Ōtaki to north of Levin

INDICATIVE BUSINESS CASE

December 2018

More information

NZ Transport Agency

If you have further queries, call our contact centre on 0800 699 000 or write to us:

NZ Transport Agency
Private Bag 6995
Wellington 6141

Approval

PREPARED BY	REVIEWED BY	SPONSORED BY	ENDORSED BY
P Peet J Povall D Ranatunga S Allan	L Dalzell G Lee	C Gasson	K Reid
Stantec New Zealand	Project Manager & Principal Planner	Proposal sponsor	System Design and Delivery
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Contents

Glossary of Terms

TERM	DESCRIPTION
ATP	Audio-tactile profiling
BCR	Benefit-Cost Ratio
CRS	Crash Reduction Study
DSi	Death & Serious Injury
EEM	Economic Evaluation Manual
GDP	Gross Domestic Product
GPS	Government Policy Statement (on Land Transport) 2018
GWRC	Greater Wellington Regional Council
HCV	Heavy Commercial Vehicle
HDC	Horowhenua District Council
HRC	Horizons Regional Council
KCDC	Kapiti Coast District Council
KPI	Key Performance Indicator
NIMT	North Island Main Trunk
NLTP	National Land Transport Programme
NoR	Notice of Requirement
NZTA (or the Transport Agency)	The New Zealand Transport Agency
O2NL	Ōtaki to North Levin
PDPS	Preliminary Design Philosophy Statement
PP2O	Peka Peka to Ōtaki
PT	Public Transport
PV	Present Value
RAMM	Road Assessment and Maintenance Management

TERM	DESCRIPTION
RED	Regional Economic Development
RMA	Resource Management Act
SH(#)	State Highway (number)
T2O	Taylors Road to Ōtaki
VOC	Vehicle Operating Costs
WEBs	Wider Economic Benefits

EXECUTIVE SUMMARY

State Highway 1 (SH1) is New Zealand's premier highway, but the section between Ōtaki and Levin is afflicted by a number of serious problems.

The importance of this highway is characterised by its function in connecting Wellington and the South Island to the upper North Island, where no other resilient route exists. It also provides an essential economic connection to Palmerston North, the largest freight node in central New Zealand.

The Wellington region has the second largest economy in New Zealand and is growing strongly. The Manawatu-Whanagnui economy has been stagnant, but recent indicators show increasing growth over the last few years. Horowhenua District Council have projected an additional 9,200 people are likely to move to the district by 2040 with an additional 5,400 dwellings.

This growth is placing increasing pressure on the state highway network. Approximately 17,300 vehicles per day (vpd), including over 1,700 heavy vehicles, currently travel along SH1 near Ōhau (2017), this is estimated to increase to 22,600 vpd by 2041 if growth occurs as forecast by the Horowhenua District Council[1].

Problems

Safety

Both SH1 and SH57 in the study area have a range of deficiencies including:

- Poor geometry and road alignment – SH1 has nine out of context horizontal curves and 14 deficient vertical curves, SH57 has the Kimberley Road / Arapaepae Road right-angle bend which is out of context with the remaining straight horizontal alignment. These deficiencies will be more pronounced once the Peka Peka to Ōtaki expressway is opened where northbound drivers will be coming off an expressway level design all the way from Wellington.
- Almost 40 intersections and over 400 accessways on the rural sections of SH1 and SH57, which is over five times the number recommended in the Planning Policy Manual for this type of highway.
- Over 50% of SH1 and 20% of SH57 have very narrow shoulders less than 1.2m, which is problematic for loss of control crashes, walking, cycling and the high number of agricultural vehicles which use this corridor.
- Approximately 82% of the length of SH1, and 89% of length SH57, is rated as consisting of either a moderate or a severe roadside hazard.
- The SH1 (National High Volume) and SH57 (National) corridors both currently have a published KiwiRAP 2 Star Rating. The SH1 corridor represents one of the longest

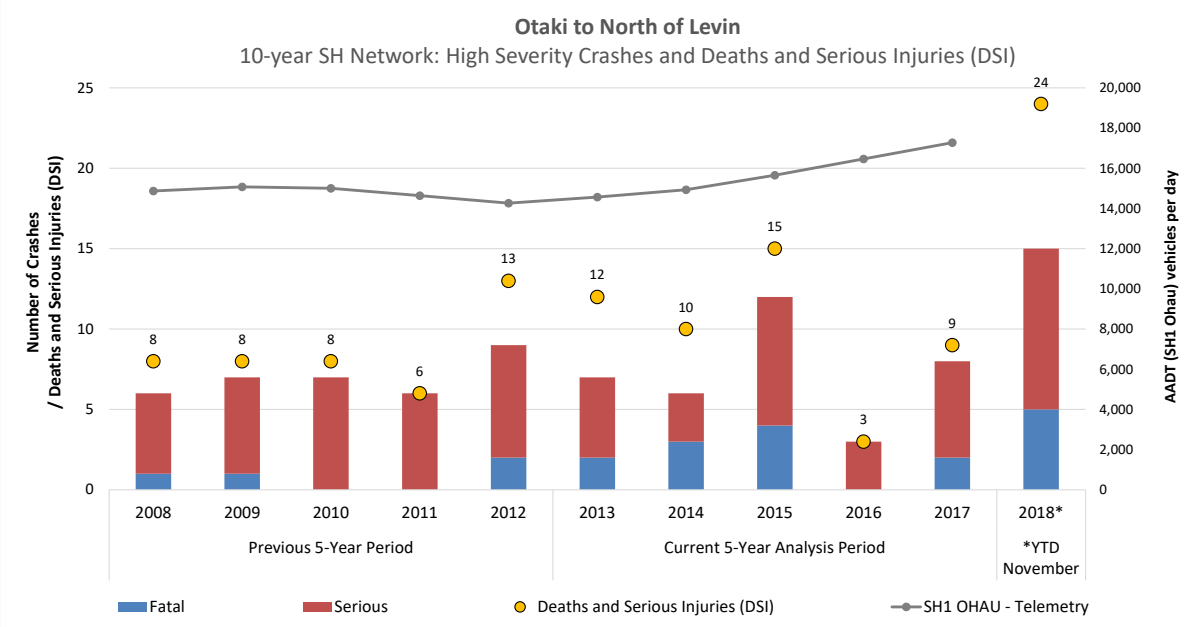
[1] The HDC LTP growth scenario (one of two modelled scenarios), represents the growth forecast by Horowhenua District Council as predicted by NZIER and Sense Partners and reflected in their Long Term Plan. Historic traffic growth is approximately 3.9% per annum since 2013.

continuous lengths[2] of 2 Star rated state highway on a National High Volume road[3] in New Zealand.

Both SH1 and SH57 within the project area place in the top band of a high risk rural road. SH1 from the Wellington Boundary to Levin ranks as the 8th worst rural state highway section in New Zealand in terms of fatalities and within the top 2% of corridors in New Zealand when comparing crashes per year per km over the five year period 2013 to 2017.

In the last five years (2013-2017), there were 11 fatal crashes and 25 serious injury crashes on the two state highways within the project area, which resulted in 49 deaths and serious injuries (DSi). Additionally, there were 98 minor injury crashes, and 261 non-injury crashes.

Unfortunately, 2018 has already become the worst year of the past ten years, with 15 high severity crashes resulting in 24 DSI in the project area. This is well illustrated by the figure below.



Resilience

This section of SH1 in particular is at high risk of closure from:

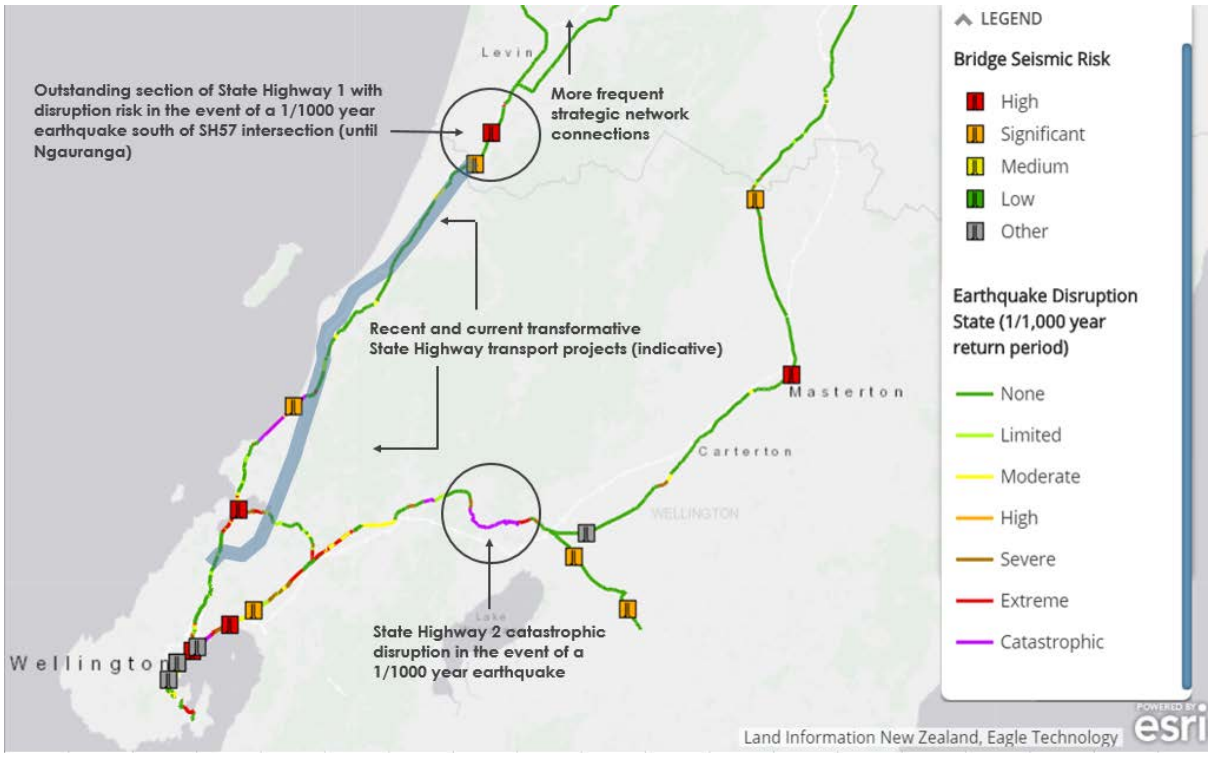
- Crashes – as outlined above
- Earthquakes – five bridges have a high or significant earthquake disruption risk
- Flooding – the existing highway passes through a floodplain and is also subject to surface flooding – two recent large scale events closed the highway – one for 90 minutes and the other for over 24 hours.

The importance of this route cannot be understated. SH1 is critical in the overall accessibility of Wellington as the only other alternative route is on SH2 via the Remutaka Hill

[2] As viewed in 5000m scale on SafetyNET (2017)
[3] Refer to https://www.nzta.govt.nz/assets/Road-Efficiency-Group-2/docs/customer-levels-of-service.pdf for information on road category ONRC targets.

which is at high risk of closure in a significant event. For SH1, two of the highway bridges with the highest risks are over the railway line, so if they fail, it affects both modes.

When an event occurs between Manakau and Ōhau that closes the highway, the trip from Wellington to Levin increases by about 2 hours. These times will be much longer during peak hours.

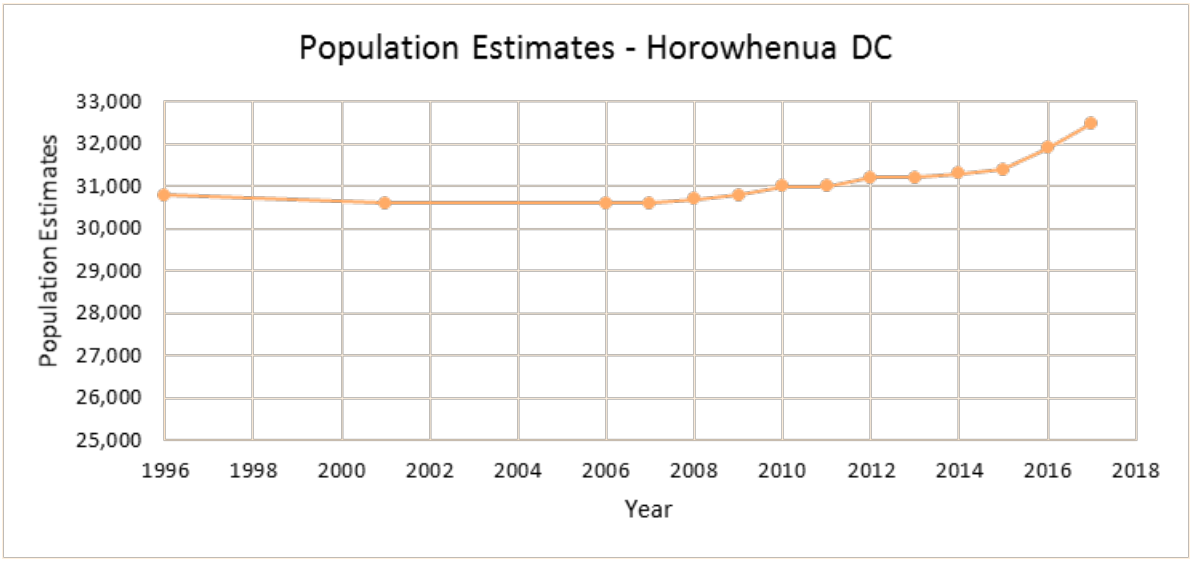


An indicative economic assessment of the impact of this showed that in a scenario where SH1 was closed and where there was no viable alternative (except SH2), then the total cost per day to road users was approximately $2 million[4].

[4] The indicative road user costs of the detour were based on the travel time, vehicle operating costs and crash costs impacts of 17,000 vehicles per day travelling the alternate route via SH2, Pahiatua Track & SH57, an additional 2 hours or 229 km.

Horowhenua Development

Horowhenua has been subject to mostly static growth in recent history. However, the last few years has seen a significant increase (see figure below). This is expected to continue, especially considering the investment in the transport corridor between Wellington and Ōtaki. Horowhenua District Council projections to 2040 equate to an additional 9,200 people living in the district.



As a population grows, so do the civil infrastructure requirements, such as transport, building floor / commercial space, and residential units. Growth areas have been identified by Horowhenua District Council at various locations within the study area including; Ōhau, Manakau and Levin East (Gladstone Green). Gladstone Green represents the Council's most significant or largest growth area. However, the traffic volumes and existing network layout do not allow for safe or effective access to these destinations.

If nothing is done, growth is likely to be stifled, and/or growth will occur in a manner that results in the inefficient use of land, causing undesirable land-use integration/ town planning outcomes and worsening of future transport issues.

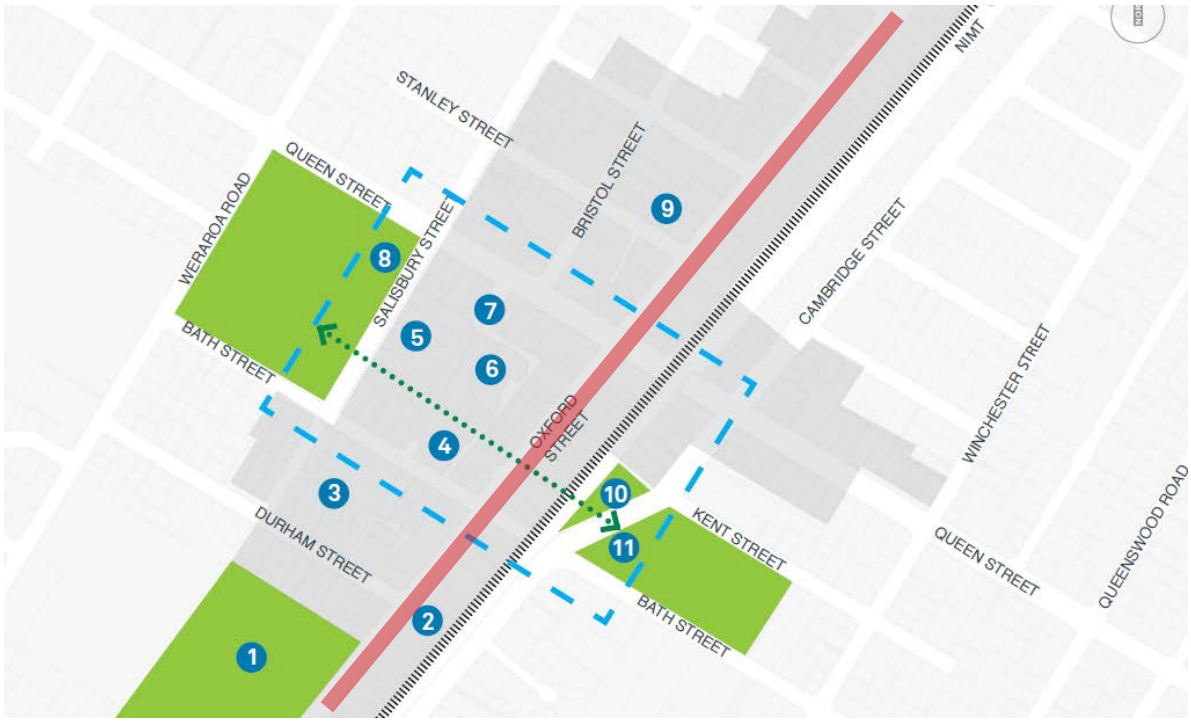
It will also impact on the realisation of a number of current strategies including the Horowhenua Growth Strategy 2040 and Accelerate 25.

This impact is difficult to quantify, however a socio-economic impact of the Horowhenua 2040 Strategy was under taken by NZIER[5] which involved a high level assessment of the economic impact of the Horowhenua 2040 portfolio of projects (including O2NL). The assessment found that based on the population and economic growth expected to stem from the O2NL offline transport improvements, the Horowhenua economy would have a Net Present Value (NPV) increase of $400M by 2040.

[5] Socio-economic impact of Horowhenua 2040 Strategy, NZIER, 2018. Appendix 6: Cost Benefit Analysis.

Levin Town Centre Revitalisation

SH1 through Levin is a National Strategic highway but as it runs straight through the middle of Levin it also serves the primary retail, commercial and hospitality areas. Levin currently has an estimated 2018 population of 21,200[6] residents.



The conflict between the use of SH1 Oxford Street as both a main freight route and a town centre results in the town centre attractiveness being much lower than it otherwise could be. This is due to a range of factors such as:

- Noise
- Emissions
- Safety
- Smell (stock trucks)
- Severance

These concerns were confirmed by the community during the 2017 consultation and reported in the Engagement Summary Report. Safety in particular is a problem (as presented above) and crashes in Levin Town Centre have been increasing in recent years.

Horowhenua District Council are currently finalising their Transforming Taitoko/Levin Town Centre Strategy which involves re-vitalising the town centre. Having a busy state highway running through the centre of Oxford Street will severely compromise the achievement of this strategy. The number of vehicles passing through Levin is projected to increase from 14,200 vehicles per day (2017) to over 16,200 vehicles per day by 2041, if growth occurs as

[6] Subnational population estimates at 30 June 2018, http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE7541

forecast by the Horowhenua District Council. This will cause corresponding noise, safety, emissions, and community severance effects to increase.

Strategic Alternatives

A number of different approaches have been considered to address the short and long term needs of the transport network between Ōtaki and north of Levin. These have been developed over a number of years and include:

- **Integrated Planning** – land use alterations to reduce the demand for travel
- **Public Transport improvements** – to reduce the demand on the road network
- **Speed Management** – a quick low cost way to partially address the serious safety issue
- **Minor Safety Improvements** – includes installing signs, line-marking, surfacing, barriers and intersection improvements to reduce the crash risk/severity
- **Localised Highway Upgrades** – infrastructure upgrades at the major problematic areas on the current highway network
- **Larger Highway Upgrades** – combining some of the nearby localised upgrades to provide a more consistent road environment
- **Upgrading the existing state highway to be a four lane expressway** with access only at interchanges
- **New offline state highway route from Ōtaki to South of Levin** –from the Peka Peka to Ōtaki expressway to the current state highway around Ōhau
- **New offline state highway route from Ōtaki to North of Levin** – extending the expressway from the south to also bypass Levin

A number of alternatives were not assessed in any detail because, by themselves, they fundamentally do not resolve the identified problems. These are Integrated Planning, Public Transport Improvements and Speed Management. However, elements of these alternatives will be very important as part of the overall response for the land use and transport network between Ōtaki and north of Levin. Accordingly, how these elements can be incorporated will remain a consideration in ongoing investigations.

A range of solutions both using the existing highways and creating new offline highways have been considered. The option of upgrading the existing state highway to a four lane expressway was discarded early, as in order to avoid constraints and achieve design standards, it would need to be offline for over 70% of the length. It would also be more expensive and would likely have greater environmental, social and cultural effects than an offline route.

The remaining approaches were subject to an analysis against the problems, the GPS objectives, other strategies and plans, potential impacts and risks. The recommended approach is one that best addresses the problems and GPS objectives whilst not creating un-mitigatable impacts or risks.

The investigation clearly shows that a four lane type solution would deliver the best results against the problems and objectives. It is recognised that such an approach is very expensive and accordingly future investigations will need to carefully consider how this investment can be staged or deferred in order to be affordable. It is necessary to progress the investigations on this basis so that the preferred corridor and its subsequent development is consistent with the long term transport requirements and is able to accommodate likely future transport demands. This approach also provides certainty to our stakeholders and partners including the local community, and thus enables them to plan accordingly. As indicated above, a key part of these future investigations is to consider and plan for the role of speed management and potential public transport improvements as part of a holistic integrated planning approach for growth in the Horowhenua District. These matters will be considered in the next phase of investigations and will advise on how transport improvements should be implemented over time.

	Strategic Alternative					
	Do Nothing	Minor Safety	Online Highway Upgrades	Online and Offline Highway Upgrades	Taylors Road to South of Levin New Offline Highway	Taylors Road to North of Levin New Offline Highway
Problem 1: Safety	NO	NO	Partially	Partially	YES	YES
Problem 2: Resilience	NO	NO	Partially	Partially	YES	YES
Problem 3: Growth	NO	NO	Partially	Partially	Partially	YES
Problem 4: Levin Town Centre	NO	NO	NO	NO	NO	YES
Land/Community Blight	NO	NO	NO	NO	Partially	YES
Iwi	NO	NO	NO	NO	YES	YES
(Part of) Enduring solution	NO	YES	Possibly[7]	Possibly[8]	YES	YES

[7] Enables four lane expressway at any location in the future. Online upgrades may be greater that what is required for revocation.
[8] Could upgrade to four lanes but it has significant impacts and may not meet long term outcomes. Could still build new offline route, but this online option would be much greater than revocation needs.

Long List Options

The long list of options was developed from historic studies, previous investigation stages of Ōtaki to north of Levin, and input from the community. This is shown in the figure below:

The routes were the subject of a four stage community Multi Criteria Analysis process involving:

- **Stage 1:** The project team updated information on constraints and opportunities mapped for the initial Area stage in 2011. It also prepared maps of a range of broad routes for consideration.

- **Stage 2:** A community workshop (Workshop 1) was held to review and revise, as appropriate, the preliminary corridors and the route options evaluation criteria.
- **Stage 3:** A community workshop (Workshop 2) was held to determine if any of the possible routes were fatally flawed, to score each option against the agreed criteria and to determine a 'community' weighting for the criteria.
- **Stage 4:** The project team undertook analysis of the findings from the community workshop.

The assessment criteria agreed through the process were as follows:

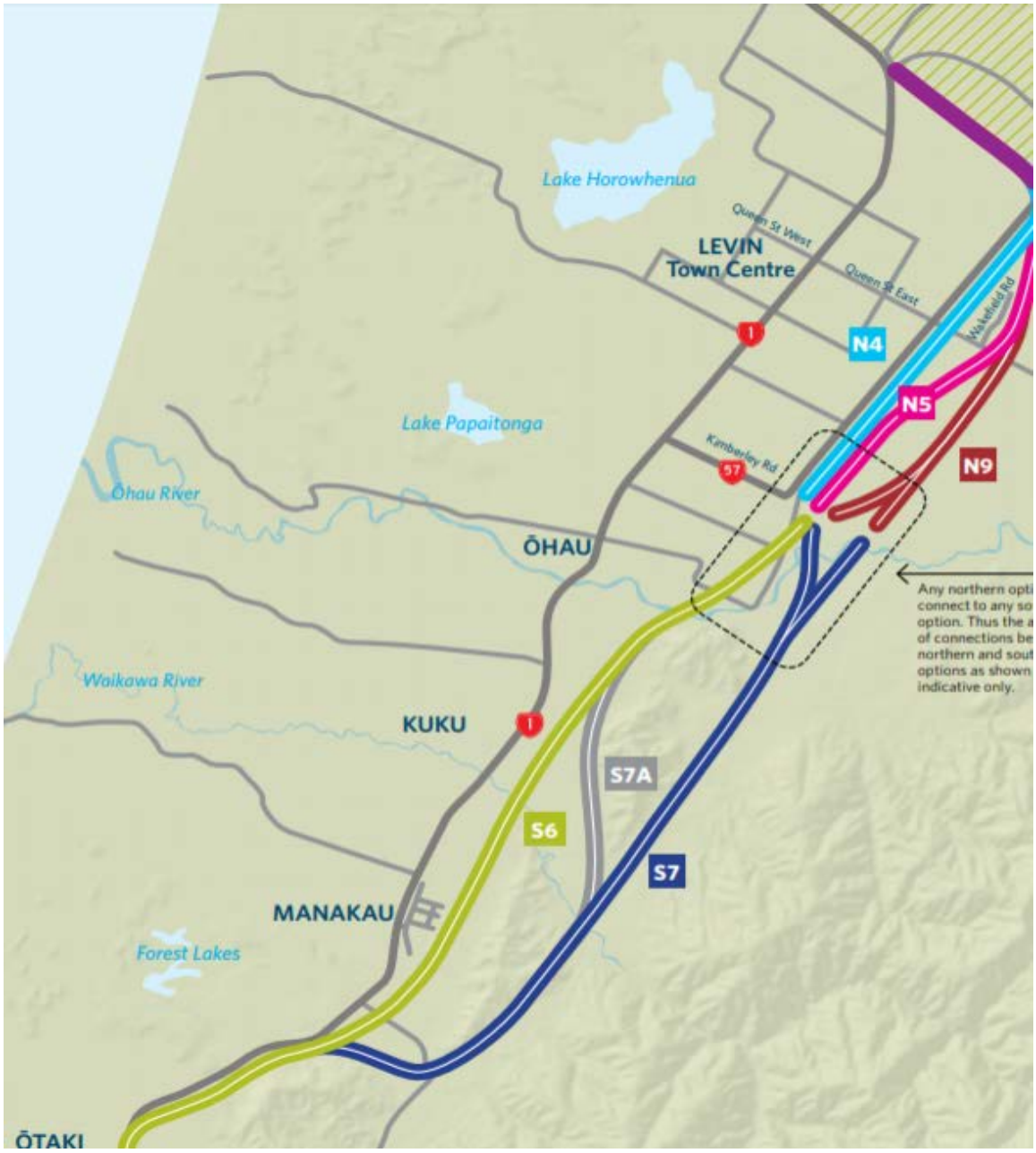
The Multi-Criteria Analysis (MCA) process reduced the long list down to 13 options, but also identified that there were a few major matters that needed to be considered in more detail before the options were shortlisted any further. Three main areas were investigated:

- **Tangata Whenua Impact**: Some of the routes were considered fatal flaws by iwi representatives in the MCA workshop due to their significant impact on sites of cultural significance, areas of previous occupation and the need to take extensive areas of Maori land. Further discussions with iwi have confirmed that routes to the west of Levin would have a very significant impact.

- **Traffic Modelling**: During the MCA investigations, some of the routes did not appear to provide for access from the new highway to the key destinations of Levin or SH57 north of the project area, so traffic modelling was undertaken to fully understand the performance of the options and the ability of the route to attract traffic of SH1. This showed that the western options were only beneficial for traffic heading to /from SH1 to the north, but not for traffic travelling to/from Levin or SH57. Likewise the far eastern route, N8, was not attractive for trips to/from Levin. Accordingly, this means that drivers travelling to/from Levin and Palmerston North are unlikely to choose to use the new highway.

- **Constructability**: Some of the alignments (S7 and S7A) go through parts of the project area which have not been considered in detail previously. Accordingly, additional information was collected through LIDAR, site visits and helicopter inspection (as some parts of the route are difficult to get to on foot) to get a better understanding of the constraints and complexities of the route. No fatal flaws have been identified in terms of the constructability of an option through this area. However, there are a number of deep and wide gullies through which the larger rivers and streams negotiate that will cost substantial amounts to traverse

Based on the above, the following options were retained and were the subject of a public consultation exercise in early 2018.



A summary of the key attributes of the shortlisted options are summarised in the table below:

Criteria	Southern Options			Northern Options		
	S6	S7	S7A	N4	N5	N9
Length (km)	14.7	15.7	16.7	9.5	9.8	9.5
Number of Dwellings located in corridor option	39	29	26	76	76	73
Amount of Productive Land located in corridor option(ha)	230	315	290	40	95	130
Cost Estimate ($M) (IBE) 4L = 4 lane / 2L = 2 Lane	4L ~$450 2L ~$360	4L ~$690 2L ~$550	4L ~$600 2L ~$480	4L ~$300 2L ~$240	4L ~$300 2L ~$240	4L ~$300 2L ~$240
BCR (excl. Wider Economic Benefits)	BCR < 1 (with N4)			BCR < 1 (with S6)		
Traffic off SH1	75% (with N4)	66% (with N4)	64% (with N4)	75% (with S6)	68% (with S6)	<68% (with S6)
Other Key Environmental Effects	Severance & Amenity around Manakau	Resilience, Ecology	Landscape, Ecology	Ecology, Heritage Buildings	Social Impact	Social Impact
Alignment with key project objectives	✓✓✓✓✓	✓✓✓	✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓
MCA performance (best to worst by section relative to one another)	1st	2nd	3rd	2nd	1st	3rd

Consultation

The Transport Agency undertook further engagement with landowners, key stakeholders and the Horowhenua community on the shortlisted options from January to March 2018.

Overall, the engagement showed that the community supports the O2NL project and recognises that something needs to be done to improve the safety, resilience and operation of the stretches of SH1 and SH57 between Ōtaki and north of Levin.

The engagement process focused on asking people to identify key features about each option that they liked or did not like; the team wanted to understand the 'why' behind a certain option preference rather than receiving a 'vote' for a favourite option. Nevertheless, throughout the process, people did tend to highlight a preference and would then explain their choice.

Option S6 was favoured by many due to the safety benefits, journey time savings, resilience and cost effectiveness of this option, but its impact on Manakau was noted. Option S7 was favoured by others as it had much reduced effects on the community and dwellings around Manakau, and there were also concerns around resilience, landscape and ecology. Whilst some people acknowledged Option S7A was a good compromise between Option S6 and Option S7 overall there was limited support for this option as it was longer, more indirect and did not meet the project objectives as well as Option S6 or Option S7.

In the north, Option N4 was favoured by many due to it best meeting the project objectives and that it is located near existing development, but impacts on ecology, productive land, heritage and existing dwellings were raised. Option N5 was not discussed by many submitters. Option N9 was favoured for a connection to S7 and due to it affecting the least number of dwellings.

Further investigations

In response to public consultation feedback, additional ecological, heritage, social and noise assessments were undertaken. The results of these assessments is presented in the table below.

Criteria	Southern section options			Northern section options		
	S6	S7	S7A	N4	N5	N9
Noise: approx. number of dwellings newly affected by road noise[9]	60	40	35	90	115	115
Social (best to worst performing)	2nd	1st	2nd	1st	2nd	2nd
Heritage	Can avoid / minimise effects	Can manage effects	Can manage effects	Can manage effects	Can avoid / minimise effects	Can avoid / minimise effects
Ecology	Can avoid / minimise effects	Can manage effects	Can manage effects	Can manage effects	Can avoid / minimise effects	Can avoid / minimise effects

The social impact assessment showed that the difference in the performance of the southern options was not as pronounced as had been previously thought, and that whilst Option S6 remained the poorest performing, it was not that much different than other southern options. The assessment shows also that of the northern sections, Option N4 represents a lowest negative effect option.

The noise assessment indicated these effects are likely to be able to be managed. For the northern section, Option N4 exposes the least number of dwellings to a state highway noise environment and has the least number of dwellings likely to require noise mitigation treatment.

Additional heritage and ecological assessments were undertaken in respect of buildings / areas identified during the consultation and engagement process that were not previously known. This process did not result in any adjustment to the MCA scores, but it is noted that there is opportunity to refine a preferred option to avoid and or minimise or otherwise manage these type of potential effects.

The MCA analysis was updated as a result of the further analysis. This did not result in a significant change to the outcomes but it did emphasise the numerous aspects, regardless

[9] Noise criteria identifies the number of properties that would be newly affected by state highway road noise but does not include properties currently affected by existing state highway noise. Assessment based on 500m wide corridor (250m either side of the centre of each corridor options).

of route choice, which the next stage of development of the preferred option (once selected) must avoid, remedy, mitigate, offset and/or compensate.

An independent peer review of the MCA process was also undertaken which confirmed that the process was valid and valuable. Whilst some opportunities for improvement were identified, the reviewer stated that these would not have been material to the outcome.

Recommended Option

From the investigations undertaken, the recommended option in the south is Option S6. It was, on balance, the best performing option through the MCA process, it is the lowest cost option, and the option which best meets the project objectives.

It is acknowledged that social impacts were assessed as being significant across all corridors, and that S6 is the option with the greatest amenity effects on dwellings. Ensuring these effects are appropriately addressed will require detailed consideration during the next phase of investigation in consultation with the local community and landowners.

The performance and impacts of the northern options are more finely balanced than the southern options. This is reflected in the overall MCA outcomes where the options are only different from one another in respect of ecology, heritage and productive land values.

Option N9 can be discarded as it was the poorest performer in the MCA workshop, is the worst at meeting the project objectives and would have the least logical alignment once connected with the recommended southern route, Option S6.

In respect of the Project Objectives Option N4 performs the best, as it offers the shortest journey, is the closest to Levin Town Centre and is predicted to divert (and accommodate) 75% of traffic from the current network onto the new state highway. This is reflected in the benefit to cost ratio calculation which shows Option N4 performing best, providing the best safety performance and journey efficiency.

Option N5 does perform the best overall from an MCA perspective, due to its lower ecological and heritage effects as compared with Option N4. However, additional field survey of the ecological and heritage areas affected suggest that the effects of Option N4 can be minimised or appropriately managed.

Additional more detailed social and noise studies have been undertaken and these conclude that Option N4 performs better as compared with the other options (in these respects).

A key differentiator between Option N4 and Option N5 is that Option N4 is aligned close to and parallel to the existing SH57, meaning that a number of the properties that Option N4 would affect (from a noise and thus amenity perspective) are already currently affected by state highway traffic, which would be diverted onto Option N4 once that is constructed. It is also noted that the community feedback tended to favour Option N4 ahead of Option N5 and Option N9 and this may be reflective of the alignment of Option N4 adjacent and close to SH57.

Accordingly, it is recommended that Option N4 is adopted as the preferred northern option, noting it performs the best in terms of the achievement of project objectives, and has least effect on existing properties and social effects. The key effects on ecology and heritage should be able to the adequately managed and mitigated. Option N4 also ties into Option

S6 coherently and had greater community support during the recent community engagement process. It is acknowledged that Option N4 is least desirable in respect of the planned urban growth (at Gladstone Green) but these potential impacts can be avoided through the design of the future growth area, i.e. these are potential effects on dwellings yet to be built and thus considered to be less determinative than effects on dwellings and urban environments that currently exist.

Care will be needed during the ensuing investigations to consider how potential effects of Option N4 on the ecological and heritage sites can be avoided or mitigated. In addition, the future urban expansion of Levin will also need more planning to ensure the development and the state highway are appropriately integrated without significant impact on one another.

Next steps

The preferred option would provide a new 24km long new highway road between Taylors Road (Ōtaki) and north of Levin. It has an estimated cost of up to $790M (95th%tile). The benefit cost ratio indicates that the level of investment required (for both 2-lane and 4-lane options) will not result in an economic return (in standard transport benefit terms) on the investment, even though this level of investment is very clearly needed to fix the fundamental issues with this corridor, and is the only method available to deliver effectively on transport safety and resilience objectives.

Accordingly, the next phase of investigation will need to critically consider how investment can be staged. Staging should consider how improvements could be achieved over sections, as well as two and four lane options. This will need to include consideration of the planned growth and development objectives of the Horowhenua District, Horizons Regional Council and Accelerate 25. Staging will also need to consider and be mindful of the potential future road hierarchy and ongoing investigation of public transport.

The safety performance of the current state highway network is of considerable concern and it is unlikely that significant investment (either on or off-line) will be constructed and completed in the short term. Therefore, online safety improvements to SH1 are recommended to be commenced immediately irrespective of the outcome of future improvements. The scope of these improvements is defined in the "Ōtaki to north of Levin SH1 interim safety improvements" September 2017 report.

Thus the overall next steps are:

1. Interim safety improvements to the existing SH1 corridor
2. Undertake a Detailed Business Case for Ōtaki to north of Levin which considers:
    a. Further potential improvements to SH1 (allowing for revocation)
    b. Staging of off line improvement options
3. Investigate public transport improvements

1. INTRODUCTION

Purpose

The purpose of this report is to outline the business case (indicative) for improvements to the state highway network between Ōtaki and north of Levin.

The Ōtaki to north of Levin project was subject to a re-evaluation process in 2018 to ensure that it aligned with the new priorities and strategic direction set out in the Government Policy Statement on land transport. This IBC has been updated since that process and reflects its outcomes. The re-evaluation report is attached as Appendix M.

Project Area and Background

The Wellington Region has the second largest economy in New Zealand. It contains the centre of Government, 11% of the nation's population and 13% of the GDP. The economy is dominated by knowledge-intensive industries, with 60% of the region's jobs located in Wellington City.

By contrast the Manawatu-Whanganui economy has been experiencing slow or static growth, ageing and declining populations and employment. However, it is full of promise with rich farmland and strong agricultural industries. It has therefore been identified by the Ministry of Business, Innovation and Employment as one of nine Regional Economic Development (RED) regions which should be prioritised to increase jobs, income and investment. An action plan (Accelerate 25) is underway to facilitate this upturn. Initial indicators show that growth is starting to accelerate:

- SH1 annual traffic growth has risen strongly in the five years to 2017, at 3.9% south of Levin and 3.3% in north Levin. Over the same period SH57 north of Levin has grown by 3.2% annually[10]. This is greater than the annual average traffic growth over the lower North Island which was 2.3%[11].
- Tourism employment growth has been at or above 8% per annum since 2015 (higher than the NZ average)[12].
- Horowhenua District has also had strong Gross Domestic Product (GDP) annual growth of up to 3.8% in 2016 and 2017, higher than NZ overall at 3.6%[13].
- Building consents are up around $400,000 compared to an average of $270,000 over the preceding 10 years[14].

To continue Wellington's and Manawatu-Whanganui's growth, it is vital to get people and freight moving safely and efficiently between these regions and to and from the rest of the North

[10] Annual Average Daily Traffic volumes extracted from four NZTA traffic count locations near Levin.
[11] This is an AADT weighted average of all national telemetry State Highway sites (except Manawatu Gorge and those with incomplete 2013-2017 data) for Gisborne, Hawkes Bay, Manawatu-Wanganui, and Wellington NZTA regions.
[12] https://ecoprofile.infometrics.co.nz/Horowhenua%20District/Tourism/TourismEmployment
[13] https://ecoprofile.infometrics.co.nz/Horowhenua%20District/Gdp/Growth
[14] http://archive.stats.govt.nz/infoshare/SelectVariables.aspx?pxID=ffed213a-c0b4-4067-a189-806934d50e4f

Island. Indeed Palmerston North, with its distribution hubs and inland ports, is the largest freight node in central New Zealand[15].

Horowhenua District Council is working closely with Accelerate 25 in order to stimulate and promote economic growth and investment in the Manawatu Region. The Council is in the process of updating its Growth Strategy and is developing a Town Centre Strategy to both encourage appropriate growth throughout the region and transform and re-vitalise Levin.

The NZ Transport Agency is working with the Horowhenua District Council in order to align and integrate the design of the transport improvements with their economic development and urban growth aspirations.

The Ōtaki to north of Levin project area is the transition between the Manawatu/Horowhenua Region and the expressway connection into Wellington and its key regional facilities including the hospital, port and airport. However, the highways (SH1 and SH57) are not designed to safely or efficiently meet the demands of our customers. SH1 between Ōtaki and Levin is a National (high volume) highway but has poor alignment, is straddled by townships and includes narrow curved bridges and many side roads. It also provides access to significant adjacent land use activities comprising residential, retail, community, commercial, industrial, farming and horticulture, conflicting with the through route function of the state highway.

The current investigations are considering the route from Taylors Road (the northern end of the Peka Peka to Ōtaki expressway) through to north of Levin (approximately Heatherlea East Road) on both SH1 and SH57, providing safer, more resilient and easier access to Levin, Palmerston North via SH57, Taupo and destinations further north via SH1.

2017 Consultation/Re-engagement

Consultation/re-engagement exercises undertaken in mid-2016 provided valuable feedback for the Project. No routes were consulted upon, instead people were asked to provide their likes and dislikes; issues; opportunities and ideas about transport within the project area. Key outcomes were:

- There are a number of features unique to the Horowhenua District: highly productive soils; village character; marae; rural lifestyle; spiritual connection between Lake Horowhenua and the Tararua Ranges; heritage buildings.
- Positive comments about the recent safety improvements in Ōhau and Manakau, but many more comments highlighting other concerns, like the narrow bridges and lack of safe passing opportunities.
- There was strong support for the need to bypass Levin and other townships/villages. There was some concern about removing passing traffic and potential trade from Levin, but the majority recognising the need to reduce congestion and to have heavy vehicles out of the town centre.
- Some people talked about routes to the east of Levin, and generally communities located to the east of SH1 / SH57 considered that a route to the west of Levin should be developed. It was considered important to find a route that minimises the impact on

[15] http://www.horizons.govt.nz/HRC/media/Media/Agenda-Reports/Regional-Transport-Committee-2016-6-09/16177%20Annex%20B%20Transport%20Investment%20Opportunities%20paper%20to%20Governance%20Group.pdf

residential and agricultural land. Some commented on the need to continue the project further north.

Location and Context

This project is predominantly located in the Horowhenua region, just over an hour north of Wellington as seen in Figure 1-1 (highlighted in purple).

Construction of the Peka Peka to Ōtaki expressway is due to be completed in 2020. Once complete, this would provide a minimum 4-lane expressway from the Wellington CBD to north of Ōtaki (Taylors Road), as the Mackays to Peka Peka expressway opened in February 2017 and Transmission Gully is also due for completion in 2020.

To the north of Levin, the construction of the Whirokino Trestle and Manawatu River Bridge replacement project has begun, which could result in approximately 40[16] additional heavy vehicles a day utilising SH1 through the northern extents of the project area[17].

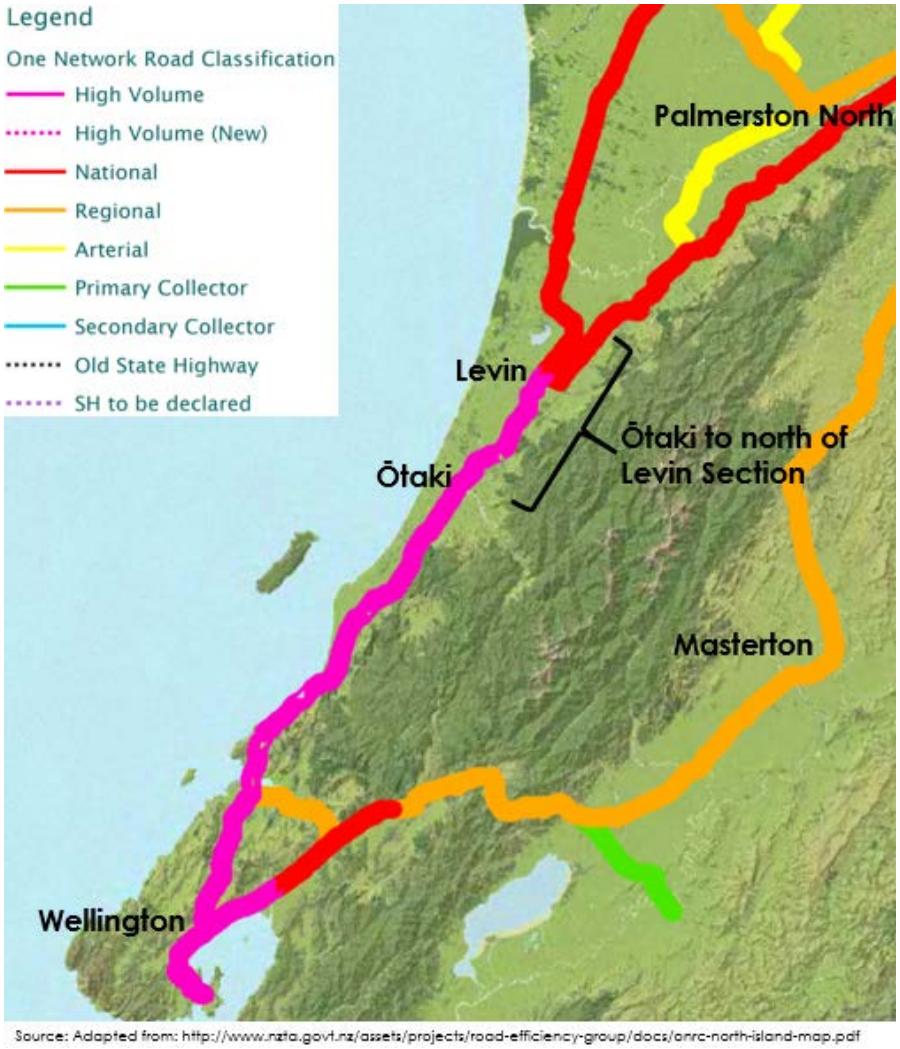


Figure 1-1: Wellington Northern Corridor

[16] This is the estimated number of heavy vehicles that will transfer from alternate SH3/54/56 route to SH1 due to the provision of a bridge that can now cater for HPMV (bridge currently only allows up to 50MAX). There is potential that the number could be as high as 60, due to suppressed demand.

[17] https://www.nzta.govt.nz/assets/projects/whirokino-trestle-and-manawatu-river-bridge/docs/PSW-202-SAR-050215-Final.pdf

Existing and Future SH1 Demand

Approximately 17,300 vehicles per day (vpd), including over 1,700 heavy vehicles, currently travel along SH1 near Ōhau (2017), this is estimated to increase to 22,600 vpd by 2041 if growth occurs as forecast by the Horowhenua District Council[18].

North of the SH1/SH57 intersection, the existing traffic volume on SH1 through Levin is approximately 14,200 vpd, this is estimated to increase to 18,000 vpd by 2041. The SH57 traffic volume north of Queen Street is currently over 9,200 vpd and is estimated to increase to 12,000 vpd by 2041. These traffic volumes consist of a mix of freight and private vehicle trips, i.e. regional/inter-regional freight and the inter-regional/local access movement of people.

The expected growth through the project area will likely result in a significant reduction in passing opportunities, a reduction in mean speed and a greater sensitivity to unplanned or unexpected events (e.g. slips, crashes or weather events are likely to cause congestion).

It also means that the ability for people to access the highway is reduced with less gaps available for drivers to safely enter the traffic flow from side roads.

[18] The HDC LTP growth scenario (one of two modelled scenarios), represents the growth forecast by Horowhenua District Council as predicted by NZIER and Sense Partners and reflected in their Long Term Plan. Historic traffic growth is approximately 3.9% per annum since 2013.

Figure 1-2: Project area traffic volumes (2017)

Impact to Key journeys

Figure 1-3 shows the average northbound weekday afternoon peak traffic speeds through the project area, between 2016 and 2017. Figure 1-3 highlights Levin as a significant constraint for regional and inter-regional SH1 journeys. This has a negative outcome for state highway freight movements, as well as local journeys that attempt to cross or join SH1.

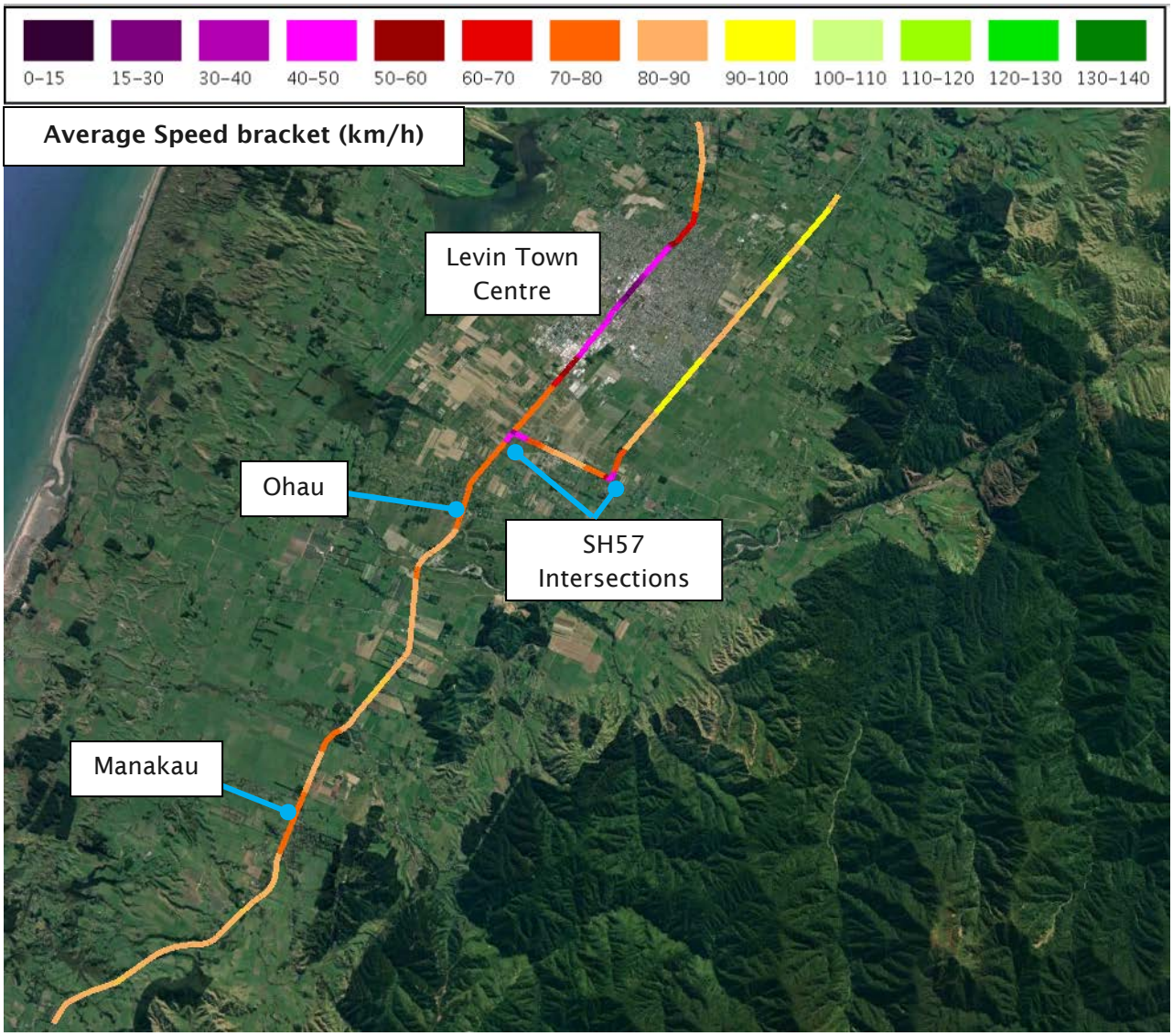


Figure 1-3: Weekday northbound PM peak Average Speed – Nov 2016 to Oct 2017 (Source: TomTom)

As presented in Figure 1-3 above, the rural average speed rarely rises above 90 km/h on either SH1 or SH57. In addition to slowing down through townships, Figure 1-3 also highlights where vehicle speeds reduce due to the combination of the poor geometric alignment and available road width of SH1. For example North of Manakau, traffic slows to 70-80 km/h to negotiate the Manakau rail overbridge, which is repeated at the rail overbridge south of Ōhau as well.

The SH1/SH57 intersection has some significant delays for right turn vehicles into SH57 as they wait for safe gaps in the opposing SH1 traffic stream and also due to the need to negotiate the right angle turn followed by a level crossing. The 90˚ bend at the SH57 Kimberley/Arapaepae also highlights that vehicles are slowing down to an average speed (through this bend and approaches) of 40-50 km/h to safely negotiate the bend, with vehicles likely to be travelling significantly slower through the bend itself.

Once SH1 traffic is north of Levin and north of the SH57 Kimberley/Arapaepae intersection, free flow conditions begin to return.

Public Transport and Active Mode Access

Bus

Currently public transport by bus makes up about 0.3% of the mode share total of work trips in the Horowhenua District[19].

Limited bus services are available around Levin, and to neighbouring districts. These include the following:

- 'A day out in town bus service' which connects Levin, Waitarere Beach, Foxton, Foxton Beach, and Shannon every Friday[20].
- Levin to Waikanae service which runs Tuesdays and Thursdays[21].
- Levin to Palmerston North commuter bus service which runs Monday to Friday[22].
- Longer intercity services which connects Levin with most other major destinations in the North Island[23].

Excluding the inter-regional intercity services, there are only 13 return bus/train services every week which could potentially be used by commuters (noting that some of these are focussed on shoppers / accessibility rather than commuters).

Rail

Currently public transport by train makes up about 0.8% of the mode share total of work trips in the Horowhenua District[24].

The Capital Connection[25] provides a daily commuter rail connection between Levin and Wellington.

Walking and Cycling

About 7.8% of people currently walk or cycle in Horowhenua District to work.

SH1 in Levin is generally wide (about 16 m kerb to kerb) with footpaths provided on either side of the road, crossings at signalised intersections, and some median pedestrian refuges. There are few formal provisions for cyclists. The urban corridor provides service for many uses; through traffic, local traffic, public transport, pedestrians, cyclists, parking, and freight. With increases to traffic volumes forecast this road will become 'all things for all people' on an increasing scale.

The rural speed environment of SH1 has sealed shoulders of varying widths (no sealed shoulders on the rail overbridges), so it is not suitable, nor safe, for cyclists to use SH1 to connect to Ōtaki and further south. Therefore, the urban and rural speed environments coupled with high overall

[19] Main means of travel to work for employed people in Horowhenua District, http://archive.stats.govt.nz/Census/2013-census/data-tables/tables-about-a-place.aspx?request_value=24465&reportid=14&tabname=Transport
[20] http://www.horizons.govt.nz/HRC/media/Media/Bus-Route/203624_Day-Out-In-Town-Flyer.pdf
[21] http://www.horizons.govt.nz/HRC/media/Media/Bus-Route/Levin-to-Waikanae-Bus-Amended-Timetable-NOV17.pdf
[22] http://www.horizons.govt.nz/HRC/media/Media/Bus-Route/Levin-timetable.pdf
[23] https://www.intercity.co.nz/travel-info/timetable/lookup/LVN
[24] Main means of travel to work for employed people in Horowhenua District, http://archive.stats.govt.nz/Census/2013-census/data-tables/tables-about-a-place.aspx?request_value=24465&reportid=14&tabname=Transport
[25] https://www.greatjourneysofnz.co.nz/northern-explorer/book/other-services/capital-connection/

traffic and heavy vehicle volumes strongly contribute to the poor uptake of active modes, particularly cycling. The long distances between townships south of Levin also makes cycling a less attractive mode of transport.

2. PROBLEM DEVELOPMENT

Based on the problem areas, issues identified during consultation, and background evidence, the project team developed the following problem statements (see Appendix C for an outline of the problem development process):

PROBLEM STATEMENTS	WEIGHT
Problem 1 – Safety: A HIGH AND INCREASING DEMAND FOR TRAVEL COUPLED WITH INADEQUATE TRANSPORT INFRASTRUCTURE IS RESULTING IN INCREASING NUMBERS OF DEATHS AND SERIOUS INJURIES ON THE ROADING NETWORK	50%
Problem 2 – Resilience: THE LACK OF RESILIENCE IN THE EXISTING TRANSPORT SYSTEM MEANS THAT CONNECTIONS, PARTICULARLY INTER-REGIONAL, ARE REGULARLY IMPAIRED OR LOST	30%
Problem 3 – Horowhenua Development: GROWTH MAY NOT BE REALISED AS EFFICIENTLY AS POSSIBLE AS SAFETY AND TRAFFIC CONCERNS ARE STYMYING THE EFFICIENT DEVELOPMENT OF PLANNED GROWTH AREAS	10%
Problem 4 – Levin Development: HIGH VOLUMES OF TRAFFIC, INCLUDING TRUCKS, THROUGH THE CENTRE OF LEVIN IS REDUCING THE ATTRACTIVENESS OF MAIN RETAIL AREA AND LIMITING INVESTMENT AND DEVELOPMENT	10%

The subsequent sections elaborate on the identified problems. Each problem is assessed in the following manner:

- The **cause** of the problem – what are the main causes which contribute to the problem?
- The **effect** of the problem – to road users, ease of access, commercial activity, the surrounding environment etc.
- The **consequence** of the problem – what are the health, environmental and economic effects created by the problem?

Problem 1: Safety

A HIGH AND INCREASING DEMAND FOR TRAVEL COUPLED WITH INADEQUATE TRANSPORT INFRASTRUCTURE IS RESULTING IN INCREASING NUMBERS OF DEATHS AND SERIOUS INJURIES ON THE ROADING NETWORK	
Cause(s)	• High, and increasing, traffic volume • Poor road geometry and alignment • Number and configuration of intersections and accessways • Narrow shoulders • Roadside hazards • Limited passing opportunities • Low Star Rating
Effect	• High risk of crashes occurring
Consequence	• High number of deaths and serious injuries • High collective risk (high severity crash density) • Crashes and DSI are likely to increase due to continued growth in traffic and land use development

Cause

High, and increasing, traffic volume

Approximately 17,300 vehicles per day (vpd) currently travel along SH1 near Ōhau (2017). This site has had a very high growth rate over the last five years - averaging 3.9% per annum. If this rate of growth continues then there will be over 20,000 vpd along SH1 near Ōhau by 2021.

North of the SH1/SH57 intersection, the existing traffic volumes on SH1 through Levin are approximately 14,200 vpd and this is estimated to increase to 18,000 vpd by 2041. The SH57 traffic volume (north of Queen Street) is currently over 9,200 vpd, estimated to increase to 12,000 vpd by 2041. These traffic volumes consist mainly of freight and private vehicle trips, i.e. regional/inter-regional freight and the inter-regional/local access movement of people.

The historic traffic growth trend is presented in Figure 2-1, which shows the increase in volume since 1992 of traffic count locations within (or very near to) the project location.

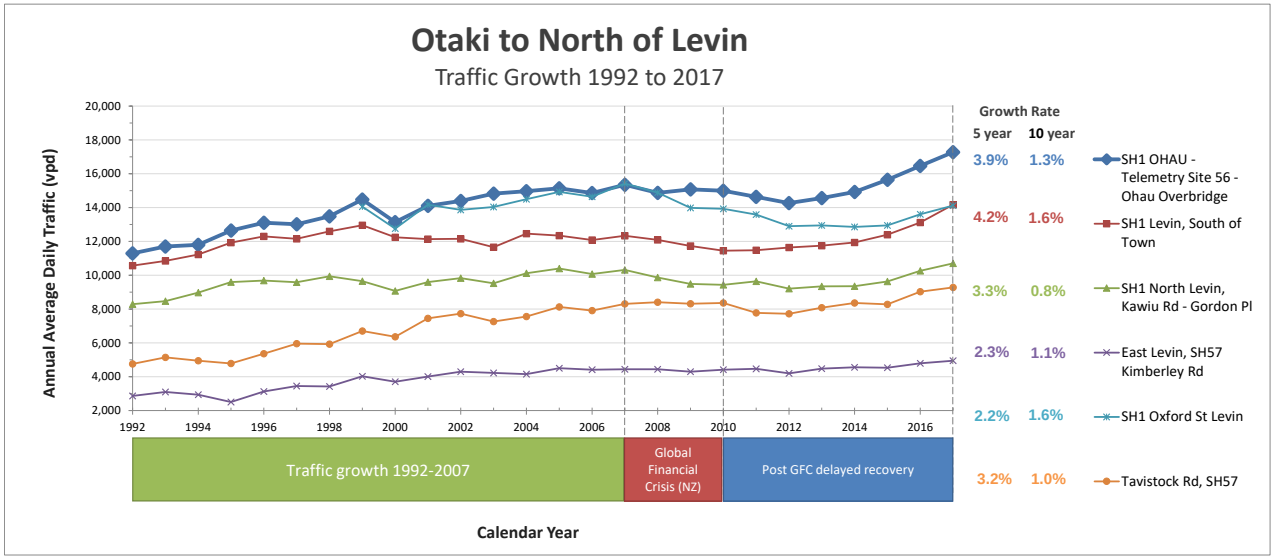


Figure 2-1: Historic Traffic Growth

Figure 2-2 provides a daily plot of traffic flow at Ōhau which shows that the volume of traffic is generally spread throughout the day, with little obvious peaks. In particular there is no AM peak and no times which are significantly quieter during daylight hours. This is likely to be a result of no strong commuter movement and also the function of Levin as a rural service town. Figure 2-2 also highlights the high, and relatively flat, average weekend traffic profile, which is equivalent to the weekday afternoon peak volume.

There are only a few other rural State Highways in New Zealand that carry in excess of 17,000 vehicles per day which are not four laned or don't bypass rural towns. These include SH2 west of Tauranga and the Hawkes Bay Expressway, both of which have significant safety upgrades planned.

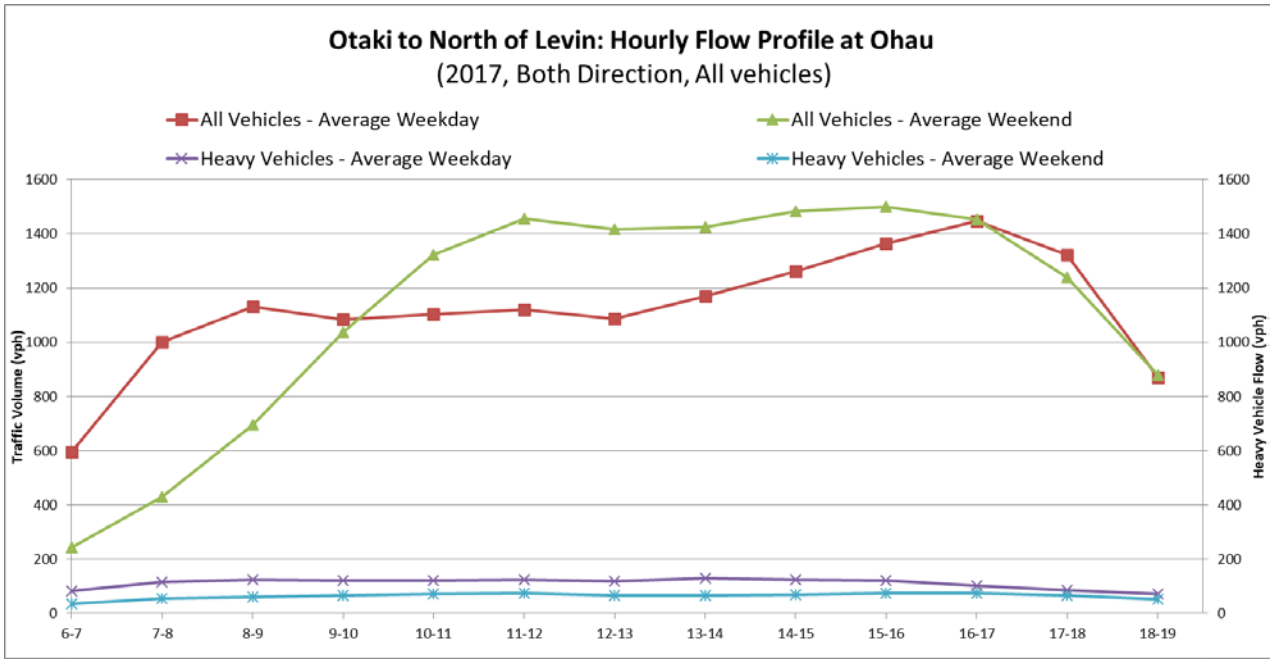


Figure 2-2: 2017 Average Weekday and Weekend Hourly Flow Profile at SH1 Ōhau (06:00 – 19:00).

Poor road geometry and alignment

SH1 has nine out-of-context horizontal curves and 14 deficient vertical curves, while SH57 has the Kimberley Road / Arapaepae Road right-angle bend which is out of context with the remaining straight horizontal alignment. Out-of-context curves include rural curves that require a significant reduction in operating speed when assessed against other geometric features[26].

With the Peka Peka to Ōtaki expressway opening in 2021, northbound motorists will transition from a high design standard expressway, where the road environment does not pose a high level of decision making for the driver, onto a substandard segment of existing SH1, that requires drivers to vary their speed, adopt a high level of awareness and thought processes to safely negotiate.

[26] Some definitions suggest a curve with at least 10 or 15km/h speed difference between the approach speed and the negotiation speed would be classed as out of context, but there is not a consensus on a single definition. For the purposes of this assessment, horizontal curves were classed as out of context if they were below 400 m horizontal radius and subject to a negotiation design speed of 10 km/h (or greater) below the approach design speed (which is the same definition used by RAMM).

Number and configurations of Intersections and Accessways

There are 29 local road priority control intersections with side road volumes varying from as low as 50 vpd (Atkins Road) to 4,950 vpd (SH57) located along the rural section of SH1 and ten along the SH57 corridor. Of the 29 intersections, one is National Strategic (SH57), one is a Primary Collector (Waikawa Beach Road), 12 are Secondary Collectors, and the remaining 15 intersections are access, low volume, or unknown in the One Network Road Classification.

Two of the most problematic intersections are the SH1/SH57 intersection and the Kimberley / Arapaepae Corner. The SH1/57 T' intersection is in high speed environment[27] with significant volumes of conflicting traffic movements, specifically the right turn movement from SH1 into SH57. The SH57 – Arapaepae Road/ Kimberley Road intersection is a crossroads priority intersection with a 90˚ change in direction with minimal curve radius and an unconventional layout.

For the remaining intersections, 60% of those on SH1 and 70% of those on SH57 lack right turn facilities; affecting both safety and efficiency. A lack of right turn facilities increases the risk of conflict between turning and through traffic while also increasing delay for through traffic.

In addition to the intersections, there are approximately 408 accessways on the rural sections of State Highway 1 within the project area which results in an accessway density of about 1 every 100m. This is significantly less than the guidelines within the Planning and Policy Manual of 1 every 500m for a posted speed limit of 100km/h. The current spacing is even less that that recommended for 50 km/h sections, which is 1 every 160m.

Narrow shoulders (more than half SH1 has shoulders less than 1.2m)

Approximately 57% of the rural SH1 corridor and 23% of the SH57 corridor have a sealed shoulder width of less than 1.2 m[28]; which is well below the 1.5 m Austroads standard for standard highways[29] and the desired 2.5m for high volume highways or expressways. Narrow shoulder widths are a concern for loss of control crashes and result in lower operating speeds and lane capacity[30], negatively impacting on journey time.

SH1 is also used by cyclists and many agricultural vehicles. The narrow shoulders pose a particular hazard for cyclists, and the lack of wide shoulders also results in agricultural vehicles straddling the lane and either holding up traffic or encouraging unsafe passing manoeuvers from following traffic.

[27] Noting that the current posted speed on SH1 through the intersection is 80km/h.
[28] Based on KiwiRAP background data sourced from the Transport Agency's KiwiRAP Assessment Tool (KAT).
[29] Table 4.5 of Guide to Road Design Pt.3 (Austroads, 2016).
[30] The State Highway Geometric Design Manual Section 6: Cross Section, paragraph 6.2.1, states that *"reductions in lane width reduces the lateral clearance between vehicles and also to fixed obstacles. This leads to reduced travel speed and lane capacity"*

Figure 2-3: Narrow shoulders on SH57 (Source: https://www.argonautltd.co.nz/roadrunner/)

Roadside hazards

The rural sections of both highways have a high frequency of moderate or severe roadside hazards. Approximately 82% of the length of SH1, and 89% of length SH57, is rated as consisting of either a moderate or a severe roadside hazard. This section of SH1 and SH57 has an approximately 25% higher proportion of moderate or severe hazards when compared to two-lane undivided sections of SH1 in the lower North Island (from the Desert Road Summit to Paraparaumu). It's not just a high proportion of moderate hazards either; severe roadside hazards account for than more 43% of the hazards along the corridor[31].

Figure 2-4 provides an example of the severe roadside hazards as classified in the Transport Agency's KiwiRAP Assessment Tool (KAT). There is a drainage ditch and fence on the right hand side and unprotected concrete power poles on the left hand side.

Figure 2-4: Example of SH1 severe roadside hazards (Source: https://www.argonautltd.co.nz/roadrunner/)

Limited Passing Opportunities

Approximately 77% of SH1 and 42% of SH57 has either double yellow lines, no sight distance for overtaking or is an urban area. The lack of passing opportunities (on SH1 in particular) is likely resulting in driver frustration and leading to motorists undertaking potentially unsafe overtaking

[31] Based on KiwiRAP background data sourced from the Transport Agency's KiwiRAP Assessment Tool (KAT). Severe hazards are defined as likely to cause fatality or serious injury e.g. trees greater than 300 mm diameter, rollover – greater than 4:1 fill, transverse wall / bridge pylon. Moderate Intermittent hazard likely to cause moderate damage or injury, e.g. shallow embankment, cut, longitudinal bridge or wall, mid-size culvert.

manoeuvres. The removal of Ōhau and Manakau passing lanes[32] on SH1 in 2015, as part of the Ōhau and Manakau Township Safety Improvements, has likely exacerbated the existing driver frustration issues.

In addition, there are no overtaking/passing opportunities through Levin (there is only one through lane at each set of traffic signals), and Figure 2-5 shows how few dedicated passing lanes are present between Ōtaki and Sanson. The O2NL project length is part of a 30km length (southbound) and 20km length (northbound) without passing lanes. This gap is much greater than the advisable distance of 5 – 10 km as recommended by the NZTA Planning Policy Manual Appendix 3E[33]. The impact of the limited passing opportunities and driver frustration will be further compounded as traffic volumes continue to grow, as opportunities for overtaking diminish and passing demand increases.

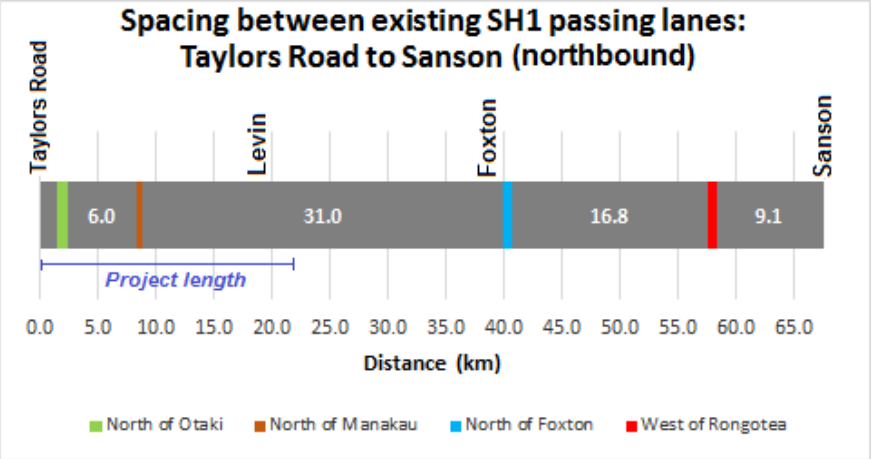


Figure 2-5: Existing SH1 northbound passing lane spacing

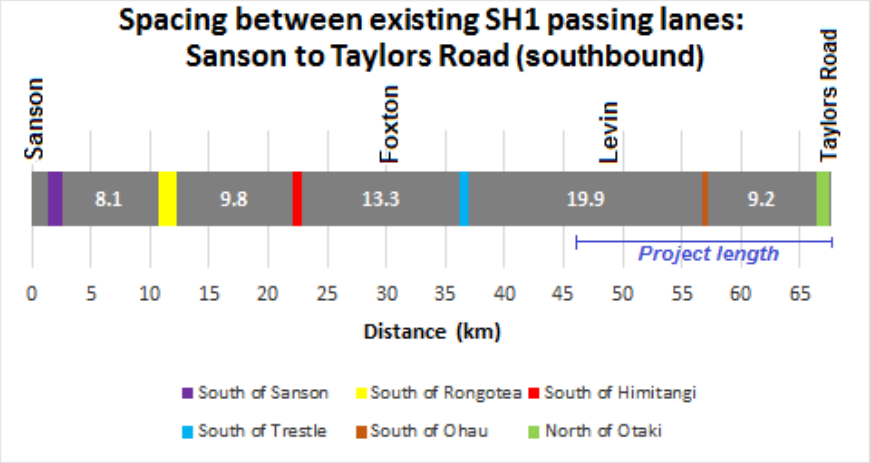


Figure 2-6: Existing SH1 southbound passing lane spacing

[32] The Transport Agency decided to remove the passing lanes at Ohau and Manakau as both passing lanes were too short and were located on the approaches into the townships, which resulted in increased vehicle speeds into the townships. The posted speeds in both townships were also reduced from 100 km/h to 80 km/h; therefore passing lanes on the approach to each township was considered out of context and unsafe.

[33] Transit (NZTA), Planning Policy Manual, Appendix 3E – Passing and overtaking,

http://www.nzta.govt.nz/resources/appendix-3e-passing-overtaking-policy/docs/passing-overtaking-appendix-3e.pdf.

In the project area there are only two passing lanes in each direction and these, at less than 1.0 km long each, are significantly shorter than the desirable passing lane length of 1.5 km.

There are no passing lanes in the 9.0 km segment of SH57, but overtaking is possible for two separate 1.5-2.0 km long sections, if there are no opposing vehicles approaching.

Poor KiwiRAP Star Rating

The KiwiRAP Star Rating is a measurement of how safe infrastructure is for the volume of traffic it carries. Many of the elements described in the sections above are used to formulate the rating as an overall indicator of safety of the infrastructure. The SH1 (National High Volume) and SH57 (National) corridors both currently have a published KiwiRAP 2 Star Rating (2.7 and 2.8 Stars respectively). The SH1 corridor represents one of the longest continuous lengths[34] of 2 Star rated state highway on a National High Volume road[35] in New Zealand.

Both ratings are below the One Network Road Classification (ONRC) targets for their respective road categories; which is 4 Star for National High Volume, and high 3 or 4 Star for National. The 500m Star Ratings of the project area are shown in Figure 2-7 (red indicating sections of 2 Star).

The three 1 Star segments circled[36] in Figure 2-7 are near the SH1 / SH57 intersection and the Manakau Township. These are rated 1-Star for the following reasons;

- **SH1 / SH57 intersection:** The North Island Main Trunk (NIMT) railway line crosses over SH57 at grade and is only 20 m back from the intersection limit line with SH1. This creates a significant hazard for heavy vehicles in the form of a short stacking hazard. The turning facilities are also substandard and there are other roadside hazards present.
- **SH57 south:** This is near the entrance to the Speldhurst Country Estate, where the right-turn bay on SH57 significantly reduces the **sealed shoulders well below 0.5 m wide.** There are also a number of non-frangible objects adjacent to SH57 that could be struck by errant vehicles, e.g. power poles and trees.
- **SH1 Manakau north:** This is the location of the Manakau Rail Overbridge, where the narrow cross section over the rail line combines with a poor horizontal and vertical alignment.

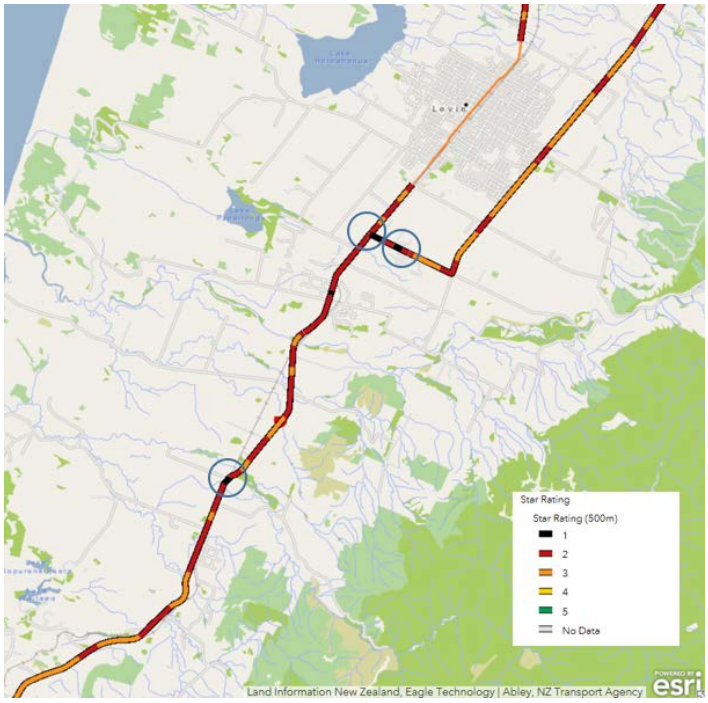


Figure 2-7: KiwiRAP Star Rating in the project area (Source: SafetyNET)

[34] As viewed in 5000m scale on SafetyNET (2017)
[35] Refer to https://www.nzta.govt.nz/assets/Road-Efficiency-Group-2/docs/customer-levels-of-service.pdf for information on road category ONRC targets.
[36] The other 1-Star segment in Ohau has been addressed by the Ohau Safety Improvements project.

Effect

The above causation factors increase both the potential for a crash and the severity outcome of a crash.

Substandard geometry increases the risk of both head-on and loss of control crashes by restricting driver's forward sight distance which means drivers have less time to react to the constantly changing and challenging road environment. The inconsistent and narrow seal width contributes to the overall risk associated with deficient geometry and the prevalent and severe roadside hazards mean that if a vehicle does leave the road, the chances of serious injury are very high. These risks and outcome severities are further exacerbated by the undivided nature of the carriageway along both SH1 and SH57.

The High Risk Rural Road Guide presents the relationship between roading infrastructure quality (Star Rating) and reported injury crash rate (per 100M VKT). This is presented in Figure 2-8. Much of the existing State Highway south of Levin has a 2 Star rating, with pockets of 1 Star. As shown in Figure 2-8 the risk of a 'good' 2 star rated road is likely to result in about three times as many injury crashes as a mid-level 4 star rated road.

FIGURE C-2 Reported injury crash rates associated with each 1/10th star rating category, based on the published 5km star rating data for rated rural state highways

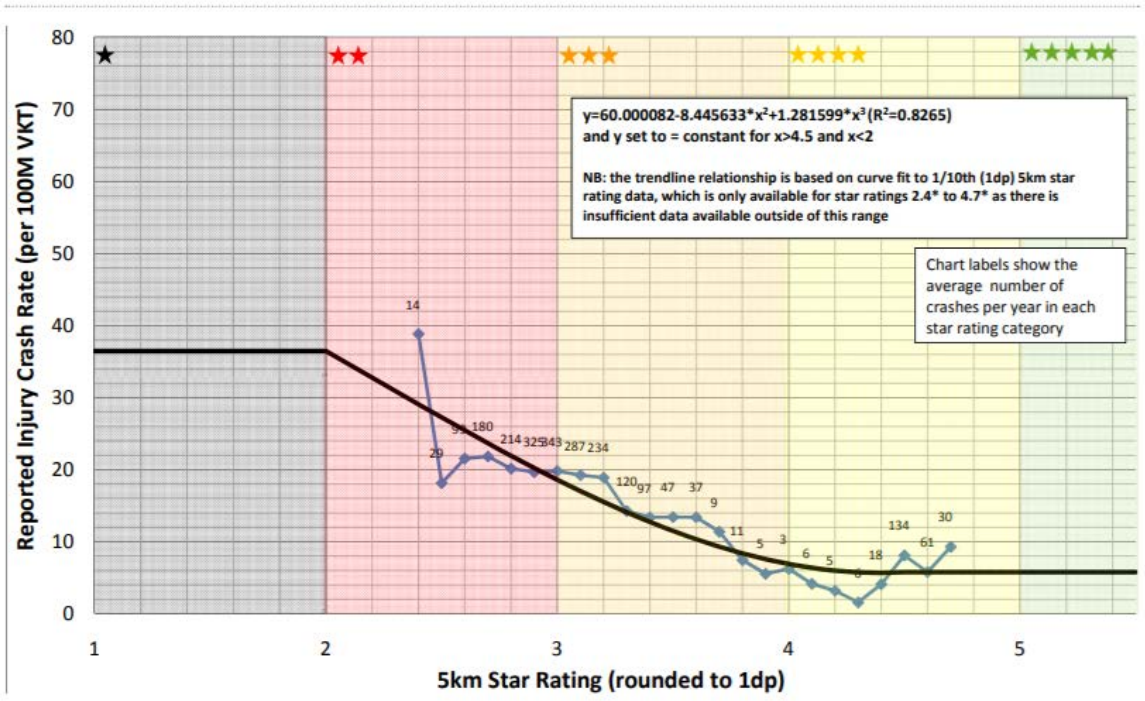


Figure 2-8: Star Rating relationship to reported injury crash rate (Source: High Risk Rural Roads Guide)

There is also a relationship between traffic volume (exposure) and the amount of crashes that occur. Based on a number of research papers "…it has been estimated that a volume increase by 1% is related to an increase in the total number of accidents (unspecified severity) by 0.88%[37]. However, Elvik et al (2009) do note that the relationship is not likely to be linear, or necessarily constant, and that some studies have shown decreased accident rates when traffic volumes

[37] Elvik et al (2009) The Handbook of Road Safety Measures Part II: 10. Pages 1028-1029.

exceed the capacity of the road. Notwithstanding, it is a reasonable general assumption that crashes on this section of road will increase as volumes increase.

Consequence

The consequence of the above is that, in the last five years (2013-2017), there were 11 fatal crashes and 25 serious injury crashes on the two state highways within the project area, which resulted in 49 deaths and serious injuries (DSi). Additionally, there were 98 minor injury crashes, and 261 non-injury crashes.

The 10-year state highway network crash history is presented in Figure 2-9 below, highlighting that the number of fatal and serious crashes has been increasing since 2008. Figure 2-9 below also highlights the correlation between crashes and traffic volumes.

Unfortunately, 2018 is already the worst year to date over the last decade, continuing this upward trend, with 15 high severity crashes resulting in 24 DSI in the project area (noting that high severity crash data up to the end of November was available at the time of reporting). This is well illustrated by the figure below.

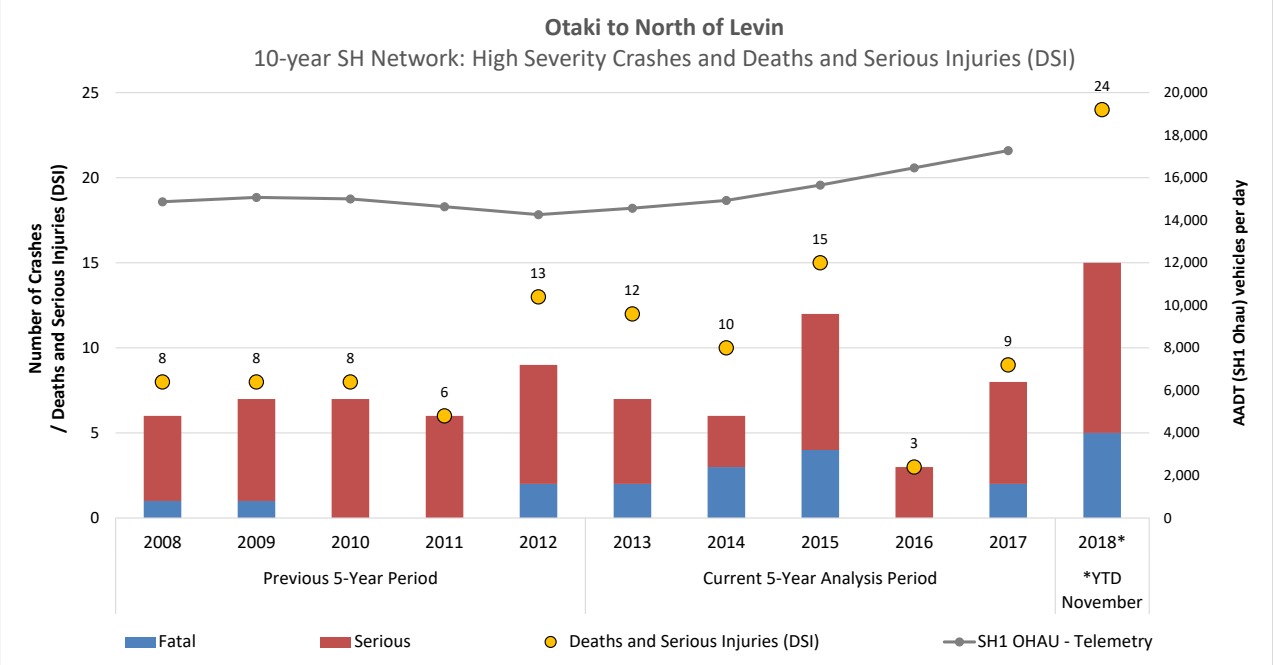


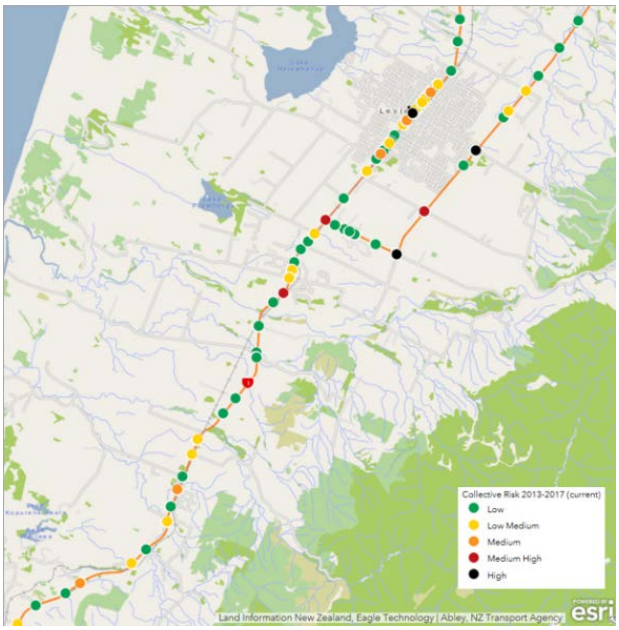
Figure 2-9: 10 year DSI and Traffic Volume

Within the rural sections of state highway in the project area, there were 25 high severity crashes (resulting in 38 DSI) in the five-year period 2013 – 2017. This classifies both sections of SH1 and SH57 as High-Risk Rural Roads due to the High Collective Risk[38]. These ratings place both SH1 (and SH57 within the project area) place in the top band of a high risk rural road.

[38] According to the NZ Transport Agency's High Risk Rural Road Guide (HRRRG), both SH1 and SH57 are classified as a 'High' Collective Risk. SH1 is classified as a 'Medium' Personal Risk, with SH57 a 'High' Personal Risk.

SH1 from the Wellington Boundary to Levin ranks as the 8th worst rural state highway section[39] in New Zealand in terms of fatal and crashes per year per km on an average of the five years 2013 to 2017; this is within the top 2%.

There are six intersections in the project area with unsafe risk ratings[40], as shown in Figure 2-10.



- SH1 / Queen Street
- SH57 Kimberley Road / SH57 Arapaepae Road;
- SH57 / Queen Street.
- SH1 / SH57 Priority T; and
- SH57 / Tararua Road
- Bishops Road / SH1

Figure 2-10: Collective Risk intersections in the project area (Source: SafetyNET, 2013-2017)

It is likely that the poor safety record will worsen over time, as the nationwide trend of increasing traffic volumes and significant local development will result in a greater exposure risk for vehicles to conflict with either opposing vehicles or other hazards. This is already being reflected in the study area, as the number of DSIs in 2018 to date (24 DSI to November) have exceeded the previous annual maximum recorded over the last decade. In fact, the DSIs in 2018 alone account for approximately 50% of the previous five-year total of 49 DSI.

Traffic volume is also a factor in the determination of Star Rating. Essentially, this means that as the volume of traffic along a corridor increases, infrastructure upgrades are required to maintain an appropriate level of safety for road users. Therefore, as traffic volumes continue to grow, the suitability of the existing infrastructure reduces.

The standard of the highways will also be further exposed once the Peka Peka to Ōtaki expressway (PP2O) opens (programmed for 2020) and road users will have driven from as far away as Wellington on a KiwiRAP 5-star median divided highway. There is a real possibility of a large increase in crashes at and after this time.

[39] For sections greater than 2.0 km in length
[40] High or Medium-High Intersection Collective Risk

Problem 2: Resilience

THE LACK OF RESILIENCE IN THE EXISTING TRANSPORT SYSTEM MEANS THAT CONNECTIONS, PARTICULARLY INTER-REGIONAL, ARE REGULARLY IMPAIRED OR LOST	
Cause(s)	• Crashes • Structures • Flooding • Lack of alternative routes • Importance of the route - a National High Volume highway connecting Wellington and the rest of the North Island
Effect	• High risk of closure • High impact of closure • High likelihood of SH1 being required to cater for additional traffic in the event of closure on SH2.
Consequence	• Closures result in massive re-routing delays and costs • The national strategic transport network in the lower north island is vulnerable

Cause

Crashes

When a crash occurs - especially an injury crash – the narrow cross section means that vehicles are often immobilised in the live lane. A series of tasks are required immediately following a crash such as urgent medical attention, machinery to move vehicle(s) to a safe location, and investigation of the crash causes. These necessary tasks often result in closure (partial or full) of roads. Data on the risk, and frequency of crashes is outlined in Problem 1 Safety above.

Structures

Table 2-1 presents the ages of the structures on the State Highway in the study area. Bridges typically have a construction life of about 100 years. Three structures along the study area have less than 20 years remaining, as outlined in Problem 1 Safety above, older structures are typically narrow with poor horizontal and vertical alignment (E.g. Manakau Rail Overbridge).

The table also presents the structure risk during storm and earthquake events based on NZTA Resilience Project information. In this instance, the oldest structures present the greatest risk in the event of an earthquake and have no local detour (Refer below for discussion on alternate routes).

Table 2-1: Structures located between Ōtaki and Levin (Source: NZTA RAMM, Maphub Resilience Project)

Structure	Age	Length (m)	Storm risk[41] (1/100 yr)	Earthquake risk[42] (1/1000 yr)	Alternate Route Detour
Ōhau River Bridge	65	136	Medium	High	>2hr
Ōhau Rail Overbridge	62	10	Low	High	>2hr
Kuku Stream Bridge	89	10	No rating	No rating	>2hr
Waikawa Stream Bridge	89	36	Medium	High	>2hr
Manakau Rail Overbridge	80	91	No rating	High Bridge Seismic Risk	>2hr
Waiauti Stream Bridge (Manakau)	7	18	Medium	No rating	Local detour available, not suitable for 2 way HCV
Pukehou Rail Overbridge	50	81	No rating	Significant Bridge Seismic Risk	

Flooding

The existing State Highway passes through a floodplain area, some of which is indicatively identified as within a 200 year reoccurrence flood area. These areas are through and around Manakau, and also near the Waikawa Stream.

In addition to the above locations, the highway north of Manakau is regularly closed due to surface flooding. Two recent large scale events were recorded on 20 June 2015 and 12 June 2016, the impacts of these events are outlined in the Problem 2 Effect section below.

Figure 2-11: 200 year flood re-occurrence risk (Source: Horizons Regional Council Flood Risk Mapping)

[41] Storm Risk relates to the 1/100 year return period and combines the Availability State (full access to road closure) and Outage State (duration of availability state – less than 1 day to very long term >6 months) into a single parameter indicating the level of disruption caused by the hazard type. Medium disruption risk indicates single lane access with events lasting less than a few days or short term full closures.

[42] Earthquake Risk relates to the 1/1000 year return period and combines the Availability State (full access to road closure) and Outage State (duration of availability state – less than 1 day to very long term >6 months) into a single parameter indicating the level of disruption caused by the hazard type. High disruption risk indicates closures are likely and when these do occur are expected to result in medium to long term outages.

Lack of alternate routes

There is no alternative route to SH1 between Manakau and Ōhau, either via another state highway or local roads.

This section with no alternate route is also at high risk of a closure due to five ageing structures (three of which are over the NIMT), flooding and earthquake risk, as presented in Table 2-1 above.

When SH1 between Manakau and Ōhau is closed, drivers either need to wait until the road is reopened or travel via SH2. This adds over two hours to the journey between Waikanae and Palmerston North (in off peak times – much longer in peak times) and can cause significant congestion.

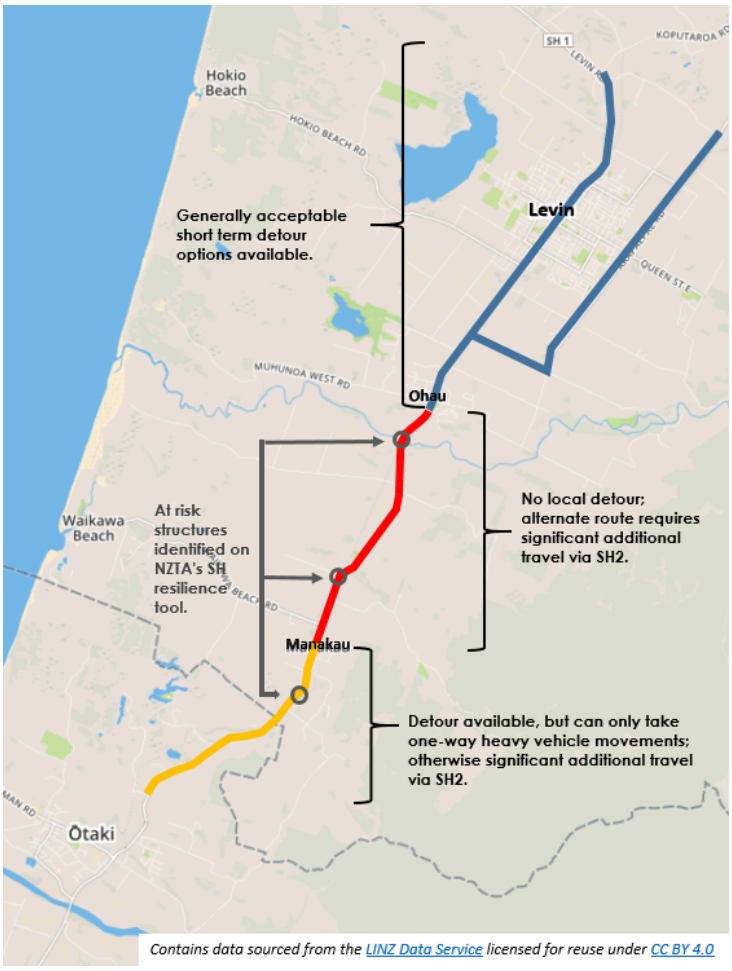


Figure 2-12: Ōtaki to North of Levin - Network Resilience

Importance of the route

The Ōtaki to North of Levin corridor is classified as a National High Volume Road under the ONRC, which is the highest classification of road in New Zealand and reflects its status as a key lifeline. It is therefore vital that this resilience risk is appropriately mitigated.

Similarly, SH1 is a critical route in the overall accessibility of Wellington and the lower north island. There are two roads, and two railway lines that connect Wellington to the rest of the North Island.

For SH1, two of the highway bridges with the highest risks are over the railway line, so if they fail, it affects both modes.

North of SH57, more options are available when an event occurs. Wellington's northern corridor (SH1) has recently been undergoing a large scale network transformation creating an alternate route, and improving infrastructure resilience.

The Ōtaki to north of Levin corridor represents the last section of State Highway 1 from Ngauranga to State Highway 57 with high risk structures in the event of a 1/1000 year earthquake. This means that in such an event access to Wellington by road from the rest of the North Island may not be possible for a significant period of time. From State Highway 57 north,

additional transport connections are available leading further into the Manawatu-Wanganui District (refer to Figure 2-13).

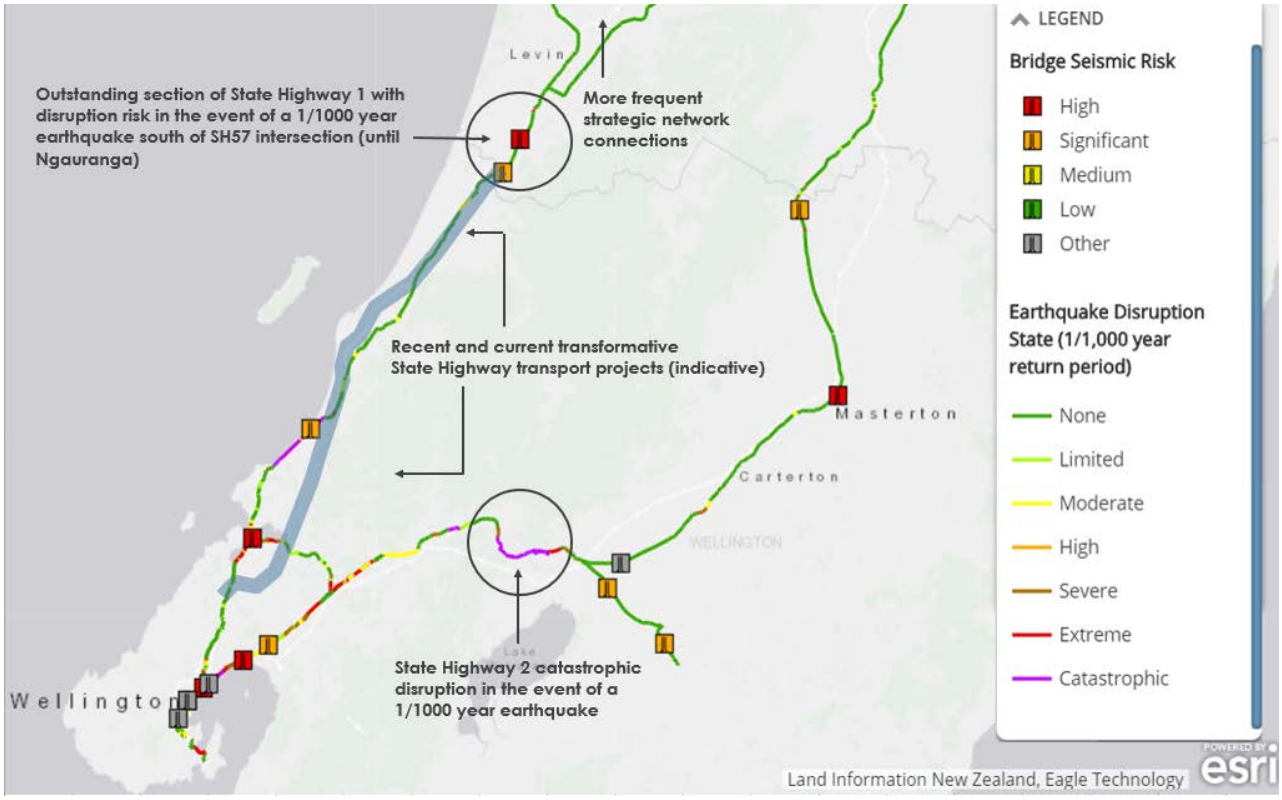


Figure 2-13: Wider Wellington Strategic Network resilience risk (Base map adapted from: https://nzta.maps.arcgis.com/apps/MapSeries/index.html?appid=5a6163ead34e4fdab638e4a0d6282bd2)

Effect

High risk in of closure

The vulnerabilities identified above mean that the network is at high risk of closure – both for low impact high probability events (LIHP – e.g. crashes and surface flooding) and high impact low probability events (HILP – e.g. large storms and earthquakes). The number of problem areas means that the cumulative risk is even higher and will worsen over time due to ageing structures.

High impact of closure

If the any of the bridges are affected, each of these is likely to be out of action for at least a day, and possibly months in the case of the Ōhau River Bridge due to its length. This is a particular concern for the Ōhau bridges, Waikawa Stream and Manakau Rail bridges as there is no alternative route. This means that the closure of one bridge will affect the entire strategic network as outlined in Problem 2 Consequence section below.

There have been at least two full road closures due to flooding in the past three years. On 20 June 2015, SH1 was closed for over 24 hours due to floodwaters washing away parts of the banks of

the Waikawa Stream Bridge[43]. SH1 along the Manakau Straight was also closed on 12 June 2016 for 90 minutes due to flooding[44].

TREIS data[45] as supplied by the NZ Transport Agency's Wellington Transport Operation Centre also recorded nine other cautions or delays caused by flooding many of which were on sections that have no alternative route. Partial closures occurred due to fallen trees across the highway, crashes, and objects/obstruction in the lane.

Figure 2-15 provides an example of the flooding that can occur on SH1, on this occasion the photo was taken by a passing motorist in December 2014 and posted on Twitter. On SH57, crashes were the only unplanned full closure events. Partial closures occurred due to fallen trees and due to a crash. However, with plenty of local road alternatives resilience is not a concern.

Figure 2-14: Semi-trailer HCV crashed through the safety barrier and over the side of the Manakau Overbridge (Source: stuff.co.nz)

Figure 2-15: SH1 flooding June 2016 (Source: stuff.co.nz)

High likelihood of SH1 being required to cater for additional traffic in the event of closure on SH2.

As presented earlier, SH2 cannot operate as an alternate route to SH1 in a major event as the Remutaka section of SH2 is identified as a catastrophic risk area. Conversely, it is therefore very important that State Highway 1 is available in a major event as it will be required to act as the alternate route to SH2 and cater for a significantly greater volume of traffic.

Consequence

When an event occurs between Manakau and Ōhau (refer to Figure 2-12) that closes the highway, the trip from Wellington to Levin (existing distance approximately 94km) increases by about 135km to 229km, or an additional 2 hours of travel time (refer to Figure 2-16 and Figure 2-17). These times will be much longer during peak hours.

A closure south of Manakau would also result in a detour, which is not as long, but only really suitable for light vehicles.

[43] https://www.nzta.govt.nz/media-releases/sh1-closed-north-of-wellington-due-to-flooding/
[44] http://wellington.scoop.co.nz/?p=89648, http://www.stuff.co.nz/national/80979934/Southerly-front-hits-Tararua-range-floods-State-Highway-1-at-Manakau
[45] Note, TREIS data can often be of variable quality and its primary purpose is for live management of incidents, rather than recording of past events.

For some people this will mean they will not choose to take trips they would have otherwise. For others it will mean increased costs and safety risks using the lengthy detour.

An indicative economic assessment of the impact of this showed that in a scenario where State Highway 1 was closed where there was no viable alternative (except SH2), then the cost per day to road users was approximately $2 million[46]. Other costs would also arise such as installing bailey bridge(s) and additional maintenance costs.

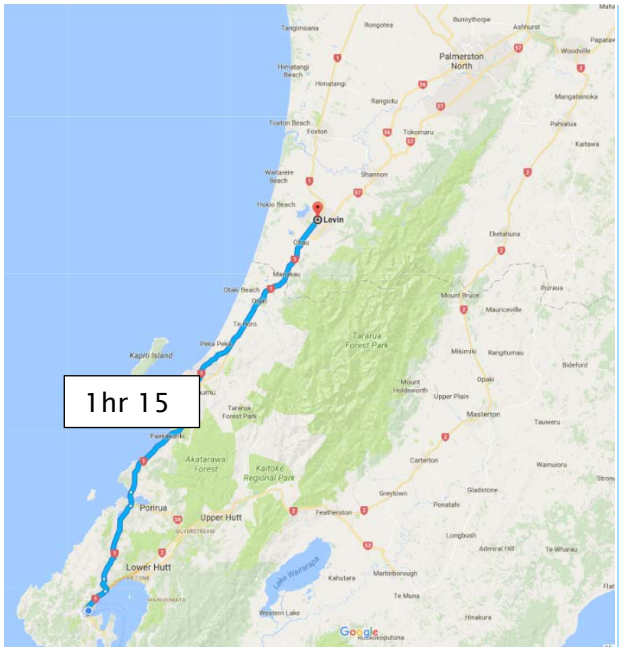


Figure 2-16: Wellington to Levin - Normal travel duration via SH1

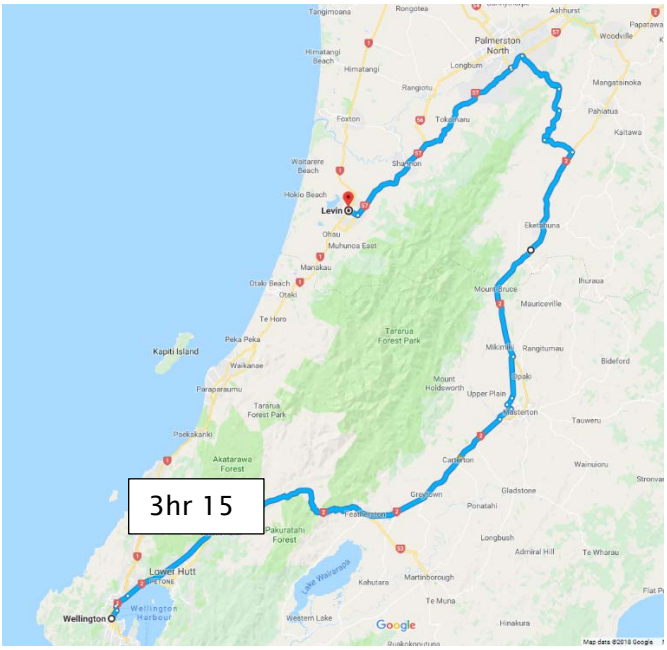


Figure 2-17: Wellington to Levin - Alternate route duration via SH2, Pahiatua Track & SH57

In terms of more common events, such as crashes, the consequence (in terms of availability of the road) is often related to the severity of the crash. Given this, we estimate (on average) that a DSI crash may close the highway for 2-3hrs, minor 30 minutes, and non-injury 10 minutes. Although 2-3hrs may be slightly conservative for a high severity crash as it depends on the crash type; a head-on crash will likely be more disruptive than a single vehicle run-off-road crash.

There are recent examples of crashes closing this nationally strategic route. In January 2018 a crash near Kuku East Road occurred on a weekday evening; it was reported[47] that 4km long queues resulted and that the road was closed between 5:30pm and 10:20pm.

In February 2018, a crash between a semi-trailer heavy vehicle and a car left SH1 fully closed for over two hours with no alternative route in the morning peak, causing significant queuing of up to 5km in either direction[48] (refer Figure 2-14 above). The crash occurred at the Manakau overbridge, which is one of the key ageing and poorly aligned assets identified by this IBC.

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[46] The indicative road user costs of the detour were based on the travel time, vehicle operating costs and crash costs impacts of 17,000 vehicles per day travelling the alternate route via SH2, Pahiatua Track & SH57, an additional 2 hours or 229 km.

[47] https://www.stuff.co.nz/national/100702371/serious-injuries-in-sh1-crash-north-of-manakau

[48] The highway was closed in both directions for about two hours, causing frustration and delays to motorists and long queues of traffic stretching more than 5 kilometres to the north and south of the crash site. The road opened to one lane about 10.20am, and then fully for about an hour from 11am to clear the backlog prior to closing the SH again to clear the vehicles involved in the crash. https://www.stuff.co.nz/manawatu-standard/news/101169149/a-truck-has-rolled-on-train-tracks-south-of-levin

The national strategic transport network is vulnerable.

Overall the strategic transport network is vulnerable to closure at a location which is critical to transport movements in New Zealand and with no viable alternative route. The corridor is also under performing when compared to standards expected of a National High Volume Route[49].

[49] The NZTA thresholds for a High Volume route with no viable alternate route are 0.4 closures per annum for short term closures (or 2 closures per 5 years). As outlined above, the project area has had numerous crash related closures and at least two full road closures due to flooding in the last three years alone. https://www.nzta.govt.nz/planning-and-investment/planning-and-investment-knowledge-base/2018-21-nltp-investment-assessment-framework-iaf/assessment-of-activities-by-activity-class/assessment-of-local-road-regional-and-state-highway-improvement-activities/#resilience-thresholds

Problem 3: Horowhenua Development

GROWTH MAY NOT BE REALISED AS EFFICIENTLY AS POSSIBLE AS SAFETY AND TRAFFIC CONCERNS ARE STYMYING THE EFFICIENT DEVELOPMENT OF PLANNED GROWTH AREAS	
Cause(s)	• Horowhenua is growing faster than before • This growth is expected to continue
Effect	• The existing infrastructure is unable to cater for the new demand. o Safety issues o Access/Efficiency issues
Consequence	• Growth in the Horowhenua District is unable to be enabled efficiently. • Horowhenua District does not develop to its full potential

Cause

Horowhenua has been subject to mostly static growth in recent history. However, the last few years has seen a significant increase, as displayed in Figure 2-18.

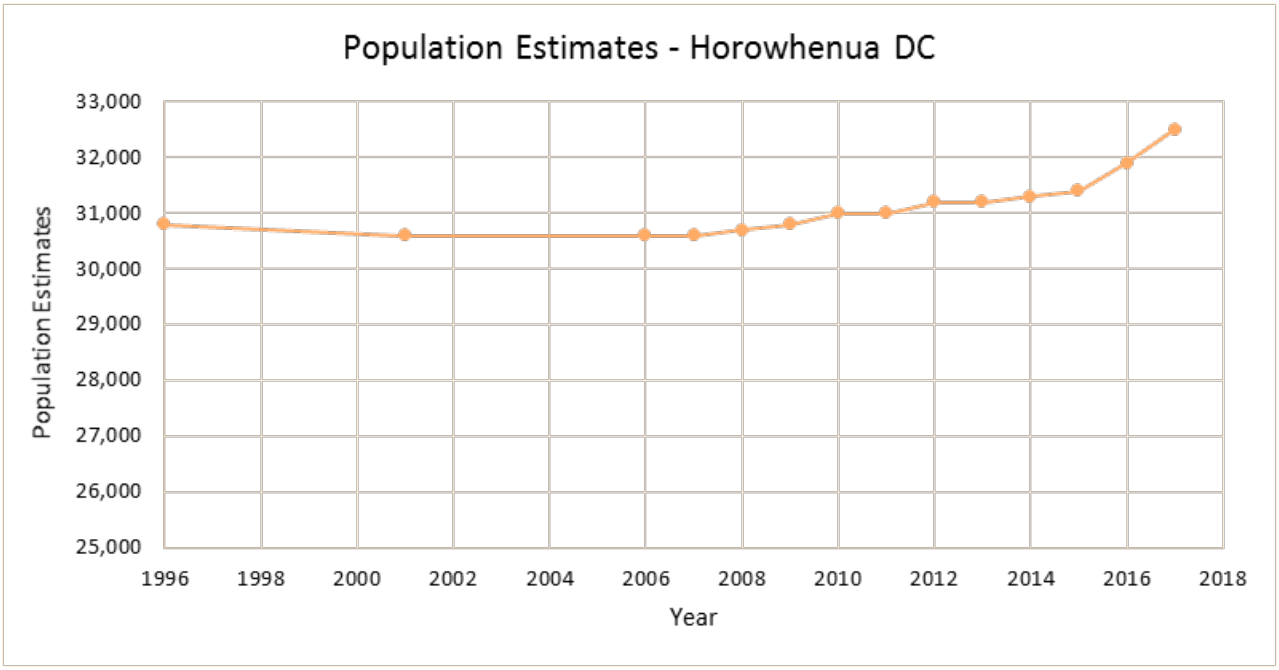

Figure 2-18: Horowhenua Population Growth (Source: HDC)

The recent growth has been reflected in the number of new dwelling consents that have recently occurred in the Horowhenua. Figure 2-19 shows that since 2015 there has been a significant rise in the number of new dwelling consents, recently surpassing the national average.

Figure 2-19: Number of new dwelling consents per 10,000 people in Horowhenua (Source: MBIE/Data from Statistics New Zealand)

As presented earlier in this report, traffic volumes have also been experiencing growth. The most notable growth, much like the population and building consents, has occurred in the most recent years.

As a population grows, so do the civil infrastructure requirements, such as transport, building floor / commercial space, and residential units. Growth areas have been identified by Horowhenua District Council at various locations in the District and relative to the state highway network between Ōtaki and Levin at; Ōhau, Manakau and Levin East (Gladstone Green). Gladstone Green represents the Council's most significant or largest growth area. However, the traffic volumes and existing network layout do not allow for safe or effective access to these destinations.

If nothing is done, growth is likely to be stifled, with growth occurring in a manner that results in the inefficient use of land, causing undesirable land-use integration/ town planning outcomes and worsening of future transport issues.

This growth is expected to continue. Horowhenua District Council has commissioned population forecasts from both NZIER and Sense Partners to determine what the future demand is likely to be. Table 2-2 shows the respective forecasts for the District through to 2038, ranging from 32,000 to over 41,000.

Table 2-2: Growth Comparison for Horowhenua (Source: Transforming Taitoko Levin Town Centre Strategy DRAFT)

	2013	2018	2028	2038
StatsNZ (2017)	31,200	32,200	32,600	32,000
NZIER (2015)	31,200	32,390	34,600	36,840
NZIER (2015) + WNC	31,200	32,450	36,740	39,910
Sense (2017)	31,200	32,450	35,118	38,314
Sense (2017) + WNC	31,200	32,758	36,886	41,128

All projections show significantly higher growth than predicted by Statistics New Zealand. Furthermore, this growth predicted to be even higher once the effects of the Wellington Northern Corridor (+ WNC) are taken into account. Horowhenua District Council have adopted the Sense Partners projection including the Wellington Northern Corridor growth. This is the 50th percentile growth projection from this study. In summary the projections to 2040 adopted by Council equate to an additional 9,200 people with an additional 5,400 dwellings. Preliminary estimates of new houses built to middle of 2018 suggest that the highest forecast provided in Table 2-2 has been exceeded.

Effect

As a population grows, so do the civil infrastructure requirements, such as transport and building floor / commercial space, and residential units. East of Levin, west of Ōhau, and west of Manakau are three locations which have been identified for development to cater for growth in the draft Horowhenua Growth Strategy 2040 (Refer to Figure 2-20, Figure 2-21 and Figure 2-22).

Figure 2-20: Manakau Potential Growth Option (Source: Draft Horowhenua Growth Strategy)

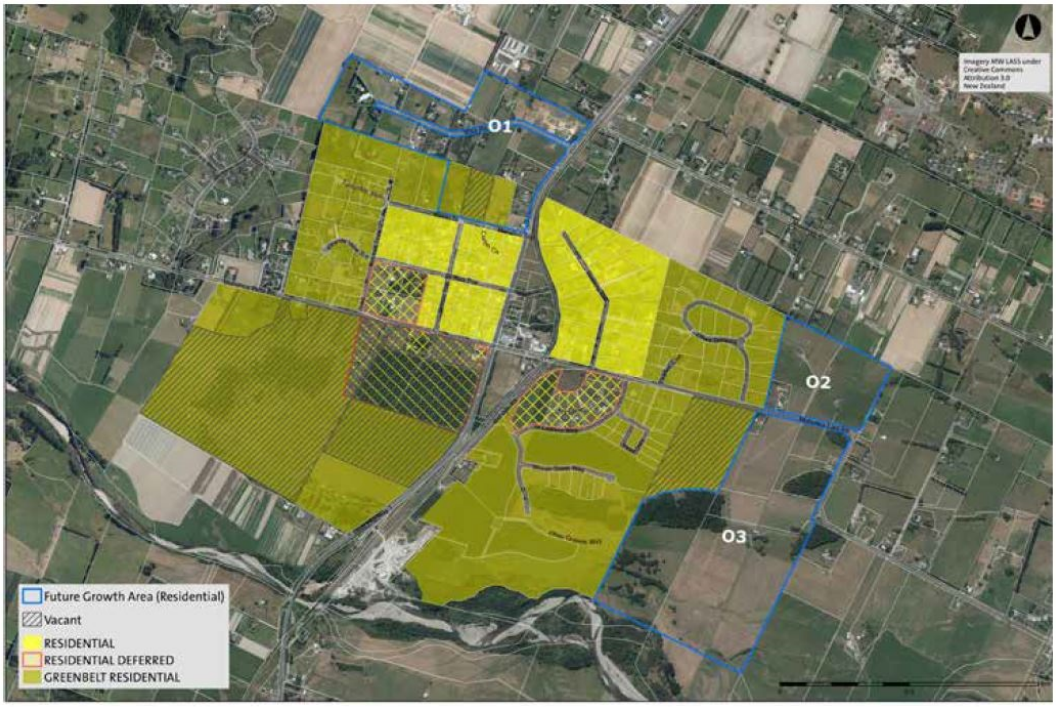

Figure 2-21: Ōhau Potential Growth Option (Source: Draft Horowhenua Growth Strategy)

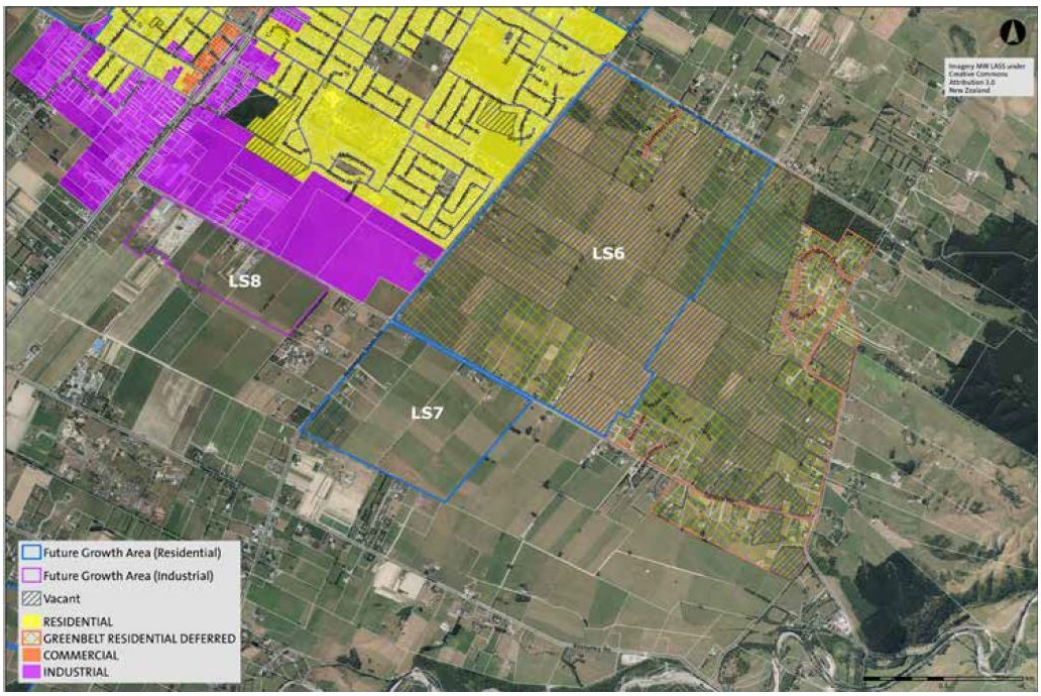

Figure 2-22: Levin South Potential Growth Options (Source: Draft Horowhenua Growth Strategy)

However, the high traffic volume, and existing network layout does not allow for safe, easy, access to these developments. Some of the key concerns for each include:

- East of Levin
  - safety concerns of increasing the number of people moving over and along State Highway 57. The Queen Street / SH57 intersection has a very poor crash history (identified as a high collective risk intersection) and increasing conflicting movements will severely exacerbate this situation. An application has already been made to subdivide a significant portion of this area and the applicant's traffic impact

assessment stated that the intersection should be addressed before any further development occurs given the safety and access risk.

- West of Manakau, and west of Ōhau
  - The images above show development on the other side of the highway than the main residential and commercial areas. Safety and severance concerns (particularly for pedestrians and school children) therefore exist in further developing on both sides of the highway when local services are all on one side.
  - Efficiency concerns in accessing development off State Highway 1. The traffic modelling is predicting delays of over a minute for side road traffic trying to access SH1 in a number of locations including the main intersections in Ōhau and Manakau. The access problems are not restricted to only weekday AM and PM peak periods. As presented in Existing and Future SH1 Demand Section above, traffic volume data from the Ōhau telemetry site shows that the traffic volumes are fairly constant throughout the day.

Consequence

The identified development areas will not only continue to have these existing safety, access, and severance issues; they will increase as the traffic flow on the State Highway increases, and as the number of people living in the new developments increase.

Potential scenarios that may emerge are:

- Growth will be stifled; either not occurring, or reducing due to conditions placed on development or limited uptake
- The growth will occur, but not in the manner, or the location planned, resulting in less land-use integration and other future transport issues.

It will also impact on the realisation of a number of current strategies including the Horowhenua Growth Strategy 2040 and Accelerate 25 and inhibit the Horowhenua to realise its potential.

This impact is difficult to quantify, however a socio-economic impact of the Horowhenua 2040 Strategy was under taken by NZIER[50] which involved a high level assessment of the economic impact of the Horowhenua 2040 portfolio of projects (including O2NL). The assessment found that based on the population and economic growth expected to stem from the O2NL offline transport improvements, the Horowhenua economy would have a NPV increase of $400M by 2040.

[50] Socio-economic impact of Horowhenua 2040 Strategy, NZIER, 2018. Appendix 6: Cost Benefit Analysis.

Problem 4: Levin Town Centre Revitalisation

STATEMENT: HIGH VOLUMES OF TRAFFIC, INCLUDING TRUCKS, THROUGH THE CENTRE OF LEVIN IS REDUCING THE ATTRACTIVENESS OF MAIN RETAIL AREA AND LIMITING INVESTMENT AND DEVELOPMENT (10%)	
Cause(s)	• A nationally strategic highway, carrying significant through movements, is located through the Levin urban area
Effect	• Reducing the attractiveness of main retail area.
Consequence	• Levin unable to transform as outlined in key strategic documents

Cause

Roads vary in size and strategic importance, and this is reflected in the One Network Road Classification which assigns all the roads in State Highway and local road networks a place in the road hierarchy. NZ Transport Agency have classified SH1 in Levin as National Strategic due to: the high number of heavy commercial vehicles, that it links populations in excess of 100,000 people, and it connects to an inland port / port that deals with >2 million tonnes / >$3 billion per annum[51].

SH1 (Oxford Street) also runs straight through the middle of Levin, bisecting the town. As presented earlier, through the centre of Levin this highway carries over 14,100 vehicles per day, including over 1,400 heavy vehicles.

Levin has a 2018 estimated population of 21,200[52] and has a number of parks and public facilities which are located on either side of the state highway. Retail commercial and hospitality activities also front the highway for a number of blocks in the town centre (as shown in Figure 2-23).

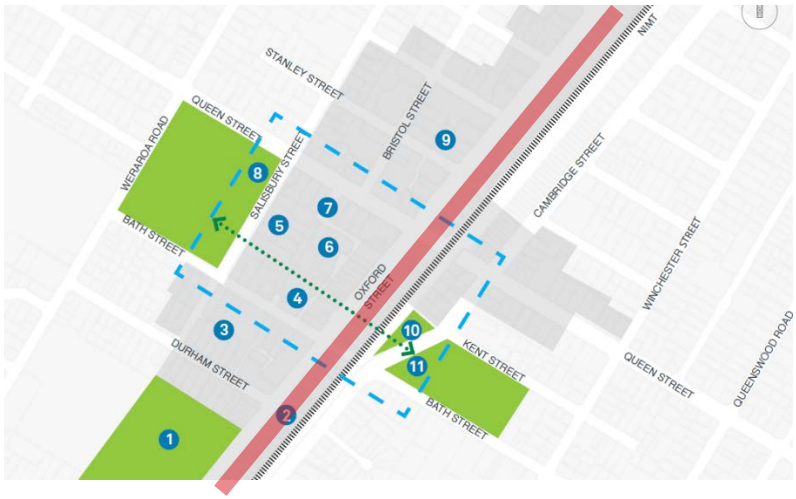

Figure 2-23: Retail/Hospitality/Commercial Development alongside State Highway 1 (Source: Transforming Taitoko/Levin – Levin Town Centre Strategy)

[51] https://www.nzta.govt.nz/assets/Road-Efficiency-Group-2/docs/state-highways-by-category.pdf
[52] Subnational population estimates at 30 June 2018, http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE7541

The centre of urban areas are often places where people meet, or undertake various activities such as shopping, or dining. Figure 2-24 presents the results of a stationary activity survey. The survey records the number of pedestrians at certain locations in the study area every 30 minutes between 10am- 5:30pm of the day as well as 'stationary activities' that indicate people are stopping to spend time in a particular spot. The results indicate that either side of the highway in the middle of Levin are popular places for people.

Figure 2-24: Public Life Survey Results (Source: Boffa Miskell as cited in "Transforming Taitoko/Levin - Levin Town Centre Strategy")

Effect

The conflict between the use of SH1 Oxford Street as both a main freight route and a town centre results in the town centre attractiveness being much lower than it otherwise could be. This is due to a range of factors such as:

- Noise
- Emissions
- Safety
- Smell (stock trucks)
- Severance

These concerns were raised during the 2017 consultation and reported in the Engagement Summary Report. Safety in particular is a problem (as presented in Problem 1) and crashes in Levin Town Centre have been increasing in recent years.

A preliminary social impact assessment of the Ōtaki to North of Levin Transport Corridor Shortlist options was prepared by Beca in 2018 (attached as Appendix E). This report highlighted that the way of life, and community cohesion, in Levin was partly contingent on the amount of traffic on State Highway 1. It was also noted that pedestrian traffic and amenity impacts the opportunity and operations of businesses such as local cafés, and that poor travel time, and reliability affects the connection of Levin with other centres where they work or distribute goods.

The Levin Town Centre Strategy states that one of the issues facing the town centre is that there is a "*…lack of east-west connections between green spaces such as Domain, the Rose Gardens and the Public Gardens.*" This is demonstrated in Figure 2-23 and Figure 2-24 above (both taken from the Town Centre Strategy document). In this instance the highway is a barrier between linking the green spaces.

Consequence

Horowhenua District Council are currently finalising their Transforming Taitoko/Levin Town Centre Strategy. This document presents the Levin Town Centre objectives as:

- Consolidate its form and concentrate development and investment to the west of Oxford Street
- Become a 'destination' that does not rely on state highway through-traffic for economic success
- Offer a high quality public realm that conveys an intrinsic sense of place that is timeless
- Provide a quality food and beverage offering and retail spaces that suit contemporary retailing
- Effectively deal with potential earthquake prone buildings and embrace flexible and fluid solutions for buildings and vacant spaces
- Provide transport options that optimally serve the community and all of its constituents

Having a busy state highway running through the centre of Oxford Street will make achievement of those objectives very difficult. As a consequence, Levin is unlikely to be unable to transform as envisaged; in particular investment into earthquake prone buildings, creating high quality public realm. Without intervention, the number of vehicles passing through Levin will continue increase, along with the corresponding effects such as noise, safety, emissions, and community severance.

3. ONE NETWORK ROAD CLASSIFICATION REVIEW

The significance of the identified problems are compounded due to the status of the highways through the project area. SH1 from Wellington to Levin is a National (high volume) road in the One Network Road Classification (ONRC) and SH1 and SH57 through and north of Levin are National roads.

SH1, being New Zealand's premier state highway carrying large volumes of traffic, means there are high expectations in respect of the form and function of this route by all road users including the local community.

However, SH1 south of Levin performs contradictory functions. It handles long haul freight, is used by large farm machinery servicing market gardens, provides access to local shops and schools and provides access to properties fronting the highway.

An assessment has been undertaken of the performance of the current highways against the customer level of service measures of the ONRC. This is presented in Table 3-1 below.

Overall, the highways through the project area fall well below the customer journey expectations.

Table 3-1: Assessment of current against the ONRC

Key	Well Below Customer Levels of Service (CLoS)	Below CLoS	Meets CLoS

	SH1 South of Levin (National – High Volume)		SH1 North and SH57 (National)	
	Target	Current	Target	Current
Safety	Mostly forgiving roads and roadsides, equivalent to KiwiRAP 4-Star standard.	2 and 3 Star highway with some 1 star sections.	A high KiwiRAP 3 or 4-star standard, or equivalent, with consistent and predictable alignment.	2 and 3 Star highway with some 1 star sections.
	User hazards absent or mitigated including head on risk.	82% of hazards are moderate or severe. No median barrier.	User hazards mostly mitigated.	82% of hazards are moderate or severe.
	Active road users generally do not have access - if present, they are provided with separate space or are physically separated.	No specific facilities for walking or cycling and some sections have no shoulder.	Active road users (if present) are mostly provided with separate space or are physically separated.	No specific facilities for walking or cycling and some sections have no shoulder.
Resilience	Route or viable alternative is always available.	Alternative routes do not exist. Between 2012 and 2016 there were At least 3 closures and 18 partial closures due to flooding, road works and crashes.	Route is always available during major weather or emergency events and viable alternatives exist.	Alternative routes do exist Between 2012 and 2016 there were at least 5 closures and 3 partial closures, all on SH57, due to fallen trees, road works and crashes.

Accessibility	Land use access for road users rare and highly engineered, usually only to highway service centres.	High number/ density of crossing places. There is approximately one access every 51m along this section (compared to recommended 1 every 500m).	Land use access for road users infrequent and highly restricted in rural areas, and often restricted in urban areas.	High number/ density of crossing places. There is approximately one access every 66m on SH1, and one every 63m on SH57.
	Strategic network connectivity for road users due to infrequent connections, generally only to National high volume roads. High volume traffic will be unimpeded by other traffic at junctions.	High number/ density of intersections. There are 25 intersections with SH1 (about one every 636m); 24 of which have ONRC status less than arterial.	Mainly strategic network connectivity for road users due to infrequent connections, generally only to other equal and higher category roads	High number/ density of intersections. There are 14 intersections with SH57 (about one every 714m); 13 of which have ONRC status of less than arterial.
	Active road users generally do not have access - if present, they are provided with network access and journey continuity by a separate space or are physically separated.	No walking/ cycling facilities.	Network access and journey continuity for active road users (if present) mostly provided by separate space or physical separation.	No walking/ cycling facilities.
	High volume traffic will be unimpeded by other traffic at junctions.	Good intersection priorities.	Easy navigation at intersections, with National road traffic given priority, unless joining with equal or higher category roads	SH1 has two signalised intersections. SH57 Arapaepae Road / Kimberley Road Intersection has poor intersection form and legibility.
	Provision of quality information relevant to national road user needs	One VMS which is inadequate due to number of issues.	Provision of quality information relevant to national road user needs	No VMS.
Optimal Speeds	Higher speeds on KiwiRAP[1] 4-star dual carriageway roads, or lower or variable speeds where required to support network safety or productivity.	Poor highway form and high speeds.	Higher speeds depending on assessed level of risk. Lower if mixed use, high intersection density, schools, shopping, and concentrations of active road users.	Speed limits lower in Levin urban area. Speeds still high on SH57 where high risk.
Travel Time Reliability	The majority of road users experience consistent travel times with some exceptions in major urban centres.	Travel time reliability issues during holiday weekends. Waikanae to north of Levin 4th most variable (out of 7) and 2nd slowest rural National HV in country.	The majority of road users experience consistent travel times with some exceptions in urban heavy peak, holiday or during major events.	Travel time reliability issues within central Levin. Waikanae to north of Levin 4th most variable (out of 7) and 2nd slowest rural National HV in country. Waikanae to Palmerston North 3rd most variable (out of 7) and 4th slowest rural National HV in country.
Amenity	High level of comfort, no discernible roughness.	94% meets roughness targets	High level of comfort, infrequent roughness.	SH1 95% meets roughness target

	(At least 95% of the sealed road network meets specified levels of ride comfort)		(At least 95% of the sealed road network meets specified levels of ride comfort)	SH57 98% meets roughness targets
	Aesthetics of adjacent road environment reflects journey experience needs of higher numbers of through traffic users. Character of scenic/tourist routes protected and enhanced.	Very poor alignment, narrow bridges on tight curves, numerous settlements, frequent accesses and intersections	Aesthetics of adjacent road environment reflects journey experience needs of higher numbers of through traffic users. Character of scenic/tourist routes protected and enhanced.	SH1 Levin is not conducive to through traffic. The traffic also significantly decreases the amenity of Levin town centre.
				SH57 is a less critical tourist route.

4. BENEFITS, OBJECTIVES AND OUTCOMES

Project Objectives

The project objectives for the Ōtaki to north of Levin project are:

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

The options and alternatives are be assessed against the project objectives, as well as a range of other criteria, to help determine the preferred option. This process is documented in the latter sections of this report.

Benefits and Investment Objectives

The benefits and investment objectives for the Ōtaki to north of Levin section are based on the problems and are presented below:

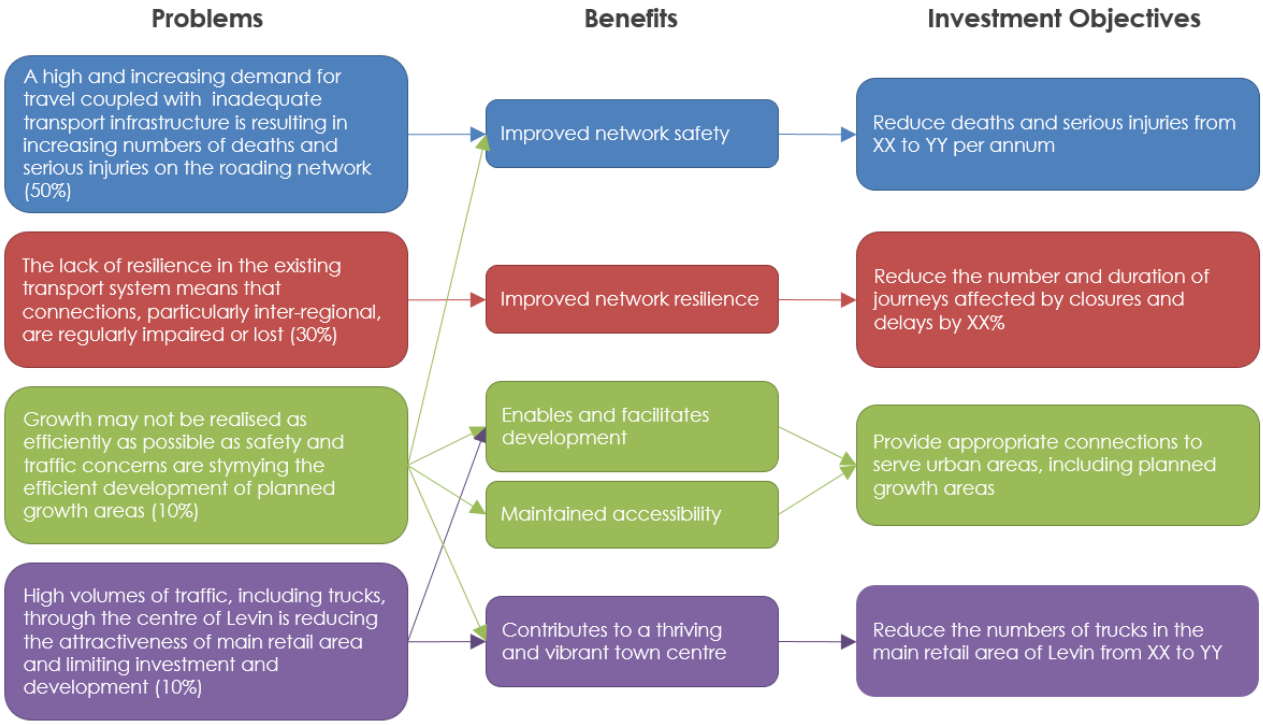

Figure 4-1: Problems. Benefits and Investment Objectives

The targets for the investment objectives will be agreed during the next DBC phase of investigation.

Project Outcomes

A set of project outcomes have been developed which draw on both the project objectives and the investment objectives – these are presented below broken down into the elements of SMART objectives. This is still a work in progress and many of the targets and measures will be confirmed during the next phase of investigation should this IBC be accepted.

Nevertheless, the outcome themes have been used in the optioneering process.

Outcomes	Why	Key Performance Indicator(s)	Baseline	Target	Timeframe	Source
Reduce deaths and serious injuries	To save lives and debilitating injuries	Deaths and serious injuries over a five year period on the current and future network	49 deaths / serious injuries (2013-17)	A minimum 40% DSI reduction	By 2031	CAS
Enhance the resilience of the state highway network;	There is only one north-south route through the area and it is subject to flooding and crashes. There are also structures nearing the end of their lives.	**1** Provide an alternative north-south route between Ōtaki and Levin **2** Number of closures and partial closures on the state highway network **3** Number of structures with a high or significant earthquake outage risk and no detour	**1** None between Manakau and Ōhau **2** 21 during 2012-2016 **3** Four (Ōhau River, Ōhau Rail, Waikawa Stream, Manakau Rail)	**1** One **2** TBD **3** Zero	By 2031	**1** Design Plans **2** TREIS **3** NZTA Resilience Assessment
Facilitate safe, efficient, growth in Horowhenua	To support economic growth and productivity in local townships, and the Horowhenua District	**1** New transport network changes fits into agreed future road hierarchy **2** Trip length for local trips **3** Development in identified growth areas is not prevented as a result of prohibitive investment on transport network	**1** N/A **2** N/A **3** N/A	**1** Agreed road hierarchy with HDC **2** No trips greater than 5km longer. TDB% of trips same distance or shorter. **3** No developments prevented due to prohibitive transport investment required	By 2025	**1** HDC/NZTA **2** Ōtaki to North Levin Traffic Model; Local Connectivity Plans **3** HDC/NZTA
Aid the improvement of Levin's main retail area attractiveness	To enhance economic growth in Levin	**1** Reduce the number of trucks in the main retail areas of Levin **2** Reduced noise and emissions **3** Reduction in urban pedestrian crashes	**1** 1,400 per day **2** TBD **3** 15 ped injury crashes (3 DSI)	**1** TBD **2** TBD **3** TBD	By 2041	**1** Ōtaki to Levin Traffic Model **2** TBD **3** CAS
Reduce travel times on the state highway network;	To enhance inter-regional economic growth and productivity	2041 PM period travel times along three key routes: **1** Taylors Rd to / from Manawatu River **2** Taylors Rd to / from Levin **3** Taylors Rd to / from Potts Hill	**1** 28min **2** 18.5 min **3** 22 min	TBD	By 2041	Ōtaki to North Levin Traffic Model

5. STRATEGIC ALTERNATIVES

A number of different approaches have been considered to address the short and long term needs of the transport network between Ōtaki and north of Levin. These have been developed over a number of years (see Appendix A) and respond to a need to consider a wide range of alternatives including:

- Solutions on the full extent of the intervention hierarchy i.e. integrated planning, demand management, optimising existing and new infrastructure
- Road based and multi-modal solutions
- Solutions that use the current highway (online) and those which propose a new (offline) route

The alternatives considered include:

- **Integrated Planning** – land use growth and development located spatially so as to maintain current levels or even reduce overall the amount of journeys made by private motor vehicles (including trucks)
- **Public Transport improvements** – to reduce the demand on the road network
- **Speed Management** – a quick low cost way to partially address the serious safety issue
- **Online expressway solutions** – upgrade the existing state highway to an expressway standard road (2 lanes and then 4 lanes)
- **Minor Safety Improvements** – includes installing signs, line-marking, surfacing, barriers and intersection improvements to reduce the crash risk/severity.
- **Localised Highway Upgrades** – infrastructure upgrades to the existing network at the major problematic areas on the current highway network
- **Larger Highway Upgrades** – combining some of the nearby localised upgrades to provide a more consistent road environment
- **Taylors Road to south of Levin new offline state highway** – from the Peka Peka to Ōtaki expressway to the current state highway around Ōhau
- **Taylors Road to north of Levin new offline state highway** – extending the expressway from the south to also bypass Levin

The rest of this section discusses the above options and how well they resolve the identified problems as well as their costs, benefits and impacts.

Alternatives that do not resolve the problems

A number of alternatives were not assessed in any detail because, by themselves, they fundamentally do not resolve the identified problems. These alternatives are discussed below.

However, elements of these alternatives will be very important as part of the overall response for the land use and transport network between Ōtaki and north of Levin. Accordingly, how these elements can be incorporated will be reconsidered once a preferred option has been identified.

Integrated Planning

Integrated planning can have significant benefits in addressing travel demand, particularly in major urban areas. However, this is unlikely to be the case in Levin.

This is predominantly because Levin operates as a rural service centre and a through route for SH1. The lack of an AM peak in the traffic flow profile (refer Figure 2-2 above) highlights that SH1 is being used by a multitude of different uses up and down SH1 through the Horowhenua. Consequently opportunities for condensing land uses to eliminate car journeys would only address a small proportion of journeys and therefore an integrated planning approach is unlikely to make significant reductions in overall private vehicle travel demand in the short to medium term.

Levin is currently experiencing significant population growth and this is likely to further increase with the other Wellington Northern Corridor projects opening in 2020 (Refer Location and Context Section above). Accordingly, integrated planning in the context of Levin is about ensuring any transport investment complements and serves current and future planned growth areas in a manner that manages future transport demand and delivers on economic development and Levin Town Centre objectives of Horowhenua District Council, Accelerate 25 and Horizons Regional Council. This growth represents an opportunity to address current integrated planning issues and thus needs to remain in consideration during the next phase of investigation.

Public Transport Improvements with no investment in Roads

Overall, it has been determined that investment in public transport would provide benefits for the travelling public but would not by itself fundamentally address the identified problems for this network. This is because in order to significantly reduce the number of vehicle crashes, a very large and unrealistic level of mode shift is required.

Increasing the proportion of public transport usage in the Manawatu/Whanganui Region (currently 0.5%) to match the Kapiti District (9.7%; an increase by a factor of 20)[53], would result in about 1,300 fewer vehicles per day on the busiest rural section of SH1. This is a high and an unrealistic estimate as there is not a large commuter movement from Levin to areas which currently have a train station.

If walking and cycling in Levin (which currently is about 15% of trips to work) was increased to a mode split similar to Ōtaki (18%)[54], this would equate to approximately 75 fewer vehicles on the local roads in Levin.

In terms of freight, goods that are low cost and not time critical are suited for rail or coastal shipping. In terms of rail nationally, the most commonly moved freight by rail (in terms of weight mode share) is coal, dairy, pulp and paper, and meat[55]. The amount of dairy products moved by rail is already higher in the Manawatu / Whanganui Region than nationally[56], and coal and pulp and paper do not have operations in the Horowhenua. However, as a test scenario, if 30% of the freight that is currently on SH1 was able to be transferred to rail, this would result in a reduction of about 500 heavy vehicles on SH1.

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[53] Ōtaki Area Unit has a similar PT usage of 11%.
[54] Statistics NZ Commuter View
[55] https://www.horizons.govt.nz/HRC/media/Media/Bus-Route-Timetable/Final-RLTP-2015-25.pdf?ext=.pdf (page 13)
[56] https://www.horizons.govt.nz/HRC/media/Media/Bus-Route-Timetable/Final-RLTP-2015-25.pdf?ext=.pdf (page 13)

Combining the above aspects, the best scenario would mean a possible shift of approximately 1,875 vehicles off SH1 per day. However, this only equates to an 11% reduction in vehicular traffic, and is equivalent to only three to four years of traffic growth (at the current growth rates). A very large investment in both public transport and rail infrastructure (as well as other initiatives to encourage mode shift) would be needed to achieve this.

Nevertheless, rail and public transport are key components of the transport system in the Horowhenua. If an offline solution was progressed for the highway, this can align with /enable investment in the rail corridor, as the location of the current state highways (notably its bridges) could constrain this from otherwise occurring. In addition, the growth forecast in Levin and surrounds (which is in part due to O2NL and other transport improvements), will provide a much larger population base if extensions to the Wellington urban rail network were to be considered[57].

Speed Management

Speed management should always be considered when addressing a safety problem. It has already been used to good effect for the Manakau and Ōhau Township improvements implemented a few years ago as part of the overall Ōtaki to north of Levin project.

However, implementing a lower speed limit over 20km of a National Strategic High Volume state highway outside of urban areas is not considered appropriate for this classification. It is acknowledged that this may be appropriate for short sections or as an interim measure whilst awaiting larger scale improvements, but not as a medium to long term treatment. If implemented it is likely to attract widespread criticism from stakeholders and the public.

In addition, speed management measures in isolation are unlikely to result in significant long term benefits. The current average speed along SH1 is already well below the posted speed limit as shown in the figure below, which means that the majority of drivers are already managing their speed rather than driving at the speed limit. Therefore, speed management measures alone will not adequately address the problem statements. Speed is also only identified as a factor in a small number of crashes.

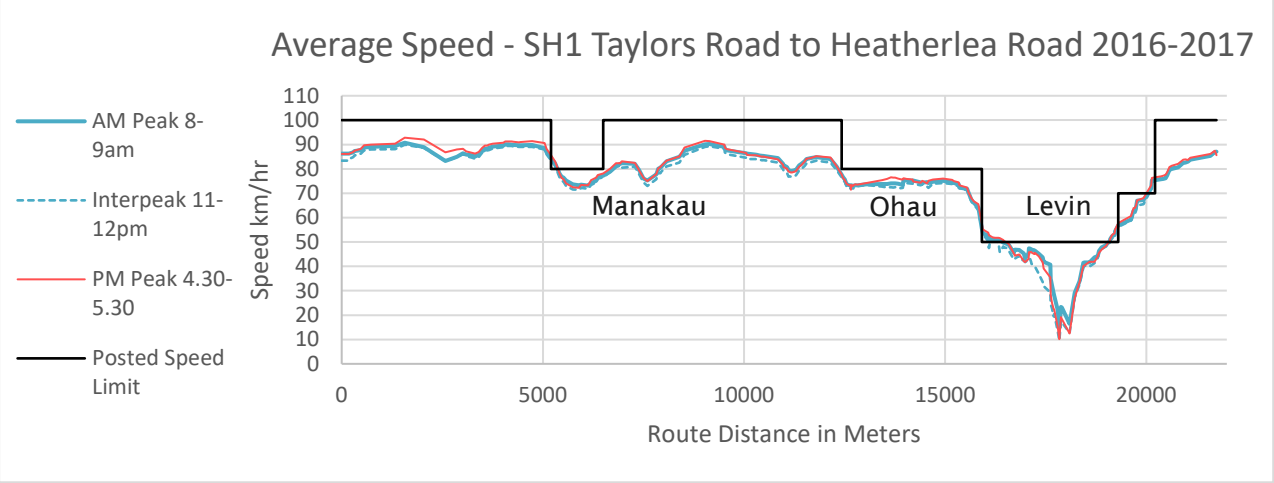

Figure 5-1: Average speeds on SH1

[57] It is noted that inter-regional public transport is now fundable from the NLTP which may assist these types of services.

Nevertheless, speed management should be included as part of a staged approach to project delivery to reduce the number of fatal and serious crashes whilst any long term solution is being progressed.

Online vs Offline solutions

A range of solutions both using the existing highway and creating new offline highways have been considered.

Online solutions

In terms of the existing highway a wide range of options have been considered:

- Minor safety upgrades
- Localised safety upgrades
- Larger highway upgrades
- Full upgrade of the current alignment to expressway standard

The first three of these are discussed later in this section. With regards larger highway upgrades, consideration was given to whether the existing highway from Ōtaki to north of Levin could be upgraded to an expressway standard or similar. This type of change was considered to be unachievable for the following reasons:

- The requirement for replacing five old sub-standard bridges (at the railway and river crossings) means that the new highway would need to be offline through those sections.
- To meet design standards whilst avoiding historical constraints, the highway would also need to be significantly realigned at a number of deficient curves.
- Parallel service roads are likely to be required to service the remaining frontage properties (there are approximately 400 accessways on the rural sections of SH1 and SH57), which will have their own physical impacts and costs.
- There are a large number of constraints adjacent to the existing alignment including Marae, Urupa, historic buildings which would be affected as part of the upgrade either by road widening or by the need to provide service lanes. In addition these constraints would significantly limit opportunities for future four laning (should that be needed).
- The current SH1 alignment traverses through the Ōhau and Manakau townships. Should a four lane expressway be needed in these locations then that would involve removal of an entire row of commercial/residential properties adjacent to the highway, and modifying or curtailing remaining access. Such four laning would also cause very significant severance between the eastern and western sides of these established communities.

Figure 5-2 shows the alignment that stays on line as much as possible. By avoiding constraints and improving the alignment to current design standards, over 70% of the alignment is actually offline. Accordingly, benefits are increased and costs and impacts are likely to be significantly decreased by going offline. Therefore, online expressway options were not considered further.

Figure 5-2: Online expressway actually 70% offline due to constraints

Offline solutions

Two different extents of offline highways have been considered:

- A new route from the end of the Peka Peka to Ōtaki Expressway to south of Levin; i.e. to Ōhau (and including a new SH1/57 intersection)
- A new route from the end of the Peka Peka to Ōtaki Expressway including a bypass of Levin and tying back into the two state highways north of Levin

These options are discussed later in this section. A new route all the way to the Manawatu River was not considered as part of current investigations[58], as traffic volumes drop to around 10,000 vpd on SH1 north of Levin. These volumes and current road geometry and context mean that online improvements are able to be undertaken to provide a state highway that is fit for purpose and ties in appropriately with the two lane bridge currently being constructed across the Manawatu River. These online improvements are identified in the North of Levin Programme Business Case (2015)[59] and are being progressed concurrently with this project.

It should be noted that the different extents of offline solutions that have been investigated with a design assumption that they are developed as four lane expressways including grade separated interchanges. This approach provides a worst case scenario in terms of cost and impact (and best case in terms of transport performance). However, these routes could potentially be progressed

[58] It was considered in the original Ōtaki to North of Levin Scoping Report, MWH, 2012
[59] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/PBC-North-of-Levin-Improvements-FINAL-red.pdf

as a two lane highway with at-grade intersections, at least initially, as part of a staged approach to a full solution.

Minor Safety Improvements

A minor safety improvements approach was investigated in 2017 (Ōtaki to north of Levin RoNS: Interim Safety Improvements (25 September 2017))[60] and is the first of the identified approaches that has been considered in detail. This approach would involve minor upgrades to the current state highway to ensure a consistent level of road safety provision with an aim to achieve a KiwiRAP 3 star rating and to reduce the number of deaths and serious injuries.

The focus of this approach is on safety maintenance, safety management and safer corridor treatments including:

- Signs and markings (delineation) improvements;
- Wide centrelines;
- Audio-tactile paving (ATP/rumble strips);
- Speed management;
- Intersection improvements;
- Reallocation of road space;
- Skid resistance improvements;
- Hazard removal; and
- Hazard mitigation (safety barriers).

The highway network within the project area has been split into two for the purposes of this approach:

- **SH1 South of Levin:** A plan of the measures that are currently identified for SH1 between Ōtaki and South of Levin are shown in Figure 5-3.
- **SH57:** Further work is currently being undertaken by the Safe Roads Alliance to determine the appropriate form of treatment for SH57 within the project area.

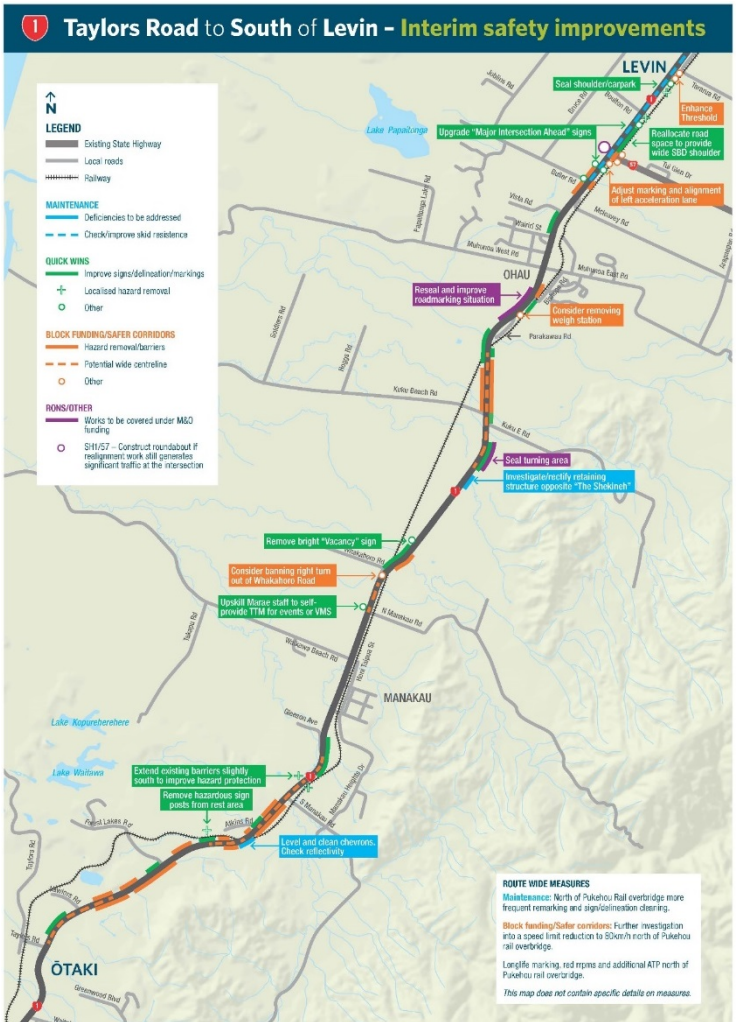

Figure 5-3: Minor Safety Improvements on SH1 south of Levin

[60] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/technical-reports/O2L-SH1-Interim-Safety-Measures.pdf

Even with this investment in safety measures it is expected that the SH1 route south of Levin will remain high risk as the fundamental form of the highway (two-lane two-way curvilinear highway with deficient bridges no median barrier and high access frequency) is inconsistent with the highway's function (national high volume highway with traffic volumes over 17,000 vpd). It is likely that a high number of fatal and serious crashes would continue to occur on this highway.

It also does little to address the resilience problem and town centre re-vitalisation opportunity.

Localised Highway Upgrades

Localised improvements to the existing highway network would address its worst performing sections, particularly from a safety point of view. These locations are listed below and shown in Figure 5-4:

1. Forest Lakes
2. Forest Lakes to Manakau
3. Manakau Rail Bridge
4. Ōhau Rail and River Bridges
5. SH1/57 Intersection
6. SH57 Kimberley Road / Arapaepae Road intersection

On line improvements would comprise:

Figure 5-4: Localised Highway Upgrades scope

Forest Lakes Upgrade[61] – this involves widening the existing alignment to provide a safer cross section including a median barrier and consistently wide shoulders between Taylors Road and the Pukehou Rail Overbridge. Some minor curve realignment would also be undertaken. It would involve removal of the southbound passing lane, as the Peka Peka to Ōtaki project to the south provides passing opportunities. See Report No.1: Forest Lakes Project Feasibility Report (April 2013)[62].

Forest Lakes to Manakau – this involves continuing the wider cross section, including a median barrier, from the Pukehou Rail Overbridge to the southern end of Manakau.

Manakau Rail Bridge – the current bridge is on substandard horizontal and vertical curves and is too narrow, therefore the proposal will be to realign the overbridge to enable a new rail bridge and Waikawa Stream bridge on an appropriate alignment. See Report No.3: Manakau to Ohau Bridges (February 2013)[63].

Ōhau Rail and River Bridges – as with the Manakau Bridges, this would involve realignment and replacement of the two sub-standard bridges in this location. See Report No.3: Manakau to Ohau Bridges (February 2013)[64].

SH1/ SH57 Intersection – the current intersection would be replaced with a roundabout and a grade separated crossing of the rail line for SH57 traffic. This requires the roundabout and the main SH1 alignment to be located further west than the current alignment. See Report No.5: SH1/SH57 Intersection and Arapaepae Curve Project Feasibility Report (April 2013)[65].

SH57 Kimberley / Arapaepae Corner – this involves realigning this corner to create one sweeping curve with a single T intersection in the middle of the curve for traffic wanting to turn

[61] Forest Lakes Project Feasibility Report (PFR), MWH, April 2013
[62] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/pfr-01-forest-lakes.pdf
[63] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/pfr-03-manuakau-ohau-bridges.pdf
[64] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/pfr-03-manuakau-ohau-bridges.pdf
[65] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/pfr-05-sh1-sh57-arapaepae-curve.pdf

on or off SH57. See Report No.5: SH1/SH57 Intersection and Arapaepae Curve Project Feasibility Report (April 2013)[66].

Whilst this approach would result in some reasonable crash savings, it is a high level of investment that does not satisfactorily resolve all of the identified problems. Whilst the number of crashes would decrease, there is still only one route between Manakau and Ōhau and therefore resilience is still a major issue. The high and increasing traffic volumes means that access to and from the highway is still going to deteriorate and there is no opportunity to improve the Levin town centre.

Overall, this is an expensive option which is not an enduring solution as it could not be upgraded to four lanes.

Larger Highway Upgrades

The Manakau bridges, Ōhau Bridges and SH57 are in close proximity to each other and solutions impact on adjacent problem locations. Considering them together opens up other opportunities such as realigning the road to the western side of the railway line (removing the need for two rail overbridges and at least three substandard curves) and enabling an improvement to the connection between SH1 and SH57 up to Palmerston North.

Accordingly, this scheme involves replacement of four of the projects outlined above with a single project, the SH1/SH57 Connection (see SH1-57 Connection Scoping Report (November 2013)[67]. This would involve a new road from the north of Manakau which would continue on the western side of the railway line until north of the Ōhau River. From this point, SH1 traffic would re-join the current alignment, and a new route would provide for SH57 traffic, joining Arapaepae Road (the existing SH57 route) in the vicinity of Kimberley Road. This is illustrated in Figure 5-5 below.

The overall form of SH1 under this scenario would be a two-lane, two-way highway with median and side barriers from Ōtaki to south of Levin.

[66] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/pfr-05-sh1-sh57-arapaepae-curve.pdf
[67] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/sh1-sh57-scoping-report.pdf

Figure 5-5: Highway Upgrades scope (potential alignment only)

Overall, these improvements would provide a much better level of service in terms of safety and efficiency compared to the localised safety improvements, at a similar cost (it is a larger project but requires fewer structures). However there is still a risk in regards to resilience, as there would still only be one route between Manakau and Ōhau, access onto the highway will continue to be difficult and the highway continues through the Levin town centre.

This option is also completely offline from north of Manakau to Kimberley Road. Accordingly, if offline options are being considered, then the full range of offline possibilities needs to be investigated properly to ensure the optimal solution is adopted and in the context of the future likely requirements, which in this instance is ultimately a bypass of Levin. This particular alignment is difficult to adapt to become a four lane expressway, due to constraints around the Ōhau area including the river, the railway line, the urban conurbation, urupa, vineyards, native bush and the need to connect to the current local road network.

Those sections which are online will be subject to increasing access difficulties due to the presence of the median barrier, and parallel service roads may need to be considered, which will involve additional land purchase to what has currently been estimated.

Taylors Road to South of Levin New Offline Highway

Based on the previously discussed online vs offline considerations, investigation has been undertaken into options which involves an offline highway from Taylor Road to South of Levin, but retains SH1 traffic through Levin.

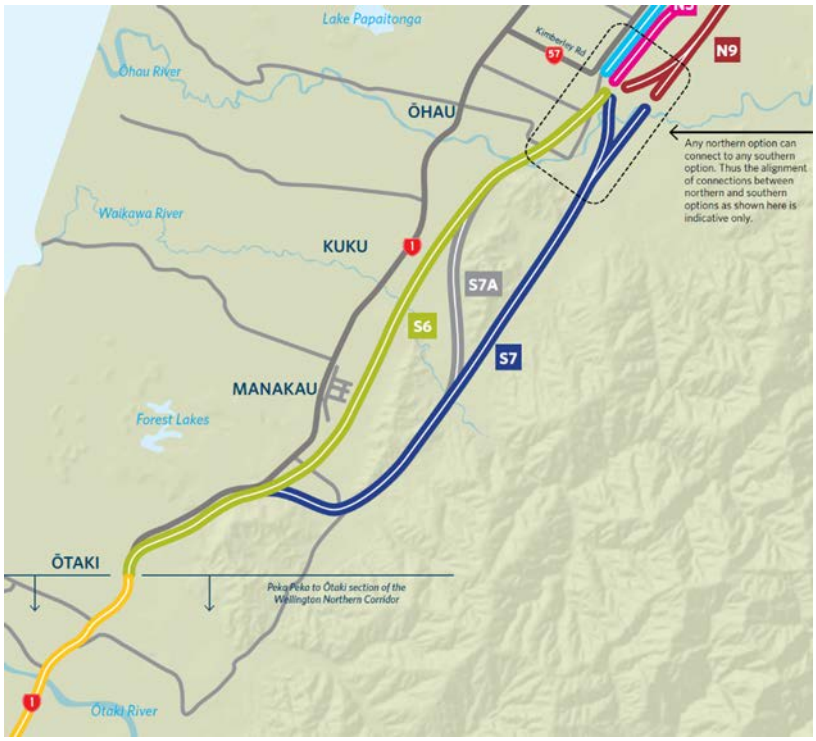

Figure 5-6: Potential alignments for a Taylors Road to South of Levin highway[68]

Previous investigations of these routes have shown that the best performing routes do not use the SH1/SH57 connection route (see Taylors Road to Ohau River Four Laning – Preliminary Options and Addendum (April 2015)[69] and Taylors Road to Ohau River Four Laning - Further Options Report (September 2015)[70]). Offline routes have fewer impacts and greater benefits, which means that using the Larger Highway Upgrades as a staged approach to a four lane expressway would be more difficult to consent.

The Taylors Road to South of Levin Offline Highway scenario addresses the problems identified for the southern part of the project area and can be used as the first stage in a full expressway from Ōtaki to north of Levin.

[68] This image shows the shortlist of options consulted upon in 2018 as part of a full offline highway route. A much wider range of options have been investigated previously and these are referenced in Appendix A.
[69] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/technical-reports/four-laning/O2NL-Taylors-to-Ohau-Four-Laning-Preliminary-Options-Report-and-Addendum-April-2015.pdf
[70] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/technical-reports/four-laning/O2NL-Taylors-to-Ohau-Four-Laning-Further-Options-Report-September-2015-front-only.pdf

Taylors Road to North of Levin New Offline Highway

The Taylors Road to North of Levin approach would comprise an offline highway from Ōtaki to immediately north of Levin.

A route all the way to the Manawatu River has not been proposed, as traffic volumes drop to less than 10,000 vpd on SH1 north of Levin and online improvements were considered to provide a state highway that is fit for purpose and ties in appropriately with the two lane bridge currently being constructed across the Manawatu River. Traffic flows on the state highway network north of the proposed SH1/57 intersection (north of Levin) are roughly half that on State Highway 1 south of this intersection.

Again, only offline routes have been investigated as they are lower cost and lower impact. The short list of these are presented in Figure 5-7.

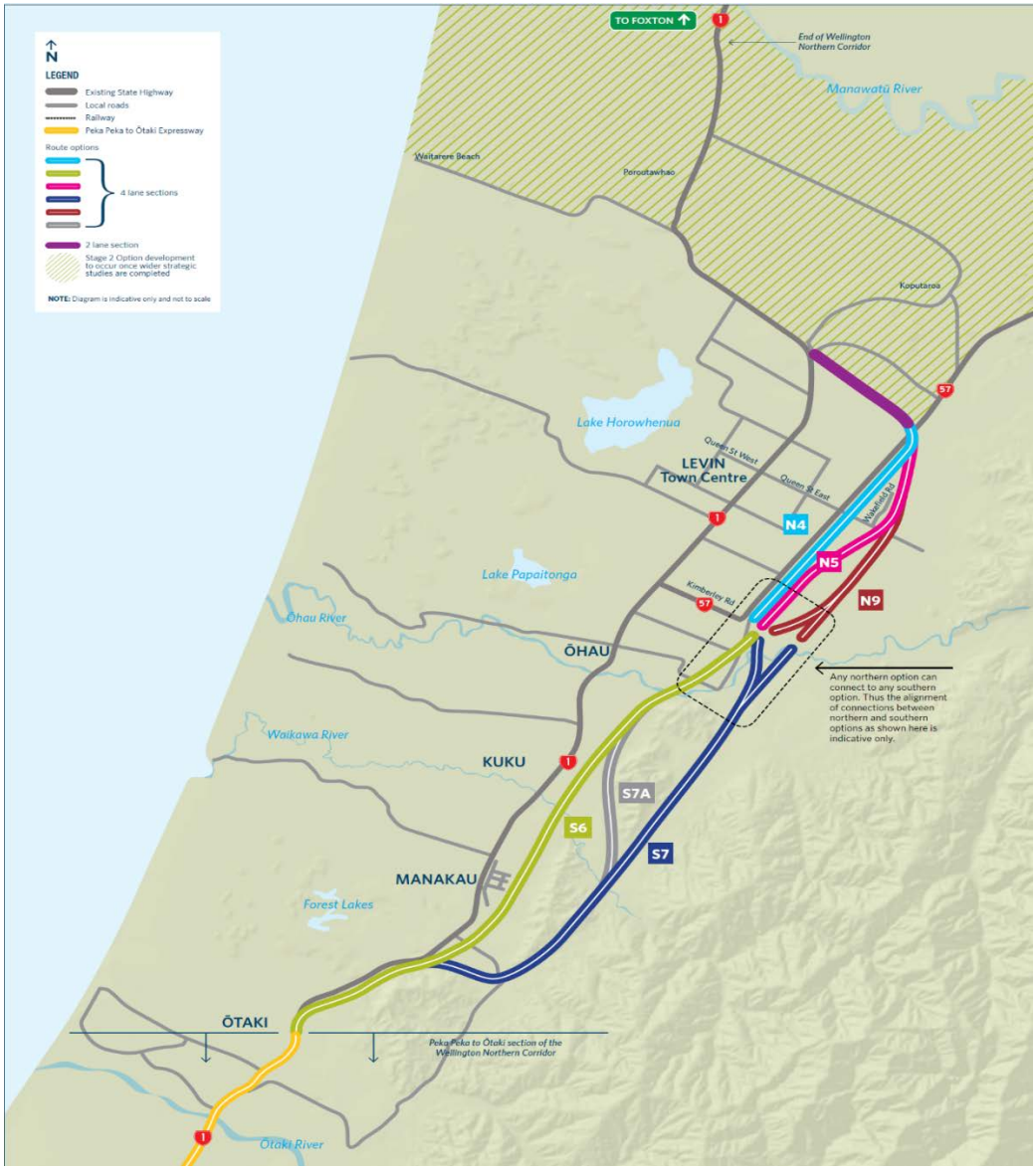

Figure 5-7: Potential alignments for a Taylors Road to North of Levin new offline highway

Alternative Comparison – Philosophy and Ability to Address Problems

Each of the approaches have been investigated and evaluated to understand the benefits, costs and impacts. These are reported in the tables below. The first table outlines the approach and how it would respond to the identified problems, and the second table presents the ability to address the Government Policy Statement objectives. The third table outlines how the approach would impact on quadruple-bottom-line measures as well as cost and risk.

Table 5-1: Summary of the different alternatives and how they address the identified problems

		Measure	Minor Safety Improvements	Localised Highway Upgrades	Larger Highway Upgrades	Taylors Road to South of Levin New Offline Highway	Taylors Road to North of Levin New Offline Highway
Philosophy			Low cost / low risk improvements on the current SH1 and SH57	Addressing just the highest safety risk parts of the current SH network (but staying online as much as possible)	Addressing the worst parts of the current SH network and providing a consistent road user experience. Involves some offline construction	Completely offline route from the end of the Peka Peka to Ōtaki expressway to around Ōhau	Completely offline route from the end of the Peka Peka to Ōtaki expressway to north of Levin including a Levin Bypass
Assumptions			Focussed on SH1 south of Levin and SH57. Would not require property or consents.	Projects would achieve a 90km/h design speed but not future proofed for expressway standard.	Projects would achieve a 90km/h design speed but not future proofed for expressway standard.	110km/h expressway standard. Assessed and costed for four lanes with grade separated interchanges.	110km/h expressway standard. Assessed and costed for four lanes with grade separated interchanges.
Description of Work			Includes: signs, line marking, wide centrelines, speed management, intersection improvements, skid resistance, hazard removal, safety barriers	Six separate projects: Forest Lakes; Forest Lakes to Manakau, Manakau Rail Bridge, Ōhau Rail Bridge, SH1/57 intersection and SH57 Kimberley/Arapaepae Intersection	Provides single solution for Manakau Rail Bridge, Ōhau Rail Bridge, SH1/57 intersection and SH57 Kimberley/Arapaepae Intersection. Forest Lakes projects as per Localised Highway Upgrades	Offline highway from Ōtaki to the south of Levin. No major works proposed within or around Levin.	Offline highway from Ōtaki to the north of Levin. Would tie in immediately north of Levin rather than extending to Manawatu River.
Project Outcomes	**Safety**	DSI Savings per 5 years	5-7	7-10	11-15	25-30+ depending on local road and revocation treatments	35 – 40+ depending on local road and revocation treatments
	Resilience	Number and duration of journeys affected	Slight reduction in number of journeys affected due to reduced crashes. Still no alternative route (detour >2hr).	Moderate reduction in number of journeys affected due to reduced crashes. Still no alternative route (detour >2hr).	Moderate reduction in number of journeys affected due to reduced crashes. Still no alternative route (detour >2hr).	Alternative route provided. Crash and flooding problems addressed	Alternative route provided. Crash and flooding problems addressed
	Horowhenua Growth	Appropriate connections to urban areas	No change to current	Potential improvements would facilitate access to Ōhau growth area.	Potential improvements would facilitate access to Ōhau growth area	Removal of through traffic improves safety of Manakau and Ōhau growth areas. Ease of access dependant on interchange strategy.	Removal of through traffic improves safety of East Levin, Manakau and Ōhau growth areas. Ease of access dependant on interchange strategy.
	Levin Town Centre	Reduce number of trucks in the main retail area of Levin	No change	No change	No change	No change	Significant reduction as Levin can be bypassed
	Inter-regional Growth	Travel times on SH network	No change	Minor improvement	Minor improvement	Minor Improvement	Improvement for all key routes

KEY IMPACTS Very Negative | Negative | Neutral/ Unknown | Positive | Very Positive

Alternative Comparison – Assessment against GPS

KEY IMPACTS Very Negative | Negative | Neutral/ Unknown | Positive | Very Positive

Table 5-2: Assessment of the different alternatives to the identified problems and the 2018 GPS

Note that while the tables shows the "Do Nothing" approach to have neutral outcomes (with the exception of major risks), this is purely because the Do Nothing is used as a baseline against which to compare the different approaches. The current situation is very negative in terms of safety and all aspects of access. In addition, as traffic volumes increase over time, the various outcomes would worsen. Similarly, the minor safety improvements will have limited benefits over time.

GPS Objective		Measure	Do Nothing	Minor Safety Improvements	Localised Highway Upgrades	Larger Highway Upgrades	Taylors Road to South of Levin New Offline Highway	Taylors Road to North of Levin New Offline Highway
Safety	A land transport system that is a safe system, free of death and serious injury	DSI Savings (per five years) estimated	0	5-7	7-10	11-15	25-30+ Including local road and revocation treatments	35 – 40+ Including local road and revocation treatments
		KiwiRAP Star Rating (Est)	SH1: 2.7 SH57: 2.8	SH1: 3.0 SH57: 3.0	SH1: 3.5 SH57: 3.0	SH1: 3.5 - 4.0 SH57: 3.0	SH1: 4.5 SH57: 3.0	SH1: 4.5 SH57: 4-4.5
Access	A land transport system that provides increased access for economic and social opportunities	Network Throughput (How much land transport system capacity is being used)	State Highways are approaching capacity. Levin Town Centre is at capacity, with growth compounding existing issues. Limited to no capacity for walking and cycling.	No change from 'Do Nothing'	No change from 'Do Nothing'. Median barrier may impact on some access.	No change from 'Do Nothing'. Median barrier may impact on some access.	Increased capacity for freight, tourism, and walking and cycling to Levin. Levin is still subject to congestion and reduced amenity/liveability.	Increased capacity for freight, tourism, and walking and cycling. Reduced traffic in central Levin provides increased economic opportunity.
	A land transport system that enables transport choice and access	Cycling, walking, PT, rail.	No improvements to any mode.	Improved shoulder width for walking/ cycling on SH57. No improvements to any other mode.	Improved shoulder width for walking/ cycling on SH57. Removes some of the constraints for rail upgrades.	Improved shoulder width for walking/ cycling on SH57. Removes some of the constraints for rail upgrades.	Improved shoulder width for walking/ cycling on SH57. Facilities to be provided on old SH1 or adjacent to new highway. Removes restrictions to upgrading rail	Walking and cycling facilities to be provided on old SH1 or adjacent to new highway. Removes restrictions to upgrading rail
	A land transport system that is resilient	Resilience	No alternative route between Manakau and Ōhau (Detour > 2hr). Network closures are typically due to flooding and crashes	No change from 'Do Nothing'	Still no alternate route between Manakau and Ōhau (Detour > 2hr). Crash problem partially addressed	Still no alternate route between Manakau and Ōhau (Detour > 2hr). Crash problem partially addressed	Alternative route provided. Crash and flooding problems addressed	Alternative route provided. Crash and flooding problems addressed
Environment	A land transport system that reduces the adverse effects on the climate, local environment and public health	Environmental Harm (levels of harmful air pollution (including greenhouse gas emissions and noise in affected areas)	See impact table below. No air quality issues identified as on plains. Large numbers of properties front the current SH1 and SH57.	See impact table below. No change from 'Do Nothing'	See impact table below. No significant change from 'Do Nothing'	See impact table below. No significant change in pollution. Reduction in traffic through townships (e.g. Kuku) but increased noise along new alignment sections.	See impact table below. No significant change in pollution. Reduced noise along existing SH1 south of Levin, but increases along new route	See impact table below. No significant change in pollution. Reduced noise along existing highways, but increases along new route
Value for Money	A land transport system that delivers the right infrastructure and services to the right level at the best cost	Costs	NA	~$5-10M	~$260-$280M + ? property	~$240-260M + ? property	~$375M+ + $75M property	~$575M+ +$125M property
		BCR (excl. WEBS)	NA	3+	~1	~1	<1	<1
Alignment to Other Strategies			Inconsistent with Regional and District growth policies, the Corridor Plan and ONRC.	Same as for Do Nothing	Slight improvement against ONRC	Slight improvement against ONRC	Achieves some objectives but not in terms of Levin Town Centre	Achieves objectives of these other strategies

Alternative Comparison – Impacts and Risks

KEY IMPACTS | Very Negative | Negative | Neutral/ Unknown | Positive | Very Positive

Table 5-3: Assessment of the different alternatives to quadruple-bottom-line impacts and risks

This table outlines how the approach would impact on quadruple-bottom-line measures as well as cost and risk

	Do Nothing		Minor Safety Improvements	Localised Highway Upgrades	Larger Highway Upgrades	Taylors Road to South of Levin New Offline Highway	Taylors Road to North of Levin New Offline Highway
Social	This table shows the "Do Nothing" approach to have neutral outcomes because the Do Nothing is used as a baseline against which to compare the different approaches. The current situation is very negative in terms of safety and all aspects of access. In addition, as traffic volumes increase over time, the various outcomes would worsen. Similarly, the minor safety improvements will have limited benefits over time	There are currently significant severance, noise, safety and other impacts on the communities that straddle SH1 including Manakau, Kuku, Ōhau and Levin. Lack of alternative routes during emergencies.	No change from Do Nothing, although increasing traffic volumes exacerbates current issues.	No change from Do Nothing, although increasing traffic volumes exacerbates current issues.	SH1 traffic continues through Manakau, Ōhau and Levin, although Kuku would be bypassed. Some minor localised impacts.	Positive impacts for urban areas of Manakau, Kuku and Ōhau. But new route affects rural residential area south of Manakau and east of Ōhau.	Positive impacts for urban areas of Manakau, Kuku and Ōhau and gives drivers a choice to travel through or around Levin. But new route affects rural residential areas south of Manakau, east of Ōhau and East Levin.
Environmental		No significant on-going natural environmental issues.	No change from Do Nothing	No change from Do Nothing	The preferred alignment runs close to stands of native bush in a number of locations but some mitigation is possible. No major natural environmental issues are envisaged	Depends on option but routes further east impact fewer stands of native bush compared to the online improvements. Any adverse effects can be mitigated through detailed design. No major environmental issues are envisaged.	Depends on option but routes further east impact fewer stands of native bush compared to the online improvements. Any adverse effects can be mitigated through detailed design. No major environmental issues are envisaged.
Cultural		Ongoing noise and safety impacts on two Marae and two urupa that front SH1	No change from Do Nothing	Realignments at Ōhau and Manakau are very close to Marae and areas of cultural significance.	SH1/57 Connection cuts through large amounts of Maori land and is very close to areas of cultural significance. Impacts reduced on one Marae and one urupa.	Eastern routes are preferred by iwi as they are further away from areas of cultural significance and affect fewer Maori land blocks. Still cultural issues which will have to be worked through.	Eastern routes are preferred by iwi as they are further away from areas of cultural significance and affect fewer Maori land blocks. Still cultural issues which will have to be worked through.
Econ-omic		The Wellington Northern Corridor will provide better connections to/from Wellington but it would stop short of Horowhenua District.	No change from Do Nothing	Does not provide significant improvements. SH1 traffic continues through Levin.	Some travel time benefits particularly for trips to /from SH57. SH1 traffic continues through Levin.	Provides a four lane highway to Levin and improves travel time. SH1 traffic continues through Levin.	Provides a four lane highway to north of Levin and maximises travel time benefits. SH1 traffic has the choice of travelling through or around Levin.
Property Impacts		Property access not affected	No change from Do Nothing	Median barrier installation will affect access to properties adjacent to the highway. There are 230 properties that front SH1 between Ōtaki and SH57 and 109 on SH57.	Median barrier installation will affect access to properties adjacent to the highway. There are 91 properties that front SH1 between Ōtaki and north of Manakau and 49 on SH57 Arapaepae Road.	Improved access for properties on the existing highway. Expressway impacts on a large number of properties, and access to other properties may be made more difficult, depending on local road connectivity	Improved access for properties on the existing highway. Expressway impacts on a large number of properties, and access to other properties may be made more difficult, depending on local road connectivity
Preclude future		NA	Doesn't prevent four lane expressway at any location in the future.	Enables four lane expressway at any location in the future. Online upgrades may be greater that what is required for revocation.	Could upgrade to four lanes but it has significant impacts and may not meet long term outcomes. Could still build new offline route, but this online option would be much greater than revocation needs.	Provides four lane expressway to Levin with options to go further North in the future.	Provides long term outcomes.
Major Risks	Very high number of deaths and serious injuries continue. Contrary to public expectation. No certainty for landowners in terms of future upgrades.		High number of deaths and serious injuries continue. Contrary to public expectation. No certainty for landowners in terms of future upgrades.	Significant expenditure without consideration of long term strategy. Median barrier installation will impact a large numbers of landowners. Option may be opposed by iwi. Contrary to public expectation. No certainty for landowners in terms of future upgrades	Option would be opposed by Iwi. The above issues, especially the property impacts of median barrier installation, would make it very difficult to consent, and would affect land acquisition process. Contrary to public expectation. Not the optimal offline option. Does not align with optimal offline highway options. No certainty for landowners in terms of future upgrades.	Large numbers of affected landowners. Significant social / amenity impacts on residential properties located to south and east of Manakau. Does not address Levin Town Centre issues. No certainty for some landowners in terms of future upgrades.	Very large number of affected landowners. Significant social / amenity impacts on residential properties located to south and east of Manakau and east of Levin.

Recommended Approach

The recommended approach is one that best addresses the problems and GPS objectives whilst not creating un-mitigatable impacts or risks.

The tables above clearly show that the Taylors Road to Levin New Offline Highway delivers the best results against the problems and objectives. All approaches have different significant impacts and risks which are summarised and discussed in the table and text below.

Table 5-4: Strategic Alternative Summary

	Strategic Alternative					
	Do Nothing	Minor Safety Improvements	Localised Highway Upgrades	Larger Highway Upgrades	Taylors Road to South of Levin New Offline Highway	Taylors Road to North of Levin New Offline Highway
Problem 1: Safety	NO	NO	Partially	Partially	YES	YES
Problem 2: Resilience	NO	NO	Partially	Partially	YES	YES
Problem 3: Growth	NO	NO	Partially	Partially	Partially	YES
Problem 4: Levin Town Centre	NO	NO	NO	NO	NO	YES
Land/Community Blight	NO	NO	NO	NO	Partially	YES
Iwi	NO	NO	NO	NO	YES	YES
(Part of) Enduring solution	NO	YES	Possibly[71]	Possibly[72]	YES	YES

With the recent change in the Government Policy Statement, it is important to think about the most appropriate way to invest in state highway improvements as this funding class is quite constrained. Accordingly, the discussion below presents the cheapest option to the most expensive to help determine whether lower cost scenarios deliver substantial outcomes with minimal risk.

- The lowest cost option, **Minor Safety Improvements**, would not address the problems or the GPS 2018 objectives in terms of reducing DSIs on this section of SH1 and SH57 (which is one of the worst state highways in the country). Minor Safety Improvements could include a reduction in speed limits, but this is not considered appropriate for a National Strategic High Volume state highway, and any viable change to the speed environment is unlikely to materially improve the safety performance of the state highway. The Minor Safety Improvements proposed would not have many impacts but still has a large risk in

[71] Enables four lane expressway at any location in the future. Online upgrades may be greater that what is required for revocation.
[72] Could upgrade to four lanes but it has significant impacts and may not meet long term outcomes. Could still build new offline route, but this online option would be much greater than revocation needs.

terms of the weight of public and landowner expectation. There are hundreds of landowners and businesses which need certainty of a new offline highway alignment (even if not constructed immediately) to continue with their lives.
Nevertheless the minor safety improvements are considered an excellent interim measure whilst the larger project is progressed through the pre-implementation phases.

- The **Localised Highway Upgrades** would partially remedy the key safety problem areas on SH1 south of Levin. However, they cost about the same as the Larger Highway Upgrades and do not provide the same level of benefit in terms of safety, resilience or access, particularly for SH57 traffic, which comprises a third of the trips travelling north from Ōtaki. They also cannot be the first part of staged approach towards a four lane highway, as the highway would need to be offline due to the significant negative impacts and costs associated with constructing a highway online. The major impact with this approach is on cultural interests and it still has the large risk of not providing certainty for an offline corridor, which will be needed in the future to cater for, and enable, growth.

- The **Larger Highway Upgrades**, including the SH1/SH57 Connection could be an appropriate strategy if four lanes were never required in the future. It provides benefits in terms of safety and access, but does not provide a fully resilient network (as there would still only be one route between Manakau and Ōhau). Unfortunately, this project cannot be the first stage of a four lane highway due to constraints around Ōhau, which means that it is not on the optimal offline alignment. Also it would be very difficult to consent as there are better routes available if four lanes were required in the future. A further consideration is that iwi would likely oppose this project as the alignment has significant negative cultural effects.

- The **Taylors Road to South of Levin New Offline Highway** is an appropriate strategy. It solves all the issues for the southern part of the corridor in terms of safety, resilience and access. It is around 50% more expensive than the Larger Highway Upgrades, and would involve some redundant expenditure (at connections) but is future proofed, thereby also giving certainty to landowners in the southern part of the area. This approach could be considered as the first stage of a Taylors Road to north of Levin New Offline Highway.

- The **Taylors Road to north of Levin New Offline Highway** is recommended as the best approach to address the key problems identified of safety, resilience, access and to assist the re-vitalisation of the Levin Town Centre. It is recognised that it is a very expensive project that may need to be staged or deferred in order to be affordable. It is considered vital to progress the investigation stage of this project (as a minimum) to confirm the preferred corridor and enable the community to understand the long term strategy and plan accordingly. Additional consideration can then be given to how the project is implemented over time.

Accordingly, further development of the **Taylors Road to north of Levin New Offline Highway** is being progressed to the optioneering phase. Whilst not considered specifically in the remainder of this report, it is noted that this strategy option can be delivered in stages, including a stage that delivers the **Taylors Road to South of Levin New Offline Highway**.

It will take some time to design, consent, construct and open a new offline highway (estimated 7 – 10 years). Accordingly, concurrent with the development of this approach, online minor safety improvements should be implemented as soon as possible to provide some reduction to the very high safety risk in the short term. In addition, investigation into public transport improvements should also be undertaken to improve accessibility and provide enhanced transport choice.

6. CONSTRAINTS AND DESIGN PHILOSOPHY

Based on discussion in the previous section, the best performing approach is the **Ōtaki to north of Levin New Offline Highway.** This approach can be staged and can be implemented alongside other initiatives such as integrating land use, public transport and interim safety improvements (these other initiatives can also be developed and implemented without the new offline highway).

This section presents the key constraints and design philosophy for the **Ōtaki to north of Levin New Offline Highway**.

Geographic Scope of Roading Options

The geographic scope is between the end of the Peka Peka to Ōtaki Expressway (at Taylors Road, north of Ōtaki) and north of Levin, in the vicinity of Heatherlea East Road. Improvements to SH1 north of this point are covered by the North of Levin Programme Business Case (encompassing passing lanes, realignments and online safety improvements). Improvements on SH57 are covered by an existing safety upgrade project (widening and barriers).

If a four-lane highway was progressed through the project area, those four lanes would extend to north of Levin and the new SH1/57 intersection, as traffic volumes on SH1 halves (roughly) from north of the new SH1/SH57 intersection, with the other half being on SH57 (traffic volumes are predicted to be approximately 10,000 vpd on SH1 and SH57 respectively north of Levin). In addition, no consideration has yet been given as to where future highway upgrades may be located further north i.e. towards Bulls, towards Palmerston North or somewhere in between. Accordingly, the current options need to consider and take account of such uncertainty.

Key Issues and Constraints

Before options can be identified, it is important to understand the constraints within the project areas[73]. Information about environmental and social constraints and opportunities was initially gathered in 2011[74] and then was fully updated in 2017 to inform the long list selection process.

The following aspects have been investigated and mapped using GIS software:

- Relief and hydrology
- Landscape and urban design quality
- Landscape absorption capability
- Heritage values
- Tāngata whenua values
- Lifelines
- Population distribution
- Geological constraints
- Ecological values

[73] The study area is bounded in the south by the Peka Peka to Ōtaki expressway, the north by the Manawatu River, the west by environmentally and culturally sensitive sand dunes (this area also contains a concentration of high tension power transmission lines and high pressure gas mains) and in the east by the foothills of the Tararua Ranges.
[74] Ōtaki to North of Levin Expressway Area Analysis Report, MWH, August 2011

- Land use capability
- Natural hazards
- Land ownership
- District and regional plan maps (zoning and specifically identified areas)
- Contaminated land/hazards.

Individual maps have been produced for each of these aspects (in some cases more than one) and these have been published on the project website[75]. In addition, a map has been produced which combines the following constraints to graphically show areas affected by multiple constraints:

- Landscape features
- Queen Elizabeth II Trust covenanted land
- Legally protected land
- Discrete areas with Tāngata Whenua values
- Ecologically significant areas
- Significant heritage locations

[75] https://www.nzta.govt.nz/projects/wellington-northern-corridor/Ōtaki-to-north-of-levin/technical-reports/

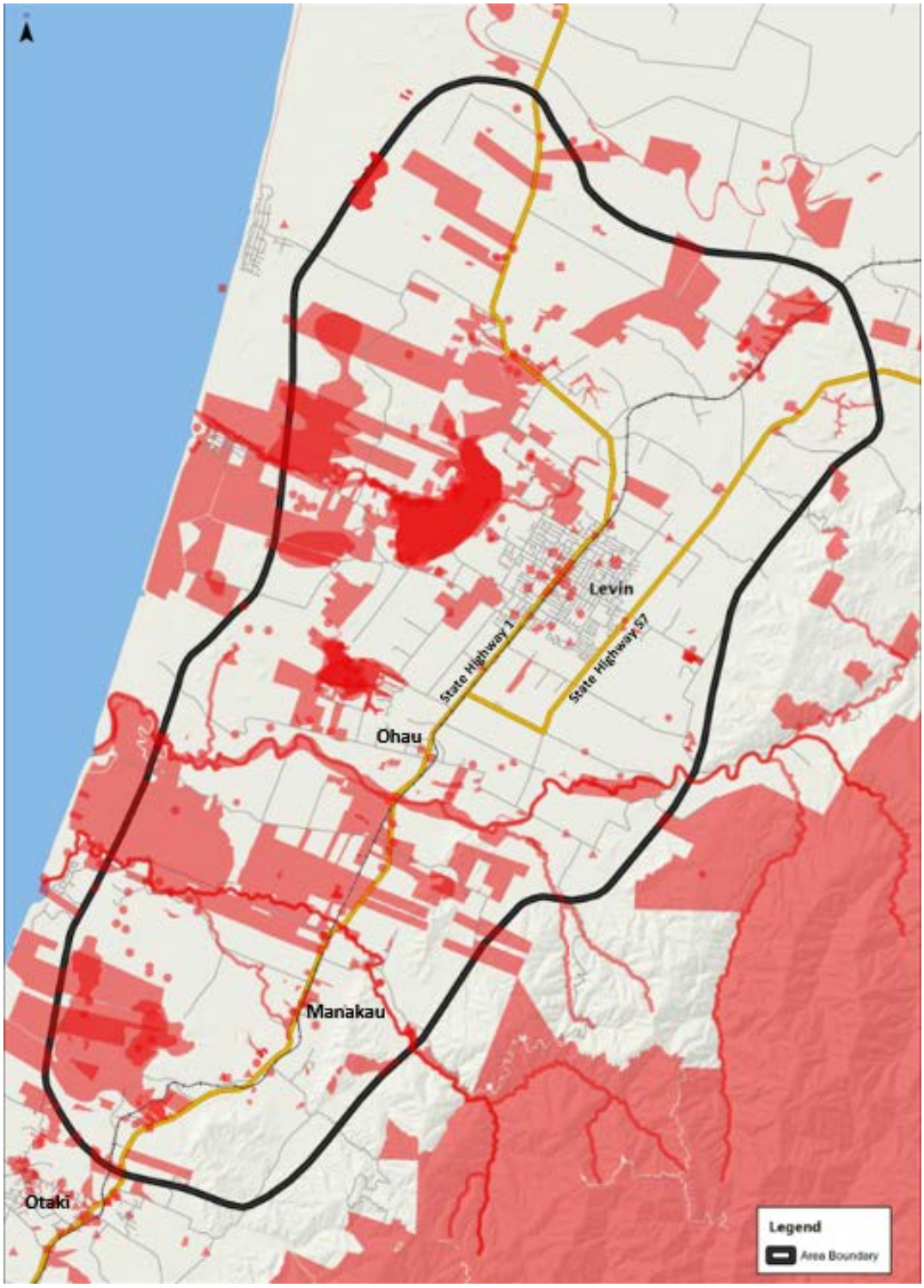

Figure 6-1: Map of combined constraints

These constraints have been taken into account in the identification and assessment of alternatives and options as outlined later in this report.

This information assisted in the formation and review of the route options discussed in the following sections as it identified areas which should be avoided, areas where various types of difficulties in locating a route would be encountered, and also areas which would be subject to limited constraints.

Design Philosophy

Although the initial form of the offline highway may be a two lane highway with at grade intersections, it is important that the design is future proofed to allow conversion into a four lane expressway at some point in the future to accommodate growth. Accordingly, the design philosophy has been to design for the larger scheme in the first instance but with full consideration of an initial two lane option as part of the next phase of work, to facilitate a staged approach to implementation.

The items for the basis of design for a four lane offline highway for the IBC stage were as follows:

- Standard: Expressway standard throughout
- Speed & geometry: a design speed of 110 km/h (operational speed of 100 km/h)
- Capacity: two lanes in each direction, median divided
- Access: all access to the highway via grade-separated interchanges, no direct side road intersections or direct property access
- Interchanges: initial consideration was given to these including how they would serve the current and future urban form and their technical requirements. However, it was determined that the interchange location would not significantly impact on the choice of a route option so detailed consideration has been delayed until the next phase of project development.

When the four lane expressway standard alignment has been determined, a scaled back option for an initial two lane highway will then be developed. This will investigate providing a two lane option prior to a future four lane solution. Investigations will determine cost effectiveness and benefits, and will include consideration of various at grade intersection forms prior to a future expressway standard being implemented.

A more detailed preliminary design philosophy statement is contained with Appendix I.

As with all environmental aspects, from an urban design and landscape perspective the project has sought to avoid or minimise adverse effects through the alignment identification process. Where mitigation / remediation is necessary, urban design and landscaping measures will be required. The principles to address effects will be developed for the project at a later stage and will be incorporated into an Urban and Landscape Design Framework (ULDF) or equivalent document.

7. LONG LIST OF OPTIONS

A significant body of work examining options between Ōtaki and Ōhau, between Ōtaki and north of Levin, and between Ōtaki and the Manawatu River has been undertaken over the past seven years[76]. This work has informed this IBC report, with elements from those previous investigations summarised below.

Given the wide ranging benefits and impacts of the options, it has been necessary to develop an investigation process for detailed consideration of the offline options. This is also described below. The detail of the option assessment process is provided in the O2NL Community Multi-Criteria Analysis Report[77] (Appendix F), and an overall summary of the process and assessments is provided in this report.

Identification of Preliminary Route Options

Recent public engagement indicated community interest in a wide geographic spread of routes across the area. Due to the array of previous investigations undertaken in recent years, the project team did not look to start option identification from scratch, instead took the outcomes of the previous studies as a starting point for discussion of long list options at Workshop 1.

The route options collated from previous studies[78] and investigations included the following:

- The Ōtaki to north of Levin Expressway - Scoping Report (MWH 2012)

  This identified four shortlist corridors for the entire study length:

  - Corridors 64 and 73 – brought forward as S5 and N4
  - Corridor 66 and 75 – brought forward as S6 and N4

  In addition, other routes from this stage were also utilised to show a broad range of options:

  - Corridors 67 and 76 – brought forward as S7 to show an eastern valley option
  - Corridors 19 and 46 – brought forward as S2 and N3 to show options between the town and lake Horowhenua

- Taylors Road to Ōhau River Four Laning Preliminary Options Report (MWH 2015) & Further Options Report (MWH, 2015)

  This identified a shortlist of routes for the southern part of the project area:

  - TO1/TO2 – brought forward as S3 and S4
  - TO17 – brought forward as S6

[76] See reports provided at: https://www.nzta.govt.nz/projects/wellington-northern-corridor/Ōtaki-to-north-of-levin/technical-reports/
[77] Identification And Assessment Of Possible Route Options – Multi-Criteria Analysis With Community Involvement, Stantec, 2017. https://www.nzta.govt.nz/projects/wellington-northern-corridor/Ōtaki-to-north-of-levin/technical-reports/
[78] https://www.nzta.govt.nz/projects/wellington-northern-corridor/Ōtaki-to-north-of-levin/technical-reports/

- Taylors Road to Levin Northern Connection, Report on Identification and Assessment of Options (MWH 2016)

  This identified a shortlist of routes for the northern part of the project area:

  - NC4 – brought forward as N4
  - NC5 – brought forward as N5

Populating a map with the above options did not show any options to the west of Lake Horowhenua[79], which, based on the response to the latest round of consultation, was of great interest to the community. Accordingly, the following options were created to fill this gap:

- S1 and N1 –A link to the west of Lake Horowhenua based loosely on an option presented in the Himatangi to Waikanae Study (Worley, 2000)
- N2 – A new option to link southern options S2 and S3 to a northern alignment west of Lake Horowhenua

The preliminary set of routes are shown on Figure 7-1. Each option is shown on Figure 7-1 as a 300 metre wide band. This width allows flexibility to locate an alignment within the band, and to leave room to avoid any particular features and address other adverse effects that may come to light during the detailed work of developing an alignment. The corridors as shown provide the minimum geometric standards appropriate for an expressway.

The corridors are split into southern and northern sections. The southern and northern sections join south of Ōhau or in the vicinity of SH57/Arapaepae Road. The southern and northern sections can be combined in various ways to create multiple whole-of-route options.

The purple section to the north of Levin would be a two lane link and would be part of all options to provide east-west movements between SH1 and SH57. The dashed black lines at the northern end of the norther corridors shows potential links into the existing state highways.

[79] A link to the west of Lake Horowhenua was ruled out early in the 2012 Scoping Report due to the wide range of constraints in this area

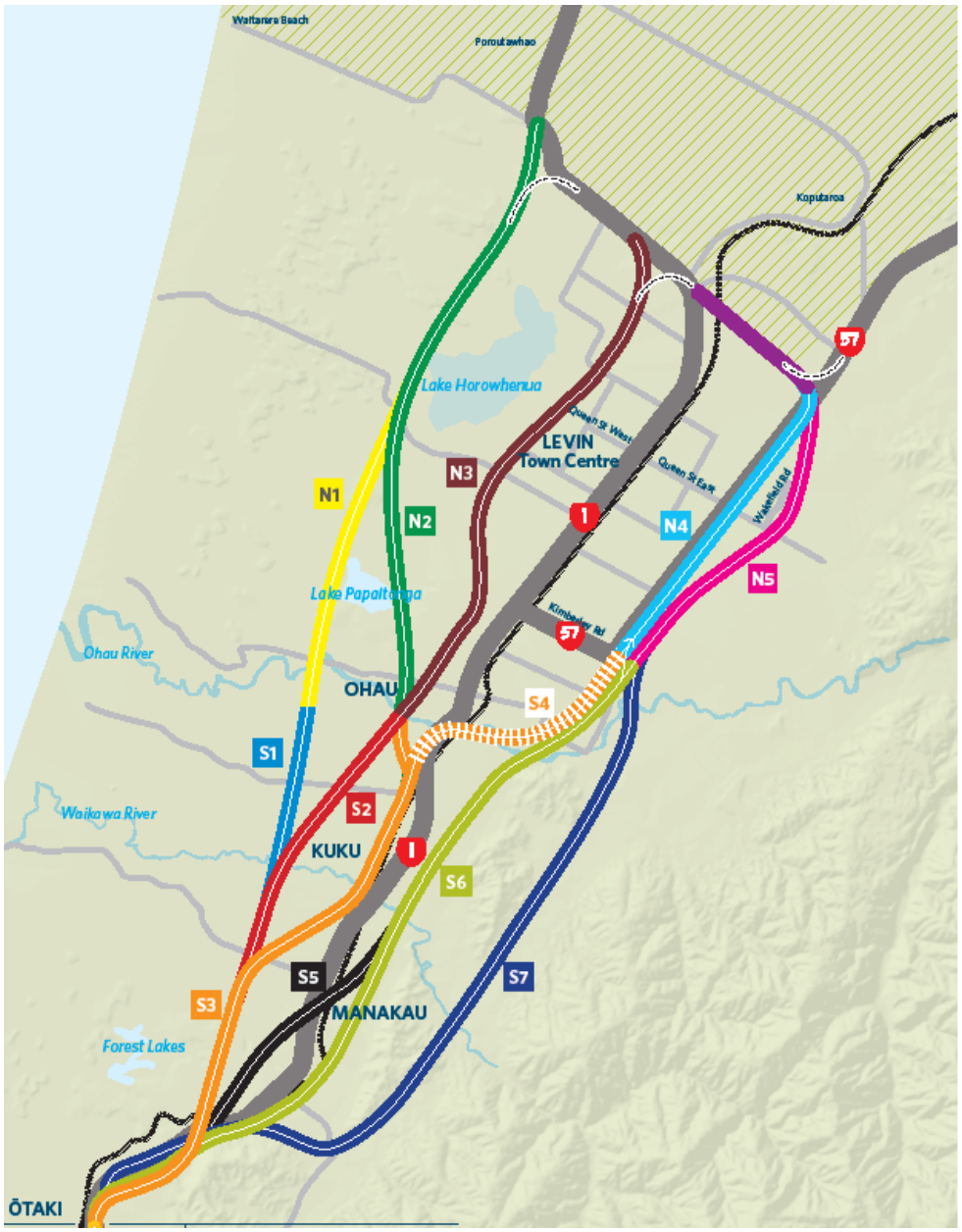

Figure 7-1: Preliminary Route Options

At the first MCA Workshop, the identified options were discussed with the project team, experts, stakeholders and members of the community. During the workshop there was a request that additional options be added into the analysis:

- Add an option to the west of corridor S1/N1, which may avoid some of the values impacted by S1N1
- Add a western route in the north which runs to the west of Lake Papaitonga on the alignment of N1 and then heads east to go east of Lake Horowhenua on the alignment of N3, again in an attempt to avoid some the values impacted by other options
- Add an option to the east of the Gladstone Greenbelt area, to avoid or mitigate potential effects on that area
- Add a northern option aligning with the existing transmission line through the Gladstone Greenbelt Area, to utilise the existing the utility corridor.

It was agreed that new route options should be added in response to these requests at Workshop 1, as shown in Figure 7-2. The options that were added at this point for evaluation at Workshop 2 are:

- S8 / N6 – a far western, whole-of-route option
- N7 – a western option which connects in the south to S1 and which follows the N1 alignment to the west of Papaitonga and then crosses to the east of Lake Horowhenua joining the N3 alignment
- N8 – a far eastern option which connects to any of S4, S5, S6 and S7 in the south
- N9 – an eastern option which broadly follows the existing transmission line[80] and connects to S7 in the south.

As previously, each option is shown on Figure 7-2 as a 300 metre wide band.

The corridors are split into southern and northern sections. The southern and northern sections join south of Ōhau or in the vicinity of SH57/Arapaepae Road. The southern and northern sections can be combined in various ways to create multiple whole-of-route options.

Figure 7-2: Route Options Following Workshop 1 (to inform Workshop 2)

[80] Note that this line no longer comprises part of the National Grid, and is technically now part of the electricity distribution network.

Multi Criteria Analysis

Assessment Process

This section sets out the most recent investigations to assist in determining route options for a four-lane offline highway from Taylors Road to north of Levin. As presented above, the investigations build on earlier options assessment work for this project.

The process described in this report had the benefit of information, comments and suggestions from the 2017 public engagement, wider engagement with Iwi, and also the participation of the Project Reference Group (PRG) which had been established for the project[81]. A specific process was determined which would seek to meet both the Transport Agency's and the wider communities' (as expressed through the PRG processes) expectations.

The work followed four stages, broadly, as follows:

Stage 1 (Mid 2017): The project team, involving the Transport Agency and its consultant team, updated information on constraints and opportunities mapped for the initial Area stage in 2011. It also prepared maps of a range of broad routes for consideration and evaluation through the community-based process (see Appendix F).

Stage 2 (Aug 2017): A community workshop (Workshop 1) was held to review and revise, as appropriate, the preliminary corridors and the route options evaluation criteria.

Stage 3 (Aug 2017): A community workshop (Workshop 2) was held to determine if any of the possible routes were fatally flawed, to score each option against the agreed criteria and to determine a 'community' weighting for the criteria.

Stage 4 (Sept 2017): The project team undertook analysis of the findings from the community workshop.

The remainder of this section describes the investigations, analysis and findings of this process.

Criteria

Before Workshop 1, preliminary criteria had been developed. Some modifications to criteria were made as a result of comments made at Workshop 1, resulting in the following revised criteria descriptions:

- **Landscape/Visual Impact** – this takes into account existing landscape character (including degree of modification and presence of structures) and the likely impact that a particular route option would have. It includes potential landscape and urban design effects when passing through or near to townships or lifestyle areas. It excludes direct visual effects on dwellings, effects of severance, and amenity considerations.
- **Ecological Impacts** – this criterion covers ecological values, including indigenous vegetation areas that are nationally, regionally or locally significant in terms of habitat

[81] See 2017 consultation report, ibid, particularly sections 4.1(4) and 5.11 and Appendix D of that report.

values or the presence of species, and the potential effects on waterways (lakes, rivers and streams) and wetlands.

- **Impact on Heritage** – this criterion takes into account known archaeological and heritage sites and features, and also the risk of encountering archaeological features, or new areas of significance.
- **Tāngata Whenua Cultural Values**– this takes into account the range of values that Tāngata Whenua are likely to associate with the area, including past and present associations, key areas of settlement (marae and papakianga), waahi tapu (if known) and other cultural value, areas of use (e.g. food gathering) current ownership, and important elements of the natural environment such as waterways and wetlands.
- **Productive Land Values** – this criterion takes into account the inherent productive values of Classes I to III soils (present and future), and the current productive land use pattern.
- **Social/Community/Recreation Impacts** – this incorporates a range of considerations such as severance, general amenity (including exposure of communities to noise), recreation impacts, and impacts during the construction phase.
- **Impacts on Dwellings** – this criterion takes into account direct effects on existing dwellings, including the need to remove dwellings, and the potential need for mitigation of adverse effects on dwellings near an alignment.
- **District Development** – this criterion includes consideration of impacts on current district plan provisions, and likely future growth areas.
- **Fit to Project Objectives** – this criterion covers travel time, safety, long-term resilience and the ability to connect effectively to Levin.
- **Property Degree of Difficulty**– this includes the number of properties, extent of severance of existing properties, the general ability to align a route option with property boundaries, potential for effect on farming/business operations, and any known land tenure issues.
- **Engineering Considerations** – this criterion addresses expected difficulties with construction of a route option (constructability), including matters such as likely geotechnical considerations, extent of structures needed, and potential flooding and groundwater issues.
- **Cost** – indicative order of cost of options.
- These revised criteria were applied by the Workshop 2 attendees.

Multi-Criteria Analysis of Route Options

Scoring

The general approach to scoring used at Workshop 2 is set out in Table 7-1 below.

This was discussed at both workshops and it was confirmed that much less was understood about benefits than adverse effects. While the project would not proceed unless there were benefits, these are not understood at the level of individual criteria. Therefore, the focus in scoring would be on the adverse effects and difficulties within the criteria.

Table 7-1: Basis for Scoring used in the MCA

Score	Description
1	The option presents few difficulties on the basis of the criterion being evaluated, taking into account reasonable mitigation proposals. There may be significant benefits in terms of the attribute.
2	The option presents only minor areas of difficulties on the basis of the criterion being evaluated, taking into account reasonable mitigation proposals. There may be some benefits in terms of the attribute.
3	The option presents some areas of reasonable difficulty in terms of the criterion being evaluated. Effects cannot be completely avoided. Mitigation is not readily achievable at reasonable cost, and there are few or no apparent benefits.
4	The option includes extensive areas of difficulty in terms of the criterion being evaluated, which outweigh perceived benefits. Mitigation is not readily achievable.
5	The option includes extreme difficulties in terms of achieving the project on the basis of the criterion being evaluated.

The workshop group elected to use a score of 5* where it was considered that an adverse effect in relation to a criterion may be a fatal flaw.

Scoring Process

Workshop 2 applied the decision conferencing process and was attended by a large and diverse group comprised of local community members, council organisations, iwi representatives, technical specialists and NZTA project and specialist staff.

Initially criteria and the proposed scoring system were discussed. Each criterion was then described and discussed by the relevant specialist, identifying issues relevant to each route option. Following this, the workshop attendees raised any questions or matters relating to the implications of a particular route option and the score proposed by a specialist for each route option. Extensive use was made of aerial “fly-overs” and other materials during the explanations and discussions.

Each criterion was scored for the southern options first and then for the northern options. In most cases a single agreed score was awarded. However, in a few cases the workshop process

did not reach a single score. In such circumstances, both scores were recorded (see Table 7-2 and Table 7-3). The various Iwi representatives present provided separate scores for the sections relevant to them.

Figure 7-3 shows the route options highlighting the key issues identified by participants at Workshops 1 and 2.

Table 7-2: Scoring of Southern Route Options

Criteria	Landscape/Visual Impact	Ecological Impacts	Impact on Heritage	Tāngata Whenua Cultural Values	Productive Land Values	Social/Community / Recreation	Impact on Dwellings	District Development	Fit to Project Objectives	Property Degree of Difficulty	Engineering Considerations	Cost
S1	2	1	4	5/4	3	2	3	1	3	5	3	2
S2	2	2	4	5/5	3	2	3	1	1	5	3	2
S3	3	3	4	5/5	3	2	3	1	1	5	3	2
S4	4	5	4	3/5	4	3	5	2	2	5	3	4
S5	4	4	4	4/4	4	5	5	3	1	5	2/3	4
S6	2	2	2	2/2	4	5	5	3	1	4	2	3
S7	3	5	2	3/3	4	2	4	1	3	4	3	4
S8	2	1	4	5/5	2	1	3	1	3	5	3	2

Table notes:

1. Cells containing two scores are reflective of different views at the workshop.
2. Separate scores for Tāngata Whenua Cultural Values were provided by representatives of Ngāti Wehi Wehi (noted first) and Ngāti Tukorehe (noted second).

Table 7-3: Scoring Northern Route Options

Criteria	Landscape/Visual Impact	Ecological Impacts	Impact on Heritage	Tāngata Whenua Cultural Values	Productive Land Values	Social/Community/ Recreation Impacts	Impact on Dwellings	District Development	Fit to Project Objectives	Property Degree of Difficulty	Engineering Considerations	Cost
N1	5	4	4	5*	2	3	3	1	3	4	3	2
N2	5	5*	4	5*	2	3/4	4	1	3	4	3/4	3
N3	4	2	4	5*	3	5	5	4	1	5	2/3	2

Criteria	Landscape/Visual Impact	Ecological Impacts	Impact on Heritage	Tāngata Whenua Cultural Values	Productive Land Values	Social/Community/ Recreation Impacts	Impact on Dwellings	District Development	Fit to Project Objectives	Property Degree of Difficulty	Engineering Considerations	Cost
N4	2	4/5	4	3	3	4	5	4	1	3	2	1
N5	2	1	2	3	3	3/4	5	4	1	3	2	1
N6	2	5	4	5	2	2	3	1	3	4	3/4	4
N7	5	4	4	5*	3	5	4	4	3	4	3/4	2
N8	4	1	2	3	4	4	5	3	3	3	2	2
N9	1	5	2	3	4	3/4	5	4	1	3	2	2

Table notes:

1. Cells containing two scores are reflective of different views at the workshop, or lack of workshop resolution.

2. Single scores under Tāngata Whenua Cultural Values were provided by representatives of Muaupoko.

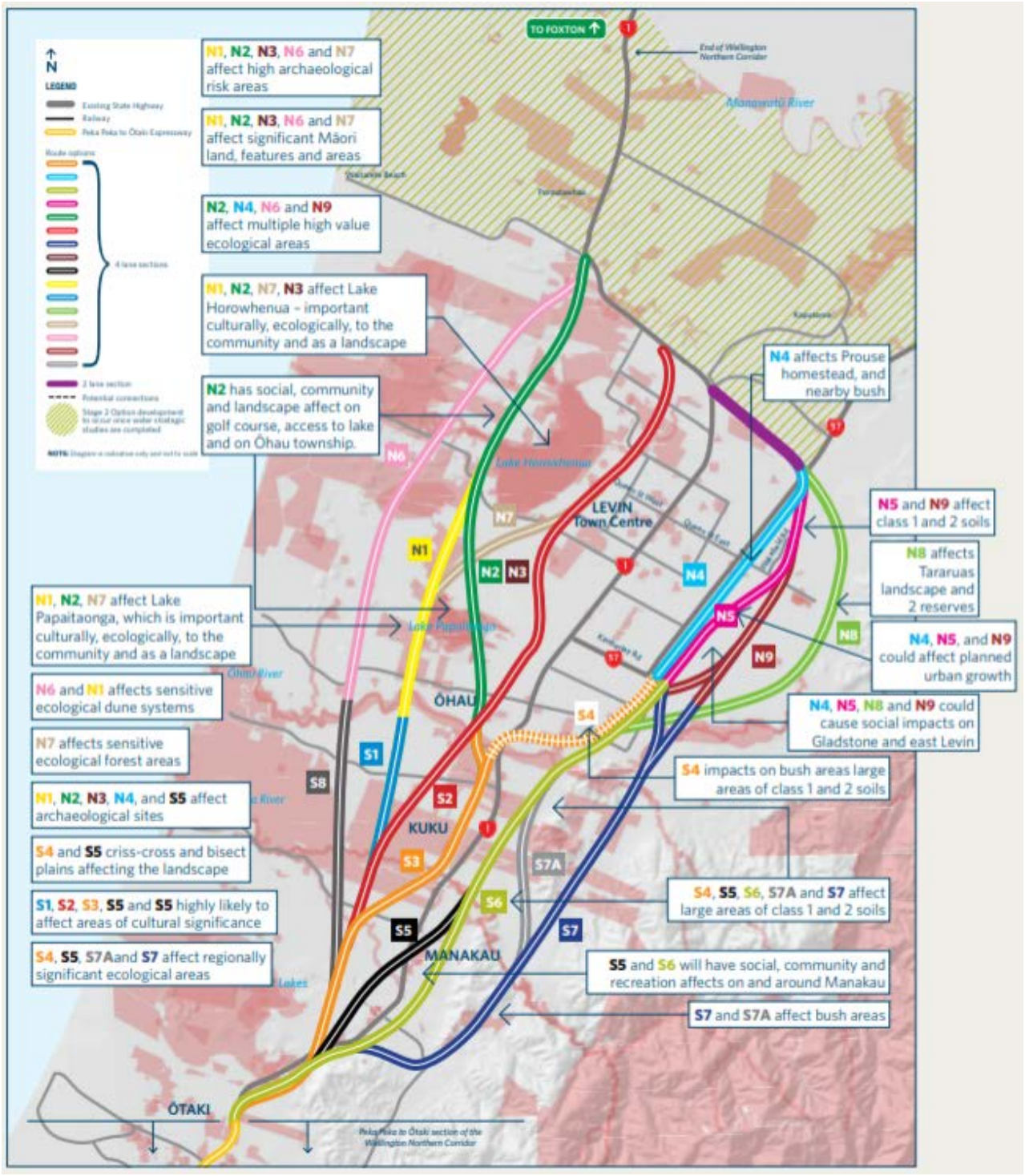

Figure 7-3: Route Options showing key issues that were identified by participants at Workshops 1 & 2

Weighting Systems

It was recognised by the workshop participants that all criteria are not of equal importance and that different people may accord different importance[82].

A "workshop" weighting was sought, and led to considerable discussion at the end of Workshop 2. This can be regarded as the community workshop weighting as it was performed as part of the workshop process and in the context of the comprehensive scoring exercise which had just been undertaken. The workshop attendees were made aware that additional weighting systems would also be applied along with sensitivity analysis.

Five further weighting systems were developed. One places an emphasis on matters of national importance which will be dominant considerations in the Resource Management Act (RMA) resource consent processes, and the remaining four are related to quadruple bottom line considerations. The analysis on this basis is relevant to matters to be taken into account under the Land Transport Management Act and other national infrastructure policy approaches. They are also pertinent to RMA and Local Government Act considerations[83].

At the time of the workshop, NZ Transport Agency had released a draft guideline on MCAs. Whilst there are a number of outstanding issues raised by submitters on this draft (and the guidelines have since been withdrawn), a weighting system based on this has been developed for comparative purposes.

At the PRG meeting following the workshops a number of community representatives stated that they felt rushed developing the community weighting system during the MCA workshop. Accordingly, the attendees of that PRG meeting were offered an opportunity to develop a new weighting system. In the end, two further such systems were developed.

MCA Results

Table 7-4 and Table 7-5 set out the findings of the analysis for the southern and northern sections. In these tables, the asterisked figures show the highest, or worst two performing, options.

[82] There was acceptance that the criteria did not represent a "base case" and there was no benefit in an analysis with all criteria accorded equal weight. This approach has been consistent with all earlier MCA exercises undertaken in relation to the project.
[83] This quadruple bottom-line weighting is a different type of evaluation from the Benefit Cost Ratio (BCR) evaluation normally undertaken by the Transport Agency.

Table 7-4: Analysis of Southern Route Sections (Scores x Weights for Different Weighting Systems)

	Un-weighted		Weighting Systems								
	Number of 5s	Number of 4s	Workshop Weighting	RMA Part 2	Social	Natural Environment	Cultural	Economic	Draft MCA Guide	PRG1	PRG2
S1	2	1	2.87	2.68	2.82	2.07	3.11	2.84	2.94	2.62	2.76
S2	1	2	2.87	2.92	2.86	2.56	3.47	2.63	2.36	2.58	2.78
S3	1	2	3.04	3.18	2.99	3.11	3.69	2.63	2.44	2.76	2.94
S4	4	3	3.72*	3.70*	3.69*	4.04*	3.75*	3.65*	3.25*	3.64*	3.61*
S5	6	3	3.87*	3.87*	3.99*	3.89*	4.22*	3.76*	2.93	3.88*	3.89*
S6	2	2	2.97	2.60	3.15	2.33	2.67	3.35	2.38	3.16	3.05
S7	4	1	3.17	3.07	3.03	3.52	2.83	3.24	3.22	3.07	3.02
S8	1	2	2.78	2.73	2.76	2.07	3.25	2.63	2.90	2.43	2.65

Based on the above analysis, it is clear that Options S4 and S5 perform less adequately than the others. These options have the highest number of 4s and 5s in the raw score analysis, and almost consistently perform worst under all weighting systems. It is therefore considered that options S4 and S5 should be discounted.

Table 7-5: Analysis of Northern Route Sections (Scores x Weights for Different Weighting Systems)

	Un-weighted		Weighting Systems								
Option	Number of 5s	Number of 4s	Workshop Weighting	RMA Part 2	Social	Natural Environmental	Cultural	Economic	Draft MCA Guide	PRG 1	PRG 2
N1	3	2	3.42	3.67	3.29	3.74	4.19	2.67	3.13	3.16	3.30
N2	3	3	3.65	3.92*	3.55	4.11*	4.36*	2.98	3.32*	3.39	3.51
N3	3	4	3.70*	3.68	3.90*	3.26	4.33	3.35*	2.67	3.73*	3.82*
N4	4	1	3.24	3.30	3.29	3.41	3.53	2.71	2.21	3.41	3.40
N5	1	1	2.59	2.38	2.77	2.07	2.58	2.57	1.96	2.78	2.77
N6	3	2	3.27	3.52	3.17	3.56	3.72	2.98	3.22	2.93	3.10
N7	5	3	4.02*	4.17*	4.03*	4.19*	4.56*	3.39*	3.42*	4.04*	4.10*
N8	2	1	3.09	2.75	3.15	2.44	3.00	3.08	2.86	3.27	3.21
N9	2	2	3.07	3.02	3.06	3.48	2.78	2.88	2.24	3.27	3.21

Based on the above analysis it is clear that Options N2, N3 and N7 perform worse than the others. Again these options have the highest number of 4s and 5s in the raw score analysis, and consistently have the worst weighted averages in the weighted score analysis. It is therefore considered that options N2, N3 and N7 should be discounted.

The overall analysis was also performed without the cost scores included. This did not change the preferences in the tables above.

With the worst performing individual sections removed (Options S4, S5, N2, N3 and N7), ten potential combined route options remain. The remaining routes comprise two western options (S8N6 and S1N1), and eight eastern options; four with S6 in the south (referred to as S6 options) and four with S7 (referred to as S6 options), as shown in Figure 7-4. An analysis of their favourability in terms of the MCA is presented in more detail under the various weighting systems as set out in Table 7-6.

The scores shown for each combined route in Table 7-6 are the sum of the relevant route sections from Table 7-4 and Table 7-5, rounded to one decimal place. Lowest scores indicate best performing options overall, and highest scores worst.

Table 7-6: Analysis of Combined Route Options

Combined Options	Workshop Weighting	RMA Part 2	Social	Natural Environment	Cultural	Economic	Draft MCA	PRG1	PRG2
S8N6	6.1	6.3	5.9	5.6	7.0	5.6	6.1	5.4	5.7
S1N1	6.3	6.4	6.1	5.8	7.3	5.5	6.1	5.8	6.1
S6N4	6.2	5.9	6.4	5.7	6.2	6.1	4.6	6.6	6.5
S6N5	5.6	5.0	5.9	4.4	5.3	5.9	4.3	5.9	5.8
S6N8	6.1	5.4	6.3	4.8	5.7	6.4	5.2	6.4	6.3
S6N9	6.0	5.6	6.2	5.8	5.4	6.2	4.6	6.4	6.3
S7N4	6.4	6.4	6.3	6.9	6.4	6.0	5.4	6.5	6.4
S7N5	5.8	5.5	5.8	5.6	5.4	5.8	5.2	5.9	5.8
S7N8	6.3	5.8	6.2	6.0	5.8	6.3	6.1	6.3	6.2
S7N9	6.2	6.1	6.1	7.0	5.6	6.1	5.5	6.3	6.2

Table 7-6 indicates that there are some routes that perform better than others under most weighting scenarios.

Of the western options S8N6 generally rates better than S1N1 in all bar one weighting system, however both perform poorly under RMA Part 2 and cultural weightings (as well as the Transport Agency's draft MCA weighting).

Of the S6 options, the variant with N5 as the northern section performs best in all weighting systems. The same is true of the S7 options.

From the earlier discussion of the scoring outcomes, it is clear that there is no option which is free of issues, problems or environmental impacts. This analysis has provided a formalised, transparent and structured means of comparing the disparate options, but more investigation and analysis is required before a preferred route is chosen.

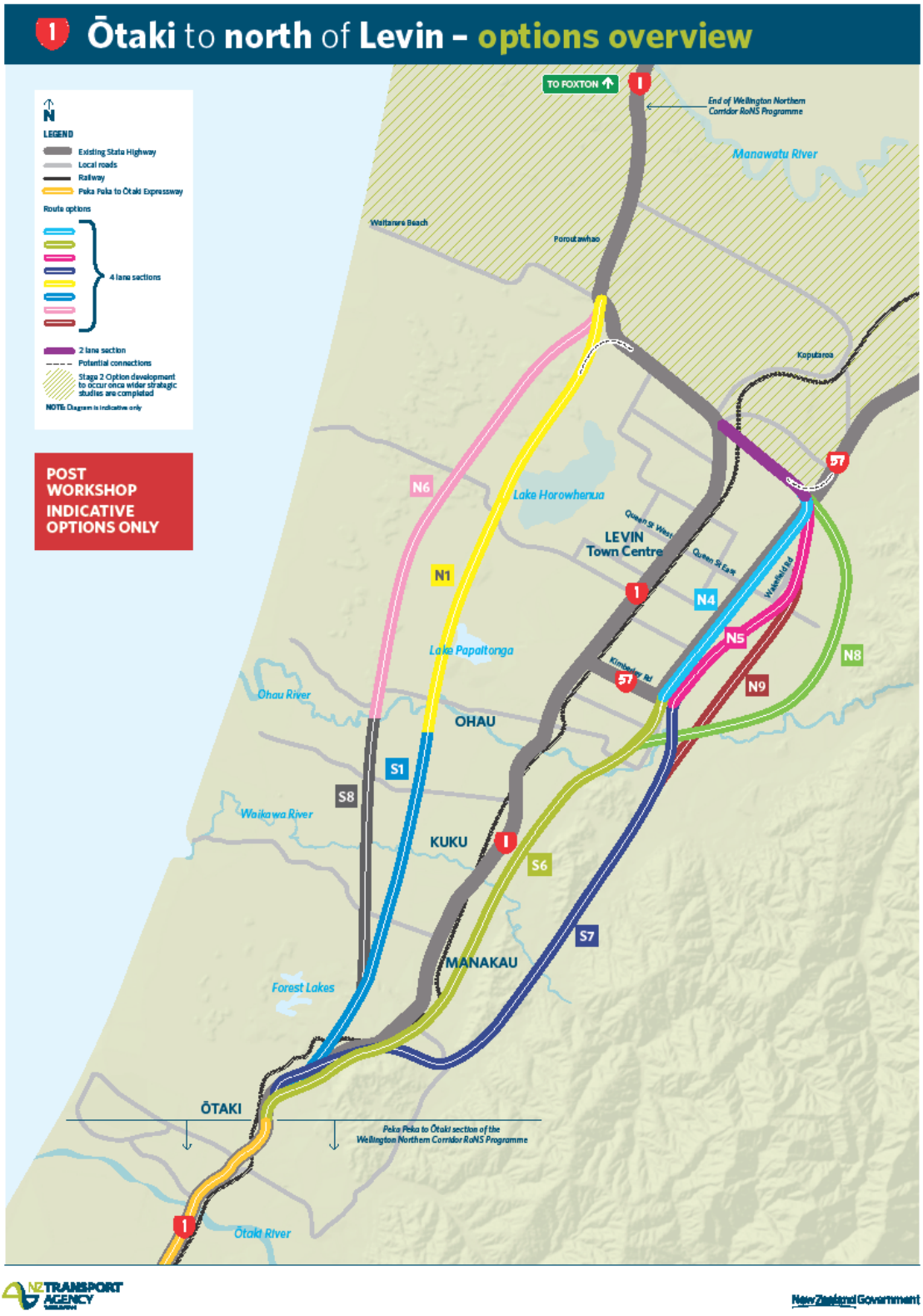

Figure 7-4: Shortlisted Route Options

8. FURTHER ANALYSIS OF SHORTLISTED OPTIONS

The MCA process also identified that there were a few major considerations that need to be considered in more detail before the options are shortlisted any further. These are:

- Tāngata Whenua Impact. Some of the routes were considered fatal flaws by iwi representatives in the MCA workshop due to their significant impact on sites of cultural significance, areas of previous occupation and the need to take extensive areas of Maori land.
- Traffic Modelling. Some of the routes did not appear to provide for access from the offline highway to the key destinations of Levin or SH57 north of the project area.
- Constructability. Some of the alignments go through parts of the project area which have not been considered in detail previously. Further investigation needs to be undertaken on route S7 and the bush areas along N4.

These aspects were presented in an NZTA report entitled Project Update on Shortlist Options for Public Consultation (NZTA, 2018)[84]. This section includes a summary of aspects of that report.

Tāngata Whenua Impact

The area to the west of Levin is of much greater significance to iwi than the area to the east, as this is historically where Maori lived or where particularly important resources, often food sources, were located[85]. The major settlements and occupation sites and key food sources of the various local iwi were predominantly located in the coastal dune belt and in and adjacent to the major rivers, streams, swamps, lagoons and inland lakes. The forested land to the east was used primarily for resource gathering and therefore fewer sites of significance are located there.

A map of the archaeological risk is shown below. The map clearly shows the difference between the areas east and west of Levin. The process for creating this risk map can be found in the Archaeological Report[86].

This is also reflected in Tāngata Whenua Areas of Significance constraint map, which is also shown below. It must be noted that this is not a complete record of sites of significance. Iwi have advised that there are many more sites of significance to the west of Levin than are currently mapped.

[84] https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/technical-reports/Project-update-on-shortlist-for-consultation-February-2018.pdf
[85] An Analysis of the Archaeological Risks for Route Options Within the North of Ōtaki to North of Levin Options Area, inSite Archaeology, September 2017
[86] ibid

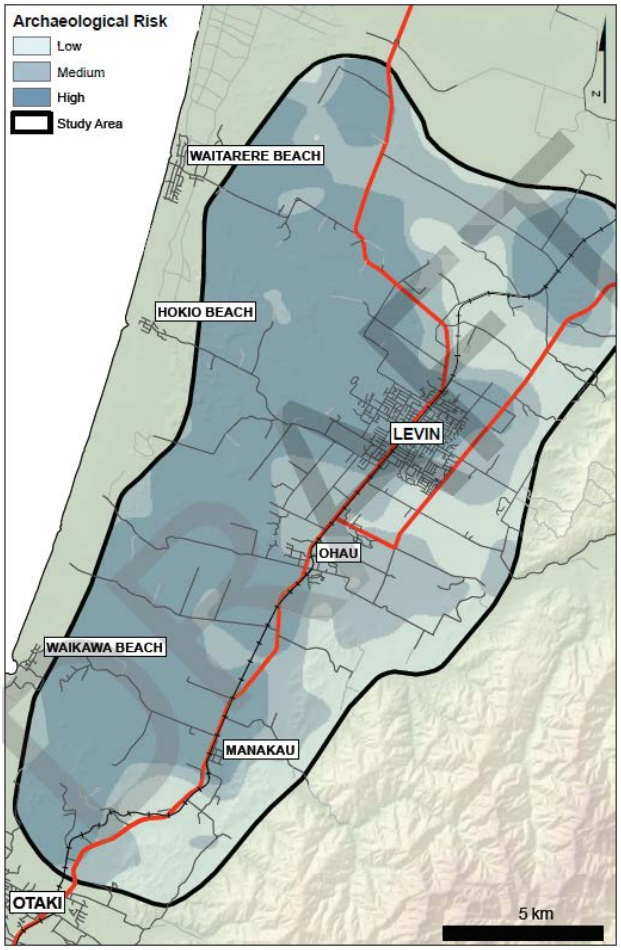

Figure 8-1: Estimated archaeological risk

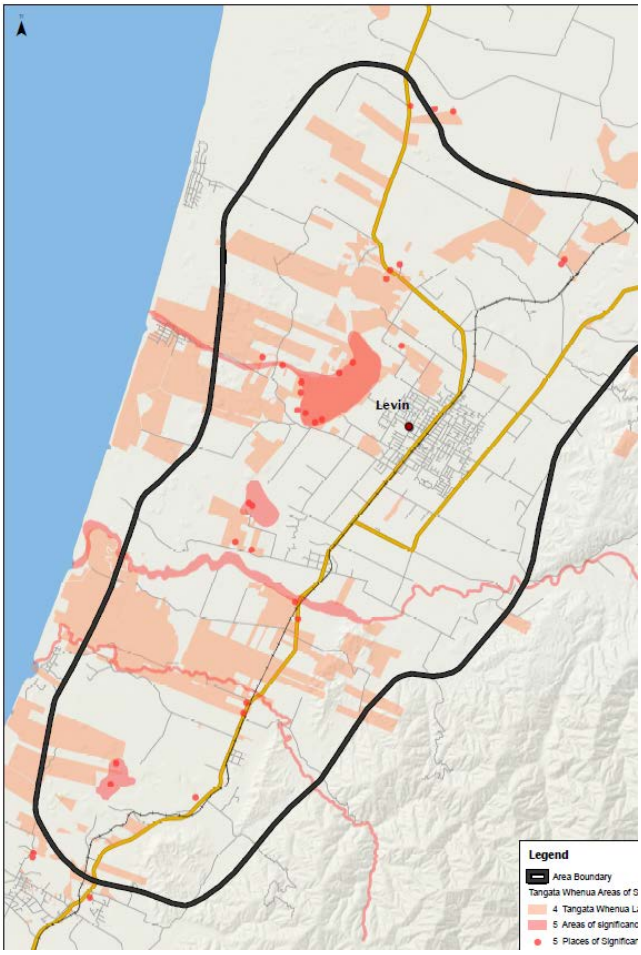

Figure 8-2: Tāngata Whenua Areas of Significance

Ngāti Raukawa and Muaupoko have advised that they have fundamental concerns and have stated that they will oppose all routes that are located west of SH1 and Levin. As shown above, these options traverse and effect areas of cultural significance, including urupa, marae, Lake Horowhenua, Lake Papaitonga and land holdings. These concerns are exacerbated in relation to options that traverse sand dunes, are close to or impact on lakes and water courses. The western options will affect a dense area of known sites of cultural significance and dense clusters of Te Tura Whenua Maori land holdings.

Ngāti Raukawa and Muaupoko also have concerns about options located to the east of SH1, as they also affect land holdings, water ways (that feed into Lake Horowhenua and Lake Papaitonga) and areas of significance, but consider, as compared with the western options, that these are more readily able to be resolved through design and mitigation.

Transport Modelling

Transport modelling of a representative sample of the 10 shortlisted options has been undertaken to determine the relative transport performance of the options against the Project Objectives (See Appendix H). The initial round of transport modelling was undertaken on the assumption that interchanges are provided at:

- Manakau;
- Tararua Road;
- Bifurcation of the new SH1 with 57 just north of Levin; and
- Reconvening of the new SH1 with existing SH1 just north of Levin.

These were chosen to be a representative interchange strategy which is suitable for the purposes of this stage of assessment and does not preclude later decisions. This strategy can be replicated across all routes so they are all consistent but is not necessarily the interchange strategy that will be adopted. Further investigation into interchange and local connectivity will occur once the preferred corridor is selected.

From the project objectives assessment undertaken as part of the MCA[87], the key regional journeys that will be affected and need to be improved by the new offline highway are:

- SH1 south to SH1 north (Ōtaki to Manawatu River, approximately 4,000 vpd in 2016);
- SH1 south to Levin (Ōtaki to Levin, approximately 7,000 vpd in 2016); and
- SH1 south to SH57 north (Ōtaki to Potts Hill, approximately 5,000 vpd in 2016).

The ability of the different options to cater for these three key journeys can be demonstrated through Select Link Analysis (SLA) plots. The following diagrams show trips with an origin south of the project area and travelling north. The thickness of the blue line represents the number of vehicles using that route.

Eastern Options vs Western Options

Figure 8-3 and Figure 8-4 below show the Select Link Analysis plots for S1N1 (the shortest of the western options) compared to S6N4 (the shortest of the eastern options).

[87] See Appendix E : Community Multi Criteria Analysis Report - Appendix K

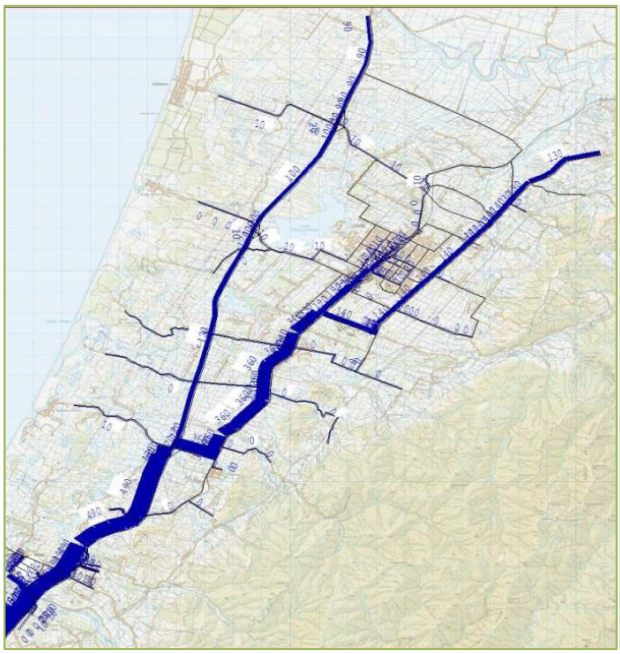

Figure 8-3: Select Link Analysis of S1N1

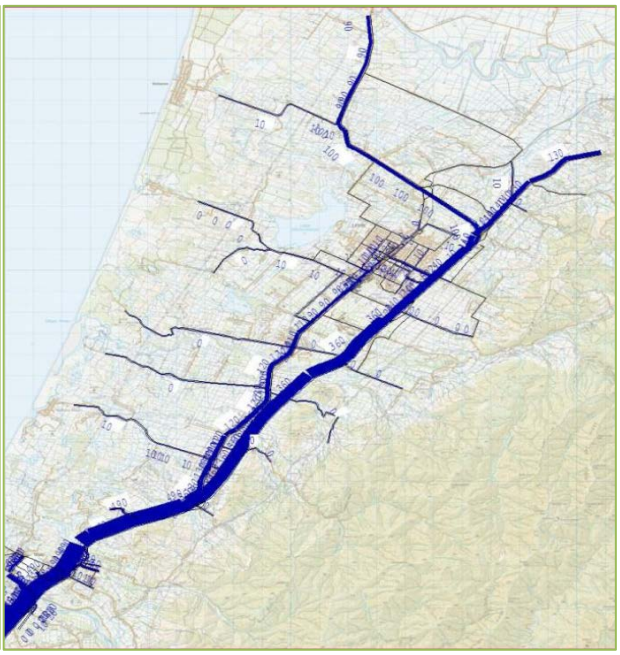

Figure 8-4: Select Link Analysis of S6N4

The SLA plots and Figure 8-5 below demonstrate that the western option S1N1 attracts only those movements heading north of Levin on SH1, i.e. only a quarter of trips on the existing SH are attracted onto the new highway route with the remainder staying on the existing network (SH1 heading to Levin and SH57). This is because while the western option does provide travel time savings for trips to north of Levin on SH1, using the new highway for trips to either Levin or onto SH57 represents a considerably longer journey than is currently available via the existing network (and therefore does not provide any travel time savings).

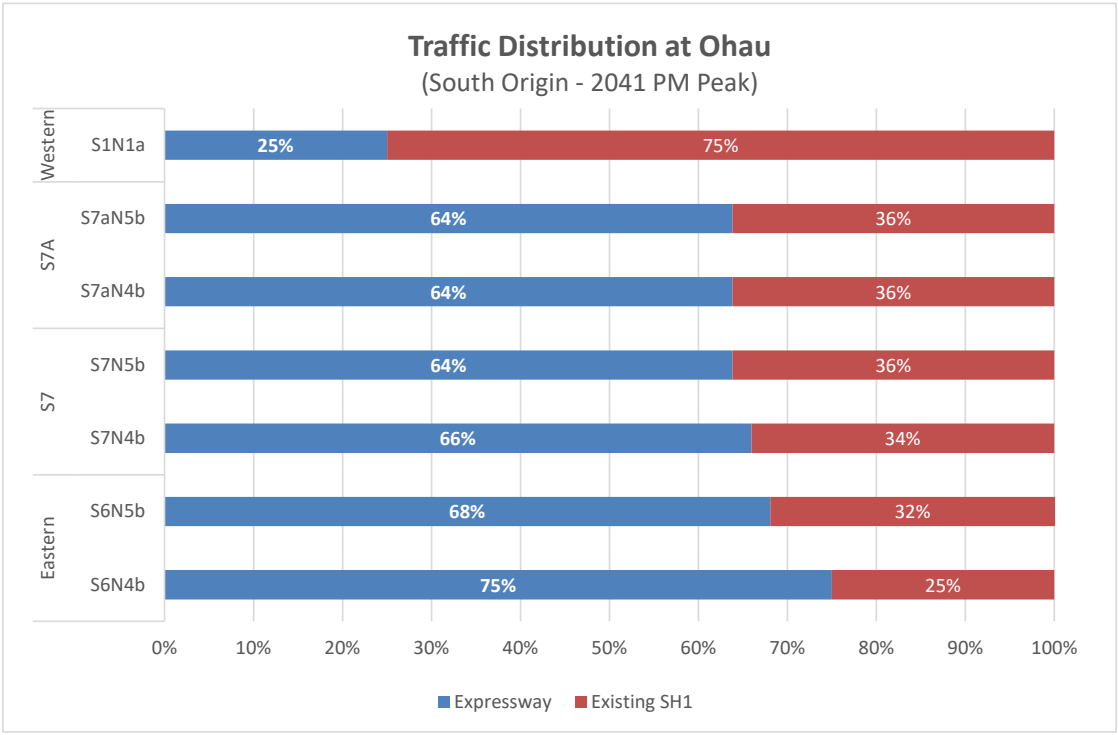

Figure 8-5: Eastern vs Western Traffic Distribution at Ōhau (2041 PM Peak)

Although the western options would reduce traffic volumes through the Levin Town Centre, they do not provide improved access to existing employment areas or to planned residential (primarily to the east of Levin) and economic growth locations. In addition, with the majority of traffic modelled using the existing state highway network, the risk of high severity crashes (and continued deaths and serious injuries) for the western option remains significant.

In contrast, the eastern S6N4 options demonstrate:

- Travel time savings for all three key journeys;
- Less traffic on the existing highway network (i.e. a greater transfer of trips onto the new highway).
- Interchange locations available that integrate with the urban areas providing improved access to both economic growth locations and the Levin town centre.

A summary of the travel times for the two options across the three key regional journeys are presented in the Table 8-1 below, for two growth scenarios[88].

Table 8-1: Comparison of Eastern and Western Route Travel Times

Option	Scenario	Key Regional Journeys		
		Ōtaki to Manawatu River	Ōtaki to Levin Town Centre	Ōtaki to Potts Hill (SH57)
Western	Low growth	10 minutes saving	1½ minutes longer	1 minute longer
	HDC LTP growth	11½ minutes saving	Half of minute longer	Unchanged
Eastern	Low growth	5½ minutes saving	Up to 1 minute saving	Up to 5 minutes saving
	HDC LTP growth	6½ to 7 minutes saving	1½ minutes saving	Up to 6 minutes saving

In addition to the three key regional journeys, analysis of wider network destinations was also undertaken and is presented in Figure 8-6 below. The results show that the eastern S6N4 option provides the shortest route to both the Manawatu Gorge and to Palmerston North, with travel time savings of up to 6 minutes via SH57 when compared to the existing network. In contrast, the western S1N1 route shows smaller savings of up to 1 minute for trips to Palmerston North (via SH1 and Highway 56) and minimal travel time savings for trips to the Manawatu Gorge.

[88] Future year models have been prepared for two growth scenarios; one representing 'low' growth assumptions reflecting growth in external State Highway trips only and the growth assumptions reflecting possible population and employment growth in response to the Wellington Northern Corridor (WNC) Roads of National Significance (RoNS) projects. The low growth scenario assumes no overall long-term growth in population and employment within the Horowhenua District, with model growth 'driven' by external growth only, based on Statistics NZ medium term population growth and long-term trends in recorded State Highway counts. The HDC LTP growth scenario represents the growth forecast by Horowhenua District Council as predicted through research undertaken by NZIER and Sense Partners and reflected in their Long Term Plan.

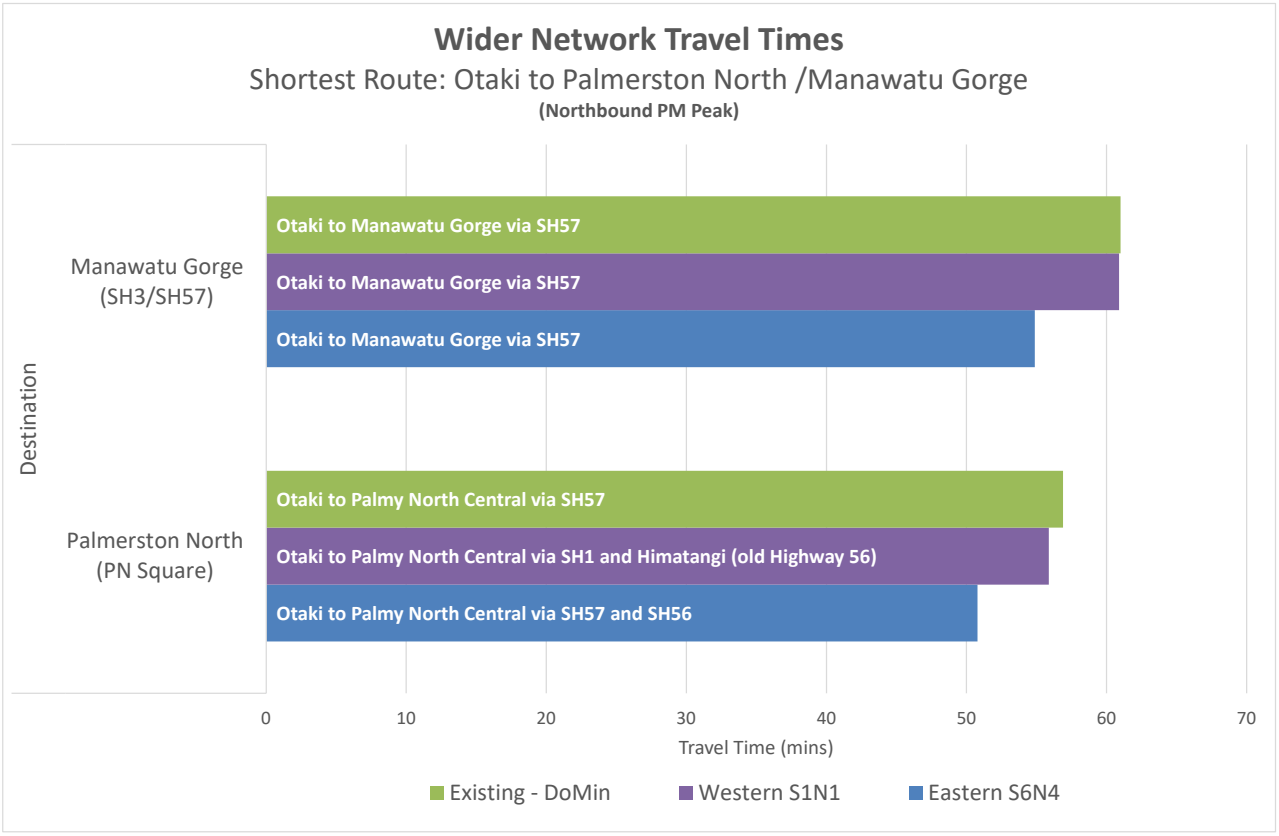

Figure 8-6: Wider Network Travel Time - Palmerston and Manawatu Gorge

Therefore, when considering the project objectives, the eastern options perform better with respect to safety and reducing travel times for the key regional journeys. The eastern options also provide improved access into the Levin Town Centre and better support the economic growth objectives of the Horowhenua District Council.

Far Eastern Options

Further investigation was also undertaken into the N8 route to the far east of Levin. The N8 route is significantly longer than the other northern routes and, therefore, modelling was undertaken to determine if the N8 alignment had a significant impact on overall network traffic flows. The outputs from this are shown in the figures below.

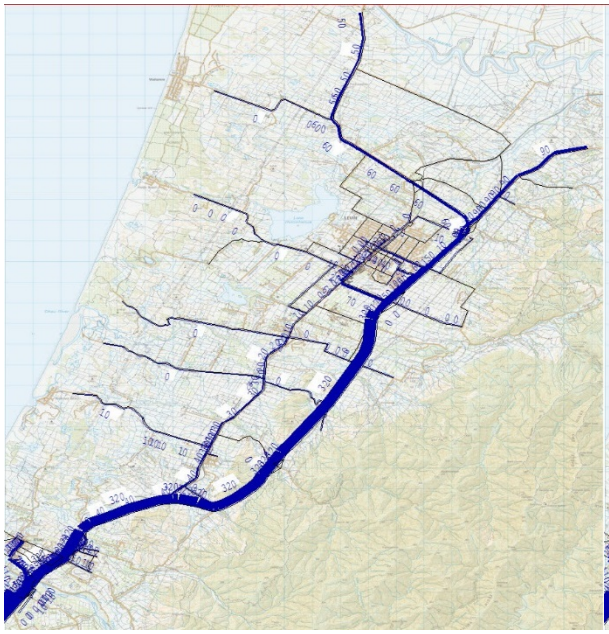

Figure 8-7: Select Link Analysis of S7N4

Figure 8-8: Select Link Analysis of S7N8

The figures above show that by constructing N4, the majority of traffic entering Levin, does so from the new highway. However, if N8 is built, the most attractive route into Levin is not using the new highway and instead traffic continues to use the current state highway.

As with the western options above (refer Eastern Options vs Western Options section above) this option also, therefore, results in a less safe network compared to the other options, and does not materially improve access to Levin.

Constructability

Prior to this round of investigation, limited exploration or examination had been undertaken into the valley through which this Option S7 traverses.

Accordingly, additional information was collected through LIDAR, site visits and helicopter inspection (as some parts of the route are difficult to get to on foot) to get a better understanding of the constraints and complexities of the route.

In summary, the valley is predominantly rural but does have pockets of rural residential development. The topography is highly variable and quite challenging in some locations. There are many streams which have carved out multiple flow paths throughout the valley areas and there are areas of regenerating natural bush.

No fatal flaws have been identified in terms of the constructability of an option through this area. However, there are a number of deep and wide gullies through which the larger rivers and streams negotiate that will cost substantial amounts to traverse. The largest of these is around 800m long and up to 35m deep. This would be in addition to the higher cost of this route due to the ground conditions, terrain and the need for structures as well as the increased length compared to S6.

More discussion on how this related to cost is presented in Section 11 below.

Option S7A

The preceding MCA, constructability and traffic modelling assessments show that options which use S7:

- Do not provide the same level of transport benefits as those that use S6;
- Are 33% more expensive than options that use S6; and
- Would (as compared to S6) minimise effects on the local community at Manakau (although it would still affect the southern part of the Manakau Heights areas).

During the MCA process the community members on the PRG identified an alignment that used the southern part of S7 and then joined onto S6 to the north, past Manakau. This was called S7A. It avoids most of the settlement of Manakau (like S7) but also avoids some of the areas that cause the significant cost differences between the S7 and S6 options. Accordingly, options that used S7A were considered, included in the traffic modelling and constructability assessments.

The traffic modelling and constructability analysis of options that use S7A shows that these options would:

- Provide fewer transport benefits that S7 (and S6) based options. This is because these options are 2km longer than options that use S6 and 1km longer than options that use S7.
- Cost 20% more than options that use S6 (i.e. $141 - $162M more than S6 options) but cost $84M-$97M less than S7 options.

Following Workshop 2, it was decided that S7A should also be considered by the subject matter specialists. So a plan of the route was developed and each of the specialists were asked to provide a score and reasoning. This score is included below in Table 8-2 alongside scores for Option S6 and S7 (for comparison purposes).

Table 8-2: Scoring of Option S7A

Criteria	Landscape/Visual Impact	Ecological Impacts	Impact on Heritage	Tāngata Whenua Cultural Values	Productive Land Values	Social/Community/ Recreation Impacts	Impact on Dwellings	District Development	Fit to Project Objectives	Property Degree of Difficulty	Engineering Considerations	Cost
S6	2	2	2	2/2	4	5	5	3	1	4	2	3
S7	3	5	2	3/3	4	2	4	1	3	4	3	4[89]
S7A	4	5	2	3	3[90]	1[91]	5	1	3	4	4	5

[89] S7 was initially allocated a Cost score of 4. When it was later assessed with further detail on terrain and in comparison to S7A, both of these options (S7 and S7A) were deemed sufficiently costly to both be scored a 5.
[90] Note that the specialist indicated this could be scored either 3 or 4, as could Option S7 which the workshop had accorded a 4 as shown. The current score provides a more favourable basis for this option.
[91] The specialist for this criterion had also proposed Option 7 as a 1, but the workshop participants considered this to be a 2. In the specialist's opinion there is little difference between Option 7 and 7A. As with the Productive Land criterion score, this score provides a more favourable basis for the analysis of this route.

Table 4-4 shows that the differences between Option S7 and Option S7A are, as follows:

- Landscape/Visual – worse than S7 in that the route is only partly confined to the valley and that it would include dog-legs to negotiate both the Waiauti and Kuku Stream valleys.
- Impact on Dwellings – Option S7A is worse than Option S7 due to more dwellings being directly affected
- Engineering Considerations and Cost – Option S7A is worse than Option S7 due to a greater number of lower (tighter) radii curves and also there are significant constructability issues with the route heading back onto route Options S6 from S7 in the Waiauti valley. These difficulties are also reflected in costs.

In addition to the above, it is noted that the Option S7A corridor is some 800m longer than Option S7 and, therefore, would have significantly fewer benefits in transport terms when compared to Option S7.

Final Shortlist for Consultation

Based on the above additional analysis, the following routes have been removed from the analysis:

- S1N1 – Due to Tāngata Whenua areas of significance and not meeting the project objectives in terms of safety and travel time for key routes
- S8N6 - Due to Tāngata Whenua areas of significance and not meeting the project objectives in terms of safety and travel time for key routes
- N8 – Due to not meeting the project objectives in terms of safety and travel time for key routes
- S7A has been retained as it offers benefits over S6 in that it avoids a significant part of the Manakau lifestyle area.

This has resulted in the following routes being taken forward for more detailed investigation, refer Figure 8-9 below.

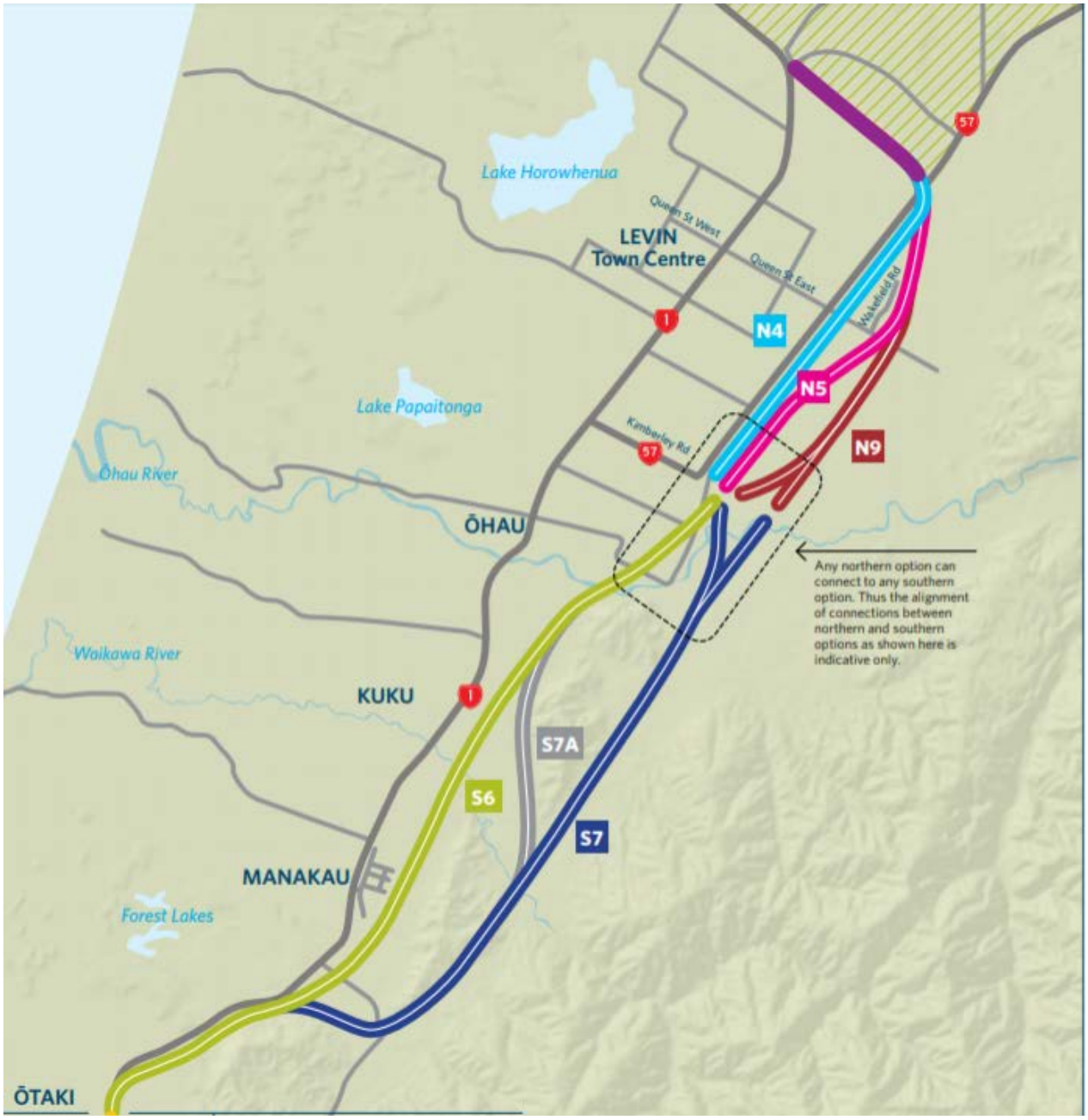

Figure 8-9: Shortlist for Consultation

9. SHORT LIST FOR CONSULTATION

The following corridors have been shortlisted:

- Southern Section: S6, S7, S7A
- Northern Section: N4, N5, N9

The combination of these route options means there are nine possible combinations of routes for the full extent.

The descriptions below are provided separately for the southern options and the northern options, instead of describing the nine full length options individually.

Option S6

Figure 9-1: Option S6 alignment

Option S6 runs east of the existing SH1 alignment throughout its length. In the southern half of S6, the offset to SH1 is around 200-500 m (measured between SH1 and to the centre of the 300m corridor). It runs east of the Manakau and Ōhau townships. Around Kuku East Road the alignment begins to deviate further to the northeast, increasing the offset to SH1 to over 1km at Ōhau River, with increasing offset north of the river as the S6 alignment curves to the east of SH57. The corridor runs close to the foot of the hills, taking into consideration property, streams, vegetation etc.

- This option requires no rail crossings of the NIMT line, as the option remains on the east throughout.
- This option requires a considerable number of structures:
  - Waiauti stream: a crossing is required of this stream to the south of South Manakau Road
  - Waikawa Stream: a crossing to the immediate north of North Manakau Road. This crossing may not be straightforward due to the potential span of the bridge required over the watercourse and flood plain.
  - Kuku Stream: a crossing north of Kuku East Road which should be fairly straightforward with a small structure.
  - Ōhau River: A large structure crossing the Ōhau River channel is expected and which may necessitate an even larger and elevated structure to ensure sufficient capacity for major flood events. The structure is also on a curved section of the alignment.
- The terrain for the alignment is on reasonably flat ground throughout with some moderate undulations – i.e. some areas of gently rolling terrain. For the most part, extremely large cuts and fills are not expected to be necessary.
- The option does cross multiple local roads that run generally perpendicular to the alignment of the route. At this stage it has not been determined how these would be managed (i.e. connection maintained or truncated with access provided elsewhere).

Option S7

Figure 9-2: Option S7 alignment

Option S7 runs east of the existing SH1 for the full extent of the corridor. From Ōtaki, for the first 3.5km the route follows the same path as S6, parallel to the existing highway approximately 250m to the east (measured to the centreline of the 300m corridor). Close to Pukehou rail bridge,

S7 curves eastwards away from the S6 corridor. At a point close to the intersection of South Manakau Road, Waitohu Valley Road and Corbetts Road, the corridor swings northwards again travelling through the valley 'behind' (or east of) Manakau.

The corridor exits the valley near to Waikawa Stream and North Manakau Road, continuing northwards without much deviation from this path.

The majority of the corridor maintains a broadly consistent offset east of SH1 of around 2.5-3.0km (other than in southernmost section described above).

- This option requires no rail crossings of the NIMT line, as the option remains on the east throughout.
- The option requires a considerable number of potentially complex and/or extensive structures:
    - Waiauti stream: this stream to the south of South Manakau Road requires a crossing of at least two stream tributaries within the floodplain.
    - Waikawa Stream: a crossing of the deeply incised channel to the south of North Manakau Road. This crossing is expected to be a significant structure due to the required span of the structure to cross the deep channel profile and maintain an acceptable vertical geometry.
    - Kuku Stream: a crossing near to Kuku East Road which is likely to a significant structure due to the required span of the structure to cross the deep channel profile and maintain an acceptable vertical geometry.
    - Makarokio Stream: a smaller span structure is expected over this watercourse.
    - Ōhau River: A large span structure crossing the Ōhau River channel is expected to ensure sufficient capacity for major flood events requiring a much larger bridge than the established channel may indicate. The structure should be able to cross the Ōhau River on a close to perpendicular alignment avoiding bridge skew.
    - A multitude of other smaller watercourse crossings are also required and which will necessitate new culverts and possibly a number of smaller span bridges.
- The terrain for the alignment is challenging with some large sections of heavily rolling terrain. In the valley east of Manakau, the surface levels rises over 80 m in vertical height over a distance of around 2km, with little uniformity in rising grade. From the peak, the vertical level then drops off considerably through Waikawa Stream channel to the northern bank with a vertical drop between banks of around 35-40 m over a length of around 800 m (400m either side of channel invert). Continuing north, the terrain continues to rise and fall but is more gradually rolling with level changes of +/- 20m elevation.
- The option does cross multiple local roads that run generally perpendicular to the alignment of the route. At this stage it has not been determined how these would be managed (i.e. connection maintained or truncated with access provided elsewhere).

Option S7A

Figure 9-3: Option S7A alignment

Option S7A runs east of the existing SH1 for the full extent of the corridor. From Ōtaki, for the first 8.2 km the route follows the same path as S7, before diverging and heading north east after crossing the Waikawa Stream. North of Waikawa Stream the alignment heads North East before joining with the S6 option north of Manakau/ Waikawa stream, broadly adjacent to Kuku.

- This option requires no rail crossings of the NIMT line, as the option remains on the east throughout.
- This option does not utilise any of the SH1/SH57 Connection options and is a new alignment
- The option requires a considerable number of potentially complex and/or extensive structures:
    - Waiauti stream: this stream to the south of South Manakau Road requires a crossing of at least two stream tributaries within the floodplain.
    - Waikawa Stream: a crossing of the deeply incised channel to the south of North Manakau Road. This crossing is expected to be a significant structure due to the required span of the structure to cross the deep channel profile and maintain an acceptable vertical geometry. Furthermore, the structure is located on a horizontal curve, which increases the length of the bridge, and may necessitate additional structure width in order to provide acceptable forward sight distance around edge and median barriers on the bridge.
    - Kuku Stream: a crossing north of Kuku East Road which should be fairly straightforward with a small structure.

- Ōhau River: A large structure crossing the Ōhau River channel is expected and which may necessitate an even larger and elevated structure to ensure sufficient capacity for major flood events. The structure is also on a curved section of the alignment, which although ensuring the bridge is all sloped in one direction, may necessitate widening to allow acceptable forward sight distance.
- A multitude of other smaller watercourse crossings are also required and which will necessitate new culverts and possibly a number of smaller span bridges.

- The terrain for the alignment is challenging with some large sections of heavily rolling terrain. In the valley east of Manakau, the surface levels rises over 80 m in vertical height over a distance of around 2km, with little uniformity in rising grade. From the peak, the vertical level then drops off considerably through Waikawa Stream channel to the northern bank with a vertical drop between banks of around 35-40 m over a length of around 800 m (400m either side of channel invert). North of the Waikawa Stream the terrain for the alignment is on reasonably flat ground throughout with some moderate undulations – i.e. some areas of gently rolling terrain. For the most part, large scale earthworks (high cuts and fill embankments) are not expected to be necessary.
- The option does cross multiple local roads that run generally perpendicular to the alignment of the route. At this stage it has not been determined how these would be managed (i.e. connection maintained or truncated with access provided elsewhere).

Option N4

Figure 9-4: Option N4 alignment

Option N4 connects with all three southern corridor options in close proximity to Kimberley Road. The exact location of the connection to either southern option depends on which southern option is selected with S6 being around 700m further west than S7.

The corridor runs parallel to SH57 for around 5.7km from Kimberley Road, through to Roslyn Road (with an offset of 150-200m between SH57 and the centreline of the 300m wide corridor). It then crosses SH57 just north of the SH57 / Roslyn Road intersection and runs parallel to, and between, Roslyn Road and Heatherlea East Road before crossing the NIMT rail line and connecting back onto SH1 near to the SH1/Koputaroa Road/Avenue North Road north of Levin.

- The alignment does not traverse any major watercourses.
- The terrain is generally flat with moderate undulation.

Option N5

Figure 9-5: Option N5 alignment

Like N4, Option N5 connects with either of the three southern corridor options in close proximity to Kimberley Road. The exact locations depend on which of the two southern options N5 connects into with S6 being around 700m further west than S7.

The corridor runs roughly parallel to SH57 between Kimberley Road and just north of Tararua Road before pushing out further east to avoid an area of concentrated development around Queen Street (Redwood Grove & Wakefield Road area). The corridor crosses Queen Street around 1.1km to the east of SH57. From here the corridor curves back toward SH57, again crossing SH57 at almost the same point as N4 (north of Roslyn Road).

Between SH57 and SH1, the corridor is identical to N4.

- The alignment does not traverse any major watercourses.

- The terrain is generally flat with moderate undulation.

Option N9

Figure 9-6: Option N9 alignment

Option N9 follows a linear alignment from the southern S7 route, connecting into S7 in close proximity to Muhunoa East Road, and continuing northwards on the same straight alignment toward Queen Street. To the east of Levin, N9 runs broadly parallel to SH57.

N9 can also connect to S6, which would necessitate either S6 or N9 alignments shifting to a location between Muhunoa East Road and Tararua Road (but this has not been considered in any detail at this stage).

N9 crosses Queen Street at the same location that N5 crosses, at a 90 degree (or perpendicular) angle to the local road. The offset of the new offline highway to SH57 at Queen Street is around 1.1km (measured to the centreline of the 300m wide alignment). Beyond Queen Street, the corridor curves back toward SH57 and crosses the highway at the same location as N4 and N5, just north of Roslyn Road.

Between SH57 and SH1, the corridor is identical to N4 and N5.

- The alignment does not traverse any major watercourses.
- The terrain is generally flat with moderate undulation.

10. COMMUNITY ENGAGEMENT

The Transport Agency undertook further engagement with key stakeholders and the Horowhenua community on the shortlisted options from January to March 2018, with the Transport Agency seeking to:

- Report back and update the public on what's been happening on the O2NL project since the last round of consultation
- Create understanding of decisions that have been made on project scope, options development and assessment and how previous consultation has informed these decisions
- Gather meaningful information from the community on areas they are able to influence
- Maintain a two-way transparent communication process and build rapport between the Transport Agency and the community
- Maintain and further grow existing relationships with key stakeholders

The public engagement period opened on Wednesday 7 February and was initially planned to run until Friday 16 March 2018, but this was extended by a week, to Friday 23 March due to a high level of interest from the public and requests from local communities for additional events.

The approach for this round of engagement took a similar form to the mid-2017 round. The Agency:

- Ran a communication and media campaign to ensure wide promotion
- Made all relevant information available on their website
- Held community drop-in events around the region
- Attended community organised meetings
- Asked for feedback via a printed feedback form, an online feedback form or email to the project inbox
- Used display boards to explain the project to date, including reporting back on feedback from the 2017 engagement, explaining the option development, assessment and further investigations, and providing a detailed overview of the shortlisted corridor options, and where interchanges could be located.

The Project Reference Group (PRG), established in May 2017 and comprising key stakeholders, iwi, and community members[92], were kept informed and engaged throughout the process. The purpose of the PRG is to provide information and a community voice as part of the O2NL project investigation process, helping the project team understand local issues and opinions and provide feedback directly to their whanau and community. The PRG met before the start of the 2017 engagement period and met again during and at the close of the engagement period. The group were involved in the MCA process, including criteria setting and the scoring workshop. The PRG have met four more times in preparation for and during the 2018 engagement period. The project team and the PRG will continue to meet on a regular basis throughout the life of the project.

In addition to the above, it was important for the Transport Agency to have a presence and be available to the community during this stage of the project. As there is no local NZ Transport Agency office in or near Levin, a pop-up shop was created in Levin to have a presence in the local area. This was open most days of the week from 7 February to 9 March.

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[92] Local councils; regional councils; AA; Heavy Haulage; Road Transport Forum; Federated Farmers; emergency services; community groups and associations; Ngati Huia; Ngati Tukorehe

Landowner letters were sent out to 490 land and property owners prior to the start of the engagement period. This was undertaken to ensure that people who may be directly affected by one or more of the proposed options were aware of the upcoming community engagement and also that they had the opportunity to speak with a member of the project team and a member of the property team first. The majority of landowners took up this opportunity during the January – March period.

During the engagement the project team held eight events around the district, these were planned and promoted. In addition, the team attended eight community planned events, meetings and huis. Around 1,400 people interacted with the project team at these events. In addition, the pop-up shop had over 1,370 visitors.

Community and stakeholder feedback

Community and stakeholder feedback provided the project team with more detailed information about features of importance, as well as identifying additional elements that need to be taken into account in the analysis of options.

Overall, the responses show that the community supports the O2NL project and recognises something needs to be done to improve the safety, resilience and operation of the stretches of State Highway 1 and State Highway 57 between Ōtaki and north of Levin. Appendix L contains the Engagement Report.

The engagement process focused on asking people to identify key features about each option that the liked or did not like; the team wanted to understand the 'why' behind a certain option preference rather than receiving a 'vote' for a favourite option. Nevertheless, throughout the process, people did tend to highlight a preference and would then explain their choice.

The Agency received a high volume of feedback through the following channels:

Channel	Number of submissions
Online forms	284
Hard copy forms	96
Emails	136
Community developed feedback forms	69 (from Manakau (19) and East Levin (50))
Total feedback (forms; emails)	**585**

Landowners

On 19 January 2018, letters were sent to 490 landowners that were identified as owning a property affected or potentially affected by one or more of the options. The letter provided these landowners with notice their properties may be affected by the O2NL project and offered a meeting with the project team.

The landowners' meetings with the project team comprised a planning/technical representative and a property specialist. The majority of meetings were scheduled to take place before the project shared the shortlisted corridor options with the wider community in February. Over 300 landowners took up the opportunity to meet members of the Project Team. These were held at the land owners' discretion and at a venue preferred by the land owner (typically at their property, or in the pop-up shop or at the NZTA offices in Wellington).

These meetings were to inform landowners about the shortlisted options and how their property might be affected, provide landowners with an opportunity to tell the project team about areas of importance and their particular circumstances (if relevant) and to help clarify the process with owners.

While there were some risks in contacting and meeting with all potentially affected landowners, in terms of causing a negative impact on individuals, the project team wanted to inform these landowners face-to-face and gather information related to individual properties. It was also an opportunity to assist landowners to, as necessary, provide access to further assistance. Meeting with landowners was a valuable part of the wider engagement activities. Landowners sought clarity about the process and timings. Further insight was gathered about specific sites of ecological, heritage and archaeological interest. These often had a very specific geographical location, so the project team have been able to plot these features on the constraint maps and discuss the effect the options could have on these sites.

Key stakeholders and iwi

On-going relationships with key stakeholders are important to the project.

The team have kept in regular contact with local hapū and iwi holding hui and having korero with:

- Te Runanga O Raukawa
- Muaupoko Tribal Authority
- Nga Hapū o Ōtaki
- Te Kotahitanga o Te Iwi o Ngāti Wehi Wehi
- Te Iwi o Ngāti Tukorehe
- Ngāti Pareraukawa
- Ngāti Kikopiri
- Kereru Marae
- Ngāti Huia ki Huia
- Ngāti Huia ki Matau

The project team have also held meetings with and/or received feedback from:

- Palmerston North City Council
- Automotive Association
- Regional Transport Committee, Horizons Regional Council

- Forest and Bird
- Housing New Zealand Corporation
- Whanganui District Council
- Kāpiti Coast District Council
- Department of Conservation
- Manakau District Community Association
- Horowhenua District Council
- Heritage NZ

The nature of these submissions was largely of support and alignment to the project objectives. Specific advice from these stakeholders will be taken into consideration as the project moves forward.

General feedback

Rather than asking people to select their preferred option, the project team sought feedback, for each option, on key features – '*What key features are most important to you?*' and '*Are there any other key features we should be aware of that would potentially impact this option?*'.

The majority of submitters are supportive of the project. There is some appetite for widening the existing highways, but very few stated that the project is not needed. When there was opposition expressed, it tended to be directed at a particular option.

Peoples comments during the engagement process tended to relate to the criteria identified through the MCA process. Feedback was categorised by these themes:

As expected by the project team, there was a lot of discussion and feedback on social and community; impact on dwellings; productive land and district development.

Responses often used the project objectives to explain why an option was important to them.

Comments about engineering considerations were focused on concerns about vibration, dust, the construction process and planting. These aspects would be common to all options and need to be addressed more at the detailed design phase.

Noise was a common concern among submitters. In response to these concerns the Agency commissioned a specific noise assessment (for more information refer Section 11).

Discussion about social, community and the impacts on dwellings were often cited together and used interchangeably. Several people considered that a social impact assessment should have been done before options were shortlisted. In response to this concern, further consideration of social impacts has now been completed (for more information see Section 11). People often talked about health issues and concerns stating that this process, along with the effects of the future highway (noise, dust and vibration), is impacting on people's health. Residents cited the elderly population within Horowhenua and that sensitivities are felt by this part of the community more. There was a lot of value placed on the potential loss of lifestyle, people often spoke from a personal point of view of how this highway could potentially affect them.

Other views about property included the concern that there's not enough properties in Levin for all the potentially displaced people; people who are 'nearby affected' want to be involved more in the process; and people want to be treated fairly and with respect under the property and planning process with compensation and mitigation occurring appropriately. The uncertainty is having an immediate effect on the property sales, property values and finding potential buyers.

There was a mixture of views regarding productive land. People talked about the importance of protecting productive land, but this was raised as a concern under all of the corridor options to varying degrees.

Southern options

Option S6

The project team identified this option as being the 'technically best performing option' – this was stated in the information presented to the public. This option best meets the project objectives and feedback from the community is in line with this. When people talked in favour of this option, they mentioned the safety benefits, journey time savings (with this route being the shortest and most direct) and resilience of this option. People also pointed out that it was a cost-effective choice.

This option also affects the community of Manakau, including affecting approximately 107 dwellings (across the 300m wide corridor consulted on). People talked about the negative social effects, damage to the community, severance and impact on dwellings in relation to S6.

Option S7

This option took a route in a valley further east of the Manakau settlement. Some people highlighted that the main benefit of this option would be the reduced effects it would have on the community and existing dwellings in the Manakau village. They acknowledged the cost but would rather village character and existing homes be avoided; they considered the longevity of this highway as justifying the additional cost.

When people raised concerns with this option, they identified key features such as the fault line, possible future resilience issues, and known areas of ecology and landscape value. The appropriateness of a road through this valley was also questioned because it would adversely affect landscape amenity; encroach on areas of regional ecological significance; have a cultural impact including in relation to wāhi tapu and Māori land; and would be located on the major Northern Ohariu fault line.

Option S7A

Feedback received for S7A highlighted the reduced effect on Manakau village and the lower cost compared to S7. However, people recognised that it is a longer, more indirect option. While some acknowledged S7A was a good compromise, there was very limited support for S7A.

Submitters noted that for this option the negatives seemed to outweigh the positives. These negatives included engineering difficulties similar to those identified for S7, the fact that this option does not meet the project objectives in the same way as S6; its cost and length. Several people referred to S7A as a 'non-option'.

Northern options

For the northern options, a technically best performing option was not identified, by the Transport Agency. The routes performed similarly in terms of length, cost, meeting the project objectives and potential effects. There was a lot more debate in the north about district development, each of the northern options were said to enhance or impact on district growth depending on the view of the submitter.

Option N4

N4 runs close to the existing SH57. People felt this option best met the project objectives, it was shorter, more direct and provided the best connection into Levin. Other reasons people favoured this option were related to district development; this option is located near existing development (local people are already used to a main road being here) and it encourages growth further east. Another feature identified through the feedback was that N4 would have the least impact on the Tararua Ranges.

Ecological value, productive land and the impact on existing dwellings were identified as key features that would be negatively impacted if N4 went ahead. While some people cited heritage values related to this option others noted that the historic house that has been identified along this route is not available to the public and needs to be restored. Several people thought that this option could use the current SH57, rather than being a new offline highway.

Option N5

This option takes an alignment that is further to the east of the existing SH57. Submitters noted that N5 connected well with the southern options, but there was not a huge amount of discussion around this option; many people seemed indifferent to it. Adverse social impact and negative effects on dwellings were features people mentioned for this option.

Option N9

Option N9 runs further east towards the Tararua Ranges, following an alignment similar to the powerlines. Submitters liked how this option would connect well with S7. People noted that this option affected the least number of dwellings, but felt that it would impact on future development and growth. It was stated that a highway would have a negative social impact on the new dwellings that are being developed in this area.

11. SHORT LIST FOR CONSULTATION – FURTHER ASSESSMENT

Cost Estimates

Cost estimates have been developed for the nine route options (i.e. three northern options plus three southern options) to an Indicative Business Case Estimate (IBE) level (See Appendix K). Table 11-1 below shows representative estimates for the combined routes using each of the southern options (As the northern options all have similar costs).

Confidence levels of estimate accuracy are suitable for an IBE level estimate; however, given the scale and complexity of the project, and limited investigation, testing and design completed to date, a level of inherent risk is inevitable.

Base estimates have been developed using initial and early state three-dimensional concept alignment design for each option to allow quantity generation for earthworks and pavement – but it must be noted that design alignments are indicative and prepared for the purposes of cost estimation; the alignments are not fixed and have not been optimised.

Property cost estimates have been supplied by a specialist property consultant.

Design and MSQA fees have been determined as a percentage of total construction and property cost.

To determine the expected estimate, the total cost for the mainline works, interchanges, property, local roads and professional and client costs have been increased by 25%. More detailed assessment of contingency has not been undertaken.

The 95th percentile costs have been approximated by adding a further 15% to the expected estimate.

Table 11-1: Summary of Shortlisted Option Costs

	S6 Options	S7 Options	S7A Options
Base Fees	$31M	$42M	$38M
Base Property	$100M	$87M	$93M
Base Total	$549M	$733M	$664M
Expected Estimate (Base +25%)	**$687M**	**$916M**	**$830M**
95th%ile (Expected +15%)	$790M	$1,054M	$955M

It is apparent that the costings undertaken for the options that include S7 are significantly greater than the S6 options (~$230M), and moderately greater than options that include S7A (~$90M). The main difference with the S7 options is the additional structural costs relative to S6 and S7A. On S7, the ground profile and hydrology requirements are expected to necessitate much more significant structures for the highway. Longer and higher structures add to complexity and have significant cost increase implications, as does the location of the fault line location.

Other key differences between the highest and lowest cost southern options (S6 and S7 corridors) relate to earthworks and ground improvements, with costs on S7 estimated to be much greater than for S6, again due to the terrain profile through this corridor.

Costs for the northern segments, N4, N5 and N9 are all broadly similar, meaning the decision to proceed with S6, S7 or S7A has the largest bearing on overall cost. In general terms, any option that utilises the S7 corridor is expected to cost at least 30% more than the options that use S6.

Transport Modelling

The Ōtaki to Levin SATURN model was interrogated to determine the travel times that would be expected for key regional journeys on the state highways once the shortlisted routes were constructed (See Appendix H). Travel times were assessed for the following key routes:

- Route 1: Ōtaki (Mill Rd / Rahui Rd / SH1) to just south of Manawatu River (SH1 – North of Levin)
- Route 2: Ōtaki (Mill Rd / Rahui Rd / SH1) to SH1 Central Levin (SH1) (SH1/Queen St)
- Route 3: Ōtaki (Mill Rd / Rahui Rd / SH1) to SH57 North east of Levin (SH57/Potts Hill)

Not all the route combinations where modelled; it was decided not to model route options with N9 at the northern end as it is assumed that this will perform similarly, but slightly worse, to N5.

Transport modelling of the shortlisted options for consultation has been undertaken on the assumption that interchanges are provided at:

- Manakau;
- Tararua Road;
- Bifurcation of the new SH1 with 57 just north of Levin; and
- Reconvening of the new SH1 with existing SH1 just north of Levin.

These are the same locations as was used in the previous short listing exercise. The locations were chosen to be a representative interchange strategy that could be replicated across all routes and is not necessarily the interchange strategy that will be adopted. Further investigation into interchange and local connectivity will occur once the preferred corridor is selected.

Key Journey Travel Times

Travel times savings for the key regional journeys, when compared to the existing highway network, are presented in the figures below, for each modelled route combination and for two different growth scenarios.

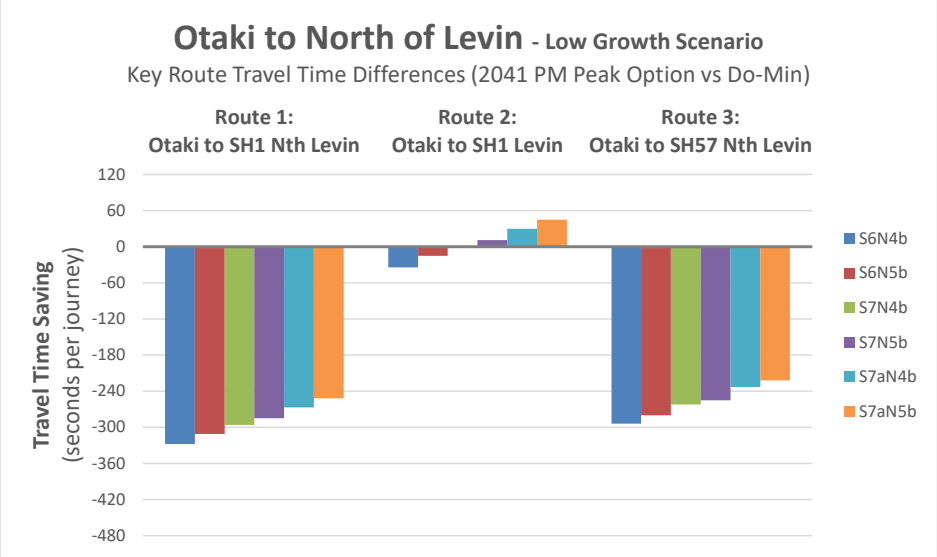


Figure 11-1: Travel Time Savings – Key Journeys (Low Growth)

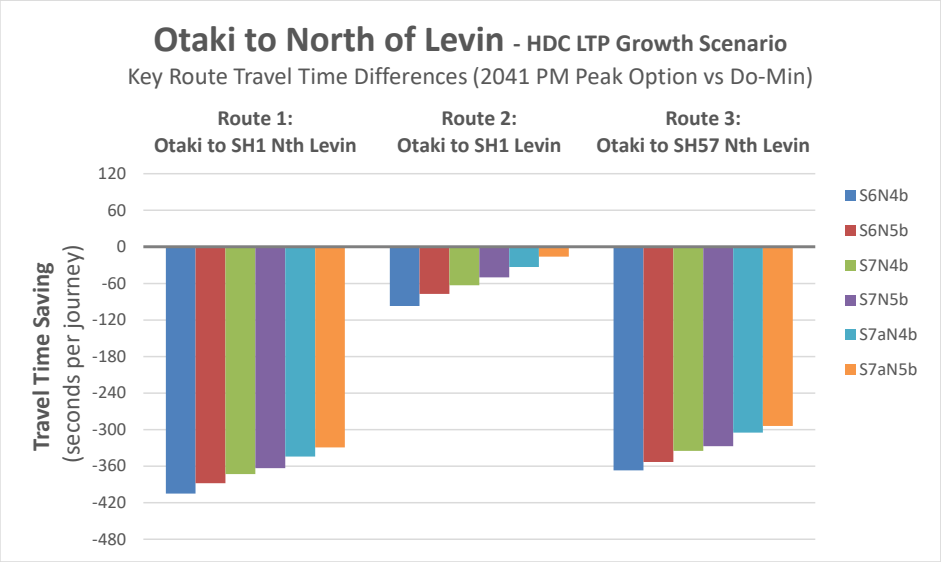


Figure 11-2: Travel Time Savings – Key Journeys (HDC LTP Growth)

All modelled shortlisted route combinations show significant travel time savings under both growth scenarios for trips to SH1 North of Levin and to SH57 North east of Levin. The HDC LTP growth scenario results demonstrate additional savings of approximately 1-2 minutes across all three routes, reflecting the worsening delays on the existing network resulting from population growth.

The reason for the travel time increases for some route combinations for trips to Route 2 (Central Levin) is due to the bypass of Levin and vehicles needing to exit the highway and travel westbound to reach the Levin town centre. Accordingly, those alignments which are shorter and closer to Levin perform better. In the higher growth scenario, as delays on the existing highway network increase, all route combinations show travel time savings for trips to central Levin.

Looking at differences between the route alignment options, S6 route options perform better than S7 and S7A options in all situations due to its reduced length. S7 route options similarly perform better than S7A options.

It is also apparent that N4 options perform better than N5 (and therefore N9) options as it is shorter and also is closer to Levin town centre.

The metrics for these travel time savings are presented in the tables on the following page along with length differences and travel route preferences.

Traffic Distribution and Route Choice

Figure 11-3 below presents the distribution of traffic at Ōhau between the new highway and the existing highway for those trips with an origin south of the project area in the PM peak. This shows that the shortlisted route combinations generally attract and retain between 65-75% of existing SH1 traffic at Ōhau on to the new highway, with the S6 and N4 routes shown to be the best performing, due to route length. As the routes become shorter, a larger proportion of long distance journeys will use the new highway, with the remaining SH1 traffic accounting for shorter journeys with local destinations (e.g. along SH1 or west of Levin).

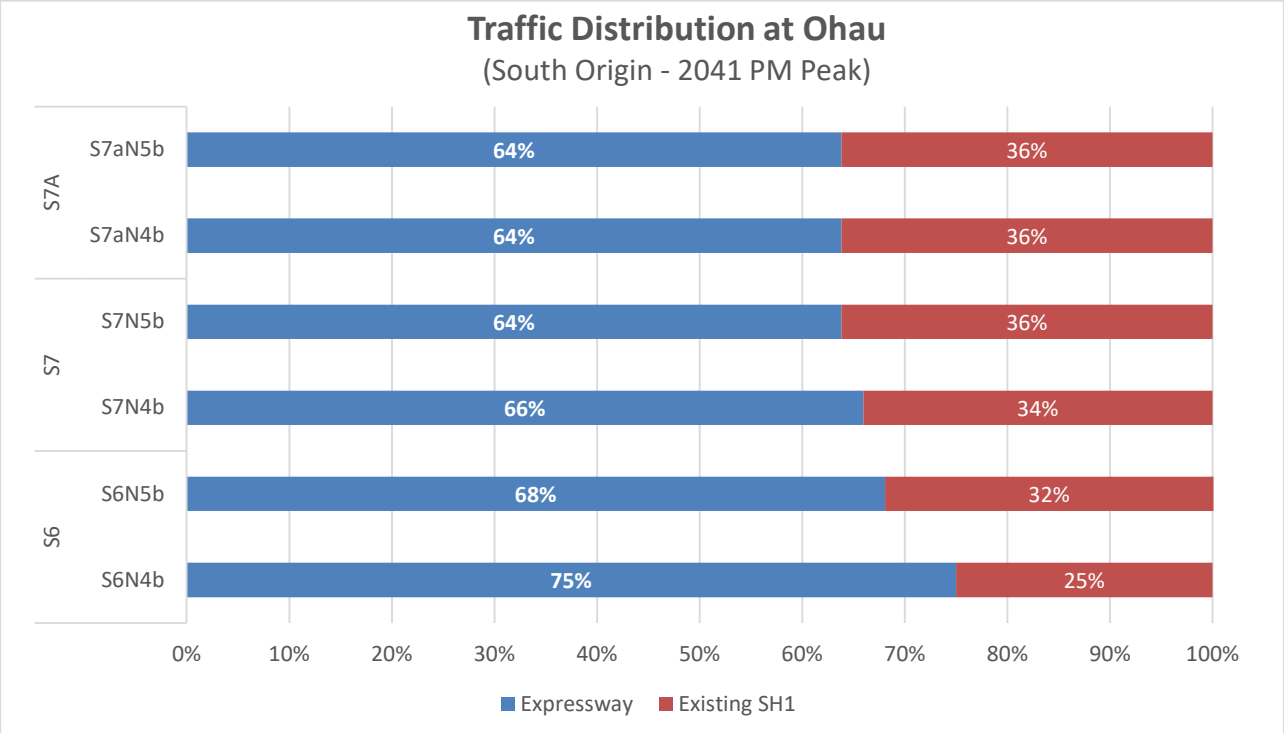


Figure 11-3: Traffic Distribution at Ōhau

The route choice by option is presented further in the SLA diagrams below, which compare how the southern alignments (S6, S7 and S7a) perform when paired with N4 and N5 respectively.

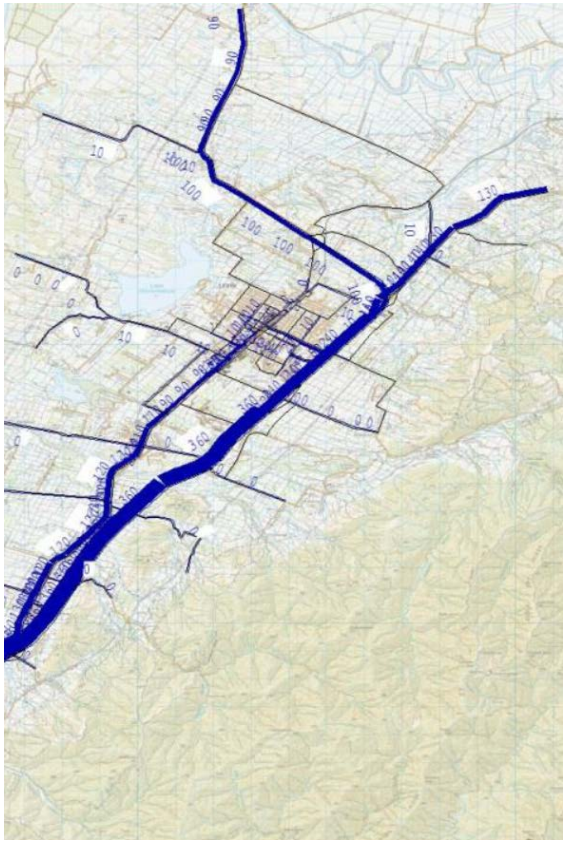
Table 11-2: Key Journey Travel Times and Distances (2041 PM Peak vs 2041 Do-Min, Low Growth)

Option	Route 1: SH1 Ōtaki to SH1 North of Levin				Route 2: SH1 Ōtaki to Central Levin				Route 3: SH1 Ōtaki to SH57 North of Levin				South Origin Traffic using Offline Highway rather than SH1 at Ōhau
	Time Diff 2041 PM (min)	% Time Diff	Length Diff (km)	% Length Diff	Time Diff 2041 PM (min)	% Time Diff	Length Diff (km)	% Length Diff	Time Diff 2041 PM (min)	% Time Diff	Length Diff (km)	% Length Diff	
S6N4b	-5.5	-21%	+1.8	+6%	-0.6	-3%	+1.8	+9%	-4.9	-23%	-2.1	-8%	75%
S6N5b	-5.2	-20%	+2.3	+8%	-0.3	-1%	+2.2	+11%	-4.7	-22%	-1.6	-6%	68%
S7N4b	-4.9	-19%	+3.0	+10%	0	0%	+2.9	+15%	-4.4	-21%	-0.9	-3%	66%
S7N5b	-4.8	-18%	+3.3	+11%	+0.2	1%	+3.2	+16%	-4.3	-20%	-0.7	-2%	64%
S7aN4b	-4.5	-17%	+3.8	+13%	+0.5	3%	+3.8	+19%	-3.9	-19%	-0.1	0%	65%
S7aN5b	-4.2	-16%	+4.3	+14%	+0.8	4%	+4.1	+21%	-3.7	-18%	0.3	1%	65%

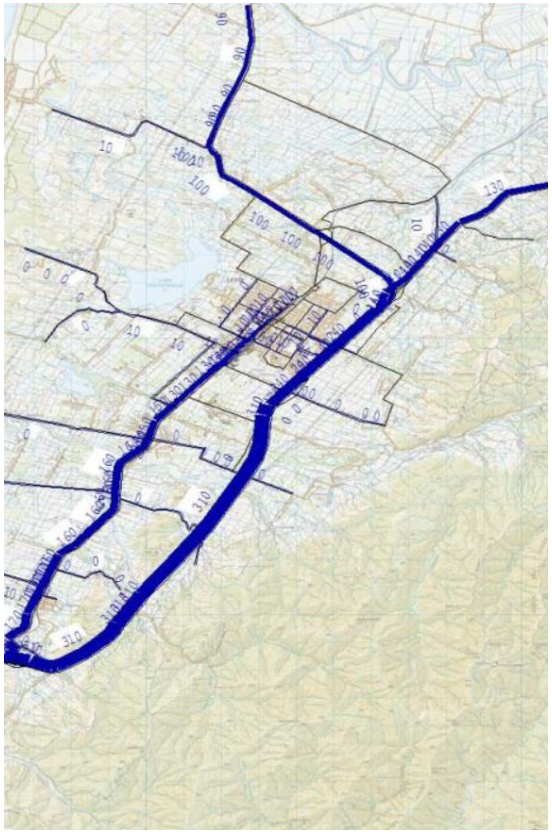
Table 11-3: Key Journey Travel Times (2041 PM Peak vs 2041 Do-Min, HDC LTP Growth)

Option	Route 1: SH1 Ōtaki to SH1 North of Levin				Route 2: SH1 Ōtaki to Central Levin				Route 3: SH1 Ōtaki to SH57 North of Levin				South Origin Traffic using Offline Highway rather than SH1 at Ōhau
	Time Diff 2041 PM (min)	% Time Diff	Length Diff (km)	% Length Diff	Time Diff 2041 PM (min)	% Time Diff	Length Diff (km)	% Length Diff	Time Diff 2041 PM (min)	% Time Diff	Length Diff (km)	% Length Diff	
S6N4	-6.8	-25%	+1.8	+6%	-1.6	-9%	+1.8	+9%	-6.1	-28%	-2.1	-8%	75%
S6N5	-6.5	-23%	+2.3	+8%	-1.3	-7%	+2.2	+11%	-5.9	-27%	-1.6	-6%	68%
S7N4	-6.2	-23%	+3.0	+10%	-1.1	-6%	+2.9	+15%	-5.6	-25%	-0.9	-3%	66%
S7N5	-6.1	-22%	+3.3	+11%	-0.8	-5%	+3.2	+16%	-5.5	-25%	-0.7	-2%	64%
S7aN4	-5.7	-21%	+3.8	+13%	-0.6	-3%	+3.8	+19%	-5.1	-23%	-0.1	0%	65%
S7aN5	-5.5	-20%	+4.3	+14%	-0.3	-1%	+4.1	+21%	-4.9	-22%	0.3	1%	65%

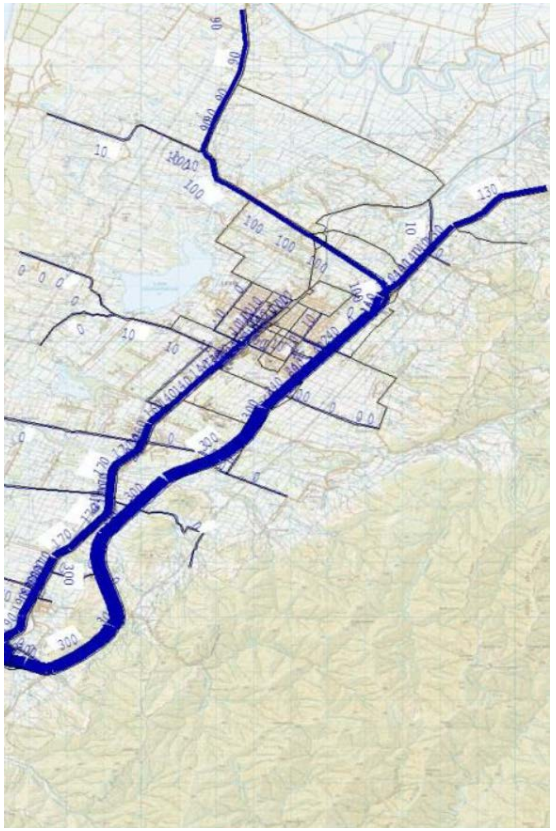
Table 11-2 and Table 11-3 above reinforce that S6 and N4 are the better performing alignments for south and north respectively, under both growth scenarios. Note that negative values indicative travel time savings or a distance reduction in relation to the Do-Minimum network.



S6N4 –1/4 traffic leaves new highway at Manakau (25% on existing SH1, 75% new highway at Ōhau)

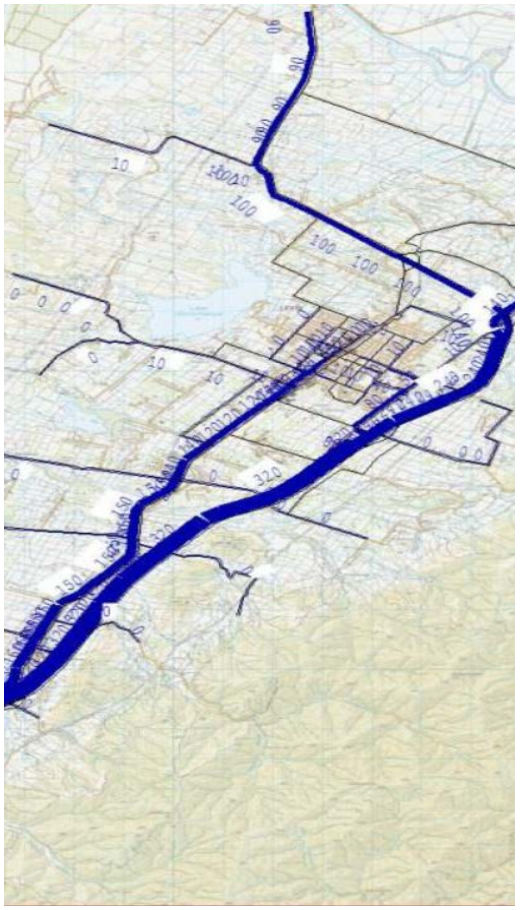


S7N4 – 1/3 traffic leaves new highway at Manakau (34% on existing SH1, 66% new highway at Ōhau)

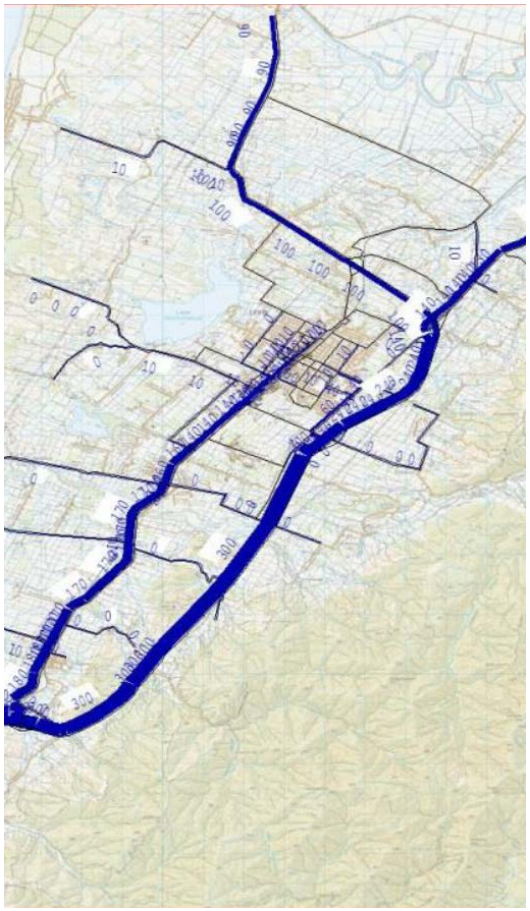


S7AN4 – 1/3 traffic leaves new highway at Manakau (34% on existing SH1, 66% new highway at Ōhau)

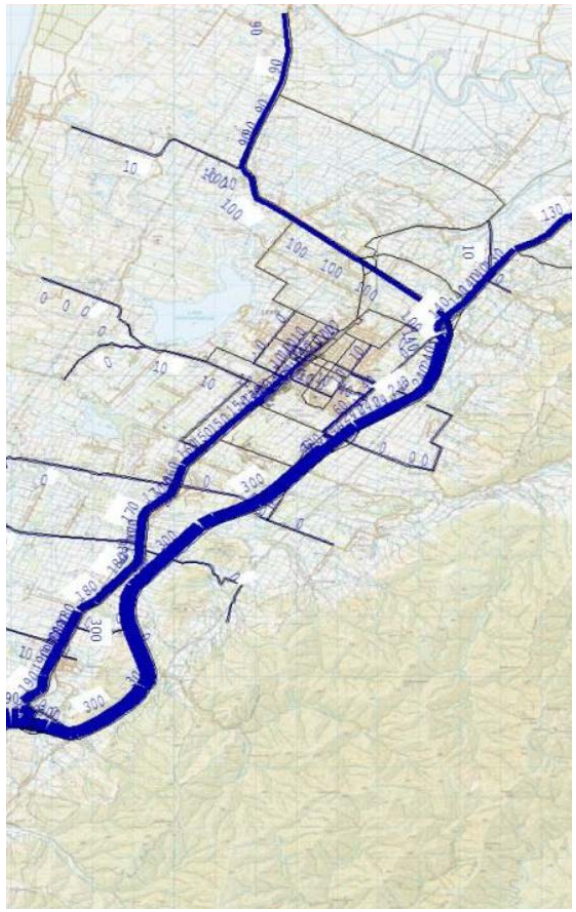
Figure 11-4: Select Link Analysis comparing the southern options when paired with N4 for trips with an origin south of the project area and travelling north. 2041 PM Peak. Comparison of traffic volumes at Ōhau.



S6N5 – less than 1/3 traffic leaves new highway at Manakau
(32% on existing SH1, 68% new highway at Ōhau)



S7N5 – 1/3 traffic leaves new highway at Manakau
(36% on existing SH1, 64% new highway at Ōhau)



S7aN5 – 1/3 traffic leaves new highway at Manakau
(36% on existing SH1, 64% new highway at Ōhau)

Figure 11-5: Select Link Analysis comparing the southern options when paired with N5 for trips with an origin south of the project area and travelling north. 2041 PM Peak. Comparison of traffic volumes at Ōhau.

The model outputs indicate that:

- All options have travel time savings for journeys between Ōtaki and SH1 north and between Ōtaki and SH57 north with smaller travel time benefits for travel time between Ōtaki and Levin.
- As the routes become shorter, a larger proportion of long distance journeys will use the new highway , with the remaining SH1 traffic accounting for shorter journeys with local destinations (e.g. along SH1 or west of Levin).
- Option S6N4 is the best performing in terms of travel time savings on the key routes.
- The S6 and N4 routes are also shown to attract and retain the largest proportion of trips with an origin south of the project area and travelling north, with only ¼ of traffic leaving the new highway onto the existing highway at Manakau for S6N4.

Further investigation into interchange and local connectivity will occur once the preferred corridor is selected, this will enable further optimisation of trips to key destinations.

Economic Analysis

Methodology

An economic evaluation has been carried out in accordance with modified full procedures of the Economic Evaluation Manual (EEM, 2016). Appendix J provides a summary of the economic outputs.

The short listed options for consultation were analysed against the Do-Minimum.

The Do-Minimum includes the recent Manakau and Ōhau Township Improvements and continued maintenance, including like-for-like replacement of the following structures at the end of their assumed 100-year design life:

- Year 11 (2028): Waikawa Stream Bridge
- Year 20 (2037): Manakau Rail Overbridge
- Year 35 (2052): Ōhau River Bridge and Ōhau Rail Bridge

The short listed options for consultation are outlined in Section 9 and include interim safety improvements on SH1 and SH57[93] which would be undertaken in the short term[94].

As was shown in the modelling section, some of the short list options perform similarly so have not been subject to separate economic analyses. The following options have been analysed:

[93] Interim Safety Improvements are linked to the new offline highway options and not to the Do-Minimum as if an alternate approach to addressing the problems along the study area was adopted, more significant online safety upgrades would be considered (Refer Section 5). Interim safety improvements include; edge protection, wide centreline median treatments, minor safety intersection improvements and delineation improvements.
[94] Larger safety improvements, as part of a potential revocation package, have also been considered including speed reductions, safer roads and roadsides, and intersection improvements. The results of which are provided as sensitivity tests in 0.

Table 11-4: Options subject to economic analysis

Southern Option	Option Combinations	Proxy for
S6	S6N4	
	S6N5	S6N9
S7	S7N4	
	S7N5	S7N9
S7A	S7AN4	
	S7AN5	S7AN9

The travel time (TT) and vehicle operating costs (VOC) savings have been calculated from the Ōtaki to north of Levin SATURN model, based on 2024 and 2041 modelled years for both the Do-Minimum and short listed options for consultation. The travel time costs were determined using the queuing delays and free flow travel time while the vehicle operating costs determined based on the fuel use output. Travel time reliability benefits have been assumed as 5% of the total travel time benefits, based on similar projects.

Crash costs were based on the latest five year period 2013-2017, using a network wide crash analysis model for the existing network (Method A and Method C) and motorway crash rate analysis for the new highway sections (Method B).

Resilience costs were based on both Low Impact High Probability (LIHP[95]) events including crashes and flooding and a high level assessment of High Impact Low Probability (HILP[96]) events such as earthquakes and storms. Both resilience assessments focussed on the key section of SH1 between Manakau and Ōhau which, as outlined in the Problem 2: Resilience Section, does not have a viable detour route and contains a number of at-risk structures.

Benefits Assessment

A summary of the road user benefits of each of the short listed options, when compared to the Do-Minimum, is shown in Figure 11-6 below.

[95] LIHP events were assessed based on CAS crash data and resilience event data from NZ Transport Agency's TREIS database.

[96] HILP events were assessed at a high level based on NZ Transport Agency resilience risk maps, developed as part of the National Resilience Project, for Earthquakes (1/1000yr return period) and Storms (1/100 year return period). The maps identify the likely disruption or outage periods which was used along with the detour costs to calculate likely road user benefits. HILP benefits will be reviewed and revised using the NZTA/Market Economics 'Modelling the Economics of Resilient Infrastructure Tool' (MERIT) when available.

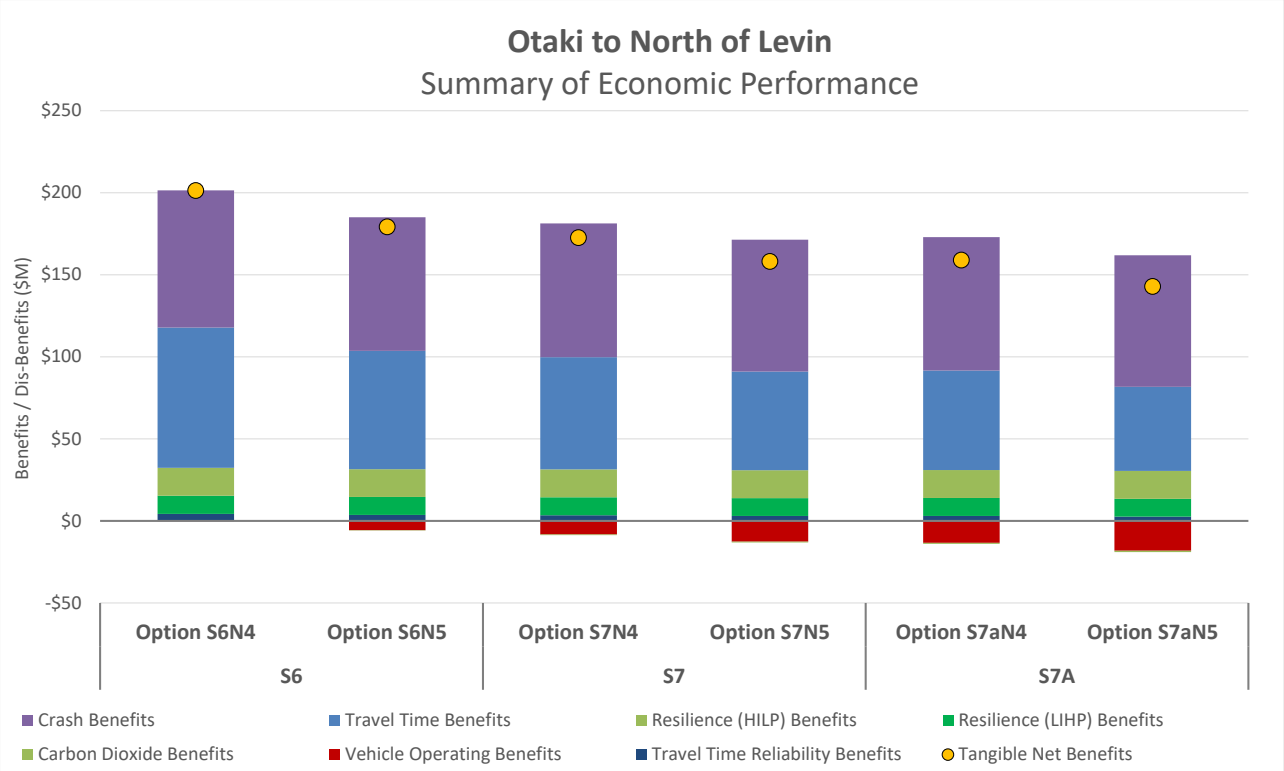


Figure 11-6: Summary of Economic Performance, HDC LTP Growth

Figure 11-6 highlights that:

- The S6N4 alignment options produce the largest net benefits, followed closely by S6N5, principally reflecting the reduced length, and therefore increased attractiveness, of S6N4 compared to the S7 and S7A variants.
- The majority of benefits for all options are obtained from crash cost savings, ranging from over 40% of net benefits with Option S6N4, to the over 60% of net benefits for Option S7AN5. This is consistent with the problem description outlined in Problem 1: Safety above. Crash savings differ slightly by option, with S6 alignments performing better than the longer S7 and S7A alignments (which attract less traffic away from the existing highway onto the safer new highway).
- As outlined in Section 11 the traffic modelling shows that all options have significant travel time savings for journeys between Ōtaki and SH1 north and between Ōtaki and SH57 north with smaller travel time benefits for journeys between Ōtaki and Levin. However, except for Option S6N4, all options result in increased fuel usage (and therefore vehicle operating cost dis-benefits) from an increase in distance travelled.
- Resilience benefits from both LIHP and HILP events contribute 14% to 20% of the net benefits of the short listed options. Resilience benefits from the new highway options relate primarily to significant reductions in road user costs from the provision of an alternate route (between Manakau and Ōhau in particular), net resilience benefits between options themselves are therefore not substantial. Secondary resilience benefits accrue from the reduced frequency and impact of crash occurrences and flooding related closures.

Cost Benefit Analysis

A summary of the benefit cost analysis is provided in Table 11-5 for the HDC LTP growth scenario.

Option S6N4 has both the highest total net benefits and lowest cost resulting in a BCR of 0.37, followed by S6N5. In contrast, the S7 and S7A alignment options all have lower net benefits and significantly higher costs, this combination results in BCRs of 0.25 or less.

Incremental analysis is not required as the best performing option, S6N4, also has the lowest net costs. However, incremental analysis will be critical in assessing the impact of different interchange and local connectivity options once a preferred alignment has been adopted.

Table 11-5: Cost Benefit Summary, HDC LTP Growth

Option		Costs ($M)		Benefits ($M)					BCR
		Expected Estimate	PV Net Total Costs	Travel Time Savings (incl. Reliability)	VOC and CO_2 Savings	Crash Savings	Resilience (LIHP, HILP)	Total Net Benefits	
S6	S6N4	$687	$539	$90	$0	$84	$28	$201	0.37
	S6N5	$691	$542	$76	-$6	$81	$28	$179	0.33
S7	S7N4	$916	$708	$72	-$9	$81	$28	$173	0.24
	S7N5	$920	$711	$63	-$13	$80	$28	$158	0.22
S7A	S7aN4	$830	$644	$64	-$14	$81	$28	$159	0.25
	S7aN5	$834	$647	$54	-$19	$80	$28	$143	0.22

Wider Economic Benefits

Agglomeration benefits were not previously considered for the Ōtaki to north of Levin section as part of the Wellington Northern Corridor (WNC) project evaluation, or the Peka Peka to Ōtaki section to the south. This is because when drafting the WNC Business Case analysis no significant improvements were identified for the Ōtaki to north of Levin section and there was concern that sections were too remote from the main urban areas for agglomeration benefits to be significant[97].

[97] Wellington Northern Corridor Business Case, Appendix B, Richard Paling Report: Assessment of wider economic impacts for the Wellington Northern Corridor RoNS, pg. 3 section 2.1, "*Beca have also modelled the project from Peka Peka to Ōtaki and MWH the project from Ōtaki to Levin. However these projects are considered to be too remote from the main urban areas for agglomeration benefits to be significant and it may be difficult to model these effects reliably in a project model.*" It is understood that at the time of the calculation Richard Paling assumed that a 4 lane expressway from Ōtaki to Levin would only be achieved in the long term and therefore the increase in accessibility associated with such an expressway was not factored in to his calculations.

Similarly, wider economic benefits (WEBs) including; imperfect competition benefits, labour supply benefits and changes in the patterns of demand for labour have not been considered north of Ōtaki in the WNC Business Case.

However, since this time a number of high level economic studies have been undertaken by third parties. Therefore, a number of sensitivity tests (outlined in the following section below) have been developed to consider:

- WEBs (including agglomeration) based on O2NL having the same percentage of WEBs as the WNC south of Ōtaki[98]
- Recent economic studies including:
    - Ōtaki to North of Levin Transport Improvements: Preliminary Assessment of Effects[99]. This report considered that:
        - Economic impacts of construction activity could amount to a combined GDP and employment impact on the Horowhenua economy of between $40-90M
        - Economic impacts of the diverted trade on Levin retail centre as a result of O2NL was estimated at between 5-8% total town centre sales ($218M). This would therefore result in a dis-benefit of between $11-17M. The report notes:

            "That level of impact would equate to somewhere between two and 11 years of market growth, depending on the growth rate assumed. Under the more optimistic growth scenarios, town centre sales would revert to pre-impact levels quickly, and thence continue to grow as they would in the absence of the transport improvements."

        - Commentary on facilitated effects arising from the improved transport connections as a result of O2NL[100]
    - Socio-economic impact of Horowhenua 2040 Strategy[101], a high level assessment which investigated the economic impact of the Horowhenua 2040 portfolio of projects. The assessment found that based on the population and economic growth expected to stem from the O2NL transport improvements:

        "Excluding O2NL from our preferred way forward with the Community Balanced option, reduces the NPV by $400M and

[98] Wellington Northern Corridor Business Case, Appendix B, Richard Paling Report: Assessment of wider economic impacts for the Wellington Northern Corridor RoNS, pg. vii, Executive Summary, section 6,*"These Wider Economic Impact benefits can be compared with the total conventional economic benefits of about $2.4b (for the projects south of Ōtaki), of which they represent about 34 per cent. Agglomeration benefits represent about 17 per cent and labour market effects (supply and demand) about 11 per cent."*

[99] Ōtaki to North of Levin Transport Improvements: Preliminary Assessment of Effects, Market Economics, 2017. https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/technical-reports/Levin-Town-Centre-Impact-Assessment-Report-15082017.pdf

[100] Facilitated effects include employment, productivity and property arising from the improved transport connections between Levin, Wellington and further north. The Market Economics report provided commentary on these benefits but the scope of the report did not include monetisation.

[101] Socio-economic impact of Horowhenua 2040 Strategy, NZIER, 2018. Appendix 6: Cost Benefit Analysis.

significantly reduces the non-monetary benefits by 47% on average"

It is recommended that detailed consideration be given to WEBs, as part of the DBC, as the project would improve connections in the wider central and lower North Island, rather than just through the WNC. Further WEBs could include the benefits of certainty and unlocking future development in Levin and the wider Horowhenua region.

Further Safety Benefits

Figure 11-7 below shows the annual network crash costs for the Do-Minimum and each of the options, along with a breakdown by speed environment and highway.

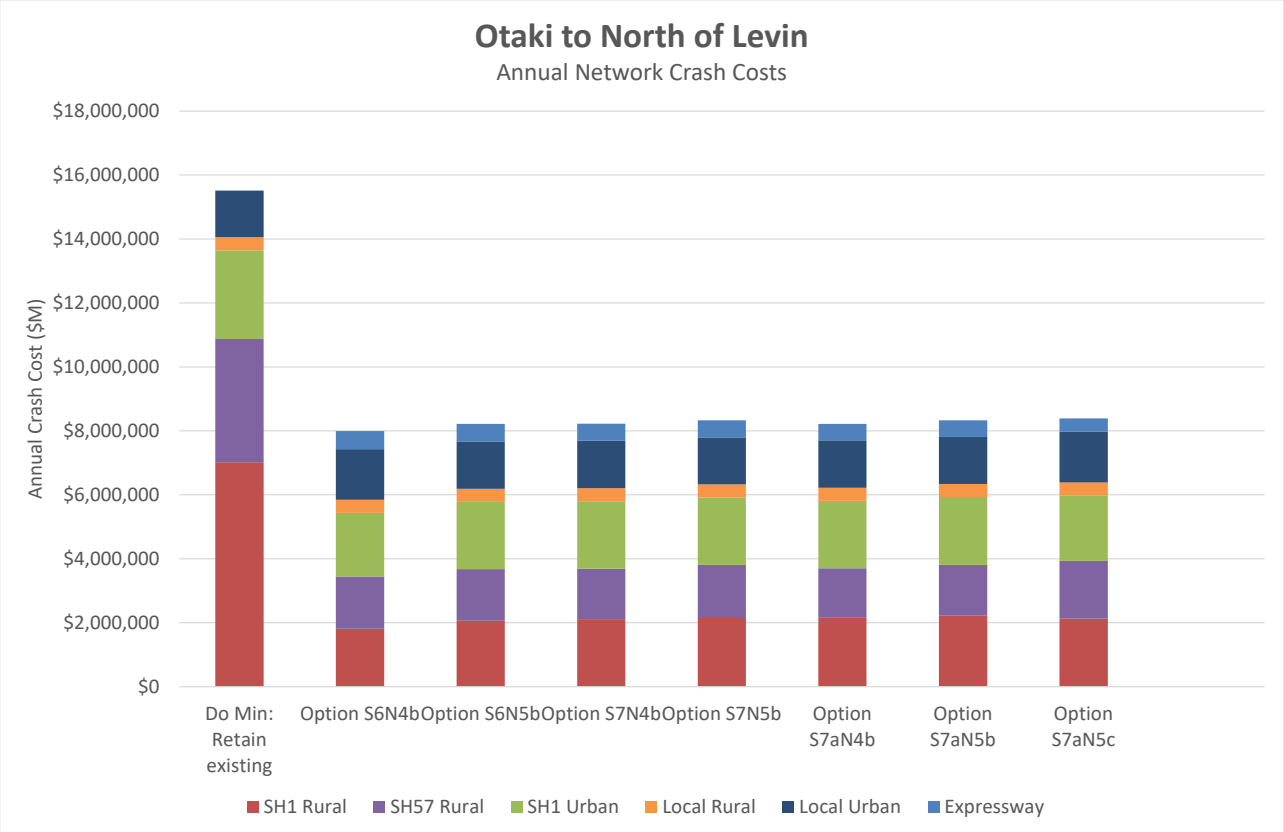


Figure 11-7: Annual Network Crash Costs, HDC LTP Growth

The figure highlights that:

- All options provide an approximately 65-70% reduction in rural state highway crash costs (identified in red and purple above) and an overall 50% reduction in the annual network wide crash cost, with the S6 options the best performing (a function of how much traffic is attracted to the new highway).
    - This in turn shows that significant opportunity remains for further investment in targeted safety treatments on the existing network, especially in those locations where traffic leaves the new highway and uses the old state highway network to access their destination (the calculated reductions in crashes do not take into account the improvements possible to the old network – it follows that all options will be better than shown (at a network level) and the performance gap between the best and worst options will increase (at a network level).

- The crash cost of the proposed new highway is a small fraction (4-7%) of the overall annual network crash costs.
- The residual crash cost is primarily on the rural sections of SH1 and SH57 and through the Levin Town Centre, due to the volume of traffic that would remain on these routes even if the new highway options are in place (the next phases of investigation will need to consider these aspects).

The key opportunities for further crash benefits could come from targeted safety improvements along the following sections:

- **SH57 North (SH57/Arapaepae Road to Tavistock Road):**
    - SH57 acts as a feeder network into Levin under the majority of the options; therefore this section of highway retains a relatively high number of vehicles per day.
    - Potential safe system options, building on the interim safety improvements, for investigation include;
        - Further safe roads and roadside improvements (e.g. median treatments);
        - Intersection improvements e.g. could include a roundabout at SH57/Queen and improvements at SH57/Tararua Road; and
        - Speed limit reduction to 80km/h.
- **SH1 south of Levin**
    - The residual crashes on the sections south of Levin are heavily dependent on the southern option chosen and interchange locations (which influence route choice) as highlighted by the range in annual crash cost between the best performing option and the worst performing option.
    - Due to the poor alignment and constraints along this section, significant improvements will be high cost and as they would primarily need to be off-line. In saying this, there is scope for undertaking interim safety improvements or consideration of a reduced speed limit.
- **SH1 Urban Levin**
    - All options show an approximately 25-30% reduction in crash cost through Levin, primarily relating to a reduction traffic volume as a result of the options (i.e. removal of traffic that can now bypass the Levin town centre).
    - The scope for further significant reductions in crashes through urban Levin is dependent on the outcome of Horowhenua District Council's Levin Town Centre proposals.

Sensitivity tests, outlined below, show that implementing a range of potential local and state highway safety measures, as part of the overall programme, could result in BCR of 0.6 (excluding WEBs) to 0.9+ (including WEBs).

Sensitivity Analysis

Sensitivity tests were undertaken to test the robustness of the BCR across a range of possible scenarios. Sensitivity testing was undertaken on the economically best performing Option S6N4.

The results of the sensitivity testing are outlined in Table 11-6 below. These highlight that the BCR ranges from 0.30, when applying a Low/No growth scenario or an 8% discount rate, to 0.65 when testing the effect of including a range of WEBs (including agglomeration). If the NZIER growth forecast and NZIERs' calculated consequent economic benefit to the District is included as a benefit of the Project then the BCR would be 1.1.

The BCR could increase further is some of the sensitivity tests were combined (excluding the NZIER growth forecast and economic benefit). For example, implementing a range of potential local and state highway safety measures, as part of the overall programme, could result in BCR of 0.57 (excluding WEBs) to 0.9+ (including WEBs).

Table 11-6: Sensitivity Analysis – Option S6N4

Variable	Base Case (BCR = 0.37)		Lower Bound			Upper Bound		
	Value	Note	Value	Note	BCR	Value	Note	BCR
Cost Variability								
Construction	$687m	Expected Estimate	$790m	95th %tile Estimate	0.32	$549m	Base Estimate	0.47
Benefit Variability								
Traffic Growth	1-1.2% SH Growth, 0.5-1% local growth p.a.	Model growth, HDC LTP Growth - based on 50th Percentile Population Growth of 0.8% p.a. reflecting likely growth as part of the WNC	<0.5% growth p.a.	Model growth, based on no population growth (Stats NZ Medium) - only external to external SH trips growth	0.31	TBD	Higher growth scenario to be modelled as part of the DBC.	TBD
Discount Rate	6%	EEM default	8%	Lower realisation of long term benefits	0.30	4%	Higher realisation of long term benefits	0.43
Network Safety Improvements	70% reduction in Rural SH crashes and 50% network wide crash cost reduction	Offline Highway programme only EEM 2016 Methodology	-	-	-	Up to 80% Network wide crash cost reduction . Does not include TT/VOC impacts.	Higher crash savings with the new highway forming a component of a programme of targeted network wide safety improvements, safer speeds and treatments in Levin Town Centre	0.57

Variable	Base Case (BCR = 0.37)		Lower Bound			Upper Bound		
	Value	Note	Value	Note	BCR	Value	Note	BCR
Travel time variability	+5% of Travel Time Benefits	Based on similar projects where congestion is becoming an issue	0% of Travel Time Benefits	Based on the lack of significant congestion on the do-minimum network	0.37	-	-	-
Wider Economic Benefits (WEBs)	N/A	Not considered under base case as per the WNC Business Case assumptions.	+10% of total conven-tional benefits (+$20M)	Low end assumption based on O2L having the same % WEBs as the WNC south of Ōtaki.	0.41	+34% of total conven-tional benefits (+$68M)	High end assumption based on O2L having the same % WEBs as the WNC south of Ōtaki.	0.50
			-$17M	Market Economics Report, *Levin Town Centre impacts*	0.34	-$11M	Market Economics Report, *Levin Town Centre impacts*	0.35
			+$39M	Market Economics Report, *Construction impacts*	0.45	+89M	Market Economics Report, *Construction impacts*	0.54
			+$42M	**All above WEBs Low (Excl. NZIER)**	**0.45**	**+$146M**	**All above WEBs High (Excl. NZIER)**	**0.65**
			N/A	NZIER Report	0.37	+$400M	NZIER Horowhenua 2040 Economic Report	1.1

Multi Criteria Analysis Update

Introduction and Method

This section outlines the outcomes of a review of the shortlist for consultation options[102] following the consultation exercises in January, February and March 2018. The review was largely undertaken in March – June 2018 and encompassed reviewing engagement feedback as well as undertaking additional more detailed noise, social, heritage and ecological investigations to address issues raised during the engagement feedback process.

The review was undertaken by technical specialists and others who had been involved previously in the Project, including as part of the multi-criteria analysis (MCA) process[103]. Each of the criteria developed for the MCA had been investigated, background notes prepared, and a presentation made by a nominated technical specialist prior to wider MCA workshop discussion[104] in August 2017.

The purpose of the review was:

- To identify whether any of the additional information and views which had been received as a result of the consultation process would have caused the technical specialists to have modified or changed their assessment as presented at the MCA workshop.
- To consider if the technical assessments and scoring in the MCA would have been different as a consequence of the additional noise, social and ecological investigations undertaken.
- To review the performance of options following the outcome of updated traffic modelling, information from additional geotechnical investigations which had enabled some refinement of understanding of technical risks, constraints and costs, updated affected property numbers and associated information, and information relating to heritage items gained from site visits.

The specialists were each asked to provide a short report as a result of their review of submissions, and that it include the identification and any additional commentary relating to other information gained from outside the consultation processes in the period since the MCA workshop. This chapter summarises their reports.

Summary

While most of the reviews have confirmed the original assessments, a few of the reviewers identified aspects where their assessments may have changed. Assessments of some options would have become more adverse, if additional information had been identified at the time the MCA was undertaken.

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[102] NZTA's engagement/public consultation material refers to these options as "corridor" options, to emphasise that they are still broad options approximately 300m wide.
[103] This is fully written-up in "Identification and Assessment of Possible Route Options – Multi-Criteria Analysis with Community Involvement – Ōtaki to North of Levin", Stantec, September 2017
2017 https://www.nzta.govt.nz/assets/projects/Ōtaki-to-north-of-levin/docs/technical-reports/mca-reports/O2NL-Community-MCA-Report-September-2017-Front-only.pdf
[104] Noting that for the criterion relating to Tāngata Whenua cultural values, the workshop presentations were made by representatives of Iwi.

This applies in relation to S6 in terms of heritage values, and S6 and S7A in relation to the Manga-huia Stream alignment due to ecological values. The cost criterion would have become more adverse in relation to S7.

For ecology and heritage (where the extent of the concerns is limited to a relatively limited length of each option), the reviewers consider that all matters can be addressed within the next stage of development. Both have confirmed their earlier assessment on that basis.

Conversely, in terms of district development, the reviewer has considered that the MCA assessment for S6 may have been conservative (as in, conservatively adverse). This relates to how the option may have impacted on future growth areas. Similarly, in relation to productive land, N4 and N5 may have been scored worse due to potential urban expansion east of Levin onto productive land. As the growth options in this area are not confirmed, no change was proposed.

The review has emphasised the numerous aspects, regardless of route choice, which the next stage of development of the preferred option (once selected) must avoid, remedy, mitigate, offset and/or compensate. These will include all environmental and social aspects identified in the original MCA and will involve significant further consultation and many methods of reducing impacts - ranging from land purchase, to means of noise and visual mitigation, to management of effects on waterways and ecological sites, and protection of archaeological and heritage resources.

Noise

Due to the large number of consultation responses which related to noise, a Tier 1 nose assessment was undertaken to feed into the option selection processes. This is provided in Appendix D.

NZS 6806:2010 sets out recommended methods for assessing road traffic noise effects of new or altered roads in New Zealand. This Standard provides a consistent methodology for the application of resources to mitigate that noise which is exceeding the relevant criteria. For noise from new roads, the thresholds for implementing noise mitigation measures commence when one or more PPFs are predicted to receive a noise increase of ≥3 dB LAeq(24h) at the design year when compared with the predicted do minimum noise environment.

A 'Tier 1' assessment is a simple, preliminary assessment based on numbers of affected "sensitive sites" (Protected Premises & Facilities or PPFs; e.g. dwellings, marae, schools) rather than acoustic modelling of noise levels at each affected site as is normally carried out later in the project, during the detailed assessment stage. A 'Tier 1' assessment considers geographic information regarding the 'proximity' of PPFs to the proposed alignment(s) together with predicted (generic) LAeq(24 hr) traffic noise level information applicable to the various route options[105]. Although generic in nature, the estimated (unmitigated) noise levels predicted for the various setback distances, coupled with the number of PPFs found within various noise bands enable broad comparisons between the expected noise effects across the route options.

[105] NZTA Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects. NZ Transport Agency. Published August 2016 ISBN 978-0-478-44573-2.

For the purposes of this Tier 1 noise assessment, the project area has included all identified PPFs located within a 500 metre wide corridor representing all existing PPFs located within 250 metres each side of the assumed centreline. This exceeds the 400m corridor width usually adopted within a Tier 1 assessment and provides a further measure of conservatism within the assessment.

NZS6806:2010 sets out the "Category A" noise category for PPFs expected to receive the least noise effect, where noise levels are expected to not exceed LAeq(24 hr) 57 dB. Categories B and C criteria apply to PPFs expected to receive traffic noise at levels greater than LAeq(24 hr) 57 dB, a level of noise triggering the investigation of noise mitigation options. As above, a Tier 1 study does not identify any specific mitigation measures to be applied within the project; this will be undertaken at later stages.

Table 11-7: Noise Summary – Northern Options

Route Option	Total number of PPFs with 250m of Route Option	Category A PPFs	Category B or C PPFs	No. PPF's expected to receive >3 dB increase
S6	112-121	98-108	13-14	25-34
S7	63-73	50-61	12-13	34-37
S7A	72-94	59-83	11-13	25-34

Table 11-8: Noise Summary – Northern Options

Route Option	Total number of PPFs with 250m of Route Option	Category A PPFs	Category B or C PPFs	No. PPF's expected to receive >3 dB increase
N4	126	108	18	23
N5	88	66	22	43
N9	86	65	21	40

From the above assessment, it can be seen that there is, unsurprisingly, a noticeable difference between the S6 and S7 options, with the S6 route impacting on a greater number of dwellings. When considering category B and C dwellings (i.e. dwellings where noise mitigation will be required) then the difference between S6 & S7 options is very similar.

At the northern end, Option N4 is closer to a lot more dwellings compared to Options N5 and N9. However, the number of dwellings that would need mitigation is actually slightly less for Option N4 than the other two options due to the properties already being in a higher noise environment.

Social Impact Assessment

Due to feedback during the engagement process, a Preliminary Social Impact Assessment report was commissioned. This is provided in Appendix E.

The purpose of the assessment was to supplement the current understanding of social impacts assessed through the Multi Criteria Assessment process for the long-list of options evaluation. It provides a preliminary screen of potential social impacts (at a regional, local and sub-local[106] scale) of the six short-list options for the O2NL (three southern and three northern options), drawing from existing data including feedback received from the engagement processes.

The report assesses the potential social impacts on each community for all related short-list options. The key positive and negative potential social impacts cover three 'key phases' of Project development (being planning, construction and operation phases) and are assessed at scales relevant to that impact (e.g. regional, local and sub-community scales).

In all cases it is noted that the potential impacts identified have the scope to be reduced, ameliorated or mitigated by alignment design, project design and implementation of management and/or mitigation strategies. These mitigations need to be considered in the further development of the project.

At a regional scale the preliminary SIA found that the potential impacts of any of the eastern corridor options are likely to be similar and positive. This is due to potential improvements in safety and resilience of the local and regional road networks, and the capacity to facilitate ongoing population and economic growth. The ability to move efficiently, safely and reliably around the region is identified as a positive social impact as it improves the way of life (including access to living, working and recreation environments).

At a local scale all corridor options are identified as having potential positive impacts for the wider local communities as the project reduces the effect of the current SH1 corridor that currently effectively dissects all three communities. The removal of this 'severance' creates opportunities to improve access, connectivity, community cohesion and socio-economic opportunities and provides the opportunity to enhance the town and village centres. A number of potential negative impacts were identified at a local level. However, for the community overall these were largely transitional (e.g. associated with construction works).

The effects identified from the Social Impact Assessment have been summarised in the tables below for each of the key communities (note these tables are not provided in the Preliminary Social Impact Assessment Report and are instead derived from it and presented here to help summarise and visually display a summary of its findings).

Table 11-9: SIA scoring scale

Positive					Negative				
High	Med/High	Med	Low/Med	Low	Low	Low/Med	Med	Med/High	High
5	4	3	2	1	-1	-2	-3	-4	-5

[106] The 'sub-local communities' identified in this report refer to smaller 'neighbourhoods' or community areas that are within direct proximity of the proposed corridor options, these are generally defined within local roads and in some cases private right-of-way accesses.

Table 11-10: Social Impacts around Levin

Option/scale / Potential impact on:	Levin				
	All	Northern connection	N4	N5	N9
	Local	Sub-local	Sub-local	Sub-local	Sub-local
Way of life	4	-5	-3	-3	-3
Community cohesion	3	-2	-3	-5	-5
Sustaining oneself	1		-3	-3	-3
The quality of the environment	2		-2	-4	-4

The table above shows that there will be overall benefits realised by all options at a local level. When considering the sub-local level, all options have negative impacts, with N4 scoring better from a community cohesion and quality of environment perspective.

Table 11-11: Social Impacts around Ōhau and Kuku

Option/scale / Potential impact on:	Ōhau and Kuku							
	All		S6		S7		S7A	
	Local	Sub-local	Local	Sub-local	Local	Sub-local	Local	Sub-local
Way of life	4			-3		-4		-3
Community cohesion	3	-2	3	-2	3	-4	3	-2
Sustaining oneself	-1			-4		-4		-4
The quality of the environment	2			-3		-3		-3

Around Ōhau and Kuku, all options have positive benefits at the local level with the exception of impacts on sustaining oneself. At the sub-local level, Options S6 and S7A score negatively (adverse) and the same, which is expected as they follow the same alignment through this part of the district. Both of these options score better than S7 which scores significantly worse on community cohesion.

Table 11-12: Social Impacts around Manakau

Option/scale / Potential impact on:	Manakau							
	All		S6		S7		S7A	
	Local	Sub-local	Local	Sub-local	Local	Sub-local	Local	Sub-local
Way of life	4			-5		-5		-5
Community cohesion	3	-4	-2	-4	1	-5	1	-5
Sustaining oneself	-1			-4		-3		-4
The quality of the environment	2			-5		-3		-3

Similar to the area to the north, the local impacts around Manakau are also expected to be positive. However, the impacts to the sub-local level are significantly negative for all

options. The option that scores the best is Option S7, however it still has high negative effects in two areas. Option S7A can be considered to be only slightly better or the same as option S6, scoring better by 2 increments in respect of 'the quality of the environment', but worse in the two areas of 'Sustaining oneself' and 'Community cohesion'.

In addition to the above, there are also impacts associated with the connections at the north, centre and south of the project which are outlined in the SIA.

Overall, while the project will result in potentially positive social outcomes, it is acknowledged that there are potential adverse social impacts that will be experienced by the sub-communities within these local communities. All the short-listed options considered in the preliminary SIA raise similar social impact issues; with the difference being the change in the sub-local community impacted. However, while there are a number of adverse social impacts identified in the preliminary SIA it is also noted that there are further opportunities to ameliorate, remedy or otherwise mitigate impacts.

Multi Criteria Assessment Peer Review

A peer review of the MCA process was commissioned by the NZ Transport Agency to examine the process used and to provide advice (see Appendix G).

The process involved reviewing the background reports, discussions with NZ Transport Agency and Stantec staff and holding a series of interviews with individuals who were involved in the Project Reference Group (PRG) to gain an understanding of the thoughts of those involved in the MCA process. The key findings of the Peer Review are summarised below:

- The MCA process undertaken was a valid process.
- Involving the community in the MCA process added value and there were many positive elements of the process
- There are some opportunities for improvements to the process, particularly if another two months was added to the programme to include additional steps. However, these improvements would ultimately not have been material to the overall outcome.

Horowhenua District Development

Horowhenua District Council officers have provided draft documentation that provides a comparative analysis of the development potential of Gladstone Green. This analysis considers the urban design outcomes and development yield estimates that would eventuate under the different northern options scenarios (N4, N5 or N9). This draft analysis has been undertaken by McIndoe Urban and Morphum and is dated 18 October 2018.

The analysis outlines potential dwellings yield as follows:

Table 11-13: Gladstone Green Dwellings Yield Estimate (fully developed)

SCENARIO	DWELLINGS YIELD (ESTIMATE)
Baseline (with SH57 reduced to speed of 60-80km/h)	2,370
Option N9 is selected	2,275
Option N4 is selected	1,490
Option N5 is selected	1,620

The dwellings yield varies between options as it is assumed that the location of the new highway will affect the type of dwellings that might be constructed. So for example for N9 it is assumed that more higher-density residential dwellings will be constructed as compared with N4 where the focus is on larger sections and rural residential development.

The assessment concludes that the baseline condition is optimal creating a high quality environment that can be integrated with the existing urban area and can enhance market perceptions of the area. N9 is the next best option, with the new highway defining and maintaining an effective boundary between suburban residential and low density rural-residential, but would also compromise views and accessibility to the Tararuas.

Options N5 is next best with option N4 ranked worst performing. Key issues with these options relate to how the new highway is integrated into proposed new urban development and provide adequate amenity, and integrating the new urban area with urban Levin (which could preclude benefits from the new development extending to existing communities).

This assessment and has not been reviewed by the NZTA project team. It provides a good understanding as to the types of issues that will need to be considered and resolved as part of the ongoing investigation.

12. RECOMMENDED OPTION

The investigations undertaken to date have been focused on understanding the benefits and impacts of the options to enable the selection of a recommended option.

This section outlines those aspects which are considered to be differentiators between the options to help with decision making. These are based on the MCA (all of the results and individual assessments), all of the further investigations that have been undertaken in this area and the feedback from the engagement exercise.

Southern Section

From the MCA analysis seven (of the twelve) criteria had more than a 1 point difference between the highest and lowest scoring shortlisted options; these are reflected in the table below. From consultation the common themes for people recommending one option over another are also represented below, where they differ from, or provide more detail than the MCA criteria. Where there was little or no difference between the criteria, these are not presented below.

The majority of the further information and community responses were already captured by the differences in the MCA scoring and these are presented in Table 12-1 below.

Table 12-1: Southern Section MCA Scoring

	S6	S7	S7A[107]
MCA Differentiators			
Landscape / Visual	MCA score: 2 Good fit with the landscape, requires less earthworks and would be located within a more modified landscape	MCA score: 3 Moderate fit with the landscape. Potential impacts on Kimberley Bush and Waikawa Stream area. Significant landform modification needed	MCA score: 4 Poor to moderate fit with landscape due to dog-legs in alignment, it affecting both valley and plains and still has landscape modification
Ecology	MCA score: 2 Able to avoid the few constraints nearby.	MCA score: 5 Many areas of significance and some are unable to be avoided e.g. Waikawa Stream Picnic area.	MCA score: 5 Many areas of significance and some are unable to be avoided e.g. Waikawa Stream Picnic area.
Social/ Community/ Recreation	MCA Score: 5 Severance and Amenity concerns, particularly around Manakau. Also affects the highest number of dwellings	MCA Score: 2 Low impacts, apart from recreational.	MCA Score: 1 Similar to S7

[107] S7A was not assessed at the workshop – it was evaluated separately by the experts at a later date but included in the MCA Report.

	S6	S7	S7A[107]
MCA Differentiators			
District Development	MCA Score: 3 MCA score was on the basis of impacts on a growth area which is now no longer proposed so this is now shown as light green.	MCA Score: 1 Impacts on rural land only	MCA Score: 1 Impacts on rural land only
Project Objectives	MCA Score: 1 Best performing option as shortest and attracts the most traffic	MCA Score: 3 Longer option that traverses fault line	MCA Score: 3 Longer option that traverses fault line in part
Engineering Considerations	MCA Score: 2 Fewer tight curves, fewer structures and generally stable geology	MCA Score: 3 Large structures, significant earthworks	MCA Score: 4 Large structures, significant earthworks, more lower radii curves and difficulties in linking back to Waiauti valley
Cost	MCA Score: 3 Shortest and easiest route	MCA Score: 4 Long route with very large structures. Shown as red as subsequent work has shown that costs would be much higher	MCA Score: 5 Longest route with some large structures
MCA Ranking (relative to each other – both with and without cost)	1st	2nd	3rd
Community Comments / Further Information			
Traffic Modelling	Shortest most direct route that takes the most traffic off SH1	Mid-length route	Longest route, takes least traffic from SH1
Social Impact Assessment	Comparatively performs best in Ōhau and Kuku but worst through Manakau	Comparatively performs worst for Ōhau and Kuku, but best through Manakau.	Performs comparatively average in both key locations.
BCR excl. WEBS **(with best performing northern option)**	0.37	0.24	0.25
Impact on Dwellings **(including noise)**	14 within 50m of CL 64 within 150m 116 within 250m 13-14 PPFs in Cat B/C without mitigation	7 within 50m of CL 41 within 150m 68 within 250m 12-13 PPFs in Cat B/C without mitigation	10 within 50m of CL 51 within 150m 89 within 250m 11-13 PPFs in Cat B/C without mitigation

Very positive	Positive	Neutral	Negative	Very negative

The table above highlights that Option S6 performed best, on the whole, across the range of MCA criteria (and further assessments). Option S6 is the lowest cost option, and the option which best meets the project objectives.

Therefore Option S6 is the recommended option for the southern section of the route.

The primary weakness of Option S6 the social effects it will have, and the relate impacts on dwellings. Noting that the initial social impact assessment highlighted that all three options present issues in terms of social effects, the social effects and effects on dwellings of Option S6 will need to be carefully managed and mitigated.

Northern Section

From the MCA only two (of the twelve) criteria had more than a 1 point difference between the shortlisted options, these were Ecology and Heritage, so these are reflected in the table below. From consultation the common themes for people recommending one option over another are also represented in Table 12-2 below. For the purposes of assessment it is assumed that the northern options will be connected to S6 (where this is clearly the preferred option and thus can be taken as a starting point for understanding the performance of these northern options).

Table 12-2: Northern Section MCA Scoring

	N4	N5	N9
MCA Differentiators			
Ecology	MCA Score: 4/5 Score based on avoidance/impact of Prouse and Arapaepae bush. Considered that these effects can be mitigated by additional planting and protection to adjacent areas.	MCA Score: 1 Can avoid Koputaroa Stream	MCA Score: 5* *MCA score was due to the option encroaching on the ecological sites at the Ōhau River and Kimberley Scenic Reserve, but this only applies if the route connects into S7, hence this is now shown as green
Heritage	MCA Score: 4 Key constraint identified in the Prouse Homestead	MCA Score: 2 No specific constraints identified. Adkin house is outside the corridor	MCA Score: 2 No specific constraints identified. Adkin house is outside the corridor
MCA Ranking (3 options only)	2nd	1st	3rd
Community Comments / Further Information.			
Traffic Modelling	Shortest most direct route that takes the most traffic of SH1	More indirect route that attracts up to 1,000 fewer trips per day from the old SH1 due to its additional length	Not modelled but likely to be worse than N5 as a connection to Levin at either Kimberley Road or Tararua Road is further away from Levin.
BCR excl. WEBs (with S6)	0.37	0.33	0.33

	N4	N5	N9
Productive Land	Corridor contains up to 40 ha of productive land.	Corridor contains up to 95 ha of productive land. Coloured orange as while has the same MCA score as N4, it affects more than double the amount of productive land.	Corridor contains up to 130 ha of productive land.
District Development	Good in terms of existing structure plan but provides urban design challenges to to expansion.	Less favourable than Option 9 with respect to future urban expansion but better than N4.	Best fit with potential future urban expansion.
Social Impact Assessment	Corridor located in an area with an existing highway impacts. But most number of people adjacent to corridor (many of them on urban side of SH57 therefore N4 benefits as it takes traffic further away). Performs best in regard to community cohesion. 76 dwellings within corridor*	Fewer people affected but the impacts are greater as they in a more rural setting. Performs poorly in regard to community cohesion 76 dwellings* within corridor	Similar to N5 but has recreational impacts in being close to Kimberley Reserve. Performs poorly in regard to community cohesion 73* dwellings within corridor
Noise	18 PPFs in Cat B/C without mitigation	22 PPFs in Cat B/C without mitigation	21 PPFs in Cat B/C without mitigation
Stage-ability and fit with S6	Very good as both corridors are close to SH57. SH57 can be used as an interim alignment.	Very good as both corridors are close to SH57. SH57 can be used as an interim alignment.	Less logical route as corridor moves from east to west, south of Levin and staging is more difficult as further away from SH57.

* Dwellings count includes connection component of option to S6

Very positive	Positive	Neutral	Negative	Very negative

The performance and impacts of the northern options are more finely balanced than the southern options. This is reflected in the overall MCA outcomes where the options are only significantly different (i.e. >1 point) from one another in respect of ecology, heritage and productive land values.

Option N9 can be discarded as it was the poorest performer in the MCA workshop, is the worst at meeting the project objectives and is the least logical fit with the recommended southern route, Option S6.

In respect of Project Objectives Option N4 clearly performs the best, as it offers the shortest journey, is closest to Levin Town Centre and is therefore predicted to divert (and accommodate) 75% of traffic from the current network onto the new State Highway. This is

reflected in the benefit to cost ratio calculation which shows N4 performing best, providing the best safety performance and journey efficiency.

Option N5 does perform the best overall from an MCA perspective, due to its lower ecological and heritage effects as compared with Option N4. However, additional field survey of the ecological and heritage areas affected suggest that the ecological and heritage effects of option N4 can be minimised or appropriately managed.

Additional, more detailed, social and noise studies have been undertaken and these conclude that Option N4 performs better as compared with the other options (in these respects).

A key differentiator is that the N4 option is aligned close to and parallel to SH57. This means that a number of the properties that N4 would affect (from a noise and thus amenity perspective) are already currently affected by state highway traffic, which would be diverted onto N4 once that is constructed. It is also noted that the community feedback tended to favour the N4 option ahead of N5 and N9 and this may be reflective of the alignment of N4 adjacent and close to SH57.

Accordingly, it is recommended that Option N4 is adopted as the preferred option, noting it performs the best in terms of the achievement of project objectives, and has least effect on existing properties and social effects. The key effects on ecology and heritage should be able to the adequately managed and mitigated. N4 also ties into S6 coherently and had greater community support during the recent community engagement process.

It is acknowledged that N4 is least desirable in respect of the planned urban growth (at Gladstone Green) but these can be avoided through the design of the future growth area. These are potential effects on dwellings yet to be built and are therefore considered to be less determinative than effects on dwellings and urban environments that currently exist.

Care will be needed during the ensuing investigations to consider how potential effects of N4 on the ecological and heritage sites can be avoided, mitigated or otherwise addressed. In addition the future urban expansion of Levin will also need more planning to ensure the development and the highway are appropriately integrated without significant impact on one another.

Initial Route Refinements to Recommended Option

Generally, route refinement and alignment selection will be undertaken during the next phase of investigations (during the Detailed Business Case). However, following the Community Engagement and Further Assessment work (described in Section 10 and Section 11 respectively), it was deemed necessary to make some initial and immediate changes to the recommended corridor.

These corridor alterations have been undertaken at this stage to provide increased certainty for landowners and the community due to identified major constraints such as heritage properties, opportunities to lessen impacts on dwellings or due to the fixed northern and southern tie-in points allowing for a reduced width corridor.

The immediate corridor changes are summarised below:

Narrowing of corridor at south end

Reason: Corridor reduced to area likely to be needed to connect with the proposed Peka Peka to Ōtaki Project whilst providing space for route refinement.

Narrowing of corridor at North Manakau Rd

Reason: to avoid and minimise effects on an historic property and its setting, whilst allowing space for mitigation to be developed

Widening of S6 / N4 transition

Reason: To retain more land area as we work through the design refinement phase. This provides opportunities to avoid, minimise and manage effects on homes within the area. It also provides greater flexibility for accommodating future local connections

Narrowing of corridor at Queen Street

Reason: To show that the new highway will be aligned so as to avoid and minimise effects on the historic homestead and its settings, whilst allowing space for mitigation to be developed

Narrowing of corridor near Waihou Road

Reason: To show that the new highway will be aligned so as to avoid and minimise effects on the historic property and its settings, whilst allowing space for mitigation to be developed

Widening of corridor near Sorensen Road

Reason: Following discussions with land owners, the corridor has been widened slightly to allow a broader range of route alignments to be considered in next phase of investigation

Narrowing of corridor at north end

Reason: Corridor reduced to area likely to be needed to connect with the existing state highway whilst providing space for route refinement

13. INVESTMENT ASSESSMENT FRAMEWORK

The Transport Agency uses the Investment Assessment Framework (IAF) to give effect to the Government Policy Statement and determine what proposals will receive funding within the activity class funding ranges. An assessment of the Ōtaki to North of Levin new off line highway has been undertaken against the NZ Transport Agency's 2018-21 IAF.

The framework, presented in Figure 13-1 below consists of a business case review and a two-factor assessment, including Results Alignment and Cost-Benefit Appraisal.

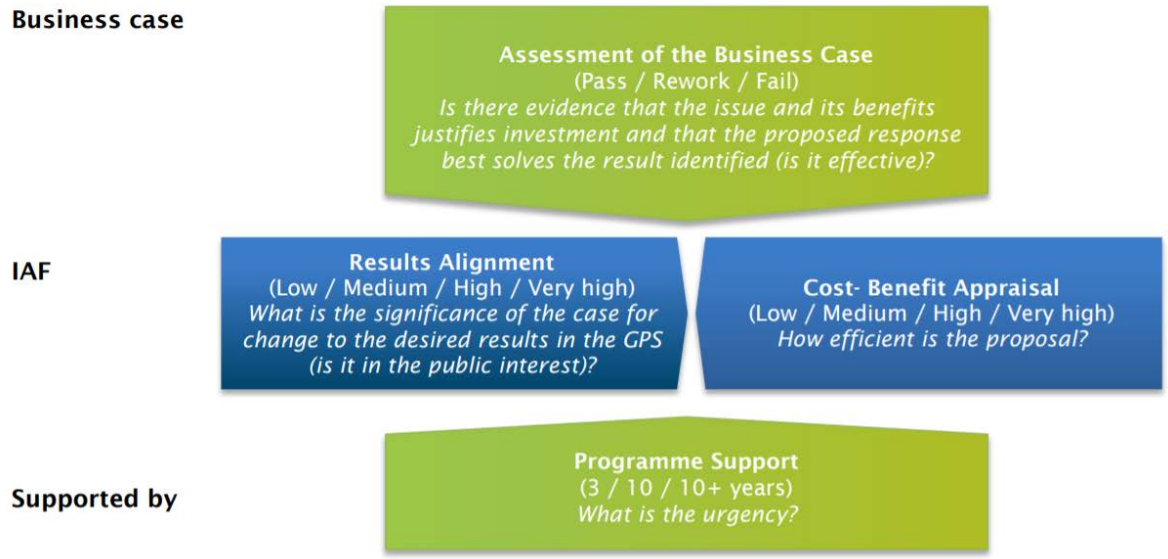

Figure 13-1: Investment Assessment Framework, 2018-21 NLTP

Results Alignment

Under the activity class for regional, local road and state highway improvements, the Ōtaki to North of Levin project is consistent with the requirements for a **Very High Results Alignment**, in response to the Safety Strategic Priority:

- **Safety – A Safe Transport System free from death and serious injury**
  - Very High Requirements:
    - implements a speed management approach focusing on treating the top 10 percent of the network that will result in the greatest reduction in deaths and serious injuries
      - *the Ōtaki to Levin section of highway is within the top 10% with high benefit opportunities according to the NZ Transport Agency's Speed Management Guide and is classified as an "Engineer Up" project .*
    - targeting areas of high collective risk with high DSI reduction measures that achieve a DSI reduction of at least 40%

- *The Ōtaki to Levin section of highway is classified as a high-risk rural road with sections of high collective risk on SH1 and SH57.* All shortlisted options are expected to achieve a minimum 50-60% reduction in network DSI.

The project also contributes to a high results alignment to the Access Strategic Priorities (Thriving Regions) by:

- Enabling a significant regional economic development opportunity in an approved RED programme.
- Addresses a significant resilience gap (e.g. no alternate route on SH1 between Manakau and Ōhau south of Levin)
- Makes best use of key corridors that prioritise national freight and tourism.

Cost Benefit Appraisal

As presented above, the cost benefit appraisal shows that all options result in a BCR of less than 1.0 and would not achieve a 'Low (BCR of 1-2.9)' cost-benefit appraisal rating under the 2018-21 Investment Assessment Framework (IAF)[108]. However, following on from the release of the GPS 2018 the NZ Transport Agency is reviewing the appropriateness and effectiveness of its current evaluation practices (EEM).

Safety Improvement Activities

Of particular relevance to O2NL, as stated in the IAF:

> *"Safety is a key priority in the GPS which signals a requirement for a significant increase in the level of ambition for delivering a land transport system free of death and serious injury (DSI).*
>
> *The Transport Agency's current evaluation methodology can result in some worthy safety projects being assessed with a very low priority which does not meet the previous expectation of a BCR greater than one, e.g. the high cost of some safety interventions and the negative impact on travel time in some cases overriding the safety benefits."*

The IAF methodology enables a step change delivery in safety outcomes by:

- Allowing for assessment and investment decisions to be made at a programme rather than individual project level;
- Providing clarification of the 'do nothing' and 'do minimum' for economic appraisal of speed management activities[109]. In this situation:

[108] https://www.nzta.govt.nz/assets/planning-and-investment/nltp/IAF-for-GPS-2018.pdf

[109] Note the IAF is currently unclear how this change impacts the evaluation of projects, such as O2NL, where components of the overall programme of work would include speed management activities. In the case of O2NL, the adoption of a safe and appropriate speed based do-minimum, while changing and potentially increasing the BCR, is not considered to have significant impact on the strategic option selection. This is because improvement projects will likely scale proportionally whilst speed management measures alone will not solve the identified problems (refer Section 2).

  - The 'do minimum' will be set at the safe and appropriate speed under the Speed management guide.
  - The 'do nothing' is the existing baseline conditions of the network, based on the existing speed limit and existing infrastructure and services and forms the basis for assessing the effects of a safe and appropriate speed limit in the 'do minimum'.

- Promoting sensitivity testing around travel time changes where they are considered to be insignificant or not relevant.

The IAF also states that:

In all instances where any proposal (standalone project, or an activity within a programme) has a BCR<1, funding for these will only be approved by exception at the appropriate level of delegation.

There are currently a number of variables that could significantly change the cost benefit appraisal including:

- recent and planned changes to both the IAF and EEM,
- further detailed consideration of wider economic benefits, and
- further flexibility around investment decisions at a programme level (noting that O2NL was part of the WNC programme which achieved a programme BCR>1)

Accordingly, and ahead of clarification and any consequent adjustment that may occur in respect of the above matters, in order to determine an overall IAF profile, a 'Low' cost-benefit appraisal is adopted at this time.

Overall Assessment Profile

Based on a Very High Results alignment combined with a Low Cost-Benefit Appraisal, the priority order for the Ōtaki to North of Levin project is 1 based on the IAF prioritisation order (refer Table 13-1 below).

Table 13-1: IAF 18-21 Prioritisation

RESULTS ALIGNMENT	COST-BENEFIT APPRAISAL	PRIORITY ORDER
Very High	**L/M/H/VH**	**1**
L / M /H	Very high (BCR 10+)	2
High	High (BCR 5 - 9.9)	3
High	Medium (BCR 3 - 4.9)	4
Medium	High (BCR 5 - 9.9)	4
High	Low (BCR 1 - 2.9)	5
Medium	Medium (BCR 3 - 4.9)	5

Medium	Low (BCR 1 - 2.9)	6
Low	High (BCR 5 - 9.9)	7
Low	Medium (BCR 3 - 4.9)	8
Low	Low (BCR 1 - 2.9)	Exclude

Funding constraints and staging

The BCR of the proposed option is less than 1 and given the current funding constraints it is prudent to consider options to reduce the overall costs of the proposed work (project) whilst retaining the overall benefits. The level of traffic on the network suggests that 2 lane options could be considered for the short to medium term. The table below compares the cost and benefits to cost ratio of 2 and 4 lane highway options (based on a preferred option S6-N4).

Option	Estimated cost	Indicative Benefits to cost ratio
2 lane highway	$550M - $630M[110]	0.5 – 0.8
4 lane highway	$687M - $790M	0.35 – 0.65

Staging, including how improvements could be achieved over sections, as well as two and four lane options, should be considered in the next phase of investigation.

The next stage of investigation should develop cost estimates for the various staging options. It will also be important to consider the additional or 'top up' costs to transition from an initial 'staged' option through to a final long term 4 lane grade separated highway.

[110] Estimate is approximately 80% of cost estimate for 4 lane option. At this IBC stage, only a high level cost estimate for a 2 lane option has been undertaken. When further work on a 2 lane option has been advanced during the next phase of investigation, a more comprehensive estimate will be developed.

14. SCOPE OF THE DETAILED BUSINESS CASE

The next phase of investigation is to develop a Detail Business Case for the Ōtaki to north of Levin Project. The focus of this phase is two fold:

- development of the design of the preferred option as a 4 lane route option which provides for the long term future transport requirements of the state highway network, including demands likely to be placed on that route by local traffic.
- how the development of the long term route can be staged by delivering a 2 lane road and/or by delivering sections (2 lane and/or 4 lane sections).

The staging assessment will need to consider the holistic performance of the transport network, and thus take into consideration options for improving the existing state highway mindful of future revocation.

The investigation will focus firstly on the identification and refinement of the required transport corridor, but will also need to include consideration of:

- the Level of Service on the revoked state highway and the scale of changes to that highway that might be desirable /needed;
- a programme of safety and resilience improvements to the existing state highways that could provide an effective interim solution to the network ahead of construction of a 2 lane or a 4 lane off-line state highway, and use this work to inform potential staging;
- the location of interchanges and intersections on the new state highway taking into consideration project objectives, the Horowhenua District Council plans for growth and development, and mindful that intersection locations could be used to inform staging approaches;
- a programme of improvements for Levin Town Centre which may be funded by NZTA or by HDC; and,
- the ongoing / parallel programme business case investigation of public transport improvement options between Wellington, Levin and Palmerston North. The recommendations from the Ōtaki to North of Levin DBC will need to integrate with the outcomes of the PBC, so as to ensure that the public transport outcomes sought are not compromised by but are instead supported by the DBC.

Approach to consenting strategy

At this stage it is not possible to confirm a consenting strategy. This will be developed during the next phase of investigation. This section outlines initial thinking and guidance on the potential consenting strategy. A key input into the strategy will be the intended construction start time and intended implementation method.

The timing of the construction of an off line route is not at this stage known and would need to be determined as part of the DBC investigations. These investigations will advise on the overall scale of investment required and how that is to be phased. Irrespective, it is anticipated that it will be highly desirable for the future long term four lane option to be

identified and to be designated promptly in a manner that allows for a staged approach to implementation.

If a staged approach to construction is taken then the opportunity to seek resource consents in a staged manner to suit will need to be considered. This would mean that resource consents for earthworks, work in streams and discharges to ground are sought as the detailed design for each stage becomes. This aspect of the consenting strategy will need to be carefully considered during the next stage, and aligned with a proposed implementation strategy.

Given the feedback received through engagement in the project to date, it is considered that the chance of the RMA decisions being challenged is high. Accordingly, a traditional two stage consenting approach is likely to result in an elongated / protracted process that will exacerbate blight and uncertainty effects on stakeholders and land owners, including HDC and their growth planning.

The application is likely to be complex due to staging options and because the project is located across two regional (GWRC and Horizons) and also two district (KCDC and HDC) authorities.

Therefore, it may be beneficial to consider using accelerated consenting paths available via the Environmental Protection Authority, as this will provide a rapid decision making process that will reduce effects on land owners and stakeholders.

This preliminary consenting strategy will need to be developed during the DBC investigation phase.

Programme

The current intention is to complete the DBC investigations within the next 12 – 18 months and to lodge notices of requirement in 2020. Such a programme relies on numerous parallel work streams being undertaken simultaneously.

The previous phase of investigation has entailed a collaborative approach and it is proposed to continue to use this approach in order to help identify and manage project consenting, community and stakeholder risks. It is noted that a collaborative approach can elongate the investigation programme.

Approach to procurement

The DBC team need to be selected mindful of the specific RMA NoR requirements, as it is likely to be preferred that the team who undertakes the DBC investigation will also complete the NoR documentation and be needed to present evidence to the relevant consequent hearings.

Thus, it is necessary and prudent to select key environmental experts that align with and treat the key consenting risks. A potential way forward is to procure the environmental services separately from the engineering/project design team.

Project and Stakeholder Management

It is proposed that existing project and stakeholder management approaches are retained, as this allows existing systems and structures to be used for the next phases. This

approach fits with the proposed breadth of the ensuing investigation which will need to take into consideration multi-faceted and competing issues.

Appendices