Business case for implementation

31/05/2018
FINAL
MANAWATŪ GORGE ALTERNATIVES DETAILED BUSINESS CASE

Part A: The Case for the Project

Detailed business case to proceed from initiation to implementation

NZ TRANSPORT AGENCY
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This document provides guidance for a detailed business case (DBC) report, in support of an investment – project, procurement or scheme. In all cases, a programme business case or indicative business case (IBC) should have been completed and agreed, prior to the submission of this document for approval. Prior to pre-implementation, the main purpose of the DBC is to evidence that the most economically advantageous offer is being procured and that it is affordable. In addition, the DBC demonstrates that the required outputs can be successfully achieved. The template is for guidance purposes only and should be completed in accordance with NZ Transport Agency guidelines set out on the NZ Transport Agency's website.

APPROVAL

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GLOSSARY OF TERMS

Abbreviation	Term
AA	New Zealand Automobile Association
AADT	Annual average daily traffic
BCR	Benefit-cost ratio
BOI	Board of Inquiry
CAS	Crash Analysis System
DBC	Detailed Business Case
DoC	Department of Conservation
EEM	Economic evaluation manual
EPA	Environmental Protection Authority
FAR	Funding assistance rates
HAIL	Hazardous Activities and Industries List
HCV	Heavy commercial vehicles
HNO	Highway and Networks Operations
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014
IO	Investment objectives
JWG	Joint Working Group
KPIs	Key performance indicators
LTMA	Land Transport Management Act 2003
M	Million
MCA	Multi Criteria Analysis
MSE	Mechanically stabilised embankment
MSQA	Management, Surveillance and Quality Assurance
NEIZ	North East Industrial Zone

Abbreviation	Term
NES Soil	National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health
NESETA	National Environmental Standards for Electricity Transmission Activities
NZHHA	New Zealand Heavy Haulage Association
NZDF	New Zealand Defence Force
NZTA (or Transport Agency)	New Zealand Transport Agency
ONFL	Outstanding Natural Landscape Features
PBC	Preliminary Business Case
PGAR	Preliminary Geotechnical Appraisal Report
PWA	Public Works Act 1981
REC2	River Environment Classification system (version 2.4)
RMA	Resource Management Act 1991
RTANZ	Road Transport Association New Zealand
SiD	Safety in Design
SH(#)	State Highway (number)
TLA	Territorial Local Authority

Executive summary

PURPOSE

The Manawatū Gorge Alternatives Detailed Business Case (DBC) summarises the process undertaken to develop and analyse options for an alternative connection between the western and eastern sides of the Ruahine and Tararua ranges on State Highway 3.

The business case point of entry for this project is this DBC, which recommends an option to be progressed through to the pre-implementation phase.

PROJECT CONTEXT

State Highway 3 through the Manawatū Gorge (the Gorge) is a vital connection between the west and east of the North Island. As well as providing connection between the Manawatū-Whanganui and Hawke's Bay regions it connects the communities of Woodville and Dannevirke with Ashhurst and Palmerston North. The route is classified as a National Road and carries freight traffic at a level qualifying it as an important national freight link.

The road was closed indefinitely on 24 April 2017 following a large slip and a history of landslides within the Gorge causing road closures and a high probability this would be an ongoing occurrence.

There are two alternative routes available within close proximity to the Gorge route, the Saddle Road and Pahiatua Track. Since the closure, traffic flows have continued at previous levels, indicating its importance to the region's communities. Even with improvement works on Saddle Road, both routes are steep, narrow and winding resulting in poor safety, resilience and efficiency outcomes. These routes are not considered to provide an appropriate level of service for the State Highway 3 link.

NEED FOR INVESTMENT

The DBC outlines the need for investment to provide the outcomes desired by the NZTA and the region's stakeholders. These are identified below.

Investment Objective 1	To reconnect the currently closed Manawatū Gorge State Highway 3 with a more resilient connection
Investment Objective 2	To reconnect the currently closed Manawatū Gorge State Highway 3 with a safer connection than the Saddle Road and Pahiatua Track
Investment Objective 3	To reconnect the currently closed Manawatū Gorge State Highway 3 with a more efficient connection than the Saddle Road and Pahiatua Track

Benefits identified through the DBC process are:

Benefit Statement 1	A safe, efficient and resilient transport corridor
Benefit Statement 2	Enables economic development and regional productivity

OPTION DEVELOPMENT

Through development of the DBC, 18 route options were considered for an alternative to the Gorge. The report also describes how this long list was assessed to determine a short list of four options.

The long list options included tunnels, viaducts and new routes over the Ruahine and Tararua ranges north and south of the existing Manawatū Gorge.

These were assessed against a set of criteria established at the start of the project and this identified four options that carried an acceptable level of risk and ability to deliver on investment objectives.

The four short list options were further refined and reassessed against the same criteria to identify a recommended option.

OPTION ASSESSMENT

The DBC process used a multi-criteria analysis (MCA) to assess options. This involved specialists providing input across social, environmental, planning and engineering areas. The MCA criteria developed considered the following areas:

Assessment Criteria I **Investment objectives**	Investment Objective 1–Resilience Investment Objective 2 – Safety Investment Objective 3 – Efficiency
Assessment Criteria II **Environmental and social impacts**	Natural environment Cultural and heritage Social Landscape and visual Infrastructure and property Human health

Assessment Criteria III
Implementability

Project risk
Cost
Construction considerations
Network dependent investments
Strategic network and land use integration

RECOMMENDED OPTION

The recommended option presented in this DBC is Option 3. It has the least risk of implementation and performed the best across the range of criteria that were assessed in the MCA.

The option provides for an 11.46 km new highway connection with a 100 km/h design speed that links the SH3 / 57 junction in the west with the intersection of SH3 and Woodlands Road near Woodville. The option traverses the Ruahine range with a two lane highway combined with crawler lanes. The maximum gradient of the route is 8%. Three bridges are required one of which will be 350 – 400 m long. Approximately 6 million m^3 of earthworks is required.

The option requires property from 11 private land owners and is likely to impact the operation of the Te Apiti wind farm.

Construction is expected to begin in 2020 and be complete late 2024. The expected estimate for the option is $517 million (including escalation).

STAKEHOLDER VIEWS

In developing the DBC the project team engaged with a range of stakeholders through public meetings, public open days, key stakeholder workshops and one on one meetings. These stakeholders included the public, councils, iwi, road user groups and businesses.

Feedback was used to develop options and assessment criteria. A small number of options were strongly preferred by some stakeholder groups resulting in the need to carry out further analysis to ensure the recommended option performs the best across the MCA criteria and wider network considerations.

A Joint Working Group comprising the project team and key stakeholders conducted a more detailed assessment of the wider economic environment in the region to consider the differences and benefits of the short list of Gorge options. The outcome of this further work has been incorporated into the options assessment and economic analysis of the recommended option.

ECONOMIC ASSESSMENT

An economic analysis carried out for the recommended option identifies benefits that are largely derived from travel time costs, vehicle operating costs and wider economic benefits with a lower, but still sizable, benefit coming from a 50% reduction in crash costs over the 40 year analysis period.

A total of $741 million Net Present Value (NPV) benefits have been calculated which results in a Benefit Cost Ratio (BCR) of 1.8.

RISKS

The DBC outlines a number of risks for the next phase. Proposed treatments are outlined in the document. Specific areas of high risk are:

- Consenting risks if consents are not granted or significant delays and cost increases are incurred to obtain the consents
- Unknown ground conditions presenting significant risk in increasing footprint or changing project alignment and costs
- Complex design and construction techniques may be required for the Manawatū River Bridge resulting in increased costs and time delays as a result of limited resources available to carry out the works.

IMPLEMENTATION

The pre-implementation phase of the project requires further development of the design to enable designation, property acquisition and consents to be obtained. This will then be followed by the completion of detailed design and commencement of construction towards the end of 2020.

Part A – THE CASE FOR THE PROJECT

1 Introduction

1.1 PURPOSE OF THIS REPORT

The purpose of this Detailed Business Case (DBC) is to:

- provide a summary of the technical analysis of current problems as a result of the closure of State Highway 3 at Manawatū Gorge
- describe the process of identifying and assessing a range of options that achieve a defined set of objectives
- clearly articulate a recommended option.

The report includes detailed technical information and supporting recommendations for the recommended option's project scope, capital and operational costs, and economic assessments required for the approval of the DBC and to enable funding for the delivery of the project to be approved.

1.2 PREVIOUS WORK UNDERTAKEN

The DBC was developed in a single stage due to the urgency of developing a solution to the problems resulting from the indefinite closure of the Manawatū Gorge in April 2017. As part of developing the DBC, the Strategic Case for the project (including the problems, benefits and investment objectives) was developed in discussion with stakeholders; this is documented in more detail in the Long List Option Assessment Report.

The other stages typical of a business case process (Programme Business Case and Indicative Business Case) have not been undertaken prior to the DBC due to the focus on expediency and the previous work that has already taken place to understand the Manawatū Gorge route and wider transport connections in the region. The previous reports which has informed the development of this DBC have included:

- Accessing Central New Zealand Strategic Case (2016) - which relates to the transport network across the Manawatū generally covering the transport network from the Manawatū Gorge to Levin and to Bulls and Sanson.
- Palmerston North-Manawatū Joint Strategic Study (2010) (the Joint Transportation Study) – which set out road hierarchies in the region, travel demands and options to address issues in the network to cater for current and future demand
- PSW 198 – SH3 Manawatū Gorge Alternative Route Assessment Final Report (MWH, 2012) – which undertook a risk assessment of probability and potential magnitude of future slips in the Gorge and reviewed and updated possible alternative routes and whether any of these were justified at that time.

1.3 DOCUMENT NAVIGATION

A summary of the content of this DBC is provided below in Table 1.

Table 1 Content of this DBC

Section	Scope
PART A – THE CASE FOR THE PROJECT	
Section 1: Introduction	A summary of the purpose of the DBC, the structure of this report and the key assumptions.
Section 2: Strategic context	Presents the background to the project, including the events leading to the closure of the Manawatū Gorge and the wider strategic and transport, economic, social and environmental context for the project area.
Section 3: Problems, benefits and outcomes	Identifies the problems to be addressed, the benefits of investment
Section 4: Alternative and option assessment	An overview of the methodology used to assess the long list and short list options and the results of this assessment, including feedback received from key stakeholders.
Section 5: Recommended project option	A summary of the recommended option and an assessment of how the recommended option will achieve the investment objectives, the anticipated social and environmental performance, implementability considerations, project risks and wider project impacts.
Section 6: Recommended option – economic analysis:	An assessment of the recommended option economic costs and benefits of the recommended option, including sensitivity analysis.
Section 7: Financial case	A summary of financial analysis on the affordability and funding options for the recommended option.

1.4 TECHNICAL REPORTS AND SUPPORTING DOCUMENTS

The following reports and documents have informed the development and findings of this DBC:

- Assessment of the Wider Economic Benefits of the Shortlisted Options (EY, 2018)
- Preliminary Geotechnical Appraisal (GHD, 2018)
- Geotechnical Literature Review (GHD memorandum, 2017)
- Design Philosophy Statement (GHD, 2018)
- Preliminary Structure Options Report (GHD, 2018)
- Future management options for the current SH3 Route through the Manawatū Gorge (GHD memorandum, 2018)
- Safety in Design Register

1.5 PROJECT GOVERNANCE

1.5.1 NZ Transport Agency

The Transport Agency is working on three strategic responses that form the foundation of its direction and how to provide for all New Zealanders.

1. One connected transport system: Transform the performance of the land transport system by integrating digital technology with physical infrastructure to create a safe, connected system that works for everyone.

2. People-centred services: Simplify our customers' lives and our partners' work with innovative services and experiences that make it easy for them to do what they need to.

3. Partnerships for prosperity: Unlock social and economic opportunities for customers, businesses and communities through targeted partnerships.

These are further defined with focus areas that encourage strategic responses. They are:

- Shape the land transport system
- Improve customer experiences
- Target rapid growth
- Connect and develop regions
- Keep people safe
- Deliver connected journeys
- Achieve organisational excellence
- Transform the Transport Agency

The Manawatū Gorge Alternatives project gives effect to the Transport Agency focus areas, specifically it improves customer experience, will keep people safe, connects and develops regions and delivers connected journeys. These reflect the Transport Agency's aim to deliver value to customers and promote economic and social outcomes.

A new state highway connection to address the State Highway 3 closure through the Manawatū Gorge is referenced a number of times in the Draft Transport Agency's Investment Programme 2018-2027. The programme identifies this project as a key issue for the transport network and notes resilience issues have been occurring over a long period. It states *"The Manawatū Gorge project continues to be well aligned with Government priorities. We are proposing to significantly improve resilience with a new route, which will help ensure the region continues to be a transport hub for the Central North Island."* The project is listed as a National Priority 1 with the alignment to the Government Policy Statement (GPS) relating to Access and Resilience.

1.5.2 Partner organisations and key stakeholders

A number of partner organisations and key stakeholders have worked with the Transport Agency in developing this DBC. This includes local authorities, iwi, road user groups, the Department of Conservation, and local economic development organisations. Details of the specific partner and key stakeholder organisations are provided in section 2.4 of this report.

2 Strategic context

2.1 BACKGROUND

The key driver, which this DBC responds to, is the need to identify a long term resilient, efficient and safe connection for local commuters, inter-regional travellers and the freight and logistics industries, following ongoing landslide issues and the indefinite closure of State Highway 3 through the Manawatū Gorge in April 2017.

The closure of the section of State Highway 3 that runs through the Manawatū Gorge was the result of major slips in April 2017 and ongoing instability. This was not an isolated event and follows a history of unplanned closures of State Highway 3 through the Manawatū Gorge due to slips blocking the road. Since 1980, seven road closures have been recorded, ranging in duration from two days to 14 months. Following the most recent slip events, the continued repair and use of the Manawatū Gorge route has been deemed unsafe due to ongoing movement and instability risk and as a result, the road has been closed indefinitely.

The scale and frequency of land instability events has been increasing, with each event requiring significant investment to remediate and resulting in unavoidable disruption to road users, due to the reduced level of service provided by alternative routes. The uncertainty regarding the future of the Gorge has also resulted in delays in business investment, increased shipping costs and productivity losses.

The section of State Highway 3 through Manawatū Gorge is used not only by local road users, to connect the nearby urban and rural areas, but also by business operators and inter-regional travellers. The social and economic effects of these closures is not isolated to the Gorge itself but also impacts on nearby residents, adjoining alternative routes and the wider region. The significant and wide-reaching social and economic impacts of the indefinite closure has resulted in the urgency of determining and delivering an appropriate solution.

At a broader level, the region has been looking at the regional transport network over the last decade to understand how this can better enable economic growth, to capitalise on the central location as a key freight and distribution hub. This has included establishing the wider regional road hierarchy in the Palmerston North-Manawatū Joint Strategic Study (2010) (the Joint Transportation Study), which has been re-examined for this DBC by a Joint Working Group (JWG) established with key stakeholders. The Accessing Central New Zealand Strategic Case (2016) examined how the wider road network may be affecting the freight supply chain and limiting further growth, concluding that a whole of network approach be considered to realise the benefits of investment. Taking into account this work, the DBC has considered the correlation between the options for a replacement route and the delivery of the Regional Freight Ring Route.

The Transport Agency has therefore commissioned this DBC to identify a suitable alternative route and demonstrate the case for investment in this important state highway connection.

2.2 REGIONAL CONTEXT

2.2.1 Introduction

State Highway 3 through the Manawatū Gorge was closed indefinitely in April 2017 following a long history of slips and subsequent road closures. The existing alternative routes, Saddle Road and Pahiatua Track (Figure 1), are not capable of providing the necessary level of service for this

state highway connection, requiring that a long-term replacement route be determined. The following sections outline the context in which the DBC for the project has been considered.

Figure 1 Project site map (not to scale)

2.2.2 Geographical, physical and environmental context

The Manawatū Gorge is the boundary between the Tararua and Ruahine ranges. It is located 16.6 kms east of Palmerston North, 31.7 kms south west of Dannevirke and approximately 155 kms north of Wellington.

The ranges reach 350 m near the Gorge, and comprise large flat topped crests. The Tararua Range crest increases in height the further it is from the Gorge. The cleft of the Gorge is 1 km wide and 6 km long. The Manawatū River flows in a westerly direction through the Gorge. Slopes on either side rise to approximately 250 to 300 m above the river. The existing road lies on the southern bank of the Gorge and sits roughly 20 m above the river and consists of a number of half bridges particularly where the Gorge slopes are at their steepest. The road cuts are larger (up to 10 m high) to the western end, while to the east, the slopes are generally less steep and therefore shallower cuts have been used to create the road.

The wider project area has a complex geology, with a number of geological formations showing contrasting geological behaviours. It is a seismically active area due to the presence of a number of active and inactive fault lines, including the Wellington and Mohaka Faults.

The Gorge is classified as a scenic reserve and comprises 962 ha of tawa podocarp broadleaf forest and nikau palms. It contains several threatened and regionally significant protected sites, for example, Lake Colenso, and the heritage site of historic Fulcher's Cottage.

The wider area includes broadleaved indigenous hardwoods and indigenous forest area, including habitats recognised within Schedule F (Indigenous Biological Diversity) of the Horizons One Plan and a number of QEII Covenants. There are also a number of waterways which traverse the project area, including the Manawatū and Pohangina Rivers which have ecological, scenic and natural character values (as well as sites of significant value which are identified within the Horizons One Plan). The floodplains of these waterbodies are also relevant considerations.

The landscape includes features recognised as Outstanding Natural Features and Landscapes (ONFLs) and areas identified within Schedule G (Landscapes) of the Horizons One Plan, Manawatū District Plan and Palmerston North City Plan.

2.2.3 Land use context

The land use in the project area beyond the Manawatū Gorge is predominately rural farmland. Anecdotal evidence suggests that the most productive land is located on the flats west of the existing State Highway 3 (Napier Road) south of Ashhurst. A long-term fertiliser trial site is located on the Ballantrae research farm, north of the Gorge near the eastern end of Saddle Road. Landowner feedback indicates that this is nationally significant, as one of only two fertiliser research farms in New Zealand.

Within the project area, dwellings are more prevalent near the townships of Ashhurst and Woodville, and the land adjacent to Napier Road, between Ashhurst and Palmerston North, where there are a number of lifestyle blocks.

Two wind farms lie to the immediate north and south of the Gorge. The Te Apiti wind farm (owned by Meridian) to the north and the Tararua wind farm (owned by Tilt Renewables) to the south. Each wind farm uses the natural contours of the ranges and the Gorge to improve its efficiency. Turbines are placed in specific locations to maximise the amount of wind energy captured.

2.2.4 Economic context

An economic analysis and traffic modelling assessment undertaken by EY highlighted the region's wider economic environment (Appendix E). The Horizons South East economy has competitive advantages in:

- Transport and distribution with strong and consolidating growth in the North East Industrial Zone in Palmerston North. This is supporting the growth of a regional logistics hub, and could respond strongly to future decisions about the location of rail infrastructure
- Food product manufacturing, particularly value added manufacturing, supported by processing red meat and dairy from the Rangitikei, Manawatū, and Tararua Districts
- Palmerston North also has a strong agricultural and scientific research focus, supported by Massey University. Food HQ is attracting outsourced food science research and development work for international companies and provides opportunities to support productivity in agriculture and food manufacturing across the region
- Palmerston North also supports a strong public sector and health workforce and NZDF's strong presence in Linton helps to support economic activity in the region.

Continued regional growth strongly depends on maintaining high quality and efficient transport links. The nature and timing of a Manawatū Gorge replacement and associated roading upgrades (including upgrades to the ring road around Palmerston North and a second Manawatū River crossing) are important to future economic growth.

The regions competitive advantage in transport and distribution in particular, is very important to the Horizons South East economy. State Highways 1, 2 and 3 pass through the Horizons South-

East region and largely provide this accessibility, and transport and distribution advantage. Analysis of employment and output trends suggest that since the Gorge closures in 2017 Palmerston North has lost its competitive advantage in this area. Between 2012-2015 road transport employment in Palmerston North increased by 50, contrary to the regional downward trend. However when the Gorge closure dates are incorporated into this data range (2012-2017) employment in road transport for this period decreases to -38, to be in line with wider regional downward employment trends in this sector.

The continued growth of the region is strongly dependent on maintaining high quality and efficient transport links. The nature and timing of the Gorge replacement is an important determinant of the Region's future economic growth. Since the closure, the efficiency of firms operation and the productivity of workers particularly in the transport, logistics and distribution sectors have been affected. Due to uncertainty, investments have been delayed in the region, and agglomeration benefits associated with travel times and bringing firms closer together within the region have been foregone. These factors are acknowledged to be affecting productivity and efficiencies, as well as regional GDP.

2.2.5 Cultural context

Three iwi groups have engaged with the Transport Agency in respect of the project, reflecting their mana whenua status (customary authority) or interest within the Manawatū Gorge area. These are Rangitaane o Manawatū (based in Palmerston North), Rangitāne o Tamaki nui a Rua (based in Dannevirke), and Ngati Kahungunu (also based in Dannevirke). Consultation has been undertaken in order to understand the cultural significance of the Gorge area and surrounding ranges and to understand potential cultural sites and the impacts of options.

The Manawatū Gorge is recognised by iwi as one of the main routes connecting the east and west. Historically, it was a trading route, connecting the two sides of the country with Rangitāne o Tamaki nui a Rua transporting wheat through the river to the mills in Foxton as early as 1860.

The Gorge (and the adjoining ranges) also encompass a number of cultural and spiritual values. Rangitaane o Manawatū bestowed the name Te Apiti, meaning the narrow passage, as it was recognised as one of the main routes connecting old rohe. In Rangitaane o Manawatū history, the spirit, Okatia possessed a giant tree on the Puketoi Ranges (east of Woodville) which had been gouged out of the Gorge[1].

Rangitāne o Tamaki nui a Rua also identified specific values and sites within the river itself, including specific rock features and mahinga kai.

Parahaki Island, located at the fork of the river just east of Ashhurst, is Maori freehold land. The area south of the island, while private farmland now, was historically used as a camping ground and as a source of food and medicine for Maori. The island is therefore considered to be a highly valued cultural site. Iwi representatives have indicated the importance of maintaining a strong connection to the island, but wish to see it protected from physical disturbance.

A carved rock on the hilltop near Saddle Road marks a battle site where ancestors were killed. According to legend, the bodies were collected and heaped and then turned to stone. The rock and hilltop are therefore also considered a highly valued cultural site.

The project area is part of a wider area of interest to Ngati Kahungunu in terms of values associated with pre-human native vegetation, waterways and the landscape value of the ranges.

[1] http://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/wanganui/manawatu-Gorge-biodiversity-brochure.pdf

2.3 TRANSPORT CONTEXT

As one of the few connections between the western and eastern sides of the Tararua and Ruahine Ranges, State Highway 3 (SH3) is a key link between Manawatū, Wairarapa and Hawke's Bay. It is a national road according to the One Network Road Classification and makes a significant contribution to the social and economic wellbeing of these regions by connecting towns and cities (Woodville, Ashhurst, Dannevirke and Palmerston North), supply chain infrastructure, amenities and employment.

Manawatū Gorge route

The route connects the Manawatū and Wairarapa/Hawkes Bay by road and rail. The road was first built in 1872 and has undergone significant construction and widening since the 1940s. With just two 3.5 m wide lanes and no shoulder, the 8 km winding route through the Gorge does not allow for overtaking. Prior to its closure, approximately 7,620 vehicles travelled through the Gorge each day. The flatness of the route made it the route of choice for heavy commercial vehicles (HCVs) comprising 11.3% of the traffic moving through the corridor. The route through the Gorge was not designed for over-weight or over-dimension loads.

The many land slips that have periodically closed State Highway 3 through the Manawatū Gorge were largely due to the geology of the Tararua Range and the presence of the road, which has destabilised the already unstable slopes forming its southern wall. Road widening by excavating into the bank has exacerbated the instability. Until 24 April 2017, these closures lasted between two hours and fourteen months (the latter happening in 2011 – 2012). The significant risk of further slips in two active locations led to the indefinite closure of this section of State Highway 3 in 2017.

Alternative local routes

When the Gorge is closed there are only two alternative routes that drivers can take – Saddle Road (a local road linking Ashhurst with Woodville) or Pahiatua Track. During a closure, approximately 6,220 vehicles per day use the Saddle Road (~80% of total traffic that previously used the Gorge route). Saddle Road measures 18 km and the general traffic travel time between the towns is 22 minutes when unimpeded. Due to the road's steeper gradients and horizontal geometry, the average travel time between Woodville and Ashhurst when compared with the Gorge route is approximately 9 minutes slower for general traffic and 15 minutes slower for heavy commercial vehicles (HCVs).

The Pahiatua Track traverses the Tararua Ranges south of the Manawatū Gorge. Before the closure it recorded 2,214 vehicles per day; since the closure 3,819 vehicles per day have been recorded. The route also has large sections of winding road with steep gradients. Commuters travelling between Palmerston North and Pahiatua or further south generally consider the Pahiatua Track the most preferred alternative, however all other traffic moving between Hawke's Bay and Woodville, and areas within and beyond the Manawatū is likely to use the Saddle Road as it is shorter in distance and travel time.

Figure 2 shows the features of each route between Woodville and Ashhurst, including traffic volumes before and after the most recent closure.

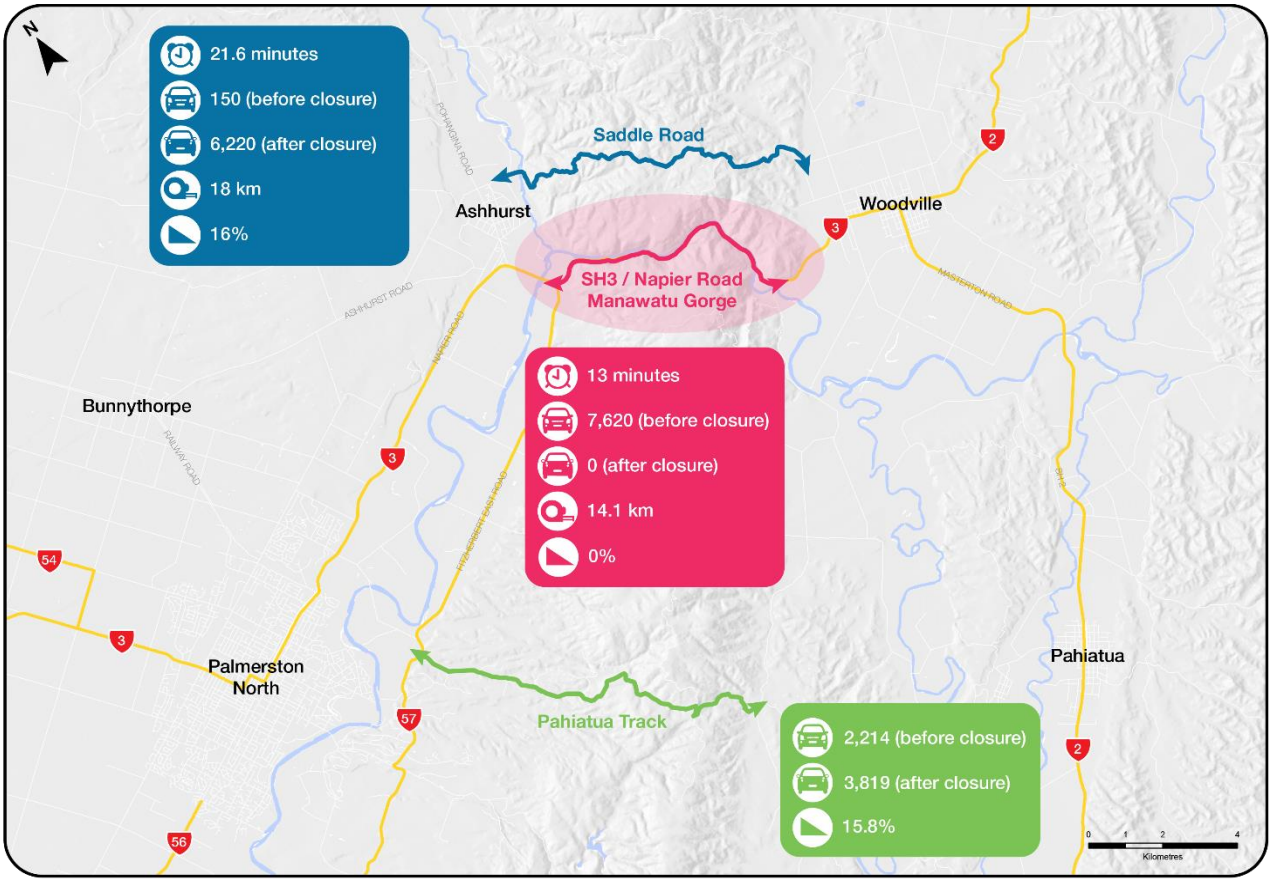

Figure 2 Manawatū Gorge, Saddle Road and Pahiatua Track traffic volumes

It is important to note that since the closure of Manawatū Gorge in April 2017 total daily vehicle volumes across the three routes have increased slightly from 9,984 before the closure to 10,039. This demonstrates the high strategic importance of the route and its inelasticity of use. Crossing the ranges is a necessity as people need to access employment, schools and services and to operate their businesses.[2]

State highway connections

State Highway 3 connects into State Highway 57 east of Ashhurst (providing a link to State Highway 1). East of the Gorge, it connects to the State Highway 2/3 intersection in Woodville which accommodates traffic movements to and from the Wairarapa and Hawke's Bay regions.

Road safety

The geometry and physical characteristics of the Saddle Road and Pahiatua Track alternative routes fall short of providing a suitable standard to deliver a safe national highway connection. The Saddle Road and Pahiatua Track provide a 2 star KiwiRAP rating, well below the preferred safety level for a road of this type.

Due to historical traffic volumes on the alternative routes being lower than on the Gorge route and the short period of time the traffic has been using the alternatives, data extracted from the Transport Agency's Crash Analysis System does not support the reduced safety, but anecdotal feedback is the alternative routes are less safe than the previous use of SH3 through the Gorge.

[2] Further detail of the transport assessments undertaken is attached as Appendix G.

Despite a series of minor works being undertaken to address urgent safety (and maintenance) issues on the Saddle Road in 2017 and 2018, it is anticipated that over time, due to the lower standard road, there will be more crashes on the alternative routes than there were on the Gorge route previously.

Public transport

Intercity New Zealand is the only national bus operator with regular bus services between Woodville and Palmerston North. There are currently between two and six services per day between the hours of 10 am and 6 pm. The average journey time between Woodville and Palmerston North is 35 – 40 minutes, and between 29 and 39 minutes in the opposite direction. These services operate as part of longer interregional bus routes.

Cycling and walking

The Pahiatua Track is the national cycling route between northern Wairarapa and the Manawatū regions. The closure of the gorge is not known to have impacted cycling levels on the Pahiatua Track but is likely to have deterred and cyclists from using the Saddle Road, however this is anecdotal and without verified counts. The only walking facilities are those through Department of Conservation reserves (see below).

Department of Conservation reserves

There are a number of scenic walking tracks traversing different routes throughout the Manawatū Gorge Scenic Reserve, which are accessed from SH3. Carparks for recreational users are located at the eastern and western entries to the Gorge. Although SH3 is closed, all five walking tracks in the Gorge remain open and accessible. This includes the 11km one way Manawatū Gorge Track which takes users from the western end of the Gorge to the eastern Ashhurst end in approximately 3-5 hours. Figures from 2016 indicate that this area had over 100,000 visitors, a significant increase (of over 350%) since 2012[3].

Rail

Palmerston North is a key freight and logistics centre for the Lower North Island. As such, volumes and movements of freight can be frequent for exports travelling to Palmerston North via the Manawatū Gorge, and imports travelling from Napier Port to Palmerston North[4]. Movements of freight by rail and road for the 2017 financial year (FY) are shown in Table 2.

Table 2 Napier Port Export and Imports transported via the Gorge 2017 FY (sourced from Napier Port)

Type	Transport Method	Volume (tonnes) per annum
Export via the gorge:		
Pulp	Rail	200,000 tonnes
Timber	Rail	50,000 tonnes
Logs	Rail	200,000 tonnes
Containers – Various	Rail	6,000 tonnes
Containers – Various	Road	20,000 tonnes

[3] http://www.teapiti.com/updates/2017/11/2/additional-facilities-enhance-te-apiti-manawatu-gorge-visitor-experience

[4] Note: This DBC does not address rail access directly as the rail line continues to operate satisfactorily on the opposite side of the Gorge from the now closed road route.

Type	Transport Method	Volume (tonnes) per annum
Import from Napier to Palmerston North:		
Cement	Road	6,000 tonnes
Containers – Various	Road	10,000 tonnes
Containers – Various	Rail	3,000 tonnes

Note: Containerised volume averaged at 13 tonnes for TEU (Twenty-foot equivalent unit)

This demonstrates the strength of the rail network for import and export freight volumes. In total rail was used to transport 459,000 tonnes of import/ export goods via the Manawatū Gorge to and from the Port of Napier (excluding all other freight movements) in 2017 FY, compared to 36,000 tonnes by road using SH3[5].

2.4 POLICY CONTEXT

Providing a new state highway connection between Woodville and Ashhurst to replace the previous Manawatū Gorge (State Highway 3) connection responds to both the previous and current Government's strategic outcomes. While this DBC was largely developed before the release of the Draft Government Policy Statement on Land Transport 2018 (draft GPS), the new state highway connection aligns well with the draft GPS. The draft GPS sets out the Government's spending priorities for the National Land Transport Fund over the next 10 years. In particular the new State Highway 3 connection reflects the four strategic priorities of the draft GPS being safety, access, value for money and the environment.

Key aspects of the draft GPS[6] relevant to this project includes the "Role of the GPS". This states:

- Transport is a critical part of daily life for all New Zealanders. We use transport for access to services, freight, travel for work, education, health, and for visiting family and friends. Transport networks allow businesses, regions and cities to be well connected and productive
- Transport investments have long lead times, high costs, and leave long legacies. Good transport investment therefore requires careful planning that allows for uncertainties to ensure today's transport network will be able to meet our future needs

Given the closure of the existing State Highway 3 route, there is a clear and urgent case for investment to meet current and future transport needs.

2.4.1 Draft GPS 2018

The Government Policy Statement (GPS) on land transport provides a long-term strategic view of the transport network that helps guide investment. The Draft GPS 2018 has four strategic priorities, two are key strategic priorities, and two are identified as supporting strategic priorities. The two key strategic priorities of GPS 2018 are safety and access and the two supporting priorities are value for money and the environment.

Providing a new state highway connection to replace the currently closed section of State Highway 3 through the Gorge demonstrates significant alignment to the draft GPS 2018. It reflects both of the key strategic priorities (safety and access).

[5] Note: this is for a normalised year (2017 FY) and doesn't take into account the fact that Napier Port had increased tonnage as a result of the Kaikoura Earthquake which impacted volumes at CentrePort (Wellington) following the earthquake.

[6] https://www.transport.govt.nz/assets/Uploads/Our-Work/Documents/Draft-GPS-2018.pdf

Greater access for all user types will be achieved once the new state highway connection has been constructed. Improvements in travel time, and increased road network resilience for traffic are the two primary factors that will help provide improved access.

In addition, value for money has been a key consideration in the planning for this new state highway connection. The wider economic benefits have been considered, especially with regard to certainty of timing and investment.

2.4.2 Horizons Regional Land Transport Plan 2018-21

The Regional Land Transport Plan 2015-25 (2018 Review) is a statutory document setting out the strategic direction for land transport in the Horizons Region. It identifies regional priorities for the next ten years. One of the key priorities is the planning and implementation of a cohesive and resilient transport network to, from and within the region. This document explicitly identifies finding a viable alternative to the Manawatū Gorge route as an immediate priority.

2.4.3 Palmerston North-Manawatū Joint Transportation Study 2010

The Palmerston North-Manawatū Joint Strategic Study *(2010)* (the Joint Transportation Study) prepared by the local and regional councils and the Transport Agency in 2010. This document, articulates the current and proposed strategic road hierarchy along with the wider strategic land use and transport context of Palmerston North and surrounds as at the time of its production.

During the DBC process, a Joint Working Group (JWG) was formed to challenge and test the proposed regional road hierarchy identified in the Joint Transportation Study and specifically *"to objectively consider the future development of a regional freight network and how the shortlisted options for the Manawatū Gorge Alternatives project can support, enable and/or complement the desired investment in the regional freight network"*[7]. The JWG representatives were outlined previously in section 2.5.

2.4.4 Horizons Regional Policy Statement

The Horizons One Plan (Regional Policy Statement) recognises the critical importance of regionally or nationally important infrastructure (and infrastructure corridors) for the economic wellbeing of the Region and the nation. Specifically, Objective 3-1 and Policy 3-1 state that the benefits of infrastructure of regional or national importance must be had regard to and their establishment, operation, maintenance and upgrading provided for. As per Policy 3-1, *'the road and rail networks as mapped in the Regional Land Transport Strategy'*[8] are recognised as physical resources of regional or national importance.

2.4.5 Tararua District Council

The Tararua District Council 2018- 2028 Long Term Plan (draft) was recently prepared, and consultation on this draft closed on the 11th May 2018. The Draft LTP defines the aim for roading within the district: to provide a safe and efficient transport network that improves the movement of people and products, both within and through the district. Currently access and movement of people and products from the Tararua District to the Manawatū region is impacted due to the closure of State Highway 3 through the Gorge. The Manawatū Gorge Alternatives project will

[7] Taken from the Joint Working Group Terms of Reference and scope of work document.

[8] State Highway 3 is recognised as a corridor of national or regional significance as an inter-regional corridor, which plays a crucial role in facilitating the movement of people and freight through the Region and North Island, in the Regional Land Transport Plan

support the direction of the Tararua District Council LTP 2018 by improving access for people and goods through this important interregional corridor.

2.4.6 Manawatū District Council

The Manawatū District Council draft Long Term Plan 2018-2028 sets out the direction of the Council's 2018-2028 programme. The overarching vision statement of the draft LTP 2018-2028 is for a connected, vibrant and thriving Manawatū District, and the specific goal for the Infrastructure Strategy within the LTP is to provide the Manawatū community with resilient infrastructure in a cost-effective way, meeting both current needs and future growth and demand. The current closure of State Highway 3 through the Manawatū Gorge has proved that resilience is currently a major issue for the council and its community. Providing a new state highway connection will greatly improve network resilience and assist in achieving its infrastructure strategy goal.

2.4.7 Palmerston North City Council

The Palmerston North City Council's 10 Year Plan demonstrates how they want the city to develop, and sets out the projects and services to be provided in that timeframe. One of the council goals of the 10 Year Plan is for a connected and safe community. The implementation of a new state highway connection will support this goal by providing increased access as well as safety improvements for the City. The Manawatū Gorge Alternatives project is referenced on the Council's 10 Year Plan website for achieving sustainable growth over the next ten years.

2.5 STAKEHOLDERS

Developing collaborative relationships with stakeholders has been central to the DBC process, consistent with the Transport Agency guidance that it is important to include the perspective of stakeholders in order to make good decisions and provide sound advice to decision-makers.

Stakeholder engagement was undertaken to gather information about project context, to understand the problems, opportunities and benefits of the project and to obtain feedback on the options considered. Working closely with stakeholders has been critical for ensuring a new route is able to meet road user and wider community transportation needs and for avoiding as far as possible, adverse effects on landowners and communities, and the environment.

The approach to stakeholder engagement was to firstly focus on engaging with identified key stakeholders through a series of workshops and then provide an opportunity for wider community feedback through online feedback and public open days. This approach recognises the Transport Agency's social and environmental responsibility, statutory obligations for the project (e.g. LTMA and RMA) and provided valuable information to be factored into the decision making process.

Key stakeholders, identified in Table 3, have worked closely with the Transport Agency throughout the DBC process.

Table 3 Stakeholders involved in workshops

Stakeholders	Role and interest in the Project
Manawatū District Council	Partner organisation. The project area is within the boundary of Manawatū District - the project will influence transport connections within this district.
Palmerston North City Council	Partner organisation. The project area is within the boundary of Palmerston North - the project will influence transport connections within the city
Tararua District Council	Partner organisation. The project area is within the boundary of Tararua District - the project will influence transport connections within this district, Woodville is a key town impacted by the closure,
Horizons Regional Council	Iwi partner organisation. The project area is within the Horizons region. Horizons Regional Council have transport and environmental interests.
Rangitaane o Manawatū	Iwi partner organisation. The project is within the rohe of Rangitaane o Manawatū.
Rangitāne o Tamaki nui a Rua	Iwi partner organisation. The project is within the rohe of Rangitāne o Tamaki nui a Rua.
Ngati Kahungunu	Partner organisation. The project is within the rohe of Ngati Kahungunu.

Stakeholders	Role and interest in the Project
Accelerate 25 - Manawatū business community	Key stakeholder. Interests relate to opportunities for supporting and promoting regional economic growth.
Department of Conservation	Key stakeholder. Interests relate to conserving natural and historic heritage and recreation opportunities.
Heavy Haulage Association	Key stakeholder. Interests relate to providing for heavy commercial vehicles, who rely on this roading connection.
Automobile Association	Key stakeholder. Road user advocacy organisation.
Road Transport Association	Key stakeholder. Road freight advocacy organisation.
Fonterra	Key stakeholder. Farmer collective impacted by road closure

The team also met with a number of other key stakeholders on a one-to-one basis. This included a range of public and private organisations such as iwi, the owners of the wind farm infrastructure located either side of the Gorge, conservation groups and others.

A Statutory Approvals Working Group (SAWG) was established with planning representatives from the relevant councils, who assisted with identifying planning and environmental constraints and issues. Internal Transport Agency specialists were also important stakeholders, who assisted the project team throughout the DBC development and carried out reviews.

Full details of the engagement undertaken for the DBC are provided in Appendix J.

3 Problems, benefits and outcomes

3.1 PROBLEM DEFINITION

3.1.1 Introduction

As part of developing the option assessment framework there is a need to define the problems that need to be addressed and to then provide evidence that supports these problems. The problem statements below were developed and discussed by the project team in the business case workshops and meetings with stakeholders.

The first problem statement addresses the issues surrounding the frequent and ongoing closures to the Manawatū Gorge as a result of its geological and physical attributes. This highlights the fact that issues relating to the long term resilience of the road would still exist even if the Gorge was open today. The second problem statement is the more immediate issues resulting from the major slip in April 2017 and indefinite closure of SH3 through the Gorge.

Figure 3 below shows the relationship between the problems being experienced and the benefits of investment.

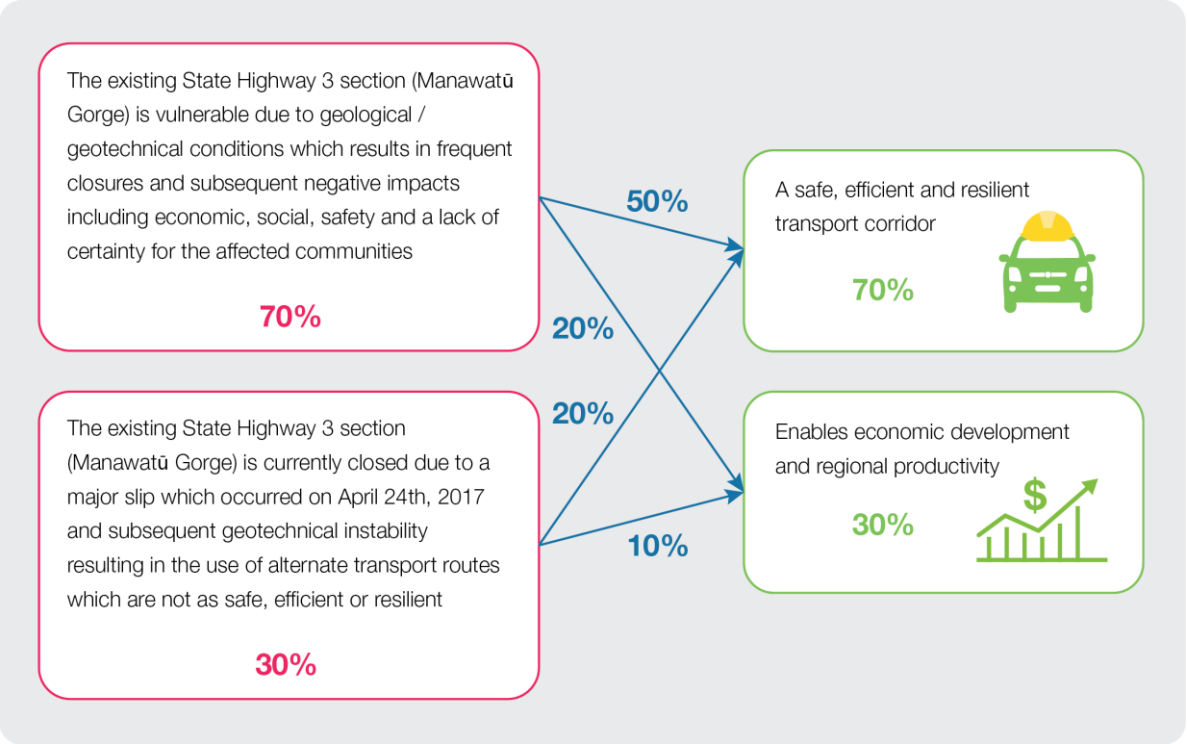

Figure 3 Investment logic map – Problems and Benefits

3.1.2 Problem Statement 1

The existing State Highway 3 section (Manawatū Gorge) is vulnerable due to geological/geotechnical conditions which results in frequent closures and subsequent negative impacts including economic, social, safety and a lack of certainty for the affected communities.

Problem Definition

SH3 through the Manawatū Gorge is highly susceptible to slips resulting from weather events. These range from small slips that cause safety and operational issues to major slips which have

historically resulted in closure of the state highway, often for months at a time. The route has been and will continue to be highly susceptible to seismic events that could cause catastrophic injury to people using the state highway as well as likely irrecoverable damage to infrastructure within the Gorge.

Manawatū Gorge is a steep and confined section of the Manawatū River, which is thought to be in response to uplift that has down cut through the axial ranges to form the Gorge. Since the construction of the road (SH3) along the southern wall of the Gorge in the late 1800's the frequency and size of landslides has increased. This is as a result of road widening and associated undercutting of the toe of the Gorge walls contributing to land instability.

Evidence of the problem

The Manawatū Gorge has suffered the threat of land slips and failures since the track was first constructed in the 1872. Since the 1920s the road has been gradually widened requiring large cuts into the southern side of the Gorge. This has only steepened the base of the slope which has led to greater instability throughout the length of the Gorge.

Despite records showing slips from as far back as the 1930s, which may have resulted in road closures, the first significant recorded road closure as a result of a slip was in 1990 near Barney's Point (a tight corner towards the western side of the Gorge). Approximately 5,000 m^3 of material blocked the road, leaving it closed for 8 days. Three separate landslides occurred in 1995 which closed the road for a total of 67 days as a result of approximately 100,000 m^3 of earth falling away from the sides of the Gorge from 100 metres high. The failures were considered to be related to the road widening which occurred in 1980, which cut back a significant portion of the toe of the slope with the slip occurring during wet weather conditions. The other slip in this decade was recorded in 1998, this was located in the central section of the Manawatū Gorge and resulted in a closure of 7 days.

In February 2004, the Manawatū Gorge received 200 mm of rain in 24 hours resulting in 9 major slips, 30 smaller slips and significant flooding throughout the Gorge. The largest slip (between 70,000 and 100,000 m^3 of colluvium and weathered red argillite) closed the road for 70 days. The larger slips were located in the central sections of the Gorge. This storm event also washed out the Saddle Road Bridge over the Pohangina River.

The landslide that occurred in August 2011 and closed the road for 14 months, was located 60 m downstream from the Rapids Bridge (in the western side of the Gorge). Table 4 provides a summary of all the recorded slips which have occurred since before 1930.

Table 4 Significant historical landslides in Manawatū Gorge

Historical Landslide occurrences	Western Section	Central Section	Eastern Section
Pre 1930-1940	13	9	-
1940	9	12	6
1968-69	4	7	1
1978-80	19	11	6
1985-86	1 (closed for 2 days)		-
1990		1 (closed for 8 days)	-
1995		3 (closed for 67 days)	
1998		1 (closed for 7 days)	
2004	7	14 (closed for 70 days)	7
2008	1		1
2011-12	1 (closed for 360 days)		
2015	2 (closed for 50 days)		
2017	2 (ongoing)		2

Source: Manawatū Gorge 2012 Landslide Risk Report-CR2012-254 (11th October 2012) and Review of geology and landsliding in the Manawatū Gorge and implications for future landslide closures of State Highway 3, GNS Science (2011).

A risk assessment undertaken in 2012 by GNS following the 2011 slip and SH3 closure identified 25 sites at risk of slips that might block SH3 within the Manawatū Gorge, shown below in Figure 4. The figure shows the locations of existing slips, historic slips sites and potential future slip sites. Of these 25 sites, eight sites were classified as presenting a moderate threat (10,000m^3), eleven high threat (10,000-25,000m^3) and six very high threat (25,000-50,000m^3)[9]. These sites were identified throughout the Gorge, with the greatest concentration in the central section of the Gorge[10].

A report by MWH in 2012 considered that it would not be economically feasible to treat these sites[11]. This MWH report estimated that a small scale event (5,000 to 20,000m^3) could be expected to occur every three to five years, resulting in a closure of 1-2 weeks for each event and for large landslides (20,000 to 100,000m^3), every 5-10 years resulting in a closure of two months or more.

[9] Engineering Geological Assessment of the Risks and Potential Magnitude of Future Landslides That Might Close SH3 within the Manawatu Gorge, GNS Science Consultancy Report 2012/254 (Draft), 11 October, 2012.

[10] PSW 198 / SH3 Manawatu Gorge Geological Risk Assessment, MWH, 9 November, 2012.

[11] PSW 198 – SH3 Manawatu Gorge Alternative Route Assessment, MWH, 14 November, 2012

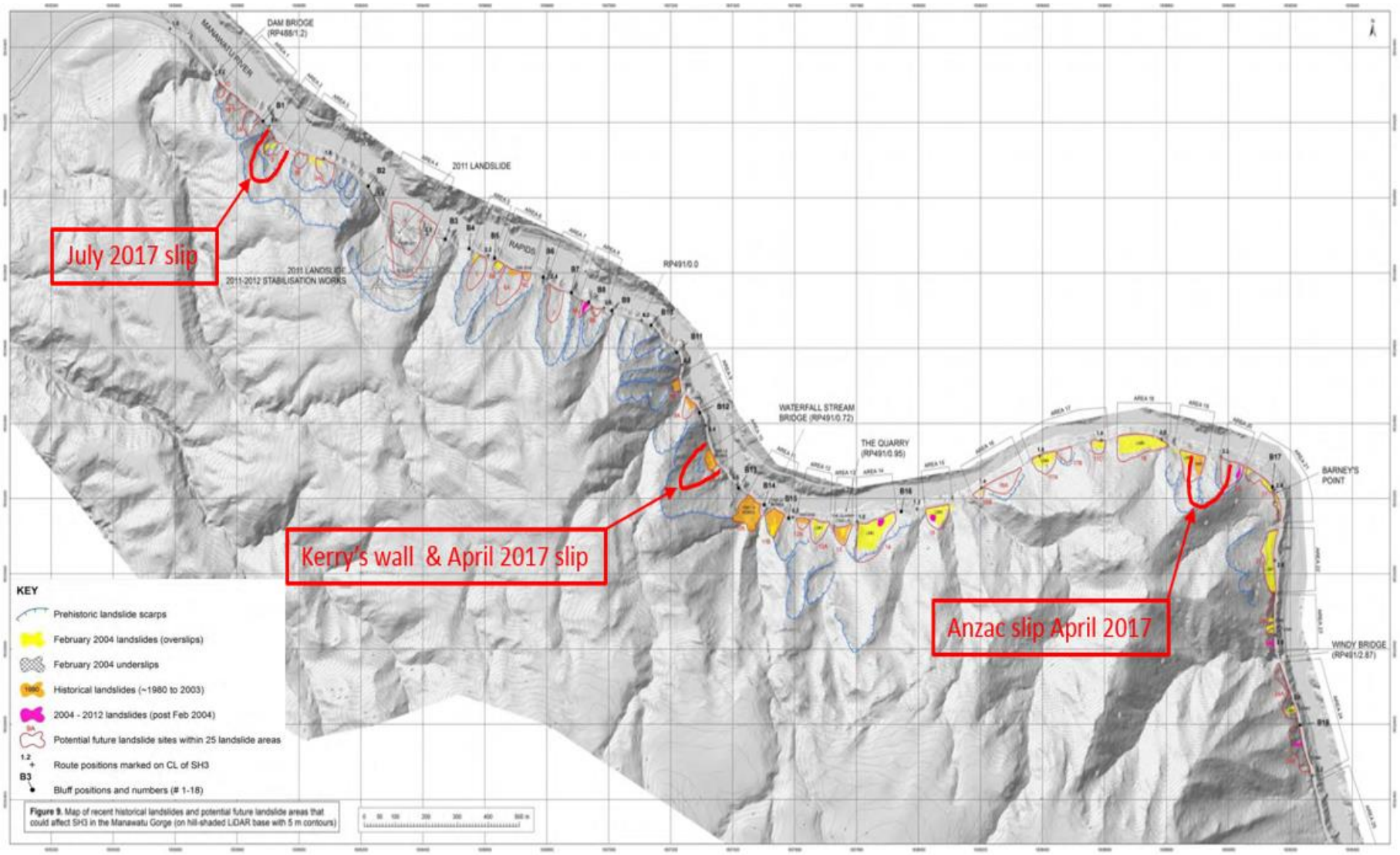

Figure 4 Plan of key risk areas. Image extracted from (and updated) from GNS (2012)[12]

Monitoring at the Kerry's Wall site since September 2015 has indicated signs of movement to varying degrees at each survey[13]. Data indicates an increase in rainfall prior to the April-June slip events, suggesting a correlation between movement and heavy rainfall. There was also a notable increase in movement after the Kaikoura earthquake (although there is a lack of data to confirm this correlation)[14].

Observations of the Kerry's Wall slip site in 2017 suggested that significant stability risks remain with a high level of imminent and longer term risk of ongoing slip failures at Kerry's Wall (and the ANZAC slip site)[15]. Similarly, a report by Beca in August 2017 concluded that a larger slope failure at this site was imminent, with a threat level of extreme[16]. The modelling discussed in the Beca report suggests that the slip at Kerry's Wall is part of a four-stage failure event (with Stage 1 – Stage 4 representing an increasing scale of event). The April 2017 slip at Kerry's Wall was described as Stage 1 (40,000 - 60,000 m^3, 6-10m thick). This report suggested that events of a scale ranging between 40,000 m^3 to 260,000m^3 and 15-20m thick (i.e Stages 1-3) will occur in the absence of mitigation or remedial work within the Gorge and a Stage 4 failure, defined as 215,000 - 260,000m^3 and 17-20m thick, may not occur for some time. This reporting also suggests that the area around Kerry's Wall may also be close to failure[17].

Further slips and instability can be expected without remedial work however the safety risk at the site make remedial works unfeasible[18]. Ongoing real-time monitoring and subsurface investigations have been recommended to further understand the failure mechanism, before workers could safety return to the site[19]. A possible remediation option, involving top down benching, would require additional geotechnical assessment along with a detailed design and consenting process, after which construction could take 1-2 years.

The frequent closure of SH3 through the Manawatū Gorge not only disrupts travel movements but also impacts on the general community, the environment, safety and individual businesses. Valuable evidence of those effects was collected from community feedback; during the long list options assessment and during the development of the long list, a number of public meetings and online community forums provided feedback on the disruption caused to the community through closure of State Highway 3 through the Gorge. These disruptions have occurred most notably in the past two decades with major closures occurring more frequently since 2011. Further information regarding the most recent slip and its impact on the community can be found in the second problem area (see section 3.1.3 below).

Census data (2013) confirms that over 500 people lived in the Tararua District and worked in Palmerston North, while another 200 people lived in Palmerston North and worked in the Tararua District. This means that approximately 700 people a day would have been

[13] Manawatu Gorge Remedial Works Reports SH3: Slip 7 Kerry's Gabion Wall Monitoring Surveys, Beca, May – November 2017.

[14] Report Update on SH3 Manawatu Gorge NOC15 - Kerry's Slip, Beca, 3 October 2017, Ref NZ1-14694032

[15] SH3 Manawatu Gorge Peer Review, Tonkin and Taylor, 6 June, 2017

[16] Report SH3 Manawatu Gorge 7016 3321495 Higgins NOC15 - Kerry's Slip Modelling, Beca, 3 August 2017

[17] Refer to footnote 17 above

[18] Report SH3 Manawatu Gorge 7016 3321495 Higgins NOC15 - Kerry's Slip Modelling, Beca, 3 August 2017.

[19] Kerry's Wall SH3 Manawatu Gorge RP491/0.48, Opus, 22 September 2017 (Draft)

significantly impacted on an almost daily basis from the major closures in 2011/2012 and 2017 as a result of closure of the Gorge. There are also two school buses that commute from Dannevirke daily which would have been required to use Saddle Road for children to travel to school.

While the Saddle Road provides an acceptable standard for short periods when the Gorge is closed, it does not offer an acceptable level of service as a state highway in the long-term. The road was designed for much lower volumes of traffic and continued use of Saddle Road will likely increase safety risk for users and maintenance costs.

Implications of the problem

The uncertainty around the state of the existing state highway section within Manawatū Gorge has caused significant constraints to local communities, businesses, the freight industry and other inter-regional commuters. Despite the many reinforcements and upgrades made to the road over the last 70 years, slips still occur and have been becoming larger and more likely to cause long term closure of the Gorge since 2011. The long term resilience of the Gorge is compromised and there are very few feasible options available that will prevent the slips from being a serious risk. There is also the potential impact from a seismic event in the region which would result in potentially permanent closure of the Gorge for any level of access.

The uncertainty around the future of the Gorge and a replacement route means businesses, which rely on reasonable access to markets are affected. There is also the potential that businesses may need to alter their operations to cater for the disruption. Some businesses have already altered their operations due to the most recent closure (e.g. Fonterra) and more are likely to if a solution is not confirmed. This is explained further in section 3.1.3.

3.1.3 Problem Statement 2

The existing State Highway 3 section (Manawatū Gorge) is currently closed due to a major slip that occurred on 24 April 2017 and subsequent geotechnical instability resulting in the use of alternate transport routes which are not as safe, efficient or resilient.

Problem Definition

Two major land slips have occurred since April 2017 within the Manawatū Gorge which have blocked the road with debris and thus forced its closure. A slip at the Kerry's Wall site occurred on 24 April 2017 causing major damage to the road, with further slips at this site occurring in the following months (Figure 5, Figure 6).

Figure 5 Kerry's Wall Slip, viewed from the western end of the Gorge

Figure 6 Aerial view of Kerry's Wall slip site (cracks circled in red)

Another slip occurred on the weekend of the 24 and 25 April 2017, and became known as the Anzac slip. The Anzac slip was repaired with the installation of new rock fall netting. However on 25 June 2017 there was a smaller slip at this site which destroyed part of the netting (Figure 7). Then on 23 July 2017, another slip occurred in another location at the eastern end of the Gorge, dislodging approximately 10,000 m^3 of material, including large boulders (Figure 8).

Figure 7 ***Anzac slip – 25 April 2017***

Figure 8 ***Aerial view of slip that occurred in the Manawatū Gorge on 23 July 2017***

Due to ongoing instability issues (as outlined above) these slip sites were assessed as a significant safety risk, which resulted in repair crews being removed from the area in July 2017. The typical approach for large landslips of this nature is to clear the debris from the top down via a series of benches. However, access is dangerous due to the steepness and height of the slopes as well as the additional unstable rock and this, combined with winter weather, means this approach has not been attempted after the closure. On-going monitoring has shown that material is continuing to move and it is still considered too unstable to re-enter. The Transport Agency made the decision in July 2017 to close the Gorge indefinitely.

As a result of the closure people and goods are now required to use the Saddle Road and Pahiatua Track as alternative routes to travel between the regions or either side of the ranges.

Evidence of the Problem

The closure of the Gorge as a transport corridor has resulted in the need for commuters and freight operators to use two lower standard routes. These routes are not resilient and are also subject to closures from slips, accidents, maintenance works and bad weather. These routes are also less safe and considerably less efficient for all road users than when people would previously use the Gorge.

The extra distance and higher gradients along Saddle Road also lead to higher vehicle operating costs, particularly for heavy vehicles. Furthermore, while some truck drivers were previously able to make two trips a day without exceeding driving limits between Palmerston North and Hawke's Bay, this has become increasingly challenging, when there are increased traffic volumes (i.e. holidays, harvesting) or other incidents such as traffic crashes or during poor weather. The additional direct travel costs are estimated to be approximately $60,000 a day or more than $22M p.a. and an increased travel time of approximately 9 minutes for general traffic and 15 minutes for freight per trip.

Major rural service, logistics and primary industry businesses have changed their business activities and in some cases, freight routes, due to the Gorge closure. In some cases neither Saddle Road nor Pahiatua Track are considered to be at a standard that can appropriately service their transport fleet. Stakeholders and members of the community provided numerous anecdotal examples of impacts to local businesses and access to amenities including additional travel times for ambulances and access to essential services.

Poor weather can cause closures to Saddle Road or the Pahiatua Track, sometimes both, which disrupts travel even more. During situations where both roads are closed people can no longer traverse the ranges without taking extensive detours to the north or south. A particular issue is impacts for those who require access to medical services including hospitals when one or both routes are closed.

There are significant costs to delay, EY have estimated that the economy would lose $279 M of output over the next 40 years if nothing was done to restore a state highway connection [20] This is due to the GDP effects of lost investment on GDP of $82 M or $7 M per annum, another $130 M or $9 M per annum from the impact of increased freight costs on output and the agglomeration efficiencies forgone relative to a Gorge open scenario of $67 M or $5 M per annum. These costs are in addition to the direct travel costs outlined above.

The current closure has already caused a considerable constraint on daily commuters. During community engagement sessions it became clear that if this continues many residents currently living in the Tararua District and working in Palmerston North would consider relocating.

The main alternative route through the range is Saddle Road which cuts directly through the centre of Ashhurst along Salisbury Street. Ashhurst School is also located on Salisbury Street. Increased traffic results in additional noise and vibration which causes disturbance to locals and general nuisance, for example, sleep disturbance. Increased traffic also raises safety risk, particularly around the school. A large number of Ashhurst residents have expressed a desire to maintain a 'quiet village' character and the presence of additional general and freight traffic is not supporting this aspiration.

[20] Assessment of the Wider Economic Benefits of the Shortlisted Options (Appendix E)

Implications of the problem

With the Gorge now closed indefinitely, traffic must use Saddle Road or Pahiatua Track. Neither of the alternative routes are capable of providing a long term, resilient solution in their current state. There is a need to address the problem associated with the current closure and provide a long term solution.

Currently 6,220 vehicles a day (820 being HCVs) use Saddle Road and 3,819 use the Pahiatua Track (which was 2,214 prior to the closure). Saddle Road was originally designed to service the local farms but has had upgrades in recent years to enable construction of the Te Apiti wind farm and more recently to improve level of service for detoured state highway traffic. Prior to the Gorge closure, Saddle Road had approximately 150 vehicle movements per day. Saddle Road does not offer the appropriate level of service for an interregional state highway connection or for the current volume of traffic and heavy vehicles. While Saddle Road is sufficient as a short term alternative route, it is not an appropriate long term option as a regionally significant state highway. Average travel times for general traffic between Woodville and Ashhurst have now increased from approximately 13 minutes for all traffic to 22 minutes for general traffic and 28 minutes for HCVs (when impeded, some trips can be even longer).

With the increase in travel times and the general uncertainty surrounding the State Highway 3 Gorge closure and the timing for a future alternative route, it is possible that residents living in Ashhurst, Woodville or further north or south east within the Tararua district could consider relocation, which would have a further impact on local businesses and the economy.

3.2 BENEFITS

As part of the Investment Logic Mapping process used by the Transport Agency to inform investment decisions, the benefits of investment are identified and shown in the Benefit Map attached as Appendix A. The benefits outlined below are a way to assess how the investment seeks to address the problems of resilience, safety and, increased travel time and costs. The identified benefits are used as the basis to determine the Investment Objectives and KPIs, which in turn are used to assess options and measure the outcomes of the investment. The benefits statements outlined below were developed during the first workshop held on 4 September 2017 and confirmed at subsequent workshops and meetings.

3.2.1 Benefit statement 1

A safe, efficient and resilient transport corridor.

It is expected that the new road corridor will:

- Reduce death and serious injuries
- Increased resilience of the corridor
- Improved travel times and reduced vehicle operating costs by 12.1 minutes per trip for general traffic, and 13.8 minutes per trip for freight that currently use the Saddle Road

3.2.2 Benefit statement 2

Enables economic development and regional productivity.

A new road corridor is expected to:

- Support regional economic activities and productivity including reduction in operating costs and travel time
- Avoid the cost of a delay to realising the benefits of the Gorge replacement, which is estimated to be $21 M in nominal dollars

3.3 INVESTMENT OBJECTIVES

The investment objectives were developed with input from key stakeholders. It was agreed that there would be three investment objectives relating to safety, efficiency and resilience, as these were identified as key issues currently being experienced (as discussed in section 3.1). Investing to resolve these problems should result in improvements to the identified benefit areas (discussed in section 3.2), these being resilience, safety, efficiency[21] and, economic development and regional productivity.

The investment objectives are:

- To reconnect the currently closed Manawatū Gorge State Highway 3 with a more resilient connection
- To reconnect the currently closed Manawatū Gorge State Highway 3 connection with a safer connection than the Saddle Road and Pahiatua Track
- To reconnect the currently closed Manawatū Gorge State Highway 3 with a more efficient connection than the Saddle Road and Pahiatua Track

The relationship between the problem statements, benefit statements and investment objectives is summarised in Figure 9.

[21] Efficiency was confirmed as covering a variety of measures, including accessibility and transport network connectivity. For example, network connectivity was assessed under efficiency by way of measuring the travel times and vehicle operating costs for key journeys, such as between Palmerston North and Woodville, Dannevirke and the Palmerston North - North East Industrial Zone (NEIZ), and Fielding and Pahiatua.

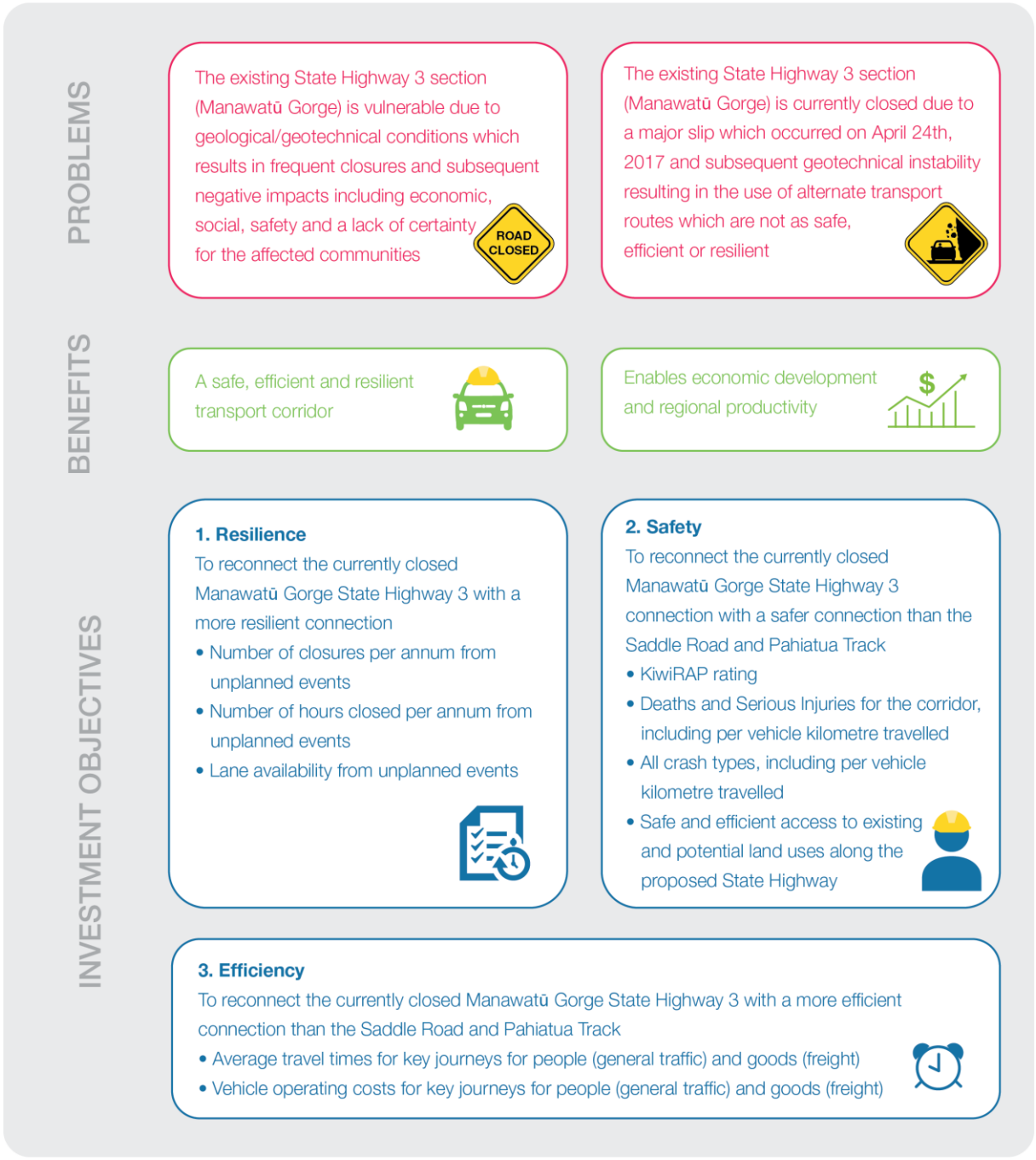

Figure 9 Summary of problems, benefits and investment objectives

Table 5 describes the supporting Key Performance Indicators (KPIs) and measures for each investment objectives. The methodology adopted for measuring the options against the KPIs and measures are summarised in the Long List Assessment (Appendix B) and Short List Assessment (Appendix C) reports.

Table 5 Investment objectives – measures, description and rationale

Investment objective	KPIs and Measures	Description	Rationale
To reconnect the currently closed Manawatū Gorge State Highway 3 with a more resilient connection	• Number of closures per annum from unplanned events • Number of hours closed per annum from unplanned events • Lane availability from unplanned events	These measure the number and effect of closures to the users of the corridor. This objective is aimed at ensuring the investment reduces impact on the region by providing state highway which is more reliably servicing its customers.	It is important to be able to predict and to track the likely level of full and partial closures for the route. This helps to assess the options as well as to track the effectiveness of the recommended option when it is in operation.
To reconnect the currently closed Manawatū Gorge State Highway 3 connection with a safer connection than the Saddle Road and Pahiatua Track	• KiwiRAP rating • Deaths and Serious Injuries for the corridor, including per vehicle kilometre travelled • All crash types, including per vehicle kilometre travelled • Safe and efficient access to existing and potential land uses along the proposed State Highway	KiwiRAP is used to measure the safety level of rural state highways. The next two KPIs relate to specifically measuring the number and effect of crashes for the route. The last KPI is about the ability to provide safe access for adjacent land users and users of the route.	Safety is a primary responsibility for all levels of government and organisations responsible for providing transport infrastructure and services. In particular it is important to provide state highways that meet design requirements that are safe for all road users.
To reconnect the currently closed Manawatū Gorge State Highway 3 with a more efficient connection than the Saddle Road and Pahiatua Track	• Average travel times for key journeys for people (general traffic) and goods (freight) • Vehicle operating costs for key journeys for people (general traffic) and goods (freight)	These measures relate to the direct transport costs for the movement of people and goods and is used to assess the options as well as track the performance of the recommended option once it is implemented.	State highways play an important part in the productivity of our cities and regions. It is important to the road users and local communities that the new state highway provide efficient access to their jobs, homes, schools and other destinations.

4 Alternative and option assessment

4.1 OPTION DEVELOPMENT

4.1.1 Options scope and overview

The long list of options considered a range of potential connection points on the western side of the Manawatū Gorge. These connections were all on State Highway 3 between the western entry to Manawatū Gorge near Ashhurst and to Stoney Creek Road near Palmerston North. The eastern tie-in point for the development of the long list of options was at the intersection of SH2 and SH3 in Woodville.

Eighteen options were developed for the long list as outlined in 4.3.1 below and were assessed by a Multi Criteria Analysis (MCA) process, as outlined in section 4.2 below. These options covered a wide range of solutions including viaducts, tunnels, 'in gorge' alignments as well as a number of route alignments to the north and south of the Gorge as detailed in section 4.1.3 below.

4.1.2 Long list option scope

The eastern tie-in point for the development of the long list of options was at the intersection of SH2 and SH3 in Woodville. This is an existing state highway connection point so accommodates a high proportion or all of the previous movements between the regions, as it did before the Manawatū Gorge closure. A connection to the south of Woodville would add to travel distance and time to Hawkes Bay SH2 traffic, likewise a connection to the north of Woodville would add to SH2 traffic from the Wairarapa.

The long list of options considered a range of potential connection points of the western side of the Manawatū Gorge. These connections were all on SH3 between the western entry to Manawatū Gorge near Ashhurst and to Stoney Creek Road near Palmerston North.

Options further to the north or south of the eastern and western state highway tie-in points were not considered feasible due to higher crossing points on the Tararua and Ruahine ranges both to the north and south, increased distances, gradients and indirect routes which would not be sufficiently better than the current Saddle Road or Pahiatua Track in terms of commuter and freight movements.

The long list options were developed without reference to mapped environmental features. The identification and mapping of known environmental features occurred concurrently with the assessment of the long list options and was informed by work undertaken by the environmental specialists.

4.1.3 Long list option development and refinement

The development and refinement of the long list options involved an initial review of previous studies undertaken on potential alternatives. The Ministry of Works first identified the potential for an alternative route in 1977, which was further investigated by Worley consultants in 1997.

Further investigations were conducted in 2012 by MWH[22] which considered four alternative routes, one of which was the 1997 Worley alignment over the Ruahine Ranges and three new alignments. Each of the options outlined in the 2012 report was refined for the current DBC and included as part of the long list assessment including the tunnel option outlined above (now the Long Tunnel option). A short tunnel option was also developed, which allowed for improved travel times in the tunnel section, but also utilised the eastern section of the Gorge. The 2012 greenfields option (now the Deep Box Cut Option), which was modified so the route would have a lower gradient (maximum of 8%). This meant a larger cut was required.

Three new options were considered within the Gorge; one provided a retaining wall and cut to the southern bank of the Gorge, along the existing alignment but higher up on the Gorge itself. The second was a similar design but to the northern side of the Gorge, following the basic alignment of the railway. Unfortunately this 'in the Gorge' option was considered to have an unacceptable level of risk on the current railway. A retaining structure further up from the railway could impact its structural integrity. This option was therefore removed from the long list. The final 'in the Gorge' option was the viaduct option, which used the bridging concept highlighted in the 2012 report.

The range of 'in the Gorge', northern, and southern options developed for the long list were representative of the potential options that could be available for replacing the state highway route. The 13 options described above were released to the public using Social Pinpoint to gather comments and community feedback. This also provided the opportunity for community input on the adequacy of the long list options. With the Transport Agency taking the time to consult on the long list for the new route, there was an opportunity for people to identify potential options that hadn't been considered in the initial development of the long list. No specific additional alignments were identified through the Social Pinpoint feedback. The long list as a whole is therefore an appropriately broad range of options and was considered to be an appropriate starting-point for the assessment.

The northern options included the 1997 Worley option and two other new alignments which traverse through the Ruahine Ranges. An upgrade to the current Saddle Road, with various design speeds were developed as options. Four southern alignments were developed. Two of the southern options connected with SH3 south of Ashhurst (closer to Palmerston North).

After further investigation and feedback, three more options were developed for the long list. The first was a new northern option which travels north of the Te Apiti wind farm, avoiding complicated and potentially costly property acquisition and infrastructure impacts. The other two were refined Saddle Road upgrade options. The original Saddle Road upgrade option was designed for 100 km/h design speed. The two alternative Saddle Road upgrade options considered alignments which catered for an 80 km/h design speed and 60 km/h design speed, providing cheaper alternatives.

Southern option 5 (which was to become Option 4 of the short listed alignments) was developed as a result of feedback from the Key Stakeholder Workshop (long list assessment) held on 3 October 2017. This option was not originally developed as the other four southern options provided more favourable gradients and travel times for vehicles. All southern options presented several limitations and constraints which had the potential to be mitigated through picking the 'best bits' of several of the southern options and combining them to develop a

[22] PSW 198 – SH3 Manawatu Gorge Alternative Route Assessment Final Report 2012

new option. This led to the development of Southern option 5. This option connects with SH3 further south (at the same point as the long list Southern option 4) but also is aligned in such a way as to reduce negative aspects such as time to construct, effects on ecologically sensitive areas, excess fill and capital costs.

As a result of the long list assessment, four options were further progressed through planning and design, and then assessed again through the MCA process.

The option development was cognisant of the need to identify suitable options to meet the transport outcomes sought, options which also minimised impacts on the community and environment and that could be feasibly delivered.

4.1.4 Reinstatement of State Highway 3

Reinstatement of State Highway 3 through Manawatū Gorge was assessed but not considered viable, prior to the long list assessment exercise. This was due to long-term resilience issues and a high level of imminent and longer term risk of ongoing slope failures impacting the road operations and user/operator safety (refer to the Geotechnical Literature Review[23], which is appended to the Long List Assessment report in Appendix B).

The Geotechnical Literature Review summarises the findings of various remedial works reports for the Manawatū Gorge. It concludes that the imminent extreme threat level for Kerry's Wall and the surrounding slopes mean that any remedial works to clear slip debris and stabilise the slopes and wall are not possible due to safety concerns for anyone working around the site. Kerry's Wall is a gabion-faced mechanically stabilised embankment (MSE) retaining wall, constructed in 1998 to stabilise a known unstable portion of the Gorge slope above the road. During construction a landslide occurred resulting in an alteration of the original design.

In addition to these remedial works reports, GNS identified in 2012 twenty five risk areas for future landslides in the Gorge (this number may have increased between October 2012 and today)[24]. These risk areas comprise six sites that are a very high threat, eleven that are high threats and eight that are moderate threats. Further to this, MWH concluded that the prevention of large scale landslip events such as those of 2004 and 2011 was not considered viable[25]. They suggested that data current in 2012 advised that the likelihood of small scale events in the order of 5,000 to 20,000 m^3 could result in closures of 1-2 weeks every three to five years. Additional larger landslides (~20,000–100,000 m^3) could occur every 5–10 years and closures resulting from these slips could be 60 to 70+ days in length.

As a result of the information risks outlined above and the instability of sections of the walls, the Gorge route was closed following the event on 24 April 2017 and is now closed indefinitely for safety reasons. Therefore reinstatement of State Highway 3 in the Gorge was not developed or specifically assessed as a long list option. Other 'in gorge options' such as the deep box cut, long and short tunnel, and the gorge viaduct options were assessed further as a part of the long list as shown in Table 6

[23] GHD Memorandum, December 2017 (attached as an appendix to the Long List Assessment report)

[24] Hancox, G.T., Robson, C.D., 1 Kukovic, B., 2012. Assessment of the risk and potential magnitude of future landslides that might close SH3 within the Manawatu Gorge. GNS Science Consultancy Report 2012/254.

[25] MWH, 2012. PSW 198 – SH3 Manawatu Gorge Alternative Route Assessment Final Report.

4.1.5 Form, function and standards

The initial design basis for each of the options was confirmed with the Transport Agency at a meeting held on 5 September 2017. The design criteria considered the guidelines for horizontal and vertical geometry and cross sections from both Austroads and other state highway design standards. In summary, a national road (according to the One Network Road Classification criteria) was sought to meet user requirements by providing a high quality, 100km/hour design speed highway, with one traffic lane and safety shoulders in either direction with crawler lanes on hill sections.

A design speed of 100km/hour has been used as a preliminary consideration of lower speed options indicated that there was only a marginal cost reduction compared to the relative disbenefit associated with lower design speed. This will be revisited following further investigations to understand the trade-offs between design parameters, safety, efficiency and cost.

The construction of a national road as the Manawatū Gorge Alternative route will make sure that the corridor meets the demands placed on it by its heavy commercial vehicle users. The ONRC defines a corridor as a national road using the general guidelines set out in Figure 10 below. Prior to the closure of State Highway 3 the Manawatū Gorge carried, 7,620 vehicles per day with 11.3% heavy commercial vehicles. These numbers exceed the HCV guidelines for National Road classification and demonstrates this corridor as being an important national freight link.

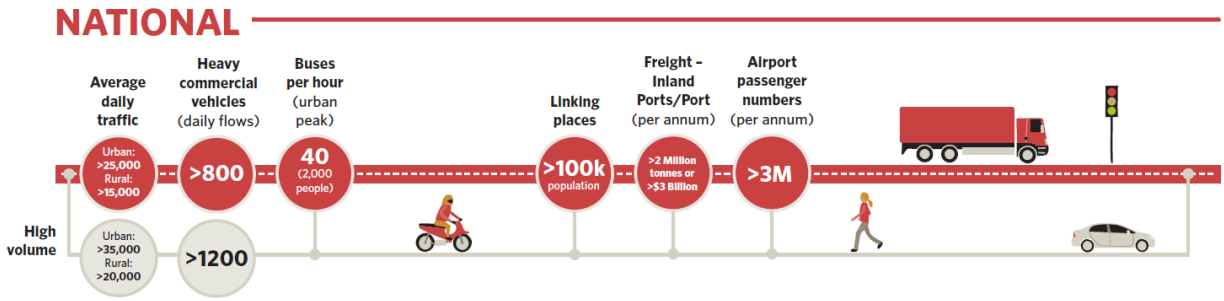

Figure 10 ONRC national road guidelines (sourced from NZTA, REG)

Since the initial design basis meeting in September 2017, there has been ongoing correspondence with regards to the design philosophy for the SH3 Alternative corridor. This is summarised in the Design Philosophy Statement (Appendix L). A road safety audit carried out in April 2018 by Opus International Consultants and the designer response is also provided (Appendix N).

4.1.6 Do minimum

In order to make a comparative assessment, base case or Do Minimum scenario is required. Due to the nature of this project there was discussion around the Do Minimum option and whether the base case should be defined as the existing situation (with most traffic using Saddle Road) or the existing SH3 along Manawatū Gorge (assuming it could be made operational). The Do Minimum option was defined as the existing situation which is traffic using both Saddle Road and Pahiatua Track, including minor upgrades to Saddle Road. Minor upgrades have already been approved and will exist within the next year and were therefore included as part of the Do Minimum. While this route is not currently at a state highway standard, this has been confirmed as a suitable Do Minimum option as it will remain the

connection until a replacement route is constructed. It is also noted that although this route provides a much lower level of service than desired for a state highway connection, it is comparable to other lower classification state highways in NZ, in terms of terrain and geometrics.

Section 9.1 (and the transport assessment attached as Appendix G) provides more detailed information regarding the do minimum as part of the economic assessment.

4.2 ASSESSMENT METHODOLOGY

In considering options for addressing the investment objectives, the development and assessment of a long list and then short list of options was undertaken. The assessment utilised a MCA process, whereby options were developed and assessed against a set of defined criteria. The project team carried out the assessment work, with input from a number of specialists who were engaged to undertake specific assessments, including social and environment specialists.

The assessment criteria were developed by the Transport Agency with input from stakeholders, sub-consultants and specialists advisors. The criteria reflect the corridor's One Network Road Classification as a national road and the function this transport connection provides to the communities it services. The assessment criteria were divided into three main key result areas; transport performance (investment) objectives, social and environmental impacts, and implementability, as detailed in Figure 11 below. Detailed descriptions of the assessment methodology are included in the Long List Assessment (Appendix B) and Short List Assessment (Appendix C) reports.

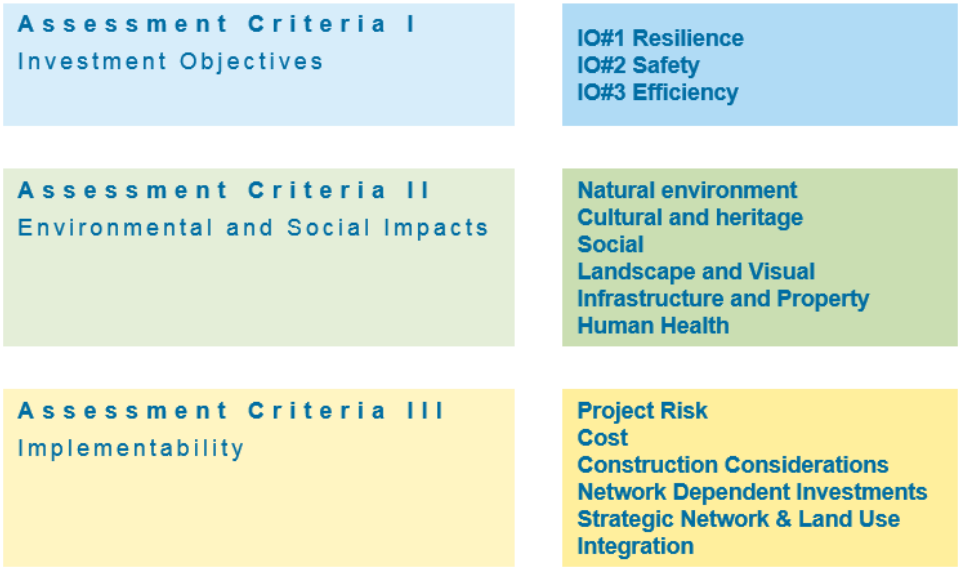

Figure 11 Assessment criteria and assessment approach

4.2.1 MCA scoring

Each set of criteria was assessed for each option and then assigned a 'score'. The scoring used for the long list and short list assessment is defined in Figure 12 and was a relative performance to the do minimum option.

✓✓✓	Substantial positive effect
✓✓	Moderately positive effect
✓	Minor positive effect
-	Neutral
x	Minor adverse effect
xx	Moderate adverse effect
xxx	Substantial adverse effect

Figure 12 MCA scoring

The Long List Assessment and Short List Assessment reports provide details of how each set of criteria was developed to reflect the information available during each assessment phase and the assumptions made to complete the assessments. A Fatally Flawed score option was also available and used in the social and environmental assessment of the long list options.

4.2.2 Collation of MCA results

For the decision making on the short list, the scores under each of the criteria were considered on a qualitative basis (i.e. reviewing all results in the round). The results for the measures assessed under each of the criteria were collated. The MCA scorings were not averaged or summed to give the overall rankings. Rather, the alignment options that featured high or multiple adverse risk were identified by the project team as being unsuitable for the short list. In addition, if two or more options were similar, the better of similar options were selected, or the best features of compatible options were selected for the short list.

4.2.3 Benefit cost assessment

A benefit cost assessment of the short listed options was also undertaken as part of the short list work. This produced benefit cost ratios (BCR) for the four options, which were considered in the short list option evaluation.

4.3 OPTION ASSESSMENT

4.3.1 Long list options and summary assessment

The final long list included 18 options (including the Do Minimum option) as discussed in section 4.1.3 above and mapped in Figure 13. The key features of each long list option are provided in Table 6. The assessment of the long list options was a risk-based assessment of the each respective alignment.

4.3.2 Long list options - stakeholder / customer feedback

The long list options assessment included public consultation as well as project and stakeholder workshops and supporting assessments to confirm the short list of options. This was undertaken during September and early October 2017.

At the long list stage, the most commentary was received on the Deep box cut option (49 comments), the Gorge Viaduct (18 comments), Southern Option 4 (21 comments), Long tunnel (16 comments), Short tunnel (10 comments) and Northern Option 7 (10 comments). The remaining 579 comments were general in nature, rather than specifically tagged to a particular option.

The key feedback from comments at the long list stage were:

- Stability and the reliability of a new route is critical – timely completion of a long term solution was sought
- There was a desire for a 'straight and short route' to reduce the time and cost of travel and achieve an efficient and direct route – inherently these themes are linked to easy gradients, so there were preferences for the flat options that did not traverse the ranges
- The desire for a solution that avoided significant impacts on property was noted by many (particularly impacts on the character of quiet rural/lifestyle areas); productive land was also important
- Impacts on Ashhurst should be avoided (in relation to future growth and amenity)
- Woodville business impacts were highlighted, with mixed views as to whether Woodville should be bypassed or not
- There was a concern that the project should not be just about an Ashhurst to Woodville connection – the wider connections to State Highway 57, State Highway 2 and surroundings should be considered as well
- The advantage of a second bridge over the Manawatū River was also noted

Similar themes emerged through the long list key stakeholder workshop also. In addition, comments from iwi representatives at the workshop highlighted the cultural sensitivity of the options within the Gorge itself.

A summary of the long list assessment is provided below in Table 7. As a result of the long list assessment, four short listed options were further developed and a more detailed assessment undertaken from October 2017 to February 2018.

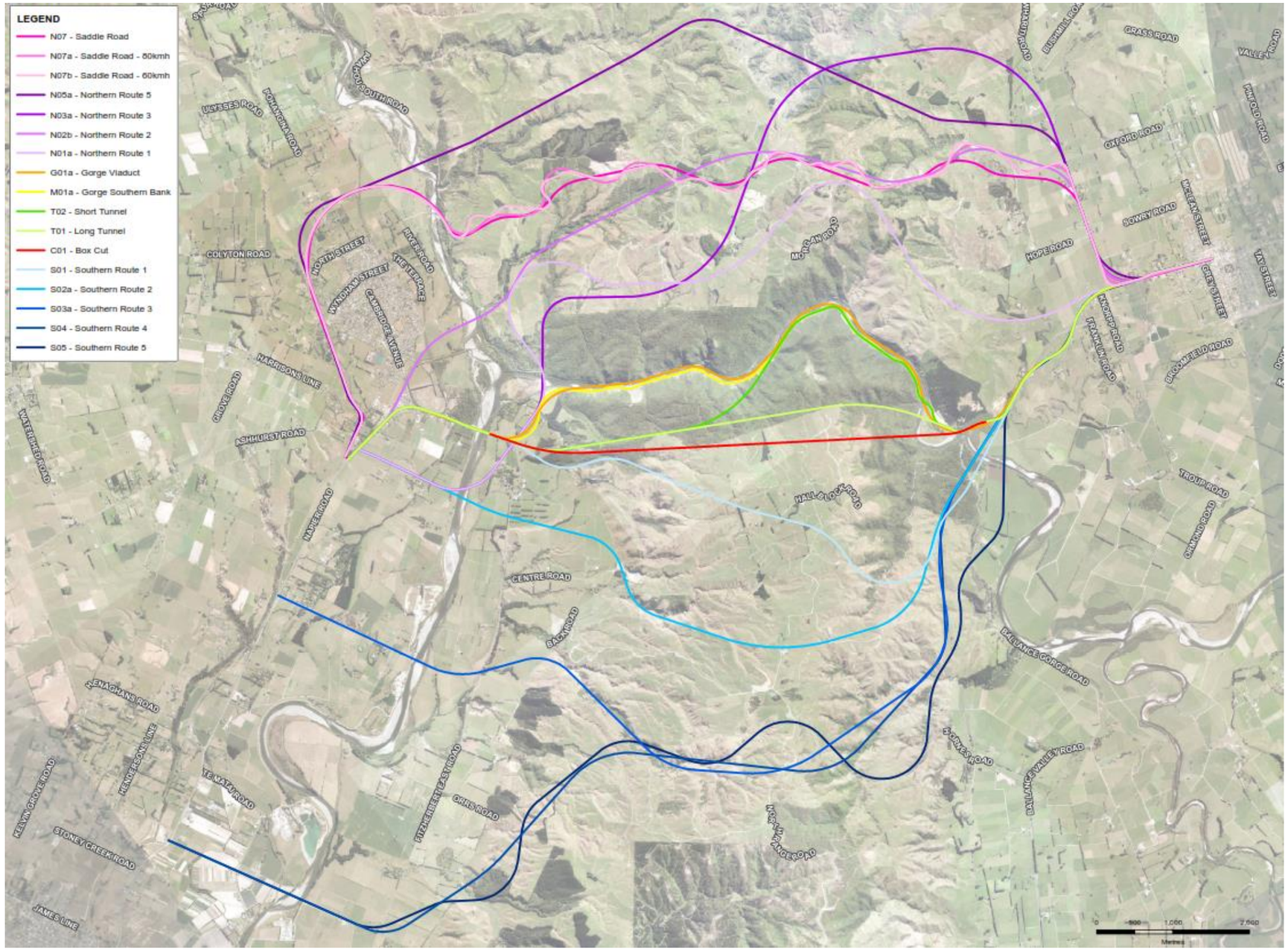

Figure 13 Long list options[26]

[26] The Do Minimum option (minor upgrades to Saddle Road) is not illustrated.

Table 6 Long list summary details

LONG LIST OPTIONS	Option Length (km)	Total Length (km)*	Design Speed (km/h)	Maximum Gradient	Travel Time (minutes)	
					General Traffic	Freight
Do Minimum (Upgrade of Saddle Road)	14.7 – 15.1	23.5 – 24.5	50	10%	25.1	34.9
Northern Option 1	13.9 – 14.3	21.1 – 21.5	100	6%	12.8	17.4
Northern Option 2	12.3 – 12.7	19.5 – 19.7	100	8%	12.0	17.7
Northern Option 3	14.9 – 15.3	22.1 – 22.3	100	8%	13.6	18.2
Northern Option 5	15.7 – 16.1	22.9 – 23.3	100	7%	13.8	18.6
Northern Option 7 - Saddle Road Upgrade (100 km/h)	15.3 – 15.7	22.5 – 22.9	100	8%	13.9	19.2
Northern Option 7a - Saddle Road Upgrade (80 km/h)	15.7 – 16.1	22.8 – 23.2	80	9%	18.0	22.0
Northern Option 7b - Saddle Road Upgrade (60 km/h)	16.0 – 16.4	23.2 – 23.6	60	10%	23.7	26.3
Deep Box Cut	8.9 – 9.3	18.2 – 18.6	100	5%	11.1	13.8
Manawatū Gorge Southern Bank	5.6 – 6.0	19.9 – 20.3	80	0%	14.8	15.9
Long Tunnel	10.5 – 10.9	18.3 – 18.7	100	0%	11.1	12.3
Short Tunnel	10.3 – 10.7	19.7 – 21.1	100	0%	13.5	15.3
Gorge Viaduct	5.5 – 5.9	19.8 – 20.2	90	0%	12.8	13.9
Southern Option 1	10.5 – 10.9	19.9 - 20.3	100	8%	12.4	18.0
Southern Option 2	10.8 – 11.2	20.2 – 20.6	100	8%	12.6	17.8
Southern Option 3	13.2 – 13.6	19.8 - 20.2	100	8%	12.3	17.6
Southern Option 4	15.0 – 15.4	18.6 - 19.0	100	7%	11.4	17.3
Southern Option 5	16.4 – 16.8	20.0 – 20.4	100	8%	12.7	18.7

[a] Total travel distance is from SH3 at Stoney Creek Road to Woodville, Total travel times are also calculated from SH3 at Stoney Creek Road to Woodville. Estimated travel times are based on total length, design speed and gradient of the route and should be used for comparative purposes of the options. Stoney Creek Rd was chosen as an end point for travel time comparisons as it is common for all options and represents a high percentage of the vehicle movements that utilised SH3 through the Manawatū Gorge prior to its closure. It should be noted that the travel time estimates and economic assessment use multiple origin and destination points that reflect the travel movements and recorded travel movements.

Table 7 Long list assessment summary [27]

Manawatū Gorge Alternative options	Do Minimum	Northern Option 1	Northern Option 2	Northern Option 3	Northern Option 5	Northern Option 7	Northern Option 7a	Northern Option 7b	Deep Box cut	Manawatū Gorge Southern Bank	Long Tunnel	Short Tunnel	Gorge Viaduct	Southern Option 1	Southern Option 2	Southern Option 3	Southern Option 4	Southern Option 5
Resilience	-	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓	✓	✓✓✓	×××	✓✓	××	××	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Safety	-	✓✓✓	✓✓✓	✓✓	✓✓	✓	✓	✓	✓✓✓	✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓
Efficiency	-	✓✓	✓✓	✓✓	✓✓	✓✓	✓	-	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Natural Environment	No fatal flaws identified								F		No fatal flaws identified		F	F	F	F	F	No fatal flaws identified.
Cultural and Heritage									F	F		F	F					
Human Health																		
Social																		
Infrastructure and Property																		
Landscape and Visual																		
Cost (Capital)	$2M	$350-450M	$500-600M	$500-650M	$350-450M	$300-400M	$200-300M	$130-230M	$1,900-2,500M	$800-1,000M	$1,700-2,100M	$1,200-1,500M	$1,100-1,400M	$1,000-1,250M	$550-750M	$800-1,050M	$800-1,050M	$550-$650M
Other major attributes and/or major project risks	Community objection to traffic through Ashhurst and inadequacy of alignment for a State highway connection	Large structure required at western end to cross Manawatū River	Rail crossing within Ashhurst area – technical feasibility and visual impact. Alignment through Ashhurst community acceptability	Large structure required at western end to cross Manawatū River. Areas of cultural significance near Manawatū River	Impact on Ashhurst residents along new highway route	Impact of construction on Saddle Rd as the primary connection between the regions	Safety risks and likelihood of deaths and serious injuries continuing from crashes	Major safety risks and likelihood of deaths and serious injuries continuing from crashes	92 M cubic metres of surplus fill Major environmental impact. 15 plus years for design, consenting and construction stages	Ongoing risk of slips causing closure and safety issues	Availability of tunnelling equipment and experience to deliver project in required timeframes	There is still considerable risk associated with section of the Gorge which is susceptible to closure	Consenting timeframes and risk of non-approval. Ecological impacts of construction and use of the viaduct	Major number of trucks and heavy haulage impacts from removal of excess fill and construction timeframes	Geotechnical uncertainty of materials and construction timeframes	Major number of trucks and heavy haulage impacts from removal of excess fill and construction timeframes	Major land acquisition costs and timeframes may delay project delivery due to large number of affected land owners	Major land acquisition costs and timeframes may delay project delivery due to the large number of affected land owners
Construction Timeframe	6 months	4-5 yrs	5-6 yrs	5-6 yrs	4-5 yrs	4-5 yrs	4-5 yrs	3-4 yrs	12-15 yrs	7-8 yrs	6-7 yrs	5-6 yrs	5-6 yrs	10-11 yrs	6-7 yrs	8-10 yrs	9-10 yrs	6-7 yrs

[27] Refer to Appendix C of the Long List Assessment report (included as Appendix B) for the environmental and social impact assessment for these options.

4.3.3 Long list assessment rationale to short list

Following the long list assessment process four short list options were selected to be investigated further (Table 8) based on the following rationale.

Table 8 Short list options

Long list option name	→	Renamed short list options
Northern option 5	→	**Option 1**
Saddle Road upgrade (100 km/h)	→	**Option 2**
Northern option 1	→	**Option 3**
Southern option 5	→	**Option 4**

Table 9 Long list assessment rationale – excluded options

Long list option	Key information	Reason for exclusion
Do Minimum (Upgrade of Saddle Road)	Cost: $2 m Time to complete: 1 year	This option did not provide the necessary levels of safety, efficiency and resilience for a state highway with current volumes of traffic and function.
Northern Options 2 and 3	Cost: $530 - 680 m Time to complete: 6-7 years	These options were not shortlisted, as they had similar or less transport benefits to Northern Options 1 and 5 with additional delivery risks or impacts (i.e. Northern Option 2 runs through Ashhurst community requiring a rail crossing). Both were substantially higher in cost than Northern Options 1 and 5.
Saddle Road Upgrade (60 and 80 km/h)	Cost: $150 – 300 m Time to complete: 4-5 years	These options provided some levels of improvement from the current Saddle Rd but due to the upgrade being on the existing alignment there were still significant issues including: · Resilience · Residual safety issues · Poor efficiency outcomes due to high gradient levels
Deep Box Cut	Cost: $1,900 m – $2,500 m Time to complete: 15+ years	The construction duration, cost, challenge with disposal of more than 90 M m^3 of excess fill, unacceptable impacts on ecology and sites of cultural significance, as well as substantial impacts on landscape were the issues identified with this option
Manawatū Gorge South Bank	Cost: $800 m – $1,000 m Time to complete: 8-9 years	This option was not as resilient as other options (numerous high risk slip sites). There were also unacceptable impacts on sites of cultural significance.
Tunnel options (long tunnel and short tunnel)	Long tunnel Cost: $1,700 m – $2,200 m Time to complete: 8-10 years Short tunnel Cost: $1,200 m - $1,500 m Time to complete: 6-7 years	The tunnel options are not as resilient as non-tunnel options, due to risk of tunnel closure from traffic incidents. Tunnels cannot accommodate all freight traffic due to dangerous goods restrictions. Fault lines across long tunnel, risk of slips on short tunnel route. There is instability throughout the Gorge with approximately half the slips from 1985 to 2012 occurring on the eastern section of the Gorge which meant the short tunnel option was not as resilient as other options. There were also large capital and operational costs for both tunnel options.
Viaduct through Manawatū Gorge	Cost: $1,100 m – $1,400 m Time to complete: 6-7 years	The concerns identified with this option included high impacts on landscape and social values, unacceptable impacts on ecology and sites of cultural significance; piles in the river would interfere with river flow. There would remain a residual risk of slips in the Gorge undermining viaduct piers and it was considered to have long delivery timeframes (due to consenting and construction risk) and a high capital cost.

Long list option	Key information	Reason for exclusion
Southern Options 1 - 4	Cost: $550 m – $1,250 m Time to complete: 8-12 years	All southern options have high construction costs and/or unacceptable delivery timeframes, primarily associated with large amounts of earthworks. These options also impact on wind farm infrastructure and resulted in unacceptable high impacts on ecologically sensitive areas.

Table 10 Long list assessment rationale – short listed options

Long list option	Key information	Rationale for short listing
Northern Option 5	**Option 1** (North of Saddle Road) Construction length: 15.7-16.1 km Cost: $350 – 450 m Delivery timeframe: 5-6 years Northern Option 5 was developed at the end of the long list assessment process following further investigation. It was not one of the 13 initial long list options released for public consultation. This option was developed following consideration of feedback to provide an option north of the gorge that would avoid construction through the wind farm and associated infrastructure	This option was shortlisted as it provides a good balance of outcomes including good travel times, resilience and, vehicle operating costs, and had limited adverse impacts compared with many other long list options.
Saddle Road Upgrade (100 km/h)	**Option 2** (Saddle Road Upgrade) Construction length: 15.7-16.1 km Cost: $300 – 400 million Delivery timeframe: 5-6 years	This option was shortlisted as overall it presented an acceptable level of implementability risk. It also had a potentially lesser risk of natural environment and landscape effects than Northern options 1 and 5 due to the alignment being generally within the existing road corridor, with similar or slightly less benefits. While there were some additional risks or impacts identified (i.e. construction on Saddle Road) it was considered that the option should be carried through to the short list so these could be investigated further.

Long list option	Key information	Rationale for short listing
Northern Option 1	**Option 3** (South of Saddle Road) Construction length: 15.7-16.1 km Cost: $350 - 450 m Delivery timeframe: 5-6 years	This option was shortlisted as it provides a good balance of outcomes including good travel times, resilience and had limited adverse impacts compared with other options.
Southern Option 5	**Option 4** (South of Gorge) Construction length: 15.7-16.1 km Cost: $550 – 650 m Delivery timeframe: 5-6 years Southern Option 5 was developed at the end of the long list assessment process following further investigation. It was not one of the 13 initial long list options released for public consultation. This option was developed following consideration of feedback and refinement of the best performing elements of the other southern long list options.	This option was short listed as it provided good travel times and vehicle operating costs for general traffic, however it did have some additional costs for freight due to the length and gradients. This option had comparably less risks and impacts on the community or environment than many other long list options.

4.3.4 Short list options and summary assessment

The alignment of the short list option corridors, including the 'J-Curve' link to State Highway 3 for the options north of the Gorge (Options 1-3) is shown in Figure 14[28]. When the short list options were confirmed, it became clear that further investigation to consider the detail of possible linkages between the options north of the Gorge into the existing State highway network was required. The J-Curve represented one of six Ashhurst connection options (Ashhurst sub-options) which were considered and assessed at the short list stage.

[28] The short list options were assessed as 500m wide corridors within which an alignment could be located.

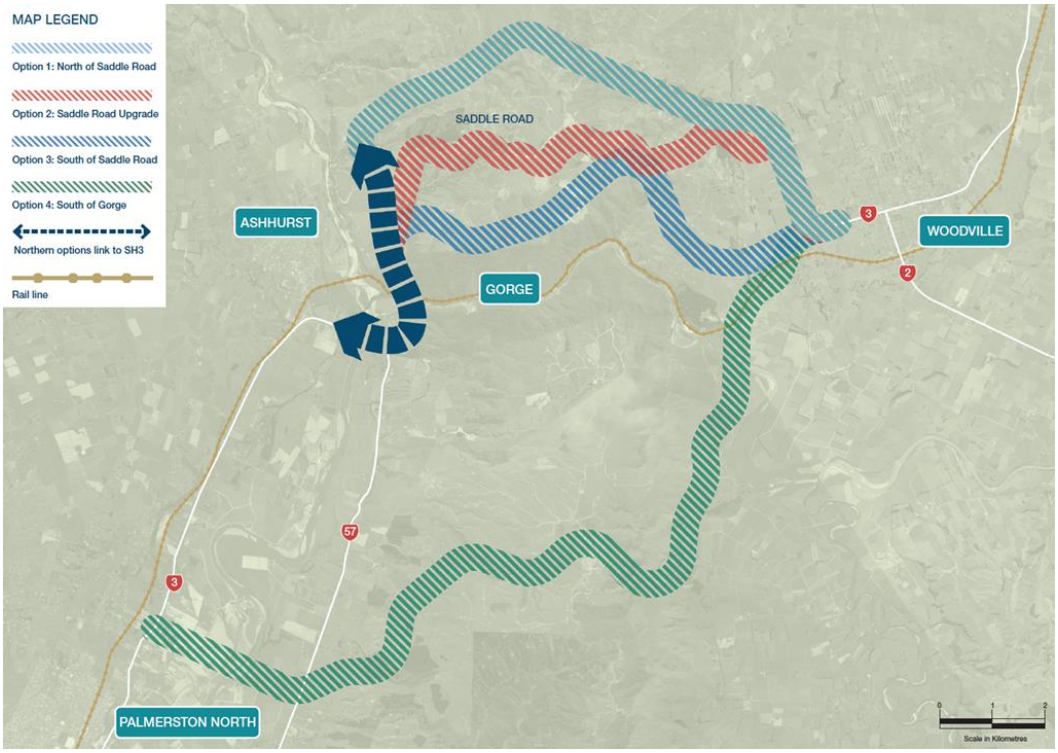

Figure 14 Short list options

The following sections and tables (Table 11 to Table 13) provide a summary of the overall MCA results for the short list options. Detailed assessments are included in the Short List Assessment report (Appendix C).

Transport performance assessment

All options provided substantial benefit in terms of transport performance when compared with Do Minimum. Option 3 was the only option that provided substantial positive effect across all three transport performance criteria assessed, these being resilience, safety and efficiency.

Option 2 had tighter geometry and steeper gradients by virtue of it being an upgrade of an existing route, and accordingly had a comparatively lower performance in terms of safety and efficiency. This option also had reduced network resilience, on the basis that it would be an upgrade of an existing alternative route as opposed to creating a new route in addition to the existing alternatives. Option 1 was the longest of the short list options and as a result it is more exposed to safety risks and had an increased travel time. Option 4 performs similarly to Option 3 in terms of safety and efficiency, however was less resilient as it is more exposed to seismic risk.

Social and environmental assessment

Across the 16 environmental and social effects assessed, all options have the potential to create a substantial adverse effect. There was not a substantial difference between the options when considering the social and environmental criteria overall, however the performance against specific metrics varied between the options.

Compared with the other short list options, Option 4 has the greatest potential effect associated with hydrology, land, operational noise and social impacts although was most favourable in terms of archaeological/built heritage and visual amenity effects.

The scores for Options 2 and 3 were comparable to at least one other option for all criteria, with the exception of freshwater ecology (where Option 3 was considered to have a lesser potential adverse effect). Option 3 was also identified as potentially affecting areas of cultural significance. While Option 1 was favourable in regard to infrastructure impacts (minor effect compared with substantial effects on other options), it had the greatest potential effect on landscape values.

Implementability assessment

All options were considered to be able to be implemented with close scores in the implementability criteria. Specifically, all options were considered to be able to provide connection into future road network configurations. The geotechnical assessment highlighted that there are risks associated with all options, although Option 3 is expected to have the lowest risk for implementation. Therefore, Option 3 was assessed to be the best performing option in the implementability assessment.

Table 11 Short list options - transport performance assessment

	Resilience	Safety	Efficiency
Option 1	✓✓✓	✓✓	✓✓
Option 2	✓	✓✓	✓✓
Option 3	✓✓✓	✓✓✓	✓✓✓
Option 4	✓✓	✓✓✓	✓✓✓

Table 12 Short list options - social and environmental assessment[29]

	Water Quality (construction)	Water Quality (operation)	Hydrology	Freshwater Ecology	Terrestrial Ecology	Archaeological and built heritage	Noise (construction)	Noise (operation)	Contaminated Land	Social	Landscape	Visual amenity	Infrastructure	Land
Option 1	×	✓	×	×××	×××	××	-	×	-	××	×××	××	×	××
Option 2	×	✓	×	×××	×××	××	-	×	×	××	××	××	×××	××
Option 3	×	✓	×	××	×××	××	-	×	×	××	××	××	×××	××
Option 4	×	✓	××	×××	×××	×	-	×××	-	×××	××	×	×××	×××

Table 13 Short list options - implementability assessment

	Project Risk[30]	Safety in design	Time to deliver	Network dependent investments	Strategic network and land use integration
Option 1	××	-	✓	-	✓✓✓
Option 2	×××	×	✓	-	✓✓✓
Option 3	×	-	✓	-	✓✓✓
Option 4	×××	-	×	××	✓✓✓

[29] Cultural values and sites are discussed separately in the Short List Assessment report and did not have a score.

[30] Including geotechnical risk, windfarm and construction impact

4.3.5 Short list options – costs and delivery

Capital construction costs were assessed and collated in the Short List Assessment report separately to the summary tables above, as summarised in Table 14 below. In addition to construction cost, the assessment of capital cost included estimates of cost related to property acquisition and wind farm impacts. Estimates of operational maintenance costs for the options were also examined.

The costs of the short list options presented in Table 14 were for the primary purpose of allowing for a relative assessment of the short list options. It was acknowledged that these estimates would be subject to change once an option was chosen to take forward and refined as the preferred option, as a result of further investigation and design.

Table 14 Short list options - costs and delivery timeframe

	Construction	Property	Wind farm impact cost range[31]	TOTAL CAPITAL COSTS	Operational	Time to Deliver
Option 1	$410-$530 M	$7 M	$0	$417 - $537 M	$280K p.a	5-6 years
Option 2	$390-$505 M	$5 M	$13 - $24 M	$408 - $534 M	$250K p.a	5-6 years
Option 3	$380-$495 M	$7 M	$5 - $59 M	$392 - $561 M	$250K p.a	5-6 years
Option 4	$580-$755 M	$10 M	$13 - $36 M	$603 - $801 M	$300K p.a	6-7 years

A benefit cost ratio (BCR) was also developed for each of the short listed options[32]. All options achieved a positive BCR (i.e. above 1), however Options 2 and 3 performed marginally better. Option 3 performed the best due it to realising a greater number of benefits as a result of lower vehicle operating costs and greater travel time savings.

4.3.6 Short list options - stakeholder / customer feedback

Public open days and Social Pinpoint were the main forums for engaging with the public and seeking feedback on the short list options, with more than 400 people attending open days in Palmerston North, Woodville and Ashhurst and 189 comments received via Social Pinpoint. A further 35 written submissions were also received.

Information received from feedback forms provided at the public open days and online, indicated that the most important considerations when determining a route were themes relating to travel efficiency and connectivity (comments related to easy gradients and travel times for all traffic, but

[31] The wind farm impact cost ranges provided by a specialist advisor to the project team for wind farm impacts, based on a range of assumptions available to estimate the numbers of turbines required to be decommissioned permanently and temporarily to accommodate each option.

[32] The methodology used to calculate a BCR for each short list option and results are reported in the Short List Assessment report (Appendix C).

notably trucks, a resilient route (comments related to the importance of a reliable route that is least likely to be closed in the future), followed by time of project delivery and cost.

There was little commentary on Option 1 via the Social Pinpoint forum (with six comments specific to this route), which related to stability concerns, the less direct nature of the route and the impacts of wind and fog. The consistent themes expressed in the feedback received via feedback forms (available at the public open days and online) were that this route was too steep and windy, had limiting terrain, was located too far north and added extra distance. Very few stakeholders selected this as their preferred option.

Feedback from key stakeholders indicated concerns with Option 2 and its effects on traffic during construction and there was a general consensus that Option 2 was not preferred. Option 2 received less comments on Social Pinpoint. Public feedback on this option was almost exclusively related to the disruption to traffic during construction of this option and the associated difficulties with construction on the current alternative route. A few people noted that this option would result in the least impact on land/property impact and was practical in that it utilised an existing route.

The majority of public feedback indicated a preference for either Option 3 or Option 4. The feedback on Option 3 was relatively consistent amongst the public – namely that this option was considered favourable as it is shortest, most direct route and has the best gradients. Associated commentary included the favourable road geometry ('less twisty') and cost efficiency. This route was also considered to have a lesser property impact than other options. Overall, there was limited negative commentary on this option (even when it was not identified as their preferred option) however concerns regarding the impact on the AgResearch fertiliser trial site, the similarity of the route (in terms of location) to Saddle Road were noted. Specific concerns regarding the AgResearch fertiliser trial site included the inability to replace or reproduce this site.

Option 4 was the most divisive of all the options, with a lot of support for and against this option. Positive comments related largely to the provision of a second bridge over the Manawatū River, accessibility to Palmerston North and surrounding areas (including Hawke's Bay, Feilding and Horowhenua), the avoidance of Ashhurst, shorter travel time and the flat gradient. The provision of key elements of the proposed rural freight ring route that came with Option 4.

Negative comments related to the associated impacts on the nearby road network (e.g. Stoney Creek Road) as result of changed traffic patterns, social impact (particularly on Whakarongo school), reduced visibility in poor weather conditions and that the option was to far south for some travellers.

Public engagement highlighted the opposing public views on which route would provide the best transport connection (e.g some stakeholders felt that Option 3 was the best east-west connection, and that Option 4 disadvantaged more northern travellers, and vice versa). Regardless of option, another common theme was the importance of Ashhurst and the value of the Ashhurst Domain. The importance of future proofing the route by providing sufficient lanes and passing lanes was also expressed.

4.3.7 Preferred Option

Taking into consideration each of the short list MCA assessment performances and the feedback received from the different forms of public consultation, Option 3 was chosen as the preferred

option. The key aspects of the MCA process, which support the recommendation of Option 3 include better transport performance, an acceptable risk of adverse environmental impacts, and greater implementability. This is detailed below and summarised in Table 15.

In terms of transport performance, Option 3 was the only short list option that provided a substantial benefit across the three transport criteria assessed (resilience, safety and efficiency).

- Both Option 3 and Option 2 provided for the greatest transport resilience, relative to the other short list options and do minimum. This is because of the exposure to seismic events (highest on Option 4) and the provision of a new alignment, additional to Saddle Road which can remain an alternative route.
- Option 3 performed well in terms of safety as a function of the design standard and the length of the route (longer routes are more likely to have a higher crash rate).
- Option 3 provides efficiency benefits, notably the shortest travel time for heavy commercial vehicles relative to the other short list options and a significant reduction in travel time costs and vehicle operating costs compared with do minimum (of a scale comparable to, or better than the other short list options).

The short list options performed similarly overall in terms of social and environmental impacts, with no fatal flaws identified on any of the alignments and at the time of the production of this DBC, these effects were considered to be able to be avoided or minimised through future design and/or addressed using mitigation and environmental offset approaches familiar to the Transport Agency, including the Public Works Act.

From an implementability perspective, which included consideration of project risk, safety in design, delivery time and cost, network dependant investment and strategic integration, Option 3 was overall the most favourable because:

- While all of the short list options have some geotechnical risk, the northern options had substantially less risk than Option 4 as a function of the underlying geology. The Preliminary Geotechnical Appraisal Report (Appendix I) confirms that Option has the least geotechnical risk of the short list options.
- Further work to understand the wider transport and economic benefits of the short list options confirmed that Option 3 along with the other short list options, was able to provide a connection to the current and future strategic road network and integrate with the current and anticipated land use.

Table 15 Short List Assessment Findings Summary

	Assessment findings
Option 1 New corridor north of Saddle Rd	This option is NOT recommended due to: • Being the least direct option and offers the longest average travel time for key journeys • Medium to high risk for significant archaeological finds along the Pohangina River edge
Option 2 Upgrade of Saddle Rd	This option is NOT recommended due to: • Providing a lower level of service than the other options, yet still costs almost as much • Being very difficult to construct, while maintaining normal flow along Saddle Road • Not offering the same level of network resilience as the other options ,as results in only two corridors, not three
Option 3 New corridor south of Saddle Rd	This option is *RECOMMENDED* due to: • Delivering the desired transport outcomes for a cost that is relatively slightly more expensive than Option 2, but is considerably less expensive than Option 4 • Providing a more direct connection than Option 1 and has the lowest average gradient of all the options • Being able to be constructed almost entirely offline and is expected to be at least one year quicker to construct than Option 4 • Having the lowest risk option in terms of impacts on social and environmental factors • With some further consideration of options for improving connectivity to Ashhurst Road, providing similar network benefits as Option 4
Option 4 New corridor south of the Gorge	This option is NOT recommended due to: • Having the most potential to cause adverse effects on the environment • Being substantially longer in terms of new road build than all options and will take at least one year longer to build

	• the alignment running parallel to a major known fault line, resulting in an increased resilience risk • Having the greatest impact on private properties – including Te Matai Road and Stoney Creek Road communities • Being the most expensive option, being at least $200 million more expensive, while delivering the same or similar transport benefits as other options

5 Recommended project option

5.1 SCOPE

Option 3 was identified through the short list assessment as the preferred long term option as the State Highway 3 Manawatū Gorge alternative. As a result, a refinement of the Option 3 corridor has been confirmed as the option that will be taken forward for further option refinement, technical assessment, and public engagement.

The recommended option runs from the western entry of the closed State Highway 3 gorge route at the State Highway 57 intersection, across the Ruahine Ranges north of the gorge, emerging near Woodville (Figure 15). Some of the key attributes of the recommended option are:

- Constructed length of 11.46 km of new state highway
- A maximum gradient of 8% and 6 km being over 6% gradient
- Three bridges
- Approximately 6.1 million cubic metres of cut and 4.7 million cubic metres of fill required

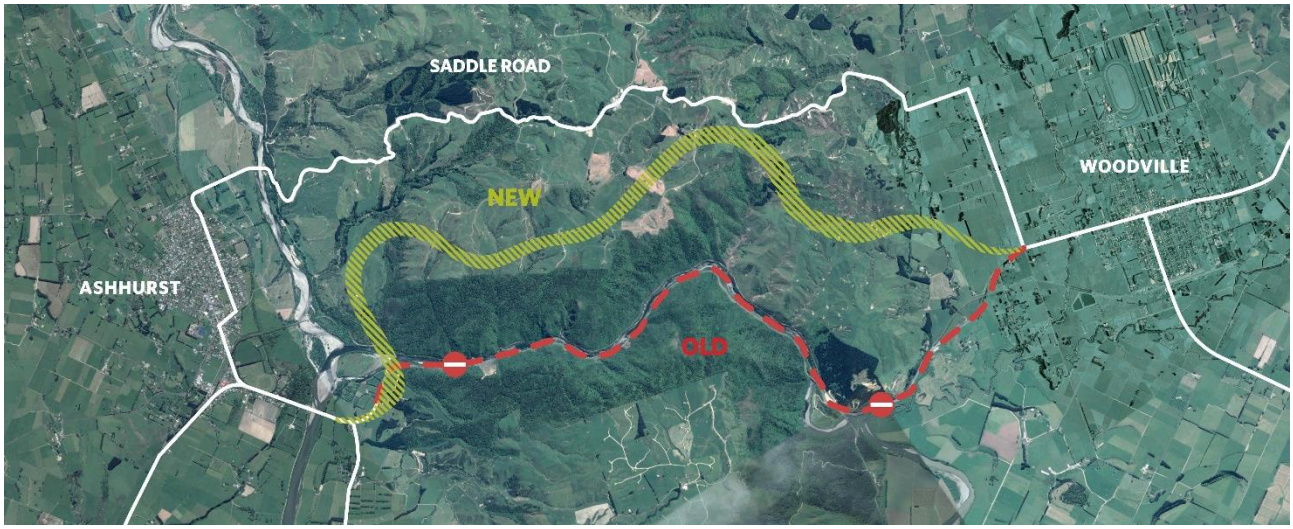

Figure 15 Recommended option

In the west, the recommended option begins at the eastern embankment of the existing State Highway 3 Manawatū River Bridge. The route follows the alignment of the existing road (State Highway 3) for a short distance, before curving north (east of the intersection with State Highway 57) to cross the Manawatū River and the rail line via a new 350-400m long bridge crossing at the western mouth of the Gorge.

North of the new bridge crossing, the alignment climbs and curves around to the north east, before running eastward through the Te Apiti wind farm over the Ruahine Ranges, approximately 1.2 km north of the Manawatū Gorge. At the most northern point, where the alignment curves near to Saddle Road, the route begins to descend downward through farmland towards Woodville, connecting back in with the existing road network at the intersection of State Highway 3 with Woodlands Road and Troup Road.

The recommended option has been refined from the alignment of short list Option 3, particularly in the eastern end. An adjustment to the corridor was made to reduce the need for significant embankments on soft soils and to minimise property impacts. This reduced the cost estimate and produced a more implementable option. To achieve this, a length of approximately 1.8km was shifted north of the short list Option 3 corridor.

Key design elements

The recommended option is a two lane highway (3.5m wide lanes) with a 2m wide shoulder with a design speed of 100 km/h. Crawler lanes will be provided in both directions (resulting in four lanes) where grades exceed 6% and between steep sections to provide a consistent corridor width (Figure 16). Where there are crawler lanes, a 6m wide median and 1m wide nearside shoulders will be provided.

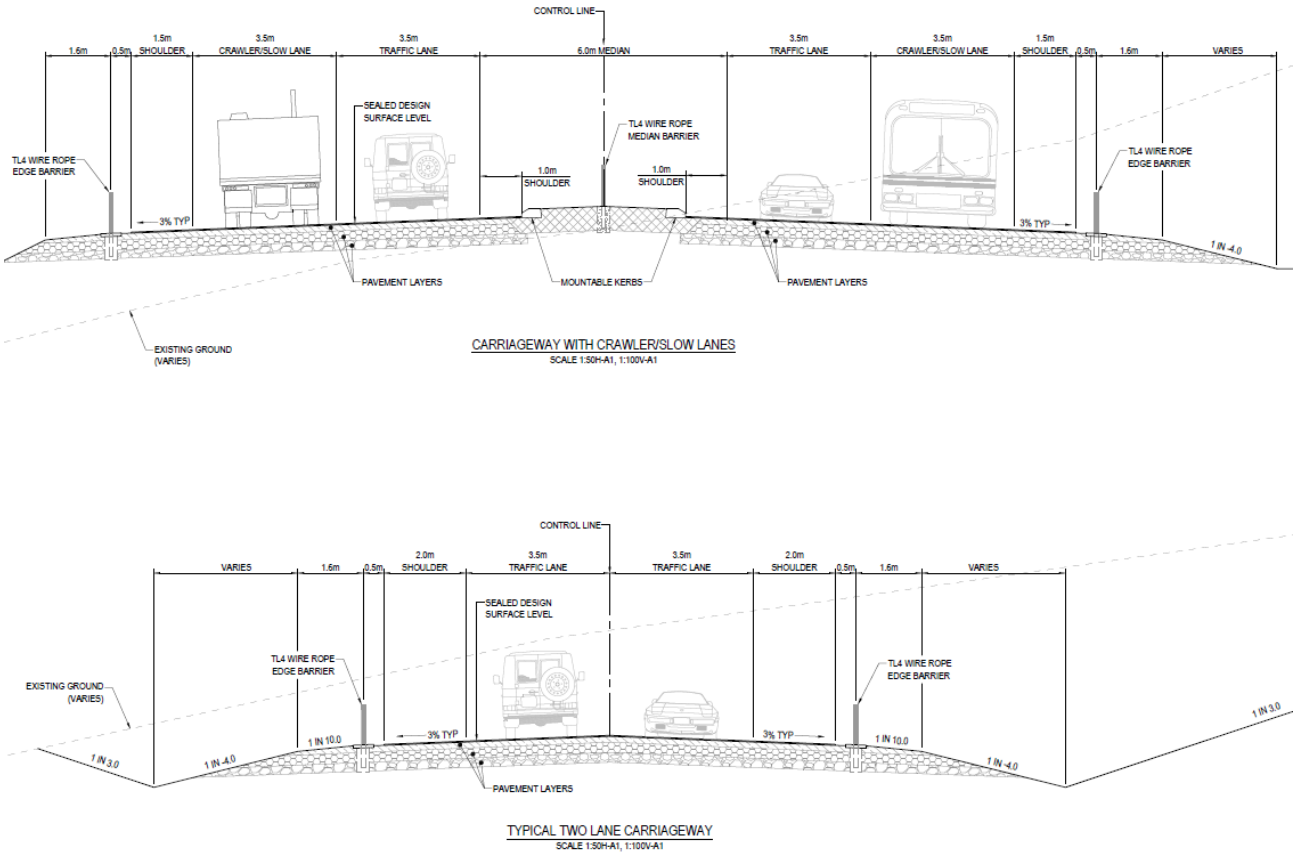

Figure 16 Typical cross sections of the recommended option[33]

The design for the new bridge across the Manawatū River (approximately 350 - 400m long) is yet to be confirmed, however the three options being considered are a composite box girder design, cable-stayed (main span) design, or Super-T girders design. These are discussed further in the Preliminary Structure Options Report (Appendix M).

The operational stormwater system will include structures for stormwater collection and conveyance, treatment systems and devices and culverts and watercourse diversions. The design will include a range of water sensitive design solutions including treatment swales and treatment

[33] Scheme drawings are attached as Appendix I

wetlands to deliver stormwater hydrology (flows and volumes) and stormwater quality (treatment) mitigation.

Walking or cycling facilities are not specifically included along the alignment, however there are wide shoulders provided for in the specification and shown in Figure 16 above. It is expected that the Pahiatua Track will continue to operate as the national cycling route between the western and eastern ends of the gorge, as was the case before the closure of State Highway 3. While there is no or very low levels of usage of Saddle Road at present due to the volume of traffic and road configuration, Saddle Road will revert to a suitable cycling route, once the new road is constructed. The Manawatū Gorge walking track between the western and eastern ends of the Gorge is expected to remain as the primary walking route.

The route traverses multiple watercourses and sub-catchments of the Manawatū River, requiring cross drainage structures, including culverts (either pipes or box culverts) and bridges. Where required, provisions for the safe passage of fish will be made in accordance with the Transport Agency's Fish Passage Guidance for State Highways 2013.

The recommended option includes rationalisation of the Te Apiti Windfarm access tracks, where required and due to the challenging terrain, multiple large cuts and embankments will be required.

The Design Philosophy Statement (Appendix L) includes further detail on the design standards, philosophies and the assumptions. The design of the recommended option is yet to be fully developed, further design work (informed by site investigations) will need to be undertaken at the next stage, to confirm the appropriate balance between design specifications, transport outcomes and the earthworks requirements.

5.2 RECOMMENDED OPTION ASSESSMENT

5.2.1 Outcomes

A comprehensive identification and assessment of options has been undertaken to identify the recommended option. The recommended option performs well against the investment objectives and provides a resilient, safe and efficient route for customers, including HCVs that use the corridor.

The recommended option has been selected as it is likely to have less impact on known sensitive social and environmental areas, however the project is significant and will require further design development and mitigation to ensure that the effects of the project are appropriately managed.

The recommended option is considered in relation to the specific investment objectives below.

5.2.2 Investment objective 1

To reconnect the currently closed Manawatū Gorge State Highway 3 with a more resilient connection

The recommended option provides an alternative route to the existing non-state highway routes (i.e. Saddle Road and Pahiatua Track) that customers are currently required to use, since the closure of State Highway 3 through Manawatū Gorge. The existing Saddle Road and Pahiatua Track will remain available as alternative routes, which will maintain resilience for the overall road network.

Due to the geology and terrain that the new route is required to traverse, it could be prone to some slips in significant storm events. The recommended option's design will minimise this risk and make the likelihood of closure significantly less likely than the Saddle Road or previous Manawatū Gorge route as the wider corridor will reduce the risk of slips reaching the road. During an earthquake event with fault rupture, there is risk of rockfall, landsliding and ground rupture. This could cause short to medium term road closures. Only a short length of road would be affected so the disruption would be able to be remedied and any closures would be much less significant than for the Saddle Road or previous Manawatū Gorge route.

In the event of flooding, the recommended option is expected to stay open and sustain no closure except for maintenance. A major storm related landslip could cause the corridor to be closed in the medium term between 2 weeks to 2 months. The preferred option has the advantage of being greenfields with the cross section being designed to accommodate minor slips relating to storms. The road could be closed long term if a major seismic event occurred on the fault lines that cross the Ruahine Ranges, availability states and outage states are estimated to be long term between 2 months to 6 months. Whilst these outages are considerable they are significantly improved from the current Saddle Road and Pahiatua Track as well as if the Gorge was still operational.

5.2.3 Investment objective 2

To reconnect the currently closed Manawatū Gorge State Highway 3 connection with a safer connection than the Saddle Road and Pahiatua Track

The recommended option will deliver a high standard route with improved safety performance over the existing Saddle Road and Pahiatua Track routes. The route is forecast to operate on average at a 4 Star KiwiRAP standard. In addition to this, traffic volumes on the existing Saddle Road and Pahiatua Track will be reduced (100% of preclosure Gorge traffic is assumed to use the new route) thereby reducing the exposure on the existing roads. Overall the Manawatū Gorge alternative is forecast to lead to a reduction of 108 deaths and serious injuries over a 30 year period.

5.2.4 Investment objective 3

To reconnect the currently closed Manawatū Gorge State Highway 3 with a more efficient connection than the Saddle Road and Pahiatua Track

The recommended option will improve travel time for general traffic using the corridor by an average of 12 minutes (as forecast in 2023) when compared with travel times for the Saddle Road route. The travel time savings are primarily as a result of easing of horizontal and vertical alignment over the Ruahine Ranges and removing traffic from travelling through Ashhurst. Heavy vehicles will experience an average time saving of 14 minutes. In addition to travel time savings, the recommended option will improve journey time reliability. The provision of a dual carriageway in areas with higher gradients means delay caused by slower vehicles will dramatically decrease on the corridor allowing more reliable travel time for all users on the route. Existing interregional bus services between Palmerston North and Woodville will observe travel time savings similar to those of heavy commercial vehicles. This could result in a more efficient interregional service, and attract more users towards Public Transport for these journeys.

5.3 SOCIAL AND ENVIRONMENTAL PERFORMANCE

Table 16 below documents the key findings from a risk based assessment of social and environmental effects, constraints and opportunities associated with the recommended option. The recommended option was considered against the environment as it is today, including consented or approved projects. This means the 'base case' or 'do minimum' option was the continued operation of Saddle Road (in its current form, including committed improvements) as the main vehicle route from Ashhurst to Woodville.

The assessment in Table 16 was informed by input from a number of social and environmental specialists who carried out a high level assessment using largely desk top resources, including:

- The location of the recommended option on GHD's WebGIS Portal
- Constraints data and mapping loaded onto GHD's WebGIS portal which were populated by the project team from a range of data sources, including council planning documents and records, Department of Conservation, NZ Archaeological Association records, NIWA, Land Information NZ, Landcare Research and utility service providers
- Information that specialists were able to draw on from their own professional experience and knowledge

- Feedback from stakeholder and community engagement
- Information from relevant RMA planning instruments
- Field observations during site visits, where these were possible.

The social and environmental assessment considered the recommended option based on information available at the time of the assessment.

Effects were considered without mitigation except where mitigation would be compliance with a Transport Agency design standard or a typical measures implemented on other Transport Agency projects (e.g. erosion and sediment control measures, traffic management plans, landscaping, stormwater management measures).

The risk based assessment is indicative only and specific mitigation measures and design refinements to avoid localised effects have not been considered at this stage. This will be undertaken at the consenting stage as part of a full assessment of effects for the project. It is likely that the level of effects indicated in Table 16 can be reduced through this process.

Table 16: Potential environmental and social outcomes of the recommended option

Effect criterion	Risk of effect	Environmental risks and constraints	Key assumptions
Natural environment			
Water quality (construction)	Minor adverse effect	A potential minor adverse effect on water quality could be expected during the construction period from the inevitable release of sediment into the receiving environment, despite the assumption that erosion and sediment control measures will be installed.	That erosion and sedimentation effects will be managed during construction in accordance with relevant guidelines.
Water quality (operation)	Minor positive effect	On the basis that the stormwater treatment measures will be incorporated into the design, a minor positive effect on water quality during operation is possible when compared to the baseline (i.e. the existing Saddle Road situation).	That stormwater treatment devices for the new road will be established in accordance with the Transport Agency's Stormwater Treatment Standard for State Highway Infrastructure (2010), and will include a preference for vegetated systems, supplemented by proprietary treatment devices if needed.
Hydrology	Minor adverse effect	The recommended option may result in a minor adverse hydrological effect due to an increased flow in downstream tributaries of the Manawatū and Pohangina Rivers where overland flows are diverted to accommodate the new road (i.e. increased flood risk, due to diversion of flow between catchments). The introduction of culverts to pass flows beneath the new road is expected to increase flow velocities to some extent, which may lead to local stream erosion however, through further design development, mitigation could be provided in the form of rip rap and other energy dissipation measures, where needed. Additional impervious surfaces creates the potential for additional volumes and flows and higher velocities of stormwater (from the road) entering the existing natural catchment. Mitigation could be provided in the form of stormwater detention devices integrated as part of the design (i.e. incorporating appropriate volume within the	That existing catchment flows will be passed through the alignment in fill areas and around the alignment in cut areas, and there may be a requirement for stream diversions and the diversion of overland flow water from one sub catchment to another.

Effect criterion	Risk of effect	Environmental risks and constraints	Key assumptions
		stormwater treatment devices), noting that space for these measures is available albeit somewhat limited due to topography. The Woodville end of the alignment crosses a number of large tributaries of the Manawatū River, requiring structures to be incorporated into the design. There is currently limited information of the hydrological regime so hydraulic catchment modelling will be required to determine the extent of the floodplain in the catchments contributing to the Manawatū River and to also determine the effect of the project's embankment and structures on upstream flooding and hydrological regime within the area.	
Freshwater ecology	Moderate adverse effect	The recommended route could result in a moderate adverse effect to freshwater ecosystems, resulting from the risk to stream environments (including streams within exotic riparian and indigenous riparian zones) and wetlands. The loss or damage of these environments would require mitigation. It is assumed that avoidance of substantial reaches of waterway effects may be possible as many of these waterways run at right angles to the alignment.	The assessment relied on the River Environment Classification system, REC2 (version 2.4) to identify the extent of perennial and intermittently flowing waterways at risk from the project. The value of waterways was evaluated through desk top consideration of the Horizons One Plan Sites of Significance–Aquatic (SOS-A) listings and the presence or absence of indigenous vegetation in the riparian zone. These variables provided an indication of the risks to freshwater ecology. Ephemeral and watershed systems and potential wetland seep habitats in pasture were not assessed, so any effects on these (if present within the project footprint) will be additional.
Terrestrial ecology	Substantial adverse effect	The recommended option risks substantial adverse effects on terrestrial ecology, as there are limited opportunities to avoid indigenous vegetation, including regionally significant indigenous forest. The loss or damage of these environments would require mitigation. An affected area of bush in the western side is QEII protected.	The risk based assessment conservatively assumed that all indigenous vegetation meeting or likely to meet One Plan Schedule F ecosystem types within a 500m buffer area of the recommended option was at risk of being affected by construction works. It was also

Effect criterion	Risk of effect	Environmental risks and constraints	Key assumptions
			assumed that no indigenous vegetation outside of the mapped footprint would be affected.
Cultural heritage			
Cultural	Unknown at this stage	The preferred route is expected to impact on cultural sites and values and will require significant involvement of iwi to work through. The route has many gullies with potential to identify significant cultural sites and has the potential to physically or visually alter views of the peak (Te Ahu a Turanga). There could also be caves along gully areas that may have been used for burials but there are no known cave locations at this stage. The route has the potential to positively connect iwi in the east with the Gorge and the opportunity to make the bridge location a celebration of Parahaki Island, which is an important site for Maori.	It is assumed that the preferred route will not directly affect the Maori freehold land known as Parahaki Island at the confluence of the Manawatū and Pohangina Rivers. The assessment was based on feedback obtained through consultation with Rangitanne o Manawatū, Rangitāne o Tamaki nui a Rua and Ngati Kahungunu.
Archaeological and built heritage	Moderate adverse effect	While the alignment avoids any recorded sites of high significance, there is potential to encounter features related to Maori settlement near the convergence of the Pohangina and Manawatū Rivers. This risk potential is assessed as being a moderate adverse effect.	The assessment relies on review of recorded sites (district plans, NZ Archaeological Association records) and the archaeologist's opinion on the risk of encountering unrecorded archaeological sites. The assumes that any remains relating to early European settlement can be dealt with through standard mitigation processes under the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA).
Social			
Social	Minor positive effect	The recommended option would result in at least a minor positive social effect overall. There will be significant positive effects for the Ashhurst community, as the alignment will remove traffic from Salisbury Street. In terms of the rest of the alignment, it is understood that the final footprint would avoid as many dwellings as possible. However, it is acknowledged that some people may be displaced from their homes (<25 dwellings are located within a	The assessment assumes that the Public Works Act 1981 (PWA) will apply as 'standard mitigation' (i.e. land and building owners directly affected by the project will be fairly compensated under the PWA).

Effect criterion	Risk of effect	Environmental risks and constraints	Key assumptions
		300m wide corridor of the alignment). There would be no change to traffic flows through Woodville (compared with baseline).	
Landscape, visual and natural character			
Landscape	Moderate adverse effect	The recommended option risks moderate adverse landscape effects, due construction within outstanding natural landscapes (ONL's), the construction of a large bridge structure at the western end and significant cuts along the alignment. It passes through landscape that is already altered by the presence of Te Apiti wind farm and Saddle Road. The alignment also presents opportunities for enhancement of the landscape in the Te Apiti- Manawatū Gorge natural/recreational area.	The landscape and visual assessments rely on preliminary feedback from Councils that the specialist's interpretation of the landscape provisions in the Regional Policy Statement (Horizons Regional Council) and the Tararua District Plan is accurate. Furthermore, it is assumed that the car park for the Manawatū Gorge Walkway can be relocated, fill areas will be close to the road to minimise the overall footprint, and the recommended option does not include elevated interchanges or large retaining walls. Natural character has not been assessed by a specialist at this stage.
Visual amenity	Moderate adverse effect	The recommended option risks moderate adverse visual effects. Cuts along western face of foot slopes of the Ruahines and Pohangina Valley would be visible from Ashhurst and environs, however this would be in the context of both Saddle Road and Te Apiti wind farm. Sections of the new road would be reasonably visually contained but high cuts would result in scarring in places that could be difficult to revegetate and erodible steep slopes could result in ongoing scarring. However, the route is reasonably visually contained within the landform, particularly on eastern side, with a relatively limited eastern viewing audience.	
Infrastructure and property			
Infrastructure	Substantial adverse effect	There is a risk of substantial adverse effects on infrastructure, primarily due to the presence of the Te Apiti wind farm, potential impacts on PowerCo transmission lines and disruption to the water supply of rural properties. All of these effects would require appropriate mitigation. Across the alignment, service alterations and relocations would be required.	Potential effects are assumed where turbines are within the earthworks footprint of the recommended option, or within 50 metres of this footprint. Potential impacts on wind farm cabling have been interpreted from the As built drawings (where shown). As built drawings provided by Transpower, Meridian and Powerco have been

Effect criterion	Risk of effect	Environmental risks and constraints	Key assumptions
			relied on for identifying potential infrastructure conflicts.
Property	Moderate adverse effect	The alignment is expected to negatively impact on properties in the area (through displacement and severance), property acquisition will be required. Interests include private farmland, AgResearch, Meridian Energy, KiwiRail, Transpower, Tararua District Council and PowerCo.	That no further land is required where the recommended option is shown to be within current road reserve. That Maori Land (Parahaki Block) can be avoided by the alignment.
Human health			
Construction noise	Minor adverse effect	Construction noise effects should be able to be managed with standard practices as the majority of activity will be remote from houses, surplus material can disposed on-site, and the bulk of heavy vehicle movements will be internal to the site.	That piling for bridge/viaduct construction can be managed with standard practices. That construction traffic does not pass through Ashhurst and any blasting is remote from houses. That surplus material is able to be disposed of on-site, away from houses.
Operation noise	Minor adverse effect	The recommended option may have minor adverse noise effects during operation. While traffic and associated noise will be significantly reduced from the current route through Ashhurst, the smooth geometry and steep gradients are likely to give rise to increased braking and engine noise. Concurrently, positive effects are anticipated in the west as traffic and associated noise will be reduced from the current route through Ashhurst.	That asphalt paving will be used on the alignment near houses.
Contaminated land	Moderate or substantial adverse effect	There are 7 potential hazardous activity and industries list (HAIL) sites located within the footprint of the recommended option. One of these, a historic landfill on Saddle Road may have moderate to major risk due to a likely requirement to disturb a contaminated site and the potential need for excavation of buried waste and potential leachate seepage effects on stormwater. The 6 other sites identified are either stockyards, transport depots or buildings which may contain asbestos. These pose a moderate risk as	The assessment relies on HAIL site information provided by the councils and a specialist's examination of Google Earth 2017 Aerial Imagery as representation of known potentially contaminated land. Unrecorded sites may be identified in the future.

Effect criterion	Risk of effect	Environmental risks and constraints	Key assumptions
		contaminated soil may need to be removed and procedures put in place to protect site workers. A number of other HAIL sites adjoin or are close to the recommended option. These pose a lower risk as they are unlikely be disturbed project, but there is a potential risk of offsite impacts having migrated into the proposed road corridor, therefore protection/preventative measures may be required in these areas as a precautionary approach.	

5.4 IMPLEMENTABILITY

The next phase of the project is the pre-implementation phase (followed by implementation which primarily involves construction). The pre-implementation phase will include design development to progress the recommended option into an indicative alignment on which a Notice of Requirement to designate land, resource consent applications and potentially other statutory approvals can be sought. The design development will focus on high risk areas, including the following:

- Geotechnical investigations including intrusive testing to understand ground conditions and identification for specific mitigations to be included into the design and specifications for implementation
- Consideration of and response to further stakeholder and landowner consultation into the new state highway requirements including accesses for adjacent landowners
- Areas of focus required for consenting (i.e. sediment impacts, disposal of fill, etc)
- Property and wind farm adjustments to accommodate the project
- Further development of the structures (including bridges, culverts) for the project
- Construction access.

As part of seeking the planning approvals an Assessment of Effects on the Environment (AEE) will be completed, including technical assessments.

The alignment of the recommended option may require amendment to manage the likely effects associated with the construction, operation, and maintenance of the road. Costs associated with these potential changes have been allowed for within the risk allowance of the project estimate.

5.4.1 Consent process

The relevant legislations for the implementation of this project are the Resource Management Act 1991 (RMA), Heritage New Zealand Pouhere Taonga Act 2014 and Wildlife Act 1953.

Based on the current alignment, it is expected that the RMA approvals required for the recommended are as follows:

- Designations within three district plans and outline plan approval/waiver
- Regional resource consents which are anticipated to include land use consents, water permits and discharge permits for the following activities:
    - Large-scale land disturbance (including earthworks) and vegetation clearance, and ancillary discharge of sediment, including within ‘at risk’ and ‘rare and threatened habitats’
    - Construction phase stormwater discharge from treatment devices to land or water
    - Operational stormwater discharges to land or water
    - Discharge of cleanfill
    - Dust generation (unless site management can achieve no offensive or objectionable odour, dust, smoke or water vapour at the boundary of any sensitive area)

  - Water take (including dewatering, if required)
  - New drainage and stream diversions
  - Work within the beds of rivers, streams and artificial watercourses
  - Activities in Schedule B (Flood Control and Drainage) rivers
- The regional consents have a Restricted Discretionary or Discretionary activity status aside from activities in 'rare and threatened habitats' which are a Non-Complying Activity.
- District resource consents may also be under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health, the National Environmental Standards for Electricity Transmission Activities (transmission line changes) and third party consent amendments (e.g. wind farm).

There are a number consent pathway options available to the Transport Agency for obtaining the necessary RMA approvals. This includes a traditional council application process, direct referral to the Environment Court or lodgement with the Environmental Protection Authority as a project of national significance. Irrespective of the consent pathway selected for the project, consideration of mitigation measures will be necessary to facilitate approvals, in relation to the social and environmental effects anticipated.

The key consenting risks are identified below in section 5.5.

5.4.2 Property impacts

Delivery of the recommended option requires land from 11 private landowners and two existing road parcels. The estimated gross cost of property acquisition costs of $9.324M[34]. Refer to the cost estimates for the project (Appendix D) for further detail.

The recommended option is anticipated to have a significant impact on four of the affected properties and a moderate effect on the remaining seven properties. Property will be acquired in accordance with processes under the Public Works Act. Any delay in the issue of land requirement plans is likely to have a direct consequence on the timing of delivery of land for the project.

5.5 PROJECT RISKS

The consideration of project risks was integral to comparing options and informing decision-making during the DBC process. It also aided in understanding the recommended option and the potential risks to project delivery during the pre-implementation phase.

As the project transitions through the business case phase and into pre-implementation, the increased maturity of project information and project understanding should reflect an increased maturity in risk assessment and application of risk management practices. During the early phases of this project development (business case phase) the principles of good risk management practice were applied, and formal risk management documentation was recorded throughout the work

[34] P50 value based on the value of the land as at April 2018.

completed to get to a recommended option. The level of detail used to investigate risks has been proportional to the maturity of project data available.

For the attached risk register, the semi-quantitative assessment used a likelihood and consequence banding system to rank risks by importance. A more advanced approach with greater complexity of analysis would not have provided value for money given the uncertainty and preliminary nature of project information. However, a more advanced approach to the consideration of risks was applied to developing a risk adjusted cost estimate where stochastic analysis informed contingency values (refer to section 7.1).

A successful transition through the business case process, pre-implementation and into project implementation will require sound application of risk management. This includes regular review of the programme and implementing treatment actions against risks relevant to each phase where appropriate. The risk register developed during the DBC is a starting point to develop further as project information develops.

Table 17 provides a summary of the significant project risks identified for the pre-implementation phase.

Table 17 Summary of key delivery risks for the pre-implementation phase

Risk	Cause	Project implications	Potential treatment strategy
Adverse effects on Outstanding Natural Character	Objective 6-2(b)(ii) of Horizons One Plan requiring adverse effects on natural character to be avoided	Increased consenting risks with inflexible avoid policy. Importance placed on the assessment of alternatives process.	Engage the legal team to understand case law and develop a case strategy. Undertake detailed technical assessments of the effects on natural character of the major rivers affected by the recommended option, using industry leading technical specialists.
Consents not granted for the project	The consent authority declines the consent application	A project halt or delay. Redesign or change of project scope. Damage to the Transport Agency's reputation	Focus on building the strategic justification for the project. A robust and defendable assessment of alternatives process. Peer review of high risk areas.
Appeals to the High Court or Court of Appeal	Stakeholders object to the project and lodge an appeal	Damage to the Transport Agency's reputation. Negative media coverage. Potentially a significant delay to construction procurement or	Present the best, and compelling case through the application process. Work with stakeholders to understand any concerns and respond where feasible and practicable. A robust and defendable

Risk	Cause	Project implications	Potential treatment strategy
		compensation to tenderers for project delays.	assessment of the alternatives process, down to individual property level.
Unknown ground profile (survey) and ground conditions	The cause of the threat is failure to gain access or time ahead of winter months for geotech testing to be undertaken ahead of key design decisions being required in prelim / specimen design phase.	The consequence of the threat is increase in construction costs and construction period due to unexpected ground conditions. Potential for increased or altered land requirement and increased property impacts.	Commence initial ground investigations and work required in summer months as early in pre implementation phase as possible. Consider land access agreements early.
Delivery resource availability and continuity	With pressure to deliver a prompt consent phase there is a risk that there are not sufficient resources available to deliver the necessary technical inputs in the time available.	Inadequate resources result in poor decisions made resulting in rework and increased costs and programme delays. Potential for rework related delays through new team of technical specialists.	Engage with service providers for pre-implementation and implementation phase early to enable delivery teams to be resourced, capable and ready for necessary delivery.
Maintenance of cut slopes impacts performance and operation of the road	The recommended option includes steep slopes to minimise earthworks	Threat to Transport Agency reputation. Increased operation and maintenance costs. Threat to route resilience.	Undertake comprehensive geotechnical intrusive investigation of the recommended option.
Disruption to windfarms more significant or Negotiations with wind farm owners take longer or are more costly than	Wind farm owners object to the recommended option or the effects it has on wind flow and operation impact. Property acquisition negotiations breakdown.	A high cost of land acquisition and compensation. Consenting difficulties and delays. Impact to the Transport Agency's reputation. A requirement for costly wind modelling.	Work with the wind farm owners through design phases to incorporate their operations within the project and construction documentation. Consider appropriate operational constraints with respect to disconnection,

Risk	Cause	Project implications	Potential treatment strategy
originally anticipated			relocation and commissioning of facilities.
Design complexity	Required function and constraints results in highly complex structures design.	Design and delivery costs and timeframes increase due to new or complex technologies requiring specialist skills and resources to deliver.	Early assessment of necessary form relating to constraints on site. Specifically relating to the Manawatū River bridge.
There is a loss of political support, or key stakeholder support	A change in political leadership, loss of support for recommended option, or other political motivating factors	A change in project scope. A risk to the Transport Agency's reputation. A challenging consenting situation with no key stakeholder support.	Clear messaging to media and stakeholders. Meaningful and robust stakeholder engagement.

5.6 NETWORK INTEGRATION

5.6.1 Network connectivity

As part of the short list assessment, investigations were carried out to assess how the options connect and integrate (assessed as 'strategic network and land use integration') and the level of investment required to connect (assessed as 'network dependent investment') into the current and future regional road hierarchy. The assessment was focussed on the interaction between the short list options and the proposed Palmerston North regional freight ring road.

The assessment approach and methodology is outlined in the Short List Assessment report (Appendix C). Supporting this, an economic assessment was also undertaken by EY to inform the short list assessment (Appendix E).

The assessment undertaken tested various ring route scenarios using the Palmerston North Area Traffic Model (PNATM) to identify differences in vehicle hours and vehicle kilometres travelled across the whole network for both general traffic and HCV's.

The assessment considered the preference of a number of the project's key stakeholders for Option 4. This preference was underpinned by the perception that the option would provide for significant economic development across the region that other options would not provide. Analysis of the wider economic benefits of the options has demonstrated that the difference between them is marginal and not directly related to the gorge alternative option specifically. The analysis showed that the differences in the benefits are derived from the ring route options and specifically the presence and location second river crossings in or near Palmerston North city.

The assessment work carried out by the Joint Working Group identified the future ring route scenarios and how the different Manawatū Gorge Alternatives options connected into them. This

assessment identified that the recommended option, Option 3, was able to integrate and connect with any of the possible future ring route scenarios. The future ring route assessment did however highlight differences in the benefits of each of the possible scenarios (not effecting integration/ connection with the recommended option) and identified the need for further analysis to develop a detailed investment case for the ring route development.

5.7 EXISTING STATE HIGHWAY 3 ALIGNMENT THROUGH THE MANAWATŪ GORGE

The construction of a new road corridor to replace the closed State Highway 3 Manawatū Gorge section will require a plan to manage the existing land and assets into the future.

The existing section of State Highway 3 through the Manawatū Gorge includes:

- Approximately 61,000m^2 of sealed pavement
- Approximately 6083m of steel guardrail, 211m of timber sight rails and 99m of concrete barriers
- Bridge structures (73, including 65 half bridges), culverts and drainage assets (74)
- Retaining walls (26, across a length of approximately 554m)
- Rockfall netting (39 structures, across a length of approximately 2274m).

Options for the existing structures range from retention with ongoing maintenance through to complete removal.

Options for the future management of this section have been considered during the development of the DBC. A memo outlining the considerations for the future management of the land and assets in the Gorge outlines the various scenarios (Appendix P). These scenarios include the Transport Agency retaining management of the land, legally stopping the road under the provisions of the Public Works Act 1981(PWA) and disposing of it to DoC, iwi or relevant local authorities: Consideration would need to be had as to whether the land is retired or used as a recreational and historic asset or for some other purpose (in which case a reserve status may be appropriate).

Regardless of ownership, the required level of maintenance and/or removal of existing infrastructure and how liability is managed will need to be considered further. Two scenarios have been considered to estimate the cost of future management, representing the two extremes of the range of options available for the treatment. This range covers a minimal physical works with an annual maintenance programme approach and a full removal of infrastructure within the Gorge approach. This cost estimate range is from $320,000 capital costs with $22,150 annual maintenance through to $15,283,800 for capital works (with the significant costs being removal of all structures) with zero ongoing maintenance costs. The capital costs are considered in the project cost estimates.

During the development of the DBC the project team briefly engaged with stakeholders to understand their views on the future management of the old state highway section through the Gorge. DoC has indicated that they would be interested in the land as a recreational asset as the

Gorge area is the highest use DoC site in the District, and there is further visitor potential which could be realised.

Rangitaane o Manawatū have indicated that they would like this land to given back to Rangitaane as a gesture, as they would value having land adjacent to the Manawatū River, and that the land should be retired. Rangitāne o Tamaki nui o Rua have indicated that they would like the area to be open and available to all and to make a feature of significant cultural sites. The matter had not been discussed with Ngati Kahungunu, at the time of writing.

Te Apiti-Manawatū Governance Group oversee the management of the scenic reserve. Consultation will need to be undertaken with this group.

The existing section of State Highway 3 from the Manawatū Gorge to Woodland/Troup Road will need to remain as a legal road, but as it will no longer serve a nationally strategic purpose, it would be expected to become local road administered by the Tararua District Council. Discussions regarding this will be commenced in the pre-implementation phase of the project.

5.8 REVIEWS

The recommended option development process has included the reviews being undertaken as outlined in Table 18 below.

Table 18 Reviews and audits

Review	Reviewer	Status
Assessment of Alternatives	Review by Jacobs – Karyn Sinclair	Review and response from GHD provided to NZTA
Long List Assessment Report	Legal review by Buddle Findlay	Complete and comments incorporated in final reports
Short List Assessment Report	Legal review by Buddle Findlay	Complete and comments incorporated in final reports
Transport Assessment	Peer Review by Commute – Tony Innes	Complete and comments incorporated in final reports
Consent Strategy	Legal Review by Buddle Findlay	Complete comments incorporated in draft strategy
Design Road Safety Audit	WSP Opus	Review and designer comments provided to NZTA
Economics Peer Review	WSP Opus – Will Wallace	Review and GHD response provided back to WSP Opus.

Review	Reviewer	Status
Parallel Estimate	BondCM	Review completed and reconciled.
Preliminary Geotechnical Assessment Report	Peer Review by Tonkin & Taylor – Stephen Crawford & Bernard Hegan	Complete and comments incorporated in final reports

6 Recommended option – economic analysis

An economic analysis has been undertaken for the recommended option in accordance with the Transport Agency's Economic Evaluation Manual and approach to land transport investments. A peer review of the economic analysis has been undertaken by WSP Opus consultants. Refer to Appendix F for the detailed economic assessment.

6.1 DO MINIMUM

The Do Minimum option is defined as the existing Saddle Road and Pahiatua Track, including committed improvements. While these routes are not currently at a state highway standard, this has been confirmed as a suitable Do Minimum option as these routes will remain the connection until a replacement route is constructed. It is also noted that although they provide a much lower level of service than desired for a state highway connection, they are comparable to other lower classification state highways in NZ, in terms of terrain and geometrics.

6.1.1 Scope: The Saddle Road and Pahiatua Track

The key details about the use of these routes, compared with the figures for the Manawatū Gorge prior to its closure, are detailed in Table 19.

Table 19 Route summary

Route	Main Features	Distance between SH3 at Ashhurst and Woodville (km)	Average Travel Times (min)	AADT (before closure)	AADT (after closure)
Manawatū Gorge	Traverses through the Gorge, flat gradient, shortest distance	14.1	13.0	7,620	0
Saddle Road	Traverses north of the Gorge through the Ruahine Range, Maximum gradient of 16%	18.0	21.6	150	6,220

Source: Tom Tom for Average Travel times, Transport Agency for AADT (AADT ranges and total AADT contributed to the Gorge closure are detailed below for June to November).

The Saddle Road has an average speed of 55 km/h. The Pahiatua Track is similar and estimated to have an average speed of 50-60 kms per hour. These compare to the Gorge with 65 km/h. The 2016 AADT for the Manawatū Gorge prior to its closure was 7,620 vpd with 11.3% HCVs[35].

With significant works being undertaken on the Saddle Road involving total road closures or directional closures the ability to source accurate AADT volumes for the traffic split between the Saddle Road and Pahiatua Track is challenging. This situation is made more complex with there being some leakage with some traffic now choosing to use State Highway 2 rather than State Highway 1 and State Highway 57 when travelling between Hawke's Bay and Wellington regions.

Post Gorge closure counts have been undertaken from 26 June through to mid-November on both the Saddle Road and Pahiatua Track. The seasonal adjustment based on the NZTA Telemetry Site is 0.915 to allow comparison of data. This results in the AADT for the Gorge for comparison purposes being 6,929 vpd for Saddle Road.

It is acknowledged that this is conservative with vehicles choosing to use State Highway 2 instead not being taken into account and that the volumes using Pahiatua could be higher but without comprehensive pre and post Gorge closure surveys and reliable traffic data to build a full transport model the approach outlined above is considered appropriate given relatively straight forward nature of the movements and low volumes that will fall outside of the assumptions.

As outlined earlier in section 2.1.3 of this report, these routes through the Gorge are also considered to be relatively inelastic in terms of usage. As Table 19 above shows, since the closure of the Manawatū Gorge in April 2017 total vehicle volumes across the three routes have increased slightly from 9,984 before the closure to 10,039 vehicles per day after the closure. Therefore this SH3 Alternative recommended option is considered to have high strategic importance for access and reliability purposes for users.

6.2 COST ESTIMATES

Cost estimates have been compiled consisting of the following:

- Professional services and Transport Agency managed costs
- Property costs
- Construction costs
- Annual maintenance costs and renewal costs
- Other (i.e. wind farm effects loss of revenue, costs associated with closure of the existing State Highway 3 in the Gorge**).**

The project cost estimate is $517M. This estimate is derived from a $363M base estimate plus $105M contingency allowance assessed through an @risk Monte Carlo simulation with a 3% allowance for escalation (changes in the cost or price of specific goods or services in a given

[35] Source: Tom Tom data pre Gorge closure for the Gorge analysis and post Gorge closure for Saddle Road and Pahiatua Track.

economy over a period) The cashflow estimate assumes the project will commence in 2018 and be delivered by the end of the June 2024 as per the cashflows in section 7.5 of this report. Earlier cost estimates provided during the DBC development were used for comparative purposes, the cost estimate outlined above and used for the assessment of the recommended option was derived from more detailed design and investigation to complete the DBC and has undergone a parallel estimate review to confirm its accuracy and robustness.

6.2.1 Transport 'model' development

For the purposes of understanding the pre and post Gorge closure travel patterns for economic evaluation, a transport 'model' was developed in a spreadsheet form. In order to develop the transport model, traffic counts were sourced from the Transport Agency Traffic Count data.. The traffic growth used for the assessment of options and economic evaluation are:

Years 0 (2018) to 6 (2023) is 2.6%

Years 7 (2024) to 12 (2029) is 5.2%

Years 13 (2030) to 20 (2037) is 3.9%

Years 21 (2038) to 40 (2057) is 2.6%

The do minimum (Do Min) and the recommended option had a vertical alignment established from the 12D model to provide gradients in 500 m lengths and Austroads gradient data was then used to establish travel times and vehicle operating costs within the transport model.

The average speed for the Do Min was calculated via Tom Tom GPS data for the Saddle Road, taken post the Gorge closure. The Do Min did not allow for speed change cycles. This has resulted in a Do Min value that is conservative.

The recommended and Do Min options were then assessed from Woodville (State Highway 2 /3) through to State Highway 3 / Stoney Creek Road and Bunnythorpe and vice versa to reflect the key origin and destination points. The origin-destination split was established from a combination of pre Gorge closure BlipTrack and the Palmerston North City Council Cube model.

The Do Min was assessed on the following trip matrix for the Saddle Road and Pahiatua Track:

Table 20: Do Minimum assessment trip matrix

Origin	Destination
Woodville (via Saddle Road)	State Highway 3 / Stoney Creek Road
	Bunnythorpe
Woodville (via Pahiatua Track)	State Highway 3 / Stoney Creek Road
	Bunnythorpe
Bunnythorpe (via Saddle Road)	Woodville
Bunnythorpe (via Pahiatua Track)	Woodville
State Highway 3 / Stoney Creek Road (via Pahiatua Track)	Woodville
State Highway 3 / Stoney Creek Road (via Saddle Road)	Woodville

The recommended option has been assessed based on the following trip matrix.

Table 21: Options assessment trip matrix

Origin	Destination
Woodville	State Highway 3 / Stoney Creek Road
Woodville	Bunnythorpe
State Highway 3 / Stoney Creek Road	Woodville
Bunnythorpe	Woodville

6.2.2 Other key inputs and assumptions

Other key inputs and assumptions include:

- Travel time and vehicle operating costs have been developed for both passenger and heavy commercial vehicles based on the vertical alignment, assessed average speeds and EEM Tables A2.4, A4.1(b), A5.1 and A5.5
- All options have been assessed on a 40 year period with a 6% discounted rate

- The Do Min and recommended options have been assessed using the EEM Method B for safety and crash predictions in the economic evaluation.

A sensitivity analysis was undertaken for the scenarios: closures to Saddle Road from weather events and slips, increased traffic and HCV volumes, decreased HCV volumes from increased rail activity, and adjustments in capital costs. This is detailed in section 6.4 below.

6.2.3 Manawatū Gorge transport methodology review

A review of the transport assumptions was undertaken by Commute transport consultants (see Appendix H) considered that the approach undertaken is appropriate given:

- The Do Minimum situation is not typical and therefore assumptions on the level of diverted traffic is appropriate
- The approach to these assumed traffic numbers is considered to be suitably conservative
- The transport modelling undertaken by Beca outside of the DBC has not shown any obvious anomalies with the approach taken in the DBC.

6.3 ECONOMIC SUMMARY OF RECOMMENDED OPTION

The economic assessment for the short listed options and recommended option have been undertaken in accordance with the Transport Agency's Economic Evaluation Manual where feasible and utilised alternative approaches when required. Wider economic benefits have been included in the valuation of the recommended option. These benefits were not used in the short list assessment but would have increased the relative value of all the short listed options. The crash analysis methodology was developed to allow analysis of a large number of options in early phases of the project. This methodology is based on the safe systems approach and used the KiwiRAP star rating. For the purposes of assessing the recommended option and developing the economic assessment the EEM Method B was applied.

The results of the economic assessment including costs and benefits are detailed in Table 22, these are based on the cost estimate information in Section 8.1 including the capital cost expected estimate of $469 M (excluding escalation, $517M including escalation).

Table 22 Economic performance of the recommended option

Outcome	Value
Net Present Value Cost	$ 422,507,774
Net Present Value Benefit, consisting of	$ 741,235,564
- Vehicle Operating Costs	$ 139,645,552
- Crash reduction savings	$ 24,231,055
- Travel time savings	$ 384,655,022
- Carbon emission reduction	$ 5,585,822
- Wider economic benefits	$ 187,118,114
Benefit Cost Ratio	1.8

Detailed information relating to the economic assessment is contained in Appendix F of this report.

6.4 SENSITIVITY ANALYSIS

A number of sensitivity tests were undertaken relating to assumed discount rates, closures, traffic volume growth, and capital costs. These are summarised in Table 23 and

Table 24 below.

The discount rates are applied to future costs and revenues that discount the value of money in the future to reflect borrowing and opportunity cost. Closure scenarios were also tested for Saddle Road for the period up until the new state highway connection is competed and is provided in Table 24 below. Traffic volumes growth assumptions were also used as well as increasing and decreasing the capital costs of the project.

Table 23 Discount rate sensitivity analysis

Sensitivity Area	Change	NPV	BCR
Discount Rate	No sensitivity (6%)	$ 318,727,790	1.8
Discount Rate	4%	$ 619,332,107	2.4
Discount Rate	8%	$ 134,114,782	1.3

Table 24 Sensitivity analysis

Sensitivity Area	Change	NPV	BCR
All	No sensitivity	$ 318,727,790	1.8
Closures	Scenario 1	$ 348,313,125	1.8
Closures	Scenario 2	$ 367,672,957	1.9
Closures	Scenario 3	$ 417,148,084	2.0
Closures	Scenario 4	$ 427,903,545	2.0
Closures	Scenario 5	$ 520,400,521	2.2
Traffic Growth	2.5% traffic growth	$ 211,977,598	1.5
Traffic Growth	7.5% traffic growth	$ 412,816,328	2.0
Traffic Growth	10% traffic growth	$ 512,349,286	2.2
Capital Costs	120% Capital costs	$ 232,015,759	1.5
Capital Costs	80% Capital costs	$ 405,439,822	2.2

The closure scenarios in
Table 24 are based on the closures to the Saddle Road from weather events and slips as outlined below in Table 25.

Table 25 Closures to Saddle Road from weather events and slips

Scenario	Days	Frequency	Weeks	Frequency	Months	Frequency
1	1	10				
2	1	5	1	2		
3	1	5	1	1	1	1
4	1	10	1	1	1	1
5					3	1

The sensitivity analysis shows a range of BCR values between 1.1 and 2.2. This recognises that even without all potential benefits included and much more conservative assumptions the project

and that these values are within acceptable variance levels and confirm that the recommended option is a suitable investment for the National Land Transport Fund.

6.5 IAF ASSESSMENT PROFILE

The Transport Agency uses the Investment Assessment Framework to give effect to the Government Policy Statement and determine what proposals will receive funding within the activity class funding ranges. The IAF uses a holistic process based on the Business Case Approach. Activities and programmes are developed using business case principles before assessment with the IAF (2015-18) and prioritisation using three factors, strategic fit, effectiveness, and efficiency or cost benefit appraisal. These factors will help to determine how well a project meets the government's investment strategy and their priority for funding.

The assessment profile for this project is high. Rationale for this rating is outlined in Table 26 below.

Table 26 Assessment profile of the recommended option – IAF 2015- 18

Measure	Rationale of recommended option
Strategic Fit (High)	The recommended option delivers improvements to the targeted areas of journey time reliability, mismatched capacity and demand, more efficient freight supply chains and resilience. *Journey Time Reliability* Along this recommended option route greater journey time reliability for freight and general traffic will be achieved and address the current travel time variance and closures that occur on the Saddle Road and Pahiatua Track. The recommended option will see average travel times and associated travel time costs and vehicle operating costs reduce. This route will provide faster access to employment as well as freight journey time improvements. *Mismatched Capacity and Demand* The recommended option is designed to state highway standards, and to meet the capacity and demand requirements of all traffic (including HCVs). Due to the volume of traffic and gradients of the recommended option crawler lanes are provided above 3% gradient to provide sufficient capacity and reduce inefficiencies that are currently being experienced along Saddle Road and Pahiatua Track. *More Efficient Freight Supply Chains* The recommended option provides improved travel times and vehicle operating costs for both general traffic and Heavy Commercial Vehicles. This factor carries great importance as this is an inter-regional connection and it has a higher than average level of Heavy Commercial Vehicles as a percentage of vehicles and impact on the regional economy and its productivity. These improvements to the

Measure	Rationale of recommended option
	linkages in this section of the state highway network will provide for greater connectivity and economic growth in the Lower North Island and Central New Zealand for key supply chains, and general traffic movements. *Resilience* The recommended option is more resilient than the current routes. It is less prone to slips, flooding or closure from seismic events and will provide improved connectivity, and network availability for general traffic and freight movement in the long term.
Effectiveness (High)	*Outcomes Focused* The recommended option is outcomes focussed and will provide significant improvements in the areas of resilience, safety and efficiency as outlined in the investment objectives. *Integrated* This option is integrated with the network currently as well as future network plans like the proposed freight ring route. The recommended programme has public support of the key project partners and stakeholders. *Correctly Scoped* The DBC has been correctly scoped and the business case process has been followed including the assessment of alternatives and options such as the 'in gorge' options. *Affordable* The benefits and costs are understood and the project is considered affordable through the lifecycle of the recommended option. A parallel estimate has been undertaken to reduce uncertainty for the estimated project cost. *Timely* The timeliness of a programme of this size has been widely acknowledged and understood by the group, and the benefits of a resilient SH3 connection is a key priority as outlined in this detailed business case. *Confidence* As displayed in this document there has been high levels of stakeholder engagement throughout this project and there is confidence that risks and outcomes (both present and future) have been identified and managed properly. A parallel estimate was undertaken to provide high levels of confidence in the capital cost of the project.

Measure	Rationale of recommended option
Efficiency – Cost Benefit Appraisal (BCR Ranges)	The recommended option achieves a BCR of 1.8. Based on this BCR, the option fits within the Low BCR range 1 – 2.9.

7 Financial case

7.1 PROJECT DELIVERY COST

The recommended option cost has been estimated to a level of detail consistent with the level of design completed. Elemental costs were prepared and reviewed in accordance with the NZTA Cost Estimation Manual guidelines, SMO14, with an advanced approach to risk based estimates recommended in NZTA Z44 for the determination of the Expected and 95th percentile estimates.

- Expected estimate of $469 M, ($517 M with escalation)
- 95th percentile estimate $604 M.

7.1.1 Capital cost estimate assumptions

The following outlines the assumptions included in the development of the capital cost estimate:

- Pricing is current as at the 3rd Quarter 2017 and have been derived from recent Transport Agency capital project rates.
- Contingencies totalling $105 M have been allowed for to cover unidentified additional activities or changes to the scope and risks identified outlined in this DBC.,This contingency and the funding risk value has been calculated from a Monte Carlo simulation using @risk.
- Pricing of costs associated with wind farm impacts have been provided by an independent wind farm specialist. This has a base cost of $12M (assumes removal of 2 wind turbines), plus $10M (expected), plus a further $38M (funding risk). This item was excluded from the Monte Carlo analysis with these contingent sums added to the P50 and P95 contingencies assessed for the rest of the project works.
- Rates and prices exclude GST.
- Escalation of 3% per annum has been allowed for in the expected and 95th percentile estimate.
- Transport Agency managed costs for all phases – 3% of physical works costs.
- Consenting, design and documentation – 6.5% of physical works cost plus an allowance for geotechnical Investigations and legal costs.
- MSQA – 4.5% of physical works cost.
- Property costs have been provided by The Property Group (TPG).
- Allowances only for environmental controls have been included.
- As there has been no intrusive geotechnical investigation, allowances only have been made for rock fall protection, ground improvements, retaining structures and subgrade treatment only reflective of a project of this scale, with high potential for significant variability including in the assessed risks.
- The Manawatū River bridge for the purpose of the base estimate has been assumed to be minimal intrusive bridge design (with respect to river impact). This has also assumed to be a 4

lane dual carriageway bridge. Final form of bridge will be determined during the pre-implementation phase.

- Pavement and surfacing has assumed to be granular basecourse and two coat chip seal.
- Allowances only have been included for barriers, signage and lighting.
- Allowances only have been included for landscaping and planting.
- Allowances only have been included architectural treatment of structures and urban design.
- Allowances only have been included for utilities diversions.
- Preliminary and general is assumed at 20%.
- A parallel estimate has been carried out Current estimate values have been determined following consideration of this review.

7.2 ONGOING MAINTENANCE AND OPERATIONS COST

Maintenance costs vary greatly depending on the age of pavement, climatic conditions, underlying geological conditions, traffic volume and percentage of heavy vehicles. The RIMS Roading Asset Maintenance Cost Guidelines published in 2012 has an average per km rate of $50,045 per km (cost escalated to Dec 2017) for all NZ state highways.

The Saddle Road has had significant investment in maintenance and capital improvements over the past 7 years ($16.22 m). Based on this renewal and maintenance spend and the carriageway being single lane with the exception of slow vehicle bays the cost of the annual maintenance per annum has been estimated at $40,000 per km which equates to an annual cost of $604,000 for the route.

A review of maintenance costs for other new dual lane carriageways across annual maintenance costs of $1 per m^2 which translates to $20,000 per km. This equates to an annual maintenance costs for the recommended option of $230,000.

It should be noted that the maintenance cost savings are considered conservative. The high capital cost of the project (due to property, windfarms and structures) means that the economic evaluation is not sensitive to these relative minor changes in annual costs.

7.3 PROJECT REVENUES

No detailed analysis of potential project revenues has been considered. Given the positive BCR and the fact that this project is a replacement of a closed un-tolled state highway route, potential project revenues such as tolling or advertising revenue are unlikely, so have not been considered further.

7.4 FUNDING OPTIONS

The current assumption is that the new improved link is paid for in full out of the SH Improvements activity class. It is noted that if reinstatement had been deemed to be a practicable option, funding for this would likely have come from the Emergency Works activity class. To this end, an initial cost of approximately $60m has been estimated for the costs associated with reinstating the gorge, including the repair of damaged infrastructure. If it was deemed appropriate to split funding across activities, it would be expected that no more than $60m could be funded from the Emergency Works activity class, with the balance of the project funded from the SH Improvements class. Any funding will be subject to the limited availability of funds within the relevant GPS activity class(es).

7.5 CASHFLOWS

The following cashflow estimates in Table 27 below are indicative and assume a commencement of the pre-implementation phase in 2018/2019, implementation 2019/2020 and works completed by June 2024.

The expected cost estimate including 3% escalation is $ 517,327,942.97.

The 95% cost estimate including 3% escalation is $604M.

Table 27 Escalated and Non Escalated cashflows

P50 No Escalation	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	TOTAL
Pre-Implementation	27	10					**37**
Property	7	14					**21**
Implementation	10	65	111	102	74	59	**421**
TOTAL	**44**	**89**	**111**	**102**	**74**	**59**	**479**
P50 3% Escalation	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**TOTAL**
Pre-Implementation	27	10					**37**
Property	7	15					**22**
Implementation	10	67	118	111	83	69	**458**
TOTAL	**44**	**92**	**118**	**111**	**83**	**69**	**517**
P95 No Escalation	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**TOTAL**
Pre-Implementation	30	12					**42**
Property	8	19					**27**
Implementation	10	74	130	120	87	70	**491**
TOTAL	**48**	**105**	**130**	**120**	**87**	**70**	**560**
P95 3% Escalation	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**TOTAL**
Pre-Implementation	30	12					**42**
Property	8	20					**28**
Implementation	10	76	138	131	98	81	**534**
TOTAL	**48**	**108**	**138**	**131**	**98**	**81**	**604**