Traffic and Transport Assessment

December 2017

Mt Messenger Alliance

Technical Report 2

NZ TRANSPORT AGENCY
WAKA KOTAHI

Mt Messenger Bypass

New Zealand Government

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Glossary

Abbreviation	Term
AEE	Assessment of environmental effects
ARRP	Accelerated Regional Roading Package
BCR	Benefit-cost ratio
DBC	Detailed Business Case
EEM	Economic evaluation manual
FYRR	First year rate of return
GPS	Government Policy Statement
HCV	Heavy commercial vehicle
HPMV	High productivity motor vehicle
HNO	Highways and Network Operations
IBC	Indicative Business Case
ILM	Investment logic map
ITS	Intelligent transport systems
LTMA	Land Transport Management Act
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NOR	Notice of requirement
NZTS	New Zealand transport strategy
ONRC	One Network Road Classification
PPFM	Planning Programming and Funding Manual
RLT	Regional Land Transport
RLTS	Regional Land Transport Strategy

Abbreviation	Term
RMA	Resource Management Act
SH(#)	State Highway (number)
TDM	Traffic demand management
WEBs	Wider economic benefits

Executive Summary

This report covers the traffic and transport effects of the construction and ongoing operation of a new section of State Highway 3 (SH3), Mt Messenger Bypass project (the Project), between Uruti and Ahititi, north of New Plymouth. This new section of SH3 will bypass the existing steep, narrow and winding section of highway at Mt Messenger. The Project comprises a new section of two lane highway, approximately six kilometres (6km) in length, located to the east of the existing SH3 alignment.

From a transportation perspective, the Project seeks to:

- enhance the safety, resilience and journey time reliability of travel on SH 3; and
- contribute to enhanced local and regional economic growth and productivity for people and freight.

The existing SH3 corridor in the vicinity of Mt Messenger currently carries in the order of 2,300vpd (vehicles per day) of which a high proportion (20%) are heavy vehicles. The corridor forms an important role within the context of the regional economy – connecting the Taranaki Region to the North, including to the Ports of Auckland and Tauranga, as well as providing an important lifeline (with no reasonable alternative route when it is closed). The existing route, originally built in 1896 and designated as a State Highway in 1935, is no longer fit for purpose (and its classification) and suffers from a number of known problems:

- Poor safety record;
- Poor route resilience (common closures, with no suitable alternative routes); and
- Poor road geometry and low speeds.

Safety

The existing corridor across Mt Messenger has suffered 31 reported crashes in the 5 year period 2012 to 2016, as follows:

Year	Fatal	Serious	Minor	Damage Only
2012	0	0	0	5
2013	0	2	0	1
2014	0	2	4	2
2015	0	2	2	3
2016	0	0	2	6
Total	0	6	8	17

This Project has been designed to 100km/h standards (higher than the existing average operating speed of 56km/h), and provides a number of safety improvements; as follows:

Benefit	Measure
Improved Star rating	Increase from Star Rating 2 to 3 The new road will be in context with the adjoining SH3 route which will benefit all road users, including tourist drivers who may be particularly surprised by the form and nature of the current Mt Messenger route
Connections to DOC tracks	Improvements to existing unsafe accesses to the walking tracks (they currently provide insufficient limited deceleration/acceleration opportunities)
Improved forward visibility	Existing curves limit forward visibility limited to 30m – 40m on some corners New road design provides visibility suitable for 100km/hr operating speed throughout
Passing opportunities	Existing: Substandard passing lane (470m), climbing lane (120m) Future: Improved forward visibility, increased passing opportunities throughout full length of Project
Reduced exposure	Reduced length (7.4km to 6km)
Improved Geometry	Eased curves with no curves requiring reduced speed advisory signs. Flatter grades: Existing max 12%, Average 8% (4.8km above 6%) Future: max 7.5% (1.6km above 6% for new route) Wider shoulders (current 0.5-1.5m, new 1.5m throughout (1.2m in tunnel)) Wider lanes from 3.4m (in localised places narrower) currently, to 3.5m throughout for the new road Side barriers provided throughout for the new road The new road will enable safe 2 lane travel throughout (current constraints such as the tunnel result in observed behaviour where vehicles stop in the lane to give way to oncoming traffic)
Reduce Driver Frustration	Road Star rating and geometry will be in context with adjoining sections of SH3 creating a ‘no surprises' environment

Benefit	Measure
	Improved journey time reliability and journey times (see below)
Better provision for active modes	The current low volume/confident active users is not expected to change but wider shoulders and improved sight distances of the Project enhance safety

Other transport benefits

In addition to the safety benefits described above, the Project enables a number of transport benefits to be realised, with respect to operational resilience, journey time savings, transport economics and environmental outcomes. These are summarised below:

Objective	Benefit	Measure
Resilience	Less closures	Current SH3 has suffered 6 closures >2hrs in the last 5 years at a level more frequent than acceptable by the ONRC guidelines. The new road, with its wider lanes and shoulders and better design will avoid these closures The new road will require less maintenance requirements due to its modern design (and when works are required provision for offline maintenance areas and measures will reduce closures and traffic restrictions)
	Faster recovery	The current road has poor geometry, narrow shoulders and carriageway, the new road will enable vehicles to greater opportunity pass a vehicle which has crashed/broken down Shorter/faster route will enable emergency services to attend events more quickly
	Improved journey time reliability	As a result of fewer planned (maintenance) and unplanned (crashes) closures Improved drainage/stormwater will reduce amount of closures For Freight (in connection with wider programme of work) improved network form from Taranaki through to Ports of Auckland and Tauranga
	Reduced Driver frustration	Greater certainty over road remaining open

Objective	Benefit	Measure
Journey Times	Reduced journey times (Local)	Reduced length: 7.4km to 6km Increasing travel time for Do Minimum (Existing route 8.45min, Year 20 = 9.14min for all vehicles) Option reduces travel times: (average all vehicles) Opening year = 4.21min Year 20 = 4.16min Option reduces free-flow travel times: (Light Vehicles @ 100km/hr) Opening year = 3:36min (saving 4.05min) Option reduces free-flow travel times: (Heavy Vehicles) 6:28min (saving 6:40min)
	Reduced Journey Times (Closures)	If SH3 closed: Alternative route via SH43 4hr 30min: 1hr 45min longer (95km), not suitable for HPMV (unsealed in places and narrow, winding route alignment) Alternative route SH4 6hr 20min: 3hr 9min longer (243km) Alternative route SH1 6hr 55min: (3hr 45min longer (286km) Improved road reduced risk/number of closures (see resilience outcomes above) Alternative routes add significant time to journeys: HV drivers have 5.5hr max drive time (before a break) and 13hrs total/day Nature of existing road means that MM requires regular maintenance ie on curves where tyres rut the pavement
	Reduced Journey Times (Over Dimension loads)	SH3 is not currently suitable for OD roads due to constraints (including the Mt Messenger and Awakino tunnels). The new road, associated with other planned SH3 upgrades, will enable the route to accommodate OD loads The current OD route using SH1 adds 6hr 55min to the journey from Hamilton to New Plymouth (3hr 45min longer)

Objective	Benefit	Measure
	Reduced driver frustration	Reduced travel times Greater passing opportunities along full length of bypass Improved journey time reliability
	Increased speeds	Existing average: 56km/h Year 1: Ave speed 77.6km/h, LV free flow speed 100km/h, HV operating speed 45km/h Year 20: Ave speed 63km/h, LV free flow speed 100km/h, HV operating speed 45km/h[1]
Economic	Lower Vehicle Operation Costs (SH3)	The new road will reduce grades, have a shorter length and height climbed resulting in lower VOC Higher average speeds
	Lower VOC (during closures)	Alternative routes add significant length with associated time/fuel costs will the new road will avoid
	BCR	Benefits from safety, travel time savings, VOC, WEBs
	Freight	Significantly reduced Journey Times for OD loads which currently are constrained from using SH3 Significantly reduced journey times for heavy vehicles which, combined with other SH3 upgrades, and the current 4 laning from Auckland to Cambridge, will significantly reduce the Wiri – New Plymouth freight journey time The new road will provide the ability for trucks to turn round in unlikely event of road closure
Environmental	Reduced CO_2	Shorter length, reduced climb, flatter grades

Construction

During the construction phase, there is the potential for adverse effects on the existing users of the corridor. However, as most of the works will be 'off line' these effects are reduced. Extra care will be required during the construction of the tie-ins to the north and south of the new alignment. The contractor involvement in the Mt Messenger Alliance, has

[1] Assumes no increase to HV performance

enabled the development of a detailed Construction Management Plan which provides greater surety over the scale and management of these potential adverse effects. The traffic management provisions within the Construction Management Plan will ensure that potential construction traffic effects are appropriately managed.

Overall

The existing route is considered not fit for purpose given its rating as a Regional Route under the One Network Road Classification criterion, and the lesser Star Safety Rating of 2 (compares to a Rating of 3 to the north and south of Mt Messenger). It is characterised by a poor safety record, with low speeds, tight curves with narrow lanes.

The Project will address the known problems along the existing corridor, and will provide a number of transport benefits in relation to safety, resilience, and journey times/reliability. The new road will contribute to a long-term transport solution connecting the Taranaki Region to the north. In particular, the Project alone, and combined with other roading improvements (some nearing completion, others being consented), will significantly improve the connectivity of freight to and from the region, appropriately reflecting the Regional Route classification of SH3.

1 Introduction

1.1 Purpose and scope of this report

This report forms part of a suite of technical reports prepared for the NZ Transport Agency's Mt Messenger Bypass project (the Project). Its purpose is to inform the Assessment of Effects on the Environment Report (AEE) and to support the resource consent applications and Notice of Requirement to alter the existing State Highway designation, which are required to enable the Project to proceed.

This report assesses the construction and operational transport and traffic effects of the Project Alignment as shown on the Project Drawings in Volume 2: Drawing Set.

The purpose of this report is to:

a Identify and describe the existing and future traffic and transport environment

b Describe the transport related features of the Project

c Describe the potential positive and negative operational traffic and transport effects arising from the Project

d Describe the potential temporary traffic and transport effects during construction of the Project

e Recommend measures as appropriate to avoid, remedy or mitigate potential effects (including any proposed conditions; and

f Present an overall conclusion of the level of potential effects of the Project after recommended measures are implemented.

This report should be read alongside the Strategic Transport Assessment (see Technical report 1, Volume 3 of the AEE), which presents an assessment of the strategic contribution of the Project to transportation locally, regionally and nationally.

1.2 Project description

The Project involves the construction and ongoing operation of a new section of SH3, generally between Uruti and Ahititi to the north of New Plymouth. This new section of SH3 will bypass the existing steep, narrow and winding section of highway at Mt Messenger. The Project comprises a new section of two lane highway, approximately 6km in length, located to the east of the existing SH3 alignment.

The wider SH3 corridor has a number of identified problems:

- Narrow lanes, no shoulder and poor geometric alignment causes a high number of crashes and an unforgiving environment results in death and serious injuries, and road closure;
- Natural events cause a high number of road closures, that, combined with no suitable alternative route, result in significant delays and adverse economic impact; and
- The lack of passing opportunities leads to driver frustration and a poor journey experience.

Within the immediate vicinity of Mt Messenger, the existing route is characterised by a steep, narrow and winding carriageway which is subject to extended road closures and its form and operation is not in keeping with the road classification of a Regional Route. The Transport Agency is currently advancing upgrade works at Awakino and safety upgrades along the entire SH3 route.

The Project has been developed to specifically address the existing problems at Mt Messenger.

A full description of the Project, including its design, construction and operation is provided in the Assessment of Effects on the Environment Report, contained in Volume 1: AEE, and is shown on the Drawings in Volume 2: Drawing Set.

1.3 Site Location

The general project area is located adjacent to State Highway 3 (SH3) in the vicinity of Mt Messenger, in North Taranaki. Mt Messenger is located approximately 58km northeast of New Plymouth and 183km south of Hamilton.

A location plan of the Mt Messenger project site is shown in Figure 1.1 below:

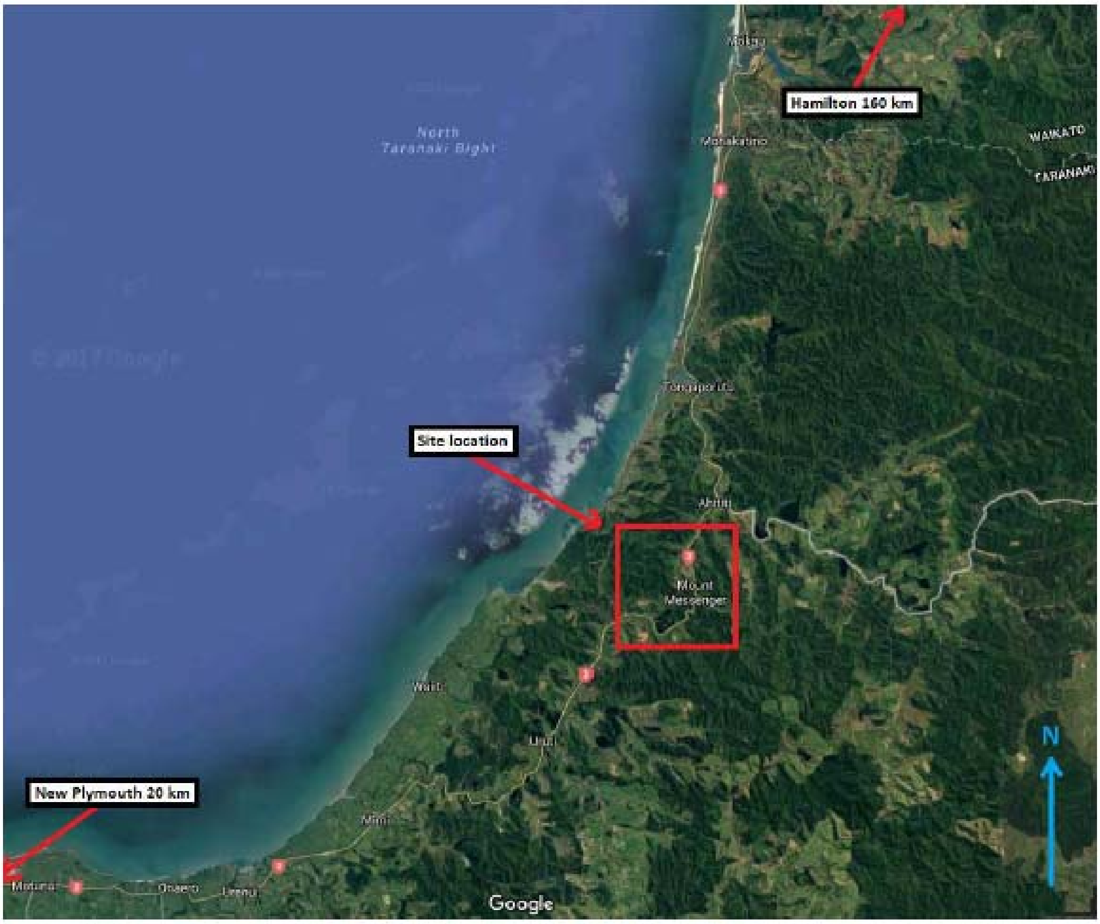

Figure 1.1 – Location Plan

A more detailed map of the Project area, showing the route and proposed designation boundaries is shown in Figure 1.2 below.

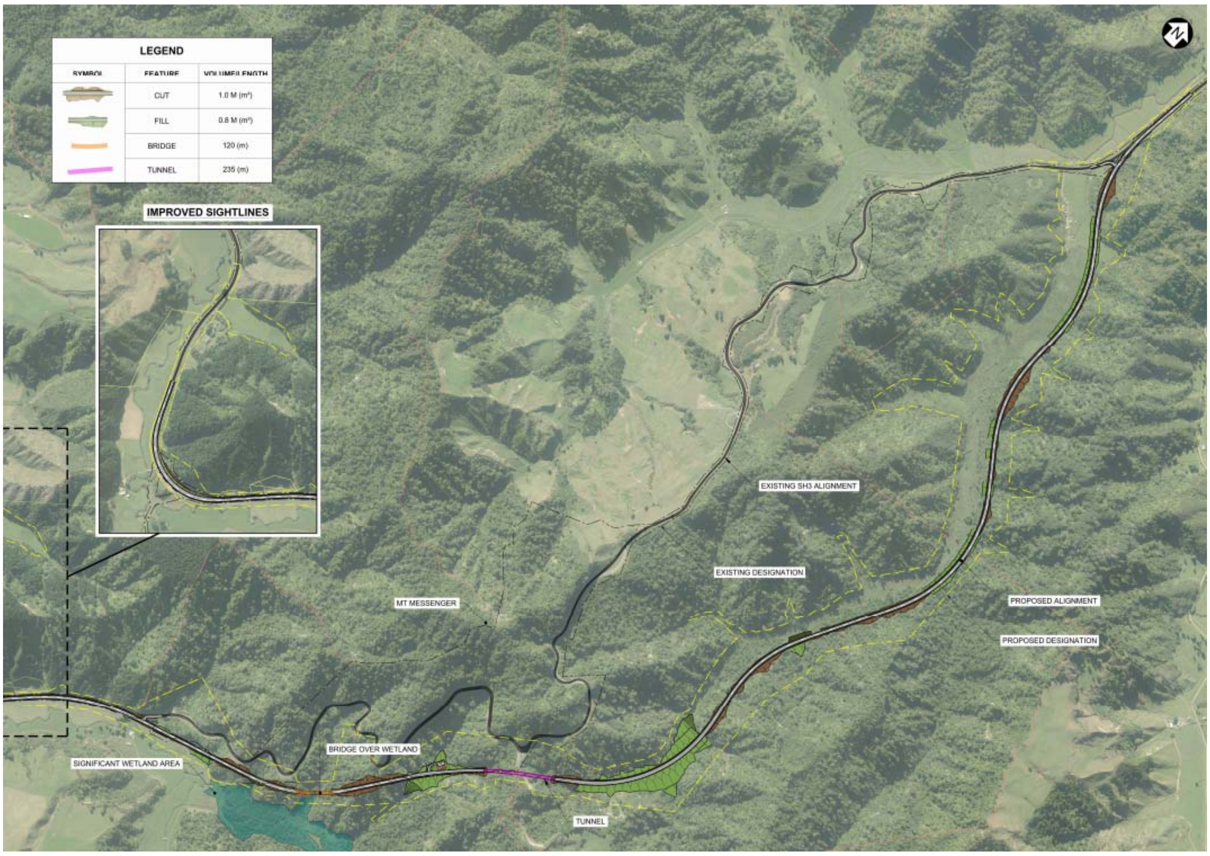

Figure 1.2 – SH3 Mt Messenger Bypass Project

1.4 Previous Investigations

Investigations into improvement of the SH3 corridor in the vicinity of Mt Messenger have been carried out by central and local government since the 1970s. These efforts include:

- Initial corridor investigations carried out by the Ministry of Works and Development for the National Roads Board in the 1970s and 1980s.These followed by a number of other studies and investigations;
- Taranaki Regional Council established the State Highway 3 Working Party in 2002 in response to ongoing concerns about route security, safety and efficiency of the section of SH3 between Taranaki and Waikato;
- In 2002 Transit New Zealand (the pre-cursor to the NZ Transport Agency) commissioned Beca to assess three re-routing options for the Mt Messenger route, including a coastal, western and eastern route; and
- In 2012 Venture Taranaki undertook an economic impact assessment of SH3 to the north of the region and published a report. Their findings highlighted that the economic potential of the route was constrained by four factors – it is relatively unsafe, difficult for freight movements, presents a challenge to urban flow, and is vulnerable to closures from crashes and slips.

The NZ Transport Agency has been actively investigating upgrades to SH3 between Mt Messenger and Awakino Gorge since 2014. In early 2016 the Transport Minister announced funding to accelerate this regionally important State Highway project as part of the Accelerated Regional Roading Programme (ARRP).

1.5 Objectives of Project

The Transport Agency's Project Objectives are:

1. To enhance safety of travel on State Highway 3;
2. To enhance resilience and journey time reliability of the state highway network;
3. To contribute to enhanced local and regional economic growth and productivity for people and freight by improving connectivity and reducing journey times between the Taranaki and Waikato Regions; and
4. To manage the immediate and long term cultural, social, land use and other environmental impacts of the Project by so far as practicable avoiding, remedying or mitigating any such effects through route and alignment selection, highway design and conditions.

Overall, the Project is expected to reduce fatal and serious crashes and road closures to contribute to an enhanced experience along the SH3 corridor. The reasons for this are discussed in the sections which follow.

2 The Existing SH3 environment at Mt Messenger

This section describes the existing, Mt Messenger section of SH3, which is to be bypassed by the Project. After describing the existing route and its use, the fundamental problems with the existing route, all of which will be addressed by the Project, are explained.

2.1 Existing Road Network

SH3 is a Regional State Highway and the main link between Taranaki and the upper North Island. It has an existing Average Annual Daily Traffic (AADT) volume of approximately 2300 vpd with 20% HCV in the vicinity of Mt Messenger. The study area is mostly within remote mountainous terrain, with Tongaporutu to the north and Urenui to the south.

2.1.1 Corridor Description

The length of the existing Mt Messenger section of SH3 is currently 7.4km and rises to a height of 175m above sea level as it crosses Mt Messenger. The route has a winding alignment and includes a short length of a narrow width tunnel near the summit.

Figure 2.1 – Existing SH3 Mt Messenger

Figure 2.2 below provides an overview of the existing SH3 route through the Project area.

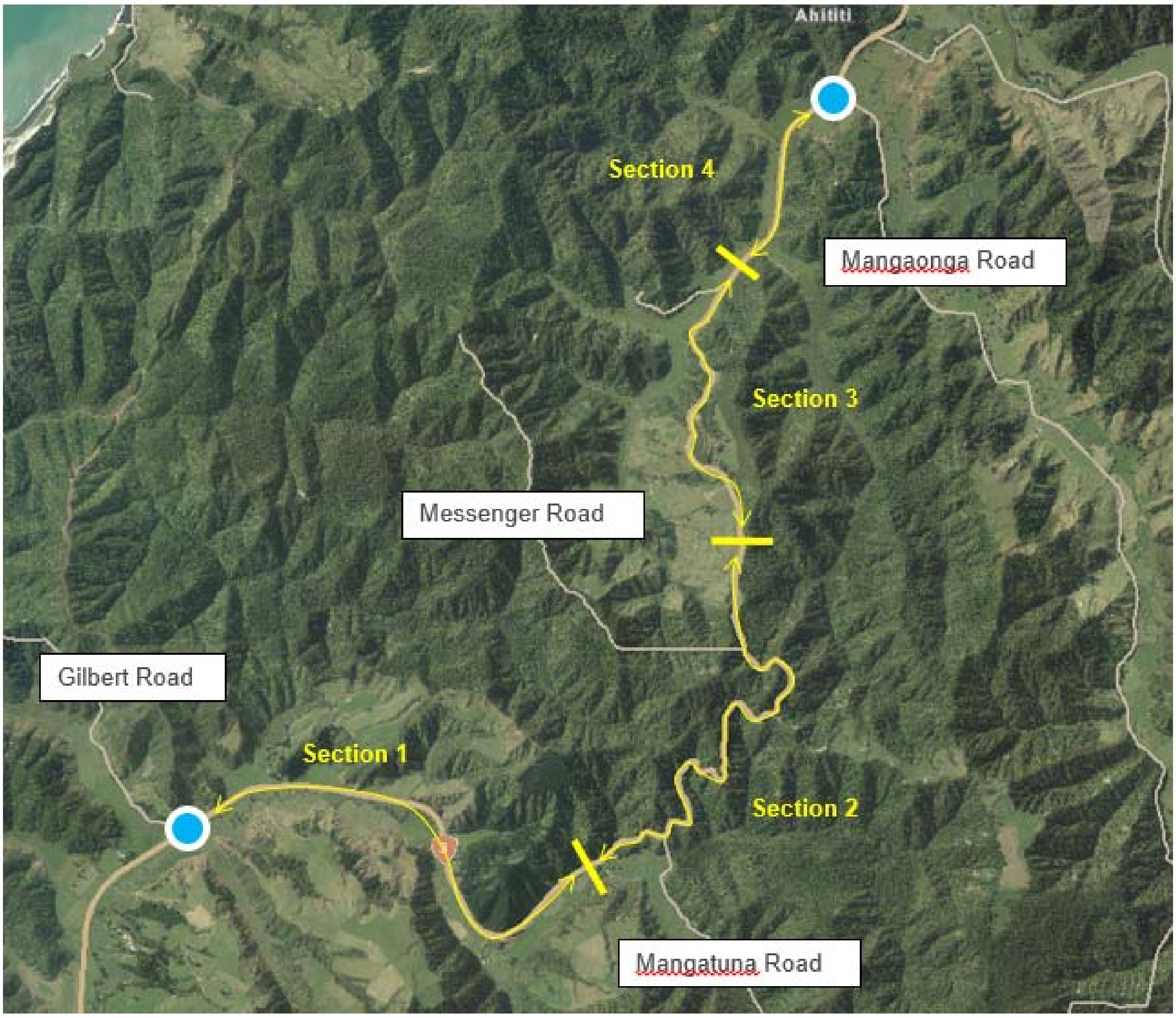

Figure 2.2 – Overview of the existing SH3 route

The roads adjoining SH3 are 'paper roads' (unformed).

The cross section through all sections is two 3.4m lanes with narrow or minimal shoulders. Particular characteristics of each section may be summarised as follows:

Section 1

Section 1 generally has a flat alignment with a number of gentle curves as listed below.

- a right hand bend with a 75km/h posted advisory speed;
- a right hand bend with no posted advisory speed;
- a right hand bend with a 75km/h posted advisory speed;
- a left hand bend with no posted advisory speed; and
- a left hand bend with a 75km/h posted advisory speed.

This section of SH3 is characterised by narrow sealed shoulders, with 'slippery when wet' advisory signs installed at a number of locations. A number of private accesses are established on either side. This section of SH3 generally performs well, with the exception of the most northern curve, which has suffered a number of loss of control crashes.

Section 2

Section 2 generally has a steep torturous alignment.

There are more than half a dozen curves with a posted speed limit of 25km/h or 35km/h, and the overall section has a 65km/h posted advisory speed. A number of notable features are listed below:

- Mt Messenger tunnel, with a mirror installed in the northern side to assist with forward visibility. The narrow width of the tunnel often requires opposing vehicles to give way;
- An embankment located immediately adjacent to the northbound lane, resulting in no recovery area in the event of a driver being distracted;
- Northbound Slow Vehicle Bay (~125m length) south of the summit
- A number of pullover / rest areas along the length, many of which have insufficient deceleration/acceleration space;
- Intermittent roadside barriers, including wooden sight rails which are not considered fit for purpose;
- A number of warning and advisory signs along the length, including 'Slippery when wet' and 'rock falling' signage;
- Evidence of historical shoulder work for improved forward visibility.

This section of the SH3 corridor represent the most challenging section through the Mt Messenger area. The grades are steep – up to 12% on some corners. With a high proportion of heavy vehicles on the corridor delays for following vehicles is a common occurrence.


Figure 2.3 – Photographs showing existing SH3 route

Section 3

Section 3 generally has a steep winding alignment with a 55km/h posted advisory speed. A number of notable features are listed below:

- several concurrent bends with 35km/h posted advisory speeds;
- Other curves posted with 45km/h and 55km/h advisory signage;
- an uphill passing lane (~450m long) – southbound.

This section can be characterised as having narrow sealed shoulders, with pasture and/or forested valley adjacent to the northbound lane and an embankment adjacent to the southbound lane. While less tortuous than Section 2, this section also has a number of curves with low speed advisory signage, which reflects the relatively challenging driving environment. Along the length are a number of private accesses.

Section 4

Section 4 generally has a flat alignment with a number of gentle curves as listed below.

- a right hand bend with no posted advisory speed;
- a left hand bend with a 85km/h posted advisory speed; and
- a right hand bend with a 85km/h posted advisory speed.

Again, this section of SH3 is characterised by narrow sealed shoulders with limited recovery areas adjacent to each lane.

2.1.2 Tunnel Restrictions

As previously noted, the Mt Messenger tunnel is a particular restriction along the SH3 corridor. While some widening of the tunnel was undertaken during the 1980's, the width remains such that oncoming vehicles arriving at the tunnel simultaneously are observed to stop to give way to the opposing vehicle. This behaviour is heighted by the high volume of heavy vehicles on the corridor. The following figures show the tracking paths of a semi-trailer and 99 percentile car travelling in opposing directions through the tunnel (and its approaches), allowing for a 1m offset of the truck to the tunnel walls (to account for the curvature of the arch). Areas of conflict are highlighted in red:

Figure 2.4 – Southbound Semitrailer and Northbound 99% Car through Mt Messenger tunnel

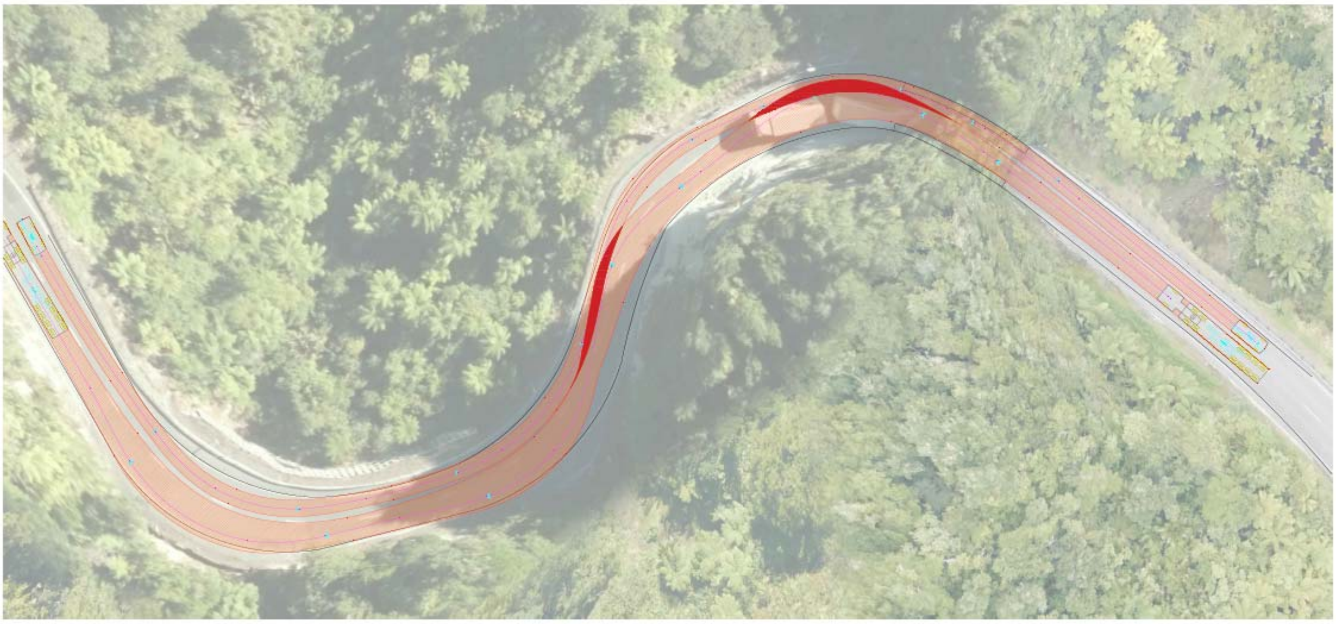

Figure 2.5 – Northbound bound Semitrailer and Southbound 99% Car through Mt Messenger tunnel

As can be seen, areas of conflict are observed in both scenarios, highlighting the limitations of the existing corridor and the associated need for improvements.

2.1.3 Curve Restrictions

In addition to the localised restricted width in the tunnel, the narrow and windy nature of the SH3 Mt Messenger crossing results in a number of locations where vehicles cross the centreline. This create a safety hazard for on-coming vehicles, and further reduces the efficiency of the SH3 corridor as oncoming vehicles are required to slow / give way to the opposing vehicles. The following figures show southbound and northbound semi-trailers traveling through some of the curves, crossing the centre of the carriageway:

Figure 2.6 – Southbound Semitrailer through curves

Figure 2.7 – Northbound Semitrailer through curves

These corridor restrictions contribute to the overall existing poor journey experience across Mt Messenger.

2.2 Road Classification

The Land Transport Management Act 2003 (LTMA) requires the development of a Regional Land Transport Plan (RLTP) consistent with the Government Policy Statement on Land Transport (GPS). This matter is discussed in further detail in the Strategic Transport Assessment (Technical report 1), but in summary, the RLTP has identified a number of forward challenges for land transport in the Taranaki Region:

1. Ensuring a regionally and nationally integrated transport network;
2. Facilitating growth and economic development;
3. Reducing the safety risk on Taranaki's transport network;
4. Maintaining and improving accessibility and travel options throughout the region;
5. Ensuring network resilience and responsiveness in the context of internal and external pressures;
6. Reducing negative environmental and community impacts arising from transport; and
7. Addressing these issues in an environment of constrained funding and affordability yet rising costs.

In order to address these challenges, there is an identified need for the Taranaki Region to address the existing limitations of its land transport infrastructure. SH3 through the Project area is classified as a Regional Route under the NZ Transport Agency's One Network Road Classification (ONRC)[2]. ONRC expectations are that travel reliability is within 10% of the average travel time for key journeys. For instance, the average travel time between Hamilton and New Plymouth is 3 hours 10 minutes and therefore a maximum increase in travel time of 19 minutes is considered acceptable by the ONRC.

The typical daily flow for this classification of road in a rural environment is >20,000 vehicles per day (AADT). Despite the fact that the traffic flows are only 10% of this figure, the criticality of the route in a regional sense relates to its purpose as the key route connecting the Taranaki region to the northern regions – as such it carries a classification usually reserved for much busier roads.

SH3 is not currently used by over-dimensional vehicles as the Awakino and Mt Messenger Tunnels are constraints along SH3 between New Plymouth and Hamilton to physical travel by these large loads. These constraints will be removed by this programme of works for the overall SH3 corridor.

[2] One Network Road Classification – Divides NZ roads into six categories based on traffic volumes, connections or lack of alternative routes (National, Arterial, Regional, Primary collector, secondary collector, Access)

2.3 Traffic Volumes

2.3.1 Existing traffic volumes

As previously described, the SH3 corridor in the vicinity of Mt Messenger carries in the order of 2,300vpd with a significant 20% heavy vehicle proportion. Traffic growth along the corridor period has been assessed as being in the order of 2.4%pa, based on historical trends.

The AADT traffic volumes, with the light and heavy vehicle spilt, is shown graphically below:

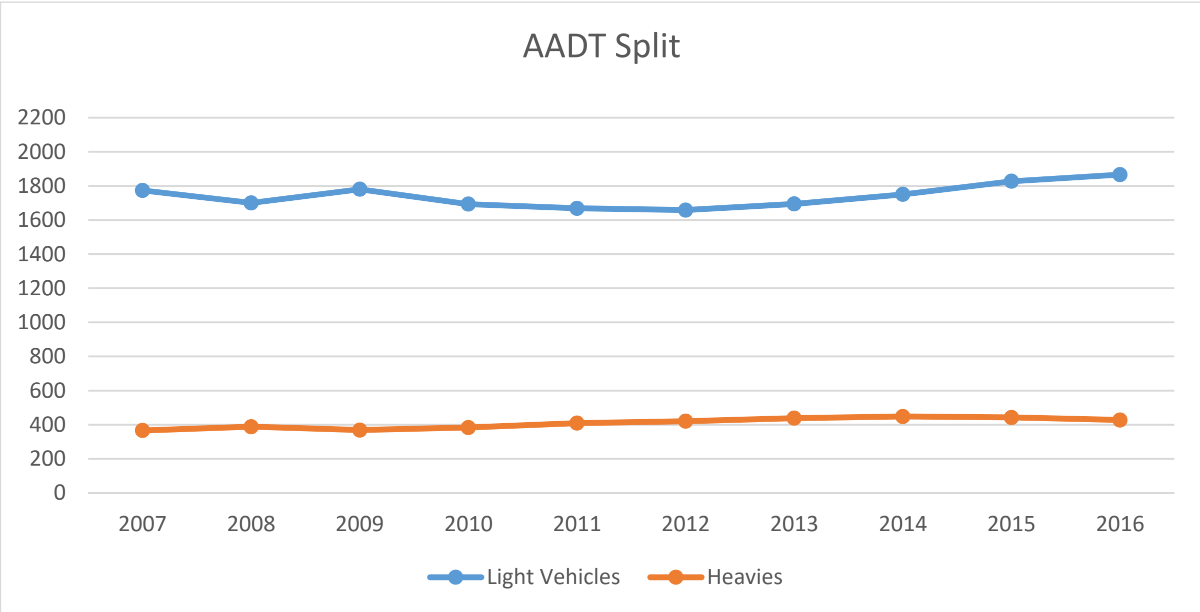

Figure 2.8 – Historical AADT (by vehicle type)

The SH3 corridor under consideration forms part of a typically much longer journey, connecting New Plymouth in the south, with Hamilton in the north. Very few (if any) travellers along this section of SH3 would have an origin and destination within the area under consideration for the Mt Messenger Bypass, and as such it is important to be cognisant of the relative merits of the improvements within the context of this longer journey. This has been recognised via the combined packages of works along SH3 between Mt Messenger and Awakino.

Daily and hourly traffic volumes through the seven days of a typical week as measured in May 2017 are shown in Figure 2.9.

The data shows weekday daytime volumes generally in the range of 130 to 150 vehicles per hour (vph). The busiest weekday hour of 242 vph was recorded at 3.00pm on the Friday afternoon. Weekend flows range from 230 to 270 vph through the middle periods of the day and up to a week peak of 297 vph at 3.00pm on the Sunday afternoon.

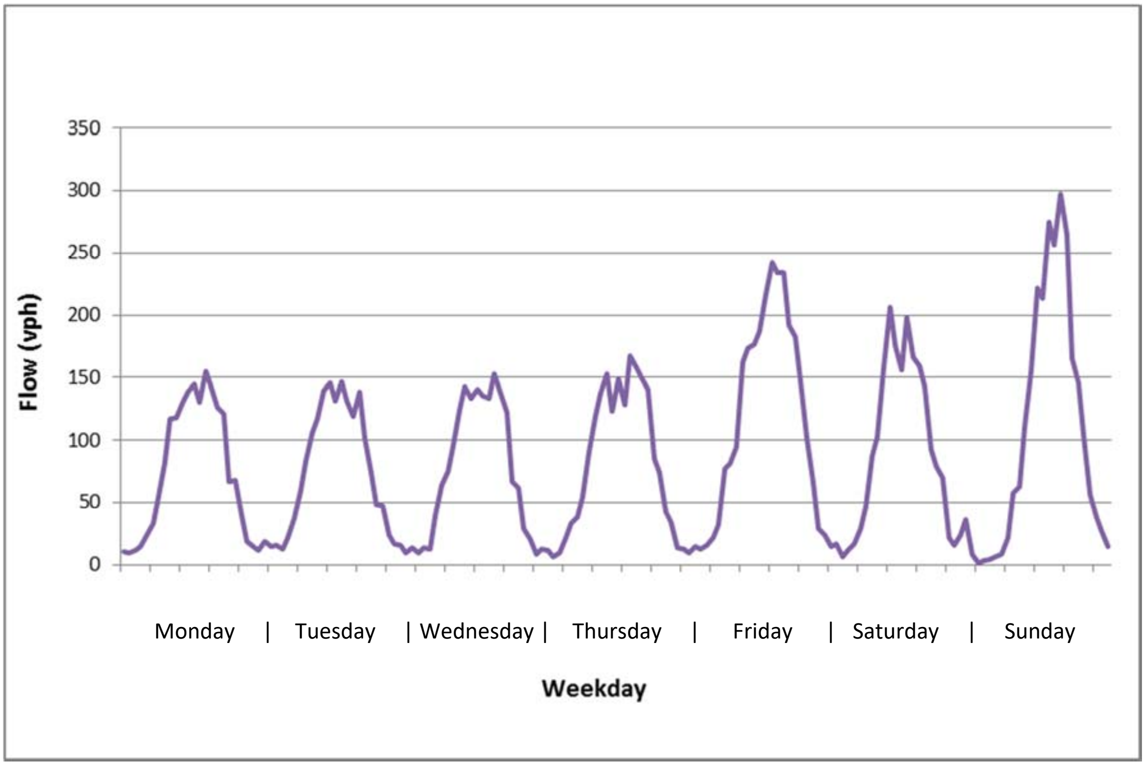

Figure 2.9 – Daily and Hourly Volumes State Highway 3 at Tongaporutu May 2017

The route currently carryes an average of 460 heavy truck movements per day. The majority of these movements are long-distance journeys hauling commercial loads and freight to and from Taranaki to destinations across the Waikato, and in Hamilton, Tauranga and Auckland. The SH3 corridor is important to the regional economy, connecting goods and produce with the northern ports. In addition, the corridor is often used to carry hazardous goods (such as LPG), and the length of SH3 across Mt Messenger introduces challenges for these vehicles, with steep grades slowing their journey and the tortuous route being hazardous for their travel.

Due to the relative remoteness of this area, there is a high reliance on travel by private vehicle. The corridor does provide some inter-city bus transport (typically two trips in each direction daily).

With no readily suitable alternative route (as described later), improvements to the transport resilience to SH3 at Mt Messenger will result in significant benefits to road users.

2.3.2 Future traffic volumes

As previously described, the growth of traffic along this corridor has grown at a historical rate of 2.4%pa over the last decade. In considering the future traffic patterns along the corridor, it has been assessed that the overall annual traffic growth will be in this order of 2.4%. However, the light vehicle annual growth rate will be higher than the heavy vehicle growth rate, in keeping with the historical trends.

The base case traffic growth, as used within the economic analysis, has been adopted as follows:

Table 2.1 – Future Traffic Growth

Year	AADT	Heavy Vehicle AADT	Light Vehicle AADT
2017	2,364	459	1,905
2027	2,996	550	2,446
2037	3,798	642	3,157
2047	4,813	732	4,081

2.4 Road Safety

The most recent 5-year period of reported crash data for SH3 across Mt Messenger (2012 to 2016 inclusive, noting 2017 is incomplete) has been obtained from the NZ Transport Agency's Crash Analysis System (CAS). The severity of these crashes is summarised below:

Table 2.2 – Crash Severity breakdown 2002-2016

Year	Fatal	Serious	Minor	Damage Only
2012	0	0	0	5
2013	0	2	0	1
2014	0	2	4	2
2015	0	2	2	3
2016	0	0	2	6
Total	0	6	8	17

A further 2 damage only crashes have been reported along this section in 2017 to date, however given the delay in crashes being included in the records, the 2017 data has not been considered further.

A number of key factors have been noted from the CAS records:

- Loss of control on bends/head on accounts for 85% of all crashes. This percentage is high compared to national rural state highway figures (32%). The Mt Messenger section of SH3 is characterised by steep grades, narrow lanes, no shoulder, poor geometric alignment and resulting poor forward visibility, leading to difficult and unsafe driving conditions;
- 70% of crashes occurred in dry weather which is slightly higher than the national rural state highway figures of 66%;

- Poor handling accounts 61% of crashes, compared to a national rural state highway figure of 30%. Too fast for conditions contributes to 39% of these crashes compared to 15% nationally;
- Road factors, for example potholes or pavement failure, contribute to 24% which is high compared to the national rural state highway figure of 18% (this reflects the surface rutting caused by the poor road geometry);
- Trucks involved in crashes accounts for 14% of all crashes which is almost the same as the national average of 13% and lower than the proportion of HCVs (20%) in the traffic system on this stretch of road;
- Motorcyclists were involved in 14% of all crashes compared to only 4% nationally; and
- Darkness does not feature as a major factor, with around 28% of crashes occurring during daylight hours which is much lower than the national rural state highways at 68%.

SafetyNet rates the road and roadside environment from one star (most hazardous) to five star (safest road) on the basis that a more forgiving environment plays a significant part in reducing the severity of the crashes. The desired ONRC Customer Level of Service for a Regional Route such as SH3, including the Mt Messenger section, is 3 star.

The road through Mt Messenger has a 2 star rating (refer to Figure 2.10 – Mt Messenger Rating on SafetyNet), in part due to the following characteristics:

- The road has mostly 3.4m lane widths, with some narrower lanes in places;
- There is minimal sealed shoulder;
- There are very limited areas where overtaking can occur, either through formalised passing lanes and slow vehicle bays, or informal passing opportunities;
- There are no median barriers; and
- There are limited side barriers.

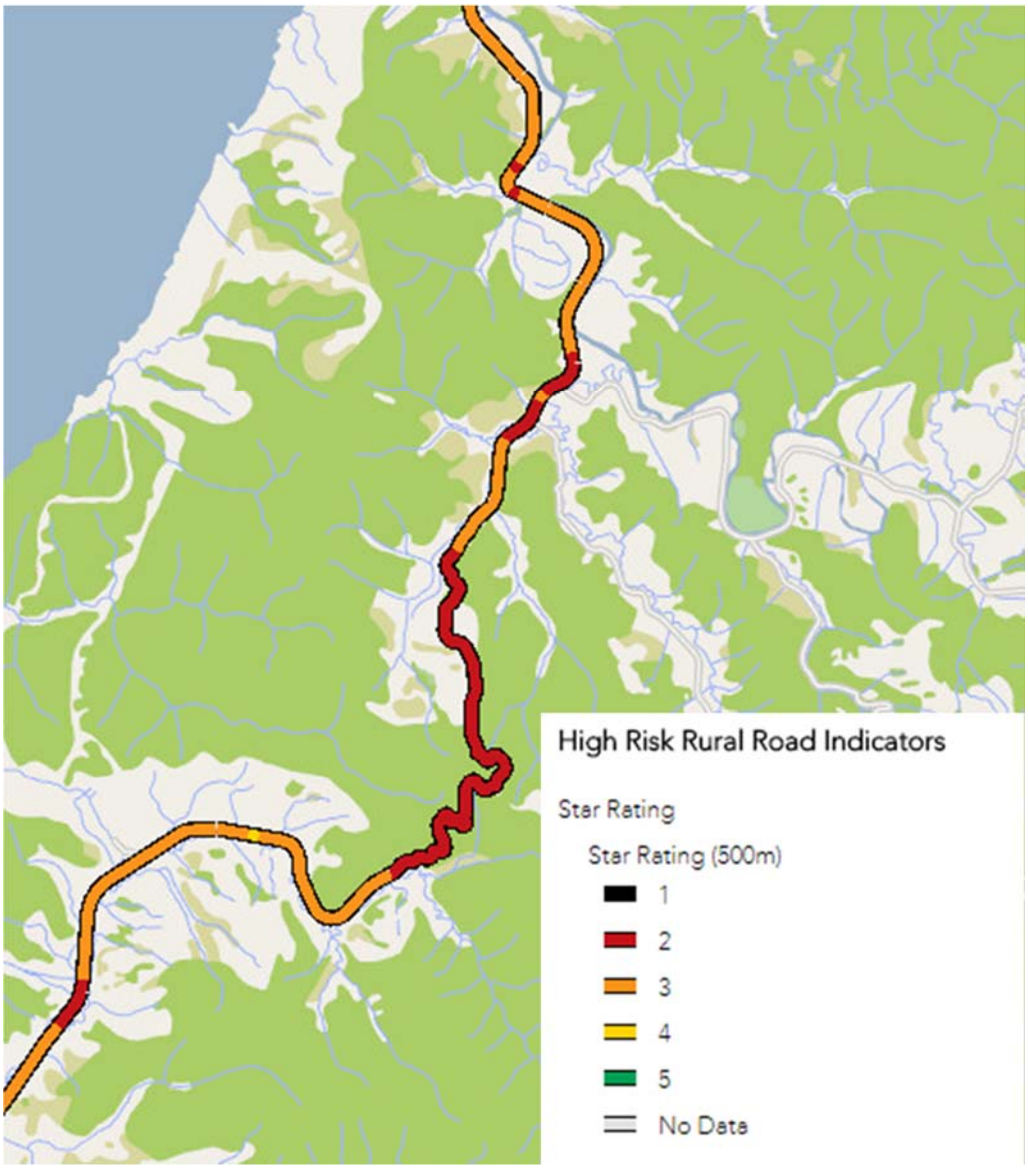

Figure 2.10 – Mt Messenger Rating on SafetyNet

The new route will improve the safety rating through the Mt Messenger area, with the other sections with a 2 Star Rating being considered as part of the wider SH3 programme of works.

2.5 Existing Route Problems

The discussion above indicates that there are a number of fundamental problems with the existing Mt Messenger section of SH3. The key problems with the existing SH3 corridor have been previously identified as being related to safety, road closures and lack of passing opportunities. These matters, and how they relate specifically to Mt Messenger, are further explored below.

2.5.1 Safety

As described above, the current road alignment is inadequate, due to its:

- Narrow lanes;
- Lack of shoulders;
- Poor geometric alignment (steep grades, tight curves)
- Slow speeds
- Limited side protection (including wooden sight rails which are considered not fit for purpose); and
- Substandard tunnel cross section.

This means that the road environment is unforgiving, with driver mistakes leading to crashes; and subsequently deaths and serious injuries, as well as road closures.

As described previously, from 2012 to 2016, there has been no reported fatal crashes and six serious injury crashes along this section of SH3. The rate of crashes due to factors such and loss of control and poor handling is higher than the national average.

The existing carriageway configuration is typically a narrow, winding alignment with steep grades of up to 12% in some locations. In many locations, the roadside environment is characterised as having steep vertical cliffs on either side with the risk of an errant driver either colliding with, or falling down the adjacent hillside. These physical features contribute to driver frustration and the severity of the crashes along the corridor.

The road configuration also results in the previously identified 2 Star safety rating along this section of SH3, which does not meet the ONRC desired minimum outcome of 3 Star. In addition, with much of the SH3 corridor to the north and south of Mt Messenger having been rated as 3 Star, the reduced rating through the Project area is considered out of context with the surrounding network and introduces a risk of 'surprise', particularly for unfamiliar drivers.

2.5.2 Road Closures

One of the identified problems of the existing corridor is that natural events and some crashes cause a high number of road closures, and, combined with no suitable alternative route results in significant delays and adverse economic impact.

As previously described, travel along SH3 in the vicinity of Mt Messenger forms a part of a typically much longer journey, often between Hamilton and New Plymouth. Travelling via SH3 between Hamilton and New Plymouth takes approximately 3 hrs 10 minutes under normal conditions. If and when the road is closed along any portion of the route, there are very few detour routes that can be used. With advanced notice that the road is closed prior to leaving Hamilton or New Plymouth, the road user has a number of alternative route options to choose from, although these increase the journey time at least 30%. However, if the user is unaware of this closure and has to turn around, the increase in journey time is significantly higher than 30%. This scenario is significant for heavy vehicles which encounter a closure on the narrow Mt Messenger section of SH3 as there are limited opportunities to turn around, and therefore the driver must wait until the road is cleared.

Table 2.3 below shows the additional travel time if the Mt Messenger section of SH3 is closed.

Table 2.3 – Travel Times[3] (New Plymouth – Hamilton)

Route	Travel Time	Additional Travel Time (Average)	Additional Journey Length (km)
SH3 (241km)	3hr 14min	–	–
SH43	4hr 59min	1hr 45min	+ 95km
SH4 via Whanganui	6hr 23min	3hr 9min	+243km
SH1	6hr 58min	3hr 44min	+286km

Discussions with the Network Contract team members have identified that it is common that when there has been a storm affecting SH3 north of New Plymouth, it also affects SH43. In this scenario, journey times roughly double in duration and may result in drivers deciding not to take the trip.

In any event, SH43 is a narrow route with a winding alignment and is unsealed over a section, making it unsuitable as a major detour route, as shown below:


Figure 2.31 – Existing SH43

The alternative route via SH43 is not recommended by the vehicle rental, bus and heavy transport industries as a suitable and safe route (narrow sections, one lane tunnels and bridges and partly unsealed), and therefore these groups use the longer route via SH4 and Wanganui. 50MAX/HPMV trucks, which carry high value goods, are not permitted to use SH43 and must use the longer detour via SH4.

The SH4 (Primary Collector) detour route adds an additional 3 hours and 10 minutes, with a journey time of over six hours to Hamilton.

This analysis assumes that drivers are fully aware of any road closure before they depart. Those already on the highway in the vicinity of Mt Messenger have very poor cell phone

[3] From Google Maps

reception and therefore to use an alternative route they will need to turn around (if possible) and backtrack some distance to access a diversion or detour route which will add further travel time and delay. For most trucks this is not a viable option as there are few practicable turning areas due to the relatively narrow road, terrain and very few driveways or side roads.

Another operational limitation for using these alternative routes when Mt Messenger is closed arises from the maximum driving times that commercial drivers are required to observe between breaks and daily total travel times. Closure of SH3 reduces the opportunity for return trips, or requires additional interventions (such as driver changes) to enable the freight to reach its destination.

Currently, the driving time between New Plymouth and the Wiri depots in Auckland along the SH3 corridor is more than the 5 ½ hour limit, and requires that drivers stop and take a break during their trip. The significant additional journey times on the alternative routes further restricts the ability for the round-trip freight journeys to be completed by a single driver.

Improvements to the Mt Messenger section of SH3, in conjunction with the Awakino and safety upgrade works, will improve route journey times, reliability and resilience. This will contribute to greater economic outcomes through increased confidence in the route for freight and the ability for the route to accommodate over dimension vehicles.

Notwithstanding the significant detour required during road closures, an assessment of the road closures on Mt Messenger was undertaken for the period 2011 – 2016. Analysis of the Transport Agency's records (contained in the TRIES and PSMC006 databases) identified that seven partial or full road closures recorded over the 2011 to 2016 period, of which six have been as a result of crashes and one because of a slip following heavy rainfall. These closures varied in length from less than two to 13hrs, and were identified as being of a frequency, and duration considered unacceptable for a Regional Arterial (with no suitable alternative route) as outlined in the One Network Road Classification (ONRC).[4]

The annual value of freight carried on SH3 is $3.7B or approximately $10M per day. If the highway is closed, there is an adverse economic impact from:

- Loss of perishable goods;
- Loss to productivity of delayed trucks;
- Subsequent financial impacts of non-delivery and/or delay; and
- Other impacts.

[4] Further detail on this can be found in the Strategic Transport Assessment (Technical Report 1), and the findings support the need to establish a more reliable corridor through this region. The Strategic Transport Assessment (Technical Report 1) concludes that *'Given the importance of the route in terms of its importance to connecting Taranaki to economic hubs in Hamilton, Tauranga and Auckland significant improvement is required".*

2.5.3 Lack of Passing Opportunities

A further identified problem along the corridor is the lack of passing opportunities which leads to driver frustration and a poor journey experience.

There is currently one formal passing lane and one slow vehicle bay provided on the Mt Messenger route:

- Southbound uphill passing lane, approximately 470m long, on the northern approach to Mount Messenger; and
- Northbound slow vehicle bay, approximately 120m long, near the summit of Mount Messenger.

The NZTA policy document 'Appendix 3e Passing and Overtaking Policy'[5] describes a 'short passing lane' as being 600m – 800m (plus taper). The southbound passing lane falls short of this description. The same document describes a slow vehicle bay as being 'generally up to 300m plus tapers'.

The remainder of the existing route, as previously described, has many tight corners with limited forward visibility which limits the opportunity for passing across the remainder of the length. The steep grades also make passing impracticable (or impossible) for smaller motor vehicles attempting to pass the longer heavy vehicle configurations. The Mt Messenger tunnel itself also often requires vehicles to stop and give way to on-coming vehicles – all of which contribute to driver frustration across the length of the route.

2.5.4 Other Constraints

The key problems along the existing SH3 corridor have been previously identified as relating to safety, road closures and lack of passing opportunities. As described above, these corridor-problems are all directly related to the existing Mt Messenger crossing. In addition, there are a number of further constraints which more specifically relate to the Mt Messenger section of SH3:

- Slow speeds – due to the steep, and tortuous nature of the existing route;
- Maximum grades of 12% in places, with over 1.7km (NB) and 2.8km (SB) of the corridor greater than 6%;
- Poor driving experience/driver frustration;
- Narrow shoulders means there is poor to no pedestrian / cycling facilities;
- HV are unable to turn around in event of closure, due to insufficient widths; and
- Steep grades result in high operating costs eg fuel consumption.

[5] https://www.nzta.govt.nz/assets/resources/appendix-3e-passing-overtaking-policy/docs/passing-overtaking-appendix-3e.pdf Effective August 2007

3 Mt Messenger Bypass

3.1 Route Physical Characteristics

The Project comprises a two-lane, undivided State Highway with the following characteristics:

- Overall length of 6km (a reduction of 1.4km length);
- Safe operating speed 100km/h;
- One tunnel 235m long;
- One bridge 120m long;
- 3.5m wide traffic lanes throughout;
- 1.5m shoulders throughout (except through the tunnel, which is limited to 1.2m wide shoulders with a 0.6 median);
- Max grade of 7.5% southbound (distance of 925m with a grade greater than 6%);
- Max grade of 7.0% northbound (distance of 675m with a grade greater than 6%).

While the detail of the design is subject to change during detailed design, the currently expected typical cross-section for the bypass is provided below:

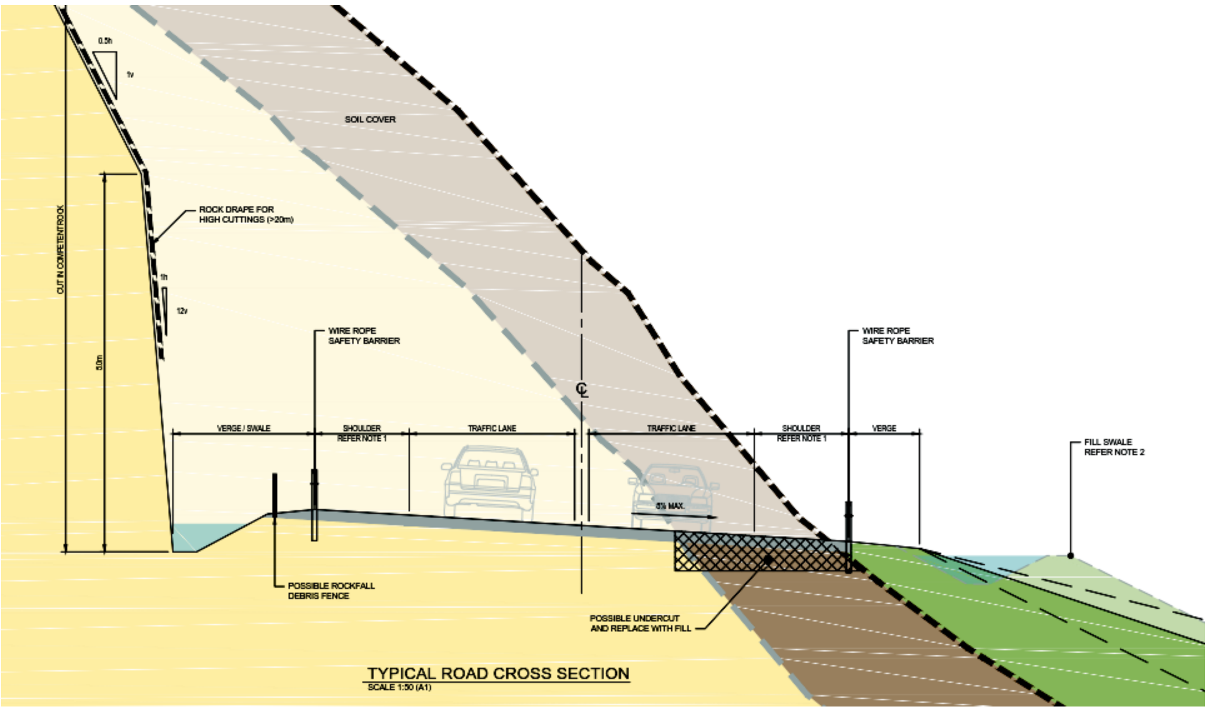

Figure 3.1 – Typical Road Cross Section (see Drawing MMA-DES-GEM-E1-DRG-3001, Volume 2 of AEE)

Through the tunnel, the shoulders are proposed to narrowed to 1.2m, with a 600mm median, as shown below:

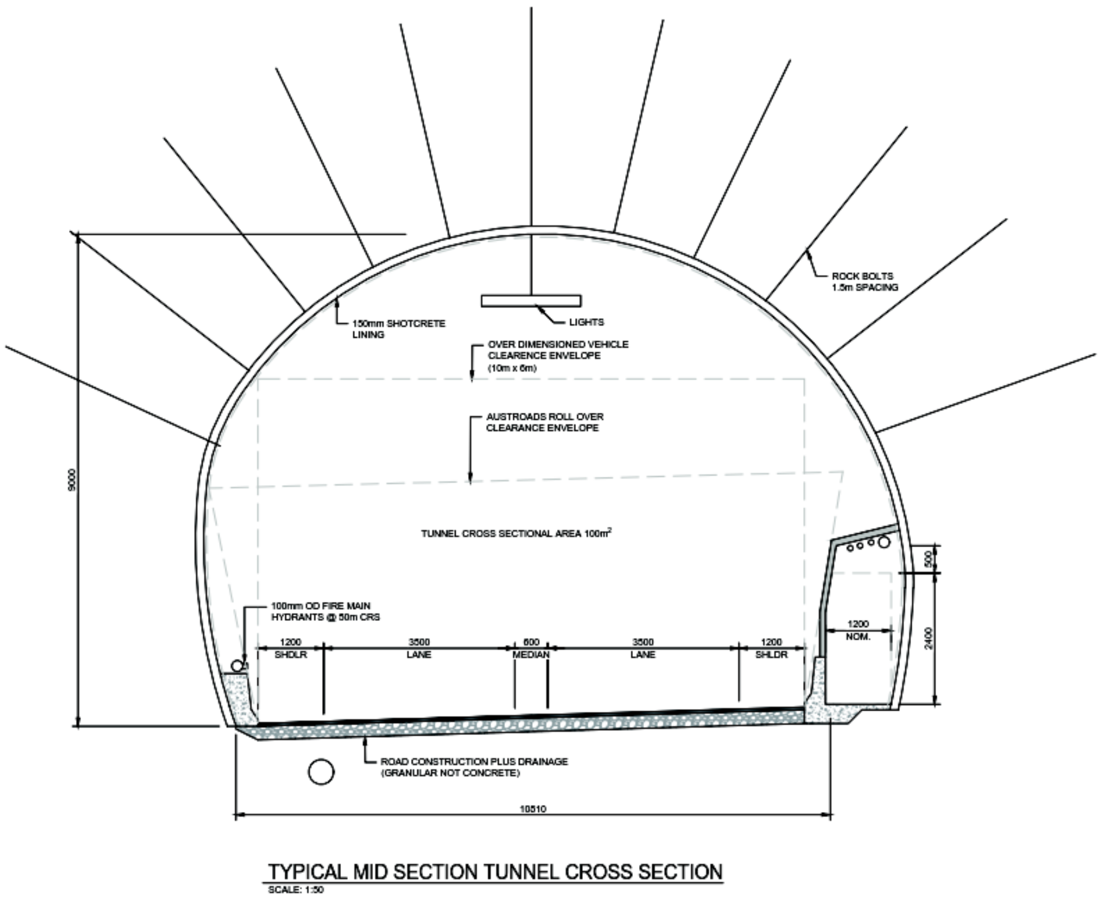

Figure 3.2 – Cross-section – Tunnel (see Drawing Number MMA-DES-TUN-E1-DRG-3001, Volume 2 of AEE)

The bridge structure also currently designed with a 600mm median, 3.5m wide lanes and a 1.5 – 3m wide shoulder, as shown below:

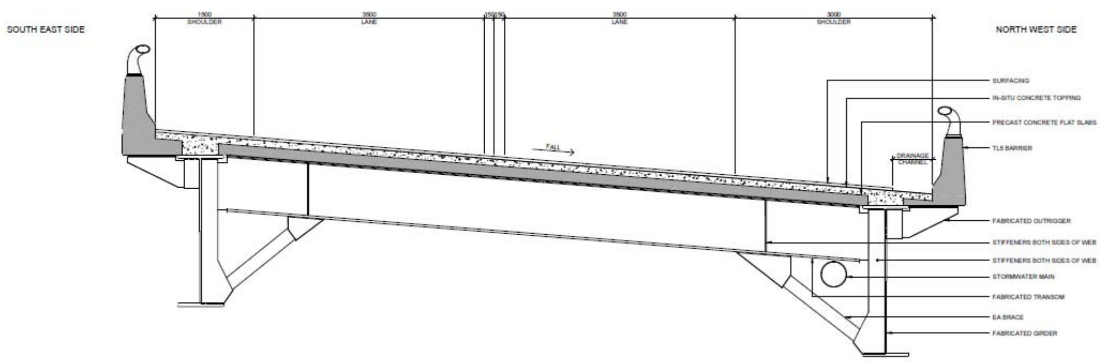

Figure 3.3 – Cross-section – Bridge (see Drawing MMA-DES-STR-E1-DRG-1103, Volume 2 of AEE)

Details on the overall route are presented in the Assessment of Effects on the Environment Report, contained in Volume 1: AEE, and are shown on the Drawings in Volume 2: Drawing Set.

3.2 Operating Speed and Travel Time

The new route has been designed to a 100km/h operating speed (for light vehicles). Heavy vehicles are expected to travel at slower speeds on steeper sections of the route.

The average travel time for all vehicles through the existing Mt Messenger section of SH3 is 8.45 minutes (for both directions).[6]

Light vehicles

For light vehicles travelling at 100km/h the new road would result in an average travel time of 3:36 minutes through the proposed new route, for a saving of approximately 4.05 minutes – more than half the existing travel time – along the proposed route. This is a significant travel time saving in the context of this length of road. It illustrates that the new road will be fundamentally more user-friendly than the existing road.

Heavy vehicles

A key outcome achieved by the Project is to support economic growth of the region, through improved freight journey times. The average truck speed along the new road will be 45km/hr, based on grades. A comparison of the travel times for just the Heavy Vehicles across the Mt Messenger section of SH3 is as follows:

- HCV travel time in the order of 13minutes over the existing 7.4km length in the existing scenario
- HCV travel time in the order of 6.5 minutes over the 6km length in the future (the proposed route) scenario.

As a result of the reduced length and grades across the Mt Messenger Bypass, the average travel times for Heavy Vehicles will be approximately half of the existing travel times (a saving of 6:40 minutes) once the new road is established. This represents a significant positive outcome of the Project, as well as contributing to overall lower freight costs on the route.

Average vehicle speed and journey time

Of course, not all vehicles will travel 100km/h through the Project route. In particular, trucks (and cars following trucks) will travel slower than this (see above).

The operating speeds expected along the new route have been assessed on a first principles basis. The analysis considered the grades of the new road as well as the vehicle composition. The operating speed across the Mt Messenger section of SH3 has been assessed within the transport economics as follows:

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[6] Obtained from google traffic application API platform, where travel times across the Project area were observed for a week-long period.

Table 3.1– Operating Speeds Opening Year (Average of all time periods and vehicles)

Operating Speeds (km/hr)	Existing road (7.4km length)	New road (6km length)
Mt Messenger	56km/h	77.6km/h

In order to be conservative the above operating speeds have assumed that there are no passing opportunities along the length of the new road, and as such all light vehicles on the route will be slowed by the presence of slower moving heavy vehicles (up and down grade). In practice, improved geometry across the length of the new road will provide greater forward visibility along its length and will provide increased opportunities for drivers to pass trucks and other slower vehicles to be realised for following vehicles.

The Transport Agency Planning Policy Manual Appendix 3E – Passing and Overtaking[7] provides guidance as to appropriate treatment with respect to future traffic volumes and terrain. As previously described, the future traffic volumes on this corridor are in the order of 4,000vpd in the 20 year horizon. In rolling and mountainous terrain such as this, recommended treatments are noted as being sight distance improvements, overtaking enhancements, possible isolated shoulder widening / crawler shoulders, and Slow Vehicle Bays and short passing lanes at 10km intervals. With the new route less than 10km in length, the treatment options under consideration match the recommended treatments over the shorter lengths. Volumes exceeding the 4,000vpd suggest full passing lanes at 5km intervals be adopted. The designation being adopted for the Project will allow for the facilities to be provided at a later date if required.

3.3 Property Access

There are three properties accessed from the existing section of SH3 which is being bypassed, including Ngati Tama's Parininihi land block. These properties are all covered at least in part by the proposed designation. The Public Works Act sets a process to establish new access arrangements for these properties.

Property access to the existing properties connecting with SH3 is intended to be retained through the use of the existing SH3 corridor (the exception is one private property to the south, which will require a dedicated access to be formed directly from SH3 itself. An intersections at the northern and southern connection with the new SH3 routes will be established as part of the project, and access to these properties (and to existing public walking tracks) will be retained on the existing route. These arrangements, including consideration of revoking the State Highway status from the existing road and determining which parts remain public road, will be determined once the designation is approved.

3.4 Summary of Characteristics

A comparison of the transport related characteristics of the existing and preferred route is summarised below:

[7] https://www.nzta.govt.nz/resources/appendix-3e-passing-overtaking-policy/

Table 3.2 – Comparison of Preferred Route against Existing

Characteristic	Existing	Preferred Route
Length	7.4km	6.0km
Lane width	3.4m (narrower in places)	3.5m
Shoulders	0.5 – 1.5m	1.5 (min) throughout 1.2m through tunnel
Max grades	12%	7.5%
Speeds	Current 56km/h operating speed	100km/h safe operating speed 77km/h average[8]
Travel Time – LV	8:45min	3:36min
Travel Time – HCV	13:08min	6:28min
Bus, Cycling, Pedestrian		Improvement over existing

Overall, the Project enables significantly improved transport outcomes through the establishment of a shorter route length, with reduced travels times and flattened grades.

[8] Average for all time periods, all vehicle types for Yr 0. In Yr 20, operating speeds have been assessed at 63km/hr.

4 Assessment of Traffic and Transportation Effects

4.1 Introduction

This chapter summarises the expected operational traffic and transport effects of the Project on the road network. In particular, the assessment focuses on the effects of the Project on safety and on resilience and journey time reliability for users of SH3 through Mt Messenger. Assessment is also made of the temporary traffic and transport effects during construction.

4.2 Road Safety

The preferred route seeks to provide an improved safety environment, beyond the existing provision. Key road safety features include the following safety limitations:

Table 4.1– Safety Changes

Characteristic	Existing	Preferred Route
SafetyNet Star Rating	2	3
Lane widths	3.4m[9]	3.5m
Sealed Shoulder width	0.5m – 1.5m	1.5m throughout 1.2m through tunnel
Passing Opportunities	1 SB passing lane 1 NB climbing lane	Higher quality route with forward visibility suitable to enable passing opportunities over full length (excluding the tunnel)
Median barriers	None	Median separation provided in tunnel
Side barriers	None	Provided full length

[9] Lane width is typically 3.4m, but is narrower in some localised places

The new road will be provided at a higher standard to the existing corridor, with a safe operating speed of 100km/hr, compared to the existing operating speed of 56km/hr.

The existing route is very steep across much of Mt Messenger, with grades of up to 12% in some locations. In addition, there are a number of tight corners which need to be negotiated. By comparison, the new road curves will be very much eased, with maximum grades of 7.5% southbound and 7.0% northbound. There is a combined two way length of 1,600m at grades of greater than 6%, which is very much reduced over the existing configuration. As a result, the ability for following vehicles to safely pass slower vehicles substantially improved, which both improves safety and reduces driver frustration along this length.

Shoulders will be provided at 1.5m throughout. The improved forward visibility to safely operate at 100km/h will improve the opportunities for safer passing across the full length of the Mt Messenger crossing (excluding the tunnel).

The shoulders through the tunnel will be narrowed to 1.2m over a length of approximately 235m. This is a standard compromise in road design where the costs of extra tunnel width increases exponentially. The reduced shoulders have been adopted in this instance to enable a 0.6m median to be provided to separate traffic travelling in opposing directions, The design does however retain sufficient width to pass a broken down car at reduced speeds.

A summary of the road safety related benefits which have been identified are summarised below:

Table 4.2– Safety Benefits

Benefit	Measure
Improved Star rating	Increase Star rating from 2 to 3 Mt Messenger crossing will be in context with adjoining route which will benefit all road users, including tourist drivers who may be particularly surprised by the form and nature of the current Mt Messenger crossing
Connections to DOC tracks	Improvements to existing (which are unsafe in so far as they provide insufficient limited deceleration/acceleration opportunities)
Improved forward visibility	Existing curves forward visibility limited to 30m – 40m on some corners Future design criteria will provide visibility suitable for 100km/h operating speed throughout
Passing opportunities	Existing: Substandard passing lane (470m), climbing lane (120m) Future: Improved forward visibility, increased passing opportunities throughout full length of project

Benefit	Measure
Reduced exposure	Reduced length (7.4km to 6km)
Improved geometry	Eased curves with no curves requiring reduced speed advisory signs. Flatter grades from current max 12% (3km above 6% on existing route) to max 7.5% (above 6% gradient for 1.6km for new route) Wider shoulders from existing (0.5m-1.5m) to 1.5m (throughout), (1.2m tunnel) Widened lanes from 3.4m (in localised places narrower) to 3.5m throughout Higher speeds from operating speed 46km/h to 77km/h average in opening year Side barriers provided throughout Route will enable 2-way passing throughout (current constraints such as the tunnel results in observed behaviour where vehicles will stop in the lane to give way to oncoming traffic)
Reduce driver frustration	Road Star rating and geometry will be in context with adjoining sections of SH3 creating a 'no surprises' environment Improved journey time reliability and journey times (see below)
Better provision for active modes	Low volume/confident active users, not expected to change as a result of project but wider shoulders and improved sight distances will better provide for them and be comparably safer for these modes.

Overall, the design of the new road will enable the current Star Rating 2 to be improved to Star Rating 3, greatly improving the safety of this section of SH3 within the immediate Project area, and importantly also ensuring the safety characteristics are in keeping with driver expectations throughout the adjoining corridor.

4.3 Journey Time Savings

The existing travel time information was obtained from Google traffic application API platform for the economic analysis for the project where travel times across the project area were observed for a week period. This assessment showed an average travel time of 8.45 minutes (for both directions).

As previously described, the new route across Mt Messenger has been assessed within the economic analysis as enabling an average travel speed of ~78km/h (allowing for the presence of the slower heavy vehicles). The resulting typical travel time across the new route is expected to be 4.05 minutes. The assessment has prepared on the conservative basis of there being no passing opportunities along the new road, however as described previously the wider shoulders, relatively flatter grades and improved road geometry will enable greater opportunity for informal passing opportunities.

Allowing for day to day variability, and the presence of heavy vehicles (or not), the typical vehicle journey on this route can be expected to save on average four to five minutes' travel time when compared to the existing route.

The Journey Time Savings benefits achieved by the Project are summarised below:

Table 4.3– Journey Time Savings

Benefit	Measure
Reduced journey times (Local)	Reduced length: 7.4km to 6km Increasing travel time for DM (Existing route 8.45min, Year 20 = 9:14min for all vehicles) Option reduces travel times: (all vehicles) • Opening year = 4:21min savings • Year 20 = 4:16min savings Option reduces free flow travel times: (LV @ 100km/hr[10]) • Opening year = 3:36min (saving 4.05min) Option reduces free flow travel times: (HV) Opening year = 6:28min (down from 13:08 min ex)
Reduced journey times (Closures)	If SH3 closed: • Alternative route via SH43 4hr 30min: 1hr 45min longer (95km), not suitable for HPMV (unsealed in places and narrow, winding route alignment) • Alternative route SH4 6hr 20min: 3hr 9min longer (243km) • Alternative route SH1 6hr 55min: (3hr 44min longer (286km) Improved road reduced risk/number of closures (ref resilience outcomes) Alternative routes add significant time to journeys: HV drivers have 5.5hr max drive time (before a break) and 13hrs total/day. Nature of existing road means that MM requires regular maintenance ie on curves where tyres rut the pavement
Reduced journey times (OD loads)	SH3 not currently suitable for OD roads due to constraints (including Awakino tunnel) Alternative route SH1 6hr 58min (3hr 44min longer (286km)

[10] The Transport Economics assessment for the project has more conservatively assessed the LV travel speed as 90km/hr

Benefit	Measure
Reduced driver frustration	Faster travel times Greater passing opportunities
Increased speeds	Existing average: 56km/h Year 1: Ave speed 77.6km/h, LV operating speed (100km/h), HV operating speed 45km/h Year 20: Ave speed 65km/h, LV operating speed 100km/h, HV operating speed 45km/h

From a transport economics perspective (as discussed later in this section), in addition to the project travel time savings, there will also be economic gains through reductions in Vehicle Operating Costs (VOC). From the perspective of users of the new road (and in particular freight operators), these benefits will result in improved productivity.

4.4 Journey Reliability

A key issue for the users of the existing Mt Messenger corridor arises from:

- the frequency and duration of the road closures along the length; and
- the lack of a suitable alternative route during these closures.

As previously described, the existing corridor is subject to crashes arising from to the poor standard of the existing geometry of the road and slips resulting from the steep hillside topography and associated geology. When such closures occur, there is only very limited opportunity for large vehicles to turn and use an alternative route. During these closures, there is limited opportunity for the large vehicles to turn to return around to travel via an alternative route.

The detour routes increase journey times by one to three hours.

Increased journey time has a particular cost implication for freight. Additional time and journey length can also lead to driver frustration, and tiredness which also does not represent a good safety outcome.

The existing corridor has been identified through the associated Strategic Transport Assessment (Technical report 1) as suffering closures of a duration and frequency greater than that acceptable within the ONRC guidelines for a road of this nature.

A key outcome for the Project is to ensure greater reliability of the road, and for the duration of any road closures to be reduced. These closures may be either planned for maintenance, or as a result of unexpected/unplanned events such as crashes or slips.

The development of the Project has been undertaken with this key outcome in mind, and is discussed in other AEE documentation. The design also provides for areas off the carriageway to undertake routine maintenance activities away from the live carriageway as far as practicable, in particular providing for access to the structures.

The benefits associated with improved Journey Time Reliability were highlighted in the previous section, noting for the Project there is inter-relatability of these outcomes.

4.5 Alternative Modes

The route along SH3 between Hamilton and New Plymouth is considered to be a common tourist route, with campervans, tourist buses and motorhomes frequently seen. The straighter / flatter new route grades will make travel easier for all drivers. The safety improvements resulting from the Project are therefore considered to be particularly positive in terms for these road users.

Cyclists are not commonly seen along this route as the distance between major townships is considered significant for this travel type. Cyclists who are currently riding over Mt Messenger are almost all on multi-day touring trips. Such cyclists are accustomed to a wide variety of road conditions, particularly narrow shoulders. The carriageway width in the proposed alignment however would be significantly more suitable for cyclists, with 1.5m shoulders throughout beside the traffic lanes, and 1.2m in the tunnel, and represents an improvement from the existing shoulder width of 0.5-1.5m (or less). It is noted that some cyclists may be more comfortable walking their cycles through the tunnel due to the presence of heavy vehicles.

Being away from residential areas, it is very rare for pedestrians to walk along this section of SH3 except in the vicinity of the access to the Parininihi Walkway on the southern side of the hill. Continued access to the walkway is proposed with a parking area and connecting track.

This access will represent an improvement on the existing configuration where informal parking areas on the side of the road lack any safe connection to the start of the track and lack safe entry and exits.

The overall effect of the Project on tourist vehicles, buses, pedestrians and cyclists is positive.

4.6 Other Benefits

The NZ Transport Agency's Economic Evaluation Manual (EEM) assesses Carbon Dioxide emissions as being linked to fuel consumption through vehicle operating costs[11]. Vehicle Operating Costs are made up of a number of components, including gradient, speed and vehicle type.

As previously described, the existing corridor has a maximum grade of 12% in a number of locations, with an overall route average grade of 8%. There is 1.7km (northbound) and 2.8km (southbound) (4.5km total) with steep climb of more than 6%. This compares to the proposed bypass, which has 1.6km with a steep climb of more than 6%, and a maximum grade of 7.5%.

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[11] Pg 5-368 of the Economic Evaluation Manual https://www.nzta.govt.nz/assets/resources/economic-evaluation-manual/economic-evaluation-manual/docs/eem-manual-2016.pdf

Using the EEM VOC costs as a proxy for CO_2 emissions (with higher fuel costs relating to higher CO_2 emissions, due to higher fuel burn rates), the VOC costs for these grades (at a nominal 55km/h operating speed) are given as follows[12]:

Table 4.4 – VOC (by grade) for Car and HCV1

Grade	Passenger Car (cents/km)	HCV1 (cents/km)
6	22.7	113.3
8	23.3	128.3
12	25.6	159.6

While the extent of the CO_2 emission reductions have not been quantified in this assessment, the above table highlights:

- Steep grades result in greater fuel costs for all vehicles types;
- Heavy vehicle fuel costs are higher than Light Vehicle costs; and
- Heavy vehicle fuel costs are more affected by grades than light vehicles.

As discussed in the next section of the report, the CO_2 savings have been costed at $1M over the life of the project.

4.7 Transport Economics

The Project has been assessed (and peer reviewed by Aurecon) in accordance with the NZ Transport Agency's Economic Evaluation Manual. The assessment has been undertaken on the conservative assumption that no passing opportunities occur along the length of the Project.

The Do – Minimum option considers the existing 7.4km section of highway, and includes the passing lane and climbing lane formal passing lanes. It has assumed that no improvements will be made to the route, and only essential maintenance is undertaken.

The economic assessment was undertaken on the following basis:

- Time Zero is 1 July 2017;
- The Base Date for the evaluation is 1 July 2015;
- The evaluation period is 40 years (EEM default);
- Benefits growth rate will be based on historic traffic growth from the past 10 years at the site;
- Construction period is 36 months starting in the 4th quarter of 2018
- Project benefits begin in the 4th quarter of year 4 (2021);
- The discount rate is 6% (EEM default);

[12] Section A5 of the EEM (as above), tables A5.1 and A5.4

- Benefits will be calculated for AM, PM and IP time periods with Off-Peak and weekend based on factored inter-peak from traffic profile information on from the nearest count site on SH 3; and
- Annualisation factors were determined from traffic profile information from the nearest telemetry site. The following factors and hours were adopted for each time period:

Table 4.5- Annulisation Factors

Time Period	Hours per Day	% Daily Flow	Days per Year
Weekday evening	8	1.38%	245
Daytime	10	7.40%	245
Weekday peak	4	3.50%	245
Weekend peak	8	0.90%	120
Weekend day	9	4.2%	120
Weekend peak	6	9.0%	120

- Dis-benefits during construction are considered minor as the option can be constructed offline to the current highway and therefore has not been included; and
- All update factors, base value travel times, vehicle operating costs etc. are based on the EEM Volume 1 (January 2016 Update).

4.7.1 Transport Benefits

4.7.1.1 Travel Time Benefits

Do minimum 2017 travel time information was obtained from the Google traffic application API platform where travel times across the project area were observed for a week period. Option travel times were determined using first principles method to take into account the impact of HCV's with lack of passing opportunities. AUSTROADS: geometric design of trucks standard was utilised to develop a travel time model to assess the impact of trucks on other traffic. This assumed a uniform (evenly spaced) traffic stream and calculated what proportion of light vehicles will be impacted by HCV's across the option length for a peak hour during the weekday.

The additional travel time was assessed as the difference between the free flow travel time (option length divided by safe operating speed) and the average travel time of trucks (AUSTROADS method). This additional travel time was then multiplied by the proportion of light vehicles, which are likely to be impacted by HCV's. This proportion takes into account the length that a light vehicle is impacted in the option as well as the number of light vehicles impacted in the traffic stream. The assessment was then extended to future years to take into account traffic growth and increase in HCV's.

Similarly, future year do minimum travel times were also determined using a similar model to assess the impact of increasing HCV's. This model was calibrated with the observed 2017 travel times to take into account the available passing opportunities.

Incremental congestion was also included in the analysis based on overtaking sight distance and percentage of time delayed. 10% overtaking sight distance was used for both the do minimum and option.

4.7.1.2 Vehicle Operating Cost Savings

The vehicle operating cost was calculated by considering the performance of 200m sections incrementally along the existing highway (do minimum), where the average speed/gradient along this section was determined using judgement and curve advisory information where available. The base running cost was based on "Rural Strategic" traffic composition as outlined in the EEM.

The option model was split into coarser sections where gradient changes were significant (rather than 0.2m sections as above).

4.7.1.3 Carbon Dioxide Cost Savings

The carbon dioxide costs was evaluated under the assumption that it will be 5% of total VOC for the Do Minimum and Option.

4.7.1.4 Crash Cost Savings

The do minimum did not contain a sufficient number of recorded injury crashes to carry out a "Method A" analysis. Therefore, "Method C" from the EEM procedure was utilised and Method B was used for the option with appropriate crash prediction model utilised from the Crash Estimation Compendium. All assumptions and EEM references are noted in the calculation sheets. The crash cost adopted for this analysis is "100km/h near rural" category on EEM Table 6.5 (a).

Crash migration was also considered in the option.

4.7.1.5 Operational Resilience

The methodology for calculating costs due to partial and full road closures are outlined below. The analysis was split up into partial and full closures. For the purposes of the economic analysis, it is assumed that a full closure signifies an event where the vehicles will have to make a detour and take an alternative route. During a partial closure, it is assumed that vehicles will still move through the affected area with the guidance of traffic management or at their own care (albeit at slower speed) and will also be delayed by the response time for emergency services and traffic management.

The basis for the analysis has been from the NZ Transport Agency's TREIS data base. Data from TREIS has been collected for a period between 2011 and 2017 in liaison with the local Network Operator.

Partial Closures

Partial closures were separated into less than and greater than 6 hour periods. Using this as a basis, the following assumptions are noted:

- Average delay incurred as a result of a partial closure is assumed as 77 minutes. This is the response time from the nearest city (New Plymouth), which is 47 minutes plus traffic management set up time assumed to be 30 minutes. This has been confirmed by the Taranaki Network Operators. This is a conservative assumption in that it does not take into account the delay for vehicles moving through the affected area.
- For closures longer than 6 hours, it is assumed that 70% of the AADT will be affected.
- For closures shorter than 6 hours, it is assumed that 30% of the AADT will be affected.
- These proportions above have been determined through traffic data analysis. This analysis looked at the proportion of traffic compared to the AADT for every six hour period.
- The frequency of partial closures itself was averaged between the six and a half ear period to attain a per annum rate.
- No additional vehicle operation costs were taken from partial closures. The travel distance remains unchanged and as the speed changes are within the context of the environment therefore, the benefits from VOC are likely to negligible. However, this adds a further conservatism to the analysis.

Full Closures

Similarly, full closures were also separated out between shorter than and longer than 6 hours. The following assumptions are noted:

- The average delay incurred as a result of a full closure is assumed as 175 minutes. This is the additional detour time taken to traverse the SH 3/4 route via Inglewood and Whanganui as outlined in the SH 3 Indicative Business Case (Table 2-3).
- For closures greater than 6 hours, it is assumed that 70% of the AADT will be affected for a full closure.
- For closures less than 6 hours, it is assumed that 30% of the AADT will be affected for full closure.
- Again, these proportion have been determined from analysing traffic data and looking at six hour volumes compared to the AADT at any given time.
- Frequency of full closures was averaged as a per annum rate using the data between 2011 and 2015.
- Whilst it is noted that (particularly heavy vehicles) some vehicles will wait for the road to open again rather than taking the detour, the analysis assumes that drivers are fully aware of any road closure before they depart.
- Vehicle operation costs were taken into consideration due to significance in the travel distance of the detour route (242km).

For full road closures drivers are assumed to have prior knowledge and hence a large proportion are likely to divert. It is also noted that partial closures (even though only one lane blocked) will have an effect on both lanes as the clear lane will be used to move traffic in both directions.

It is noted that the validity of the dataset from TREIS was not ideal having incomplete and/or conflicting information. It was interpreted and filtered through to the best ability and verified with the NOC contractor where necessary (i.e. for the full closures). The actual duration of closures may not necessary correspond to the system start and end date but in instances where no other information was available (i.e. from NOC contractor), the start and end time on TREIS was assumed as the actual duration of closure.

4.7.2 Capital Costs and Implementation

The expected capital cost (including property, mitigation, professional services and construction) is $199.6 million for the preferred option. The construction timeline is 36 months, starting at the fourth quarter of 2018.

Maintenance costs were determined using rates per vehicle kilometres travelled and dollars per kilometres on the Network Operation Contracts (NOC). Furthermore, additional costs were included in the option for a bridge and tunnel ($6,400 per year and $20,000 per year). These were both determined from rates provided from the Wellington region civil structures maintenance team.

Due to the comparatively short length, the maintenance costs in the option are overall lower than the Do Minimum. Therefore in the economic analysis, the maintenance costs have been included as a negative cost (i.e. benefit) in the net present value calculation.

4.7.3 BCR and Funding Profile

The project net present value benefits, costs are summarised below with the project Benefit Cost Ratio (BCR) and First Year Rate Return (FYRR) following this:

Table 4.6- Benefits Summary

Benefit Cost Stream	Net Present Value Benefits
Travel Time and Congestion Relief	$44.8M
Vehicle Operating Cost	$19.9M
Carbon Dioxide	$1M
Crashes	$11.3M
Operational Resilience	$13.7M
Net PV Benefits	**$90.8M**
Net PV Implementation Cost	$170.3M
Net PV Maintenance Cost	-$1.2M

Net PV Costs	$169.1M
Benefit Cost Ratio (BCR)	0.5
FYRR	2.7%

The Project has been assessed as having an investment profile of M/M/0-1 under the 2015-2018 assessment framework.

4.8 Summary

In addition the anticipated travel time savings, the improved geometry and modern design standards for the structures and earthworks, and the higher resilience of the highway will enable a significantly improved journey time reliability to road users. The new road will also provide an improved environment for non-vehicular modes, when compared to the existing route. The upgrade of the safety rating to that encountered to the north and south of the Mt Messenger route will enable greater safety outcomes for all users of the road through the removal of the out-of-context form, particularly for those unfamiliar users of the route.

5 Assessment of Temporary Traffic and Transport Effects during Construction

The NZ Transport Agency has engaged an Alliance team to deliver the Project (the Mt Messenger Alliance). The Alliance has provided detailed input on the construction programme and construction methodology likely to be adopted throughout the construction phase of the Project. As such, there is greater ability to assess the expected effects of construction throughout the phase, beyond a level that would normally be expected within an AEE. This section considers the known and potential traffic effects relating to the construction of the Project.

5.1 Construction Traffic Demands

The construction of the new SH3 road in the vicinity of Mt Messenger will result in additional traffic on the adjoining SH3 corridor throughout the construction phase. The early inclusion of construction planning for the project enables opportunities to minimise these effects to be investigated, however it is not anticipated in practice that this effect will be able to be completely avoided.

The following traffic movements are anticipated to be generated:

- Staff: At peak periods, a total of 200 to 250 staff are expected to be onsite at any one time. By the nature of the workforce, some will travel to site by a single occupant vehicle, while others will choose to carpool with three to four people per vehicle. Based on experience elsewhere, the Mt Messenger Alliance has advised that, on average, 2 movements/staff member would be expected corresponding to an additional 500 movements/day during peak times.
- Construction materials transport:
  - Bulk Fill: During the early periods of the construction phase, there is an expectation that some fill will be transported from the southern portion of the site to the northern end via the existing SH3 road. These trips will be minimised, and are expected to be undertaken by single unit trucks. Up to 87,000m^3 may be transported to the fill sites on the southern side of the project, involving approximately 80 truck movements per day over six months.
  - Aggregates: Aggregate will be transported to site from quarries within the Taranaki Region by truck and trailer units. An average of 10 aggregate deliveries (20 movements) each day will be expected throughout the duration of the works, with an expected peak of 60 deliveries (120 movements) per day.
  - Concrete: Will be brought to site ready-mixed from New Plymouth. A total of 8 truck deliveries (16 movements) per day can be expected over a 12 month period during the tunnel lining phase.
  - Pavement materials: The number of trips generated to transport this material to site is expected to be low within the context of the construction programme, at 60 deliveries (120 movements) per day over 120 days.

- Plant: Throughout the course of the construction period, there will be a need to transport plant to site, and to different locations across the site. This will be achieved by transporting the plant along the existing SH3 route between the various site accesses. The number of movements is expected to be minimal. Some of the plant will require Over Dimension permits to travel along the existing route.
- Bulky Items: Culverts, geotextile, steel, barriers, fencing materials and other such bulky construction items will be delivered to the site via SH3, from either New Plymouth or Hamilton. These will generally arrive on single unit trucks or semi-trailers
- General construction traffic: Other truck movements include daily delivery of fuel to site by mini tanker, along with potable water tankers and trucks to remove sewage from on-site toilets, which will visit the site as required.

Overall, and in considering the overlap of activities, the amount of truck traffic can be expected to fluctuate between 30 deliveries (60 movements) per day and 80 deliveries (160 movements) per day, with an overall average of around 40 deliveries (80 movements) per day. With an existing daily traffic volume of 2,300vpd (and 20% heavy vehicle proportion) these additional traffic volumes are able to be accommodated within the availability spare capacity of the existing SH3 corridor. While the additional traffic is likely to be noticeable to regular users of the corridor, the effects will be mitigated through measures such as best practice traffic management, use of tools such as ITS to warn drivers of changing road conditions.

5.2 Site Access

A number of site accesses are proposed to be established along the length of the existing SH3 corridor to enable site access throughout the construction phase, as shown in Figure 5.1 below.

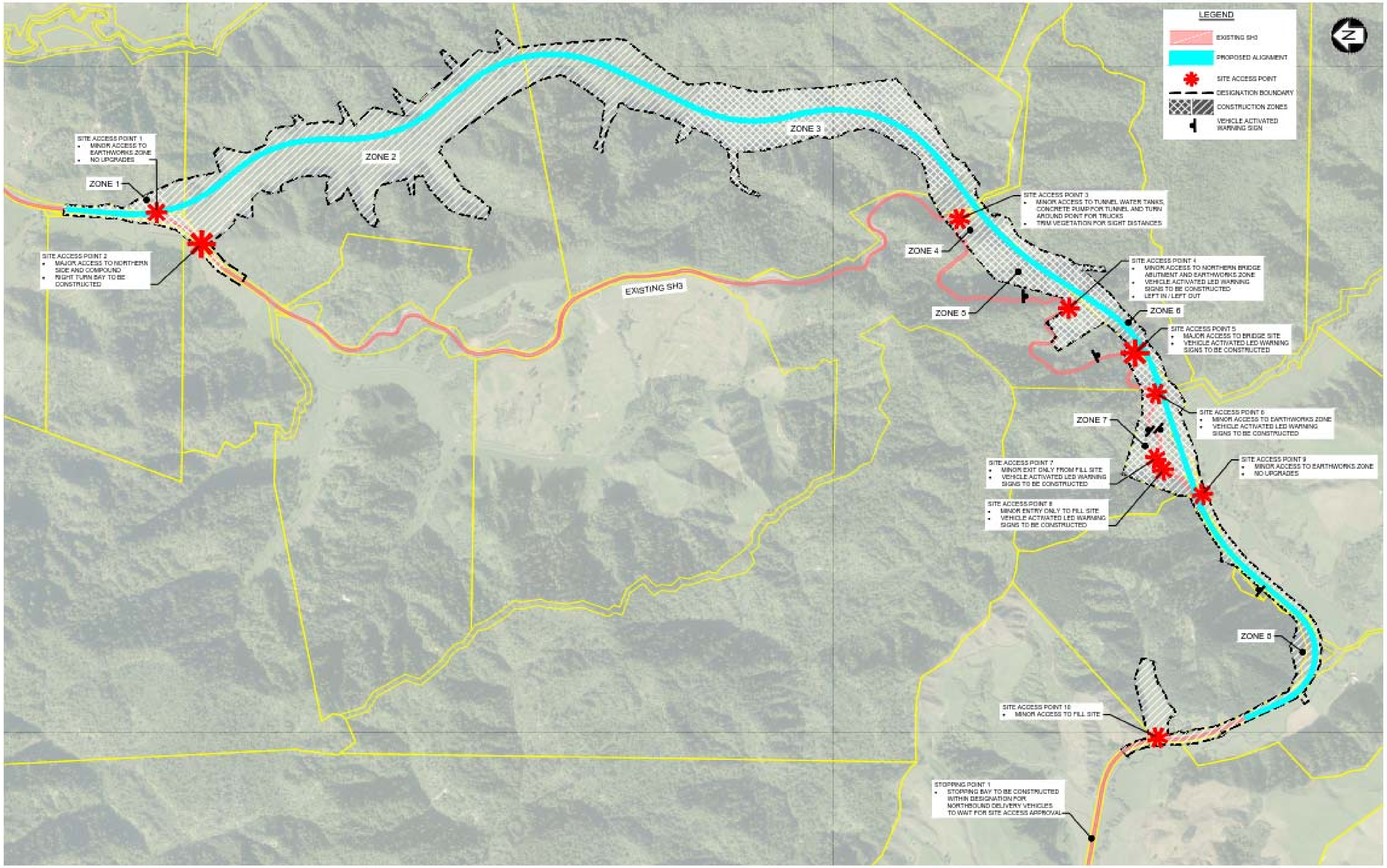

Figure 5.1 - Proposed Site Accesses

All site accesses will be controlled, so that access will only be possible for those authorised to access the site (including workers, and movement of materials and plant). Overall, the proposed site access arrangements are appropriate, and will not impact the safety of the existing route. The accesses will be locked overnight. All site accesses will be developed so as to ensure good visibility to and from the accesses in keeping with the approach safe operating speeds. Where appropriate, the access points will be sealed for the first 10m to prevent detritus spreading onto the road.

Access locations will be managed as follows:

5.2.1 Site Access Point 1

Site access point 1 will provide access to Zone 2 during the early phase of earthworks. This will involve relatively infrequent use to mobilise plant and then daily arrivals of staff and consumables to enable the earthworks at the northern end of Zone 2.

5.2.2 Site Access Point 2

Site access point 2 will be the primary access point to the northern side of the project, including the main compound. A right turn bay will be constructed to facilitate the safe movement of comparably high volumes of traffic (compared to other site accesses) in and out of the site.

5.2.3 Site Access Point 3

Site access point 3 is at the top of the hill, where the tunnel control building may be located. Vehicles accessing this location will include staff light vehicles, a modest amount of truck traffic to bring building supplies and equipment for the control building and possibly concrete trucks delivering concrete for the tunnel linings via a pump to the portals.

5.2.4 Site Access Point 4

Site access point 4 is a strategically important access as it will facilitate work on the northern abutment of the bridge and the deep cut and fill between the bridge and the tunnel. The access track will be steep and the location of the connection to SH3 is controlled by the need to minimise the grade and footprint of the access track.

The access point will be located on the inside of a bend in a steep, but slow speed area. Safety will be improved by providing LED warning signs on each approach that illuminate when a vehicle is approaching on SH3 and there is a vehicle either exiting or entering the access point.

5.2.5 Site Access Point 5

Site access point 5 will be the primary access on the southern side of the site. The site access point is located on the outside of a corner, where approach speeds and visibility are constrained by the existing SH3 geometry. Vehicle activated LED warning signs, like those described above, will be provided for this access.

5.2.6 Site Access Point 6

Site access point 6 will be a minor access used for preparatory work at times when congestion around the southern bridge abutment makes access via Site Access Point 5 impractical. This access will include vehicle activated LED warning signs.

5.2.7 Site Access Point 7

Site access point 7 is the connection with the old alignment of SH3 and may be used as a fill disposal site and/or laydown, potentially as a one way loop. Vehicle activated LED warning signs will be installed in conjunction with site access point 8.

5.2.8 Site Access Point 8

Site access point 8 will be the entry to the area of old road, if used. As an entry only, it will have LED warning signs to indicate when a vehicle is waiting to turn right into the site. This will be part of the same system that operates site access point 7.

5.2.9 Site Access Point 9

Site access point 9 is where the new alignment meets the existing SH3 at the southern end.

Once a continuous route along the new alignment it completed, this access will serve as the primary entry point from the south to minimise the amount of construction traffic on the existing hill section of SH3.

5.2.10 Site Access Point 10

Site access point 10 will provide access to the fill site just south of the project. If used, trucks will turn right into the site and left out.

5.2.11 Stopping Bay 1

A stopping bay is proposed on the southern approach to the site. This will provide a location where trucks can pull over and wait if access to the site is not immediately available. Truck drivers will have radio contact with site crews from this point and be able to check that the access point and laydown they are heading to are clear, and wait if need be.

5.3 Online Construction

There will be two sections of the existing SH3 road which will require online works as part of the overall construction, and as such will have a temporary effect on the operation of the existing corridor.

At the northern end of the site, a length of the existing SH3 route will be required to be dug out and rebuilt as part of the works. This short section of the corridor will be controlled through the use of temporary signals or stop/go control.

At the southern end of the site, a longer length of the existing SH3 road will be upgraded as part of the overall improvement works. To minimise the impact on the operation of the existing road, it is proposed that the eastern lane be constructed first, the live traffic will then be moved across to the new lane to enable the new western lane to be constructed.

All on-line construction will be undertaken in accordance with best practice, to ensure a safe worksite is established and controlled in a manner which will minimise delay and inconvenience to the customers on the route.

6 Recommended Conditions of Consent

It is recommended that the designation for the corridor be of sufficient width so as to enable passing lanes to be provided when traffic volumes warrant the establishment of the facilities, if not included as part of the detailed design.

The development of the Project design and construction method by the Mt Messenger Alliance has enabled a high level of contractor involvement at the early stage of the project planning. As such, greater confidence than would usually be possible can be given at this consenting stage as to how the potential adverse construction effects will be mitigated. In order to minimise the effect of the construction activity on existing road users, it is recommended that a condition of consent be included to require construction to be undertaken in general accordance with the Construction Traffic Management Plan provided within the AEE documentation.


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