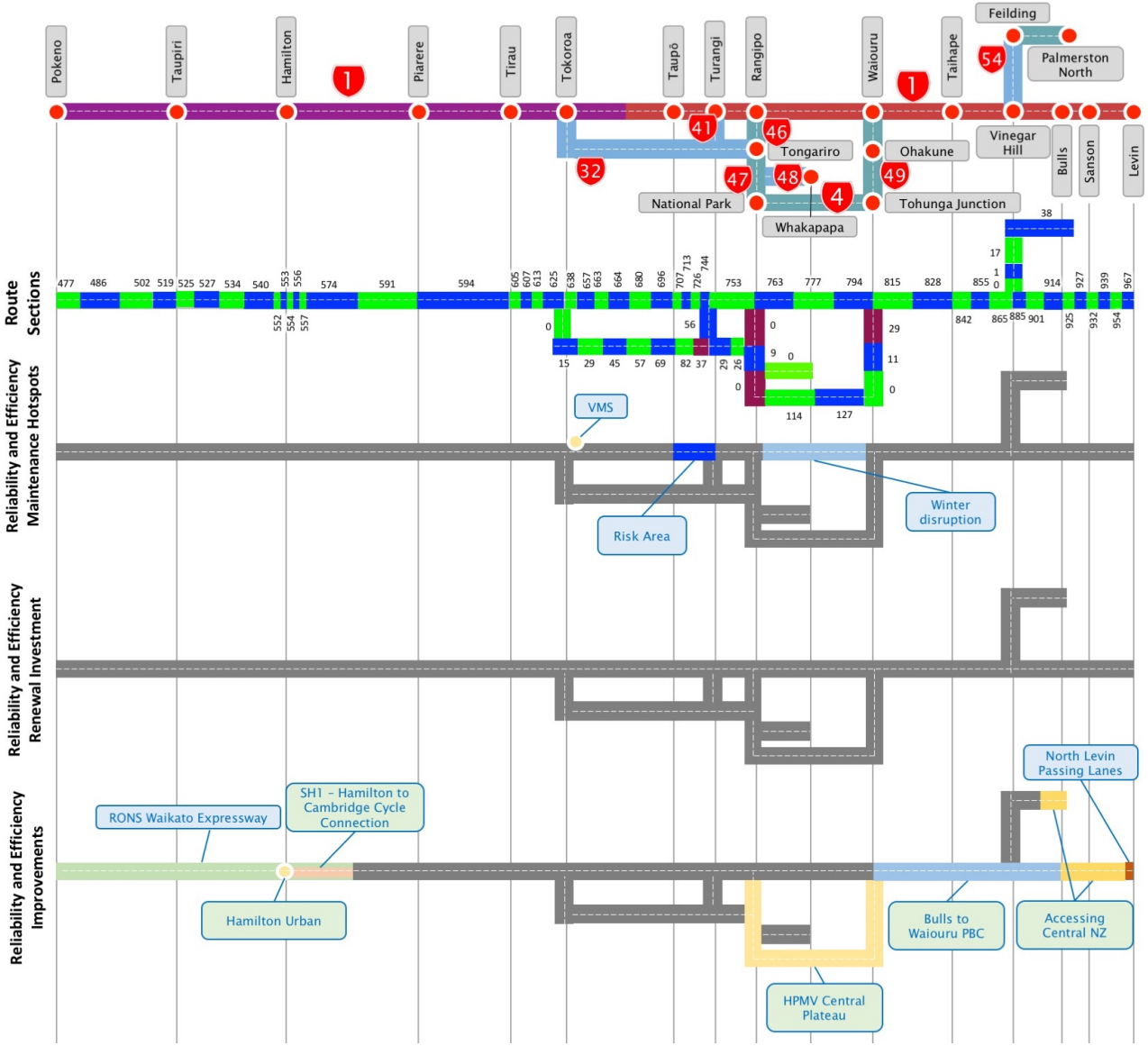
Maintenance hot spots

- **Taupo to Turangi:** This is a risk area. It is narrow, and hard to get cranes into resulting in crashes closing the road for a long time when they occur.
- **Winter maintenance:** During winter months, management of snow and ice on the Desert Road is a constant concern.
- **Real-time information:** Informing travellers promptly of closures on the route so alternatives options can be used is important. Currently a VMS sign is in place southbound at Tokoroa.

Renewals

There are no planned reliability and efficiency related renewals planned for the corridor.

Figure 25 – Reliability and efficiency investment



Improvements

Planned

The following projects are planned and underway. Details of the project progress can be found on the Transport Agency website at: https://www.nzta.govt.nz/projects/

SH1 – RONS – Waikato Expressway

Description: The Waikato Expressway project will improve safety and reliability and reduce travel times and congestion on SH1 by delivering a four-lane highway from the Bombay Hills to south of Cambridge. The expressway is being built in seven sections. When complete the Waikato Expressway will be the key strategic transport corridor for the Waikato region, connecting Auckland to the agricultural and business centres of Waikato and Bay of Plenty. The Expressway will improve economic growth and productivity through more efficient movement of people and freight.

- **SH1 – Waikato Expressway – Long Swamp Section**

  Description: The Longswamp section of the Waikato Expressway links the already completed Mercer section (just south of the Hampton Downs Interchange) to the Rangiriri section to the south. This project involves the upgrading of 5.9km of SH1 to full expressway standard.

- **SH1 – Waikato Expressway – Huntly Section**

  Description: In March 2015, the Transport Agency selected a joint venture of Fulton Hogan, HEB, Jacobs and Opus International Consultants to construct the Huntly section of the Waikato Expressway.

- **SH1 – Waikato Expressway – Hamilton Section**

  Description: The Hamilton section commences at the Lake Road junction with the Ngaruawahia section in the north. It then runs south, to the east of Hamilton, connecting to the existing Tamahere interchange deviation just south of Hillcrest.

SH1 – North Levin passing lanes

Description: The Otaki to North of Levin project aims to provide a modern state highway network that can accommodate expected future traffic volumes. We are taking a staged approach to this work, concentrating on safety and/or efficiency improvements as a first priority.

Draft Regional Programme considered for SHIP

The following table shows the list of projects being considered through the Draft Regional Land Transport Programme though the SHIP, and cover the next 10 years.

Table 3- Draft regional programme considered for SHIP

Project	Funding Status	Description
SH1 – Waikato Expressway – Ngaruawahia Section Barrier Infill		Part of the Waikato Expressway (Road of national Significance) completed in 2013 however some sections do not have side barriers as per new sections up and downstream.
SH1 – Hamilton to Cambridge Cycle Connection		New cycleway between Hamilton and Cambridge in partnership with Councils - part will be on SH1.
HPMV SH46/47/4/49 Central Plateau		The upgrading of the structures on SH46, SH47, SH4 and SH49 would provide a possible diversion route for HPMVs when the Desert Road is closed and would also provide opportunities for existing traffic along the route to upgrade to HPMV operation.
SH1 Cobham Drive / Cambridge Road Improvements Implementation		Efficiency improvements to existing intersection to deliver outcomes of OneNetwork Corridor approach.
Urban Hamilton – SH1 Greenwood/Kahikatea Drive		Widening of Greenwood Street to provide for additional demand. Aligns with Auckland to Levin CMP, Network Improvement Plan, Southern Links and activity strategic case.
Hamilton Urban - SH1 Greenwood/Kahikatea Drive LT Efficiency Improvement		"Improvements to SH and local roads in south-east quadrant of Hamilton city to improve levels of service for different modes/users at different times of day in line with the Hamilton Network Improvement Plan. Includes SH1 Cobham Drive, SH1 Cambridge Road and SH26 Morrinsville Road Indicative intervention - new facilities along and across SHs.

Project	Funding Status	Description
Hamilton Urban Improvements - South-East Hamilton.		"Improvements to SH and local roads in south-west quadrant of Hamilton city (Frankton & Dinsdale) to improve levels of service for different modes/users at different times of day in line with the Hamilton Network Improvement Plan. Includes SH23 Whatawhata Road Indicative intervention - intersection improvements and improved crossing facilities for pedestrians and cyclists.
Hamilton Urban Improvements - South-West Hamilton		"Improvements to SH1 to optimise network for all users, improve accessibility and reduce car dependency - trial site Indicative intervention - upgrade & link traffic signals, better urban design.
Hamilton Urban Improvements - SH1 Lorne Street.		"Improvements to SH and local roads in Hamilton city particularly to improve levels of service for cyclists in line with the operating gaps identified in the Hamilton Network Improvement Plan. Includes SH23 Whatawhata Road Indicative intervention - new cycle facilities plus crossing facilities.
Hamilton Urban Improvements - Suburban cycle routes.		Improvement to SH1 through Hamilton city to improve levels of service for public transport in line with the operating gaps identified in the Hamilton Network Improvement Plan. Includes SH1 Cambridge Road, SH1 Cobham Drive, SH1 Greenwood St, SH1 Kahikatea Drive Indicative intervention - new or improvements to signalised intersections.
Hamilton Urban Improvements - Bus priority hotspots.		Improvements to SHs to improve accessibility for all users Indicative intervention - dropped kerbs, new pedestrian crossing, new footpath links to close missing links.

Project	Funding Status	Description
Hamilton Urban Improvements - Accessibility Hotspots.		transport planning activity to review Network Operating Plan and Network Improvement Plan - develop operating gaps for 2041 but also review road hierarchies with wider community and stakeholders.
Hamilton Urban - Network Improvement Plan 2018-21		Implementation of a Stage 1 of a joint Traffic Operations centre for the Waikato in Hamilton. Agreed approach is staged delivery of TOC with increasing activities.
WaiTOC Managing Network through Influencing Journeys (joint SH activity & HCC) - stage 1		Implementation of Stage 2 of a joint Traffic Operations centre for the Waikato in Hamilton. Agreed approach is staged delivery of TOC with increasing activities.
WaiTOC Managing Network through Influencing Journeys (joint SH activity & HCC) - stage 2		Project is to design and construct the replacement of the Whirokino Trestle and Manawatu River Bridge.
Accessing Central New Zealand Business Case (Bulls - Levin - Ashhurst)		The programme business case will develop a programme to deliver against the growth in the freight hubbing and distribution sector and other industries in the Palmerston North and wider area. The JTS represents a programme maximum for the network, and as an economic enabler of transport programmes should be right sized for the development that is occurring and investment over the short to long term.
Accessing Central New Zealand SH3/54 Kairanga Bunnythorpe		This activity delivers on the regional economic development action plan 'Accelerate25' by enabling efficient freight and distribution activities around the wider Manawatu region.
SH1 North of Bulls to Waiouru Business Case		A business case to investigate further the improvements required to improve customer experience along the corridor.
SH1/2/4 improved tourist facilities		Improved tourist facilities e.g. stopping facilities, signage and marking, viewpoints, visitor centres/information management, variable messaging signs.

Investing in safety

Operations and maintenance

The main areas of investment to provide and preserve reliability and efficiency are environmental maintenance through keeping potential obstructions clear of the highway, wayfinding signage, and operational traffic management.

Maintenance hot spots

- **Tokoroa to Wairakei:** South of Tokoroa through to Wairakei there are a large number of 'loss of control' incidents
- **Dozing drivers:** On the East Taupo Arterial road, there is a high incidence of dozing drivers. This may be because of the distance into the journey from either Wellington or Auckland, combined with a relatively unchallenging piece of highway causing drivers to relax after hours of challenging driving.
- **Bulls to Sanson:** This is a safety risk area, a rural road with two major turning points. The weigh station is only operating southbound because of safety concerns. Ohakea base access has morning queues. Crashes in this section are dominated by nose to tails.
- **Pedestrian issues:** In Bulls pedestrians conflict with the combined traffic on SH1 and SH3 causing low speed crashes, and inherent pedestrian risk.

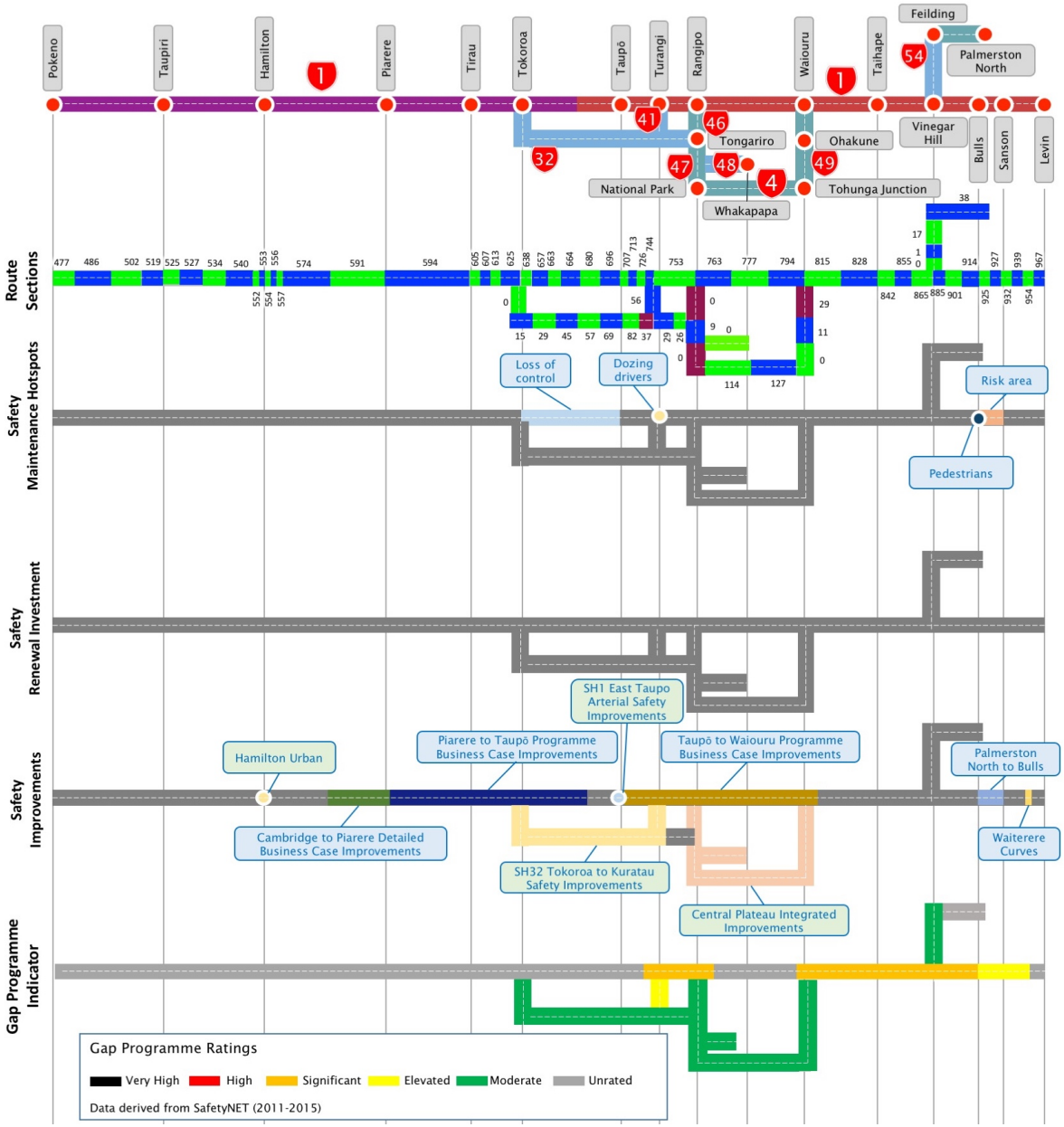
Gap programme indicator

The potential for reducing fatal and serious injuries across the corridor has been assessed under the Gap programme. The Gap programme looks at the collective risk rating, likely level of intervention and the potential reduction in death and serious injury that may be achieved to determine a possible treatment approach. For instance, a road segment rated 'Very High' could potentially achieve a 50-70% reduction in fatal and serious injuries with the application of high cost improvements. Alternatively, if the risk level is 'Elevated' a 10-20% reduction may be realised through targeted low cost, high coverage treatment improvements.

There is a significant potential to reduce fatal and serious injuries between Turangi and Rangipo, and between Waiouru and Bulls where targeted medium-high cost improvements will be beneficial.

There is a moderate potential for fatal and serious injury savings along SH4, SH47, SH48, SH46, SH41 and SH32. These sections would benefit from targeted low cost, high coverage, improvements.

Figure 26 – Safety investment



Renewals

There are no planned safety related renewals planned for the corridor.

Improvements

Planned

The following projects are planned and underway. Details of the project progress can be found on the Transport Agency website at: https://www.nzta.govt.nz/projects/

SH1 – Cambridge to Piarere

Description: With the completion of the Cambridge section of the Waikato Expressway and increasing volumes of traffic using this section of SH1, short-term safety improvements are now needed to this part of the existing SH1. This stretch of SH1 from the southern end of Cambridge section to and including the SH29 turnoff at Piarere has seen five people die and 14 people seriously injured in crashes over the five years 2011-15. The Safe Roads Alliance has been investigating options to improve road user safety on the current SH1.

SH1– Piarere to Taupo

Description: Assessment into opportunities for immediate safety improvements that complement the long-term plan. General treatments could include side barriers at high risk locations, rumble strips along edge lines and improved signage.

SH1– Taupo to Waiouru

Description: Assessment into opportunities for immediate safety improvements that complement the long-term plan. Project potentially includes complimentary other benefits such as efficiency improvements. General treatments could include side barriers at high risk locations, rumble strips along edge lines, road slip mitigation, pedestrian and cycling facilities and improved signage.

SH1– Waiterere Curves

Details: Part of Otaki to Levin programme. This area has a history of serious and fatal crashes, particularly head-on crashes, which needs to be resolved to meet our objective of improving safety as well as efficiency north of Levin. Our proposals to address the safety concerns include straightening the three curves in the road, providing parallel access for local traffic, (particularly to adjoining properties which currently have direct access to the highway), edge barriers and installing a wire rope median barrier to eliminate the risk of future head-on crashes.

Draft regional programme considered for SHIP

The following table shows the list of projects being considered through the Draft Regional Programme for SHIP, and cover the next 10 years.

Table 4 - Draft regional programme considered for SHIP

Project	Funding Status	Description
SH1 South Waikato Town Centre Accessibility Improvements		Joint activity with South Waikato District Council including improvements to SH1 through towns of Tirau, Putaruru & Tokoroa in line with the 2016 Piarere to Taupo Corridor PBC.
SH1 East Taupo Arterial Safety Improvements		Safety Improvements to SH1 East Taupo Arterial to reduce risk of high speed head on crashes.
SH1 Tauranga-Taupo Bridge Realignment		Implementation of replacement of Tauranga-Taupo Bridge on SH1 and realignment of approaches as per 2016 Taupo to Waiouru Corridor PBC. DBC work is covered under SH1 Taupo to Waiouru Improvements but pre-imp & imp likely to be covered separately.
Central Plateau Integrated Improvements		Improvements to SH41, 46, 47, 48, 4 & 49 to respond to safety problems and improve visitor management as identified through the Auckland to Levin Corridor Management Plan. Align with Council project to look at similar issues on south side of mountain.
SH32 Tokoroa to Kuratau Safety Improvements		Safety improvements on SH32 from Tokoroa to Kuratau as identified in the NSRRP Review.
SH1 Cobham Drive Pedestrian Facility Implementation		New walking & cycling facility in the form of an underpass across SH1 Cobham Drive at Sillary Street and near Hamilton Gardens. LTSV recognises the issues that result with strategic through traffic mixing with local traffic (including active modes).
Hamilton Urban – SH1 Greenwood/Kahikatea Drive Short Term Safety Improvements		Improvements to SH1 through Hamilton city (from the Norton Road Roundabout through to the SH3 Ohaupo Road signals to respond to safety and accessibility problems. Aligns with Auckland to Levin CMP, Network Improvement Plan and activity strategic case.

Project	Funding Status	Description
SH3 Palmerston North to Bull		This activity will be a safer roads initiative to provide a safer road environment for SH3 between Bulls and Palmerston North.
Weigh Right Regional Construction		Improve weigh pits to improve overweight detection and to meet new vehicle and safety standards.
Speed Management Implementation		Transport planning activity to enable development of Regional Speed Management Plan in conjunction with partner Road Controlling Authorities.
Minor Improvements 18/21		Activities will be targeted to low cost safety, optimisation and resilience activities which contribute to the Transport Agency's goals of either reduce the level of deaths and serious injuries, improve urban network capacity in our major centres or to reduce the resilience risk on our key routes through preventative maintenance activities.
Accelerated LED Renewals for SH Street Lighting		To replace all street lights with more cost-effective LEDs to save costs on power and maintenance.

SH1 – Cambridge to Piarere safety improvements

Investing in people, places and environment

Operations and maintenance

The main areas of investment into people, places and environment are: pavement rehabilitation to ensure a high proportion of travel on smooth roads, control of litter, provision of rest areas and stopping points, landscaped areas maintenance, and, environmental compliance.

Maintenance hot spots

- **National Parks**: Areas where the highway traverse national parks are environmentally sensitive

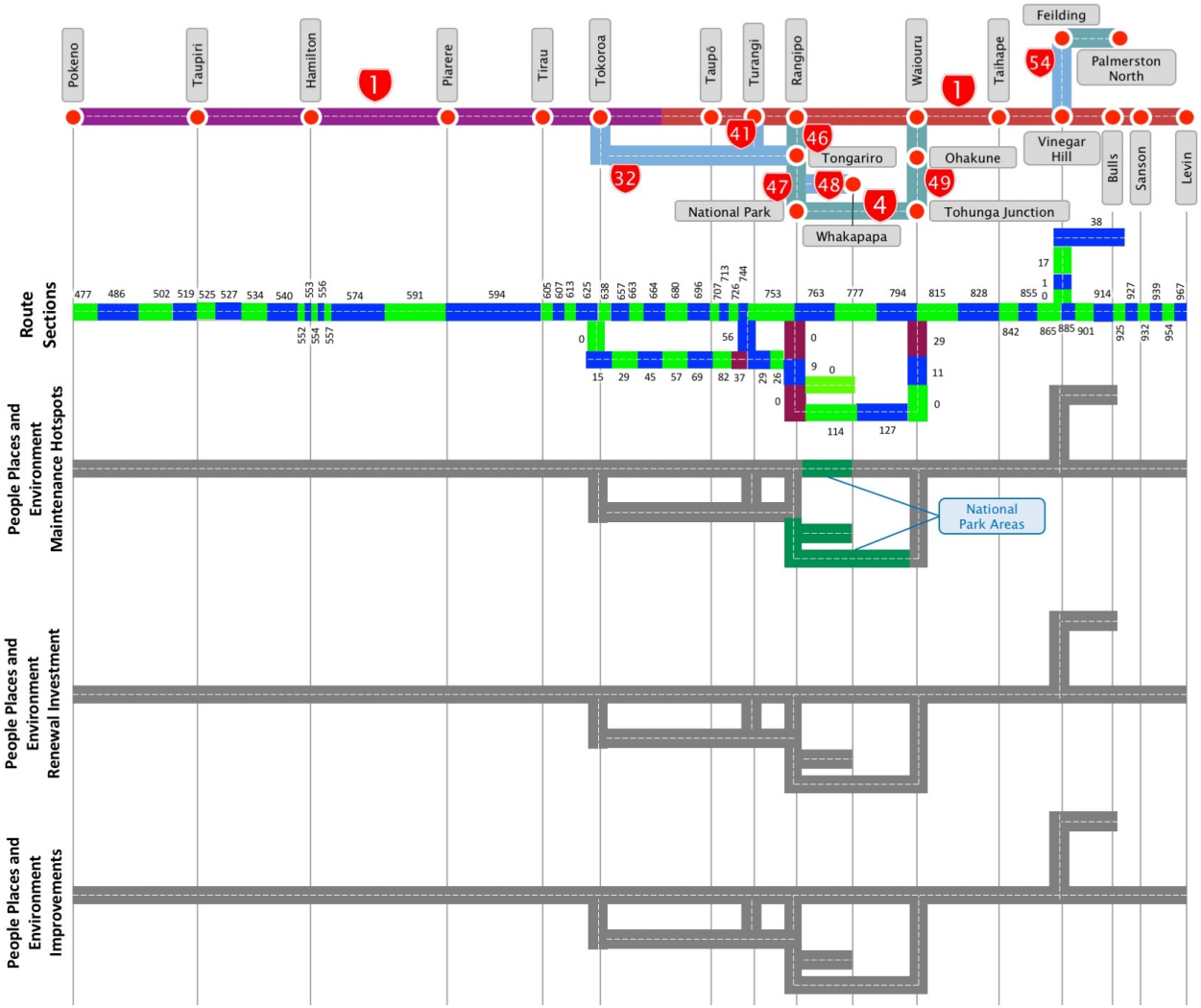
Renewals

There are no planned people, places and environment related renewals planned for the corridor.

Improvements

There are no planned people, places and environment related improvements planned for the corridor.

Figure 27 – People, places and environment investment



Investment pressures

Access and resilience

The following concerns excerpt pressure on the investment in **Access and resilience** on the corridor.

- **Strategic Route:** This is a high volume strategic route, and the principal road freight corridor for the North Island of New Zealand. There is a high expectation of uninterrupted access to the corridor, requiring a high level of response to disruptive events.
- **Appropriate construction methods:** Using construction methods appropriate to the road classification, i.e. for this corridor, investing in higher value but longer lasting treatments
- **Winter repairs:** Circumstances for repairs are adverse in winter with ambient temperatures limiting the type of treatments that can be used.
- **Constrained road geometry:** There are specific sections (Three Sisters and along Lake Taupo) along the existing SH1 alignment that are physically constrained resulting in inefficient movement of goods and people. Planned maintenance events impact the reliability of the route around the lakeside where the constrained carriageway width and geography require one lane to be closed for the health and safety of crews working in the carriageway.
- **Interim improvements.** Staging of renewal and improvement works on sections to be replaced with improvements needs careful management. This involves the diligent use of interim treatments until improvements come on stream.

Reliability and efficiency

The following concerns excerpt pressure on the investment in **Reliability and efficiency** on the corridor.

- **Customer communication:** Putting in infrastructure to adequately inform the travelling public and freight operators about closures and alternative routes.
- **Impact on traffic:** Managing the impact of maintenance works on traffic. This may require undertaking works at times that are least disruptive, such as evening/night works.
- **Waikato Expressway:** The construction of the Waikato Expressway is gradually dealing with the travel time reliability issues at the northern end of the corridor. When completed, significant improvements in journey times will be realised.
- **Wellington Northern Corridor RONS:** Likewise, the Otaki to north of Levin section of the Wellington Northern Corridor RONS will provide for improvements in travel time efficiency at the southern end of the corridor.

Safety

The following concerns excerpt pressure on the investment in **Safety** on the corridor:

- **Winter Maintenance:** The Central plateau team out of Waikato come as far south as is needed for snow and ice effects. This can sometimes be as far south as Taihape.
- **Three sisters:** A business case to improve road to Waiouru and likely to be delineation dominated on this corridor. At the moment, there is nil in the budget for night time delineation as this would be removed by snow grading.
- **Increasing maintenance burden:** New safety assets put pressure on constrained maintenance budgets. For example, between Bombay and Hampton Downs barriers require additional inspections and have higher costs to repair than previously.
- **Fatigue:** The central section of the corridor is within a 3-4 hour driving window from Auckland and Wellington, the time at which fatigue sets.

People, places and environment

The following concerns excerpt pressure on the investment in People, places and environment on the corridor.

- **Stormwater management:** Throughout the corridor there are a variety of sensitive freshwater environments which experience discharge and nutrient run off. Streams in the central plateau support sensitive native plants and aquatic animals as well as recreational fish such as trout which require specific maintenance practices.
- **Demand for stopping places:** There are numerous locations along Lake Taupo for traffic to stop, however the level of facilities provided at each site and the advance warning of sites is inconsistent. Maintenance of facilities is seasonal with additional resources required during summer months and after long weekends.
- **Tourism:** There are sites along the corridor of cultural and spiritual significance which also provide tourism and historic value to the region and country. Additional tourism numbers require higher levels of maintenance of facilities and access.

Investment future considerations

- **Increase in demand:** The projected increase in population in the Hamilton area, coupled with changes in land use from forestry to dry stock throughout the corridor, and the expected increase in freight demand will all contribute to a growing demand on the corridor, with the consequent requirement for increased investment on this nationally significant route.
- **Improved maintenance and operations**: Develop the systems and process to reduce the duration of weather related incidents particularly through the Desert Road. Implementing a strategy to enable a more rapid response to incidents will have the corridor open quicker. This could include making better use of the data from weather stations to improve the ability to forecast and improve management of unplanned events. This would also assist with winter operational maintenance programme planning and pre-event management enabling a pro-active approach to events where possible.
- **Use of alternative treatments**, which may be more expensive but may ultimately have a lower overall lifecycle cost, requiring less intervention, and less disruption for maintenance, need to be considered for this corridor.
- **Increased maintenance burden:** The ever-increasing use of wire-rope side barriers is creating a maintenance burden, due to the need to respond to more barrier strikes, as well as the increased cost to undertake other activities such as vegetation control. There is a need to consider the total impact across capital and maintenance budget in the immediate and longer term to understand the operational constraints and budgetary implications of additional barriers.
- **Co-location of amenities:** there is a need to consider co-locating amenities to increase foot traffic and lower vandalism. This could include weight stations, rest areas, electric vehicle charge points. This should include working with the freight industry, councils and other agencies to identify and develop well designed heavy vehicle stopping areas with good facilities. Consideration should also be given to how increasing tourist numbers can be catered for at these sites.

Appendix A – Information sources

Section	Infographic	Information Source	Date
Introduction	Corridor Overview Map	The Road Efficiency Group https://www.nzta.govt.nz/roads-and-rail/road-efficiency-group/onrc/	2013
Understanding our Customers			
Key Customers	Key journeys	Network Manager and Regional Staff	2016
	Daily commuters	Network Manager and Regional Staff	2016
	Freight	Network Manager and Regional Staff	2016
	Tourism and recreation	Network Manager and Regional Staff	2016
	Demographics and population centres	MBIE Regional Economic Activity Report Web Tool http://www.mbie.govt.nz/info-services/business/business-growth-agenda/regions	2015
Understanding Customer Levels of Service on the Corridor			
Customer Levels of Service	Corridor classifications	The Road Efficiency Group ONRC -right-road-right-value-right-time-combined-poster.pdf https://www.nzta.govt.nz/roads-and-rail/road-efficiency-group/onrc/	2015
Current Levels of Service Performance	Current ONRC Levels of Service Performance	Network Manager and Regional Staff	2016
Improving the Customer Experience	Significant planned improvements	Network Manager and Regional Staff NZTA Projects web page: https://www.nzta.govt.nz/projects/ NZTA Safe Roads web page: https://www.nzta.govt.nz/safety/our-vision-vision-of-a-safe-road-system/safe-roads/ Submitted Regional SHIP programmes	2017

Section	Infographic	Information Source	Date
Access	ONRC classification	The Road Efficiency Group https://www.nzta.govt.nz/roads-and-rail/road-efficiency-group/onrc/	2013
	Carriageway configuration	Network Manager and Regional Staff Corridor drive-over Highway information Sheets	2016
	Posted speed limit	NZTA – MapHub Speed Limits on NZ Road Network	2016
	Topography	Elevations derived from Google Earth™	2016
	Geography	Network Manager and Regional Staff Corridor drive-over	2016
	Traffic volumes – heavy vehicles	RAMM Carriageway Table – December Traffic Estimates	2015
	Traffic volumes – all vehicles	RAMM Carriageway Table – December Traffic Estimates	2015
	HPMV routes	NZTA – MapHub High Productivity Freight Network	2016
	Critical Customers	Network Manager and Regional Staff	2016
	Critical Assets	Network Manager and Regional Staff	2016
Resilience	Vulnerabilities	NZTA – MapHub Hazard Incidents and Area Warnings	2016
	Major Alternate Routes	Network Manager and Regional Staff Desktop analysis Corridor drive-over	2016
	Diversion Lengths	NZTA StateHighways.pptx Diversion Routes	Unknown

Section	Infographic	Information Source	Date
	Closures	NZTA 2011-2015_Treis_incidents_by_region.xlsx	2015
Reliability and efficiency	Efficiency	NZTA – MapHub EfficiencyNet	2016
	Variability	NZTA / Beca Dwg No. GIS-3391515-500-4 Network Performance - Attachments.pdf March 2012 eRUC Commercial Vehicle Data – State Highway Austroads Variability Assessment	2012
	Commercial Vehicle Average Speed	NZTA / Beca Dwg No. GIS-3391515-500-5 Network Performance - Attachments.pdf March 2012 eRUC Commercial Vehicle Data – State Highway Average Speeds	2012
	Current Constraints	Network Manager and Regional Staff Corridor drive-over	2016
Safety	KiwiRAP Collective Risk	https://nzta.abley.com/SafetyNET_2017 SafetyNET	2016
	KiwiRAP Personal Risk	https://nzta.abley.com/SafetyNET_2017/ SafetyNET	2016
	KiwiRAP Star Rating	http://www.kiwirap.org.nz From 2010 KiwiRAP star rating report.	2010
	Intersection Risk Indicator	https://nzta.abley.com/SafetyNET_2017/ SafetyNET	2016
	Gap Programme Rating	https://nzta.abley.com/SafetyNET_2017/ SafetyNET	2015
Environment Culture and Heritage	Natural Environment	NZTA - Environment and Urban Design Team	2016
	People and Place: Journeys	NZTA - Environment and Urban Design Team	2016
	People and Place: Landmarks and Heritage Places	NZTA - Environment and Urban Design Team	2016
	Noise and Vibration	NZTA - Environment and Urban Design Team	2016
	Drainage Catchments	NZTA - Environment and Urban Design Team	2016
Understanding the Infrastructure Assets			
Overview	Corridor Asset Base	NZTA_ 2017 Values by Corridor.xlsx complied by Opus International Consultants from RAMM and other asset information sources	
	Asset Condition and Performance	Summarised from the data sets described below	
Asset condition and performance	Surface Skid Resistance	SCRIM data derived from RAMM by NZTA Data Quality and Access team	2016
	Surface Safety Treatment	SAL data derived from RAMM by NZTA Data Quality and Access team	2016
	Surface Defects	100m Priority data derived from RAMM by NZTA Data Quality and Access team	2016
	Surface Age	Surface Age data derived from RAMM by NZTA Data Quality and Access team	2016
	Service life of Prior Surface	Surface Age data derived from RAMM by NZTA Data Quality and Access team	2016
	Resurfacing	Resurface data derived from forward works programme	2016
	Proportion of Travel on Smooth Roads	STE data derived from RAMM by NZTA Data Quality and Access team	2016
	Pavement Strength	Deflection data derived from RAMM by NZTA Data Quality and Access team	2016
Investing in the Corridor			
Summary Investment	Summary Corridor Investment	2028-21 SHIP programme funding requests 2017/18 Annual Plans	2017
	Summary investment by work category	2028-21 SHIP programme funding requests 2017/18 Annual Plans	2017
Investing in access and resilience			
	Maintenance Hot Spots	Network Manager and Regional Staff	2017

Section	Infographic	Information Source	Date
Investing in access and resilience	Resurfacing 2018 - 2021	Resurface data derived from forward works programme	
	Renewal Investment	National Bridge Replacement Programme National bridge replacement programme 2017 LCMP data.xlsx	
	Improvements	Network Manager and Regional Staff NZTA Projects web page: https://www.nzta.govt.nz/projects/ Submitted Regional SHIP programmes	
Investing in reliability and efficiency	Maintenance Hot Spots	Network Manager and Regional Staff	2017
	Renewal Investment		
	Improvements	Network Manager and Regional Staff NZTA Projects web page: https://www.nzta.govt.nz/projects/ Submitted Regional SHIP programmes	
Investing in safety	Maintenance Hot Spots	Network Manager and Regional Staff	2017
	Renewal Investment		
	Improvements	Network Manager and Regional Staff NZTA Projects web page: https://www.nzta.govt.nz/projects/ NZTA Safe Roads web page: https://www.nzta.govt.nz/safety/our-vision-vision-of-a-safe-road-system/safe-roads/ Submitted Regional SHIP programmes	
Investing in people places and environment	Maintenance Hot Spots	Network Manager and Regional Staff	2017
	Renewal Investment		

Section	Infographic	Information Source	Date
	Improvements	Network Manager and Regional Staff NZTA Projects web page: https://www.nzta.govt.nz/projects/ Submitted Regional SHIP programmes	

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