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SCOPING REPORT

Ōtaki to North of Levin Expressway

Prepared for the NZ Transport Agency

JULY 2012

QUALITY STATEMENT

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NZ Transport Agency

Ōtaki to North of Levin Expressway

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Purpose of Study

The purpose of the study is to identify a preferred alignment for an expressway between north of Ōtaki and north of Levin and prepare applications for the required designation and resource consents.

Project Objectives

The Ōtaki to north of Levin expressway is the northernmost project within the Wellington Northern Corridor RoNS. The objectives of this project for the scoping options stage are:

- to provide a value for money proposal which will achieve the RoNS goals for this corridor of building a high quality expressway route between north of Ōtaki and north of Levin;
- to provide a better journey time Level of Service between north of Ōtaki and north of Levin;
- to reduce and progressively eliminate at-grade intersections between north of Ōtaki and north of Levin;
- to engage effectively with key stakeholders;
- to lodge Notices of Requirement and key resource consents with the appropriate consent authority by the 2012/13 financial year; and
- to improve safety on the route.

ACRE Process

The method being used to identify and secure the most suitable route for the expressway is the ACRE model; the acronym standing for Area, Corridor, Route, Easement.

This process starts with the broadest feasible area and systematically and progressively narrows the area of interest down to a single preferred route through enhanced information and analysis. The approach is internationally recognised whilst also meeting the information, analytical and consultation requirements of the RMA. This process will result in a defensible preferred route, appropriately connected to existing road networks, which can then be further evaluated and tested through the RMA statutory processes.

This scoping study covers the Area and Corridor Stages of the ACRE process whilst also fulfilling the NZTA's requirements for investigations and consultation processes. It also encompasses the typical optioneering processes for considering new routes. The work to date following these processes provides sufficient information to prepare a scoping report and then to commence investigations and consultation in the early stages of the scheme assessment.

The Study Area was determined early in the commission to include the length of SH1 from 500m south of the Manawatu River in the north to Taylors Road in the south (the northern extent of the Peka Peka to Ōtaki project). It is unlikely that the bridges over the Manawatu River and the adjacent floodway will be widened to 4 lanes in the foreseeable future. A Ministerial Briefing Note dated 23rd August 2011 explains the rationale for like for like replacement of the 2 lane bridges, based on anticipated traffic volumes. Including the bridges in the study area would require the investigation of four lane replacements and these are not considered to be economically justified for the next 50 years even on optimistic traffic growth forecasts. Defining the northern boundary of the study area 500m south of the river allows for connecting the northern end of the expressway to the present bridges and to any future replacements located nearby.

The western boundary of the area is the base of the foothills in the east and the sensitive coastal dunes and estuaries to the west. The area encompasses part of SH57.

Information relating to a wide range of engineering, economic, planning, environmental, cultural and social aspects was obtained and plotted to create a series of constraint maps. This data was used to identify “no go” areas and show likely degree of difficulty in other areas. This enabled the identification of three corridors (eastern, central and western) through which a potential expressway could run. The corridors provided for linkages at various points so that it would be possible for a preferred corridor ultimately to contain parts of all three corridors.

Multi Criteria Analysis (MCA) was then undertaken to evaluate specific sections of each of the corridors. These individual sections were also combined to form contiguous corridors though which potential routes could run. Out of a total of 81 contiguous corridors identified and analysed, 13 were selected out of the MCA process for further evaluation

To narrow down the list of potential corridors further, some indicative routes within the contiguous corridors were developed using the route optimisation software Quantm. These indicative routes were subject to initial rough order cost estimates and transport modelling to determine their relative merits. Using this information, as well as the outcomes of the MCA analysis and an understanding of the likely effect on dwellings, four options have been recommended for detailed investigation in a scheme assessment report.

Short Listed Options

The four contiguous corridors recommended for further investigation all involve an eastern bypass of Levin. At this stage it has been assumed that the route will be a four lane expressway with grade separated interchanges. This assumption will be challenged in the scheme assessment report, where consideration will be given as to whether the project could be staged i.e. with a lower level of service such as two lanes with passing lanes provided north of Levin. All options include connections to SH57 in recognition of the volume of traffic and freight using this route.

Indicative routes through these corridors have been developed for evaluation and comparison purposes. As all constraint data has not yet been identified (e.g. individual houses and property boundaries) and as full survey information has not yet been collected, the routes identified initially may not be the same as the routes that will be identified once this additional information is collected and analysed. Nevertheless, they provide an indicative “best” route for which cost estimates and transportation modelling can be undertaken to enable comparison between contiguous corridors.

The following table outlines the costs and benefits for the short listed corridors.

Table 0-1 : Costs and BCRs of Short Listed Options

Corridor	Expected Estimate	BCR
64	$457M	0.01
66	$453M	0.05
73	$457M	0.12
75	$437M	0.06

Conclusions and Recommendations

In summary, it is recommended that four corridors be brought forward for further investigation. Routes within these corridors need to be identified and analysed within a Scheme Assessment Report before selecting a preferred alignment to take through statutory approval processes.

The modelling results and BCR analysis indicates that further work needs to be undertaken to determine the ability to improve the economic performance of the expressway. This could include investigation into aspects such as:

- route optimisation;
- staging options;
- different interchange locations and layouts; and
- value engineering (i.e. scope and standards).

Further consultation with key stakeholders and the wider public also needs to be undertaken to present the corridors and to elicit information to assist with later decision making.

1 Introduction

1.1 Purpose of Study

The purpose of the study is to identify a preferred alignment for an expressway between north of Ōtaki and north of Levin and prepare applications for the required designation and resource consents.

This Scoping Report is the first major deliverable for this study. It presents the methodology and outcomes to date in terms of identifying the preferred alignment. The next stage is the scheme assessment, which will take the short list of options from this report and develop them to a level of detail that, along with consultation outcomes, enables a preferred alignment to be chosen.

1.2 Roads of National Significance

The Government has nominated seven parts of the state highway system that are essential to New Zealand's economic prosperity. These have been identified as roads of national significance (RoNS) and the Government has determined that they will be upgraded to expressway standard. The NZ Transport Agency (NZTA) is charged with substantially completing these state highway projects within the next ten years.

The RoNS programme represents one of New Zealand's biggest ever infrastructure investments and is a key part of the Government's National Infrastructure Plan and the Government's Policy Statement on Land Transport Funding.

The seven roads of national significance are:

- Puhoi to Wellsford;
- Completion of the Western Ring Route;
- Victoria Park Tunnel;
- Waikato Expressway;
- Tauranga Eastern Link;
- Wellington Northern Corridor; and
- Christchurch Motorways.

The Wellington Northern Corridor, stretching from Wellington Airport to north of Levin, is one of the seven roads of national significance and the corridor has eight distinct project sections. These are:

- Airport to Mt Victoria Tunnel (including tunnel duplication);
- Transport improvements around the Basin Reserve;
- Terrace Tunnel duplication;
- Ngauranga to Aotea Quay;
- Linden to MacKays (Transmission Gully);
- MacKays to Peka Peka;
- Peka Peka to Ōtaki; and
- Ōtaki to north of Levin.

Progress on the projects south of the Ōtaki to north of Levin project is as follows at the time of this report:

- Peka Peak to Ōtaki: A design/construct consortium has been engaged by NZTA and the project is at the Scheme Assessment stage.
- MacKays to Peka Peka: An alliance of the NZTA, KCDC, a Contractor and a consultant has been formed. A preferred route has been identified and lodged with the Board of Inquiry.
- Transmission Gully: NZTA has submitted a Notice of Requirement for the new route across Transmission Gully which has been provisionally been confirmed by the Board of Inquiry.
- Ngauranga to Aotea Quay: NZTA has appointed an ECI Contractor and is working with the contractor to identify how peak traffic flows can be improved on this heavily trafficked section of motorway.

- Terrace Tunnel duplication: There has been no substantial progress on this project as yet.
- Basin Reserve improvements and Airport to Mount Victoria tunnel: In July 2011, the NZTA released detailed plans of proposed improvements from the Basin Reserve to Calabar Road including the proposed improvements at the Basin Reserve, a second Mount Victoria tunnel and widening Ruahine Street and Wellington Road.

The investigation and consenting processes for the Ōtaki to north of Levin section are undertaken within a series of objectives for the Wellington Northern Corridor known as the RoNS Wellington Northern Corridor objectives. These are as follows:

- to enhance inter regional and national economic growth and productivity;
- to improve access to Wellington's CBD, key industrial and employment centres, port, airport and hospital;
- to provide relief from severe congestion on the state highway and local road networks;
- to improve the journey time reliability of travel on the section of SH1 between Levin and the Wellington Airport; and
- to improve the safety of travel on state highways.

Within these overall objectives, each project has its own specific objectives.

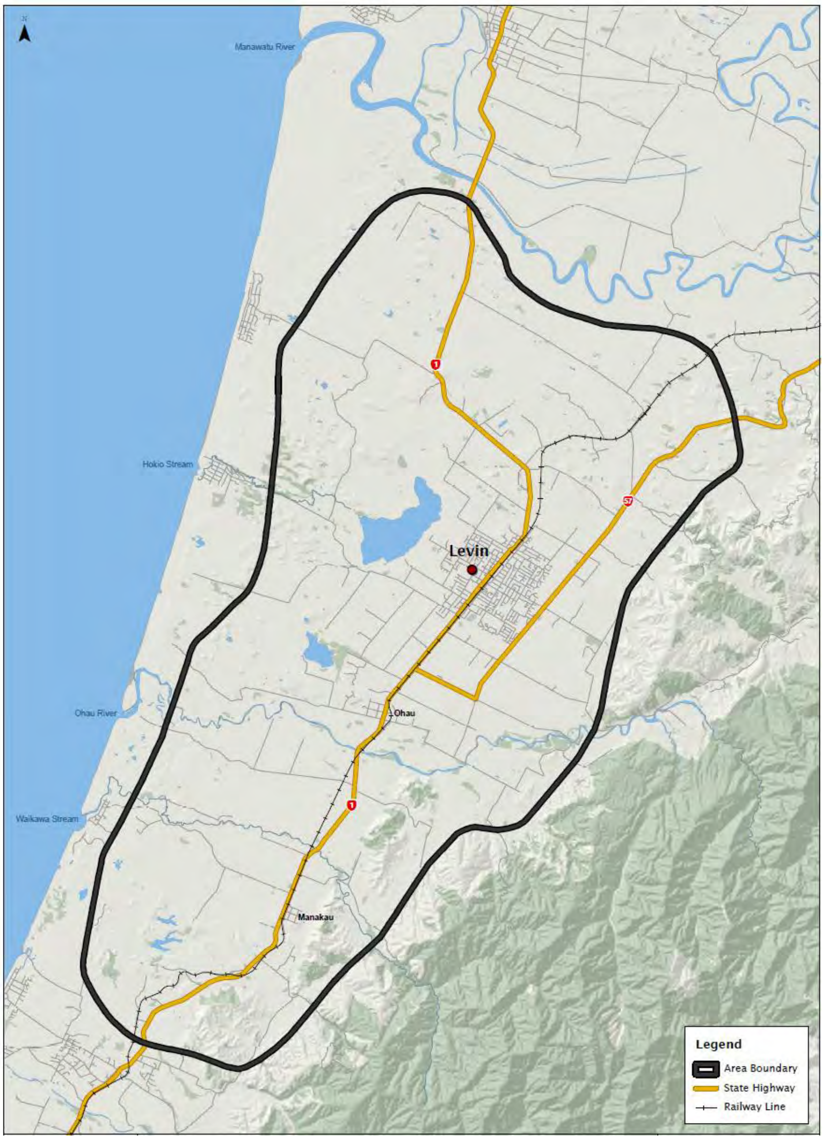
1.3 Area of Study

This section of State Highway 1 (SH1) extends for some 32km, located in the Horowhenua District and the northern part of the Kapiti District. It is generally a two lane, undivided highway with many side roads, commercial frontages and private accesses. The existing route passes through a number of urban settlements including the town of Levin and the smaller settlements of Ohau and Manakau.

The area is constrained at the southern end by the termination of the Peka Peka to Ōtaki RoNS project alignment. This is still being confirmed as part of the study for that section of the RoNS, but is expected to be close to the existing State Highway at the project boundary. At the northern end, it is constrained by the bridges across the Manawatu River and floodway. MWH and NZTA agreed that it would be prudent to terminate the expressway 500m south of the present river bridge to allow flexibility for future replacement of the bridges.

SH57 is also a major route in the area of interest as it connects to Palmerston North and beyond, and carries a high proportion of freight traffic. Because of this, and the potential benefits for improving travel on SH57, it was important to include an area encompassing the affected part of SH57.

Whilst the effects of improvements on SH57 are considered in this report, SH1 is expected to remain the principal north-south route for traffic.



Natural and artificial boundaries define the western and eastern boundaries of the study area. To the west, environmentally and culturally sensitive sand dunes form the boundary. This area also contains a concentration of high tension power transmission lines and high pressure gas mains. To the east, the land rises steeply to the foothills of the Tararua mountain range, forming a natural boundary.

The area identified is shown in Figure 1.1 and Appendix A, and is referred to throughout the remainder of the report as the "Study Area". This area was considered large enough to provide for feasible draft corridor options to be identified at the conclusion of the Area investigation. The Study Area has a maximum north-south length of approximately 28 kilometres and its maximum east-west width is approximately 13 kilometres.

In terms of Route Position, the southern boundary is at RP 1N/995/3.30 and the northern at RP 1N/967/0.50. SH57 crosses the northern study area boundary at RP 57/0/14.31[1].

Figure 1-1: Location Map

1.4 Summary of the Study Process

The ACRE process adopted for this study is explained in full in Section 7 of this report.

The purpose of the study is to identify a preferred alignment for an expressway and prepare applications for the required designation and resource consents. The work will need to be undertaken in a way that enables the NZTA to meet its statutory obligations, including those under various statutes such as the Resource Management Act 1991 (RMA), the Land Transport Management Act 2003 (LTMA) and the Historic Places Act 1993 (HPA).

A systematic process of identifying the preferred route option has been adopted. The key elements of the processes involve a range of "best practice" methods of identifying a preferred route option followed by refinement of that route, all in accordance with NZTA processes, consultation stages and reporting.

[1] Note that Route Position on SH1 increases from north to south and descriptions of the highway normally follow this convention. For the RoNS, this section has been named Ōtaki to north of Levin and the south to north description has been adopted for this report.

The statutory processes required for the project demand a rigorous level of detail and completeness throughout all phases of investigation and reporting. Each step of the process must be undertaken with care. The Board of Inquiry process specifically requires that alternative routes be considered and environmental impacts be avoided, remedied or mitigated.

1.5 NZTA Minimum Standard Z/18

The adoption of the ACRE methodology was agreed with the NZTA. The methodology has meant that this Scoping Report differs in some respects from a conventional report. The differences have been discussed and agreed with the NZTA and are based on the flexibility allowed in Z/18.

The principal differences are:

- Problem Description. This expressway is being investigated in response to the Government Policy Statement on Land Transport Funding rather than being identified in a Strategic or Corridor Study. This section has been modified to describe the problems on the two State Highways in the study area.
- Site Description. Some of the details of the site description listed in Z/18 will be investigated in more detail for the Scheme Assessment.
- Collected Data
    - Topographical Survey. This will be carried out for the Scheme Assessment.
- Stakeholder Relationship Management and Consultation. Details of the consultation conducted for the Scoping Report are included in this report. NZTA asked that public consultation be delayed until after the Scoping Report was completed.
- Option Drawings. During the preparation of the Scoping Report a series of maps was prepared showing the constraints to any new routes that might be chosen. These were used in identifying the options for further consideration in the Scheme Assessment. The options are not routes, but corridors in which it is expected that the routes will lie.

A preferred option will be identified following completion of public consultation early in the Scheme Assessment stage.

2 Project Objectives

At the time of preparing this report, the following project objectives apply to the Ōtaki to north of Levin expressway project:

- to provide a value for money proposal which will achieve the RoNS goals for this corridor of building a high quality expressway route between north of Ōtaki and north of Levin;
- to provide a better journey time Level of Service between north of Ōtaki and north of Levin;
- to reduce and progressively eliminate at-grade intersections between north of Ōtaki and north of Levin;
- to engage effectively with key stakeholders;
- to lodge Notices of Requirement and key resource consents with the appropriate consent authority by the 2012/13 financial year; and
- to improve safety on the route.

These project objectives will be refined as part of the on-going process of investigations.

3 Statutory and Planning Context

3.1 National

3.1.1 Connecting New Zealand

The New Zealand Government has recently released a new document entitled Connecting New Zealand. Connecting New Zealand summarises a number of direction-setting documents for the transportation sector. It draws together the policy direction that has been set out in a number of policy decisions and guidance documents over the last two years. These include the National Infrastructure Plan, the Government Policy Statement on Land Transport Funding 2012/13–2021/22, the New Zealand Energy Efficiency and Conservation Strategy, the KiwiRail Turnaround Plan and Safer Journeys: New Zealand's Road Safety Strategy 2010–2020.

The key themes underpinning Connecting New Zealand are:

- economic growth and productivity;
- value for money; and
- road safety.

The key government actions as set out in Connecting New Zealand for Roads and Road Safety are as follows:

Road

- Invest $36 billion in land transport over the next decade via the National Land Transport Fund. This includes $19.5 billion in state highways and $12.5 billion in subsidies for regional and local roads and public transport.
- Complete the first set of Roads of National Significance (RoNS).
- Drive greater performance and value for money from the NZ Transport Agency (NZTA).
- Continued reduction in emissions of carbon dioxide from land transport over time.

Road safety

Implement the new Safe System approach, including:

- increasing the safety of young drivers
- reducing the impact of alcohol and drug-impaired drivers
- improving the safety of our roads and roadsides
- increasing the safety of motorcycling
- helping people drive to the conditions and encouraging them to comply with safe speed limits

The above themes and actions directly relate to the Ōtaki to north of Levin expressway as it is part of a Road of National Significance which is likely to provide significant gains in economic growth and road safety.

3.1.2 Land Transport Management Act

The Land Transport Management Act (LTMA) provides the legal framework for managing and funding land transport activities. The purpose of the LTMA is to contribute to the aim of achieving an affordable, integrated, safe, responsive and sustainable land transport system. The LTMA:

- provides an integrated approach to land transport funding and management that takes into account the views of affected communities
- improves social and environmental responsibility in land transport funding, planning and management
- provides the NZTA with a broad land transport focus
- ensures options and alternatives are given full consideration at an early stage in the development of programmes
- improves long-term planning and investment in land transport
- ensures that land transport funding is allocated in an efficient and effective manner
- improves the flexibility of land transport funding by providing for alternative funding mechanisms.

The LTMA states that Government Policy Statements, national and regional land transport strategies, land transport programmes, activities and combinations of activities must contribute to the purpose of the LTMA and consider the following five matters:

- Assisting economic development
- Assisting safety and personal security;
- Improving access and mobility;
- Protecting and promoting public health;
- Ensuring environmental sustainability.

In late 2011 or early 2012, amending legislation will be introduced to parliament with the aim of making the LTMA simpler, more streamlined and less prescriptive. These changes will:

- put in place a clearer, more straightforward, statutory purpose for the LTMA to drive better decision-making;
- significantly reduce the number of assessment criteria used throughout the LTMA
- rationalise national level strategic documents and clarify their relationships with lower level documents, to allow for clearer national guidance;
- extend the role of the Regional Land Transport Programmes so they identify the outcomes, objectives and interventions proposed for at least 10 years, and remove the requirement to produce a separate Regional Land Transport Strategy;
- provide more flexible, less prescriptive consultation requirements;
- enable Regional Transport Committees (RTCs) to be smaller and more focused by removing the requirement to have appointed members to represent various transport objectives. RTCs can still use external advisers if they wish but this will not be prescribed by the legislation;
- create more flexibility in the LTMA to use borrowing to support land transport investment should future circumstances make this desirable;
- improve the tolling and public private partnership (PPP) provisions in the LTMA to reduce barriers to their use; and
- repeal the provision for regional fuel taxes.

The project team will take into account the above changes as and when they come into effect.

3.1.3 Resource Management Act

The RMA promotes managing the use, development and protection of natural and physical resources in a way, or at a rate, that enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety, while:

- sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations;
- safeguarding the life-supporting capacity of air, water, soil and ecosystems; and
- avoiding, remedying or mitigating any adverse effects of activities on the environment.

The RMA sets out the functions, powers and duties of local government, and the resource consent and designation process. The RMA requires the NZTA to avoid, remedy or mitigate adverse environmental effects caused by the construction and operation of the Ōtaki to north of Levin expressway.

The Phase 2 reform of the RMA is currently underway. One of the key areas for investigation is the methods for approval of large infrastructure projects and the use of designation.

3.1.4 Other

There are numerous other national legislative and non-statutory documents which need to be taken into consideration when developing the expressway project, including:

- Public Works Act
- Historic Places Act

- National Environmental Standard for Air Quality
- Reserves Act
- New Zealand Urban Design Protocol
- NZTA Plans, Manuals and Strategies
- Land Transport Rule: Vehicle Dimensions and Mass Amendment 2009

3.2 Regional

This project extends over two regional council areas and therefore consideration has to be given to both Council's plans, policies and strategies during the development of the scheme.

3.2.1 Regional Policy Statements

Regional Policy Statements identify regionally significant issues around the management of the regions' natural and physical resources and set out what needs to be achieved (objectives) and the way in which the objectives will be achieved (policies and methods).

Regional and district plans are required to give effect to the Regional Policy Statement, so have a direct bearing on what councils will need to do to protect and enhance our environment. The RMA statutory approvals for the Ōtaki to north of Levin expressway will need to take into account the Regional Policy Statements for the Wellington and Manawatu-Wanganui Regions, as appropriate.

The operative Wellington Regional Policy Statement is dated 1995; however, Greater Wellington has developed a proposed Regional Policy Statement on which decisions on submissions have been made. It is soon due to become operative.

The operative Horizons Regional Policy Statement is dated 1998. This includes the objective "To have land transport systems and public utility networks which meet the needs of the Region, while avoiding, remedying or mitigating adverse environmental effects." A replacement Regional Policy Statement is included in the Proposed One Plan. This has completed the hearing and decision process and is subject to appeals. Strategic roads are recognised in this document as physical resources of regional or national importance which must be recognised by the regional council and territorial authorities.

The objectives and policies of the Regional Policy Statements are important in informing the assessment of options for the project.

3.2.2 Regional Land Transport Strategies

Wellington Regional Land Transport Strategy 2010-2040

The Wellington Regional Land Transport Strategy 2010-2040 (Wellington RLTS) is a strategic document with a vision to "deliver an integrated land transport network that supports the region's people and prosperity in a way that is economically, environmentally and socially sustainable". The Wellington RLTS guides the development of the regional transport network encompassing roads, walking and cycling, rail, freight and public transport over the next 30 years.

The Wellington RLTS aims to address the following key issues and pressures affecting the region:

- Access to goods and services, employment and amenities
- Regional road safety, particularly for cyclists
- Severe traffic congestion, particularly at peak times
- East-west connections between key transport corridors and regional centres
- Reliability of the transport network
- Transport related greenhouse gas emissions
- Public transport capacity and mode share.

The strategy identifies a number of key outcomes which the region intends to achieve over the long term. The outcomes have been given a hierarchical structure of 'key outcomes' and 'related outcomes' to clearly show the regional strategic priorities over the next 30 years.

The key Wellington RLTS outcomes include:

- Increased peak period public transport mode share
- Increased mode share for pedestrians and cyclists
- Reduced greenhouse gas emissions
- Reduced severe road congestion
- Improved regional road safety
- Improved land use and transport integration
- Improved regional freight efficiency.

The Wellington RLTS will be implemented through the vision, outcomes and objectives which will be converted into action programmes, implementation and corridor plans as well as policy. The most significant features that are to be processed in the implementation plans are:

- Progress on the key routes of national and regional significance (including the State Highway 1 Wellington Road of National Significance)
- The improvement of the region's rail network, including infrastructure and rolling stock upgrades
- A comprehensive programme of measures to manage the demand for travel.

The funding chapter of the Wellington RLTS outlines the main sources of funding available in the region. The NZTA's National Land Transport Programme details its proposed funding plans in the next three year period, with the Greater Wellington's Regional Land Transport Programme detailing proposed funding for the next 10 year period. The NZTA announced in December 2009 its decision to invest over $2 billion in the Wellington RoNS corridor project.

Horizons Regional Land Transport Strategy 2010-2040

The Regional Land Transport Strategy for the Manawatu-Wanganui (Horizons) Region provides the strategic direction for future transport planning by outlining the vision, objectives and outcome to guide the region's development over the next 30 years. The Horizons RLTS covers all forms of land transport including public transport, walking and cycling, roads and freight. The vision for 2040 is "A safe, sustainable and resilient transport system that supports economic development and lifestyle choices, with strong connections to national corridors".

Six strategic objectives were developed that define the key areas that the region needs to focus on to achieve the vision, these include:

- A resilient and effective transport system that supports economic growth.
- A multimodal transport system that provides access to work, social and recreational opportunities for all sectors of the community.
- A safe transport system.
- A transport system that protects and promotes public health.
- A transport system that protects cultural values.
- A transport system that ensures good environmental outcomes.

In addition to the vision and objectives outlined above, the RLTS also outlines the preferred strategic option that is intended to help achieve the regions transport targets in the next 30 years. The preferred strategic option includes a combination of public transport improvements, travel demand management tools and road network improvements to cater for traffic growth.

The following comprise the main components of the region's preferred strategic option:

- On-going maintenance and renewal of the regional roading network to ensure no deterioration over time.
- Upgrades to the section of State Highway 1 between Levin and Ōtaki as part of the Government's strategy to improve the Road of National Significance between north of Levin and Wellington Airport.
- Roading upgrades and planning controls for the Palmerston North and Manawatu area strategic network, as identified in the Palmerston North-Manawatu Joint Transport Study (JTS).
- Safety improvements to known black spots on state highways and local roads.
- An on-going programme of road safety education and enforcement measures to address behavioural causes of crashes.
- Service frequency and coverage improvements to Palmerston North and Wanganui urban bus services.
- Improvements to commuter passenger transport services between major and minor population centres where justified.
- Improvements to community public transport services where justified.
- Travel behaviour change measures to reduce single-occupancy vehicle trips and increase use of alternative transport modes.

3.2.3 Other

There are numerous other regional legislative and non-statutory documents which need to be taken into consideration when developing the expressway project, including:

- HDC Lake Horowhenua & Hokio Stream and Catchment Management Strategy
- HDC Land and Riparian Management Strategy
- The Proposed Horizons One Plan (combining all regional RMA provisions)
- The operative Manawatu-Wanganui Regional Land and Water Regional Plan
- The operative Manawatu-Wanganui Regional Air Plan
- Wellington Regional Strategy
- GW Regional Air Quality Management Plan
- GW Regional Freshwater Plan
- GW Regional Plan for Discharges
- GW Regional Soil Plan
- GW Regional Walking Plan
- GW Regional Cycling Plan
- Kapiti Coast District Plan

3.3 Summary of Statutory Context

The proposed expressway is consistent with national and regional statutory documents. The detailed design and construction of the expressway is required to be consistent with regional, local and other non-statutory documents, most of which are listed above.

4 Previous Reports

There have been a number of transport studies undertaken within the Ōtaki to north of Levin study area, dating back to the mid-1980s. A review of these reports has been undertaken to determine what has previously been identified as key concerns and the associated options and proposals to mitigate and address these concerns. While the studies generally recommend short and long term solutions, this literature review only focuses on the long term, large scale options that are applicable to the Ōtaki to north of Levin expressway project.

The reports reviewed are;

- Levin Bypass Scoping Report, 1989, Works Consultancy Services
- Levin Bypass Project Investigation, 1990, Works Consultancy Services
- Levin Transportation Study, 1995, Traffic Design Group
- SH1 Horowhenua District Strategy Study, 1996, Works Consultancy Services
- Himatangi to Waikanae - Review and Development Study, 2000, Worley
- Himatangi to Waikanae - Strategy, 2000, Worley
- SH1 Levin to Ōtaki Expressway – Proposed Designation Methodology, 2000, Meritec
- Roads of National Significance (RoNS) Wellington Airport to North of Levin Scoping – Taylors Road (Ōtaki) to North of Levin, 2010, NZTA
- Taylors Road to Pukehou Rail Overbridge – RoNS Corridor Study, 2010, Opus

4.1 Levin Bypass Scoping Report, 1989, Works Consultancy Services

This report assessed a wide range of options for a bypass of Levin. It included upgrading the existing State Highway, utilising the railway corridor (and relocating the railway) and four western bypass options.

The report did not consider an eastern bypass. This was due to a previous Ministry of Works and Development Report entitled “Western Corridor Study (Northern Section)” which dismissed an option using Kimberly Road, Arapaepae Road and Roslyn Road due to the additional 4.3km of distance vehicles would be required to travel on SH1.

It recommended that the options of upgrading the existing State Highway and the options between Levin and Lake Horowhenua be taken forward for further consideration. It recommended that options using the railway corridor or options to the west of Lake Horowhenua be discarded.

4.2 Levin Bypass Project Investigation, 1990, Works Consultancy Services

This study was carried out for Transit New Zealand and the Horowhenua District Council and focused on four options identified in the 1989 Levin Bypass Scoping Report. The investigation included:

- engineering assessment – traffic surveys, noise, topographical and geotechnical conditions, highway alignment and design requirements;
- planning assessment – agricultural impact, impact on retail businesses, environmental impacts, particularly associated with Lake Horowhenua and consultation with property owners and liaison with tangata whenua; and
- economic assessment – benefits of savings in times, vehicle operating costs and accidents against costs of construction and land and property purchase.

Four full bypass options were considered, all of which were to the west of the existing SH1 alignment and are shown in Figure 4-1. The four options have the same northern section west of the Levin town centre, and differ in the southern section where they depart from the existing alignment. Compared to an existing length of highway between Ohau Bridge and Waitarere Beach Road of 14.83 km, the four options include:

- Option 1 - 12.6 km of new road.

- Option 2 - 11.4 km of new road, utilising 2.0 km of the existing SH1 for a total length of 13.4 km.
- Option 3 - 9.4 km of new road and utilising 4.0 km of the existing SH1 for a total length of 13.4 km.
- Option 4 - 7.3 km of new road and utilising 5.2 km of the existing SH1 and 1.6 km of the existing local road for a total length of 14.0 km.

All of the options were based on an overall operating speed of 100 km/h except for Option 4 which passes through 70 and 50 km/h zones. All options were evaluated on the basis of providing a 3.5 m lane in each direction with a 1.5 m sealed shoulder through the rural areas.

The costs of the options ranged from $10M to $16M with BCRs between 1.5 and 2.5. The most economic option as calculated was Option 3.

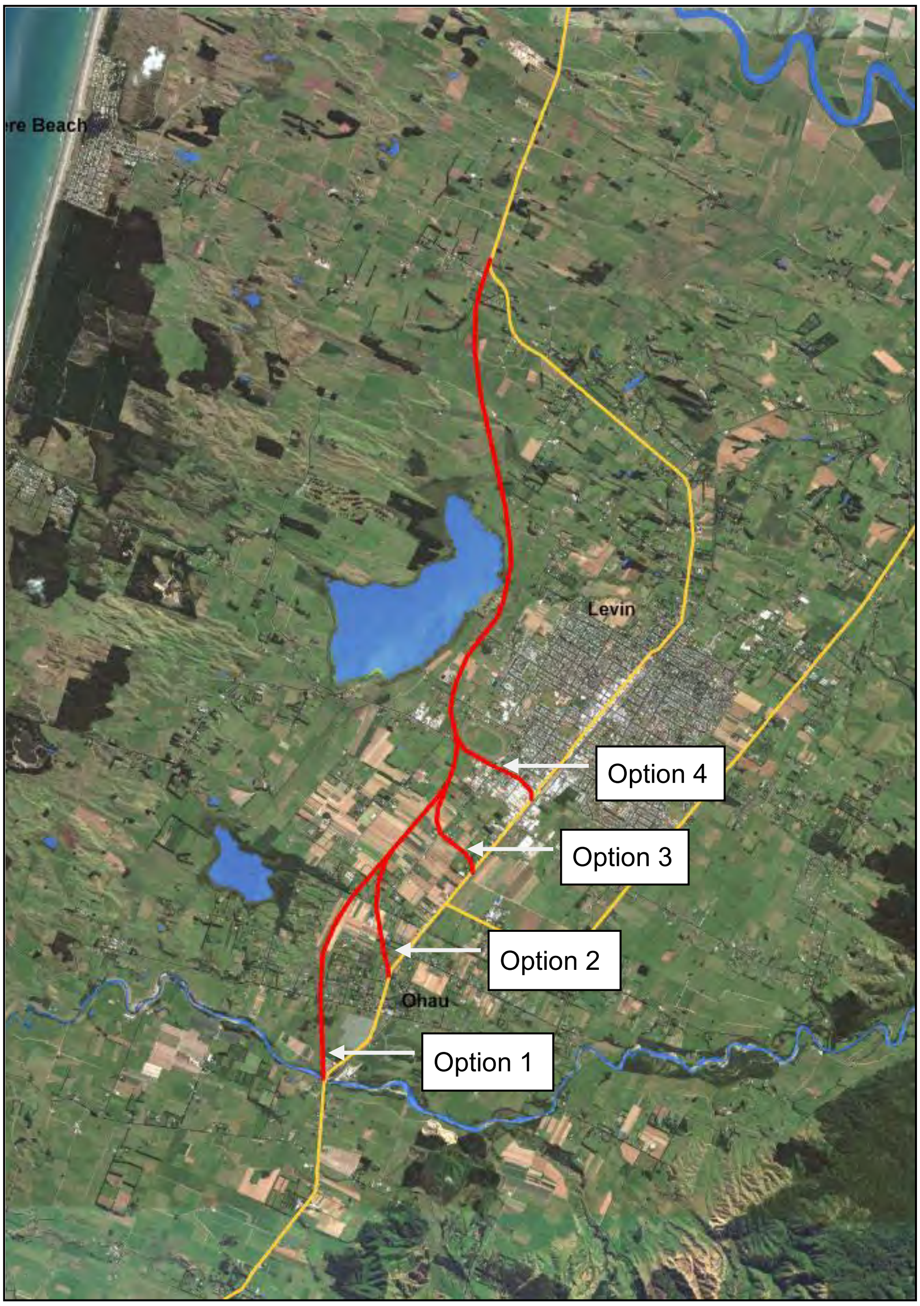


Figure 4-1 - Map showing options considered for Levin Bypass Project 1990.

At the conclusion of the study, the study Steering Committee recommended that:

- the matter of the bypass be abandoned for the foreseeable future;
- Transit New Zealand uplift the motorway designation between Hokio Beach Road and Waitarere Beach Road; and
- no further investigation work be undertaken.

4.3 Levin Transportation Study, 1995, Traffic Design Group

One of the aims of the Levin Transportation Study undertaken in 1995 was to;

- Evaluate alternate State Highway routes to serve as a full bypass.

The same four options proposed by Works in the 1990 study were analysed in further detail. A full transport model for the urban Levin area and neighbouring rural sectors was prepared as part of the study.

Benefit cost ratios were only calculated for Options 1 and 3 of the 1990 study as these were the most likely practical alternatives. The analysis found that Option 1 had a BCR of 1.99 and Option 3 of 2.07. At the time a BCR of 5 was required for a proposal to be included in the Land Transport Program and thus it was concluded that funding would not be available in the near future.

Recommendations associated with the bypass include;

- The State Highway will remain in its present location for at least 10 years, and probably 15 years
- Any future bypass to the west will divert substantial traffic volumes to the east-west oriented arterials of Queen Street, Mako Mako Road and Hokio Beach Road.

4.4 SH1 Horowhenua District Strategy Study, 1996, Works Consultancy Services

This study was commissioned by Transit NZ to identify a development strategy for State Highway 1 in the Horowhenua District. The aim of this study included determining a strategy for future upgrading of the highway.

The report recognised the significant problems along the section of SH1 between Waitarere and Pukehou and concluded that significant geometric and traffic capacity improvements would be required within the next 10 years.

The option of upgrading the existing route was not recommended as the most appropriate longer term strategic solution due to the planning related impacts associated with the intensive development immediately adjacent to the existing highway and difficulties in acquiring the land required.

The recommended solution was to provide a limited access western bypass of the Levin township, extending south to the Manakau or Pukehou Overbridges to separate local and arterial traffic.

4.5 Himatangi to Waikanae – Review and Development Report, 2000, Worley

This report comprised an assessment of the existing highway and an analysis of the wider area including geotechnical issues, land use and structures. It also identified a number of options to upgrade the highway to reduce accidents and meet the growing traffic need.

These options included nine two-lane options between Waikanae and Himatangi. Two of these included an eastern bypass of Levin, two included a route between Levin and Lake Horowhenua and four were located west of Lake Horowhenua (the remaining option was a Foxton bypass).

Five four-lane options were also considered; one to the east of Levin, one through Levin, one between Levin and Lake Horowhenua and two west of the lake.

SATURN modelling was undertaken to determine the benefits of the options. The cost for upgrading the existing highway was estimated to be approximately $150M yielding a BCR of 2.3. The costs of the other options ranged from $175M to $200M yielding BCRs of between 1.7 and 2.3.

The report concluded that there would be a future need to provide four lanes of highway to bypass Levin. It recommended that any future route closely follow the existing highway except through Levin where eastern and western bypass options should also be considered. It was recommended that the highway be constructed in approximately 15 years' time.

4.6 Himatangi to Waikanae – Strategy, 2000, Worley

This report comprised stage 2 of the four-stage Himatangi to Waikanae Study, with the last two stages, consultation and scheme assessment, not being progressed for the Ōtaki to Levin section.

This report presents the strategy for undertaking improvements to the SH1 corridor from Waikanae in the south to Himatangi in the north. For the section from Ōtaki to north of Levin, this comprised improvements on or near the existing SH1 to ultimately achieve an expressway, with the exception of a Levin Bypass.

The study presented four options for a Levin Bypass:

- Between Levin and Lake Horowhenua
- West of Lake Horowhenua
- Through Levin
- Along SH57 / Heatherlea

From these options, the SH57 / Heatherlea option was recommended due to the far western option not being favoured by the community, the difficulty in constructing a bypass between Lake Horowhenua and Levin and the urban option not being in keeping with Transit objectives. It was noted that the Horowhenua District Council supported the SH57/Heatherlea option, but that further investigation was required before a final decision was made.

The report recommended that the four laning and the Levin bypass be undertaken in stages over the next 15 years.

Following this report, the Transit NZ Authority considered a staff report on the subject (CS/00/10/3770) and noted that the proposed strategy comprised:

- A four lane highway in the existing corridor between Waikanae and Levin;
- A two-lane eastern bypass of Levin;
- Retaining the existing two lane highway north of Levin with improvements including
    - Seal widening
    - Additional Passing Lanes
    - A short realignment south of Foxton.

The Authority also noted that the strategy would be subject to consultation and be the basis of detailed scheme assessments of the various sections.

4.7 SH1 Levin to Ōtaki Expressway – Proposed Designation Methodology, 2000, Meritec

Following on from the Himatangi to Waikanae Study, this report presented the methodology that Meritec (formerly Worley) proposed that Transit NZ use to obtain a designation for the Ōtaki to Levin expressway. The methodology suggested the following stages:

- Preparing a public relations strategy
- Defining Transit NZ objectives
- Undertaking constraint mapping
- Holding a risk management workshop
- Developing preliminary routes
- Undertaking an environmental assessment
- Preparing a scheme assessment report
- Undertaking public consultation
- Preparing Notice of Requirement and Assessment of Environmental Effects
- Attending hearings

This methodology was subsequently subject to an independent peer review by Christine Ralph and Sylvia Allan.

It is understood that no further work was undertaken on progressing any aspect of the methodology at that stage, including undertaking a Scheme Assessment Report.

4.8 Roads of National Significance (RoNS) Wellington Airport to North of Levin Scoping – Taylors Road (Ōtaki) to North of Levin, 2010, NZTA

In early 2010, the NZTA produced a scoping document setting out the background to the Ōtaki to Levin project including descriptions of the current highways, identification of problems and analysis of crashes. It also discussed previous reports, possible objectives for the route, and assessed options to achieve these.

The potential options considered were:

- The Levin urban route ($146M plus upgrades in urban Levin)
- The Levin eastern route ($131M)
- The Levin western route ($152M)

The report considered that an urban option though the central business district of Levin was limited in its ability to deliver on route objectives appropriate to a highway of high status and would be very costly both monetarily and environmentally due to property and severance issues and a range of other constraints.

The report stated that the eastern option would minimise the length of state highway and local road network needed to satisfy traffic forecasts as well as cater for freight transport demands on both SH1 and SH57. It avoids areas of social and cultural interest to a greater extent than other options.

The western option would be shorter for SH1 traffic and caters in particular for the SH1 long haul freight. However, it was considered that it encounters issues where it joins SH1 at the north, and also means that improvements would be needed on SH57. The western option results in an excess of road network to match demand, with three parallel major road transport routes catering for 18,000 vpd and 18km of additional infrastructure.

The report summarised that there is a sufficiently commanding case to pursue detailed investigation of an eastern option, however also stated that it is fundamental to consult with the local community on the three options.

4.9 Taylors Road to Pukehou Rail Overbridge – RoNS Corridor Study, 2010, Opus

Opus was commissioned to complete a high level RoNS corridor study from Taylors Road to Pukehou Rail Bridge. This was undertaken given that the Ōtaki to Levin RoNS investigations had not started yet, but the Peka Peka to Ōtaki investigations were underway. Beca had investigated safety improvements in the vicinity of Forest Lakes on the existing SH1, which demonstrated significant benefits over the short/medium term. Accordingly this study was commissioned to:

- Assess if the existing SH1 alignment between north of Taylors Road and the Pukehou Rail Bridge could be upgraded to a RoNS standard, or if it is fatally flawed.
- Identify the preferred RoNS corridor alignment for the section connecting to the northern boundary of the Peka Peka to Ōtaki (PP2O) project and the Pukehou Rail Bridge.
- Identify how this section of expressway will connect to the PP2O project to the south and how it could connect to the Ōtaki to Levin (O2L) project to the north.
- Assess the ability for the Forest Lakes improvements to be implemented in the short term without pre-determining the RoNS alignment and cross section north of Taylors Road.
- Ensure that the outputs from this study could be usefully used for the O2L Study.

Four expressway alignments were identified:

- Option 1 – Close to existing SH1 (Expected Estimate $98M)
- Option 2 – South of existing SH1 (Expected Estimate $93M)
- Option 3 – North of existing SH1 (Expected Estimate $107M)
- Option 4 – Along existing SH1 alignment (Expected Estimate $86M)[2]

The investigation confirmed that the existing Pukehou Bridge does not comply with the geometric requirements of the RoNS expressway guidelines but could be used for local access if required.

The study determined that the Forest Lakes Safety Improvements could be implemented prior to the construction of the expressway, as it results in a BCR of over 1 by 2017[3]. However, it also stated that these works would either be removed if the new expressway was constructed along the alignment of the existing SH1 or might not be in keeping with the future status and traffic characteristics of the highway after it became a local arterial road.

A high level multi criteria assessment showed that Option 4 had the greatest potential for achieving the best balanced outcome for the route of an expressway to the north of Ōtaki between Taylors Road and Pukehou Rail Bridge. This option follows the existing alignment and is the cheapest of all the options to construct. Severance issues are fairly significant, however this can be addressed through the provision of a new arterial road, service roads and connecting property links.

The Peka Peka to Ōtaki project and preliminary investigations identified an at grade solution for tying Taylors Road into the Forest Lakes safety improvements and expressway to the south. The report considered that, as part of the future Ōtaki to Levin project, a grade separated link could be provided across Taylors Road to connect to the local arterial to the south on the east side of the expressway. The final form and layout will be dependent on the Taylors Road to Pukehou Rail Bridge options that are adopted.

4.10 Summary of Previous Reports

There has been a number of studies undertaken over the last 25 years, the principal purpose of which has been to identify a route for a Levin bypass; only recently has a bypass been considered as part of an overall expressway solution.

[2] These cost estimates are taken from the Opus Report. They are not consistent with the cost estimates developed for this Scoping Report

[3] The BCR is expected to increase with time after 2017 as well.

It is interesting that in the early studies the recommended option was a western bypass and in the more recent studies an eastern one. The study team has considered this and has postulated several reasons for the change:

- Increasing cultural awareness now acknowledges the impact on local iwi of routes across land which is known to contain sites of cultural and historical significance. Areas to the west of Levin are expected to contain large numbers of such sites which have not yet been identified.
- The number of unknown cultural and historical sites is expected to decrease from west to east, thus impacts on these aspects are expected to be lower for an eastern bypass.
- Previously unused land between Levin and Lake Horowhenua has been developed for housing.
- The western route shortens the length of SH1, which used to carry most of the traffic north of Levin. Thus a western route was attractive economically. Changing traffic patterns have increased traffic volumes using SH57 relative to SH1; recent counts show more traffic using SH57 than using SH1 north of Levin. A western route will increase the travel distance for traffic using SH57, reducing the economic benefits of a western route significantly. Thus it has become increasingly attractive, economically speaking, to consider an eastern bypass, which also benefits traffic on SH57. Considering the network as a whole leads to consideration of network benefits, not just benefits for SH1.
- Increasing environmental awareness has placed more emphasis on the environmental impacts of a western bypass, particularly close to Lake Horowhenua.
- Increasing awareness of the potential effects of earthquakes on a new expressway has prompted a move away from the lower ground and soft liquefiable sediments that occur on the western route. The land is higher to the east and is less prone to liquefaction in an earthquake.
- The last round of public consultation, carried out over ten years ago, was firmly in favour of an eastern bypass.

When previous studies predicted timeframes for the construction of a bypass, the indicative times were 2010 to 2015. Thus the present study is well timed.

5 Problem Definition

The rationale prompting this study is the construction of the Wellington Northern Corridor Road of National Significance, a highway, typically of expressway standard, from the airport in Wellington (southern termination of SH1N) to north of Levin. The vision of the RoNS is to promote economic growth and constructing expressways in key locations will yield long term economic benefits for the country. Thus this Investigation and Reporting phase does not necessarily seek to correct problems on the highway, but to fulfil the national vision for RoNS.

There are problems, however, with the existing highway. The following descriptions include problems identified in the Wellington Airport to North of Levin Scoping – Taylors Road (Ōtaki) to North of Levin Report, 2010, NZTA.

5.1 State Highway 1

Due to the severe constraints on the existing route, passing lanes are generally short and can be inefficient at freeing up traffic flow. To improve traffic flows in holiday periods, some passing lanes are coned off to keep traffic in a single file and moving at constant speed.

Level of Service rates on SH1 south of Levin through to Ōtaki appear to be limited to about 1400 vehicles per hour (vph). NZTA's Traffic Monitoring System (TMS) records show average peak hour traffic flows level out at this figure and continue to do so until traffic flows ease off. During these periods, travel speeds are compromised, particularly in the south bound direction. Observations show there is a major bottle neck at Ōtaki which limits the ability of SH1 to carry greater volumes of traffic. As traffic volumes continue to grow, this problem will be exacerbated.

There are two schools in close proximity to SH1. The first, at Poroutawhao, is located on a 100 km/h section of highway, with direct access to and from SH1. The second is at Ohau which is located on a side road (Muhunoa East Road). Both schools generate a lot of low speed turning movements conflicting with high speed highway traffic.

A pedestrian underpass was built under SH1 at Ohau some years ago, following the death of a school pupil being hit when crossing the highway to get to school.

For some years, Oxford Street (SH1 and the main shopping street in Levin) was marked up with four lanes through the town, between the traffic signals at Queen and Bath Streets. The four lanes of traffic created a raceway effect as SH1 traffic tried to overtake slower traffic, such as trucks and vehicles manoeuvring in and out of parking spaces. Transit New Zealand remarked it to two lanes with a painted median, due to increasing traffic and subsequent high crash numbers caused by the conflicts between through traffic and angle parked traffic. This led to improved safety, albeit with a trade-off against capacity. There are two sets of traffic signals to cater for the high volumes of cross traffic, reducing the efficiency of SH1.

SH1 divides the township of Levin both geographically and functionally. It provides local access for retail and commerce, as well as being the major north south heavy vehicle route. The commercial heart of the town is adversely affected with the associated noise, smell and vibration effects of heavy traffic on the shopping environment and local businesses.

The existing rail bridges at Ohau and Manakau were designed and built in the 1930's and are fast approaching the end of their economic and useful life. These bridges are narrow, with poor geometry on their approaches and hidden intersections and driveways located in close proximity. In recent years there have been a number of fatal crashes on these bridges.

In addition, there are large river crossings over the Ohau and Waikawa Rivers and two stream crossings, one at Kuku and the other at Waiauti. Other minor tributaries are crossed by means of culverts. Several areas of SH1, especially around Kuku, are subject to regular flooding due to the low lie of the land and the highway being within the flood plains. When intense rainfalls occur in the Horowhenua, SH1 traffic is often brought to a standstill, or reduced to a crawl pace as flood waters cross the highway.

Few of these river and rail bridges meet the demands heavy freight traffic wishing to use SH1. They also have no provision for cycling or pedestrian traffic.

5.1.1 State Highway 57

The largest shortfall of this route is the link from SH1 to Arapaepae Road. This comprises a T intersection with SH1, followed closely by a level crossing of the Main Trunk Railway Line and, some distance away, a 90 degree corner at the intersection of Kimberley and Arapaepae Roads.

There is one bridge structure on Arapaepae Road at the Koputaroa stream and a large culvert at Broadbelts Creek. There are a number of cross road junctions which have in the past been the scenes of fatal and serious injury crashes. Improvements have been made at these intersections over the years but, with increased traffic volumes and development east of SH57, these sites continue to be problematic.

6 Existing Highways (SH1 and SH57)

The existing highways in the study area include the section of SH1 from Taylors Road intersection, RP 1N/995/3.30, north through to Levin to just south of the Manawatu River at RP 1N/967/0.50. This section of SH1 has a length of 31.4 km. Also included is a section of SH57, from the beginning at RS 0/0 to Rolston's Corner Rest Area at RP 0/14.31. This section of SH57 has a length of 14.3 km.

6.1 Description and Function

6.1.1 State Highway 1

SH1 is classified as 'National Strategic High volume' from Wellington to Levin and 'National Strategic' from Levin to Taupo.

SH1 through the study area is generally a two lane two way road that passes through rural and urban sections from north of Ōtaki to the Manawatu River Bridge. It follows the historic route established in the late 19th and early 20th centuries. As a consequence, it is constrained by a now substandard alignment, towns and settlements, narrow winding bridges and significant side friction caused by local roads, commercial frontages and property accesses for the entire stretch.

Northbound passing lanes are located north of Ōtaki, north of the Waikawa River and north of the Ohau River. Southbound passing lanes are located south of the Manawatu River, south of the Waikawa River and south of Pukehou.

The topography of the route is generally flat with some moderately hilly sections. This section of SH1 passes through the township of Levin, and settlements of Ohau and Manakau. The speed limit is 100 km/h, except in the urban and peri-urban areas of Levin, where 80, 70 and 50 km/h speed limits apply.

SH1 through the study area provides access between Wellington (and the South Island) and a major part of the remainder of the North Island. It connects locations of national economic significance in an area where there are no practicable alternative highway routes.

SH1 also provides access to numerous rural properties, rural selling places and acts as a collector road for many local roads.

6.1.2 State Highway 57

SH57 is classified as a 'National Strategic' route.

SH57 commences at its junction with SH1 at Kimberley Road, south of Levin and proceeds east to Arapaepae Road, which it meets at a 90 degree angle. It then follows Arapaepae Road north, passing east of Levin and continuing on towards Shannon, Palmerston North and the eastern North Island via the Manawatu Gorge. The topography of the route within the study area is generally flat. It has two traffic lanes with the exception of a northbound passing lane north of Potts Road.

SH57 serves as the primary southern link between SH1 and Palmerston North. As such it carries a high proportion of commuter traffic between Palmerston North and Horowhenua. Also, most of the freight movements between Wellington and Palmerston North and other regions to the east of the Manawatu Gorge use SH57 as an arterial route.

6.2 Traffic Data

6.2.1 Traffic Surveys

Four different types of traffic surveys were undertaken as part of this study, as follows:

- **Origin-Destination** surveys. These were undertaken using Automatic Number Plate Recognition (ANPR) video surveys at nine locations
- **Link** surveys. These comprised quarter hour manual classified counts at the same nine survey locations.
- **Intersection** surveys. The special intersection surveys comprised quarter hour video classified turn counts at 45 intersections throughout the study period
- **Travel time** surveys. Travel time surveys on SH1 and SH57 were undertaken using GPS.

Further information on these surveys is presented in Appendix B.

In addition to the surveys, traffic count information was also gathered from Horowhenua District Council and the NZTA (including Traffic Monitoring System (TMS) data), SCATS data in Levin and previous classified turning count surveys).

6.2.2 Traffic Volumes

The Average Annual Daily Traffic Volumes (AADTs), as determined by the NZTA, vary significantly throughout the study area as shown below:

Table 6-1 : 2010 AADTs on State Highways

SH	RS	RP	Location	AADT
1	985	3.48	Ohau (Telemetry)	15,000
1	967	17.27	South of Levin	11,500
1	967	13.58	Central Levin	13,900
1	954	11.12	Whirokino	7,700
57	0	1.8	Near SH1	4,400
57	0	9.6	North of Levin (near Tavistock Road)	8,400

Based on the traffic surveys, further detail can be provided in terms of peak period traffic volumes and directional variability. This data is based on an average week day.

- On SH1 at the southern end of the study area, the AM, interpeak and PM traffic volumes are 1000 vph, 800 vph and 1200 vph respectively with little variability between northbound and southbound volumes.
- On SH1 at the northern end of the study area the AM, interpeak and PM traffic volumes all range from 400 to 500 vph; i.e. less than half of the volumes at the southern end.
- On SH57 at the northern end of the study area the AM, interpeak and PM traffic volumes are 650 vph, 450 vph and 650 vph, with northbound flows dominant in the AM and interpeak and southbound flows dominant in the PM peak.
- On SH1 within Levin the AM, interpeak and PM traffic volumes are 850 vph, 800 vph and 1200 vph with southbound flows dominant in the AM peak and northbound flows dominant in the PM peak.

The above data shows that there is a large variability of traffic volumes due to the highway travelling though rural and urban areas and the splitting of traffic and the SH1/SH57 intersection. It is noted that there is a larger number of vehicles travelling on SH57 north of Levin compared to SH1 north of Levin

In terms of weekly variability, the peak period is the Friday PM peak. For the week of the traffic surveys, at the Ohau telemetry site, the Friday PM peak had 1405 vph compared to the remainder of the weekdays which had 1165 vph. Of this, 715 vph were northbound on the Friday compared to 570 vph on the other days. This is equivalent to a 20 to 25% increase in traffic volumes.

6.2.3 Heavy Vehicle Volumes

In terms of heavy vehicle volumes, data from the traffic surveys is presented below.

- On SH1 at the southern end of the study area, the AM, interpeak and PM traffic volumes are 125 vph, 105 vph and 85 vph respectively. This equates to 7% to 13% of AADT.
- On SH1 at the northern end of the study area the AM, interpeak and PM traffic volumes are 70 vph, 70 vph and 50 vph respectively. This equates to 10% - 18% of AADT.
- On SH57 at the northern end of the study area the AM, interpeak and PM traffic volumes are 60 vph, 50 vph and 40 vph. This equates to 6% - 11% of AADT.

This shows that there is slightly more heavy vehicle traffic on SH1 north of Levin when compared to SH57.

6.2.4 Traffic Growth Rates

Traffic growth has been calculated at the Ohau telemetry site. For the period 1992 to 2010, the annual traffic growth has been approximately 1.4% per annum. The numbers of heavy vehicles have increased by approximately 2% per annum.

Further information on traffic volumes and growth is presented in Appendix B.

6.2.5 Travel Times

The results of the travel time survey data can be summarised as follows:

- The SH1 through route from near SH1 / Koputaroa Road north of Levin to SH1/ Taylors Road (project southern boundary) ranged from 20 to 23 minutes[4]; equivalent to an average speed of 79 km/h
- The SH57 route from 0.4 km north of SH57 / Tavistock Road to SH1/ Taylors Road ranged from 15 to 18 minutes[5] equivalent to an average speed of 91 km/h.
- The circuit from the intersection of SH57 and Potts Road down SH57 to SH1, SH1 between SH57 and Queen Street and Queen Street between SH1 and SH57 took between 24 and 27 minutes, equivalent to an average speed of 45 km/h.

Generally the measured travel times did not vary significantly between the AM, interpeak and PM peak periods, nor by direction or by the type of vehicle.

Based on the surveys it is evident that for a typical weekday (excluding the Friday peak), there is not a significant level of congestion influencing travel times on the current road network in the study area.

6.2.6 Public Transport

The North Island Main Trunk railway line runs through the study area. This line carries two passenger services, the Overlander from Auckland to Wellington and the Capital Connection from Palmerston North to Wellington. Both services have one train per day in each direction on weekdays. The Overlander has seasonal weekend services. All trains stop at Levin within the study area and the Capital connection stops at Ōtaki and Shannon outside, but close to, the study area.

Only one public bus service runs within the study area. This is the Levin – Palmerston North commuter service which comprises one bus from Levin to Palmerston North in the morning and one bus from Palmerston North to Levin in the evening. This joins SH1 from Exeter Street, Levin and travels to Palmerston North via Foxton.

Other private bus companies run long-distance services on SH1 and SH57.

[4] These travel times are for those vehicles that did not stop in Levin; that is excluding travel times greater than 26 minutes.
[5] These travel times are for those vehicles that did not stop in Levin; that is excluding travel times greater than 21 minutes.

6.2.7 Other Road Users

There are no data on other road users. However, the highways are known to be used by motor-cyclists, cyclists, pedestrians and agricultural vehicles.

6.3 Modelling

6.3.1 Purpose and Objectives

The purpose of the modelling activity in this project is to develop a SATURN based traffic assignment model to help evaluate various highway options for the Ōtaki to north of Levin expressway.

- The model must specifically take into account the impact that the various alternative highway options have on regional and sub-regional traffic as well as local access and travel.
- The model must be capable of being added/joined to the adjacent Peka Peka to north of Ōtaki model and the MacKays Crossing to Peka Peka model, although that conjugation is not part of the current project.

The SATURN model has been built and employed in the project to assess the travel time and vehicle operating costs and benefits of the current and future network and options; initially for the first cut scoping and sieving of a preliminary wide range of corridors and indicative routes. In later stages it will be used to assess operational performance and staging of preferred options.

During the Route stage, the model will also be used to provide further information in the refinement and analysis of the location and operation of different intersection and interchange forms as well as the wider option network structure.

The travel time and operating costs results will be combined with expected safety and other economic benefits and costs to provide economic assessments at the various decision making and analysis stages.

6.3.2 The Model

The model used for this project includes a 2011 base year model as well as future year models based on forecasts for 2016, 2026 and 2041, with morning peak, inter-peak and evening peak hour models being built for each assessed year. It assesses the road network within the Study Area (see Figure 1-1).

SATURN is a traffic assignment model, not a full four stage transportation model. Given the presence of similar models being used on other RoNS projects to the south, the ability to model multiple user classes (particularly heavy freight vehicles) and the fact that there is a general lack of congestion on the relatively simple linear network, the choice of SATURN is very appropriate for the purposes and type of analysis required for this study. The use of the two vehicle classes allows better control of information both as inputs and results for each class, given the anticipated high growth in the numbers of heavy vehicles in coming years as well as the key focus on economic growth and development in current government policy.

Unlike the other traffic models used on the RoNS projects to the south, this project is mostly outside of the Greater Wellington region. Hence the Wellington Strategic Model (WTSM) cannot be used as an underlying model from which key model base information can be directly drawn, such as current and future year trip patterns and volumes.

The basic model build process followed standard practice for the formulation of the transport network, demand matrices, calibration, validation and assignment. The development of the trip demand matrices required significant pre-work and development prior to running the models as they had to be developed with no prior trip matrices in the area. The process is described below.

6.3.3 Model Periods and Years

The Ōtaki to north of Levin Traffic Model (the Model) is based on developing three period specific models for each assessed year. These cover the one hour AM Peak, PM Peak and inter-peak periods, developed out of the 2 hour periods for which traffic flow data was analysed to identify the key hour for analysis. These periods are for a typical weekday; no weekend models have been created. The selected modelled hours were determined as:

AM Peak: 08:00 to 09:00 hrs
PM Peak: 16:30 to 17:30 hrs
Inter-peak: 11:00 and 12:00 hrs

The years to be modelled have been selected as 2011, 2016, 2026 and 2041.

6.3.4 Zone System

The zone system developed for this model is shown in Figure 6-1, and is based on breaking the project area up into approximately 40 internal and 3 external zones. The internal zones were formed by combining Statistics New Zealand census mesh blocks based on:

- Major roads within the proposed network;
- Geographic limitations to connect to the model such as rail lines and streams or rivers;
- Likely trip catchments;
- Generally similar zone trip demand sizes (by zone general type);
- Existing development; and
- Future development planning.

The three external zones relate to the three points at which traffic enters and exits the model area, conveniently on the three state highways (SH1 south of Waitohu Valley Road, near Ōtaki, SH1 near Manawatu River (Whirokino) and SH57 north of Potts Road).

There is a fourth connection to the model area, Waitohu Valley Road, which connects South Manakau Road to Otaki. This is a narrow road with a poor horizontal alignment. It carries very low traffic volumes and has not been included in the model.

Additionally some of the small towns/beach settlements and local roads on either side of highway have been modelled similar to external nodes, such as Manakau South Road, Manakau, Kuku East Road and Waitarere Beach. These locations have been assumed to not connect to places outside of the study area.

6.3.5 Land-use Inputs

There is no strategic transport model which covers the project model area. Therefore the Model has been built as a new model for the area with a need to be able to link with the RoNS models to the south but based on a different methodology for determining the travel demands in the area. As such, land use statistics have been very important in the development of the model trip matrices, both current and future.

The Model has sought to use trip rate information from WTSM to maintain a similar basis for trip matrices between this project model and the southern RoNS models (which are based on WTSM). The trip rate information has been sought by seeking to identify and match similar zones between the Model and WTSM. The matching process was based on seeking the closest matches of households and employment location densities of zones. Household and employment densities have been used to compare the much smaller Model zones with the much larger WTSM zones. Therefore land use data has been critical to determining trip rates and demand matrices.

The 2006 mesh-block census data for the zone areas, Permanent Households and the Weekday Total Employment have been used to create the densities used, along with Statistics NZ future projections for these variables.

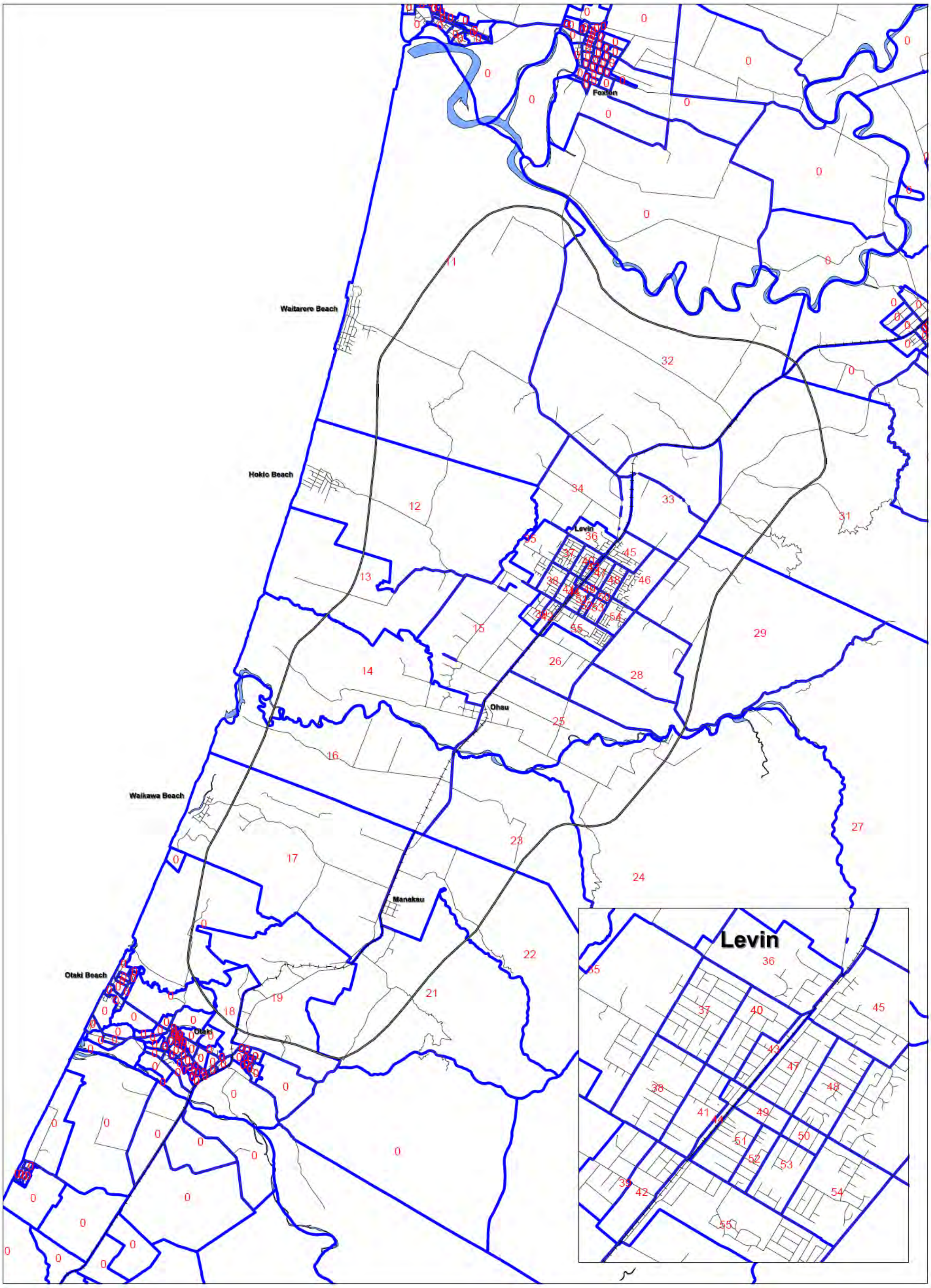


Figure 6-1 : Project Traffic Model Zones

6.3.6 Demand Matrices

The approach used for this model to derive internal zone trips was to apply the WTSM vehicle trip production/attraction rate factors and the 2006 census data to generate the 2006 origins and destinations. The 2006 mesh-block census data has been aggregated into the model zones for the Permanent Households and the Weekday Employment and was divided by the zonal area to create densities for these variables. The household and employment density for each of the model zones have been compared with those densities for the WTSM zones to determine which WTSM zone has the “closest” densities match. Once the best fit WTSM zone had been determined, the AM peak, PM peak, and inter-peak origins and destinations totals (adjusted to 2011 from the WTSM growth factors) for light and heavy vehicles of the WTSM zones was scaled based on relative areas to match with the Model zones. This provided the total productions and attractions for each internal zone for the base year.

Trips to/from the (three) external zones were derived separately to the process used for the internal zones above. Data from both the number plate surveys, manual control counts undertaken at the same time as the number plate surveys and the NZTA count stations were used to develop the external zone origins and destinations (the trips entering and exiting the model area).

From the number plate survey data the external to external trips that travel directly through the model area were identified (recognising expected travel times between the external zones and adjusting for the under-reporting of the number plate survey). The balance of trips between the total inward trips and the through trips from a zone represent the external to internal trips associated with that zone; and vice versa for the internal to external trips. The external to internal trips were allocated to internal zones in proportion to the relative attraction of a zone to all zones; similarly the internal to external zones were allocated from the internal zones in proportion to the relative production of trips of a zone to all zones.

To start the final development stage of the three 2011 period matrices a seed matrix was needed, so a unit matrix was initially developed with a single trip allocated to each O-D cell. This was run on the 2011 network, and a cost matrix was skimmed. A seed matrix was then created by, for each O-D cell, dividing the total cost of the cost matrix by the cost of that O-D pair.

Using the seed matrix and the Origin and Destination totals for each zone, vehicle class and period, the matrices were formed using the Furnessing process which provided a set of base 2011 base matrices. Using a similar process with the 2011 matrices as the new seed matrices and future household and employment projections, matrices for 2016, 2026 and 2041 were produced.

6.3.7 Road Network

For this model, the entire network, shown in Figure 6-2, has been modelled as a simulation network in SATURN.

The rural network has been built based on the two major state highway spines: SH1 between Ōtaki and the Manawatu River, and SH57 between SH1 south of Levin and Potts Hill (north of Potts Road). On either side and between these spines there are local rural roads which branch out to serve the surrounding rural activities and the smaller local communities which exist between the Tararua Ranges and the sea. Much of this network has used links with speed-flow curves only to recognise that there is little direct delay caused by intersections, and any delays on the links are related primarily to other traffic travelling on that link.

The urban network is based solely in Levin and the immediately surrounding roads. Levin has an approximate 2 km by 2 km grid pattern of roads with Oxford Street (SH1) and Cambridge Street running north-south in parallel through the centre of Levin, either side of railway tracks. The railway tracks present a physical barrier and so every crossing of the rail way tracks has been included within the model (6). Additionally all roads within the Horowhenua District Plan which have a hierarchy of either an Arterial Route or a Collector Route within Levin have been included as well as some local roads to make key connections. The majority of local roads have not been individually coded and are represented by connectors joining the major roads from the internal zones. The urban road network has been coded using both link capacity and speeds, and separate coding of the intersections (recognising the intersection controls and lane configurations).

6.3.8 Validation and Peer Review

The requirements and standards used in validating the model were based primarily on the NZTA's Economic Evaluation Manual (EEM). This series of criteria have been applied in the validation testing of all three time periods in the project base year SATURN model. The criteria relate to various measures, as follow:

Link Flows: Modelled link flows were compared with the observed flows in the model area for each of the time periods, using three different tests. These are:

- GEH Statistic – this measure is assessed for each observed site in the model area. It is a form of Chi-Square measure of fit. The target thresholds for GEH in validating a model to acceptable NZTA EEM standards are:
    - At least 60% of individual link flows should have a GEH less than 5;
    - At least 95% of individual link flows should have a GEH less than 10;
    - All individual link flows should have a GEH less than 12; and
    - Screen-line flows should have GEH less than 4.0.
- Scatter Plots and Regression Analysis – The EEM requires scatter plots with an associated best fit line and the coefficient of determination (R^2) calculated for the modelled versus observed flows. The EEM requires that the R^2 values should be generally less than 85%.
- Root Mean Square Error – This measure considers the error in relation to all errors and the total number of counts. The RSME is calculated for each of the time periods modelled, and the target value for RSME is to be less than 30%.

Travel Times: The modelled travel times are compared against observed travel times. Most of the travel time routes checked were for trips on the state highway network, and partly on the key roads in Levin. Whilst the EEM appears to not provide a target for travel time validation, the Design Manual for Roads and Bridges (DMRB), a well-recognised UK Department of Transport standard project control manual, requires that 85% of modelled travel times must be within 15% (or 1 minute if higher) of the observed travel time.

Intersection Counts: Turning flows at numerous intersections were compared between the modelled and observed flows. The EEM criterion for turning flows is that the modelled flows should be within 30% of the observed flows.

Model Convergence and Stability: The EEM considers transport models to be stable and suitable for project assessments of options if they meet set criteria for each of the base year periods modelled. To be considered stable, the EEM requires that the following convergence criteria are met:

- The number of (assignment/simulation) iteration loops to reach convergence is less than a set number (for this model the number has been set at 99);
- 95% of assigned links have calculated flows that have changed by less than 5% compared to the previous iteration results; and
- The normalised gap is less than 1% in the final assignment

The validation testing and reporting process for the base year model has achieved all of the above criteria. Completing the model build, validation and option testing for this report has taken more time than initially anticipated and been assigned a higher priority than completing the normal Peer Review process which would normally be desirable at this stage. The Peer Review process will be completed in parallel with the review stage of this report, and finalised prior to the model being used in the more critical scheme assessment stage (given the very similar main options being assessed in this report do not demonstrate significant differences in results and impacts on evaluation, but will still be vital in final economic analyses).

Figure 6-2 : Project Modelled Road Network

6.3.9 Do Minimum Network

The future Do-Minimum networks for 2016, 2026 and 2041 were developed by firstly researching future committed network improvements works for both NZTA and Horowhenua District. No committed improvement works were found in any capital works programmes, although three Project Feasibility Reports from the NZTA were found. If implemented, these would not change the network operation noticeably (all straighten/widen curves/bridges and would result in minor travel time savings). There is no commitment to building these presently, they would be bypassed should the option expressway be built, and given link aggregation and variability effects it was decided that these did not warrant including in the Do-Minimum networks.

Secondly, the 2041 matrices were loaded on the 2011 network to assess if any deficiencies resulted, with thresholds for interventions considered at level of service (LoS) D/E boundary for intersections (worst approach delay) and links (volume: capacity ratio). The results of this assignment indicated that no modifications to the network were required. Independently, the two signalised intersections in Levin were assessed with SIDRA and this confirmed that their performance would not deteriorate to LoS E subject to minor adjustments to lane utilisation and relaxing the cycle time and phase times for SATURN to optimise. Thus overall the Do-Minimum future networks are the 2011 network (or could be also labelled the Do-Nothing networks).

6.3.10 Model Outputs

The outputs of the modelling can be put to a range of purposes including evaluating the performance of the network, assessment of environmental effects (e.g. noise assessments), information for economic evaluations and data for road safety assessments.

These outputs can be provided at individual link and intersection level and at whole of model level for measures such as vehicle flows at various points on the networks, travel times (individually and collectively) and distance travelled (individually and collectively), and each of these for each vehicle class/type (in this model, light and heavy vehicles).

The headline outputs for the Do Minimum are presented below and the outputs for the options are provided in Section 13.2. These outputs are presented in more detail in Appendix O. The increase in network speed over the 30 year time period (2011-2041) is a result of most of the growth in traffic in the model using the SH routes, and thus pushes up the relative proportion of vehicles using higher speed roads which remain relatively uncongested.

Table 6-2 : Summary results from 2011 and 2041 Base Network Models

Modelled Year	AM	IP	PM
Total Travel Time (veh.h/h)			
2011	1325	1532	1491
2041	1610	1340	1832
Total Vehicle Kilometres (veh.km/h)			
2011	97673	108199	108438
2041	125695	104511	141198
Average Network Speed (km/h)			
2011	73.7	70.6	72.7
2041	78.0	78.0	77.1

6.3.11 Initial conclusions

Whilst evaluation of the options from the model outputs is provided in Section 13.2 below, there are some initial conclusions which can be provided in relation to the modelling activity for this study at this point.

Firstly, the models built for this project can be considered (from the validation process) fit for purpose. The response from the independent Peer Reviewer supports this conclusion.

Secondly, with the low demand across the network which results in generally good on-going performance into the future, the level of benefits and improved network performance directly from a transport network improvements perspective (unless substantive shortening of key routes) will likely remain small overall. Notwithstanding, the model is assessing normal weekday operation and does not give any indication of how the network operates during other (high demand) periods.

6.3.12 Further modelling

From the modelling work conducted to date for this Scoping Report, a range of possibilities for further modelling have been identified potentially for the scheme assessment stage or as separate analyses for other purposes, as noted below.

- During the scheme assessment reporting period, an optimisation of the configuration of interchanges and local road treatments should be made including consideration of alternative locations, different types of interchanges and options for local road network integration; these changes will need to be modelled to include these improvements in the various analyses (e.g. economic analysis).
- During the scheme assessment reporting period, sensitivity testing of model outputs should be undertaken in areas such as assumptions in traffic growth at model boundaries, number of accesses to the expressway and capacity restraint at the south end of the model area (to represent significant delays occurring in Ōtaki).
- A weekend and holiday period model assessment process developed (in conjunction with the other RoNS models to the south) to allow testing of effects of non-traditional / irregular high demands on the network.
- Integration of this model with the RoNS SATURN models to the south could be pursued.

As the primary options being considered for this project are expressways which by-pass and provide limited access points into Levin, there is little purpose in developing or testing improvements within Levin itself despite the model being capable of such, unless the District Council raises significant queries or requests work for which modelling would be required.

6.4 Crash Data

The NZTA's Crash Analysis System (CAS) was interrogated to analyse the crash history, contributing factors and trends for the state highways within the study area[6]. A total of 476 crashes occurred in the study area during the five year period 2006 – 2010, including 14 fatal and 39 serious injury crashes, as shown Table 6-3 below. The crash locations and severity within the study area are shown in Figure 6-6 below.

[6] For the purposes of the crash analysis the sections investigated were SH1 967/0.265 to 995/3.89 and SH57 0/0 to 0/13.9. Crash Data is presented in Appendix C.

Table 6-3 : Ōtaki to North of Levin 2006 – 2010 Crash Record

Severity	2006	2007	2008	2009	2010	Total
Fatal	6	3	1	4	0	**14**
Serious	9	10	5	8	7	**39**
Minor	22	19	28	29	27	**125**
Non-Injury	63	63	66	51	55	**298**
Total	**100**	**95**	**100**	**92**	**89**	**476**

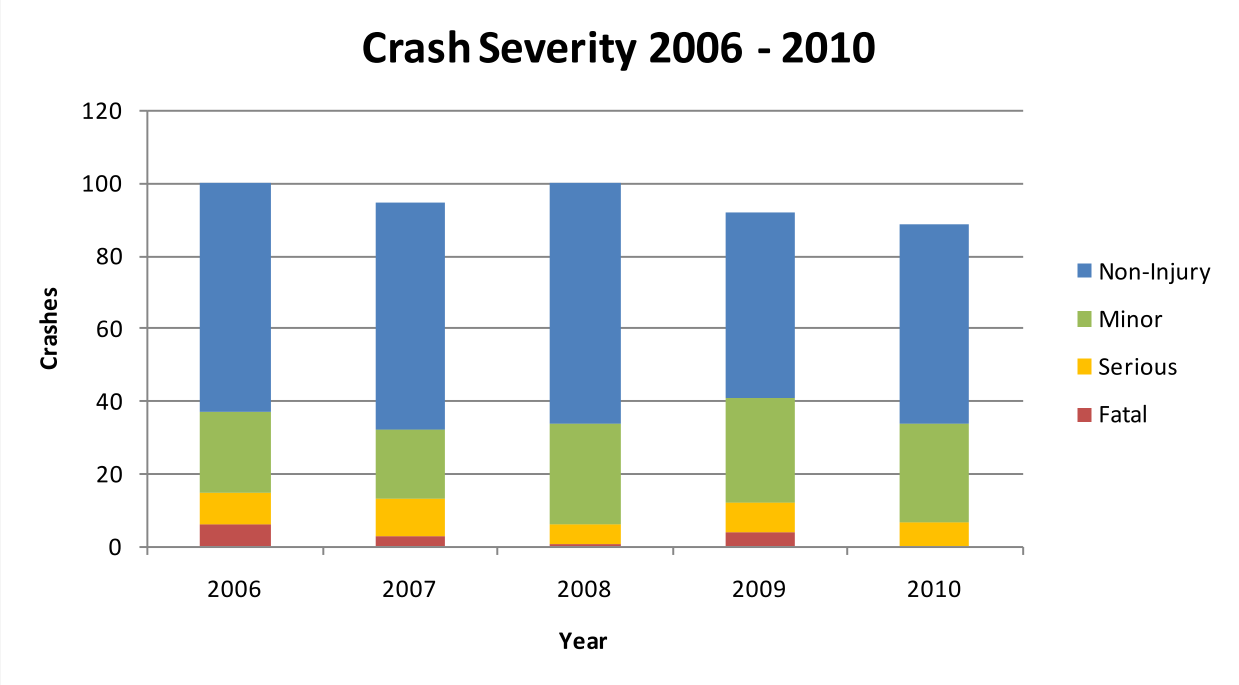


Figure 6-3 : Graph of Crash Severity

Figure 6-3 above shows the total number of crashes across the study area has remained relatively consistent in the five year period 2006 – 2010; however a slight declining trend is evident in the last three years. In saying this, the total number of injury crashes has been fluctuating around 35 – 40 per year, which indicates that the main reduction in the last three years has been in non-injury crashes.

6.4.1 Crash Locations

To analyse location specific crash patterns and trends, the crash data was split into the four sections outlined below and shown in Figure 6.4 below.

- **Section 1**: State Highway 1, north of Ōtaki to south of Levin (rural), 15.9 km
- **Section 2**: State Highway 1, Levin (urban), 6.2 km
- **Section 3**: State Highway 1, north of Levin to just south of the Manawatu River (rural), 10.7 km
- **Section 4**: State Highway 57 up to Rolston's Corner Rest Area (rural), 14.4km

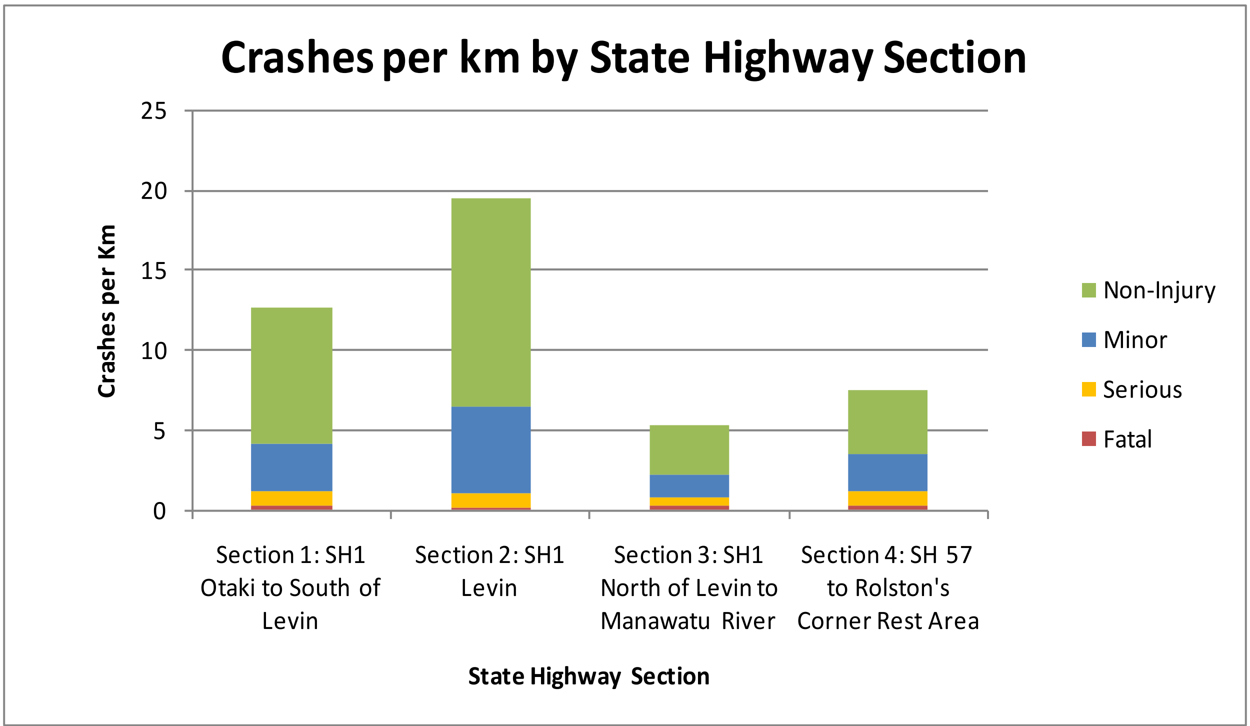


Figure 6-4 : Crashes per km by State Highway Section

Figure 6-4 above shows that the SH1 section that passes through urban Levin has the highest crash rate of nearly 20 crashes per kilometre. It is noted that a large number of these crashes are non-injury, in part due to the low urban speed environment; however, the total number of injury crashes is still higher (7) than section 1 between Ōtaki and south of Levin with the second highest crashes per km (4).

When considering crashes per kilometre it is important to consider the number of vehicles travelling along each section. Accordingly the injury crash rates per 100 million vehicle kilometres travelled (vkt) has been calculated based on the average annual daily traffic (AADT), section length and injury only crashes for the five year period.

Figure 6-5 below shows that once AADT is considered, the SH57 section has the highest number of injury crashes per 100 million vkt (41). The section with the second highest number of injury crashes per 100 million vkt is the urban Levin section (30).

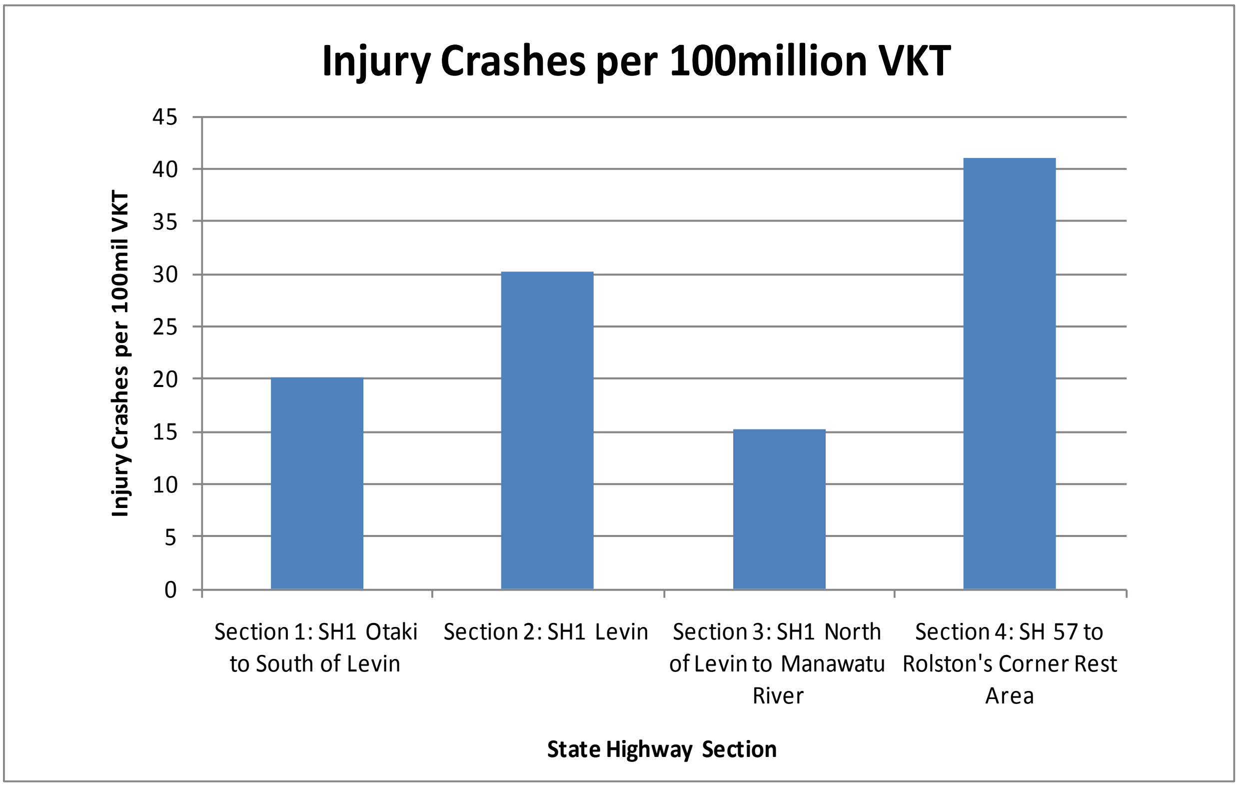


Figure 6-5 : Injury Crash per 100 million VKT

A map of the injury crash locations and severity is shown in Figure 6-6 below. The map shows the location and severity of all the injury crashes that have occurred in the study area in the five-year period 2006 – 2010. By excluding non-injury type crashes, the higher social cost crashes can be more easily identified.

Figure 6-6 below displays the crash clustering of minor and serious injuries crashes around urban Levin section, while the fatal crashes have tended to occur in the higher speed rural environments contained within the study area.

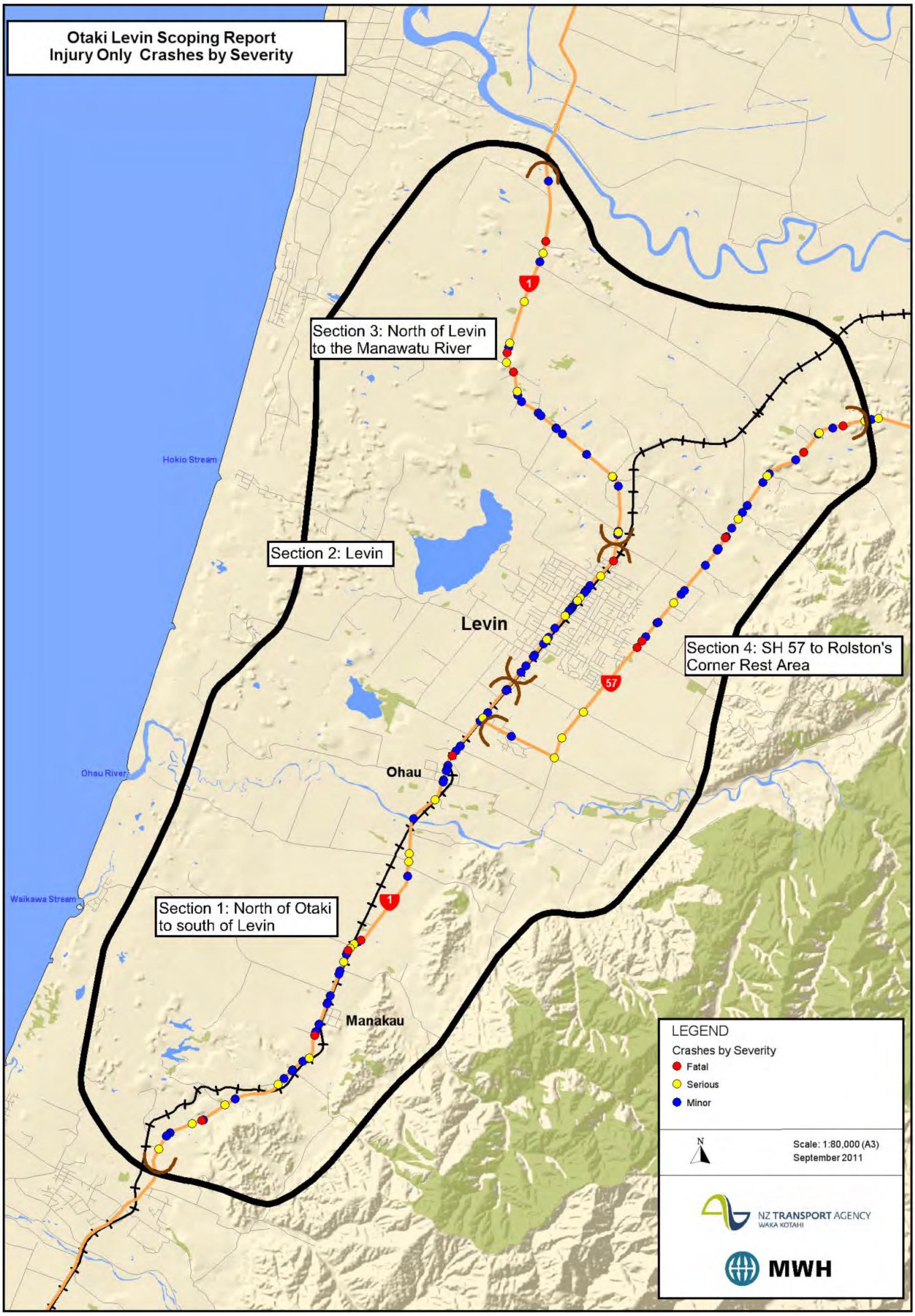


Figure 6-6 : Map of Injury Crash Locations by Severity

6.4.2 Crash Blackspots

The five year crash data was analysed to determine crash blackspots or locations where a large number of crashes have occurred within short section of state highway. For urban sections, crashes were grouped with a 30 m radius while a 250 m radius was used for rural areas. The criteria for locating and ranking crash blackspots is shown in Table 6-4 below.

Table 6-4 : Blackspot Criteria

Blackspot Criteria	
Total number of crashes greater than or equal to	9
Total number of injury crashes greater than or equal to	4
Total number of fatal/serious crashes greater than or equal to	2
Total crash cost greater than or equal to	$300,000

Sites in the study area with two or more of the above criteria are classified as blackspots. There were 12 blackspots found in the study area, shown in Table 6-5 below, with a large majority (9) occurring at intersections. The blackspots mapped along with social cost and KiwiRAP star ratings for the study area are shown in Figure 6-5 below.

The largest blackspot in terms of crash cost was located in the vicinity of the SH1 and Whakahoro Road intersection. This blackspot had a total of 18 crashes, with 14 being curve related and 11 having a wet road as a factor. The blackspot also included four high severity crashes, contributing to a total crash cost of $7.5 million. The second largest blackspot occurred on SH 57 at the intersection of Queen St. This blackspot had 13 crashes being intersection related out of a total of 15 crashes and included three high severity and one pedestrian crash, with a total crash cost of $5.9 million.

Table 6-5 : Crash Blackspots

Rank	State Highway	Side Road	Fatal	Serious	Minor	Non-injury	Total	Cyclist and Pedestrian	Intersection Crashes	Crash Cost
1	1N/985/7047	Whakahoro Road	1	3	5	9	18	0	2	$7,547,703
2	57/0/5581	Queen Street East	1	2	6	6	15	1	13	$5,901,932
3	1N/967/5894	Waitarere Beach Road	2	1	0	1	4	0	2	$4,901,432
4	1N/995/1249	Forest Lakes Road	0	2	3	5	10	0	7	$3,861,482
5	1N/985/9277	Gleeson Road	1	1	1	5	8	0	3	$3,613,082
6	1N/985/0	Kimberley Road	0	1	9	17	27	0	15	$3,602,611
7	1N/995/1949	South of Forest Lakes Road	1	1	1	1	4	0	0	$3,408,842
8	1N/967/2668	North of Koputaroa Road	1	1	0	1	3	0	0	$3,284,642
9	57/0/9010	Heatherlea East Road	1	0	3	7	11	0	0	$2,346,811
10	1N/967/14006	Bath Street	0	2	4	12	18	3	13	$2,232,380
11	1N/985/10393	South Manakau Road	0	0	4	9	13	0	3	$956,340
12	1N/967/8100	Te Whanga Road	0	0	4	5	9	1	4	$752,100

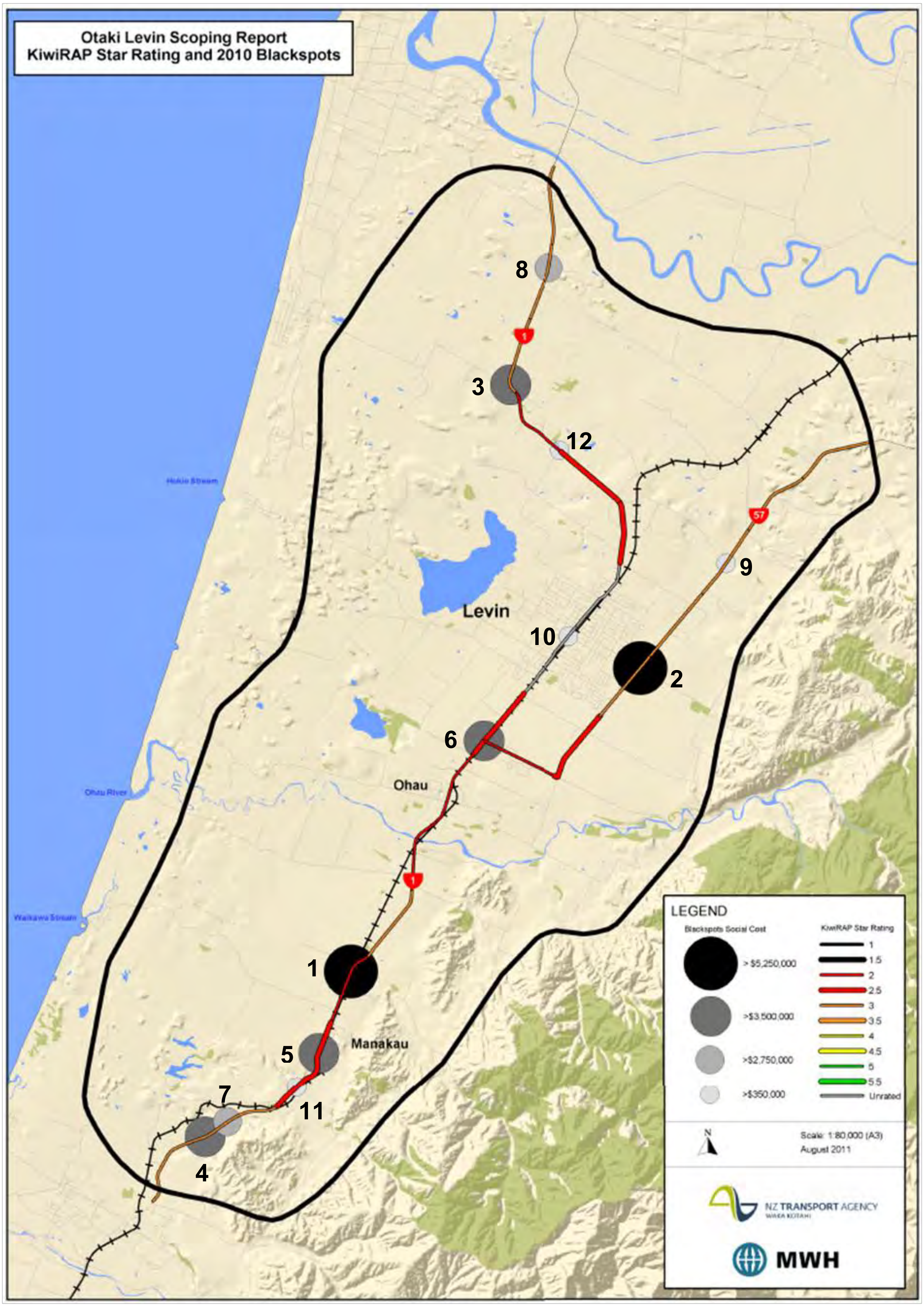


Figure 6-7 : Ranked Blackspot Locations and Social Cost

6.4.3 Crash Types and Factors

Crash Movement

When considering five year crash data for the whole study area, the most common crash movement types were 'Rear end/obstruction' accounting for 33% of crashes followed by 'Crossing/Turning' with 21%. ‘Loss of control/Head on’ crashes were split into straight (17%) and bend (15%) loss of control. The different types of crashes that occurred in the study area were analysed further and broken down into each state highway section with Table 6-6 below summarising the results.

Table 6-6 : Section Crash Types

State Highway Section	Length (km)	Rear End/ Obstruction	Crossing/ Turning	Straight Loss of control/ Head on	Bend Loss of control/ Head	Pedestrian	Overtaking	Other	Total
All Sections	47.2	158 (33%)	98 (21%)	80 (17%)	70 (15%)	16 (3%)	42 (9%)	12 (3%)	476
Section 1: SH 1 Ōtaki to south of Levin	15.9	69 (34%)	36 (18%)	28 (14%)	39 (19%)	0	19 (9%)	10 (5%)	201
Section 2: SH 1 Levin	6.2	62 (51%)	30 (25%)	5 (4%)	4 (3%)	15 (12%)	5 (4%)	0	121
Section 3: SH 1 North of Levin to the Manawatu River	10.7	11 (19%)	10 (18%)	15 (26%)	11 (19%)	0	9 (16%)	1 (2%)	57
Section 4: SH 57	14.4	16 (15%)	31 (28%)	34 (31%)	17 (16%)	1 (1%)	9 (8%)	1 (1%)	109

All three rural state highway sections had similar figures for 'bend loss of control' of between 16% and 19%; however, 'straight loss of control' figures were higher on both section 3: north of Levin and section 4: SH 57, due to the long straights present on both these routes.

Rear end crashes accounted for over 50% of all crashes within urban Levin for section 2 Levin; this is not surprising given the low speed environment. Section 1: Ōtaki to south of Levin also had a high rear end/obstruction crash rate of 34% due to this section passing through small urban settlements of Manakau and Ohau and the congestion related crashes from queues heading into Ōtaki during holiday periods.

Pedestrian crashes accounted for 16 (3%) of all crashes in the study area; 15 of these occurred in Levin. This is a direct result of the proportion of pedestrian traffic in and around the state highways in an urban vs. rural environment. Crossing and turning crashes were 25% and higher in both Levin and SH 57 and only 18% in the two other State Highway 1 sections.

Intersection Crashes

Of the 476 crashes that occurred in the study area in the five-year period 2006 – 2010, 162 (34%) were intersection crashes. The principal injury crash factors in intersection crashes were:

- Failure to Give Way/Stop;
- Incorrect lane; and

- Poor judgement or observation.

Weekend Crashes
Crashes that occurred during the weekend, defined as 6 pm Friday to 6 am Monday, accounted for nearly 40% (180) of all crashes. Weekend crashes were found to have a high severity (fatal and serious) crash rate of 12% compared to a 10% high severity crash rate during the working week. The highest number of crashes occurred on Fridays (88) with the lowest recorded number of crashes on Mondays (49).

6.4.4 High Risk Rural Roads

The study sections were also analysed according to the NZTA's Draft High-Risk Rural Road Guide (HRRRG) with the results summarised in Table 6-7 below. As this guide considers rural roads only, section 2: SH1 Levin was excluded from this analysis.

According to the guide, a high risk rural road is classified as one which has:

- a high fatal and serious crash rate (Personal Risk) or crash density (Collective Risk) compared with other roads as defined in the HRRRG section 4;
- a high or medium–high collective; or a high or medium-high personal risk route (as defined by KiwiRAP[7]);
- features that are likely to increase the potential for fatal or serious injury crashes along a route as determined by the KiwiRAP star rating or road protection score (RPS), i.e. 1 or 2 star road or an RPS greater than 10 (section 4); or
- a high risk score from an equivalent process such as the Road Safety Infrastructure Assessment (RISA) where the risk score is greater than 3.0 (section 4).

For this analysis the both the personal and collective crash risks were calculated to determine the appropriate treatment philosophy as defined in the HRRRG.

Table 6-7 : Collective and Personal Crash Risk

NZTA High Risk Rural Roads Guide				
State Highway Section	Collective Crash Risk		Personal Crash Risk	
	High severity crashes per km per year	Collective Crash Risk	High severity crashes per 100million VKT	Personal Crash Risk
SH1 Ōtaki to South of Levin	0.24	HIGH	5.71	MEDIUM
SH1 Levin (Urban)	N/A	N/A	N/A	N/A
SH1 North of Levin to Manawatu River	0.17	HIGH	5.70	MEDIUM
SH 57 to Rolston's Corner Rest Area	0.24	HIGH	13.65	HIGH

All three of the rural sites are classified as having a 'High' collective crash risk. Collective risk (also known as crash density) is a measure of the number of high severity (fatal and serious) crashes that have happened per kilometre of road per year.

7 KiwiRAP is New Zealand's joint agency Road Assessment Programme. The Ministry of Transport, NZTA, Police, ACC and AA developed the programme to assess the risk of New Zealand roads and targeted it at decision makers and the wider public.

Personal risk (or crash rate) is a measure of the number of high severity crashes that have occurred per 100 million vkt. The personal crash risk was lower in two of the three sections, with both SH 1 Ōtaki to south of Levin and SH 1 north of Levin to south of Manawatu River having a 'Medium' personal crash risk.

The HRRRG's safety improvement strategy is shown in Figure 6-8 below. This was developed to guide the selection and implementation of various improvements based on metrics such as traffic volume, collective crash risk, personal crash risk and KiwiRAP star rating, among others, which define the risk of a particular route under consideration. Under this strategy, when a section has both a high personal and collective risk it is classed as a 'Safe Systems Transformation Works' and there are likely to be significant crash reduction benefits to justify larger infrastructure improvements.

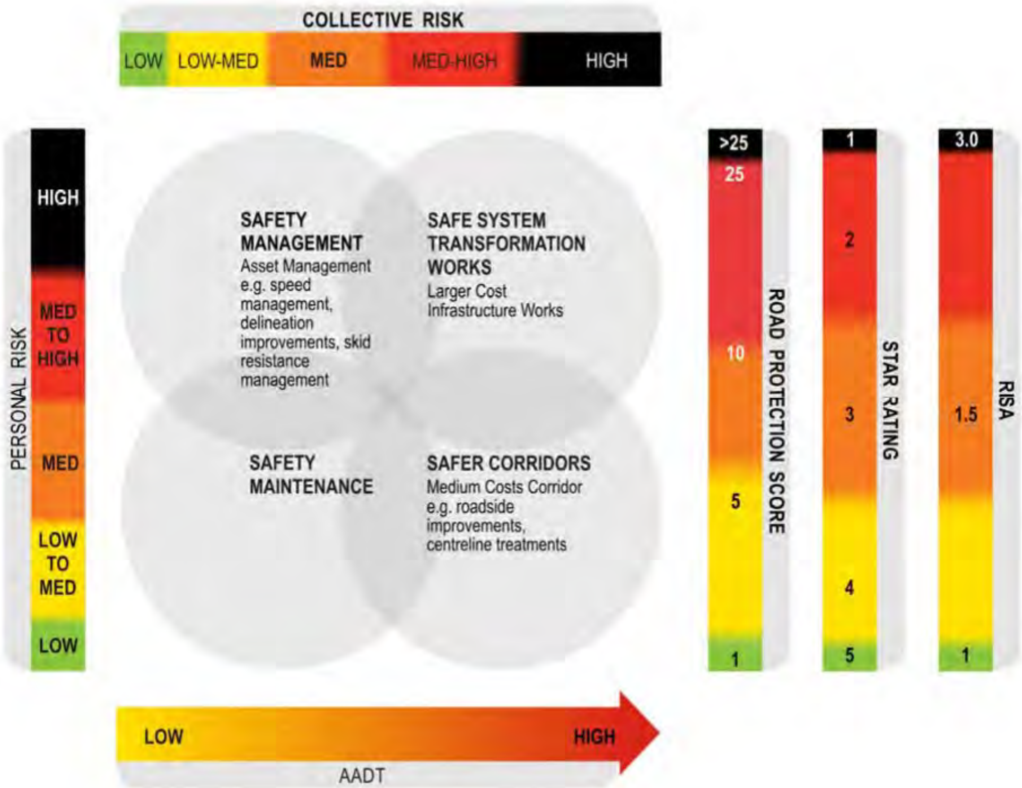


Figure 6-8 : Treatment Philosophy Strategy

However when a route has a low or medium personal crash risk, large infrastructure improvements investments may not be warranted. The 'Safer Corridors' treatment approach relates to routes with a low to medium personal risk as well as high AADT, while not qualifying for road environment transformations, they do meet the criteria for incremental improvements including hazard management, barriers, medians or other theme based treatments along the route.

The SH 1 Ōtaki to south of Levin and SH 1 North of Levin to the Manawatu River both overlap between a 'Safe System Transformation Works' and a 'Safer Corridors' approach, as a result further analysis was undertaken, outlined in Table 6-8 below. This included identification of the road protection score (RPS) and the KiwiRAP star rating for the sections of highway in question.

Table 6-8 : Treatment Philosophy

State Highway Section	Collective Crash Risk	Personal Crash Risk	Road Protection Score (RPS)	KiwiRAP star rating	Treatment Philosophy
SH1 Ōtaki to South of Levin	HIGH	MEDIUM	11.2	2.67	Safe System Transformation Works
SH1 Levin (urban)	N/A	N/A	N/A	N/A	N/A
SH1 North of Levin to Manawatu River	HIGH	MEDIUM	9.7	2.91	Safe System Transformation Works
SH 57 to Rolston's Corner Rest Area	HIGH	HIGH	9.0	2.97	Safe System Transformation Works

After including the RPS and KiwiRAP ratings in the analysis along with the personal and collective crash risk and study area being a RoNS, the treatment philosophy for all three sections falls into the ‘safe system transformation works’ category, which warrants large infrastructure development expenditure.

This treatment philosophy can be seen as an early signal for the justification of building a high quality expressway route between north of Ōtaki and north of Levin, being consistent with the higher level RoNS goals for this corridor.

7 Study Process

The NZTA has determined that strategic decisions need to be made regarding the state highway network through this area. As part of the Wellington Northern Corridor RoNS, this section has been fast-tracked for improvements in accordance with the objectives set out in Sections 1.1 and 2 of this report.

The Ōtaki to north of Levin project will include investigating options for a four-lane expressway through the project defined area and appropriate connections to other roads, including State Highway 57 (SH57). MWH has been contracted to assess alternatives, prepare a scheme assessment, and to prepare preliminary designs and documentation to obtain designations and resource consents for the highway proposal.

A key component of the work is to identify and analyse options and determine a preferred route. The work will need to be undertaken in a way that enables the NZTA to meet its statutory obligations, including those under various statutes such as the Resource Management Act 1991 (RMA), the Land Transport Management Act 2003 (LTMA) and the Historic Places Act 1993 (HPA).

The process of identifying the details of an appropriate project preferred route option, for which a designation and consents for an expressway will be sought, is systematic. The key elements of the processes involve a range of "best practice" methods of identifying a preferred route option and refinement of the route, in conjunction with NZTA processes, consultation stages and reporting.

The statutory processes required for the project require a high level of detail and comprehensiveness throughout all phases of investigation and reporting. Each step of the process, from understanding the project area, to development of corridor and route options, to consulting with key stakeholders and communities must be undertaken with care. The designation process specifically requires alternative routes to be considered and environmental impacts to be avoided, remedied or mitigated.

A diagram that shows the relationships between the various inputs, stages of project development and reporting that is being applied to the project provided as Figure 1-2 below.

ACRE/ Planning Process	Optioneering	Reporting	Consultation	NZTA Outputs
Area	Option Identification & Constraint Map	Area Analysis Report	Key Stakeholders	Scoping Study
Corridor	Desktop Study & Initial Modelling	Corridor Options Report	Key Stakeholders	
Route	Scheme Assessment Investigations	Preliminary Route Assessment Report & Final Route Assessment and Decision Report	Key Stakeholders General Public Directly Affected and Nearby	Scheme Assessment
Easement	Option Detail and Mitigation	Project Description, AEE and Statutory Applications	Key Stakeholders General Public and Negotiation	AEE and Statutory Applications

Figure 1-2: Matrix outlining the ACRE process and the various phases of the project

7.1 ACRE Methodology

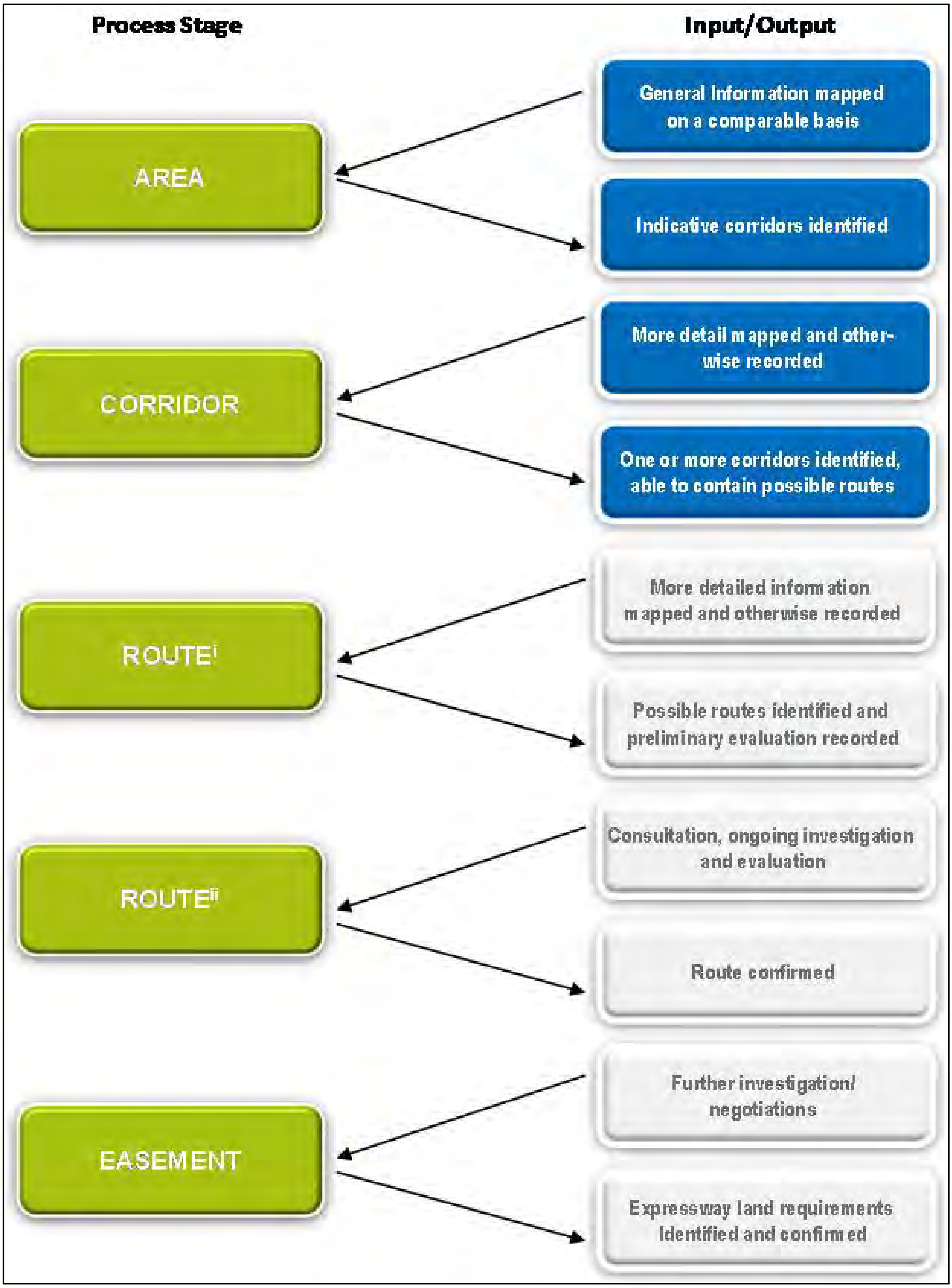


Figure 1-3: ACRE Process for Identification of Preferred Route for Ōtaki to north of Levin Expressway (completed inputs/outputs in blue)

The type of approach used internationally to identify and secure the most suitable route for network utilities has been used recently in New Zealand for consenting major projects. It is described as the ACRE model[8]; the acronym standing for Area, Corridor, Route, Easement[9].

This process starts with the broadest feasible area and systematically and progressively narrows the area of interest down to a single preferred route through enhanced information and analysis. The generic process is set out diagrammatically in Figure 1-33. Although the approach or process is internationally applicable, it also meets the information, analytical and consultation requirements of the RMA. Application of this process to the Ōtaki to north of Levin RoNS project will result in a defensible preferred route, appropriately connected to existing road networks, which can then be further evaluated and tested through the RMA statutory processes.

The ACRE methodology is also specifically tailored to meet section 171(b) RMA requirements in the identification and analysis of route alternatives. It is a process of progressively narrowing down an area of interest into potential route options, with progressively increasing information and design detail. It takes into account RMA section 6 and 7 matters, and provides a framework for consideration of avoidance, mitigation and remedy of adverse effects.

This scoping study covers the Area and Corridor Stages of the ACRE process whilst also fulfilling the NZTA's requirements for investigations and consultation processes. It also encompasses the typical optioneering processes for considering new routes. The work to date following these processes provides sufficient information to prepare a scoping study and then to commence investigations and consultation in the early stages of the scheme assessment.

This report reflects the intent of the NZTA minimum standard for scoping reports but, in order to achieve the project objectives, the standard format has been modified to reflect the scale and scope of a project of this type See Section 1.5).

[8] The approach was initially adopted in New Zealand for Transpower's 400kV North Island Grid Upgrade, and was accepted by the Board of Inquiry in granting statutory approvals for that project.
[9] Easement in the case of a highway will involve a designation of land to be owned by the NZTA, and possible limitations on other nearby land.

8 Area Description

8.1 Aspects considered and categorisation

This initial stage of investigations largely involved a desktop study but was also supported by initial field reviews from public roads by key project team members and NZTA staff. The purpose was to obtain, categorise and map information at a scale and in a way that would enable identification of "no go" areas, and show likely degree of difficulty in other areas.

The following aspects were identified as relevant to Area Stage consideration:
- Relief and hydrology.
- Landscape and urban design quality.
- Landscape absorption capability.
- Heritage values.
- Tāngata whenua values.
- Lifelines.
- Population distribution.
- Geological constraints.
- Ecological values.
- Land use capability.
- Natural hazards.
- Land ownership.
- District and regional plan maps (zoning and specifically identified areas).
- Contaminated land/hazards.

Information on other aspects, such as property value, was not considered necessary for the analysis at the Area Stage given that the cost of property was not seen as a particular constraint in the identification of suitable corridors. Similarly, detailed land use mapping was not considered relevant at this stage. The land use capability information would provide some general information which would relate to both land use and land value.

A series of maps was prepared as basic information to inform other aspects of the analysis. These maps included a topographical map, contour map and relief map.

Given that each map involved different expertise, it was not possible to apply a completely consistent approach in the collection and categorisation of mapped information. The following general principles were, however, applied:

- Only information that would provide assistance at the broad Area Stage was mapped and analysed[10]. Further detail would be added later for the Corridor and Route analysis.
- The information was categorised in a way that enabled it to be readily sourced.
- The information was categorised and mapped in a way that would assist the analysis. Thus a first-stage analysis was applied, with the assistance of specialist advice.
- To do this, a ranking system was applied which presented a "significance" scale that was simple and relatively consistent – i.e. a maximum of five categories, where 5 is likely to pose major constraints for the routing of an expressway and 1 is a low level constraint.
- Where categories 1 to 5 are not used, an appropriate range was selected.
- Only areas that were relevant to the aspect would be mapped. Thus only some maps would show information that is continuous – e.g. landscape and geotechnical information. Other information, such as historic or archaeological areas affect only points or small areas at the Area mapping scale.

[10] The metadata which describes the "data about the data" includes keeping notes on the source and accuracy of the data, date of information, any data limitations etc. This is tabulated in a Data Register to assist with validation later in the process.

- The categories on the maps were "colour themed" – dark tone for "5", shading to pale for "1". Where possible transparent tones were used so maps could be overlaid.
- Some types of information, such as population, specific land ownership, and lifelines, did not require categorisation on the basis of constraints at the Area stage.

The relief map, with major rivers and lakes, state highways and the railway, provided the basis for other mapping. The relief map is shown on Map 1 (and the constraints on Maps 2 to 17) in Appendix D. The area is characterised by river plains and terraces. It is dominated by the coastal lowland in the west and the Tararua Ranges to the east. An analysis of these and other features in the context of landscape and urban design is provided below.

8.2 Landscape and Visual Aspects

The landscape and visual analysis is considered to be a key aspect for evaluation at Area level, as well as at Corridor and Route Stages. The landscape and visual analysis was undertaken by the landscape and urban design specialist. A Landscape and Urban Design baseline report was prepared to provide baseline information on the area's landscape, including its landscape character units and features (see reference list). As far as relevant, this report also includes urban design commentary.

The methodology at Area level involved researching and describing the landscape between the Manawatu River in the north and Ōtaki in the south in terms of its natural and human history to provide an overall context. The Study Area was then divided into five landscape sections, each of which was further sub-divided into landscape units. Each landscape unit was then assessed in terms of two parameters:

- Landscape (or urban) quality – taking into account biophysical values such as the natural science values of landform, vegetation, waterways; perceptual values such as aesthetic quality, legibility (way-finding and orientation), distinctiveness and memorability; associative factors such as historical associations, recreational values, or values that tangata whenua and others might associate with a landscape.
- Absorption capability – providing an appraisal of the landscape's ability to accommodate an expressway such as that proposed, and the likely degree of effects, taking into account modification to natural vegetation, waterways or landform that could be anticipated as a consequence of road construction; and likely prominence, including extent of screening by trees or topography, density of dwellings, proximity to settlements, and the ability to fit an expressway to the contours.

Maps are included in Appendix D relating to Landscape Quality (Map 2) and Absorption Capability (Map 3). Relative rankings for landscape 'quality' and 'absorption capability' are summarised in the landscape report.

In summary, the map of landscape quality shows the highest qualities around Lake Papaitonga, with other areas of high quality including Lake Horowhenua, its margins and the sand dune country to the immediate west of the Lake; the area of lakes, wetland and scattered bush in the south-west of the Area; the hill country in the south-east of the Area; and the area east of Levin including a strip of plain and the nearby rising slopes towards the Tararua foothills. The small settlements of Manakau and Ohau are also identified as areas with high landscape and urban design quality. Areas with the lowest landscape quality are found in the north of the area in the low-lying area west of State Highway 1, and in the working rural and horticultural areas south of Levin and Ohau and west of State Highway 1.

The map showing landscape absorption capability shows that most areas of low absorption capability coincide with areas of high landscape quality. However, the area in and around Levin and the area to the north of State Highway 1 and to the west of the North Island Main Trunk railway line are also identified as having low absorption capability.

The following specific points are also made in the landscape report:

- The main linear features with high landscape values are the rivers and streams; particularly Ohau River, Hokio Stream, Waikawa Stream, and Manakau Stream. The natural character of each has been modified to some extent by clearance of bush, adjacent land use, and in some cases modification to stream beds. Locations with high natural character include the Ohau River adjacent to Kimberley Reserve.
- An obvious 'pinch point' for any new road is identified in the vicinity of Levin township, Lake Horowhenua and Hokio Stream. This is also an area of high value for tangata whenua.
- Other areas of high landscape quality are Lake Papaitonga (which warrants recognition as an outstanding natural feature) and Manakau settlement (for its aesthetic and heritage values).
- Localised landscape features (Map 4) include a relatively high number of marae, churches, rural localities, historic sites, stands of remnant bush, small wetlands and dune lakes.

8.3 Heritage

Heritage can encompass a range of natural and man-made features all of which contribute to the cultural and spiritual characteristics of the area. The value that a community places on these features is a complex blend of physical and cultural inter-relationships. The Heritage Areas (Map 5) includes all known archaeological sites, historic buildings and notable trees.

8.3.1 Historic Buildings

Historic places and buildings were identified from the Horowhenua District Plan (Schedule 2: Heritage Features – Structures). These were categorised as 5 for mapping purposes, as historic items are usually expected to be preserved in their entirety (including, for example, both buildings and their settings), and an expressway is likely to be seen as an unacceptable threat.

Most listed historic buildings and structures are located in the town of Levin and the smaller settlements of Ohau and Manakau, or near State Highway 1.

8.3.2 Notable Trees

Notable trees have also been identified from the Horowhenua District Plan (Schedule 2: Heritage Features – Notable trees). These are trees that have been assessed and found to have significant values and have therefore been given a categorisation of 5.

The notable trees are widely scattered in the rural area, but many are found within the urban area of Levin, including the trees in the central shopping area which lines Oxford Street (State Highway 1).

8.3.3 Archaeological Sites

The locations of approximately 55 identified archaeological sites within the Area were obtained from the NZ Archaeological Association database. These were able to be directly mapped from the co-ordinates provided.

The locations are not precise[11], and at an Area scale most sites would not be evident. However, the individual sites are strongly clustered in some specific areas, so the sites were mapped as small circles, with a categorisation of 5 indicating that they are a significant constraint and will need to be avoided, if possible, during design and construction.

As many archaeological sites are pre-European, clusters of archaeological sites are also likely to give an indication of tangata whenua values attached to an area.

Most known archaeological sites are west of State Highway 1, particularly near to the two larger lakes.

[11] Only to within 100m of the actual location.

8.4 Māori Values/Tangata Whenua

Two types of land of significance to tangata whenua were identified at an Area level: areas of high traditional, cultural or spiritual significance, and parcels of Māori owned land. This information is shown in Map 6. The areas of high cultural significance were identified and mapped on the basis of advice from the team's cultural advisor. These areas include main waterways and estuaries as well as significant lakes, wetlands and forest areas. These areas have all been identified as category 5.

Māori owned land under the Te Ture Whenua Māori Act 1993 (in multiple or Trust ownership/administration) was identified on the basis of LINZ cadastral and ownership information. This was categorised as 4 and shown on the map.

Places of significance were identified and mapped as points. These include pas, urupas and marae. This map, perhaps more than the other maps, may be lacking in information, particularly in relation to wāhi tapu. This has been recognised by the project team and on-going discussions with tangata whenua will occur throughout the project to ensure that as much relevant information as possible is incorporated in the decision-making process.

While the places of significance are clustered in several areas – particularly indicating areas of long settlement of tangata whenua – Māori multiple-owned land parcels are found throughout the Area, with clusters towards the west.

8.5 Lifelines

Lifelines are key social infrastructure which a community relies on during emergencies. Lifelines include major roads, rail, gas pipelines and transmission lines, as well as sites associated with emergency services, major healthcare facilities, water and wastewater treatment plants etc. Note that these "life-lines" were not categorised in terms of importance, but provided an additional layer of relevant information for the analysis, which will become more important at Corridor and Route stages.

Map 7 shows the location of the lifelines, including state highway and rail systems. The linear lifelines run north-south through the Area and relatively few "point" lifelines have been identified – most are close to Levin.

8.6 Population Distribution

An indication of population distribution was obtained based on the use of cadastral information. Individual land parcels were taken as a proxy for habitation and the centre-point of each parcel marked with a dot. This yielded a distribution pattern which was considered to be more indicative of the general population distribution than the more generalized census mesh-block density information. Both types of mapped information clearly identified settlements, but the cadastral-based information showed more clearly the general distribution of rural population. This was therefore used as the basis for Map 8.

Population is clearly focused in the only town in the Area, Levin, which had an estimated population of almost 20,000 in 2010. The settlements of Manakau and Ohau contain much smaller populations, at least an order of magnitude smaller, with residents on life-style blocks nearby. There is a widely-spread, low-density, rural population in much of the Area. Map 8 indicates that it will be a challenge to avoid all areas of population.

8.7 Natural Hazards and Contaminated Sites

The desktop study and a site visit by MWH engineers revealed several geotechnical hazards within the Study Area which could potentially influence the design and construction of the proposed expressway. Some of the hazards identified included the following:

- Potential seismic issues and tsunami risk resulting from fault rupture

- Soft ground - swamps/peat
- Slope stability and lateral spreading/landsliding
- Settlement and ground cracking
- Bearing capacity
- Earthworks (cut/fill)
- Flooding
- High groundwater levels and groundwater contamination

On the basis of the hazards identified, three constraints maps showing the presence of faults, areas of potential for liquefaction effects, areas with potential settlement issues, and flooding and tsunami influence areas, have been developed. The maps show the extent of these hazards and areas susceptible to their impacts. See Maps 9, 10 and 11.

Data on the tsunami influence zone was obtained from Horizons Regional Council. It has been noted that the data was prepared for the purposes of emergency evacuation and not for district plan and community development. The data was made available on hard copy and was digitised from maps supplied by Horizons. The zone indicated as a “medium” hazard is likely to be evacuated in the event of a 1-3m tsunami and the “low” hazard zone in the event of a 3-5m and greater tsunami. The “medium” and “low” zones correspond with ~500 year and ~2,500 year return events respectively. The areas that are considered of a “high” hazard are not shown on the map given that they are immediate coastal areas mostly likely to be affected by tsunami events of less than 1m (and well outside the Study Area).

Data on flooding was obtained from Horizons Regional Council. Given the lack of comprehensive flood data for the entire Study Area, the data is based on known areas prone to flooding within a 20m contour of the waterway.

Details of geotechnical aspects are discussed further in the Preliminary Geotechnical Appraisal Report, April 2011. Further detailed studies will be undertaken during later stages of the project.

Data on contaminated sites as shown on Map 16 was obtained from the Hazardous Activities and Industries List (HAIL) and contaminated sites register held by Horizons Regional Council. There are relatively few of these sites, most being in the vicinity of Levin.

Further geotechnical information is presented in Appendix M.

8.8 Ecological Values

The terrestrial and aquatic ecology information brings together a range of source material. Ecological values were assessed by a terrestrial ecologist and a freshwater ecologist. For the purpose of the ecological constraints map (Map 12) two categories have been identified, these being:

- regionally significant (category 4)
- nationally significant (category 5)

For the analysis of terrestrial ecology, areas of the conservation estate with specific ecological values were obtained from the Department of Conservation’s Geographic Information System (GIS). Threatened land environments were identified (Level IV). Mapped information also included privately owned land with recognised ecological values. Land owned by the Queen Elizabeth II (QEII) Trust was deemed to be regionally significant in ecological terms. Records of these sites were obtained from the Trust.

The Area includes the following nationally significant sites:

- Dune wetlands associated with Lakes Waitawa and Kopureherehere, habitat for nationally threatened flora
- National threatened flora associated with riparian margins of Ohau River
- Lake Papaitonga Scenic Reserve, wetland habitat for nationally threatened flora
- Lake Horowhenua, includes Recommended Areas for Protection (RAPs) at the northern end and localised areas around margins and shallow zones supporting nationally threatened flora

- Concentration of Sites of Special Wildlife Interest (SSWI) associated with dune wetlands/habitat for indigenous (wetland) fauna
- Wetlands associated with Koputaroa Stream supporting threatened flora
- Other factors determining national significance are the existence of RAPs associated with a number of wetlands and existence of groupings of threatened flora and herptofauna (lizards). Individual sites where threatened flora and herptofauna have been recorded are indicated with dots, and have been treated as nationally significant.

As can be seen from Map 12, regionally significant areas and sites are widely spread around the Area. This includes the forest associated with "Mt" Poroporo.

The aquatic ecology information sourced from Horizons Regional Council includes the following surface water management values:

- Sites of significance – aquatic
- Sites of significance – riparian
- Inanga spawning
- Whitebait migration
- Trout spawning
- Trout fishery.

All of the sites listed by Horizons Regional Council as having surface water management values listed are considered to be regionally significant. Those sites listed as having surface water management values *and* which provide habitat for aquatic species listed in Hitchmough *et al* (2005) or Allibone *et al* (2010) as 'at risk' or 'threatened' are considered to be nationally significant. These include sites which provide habitat for giant kokopu, shortjaw kokopu, koaro, redfin bully or bluegill bully.

Aquatic and riparian areas of significance largely follow the east-west drainage pattern and inevitably will need to be crossed by the expressway.

8.9 Land Use Capability

The land use capability (LUC) system of land classification assesses the land in terms of its capacity for sustained productive use, taking into account physical limitations, management requirements and soil conservation needs. The eight classes represent the versatility of the land and give the general degree of limitation to use. This data was obtained from Landcare Research.

The Horowhenua District Plan applies Class 1 and 2 to the area to determine highly versatile soils and potentially the most productive arable land, with Class 1 being the most productive. Parts of the District have particular qualities of highly fertile loam soils and climate which make them highly versatile and suitable for a diverse range of uses. These areas are in relatively limited and finite supply.

Map 13 indicates five of the eight classes of the LUC classification. The higher the capability, the greater importance given to the area as a constraint. Land with the highest capability is found in the extensive lengths across the central part of the area, running generally east-west, reflecting past drainage patterns. It will be difficult to avoid all these areas.

8.10 Land Ownership

Land in Crown ownership was identified and mapped (see Map 14). This is because the compulsory acquisition powers contained within the Public Works Act do not provide for compulsory acquisition of such land. An additional reason to identify such land early in the process was because Crown land is usually held for a specific reason – either for a public use (such as schools) or for a public benefit (such as ecological or heritage land). The ownership of this land was identified from the LINZ database, and land was mapped on the basis of cadastral boundaries.

Council owned land, designations and land held for conservation purposes are also indicated, as these types of land can pose constraints.

No ranking was allocated to this land ownership, as the ability to acquire such land varies (for example, reserves and conservation areas are difficult to compulsorily acquire, and designated land requires the approval of the designating authority) and further detailed investigation would be needed in terms of any parcel. Land ownership, as mapped, indicates a potential constraint in terms of the ability of the NZTA to reasonably acquire land for the purpose of an expressway.

These types of land are found primarily in and around Levin although there are parcels in many parts of the Area.

Māori owned land is shown on Map 6 associated with Tangata Whenua Areas of Significance (refer to section 5.4).

8.11 Regional/District Plans

The organisations with a responsibility for statutory planning within the Study Area are Horowhenua District Council, Horizons Regional Council, Greater Wellington Regional Council and Kapiti Coast District Council. Information was gathered from each of the district and regional councils.

Types of land use zoning identified in the district and regional plans was then given a weighting of 1 to 5 dependent on the likely degree of difficulty associated with routing of an expressway. They were defined as follows:

- 1 - Rural
- 2 - Industrial/commercial
- 4 - Residential/open space/conservation areas
- 5 - Designations

The higher the category the greater importance given to the area as a constraint. Designations and areas zoned for residential, open space and conservation were identified as a constraint due to the high investment, high population density, and potential incompatibility with an expressway. Areas of potential growth are also identified (although the main area is “deferred” low-density residential, meaning that a plan change would be necessary for any residential development to occur in this area).

Rural land was given a weighting of one as it was considered to place the least significant constraint throughout the Study Area.

This information is shown on Map 15. The greatest zone-based constraints are found around Levin, Ohau and Manakau.

8.12 Conclusion

The information collection and mapping undertaken in this stage of the study at Area level provided a major resource in the form of mapped data. Care was taken not to overlook key aspects in compiling and organising the material. Some of the information gathered (for example, archaeological sites and the location of individual marae) will only become of specific interest at the Corridor and Route analysis stages.

The mapped information was used to assist in identifying a number of general corridors, based on areas of least constraint. The method by which this was achieved is described later in this report.

Most of the information does not comprise absolute constraints. As noted, throughout the mapping process, category 5 areas, for whatever aspect, are considered to denote areas which will involve high degrees of difficulty in achieving designations or obtaining resource consents or in property acquisition (once designated). Generally, they do not comprise absolute constraints or “no-go” areas. In contrast, areas which have been categorised as 1, or on some maps areas which are omitted, are anticipated to provide the least degree of difficulty in terms of the aspect being considered.

9 Area to Corridors

Using the mapping as a primary foundation, an Area workshop was held, involving NZTA representatives and the key project team. The purpose of the workshop was to explain and discuss the mapped information, including the range of constraints that applied in different parts of the Study Area, and to identify one or more broad corridors, in a preliminary way. The preliminary corridors would be further refined following the workshop and would then provide the basis for the Corridor stage of investigation.

The workshop also took into account a range of contextual information such as:

- the RoNS objectives and draft project objectives
- absence of any directive to avoid urban areas or town centres
- uncertainty around the "degree of difficulty" identification of an area as a 5 (i.e. high constraint) involved in terms of an expressway. It was acknowledged that some 5s were equivalent to a score that might be sufficiently detrimental to jeopardise the project, whereas others could be addressed by mitigation measures that could be developed during more detailed investigations and design phases, if a corridor or route could not avoid them
- it is desirable to have corridors of maximum practicable width (i.e. up to 4 kilometres) but, in practice, constraints would mean that the corridors would have variable widths.

It was considered that the mapped information was sufficient to enable preliminary identification of corridors and that no further information was required at the Area stage – i.e. there were no omissions of concern with the level of detail or the range of aspects for which data had been collected.

The workshop analysed the information in two ways: firstly on the basis of a significant constraints only analysis, and secondly on the basis of sieve mapping: overlaying the acetate maps to identify areas where combinations of constraints were likely to make inclusion of these areas in a corridor difficult from a consenting or practical viewpoint.

The key considerations in terms of identifying significant constraints for future corridors under the first method were:

- ecological values
- significant cultural values
- areas of clustered archaeological or heritage values
- areas of particularly high urban design quality
- some areas of specific land ownership.

These were identified and mapped as areas of significant constraints, and are shown on Figure 9-1.

These constraints were chosen principally to cover requirements under the RMA and under the Historic Places Act.

The sieve mapping, or overlay analysis, undertaken at the workshop determined that key considerations related to:

Map 2 – Landscape/urban design quality
Map 5 – Heritage areas
Map 6 – Tāngata whenua areas of significance
Map 12 – Ecological areas of significance
Map 14 – Land ownership

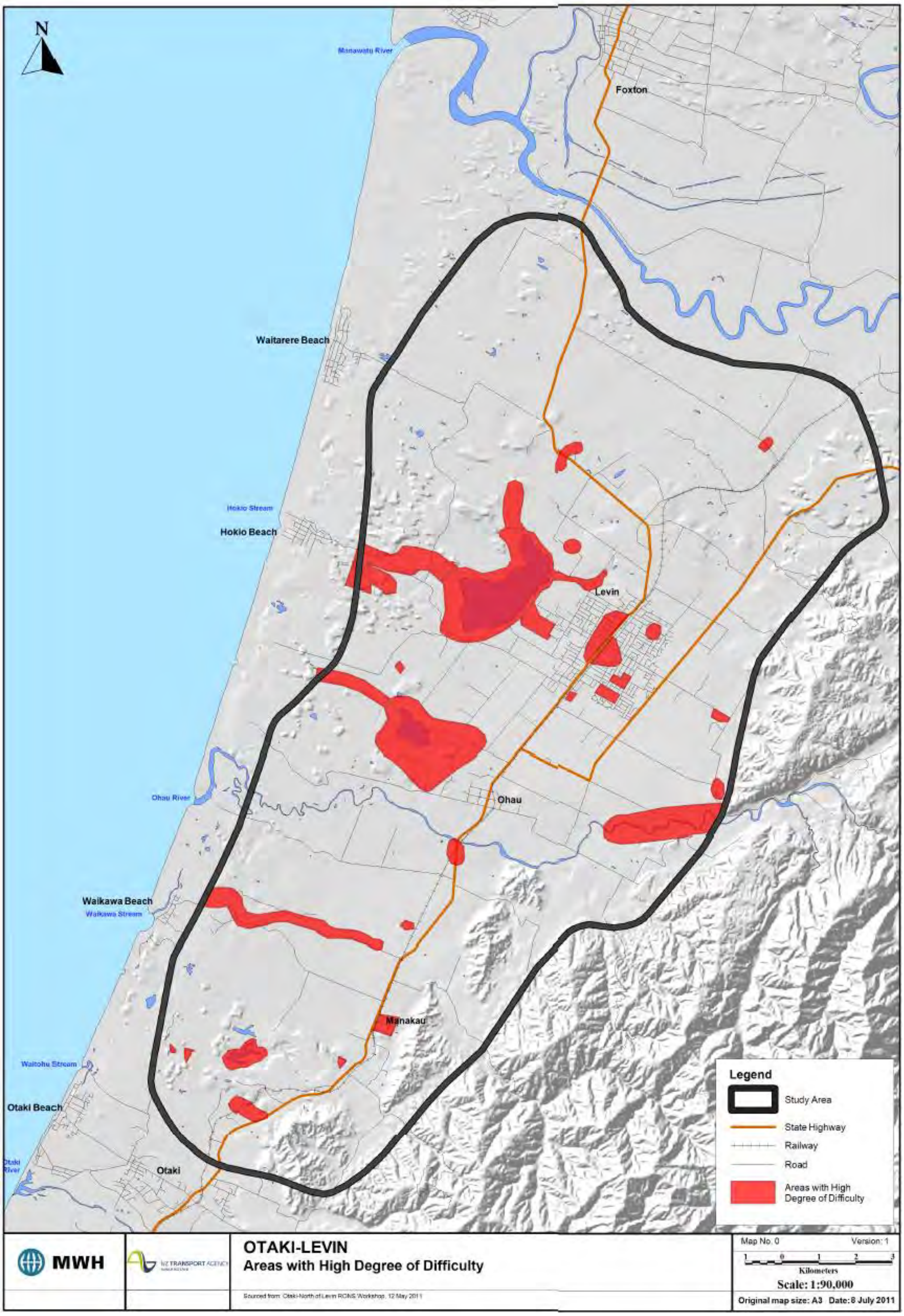


Figure 9-1: Areas with Particularly Significant Constraints identified at Workshop

These were the key maps used in the sieve mapping (overlay) analysis. As other considerations were also relevant, the additional mapped information was used as a check and means of confirmation of the degree of difficulty in establishing a route in an area. This information assisted in determining whether an area should, or should not, be included within a corridor.

Preliminary corridors were identified from the workshop, with the agreement that they would be further considered and confirmed following the workshop by a smaller team.

In particular, the workshop considered that a corridor to the west of Lake Horowhenua should not be included because of the high cultural values and the ecological values of the lower reaches of the streams in this area, compounded with high landscape quality and low landscape absorption capability and geotechnical limitations. This outcome can be seen graphically by looking at the constraint maps in Appendix D and also at the areas in Figure 9-1.

Landscape values and ecological considerations also applied to exclude areas to the extreme east of the Study Area.

Following the workshop, further sieve mapping analysis was carried out by a small team consisting of planner, landscape architect and engineers. This refined the preliminary corridors and added some additional possible links between eastern, central and western corridors. The preliminary corridors resulting from the Area analysis are as shown in Figure 9-2.

At a subsequent project team meeting, the preliminary corridors were confirmed with the NZTA project team as an appropriate basis to proceed to the Corridor stage.

Briefly, the three draft corridors are described as follows:

- Eastern Corridor: a broad corridor running the length of the eastern side of the Area, which splits to avoid areas with a range of high values and sensitivities, and which excludes areas which cannot sensibly link with others to form part of a continuous corridor.

- Central Corridor: a corridor which encompasses the existing SH1, but which allows for deviations from the existing highway within the identified corridor area.

- Western Corridor: a corridor which is relatively broad at the southern end but splits at the northern end to avoid a range of values (where it joins with the central corridor).

The three corridors all provide opportunities for linkages at various points, so that it would be possible for a preferred corridor ultimately to contain parts of all three corridors.

It is also noted that all draft corridors contain areas with localised constraints, some of them very significant, on which decisions will need to be made during the Corridor or subsequent (Route) stages of analysis. The extent of these areas, the way in which they could be affected by an expressway project, and the significance of the values, may all influence whether a corridor can contain a feasible route, and thus whether some sections of corridors are retained. This analysis is undertaken in the Corridor stage.

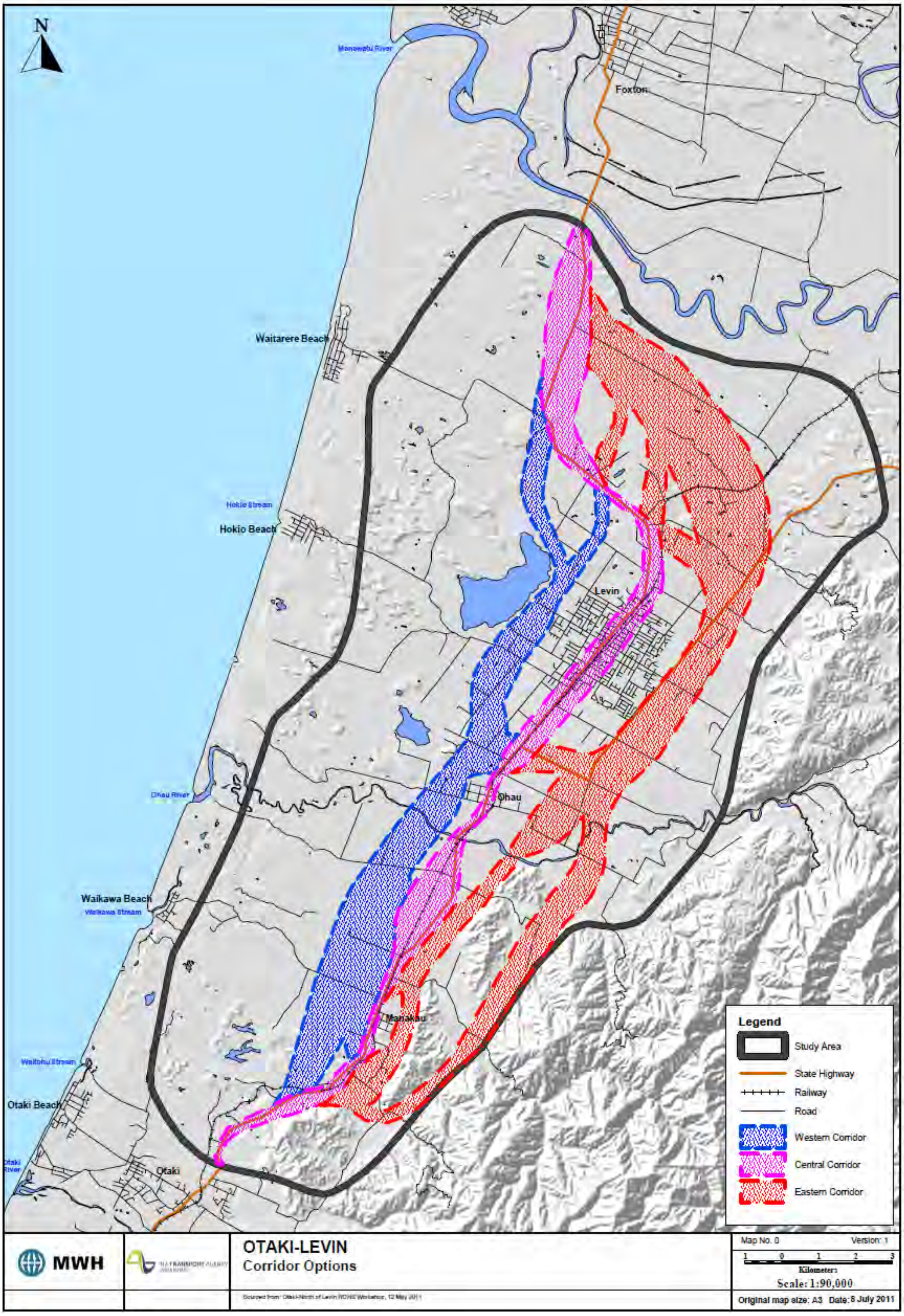


Figure 9-2 : Draft Corridors, Identified at End of Area Stage of ACRE process

9.1 Review of Draft Corridors

The draft corridors identified at the conclusion of the Area Stage, and as shown in Figure 9-2, were recognised as being preliminary in nature. They had been identified from an evaluation of mapped information including constraints, through a workshop process. They required further consideration and review both in the field (to the extent practical from public roads) and from aerial photographs. The purpose of the review was particularly to examine the practicality of some corridor sections in order to retain, reject or modify them as parts of the corridors.

The field review was undertaken by landscape, planning, engineering and ecological specialists[12]. The areas particularly addressed, and the findings made, were as follows (in no particular order):

1. The area to the south-east of Manakau included in the eastern corridor was inspected to confirm its topography and the landscape assessment. It was decided that this area should be retained in the corridor for further analysis.

2. The section of the western corridor between Ohau and SH1 was also inspected, particularly in relation to areas with ecological values and some land use activities (including the residential expansion of Levin, the high pressure gas line terminus, the wastewater treatment plant and some significant industries). It was decided to further widen the corridor in the southern part of this section to ensure it was wide enough to contain future routes that could avoid some of these land use activities.

3. The northern point where the central and western corridor coalesced (near a significant curve in SH1) was widened to allow for better route geometry if needed.

4. The part of the central corridor which runs along SH1 north of the westward curve was determined as needing widening on the northern side. This was to allow for adequate geometry for a connection to a leg of the eastern corridor in this location. It was noted that this area has low landscape absorption capability which (if included later in a route) may require specific mitigation.

5. Additional width was added to the south-eastern-most section of the eastern corridor which runs through a remote valley. This was to provide more flexibility in determining a future route in this area, including the ability to avoid the existing high-voltage power line, if the corridor in this area was retained.

6. The central corridor where it traversed Levin was also inspected in some detail to assess its potential to accommodate an expressway. A preliminary field assessment was made which concluded that the environmental and social effects of retaining a corridor for an expressway through the urban area would be very significant and that this part of the central corridor should not be further considered. Alternative road configurations (such as a one-way street system) would not meet the project's objectives, as well as having their own associated significant environmental and social implications. These findings were discussed further at the first Corridor Stage workshop[13], where the preliminary field assessment was confirmed by the wider team associated with the project. This assessment was written up as a short paper for consideration by the NZTA's Regional Decision-Making Team[14], and was confirmed by them. The paper put to the Decision Making Team (DMT) is included as Appendix E to this report. As a result, the central corridor section through Levin and between the points where that corridor connects to the eastern and western corridors was removed from further consideration. It was also decided to remove the short link to the north within the eastern route, as, with the removal of the central corridor to the south, it would not link effectively with other potential future routes in the eastern corridor.

[12] Gavin Lister, Sylvia Allan, Phil Peet and Adam Forbes
[13] Described later as the Multi-Criteria Workshop (22nd June 2011).
[14] This group within the Wellington regional office of the NZTA is known as the DMT and is charged with the responsibility of decisions on state highway matters throughout the Wellington region, including the Wellington RoNS projects.

The modified corridors which were then taken to further analysis are shown in Figure 9-3.

9.2 Review of Aspects for Corridor Analysis

As described in the Area Analysis Report, a wide range of information had been mapped at the Area Stage. Some further or improved information had subsequently been added as a result of a consultation round with stakeholders[15], and from the additional field observations.

The Area investigation had compiled and mapped information on 17 aspects[16] as set out in the Area Analysis Report. Key information from this mapping process which was used in terms of identifying areas of significant constraints for future corridors were:

- ecological values;
- significant cultural values;
- areas of clustered archaeological sites and/or historic buildings;
- areas of particularly high visual /urban design quality; and
- some areas of specific land ownership.

Key maps which were overlaid to identify areas of least constraint, and ultimately the draft corridors related to:

- landscape/urban design quality;
- heritage areas;
- tāngata whenua areas of significance;
- ecological areas of significance; and
- land ownership.

The team's knowledge and experience of the Board of Enquiry process identified these aspects as being of greatest influence when applying for a Designation and Resource Consents.

It was anticipated that these aspects would be of considerable assistance in the analysis of the broad corridor options. The information collection and mapping at Area Stage was considered to also provide adequate detail for the Corridor Stage in terms of those aspects[17]. However, the specialists in these areas were requested to undertake any additional visits to the Area, literature reviews, liaison with key informants, and/or careful inspection of aerial photographs, in order to further familiarise themselves with the corridor areas in Figure 9-3 of this report and the extent and significance of any constraints within their subject areas.

Consideration was also given to any additional aspects that should be taken into account in analysing the corridors and determining which of them to proceed with into the Route Stage. Additional aspects which it was considered should also be taken into account at the Corridor Stage were:

- specific land uses; high value land is usually more difficult and expensive to acquire;
- number of dwellings; this was taken as a measure of both cost and level of protest against the proposed route;
- constructability; this relates to cost; and
- alignment with project objectives.

[15] A series of meetings was held with key stakeholders during June 2011, providing an opportunity for review of the Area Stage map information.
[16] The 17 aspects are shown on the Constraint maps in Appendix D to this report.
[17] See the Area Analysis Report, Appendix I, for the metadata used in compiling the maps.

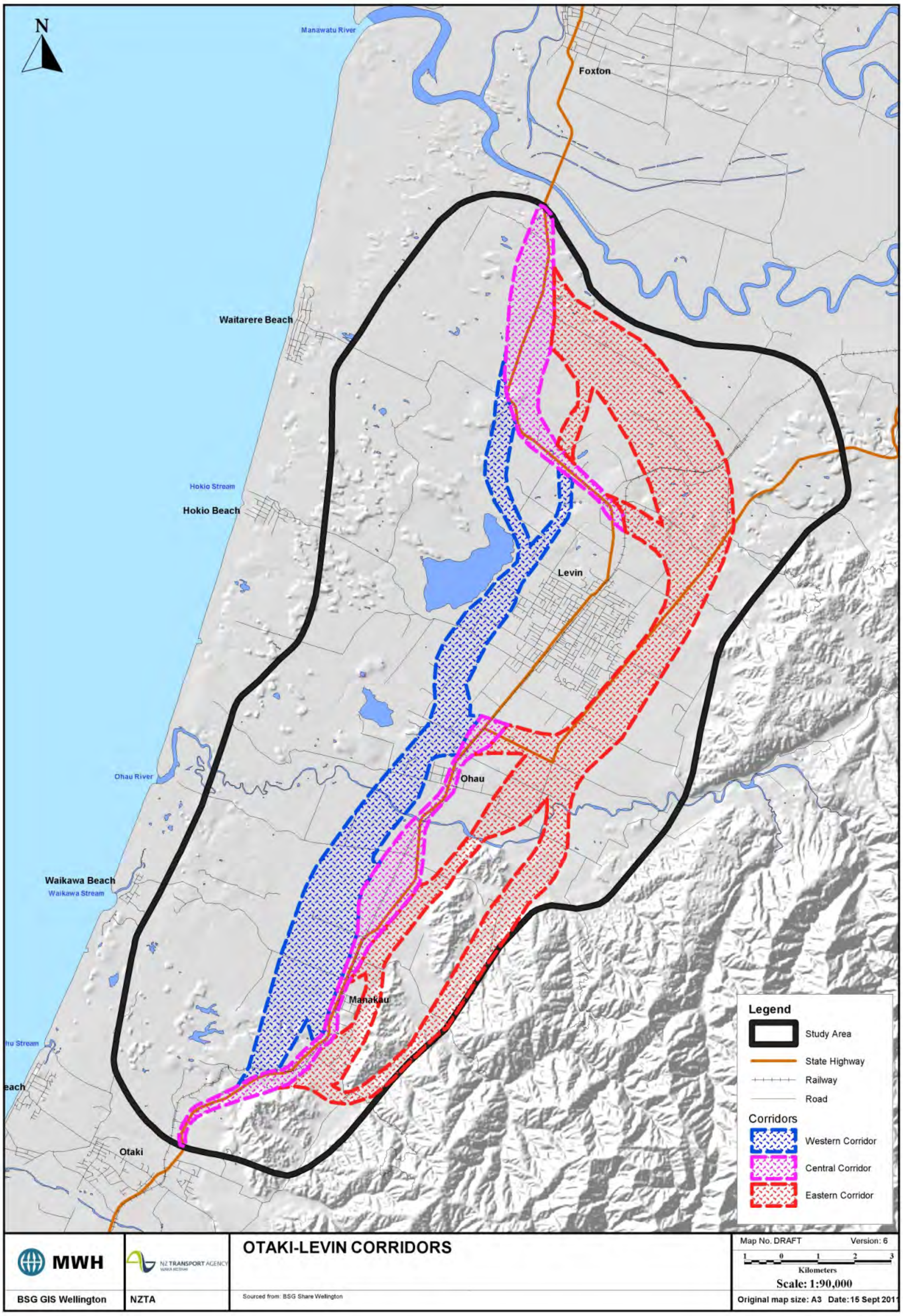


Figure 9-3: Corridors for Further Analysis in the Corridor Stage

Additional mapping was undertaken of specific land uses and dwellings in the corridors. These were identified from aerial photography and local knowledge (of the land uses), and mapped. These maps, along with other maps providing more details on specific items already mapped within and near to the corridors, are provided in Appendix F.

The ability to focus in on specific areas through the use of GIS mapping techniques and data projection, including overlaying on aerial photographs and illustrating features by means of photographs were essential tools in the Corridor evaluation process.

It was decided that the number of aspects to be applied in the analysis should be rationalised to between 10 and 12. This would provide for efficient application of the preferred (multi-criteria) analytical approach. The following list of aspects, along with descriptions of their scopes, was decided upon as:

- **Landscape values** – A broad assessment taking into account landscape/urban design quality and landscape absorption capability as identified from the earlier expert evaluation[18].
- **Ecological values** – This aspect combined terrestrial, wetland, riparian and aquatic ecology considerations such as habitat values, importance of ecosystems, presence of threatened or at-risk species and legally protected areas.
- **Archaeological and heritage values** – This included identified archaeological sites and localities of listed buildings and trees identified for protection.
- **Tāngata whenua values** – Areas of cultural significance including marae, urupa, waterways of cultural importance, wāhi tapu (to the extent known) and Māori owned land.
- **Dwellings in and near the corridor** – The number of residential buildings, as far as possible identified from aerial photographs.
- **Specific land uses** – This took into account areas with significant buildings or investments, and areas of community significance not already identified under other categories (such as major industries, major rural buildings, cemeteries, infrastructure, recreational facilities, quarries, and areas of lifestyle development).
- **District/Regional Plan fit** – This assessment included areas where consent difficulties could be anticipated, including areas of RMA section 6 importance (natural character, areas with habitat values, and waterways) and areas where multiple regional consents would be needed including areas with potential for major earthworks and stream crossings.
- **Geological constraints** – Including surface and sub-surface conditions, likelihood of settlement and liquefaction potential.
- **Flooding** – This took into account elevation and flooding potential, including proximity to rivers, swamps and typical ground water levels.
- **Contaminated sites** – The sites identified at Area Stage from the regional councils' registers, and from district councils.
- **Specific land ownership** – This included areas of Crown ownership, designated land, reserve land, council-owned land, and DOC and covenanted land, all of which hold some community significance and could pose some issues in acquisition

[18] A comprehensive landscape and visual assessment report had been prepared in the first stage of the Area analysis, which formed the basis for the three landscape-related Area Stage maps. See Ōtaki to North of Levin Landscape and Urban Design Area Phase Report, Isthmus

- **Constructability –** This identified construction difficulties, including those associated with terrain; obstructions and structures including the presence of railway lines, trunk utilities and physical constraints such as rivers and streams; along with the likelihood of having to build future structures as part of the expressway.

- **Alignment with Project Objectives** – An evaluation relating to the current version of the project objectives, developed from the NZTA's draft at the start of the Area Stage.

9.3 Commentary

The two types of reviews outlined in Sections 9.1 and 9.2 of this report are essential steps prior to the commencement of a comprehensive analysis of the corridors.

The first review "ground-truthed" and refined the draft corridors identified at the end of the Area Stage including extending the corridors in some areas but, most importantly, it considered the implications of taking an expressway through a closely textured and integrated urban area and excluded this option for reasons stated in a separate report (see Appendix E). It is noted that all those involved in the first Corridor Workshop agreed with this decision, and it was signed off by the NZTA's Regional Decision Making Team.

The second review – relating to identification of the aspects which would then be applied to the analysis of the corridors – was also significant, as it involved a number of considerations and information collection beyond that involved in the Area Stage. This demonstrates the need for increasing comprehensiveness of consideration of impacts and issues as the area within which a future expressway route might be located is narrowed down.

The level of detail at the Scoping stage is not sufficiently great to identify all the smaller constraints to the route options within the corridors. Expressway geometric constraints dictate that avoiding small 'no-go' areas that might not have been identified at the Scoping stage may require a wider corridor. In some areas, the number of constraints was small and there was no reason to restrict the corridor widths. The study team felt that wide corridors, very wide compared with the width needed for an expressway, should be identified wherever possible to allow flexibility at the Route Stage. At this stage, the level of detail of investigation is further enhanced as routes for the expressway are identified and analysed.

9.4 Corridor Analysis

This stage of the ACRE process involves evaluating the corridors and identifying one or more as preferred corridors within which a future expressway could be located. The Corridor Stage analysis and associated decisions must be made on the basis of a robust and defendable process.

To achieve this, the following were required:

- **Information** – This had to be comprehensive yet detailed enough to enable an evaluation of each corridor on the basis of the aspects particularly relevant to the RMA process. The information collection process described earlier in this report provides an appropriate level of information. As described later, additional information was obtained to enhance the analysis at a later stage.

- **Methodology** – This had to be acceptable and appropriate to withstand close examination through a designation or resource consent procedure where alternatives, including alternative corridors, would be considered[19].

[19] Sections 171(1)(b) and 174(4) of the RMA require that a territorial authority in making a recommendation, a Board of Inquiry in making a decision, and the Environment Court in determining an appeal, must have particular regard to 'alternative sites, routes or methods of undertaking the work' where a designation is on land in which the requiring authority does not have a sufficient interest to undertake the work, or where adverse effects are likely to be significant.

- **Process** – This had to be comprehensive and robust, and avoid any suggestions of bias or omission in the application of information, while recognising that the analysis was still based on relatively broad information.

The methodology, process, analysis and outcome are described in the following sections.

9.5 Corridor Analysis Methodology/Process

9.5.1 Analysis Process Overall

Because of the complexity of the corridors and the number and scope of aspects to be taken into account in identifying preferred corridors, it was recognised at an early stage that the analysis methodology would be complex. This was especially due to:

- the range of possible combinations of corridor sections which could be linked to achieve joined-up contiguous corridors[20];
- the scale of the corridors (over 30 km in length) and the variation that would be found amongst the criteria along the corridors; and
- the fact that one of the aspects to be included, the alignment with project objectives, could only be applied to the contiguous corridors.

Thus it was identified that a clear step-wise process would be involved, including the following steps:

1. Breaking down the corridors into sections that could ultimately be recombined into contiguous corridors.
2. Analysis of aspects in terms of each corridor section (except for the alignment with project objectives).
3. Analysis of the contiguous corridors in terms of alignment with project objectives to complete the analysis of aspects.
4. Combining the analysis of all aspects for each contiguous corridor.
5. Reviewing the findings and identifying the preferred corridor (or corridors) to proceed with the Route Stage.

How these steps were achieved is described further in the remainder of this report.

9.5.2 Multi-Criteria Analysis

Combining information about the diverse range of aspects relevant to the choice of a preferred corridor (or corridors) was undertaken through a multi-criteria analysis process.

Multi-criteria analysis is a recognised method to bringing together information to assist in identifying a preferred option, when a diverse range of aspects (or criteria) must be brought into the evaluation and these aspects include intangible values which cannot readily be translated into monetary terms. It requires application through a systematic method or process.

The method used to analyse the information for the Ōtaki to north of Levin expressway project applied multi-criteria analysis through a decision pool or decision conferencing technique[21]. This is a risk based approach and relies on combining the judgement of a group of relevant knowledgeable people (in this case planners; engineers; landscape architects; ecologists; project managers; cultural advisors and risk experts) who also have a reasonable level of familiarity with the project parameters.

[20] Contiguous corridors is the term applied throughout the analysis to a combination of corridor sections which could contain one or more continuous connected routes through the Study Area between the northern and the southern Area boundaries.

[21] As discussed for example in *Experts in Uncertainty: Opinion and Subjective Probability in Science*, Roger M Cooke, Oxford University Press, 1992. The method is similar to that used in value management system analysis and is recommended by the NAM (National Asset Managers) Group in New Zealand.

A typical method involves a facilitated workshop in two stages – the first part comprising presentation and discussion of information and the second part comprising elicitation of scores or values, prior to combining them in various ways. This process was followed.

The workshop process is usually followed by review, further analysis, and sensitivity analysis of the workshop findings.

9.5.3 Structured Workshop

A full day multi-criteria analysis workshop was organised and a preparatory paper including commentary on methodology was circulated in advance. The intention was that all participants would understand the process and be ready to engage in it from the start. Those invited were chosen because of their involvement in the overall project and/or their specific knowledge and skills. The individuals had varying degrees of knowledge and familiarity with the corridor areas.

As a preparatory stage, and to enable the application of the multi-criteria analysis, the corridors had been divided into sections to allow for future combinations of parts of corridors. There were 25 corridor sections, each of which was evaluated in terms of each of the aspects. Figure 9-4 shows how the corridors were divided to allow for effective re-combination.

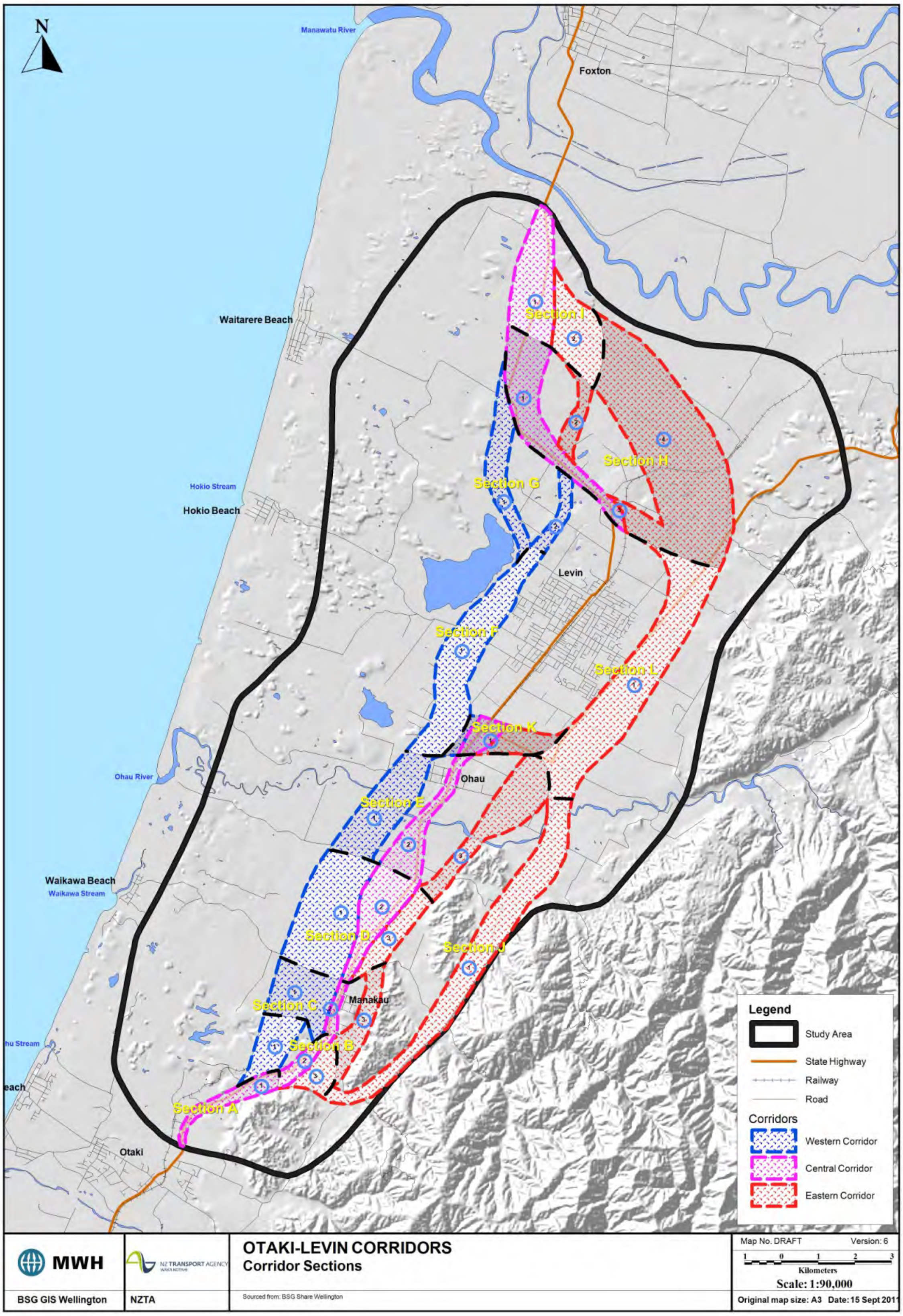


Figure 9-4: Corridor Sections used in the Analysis

Following preliminary discussion[22], each aspect was described and discussed by the presenter, identifying issues relating to each corridor section. This was followed by questions and discussion. GIS information was presented by two operators, allowing for ready access to all mapped information at whatever combination of information and scale was appropriate.

The workshop then proceeded to the evaluation stage, giving each section of each corridor (a total of 25 in all) a specific score for each aspect. Each aspect was evaluated for all corridor sections in turn. This was to encourage a balanced view of the relative merits of each corridor for each aspect before moving to the next aspect. To avoid patterning, the order of scoring corridor sections was varied each time a new aspect was evaluated.

The scoring schedule applied is shown in Table 9-1.

Table 9-1: Scoring Schedule used in Multi-Criteria Analysis

Score	Description
1	The corridor section presents few difficulties on the basis of the attribute being evaluated, taking into account reasonable mitigation proposals. There may be significant benefits in terms of the attribute.
2	The corridor section presents only minor areas of difficulties on the basis of the attribute being evaluated, taking into account reasonable mitigation proposals. There may be some benefits in terms of the attribute.
3	The corridor section presents some areas of reasonable difficulty in terms of the attribute 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 corridor section includes extensive areas of difficulty in terms of the attribute being evaluated, which outweigh perceived benefits. Mitigation is not readily achievable.
5	The corridor section includes extreme difficulties in terms of achieving the project on the basis of the attribute being evaluated. Mitigation will be difficult to achieve.

The workshop session completed the scoring process for all but four of the aspects.

A general commentary on the scoring outcomes for these aspects is given in Table 9-2 below. Generally, scoring was by consensus, but where there were differences of opinion, these were recorded for subsequent sensitivity testing.

[22] Which included an outline of the field review of the corridor areas, a discussion on the urban Levin parts of the Central Corridor (discussed in section 9.1 and Appendix E of this report), and a presentation on the multi-criteria analysis methodology to be applied.

Table 9-2: Commentary on Scores

Aspect	Comments
Landscape/Visual	The scores ranged from 1 to 5, with the sole 5 score being section F1, adjacent to Lake Horowhenua where landscape and visual values were identified as very high, and the ability to absorb an expressway in the landscape were considered to be low. Sections where scores of 4 were awarded were generally alongside State Highway 1 where there are numerous existing dwellings – even though landscape values may not be very high, the ability to absorb an expressway is low. Section J1 was, however, also awarded a 4 because of its remoteness and the landscape implications of a new expressway in the area. Areas which were open rural landscape of a working character with low settlement density and the ability to absorb an expressway were awarded a 1 or a 2.
Ecology	The scores ranged from 1 to 5, with the sole 5 score being section F1, adjacent to Lake Horowhenua, which contains part of a DOC listed site (Te Kowhai Bush) with a naturally vulnerable plant species present in part and the nationally significant margins of Lake Horowhenua, and which crosses a number of small streams with habitat for threatened fish species. Potential effects of an expressway in this area (from, e.g., runoff into the lake) were considered to be significant. Areas awarded a 4 had significant bush and/or wetland areas and /or presence of important species and (in the case of section J1) also crossed numerous small tributaries of Ohau River and Waikawa Stream, supporting a number of threatened fish species and possibly trout spawning habitat. The three areas scored as 1 were open farmland with little or no bush or wetland areas.
Archaeology/Heritage	No section scored a 5, and only two scored a 4, although archaeology has not yet been investigated in detail. These sections were around and north of Lake Horowhenua which have a high incidence of archaeological sites and several heritage buildings. The range and location of scores 1 to 3 reflect the known and likely occurrence of heritage and archaeological items.
Tāngata whenua values	The range of scores of 4 and 5 for this aspect generally reflect corridor sections containing or close to marae, urupa and Māori settlements. They tended to be north of Lake Horowhenua, or in the Manakau area. Section F1, adjacent to Lake Horowhenua, was awarded a score of 4 because of the importance of the lake margins and streams, and connectivity between the land and the lake. Elsewhere, Māori land ownership and important water resources influenced the scoring between 2 and 3, with no areas scoring 1. In part this reflects the widespread presence of multiple-owned parcels of Māori land.
Specific Land Uses	There were no scores of 5 for this aspect in the corridor sections. Only sections F1 and K1 scored a 4 – the former due to the presence of a number of important land uses (abattoir, wastewater treatment plant, natural gas station and lifestyle development near Ohau); the latter due to Kimberley, an agricultural institute and market garden retail outlets. Most sections scored 1, with those scoring 2 or 3 having the presence of other activities such as glass houses, timber yards, nurseries, or special agricultural production.
District Regional Plan Fit	Section F1 scored a 5 due to the complexity of regional consents needed close to Lake Horowhenua, and the proximity to housing areas and inclusion of recreational and other specialist zones and designations within the Horowhenua District Plan. All other sections were considered to score 3 or less, with the sections scoring 3 containing waterways, wetlands, patches of bush, and/or dwellings (including any heritage or other protected sites) or likely to involve areas of significant earthworks.

Geological Constraints	The one corridor section which scored a 5 was close to and north of Lake Horowhenua, section G1, with very high ground settlement expected. The several sections scoring 4 were found in either the northern or southern ends of the corridors, where much ground was soft and swampy with small lakes, or there were very soft ground conditions. Sections scoring 3 included areas close to rivers and/or areas with some ground which was soft and swampy and/or low-lying. The remainder of the sections were scored as 2, indicating that no areas are risk free in geological terms.
Flooding	Flooding aspects were scored between 1 and 4. The scores of 4 were awarded where rivers would need to be crossed and in areas of low topography and/or high groundwater, where there is known flooding potential. Scores of 1 were given where all land was more elevated and appeared to avoid risk from flooding from major streams/rivers. Scores of 2 and 3 represented relative risk of flooding, intermediate between sections scored as 1 and 4.
Constructability	The constructability scores varied between 2 and 5 (2 being the minimum possible because of the range of items combined under this aspect). Sections B2 and E2 were scored 5, largely because of the potential for complex river and rail crossings, with the sections scoring 4 having similar issues but of lesser significance. Areas scoring 2 posed few potential constructability difficulties, with those scoring 3 having some potential issues.

The aspects of Specific Land Ownership, Contaminated Sites and Dwellings In and Near the Corridor were considered able to be adequately assessed post-workshop, as they were able to be scored on the basis of numbers or areas, rather than on the basis of values and expert judgement. The final aspect, Alignment with Project Objectives, required a subsequent analysis as the basis of contiguous corridors, as discussed in Section 9.7.

In terms of these aspects:

- Specific land ownership involved a visual assessment of the extent of these mapped areas as they intruded with corridor sections. Only some of the corridor sections contained any such land and were scored 2 and 3 for small intrusions and 5 for section F1, which contained large areas of such land. The remainder of the sections were scored 1.

- There were only four corridor sections containing a contaminated site. On inspection, these were either remediated or had an entered in error notation from the original database. Thus the contaminated site aspect was removed from the evaluation framework, as it would not be material in the choice of a preferred corridor.

- The number of identified dwellings in and near the corridor had been counted and adjusted to a density basis per section integer, taking into account the area of each corridor section. The range was between 3 and 160[23], with all but one below 80. The section with the highest density was awarded a 5, with the other sections given scores between 1 and 4 on the basis of 20 integers (or density steps) within each score.

The overall scores identified as a result of the workshop and subsequent scoring processes are shown in Table 9-3.

[23] The score is proportional to density of dwellings per unit area.

Table 9-3: Scoring of Attributes by Corridor Section

Scenario / Option	Landscape / Visual	Ecology	Archaeology / Heritage	Tāngata Whenua Values	Dwellings in and near Corridor	Specific Land Uses	District / Regional Plan Fit	Geological Constraints	Flooding	Contaminated Sites	Specific Land Ownership	Constructability	Alignment with Project Objectives
Section A1	2	2	1	2	1	1	3	2	3		1	2	
Section B1	2	2	3	3	1	1	3	3	2		1	3	
Section B2	2	3	2	3	3	3	2	2	2		1	5	
Section B3	3	2	1	2	1	1	2	3	1		1	2	
Section C1	2	2	2	3	1	1	1	3	2		1	2	
Section C2	4	2	3	3	5	2	1	2	1		1	4	
Section C3	3	2	1	2	1	1	1	2	3		1	2	
Section D1	1	2	1	4	1	1	2	3	3		1	2	
Section D2	3	2	2	4	2	2	2	3	3		2	4	
Section D3	1	1	1	2	1	1	2	3	2		1	2	
Section E1	2	2	2	3	2	1	3	3	4		1	3	
Section E2	4	3	3	4	4	2	3	2	2		2	5	
Section E3	2	3	1	2	1	3	3	3	2		1	3	
Section F1	5	5	4	4	2	4	5	4	3		5	2	
Section G1	4	4	4	5	1	1	2	5	4		3	4	
Section G2	3	4	3	5	2	1	3	3	2		1	4	
Section H1	1	4	3	4	1	3	2	4	4		1	2	
Section H2	2	2	2	2	2	1	1	4	3		1	2	
Section H3	3	1	2	2	4	1	1	3	2		1	4	
Section H4	2	2	2	2	1	1	3	3	4		1	3	
Section I1	1	2	3	3	1	2	1	4	3		1	2	
Section I2	1	2	3	3	1	1	1	4	4		1	2	
Section J1	4	4	1	2	1	1	3	2	1		1	3	
Section K1	2	1	1	2	2	4	1	3	1		1	2	
Section L1	2	2	2	2	3	2	2	2	2		1	2	

Notes:

- Sections where a score of 1 was applied are shown as a green tone. These highlight corridor sections with little or no constraint in terms of the aspect.
- Sections where a score of 5 was applied are shown as a red tone and indicate potential constraints for any route within a contiguous corridor containing the section.
- The following were the situations where complete consensus was not achieved, giving alternative scores as follows:
    - Landscape / Visual – C3 could be a 4; J1 could be a 3
    - Ecology – E3 could be a 2
    - Archaeology / Heritage – L1 could be a 1
    - Tāngata Whenua Values – D1 could be a 5
    - Specific Land Uses – B2 could be a 2; L1 could be a 3
    - Flooding – H2 could be a 4; L1 could be a 1

  When examined later in the analysis, the alternative scores were found not to change the order of preference amongst the preferred options.

9.5.4 Weighting Systems

The workshop had scored the different aspects, but it was recognised that not all aspects should have the same weight in the analysis of preferences.

The workshop discussed the weighting and developed an agreed weighting system. This can be described as expressing the expert, or professionals' view of the relative importance of the different aspects in selecting the preferred corridors.

Following the workshop, alternative weighting systems were developed. These were focused on the Resource Management Act 1991 Part 2 considerations (the overall purpose and principles which require a balanced approach to use, development and protection, and enabling the community to achieve its social, economic and cultural wellbeing while ensuring environmental sustainability), the section 6 matters of national importance in the Resource Management Act, and the "four wellbeings" (social, environmental, cultural and economic) in the Local Government Act 2004.

These weightings are described below:

- Workshop Weighting – The maximum weight is placed on alignment with project objectives, tāngata whenua values, and the "proxy" for social impact (number of dwellings in the corridor). Some emphasis is also placed on archaeology and heritage, and specific land ownership.

- RMA Section 6 Emphasis (Matters of National Importance) – The maximum weight is placed on ecological and tāngata whenua values, followed by archaeology and heritage and landscape/visual impact (the latter two not given the maximum weight, acknowledging that no outstanding characteristics were found within the corridors). All other aspects are set at much lower weights.

- RMA Part 2 Emphasis (balanced) – More equable weighting across all aspects, reflecting the range of aspects that contribute to overall community wellbeing.

- Social Emphasis – highest weight placed on the number of dwellings as a proxy for social impact, with emphasis on other aspects that are likely to affect people and communities most directly. Other aspects that have a social component also given some, although less, weight.

- Environmental Emphasis – The most equal of all the weighting systems, recognising the broad definition of environment and how the physical environment's interaction with people and communities is expressed in all of the attributes.

- Cultural Emphasis – Highest weighting placed on tāngata whenua values, but also emphasising archaeology and heritage and ecological values, along with potential social impacts.

- Economic Emphasis – This placed greatest weight on alignment of project objectives, and aspects with potentially strong economic implications including specific land uses and number of dwellings in the corridor.

The weighting systems were to be applied to the scores from multi-criteria analysis once it was completed.[24] How the remaining aspect, consistency with project objectives, was integrated into the multi-criteria analysis is now addressed.

9.6 Identifying Contiguous Corridors

To complete the multi-criteria analysis, an assessment was undertaken of the corridors against the project objectives. As the project objectives include a strong focus on economic benefits, this can be

[24] While all seven weightings were used to narrow the range of options for further consideration, it was felt that the last four as listed above were also represented in the first three. Thus in the final analysis only the first three of these weighting systems were used.

undertaken only once there is a good understanding of the travel time benefits gained from an expressway. However; travel time benefits will vary depending on the location of the expressway.

Accordingly, combinations of sections were identified which could form contiguous corridors (see earlier description, footnote 20) to enable an assessment of the travel time implications. This was undertaken initially by looking at the number of section combinations available in four different areas as follows:

- The southern extent of SH1 within the project area to Queen Street west of Levin (i.e. a south western alignment)
- The southern extent of SH1 within the project area to Queen Street east of Levin (i.e. a south eastern alignment)
- Queen Street west of Levin to the northern extent of SH1 within the project area (i.e. a north western alignment)
- Queen Street east of Levin to the northern extent of SH1 within the project area (i.e. a north eastern alignment)

Each contiguous corridor would comprise a south-western and north-western combination or a south-eastern and north-eastern combination. Three potential section combinations were identified in the north-western and north-eastern areas and nine potential section combinations were identified in the south-western and south-eastern areas. These are presented in the table below.

Table 9-4 : Combinations of Sections

	Sections						
NE1	H1	H3	I1				
NE2	H2	H3	I1	I2			
NE3	H4	I1	I2				
NW1	G1	H1	I1				
NW2	H2	H1	I1				
NW3	G2	H2	I1	I2			
SE1	A1	B1	C1	D3	E3	L1	
SE2	A1	B2	C2	D3	E3	L1	
SE3	A1	B2	C3	D3	E3	L1	
SE4	A1	B3	J1	L1			
SE5	A1	B1	C1	D1	E1	K1	L1
SE6	A1	B1	C1	D2	E2	K1	L1
SE7	A1	B2	C1	D1	E1	K1	L1
SE8	A1	B2	C2	D2	E2	K1	L1
SE9	A1	B2	C3	D2	E2	K1	L1
SW1	A1	B1	C1	D1	E1	F1	
SW2	A1	B1	C1	D2	E2	F1	
SW3	A1	B2	C1	D1	E1	F1	
SW4	A1	B2	C2	D2	E2	F1	
SW5	A1	B2	C2	D3	E3	K1	F1
SW6	A1	B2	C3	D2	E2	F1	
SW7	A1	B2	C3	D3	E3	K1	F1
SW8	A1	B2	C3	D2	E1	F1	
SW9	A1	B3	J1	K1	F1		

In addition to the above list, consideration also had to be given on how a contiguous corridor would link to SH57. For those routes that traverse the east of Levin, these would connect directly. For those routes to the west of Levin each alignment needed to be assessed with a connection to SH57 south of Levin (i.e. similar to the existing SH1 / SH57 layout) and with a connection to SH57 north of Levin, as this would have an impact on the overall network travel time.

With all the above combinations of northern and southern corridors, a total of 81 contiguous corridor options were identified across the three main corridors (Eastern, Central and Western corridors).

9.7 Scoring the Aspect of Alignment with Project Objectives

The project objectives are currently expressed as follows:

- to provide a value for money proposal which will achieve the RoNS goals for this corridor of building a high quality expressway route between north of Ōtaki and north of Levin;
- to provide a better journey time Level of Service between north of Ōtaki and north of Levin;
- to reduce and progressively eliminate at-grade intersections between north of Ōtaki and north of Levin;
- to engage effectively with key stakeholders;
- to lodge Notices of Requirement and key resource consents with the appropriate consent authority by the 2012/13 financial year; and
- to improve safety on the route.

Of these, the objectives that are to engage effectively with key stakeholders, and to lodge statutory authorisations within a specified time frame are not objectives that would distinguish between options. Of the remaining objectives, these can basically be refined to three specific areas; cost, safety and journey time.

Costs cannot be accurately quantified at this stage, especially for each of the 81 contiguous corridors. However, this aspect is reflected somewhat in the multi-criteria analysis; in particular in the constructability aspect, but also in other aspects, as increased difficulty in these aspects (i.e. when scores of 4 and 5 are awarded) often results in increased cost (for example in mitigation or complex land purchase processes). The length of the contiguous corridors will also have an impact on the cost and this is reflected by the number of vehicle kilometres travelled (vkt) calculation used for journey time (see below).

Safety needs to be considered in more detail later in the project development, but due to the level of detail, cannot be used to distinguish between contiguous corridors at this stage. The current assumption that the whole project will ultimately be developed as an expressway with grade separated interchanges, including any routes in the direction of the current SH57[25] means that all options will result in significantly fewer and less severe crashes.

Journey time is an aspect that can be quantified at this stage. To do this, estimates were made of the length of travel via expressway and the number of vehicles that would be undertaking these journeys. This is expressed as the number of vehicle kilometres travelled (vkt). The vkt calculation takes account on traffic travelling on SH1 and SH57 both north and south of Levin, assuming origins and destinations either outside the study area or within the Levin urban area, and the same volume of traffic being attracted to the expressway under each of the 81 scenarios. Accordingly, the contiguous corridor that delivers the least vkt as part of the combined total network would operate the most effectively in terms of total journey time.

In summary, vkt is the only aspect which can be quantified at this stage and is the only variable used to score each alignment section against project objectives. It encompasses the length of each alignment section, which is broadly proportional to cost.

9.8 Completing the MCA analysis

The contiguous corridors were scored on a scale of 1 to 5 for their consistency with project objectives. The contiguous corridor with the lowest vkt was given a score of 1 and the highest vkt given a 5 with the remainder given a score rounded to the nearest 0.5.

The scores for the other aspects, which were originally assigned by the workshop for each section were averaged to give a score for each contiguous corridor; i.e. the landscape / visual scores for A1, B1, C1,

[25] The consideration of the needs of traffic on both SH1 and SH57 was confirmed by NZTA's Regional Decision Making Team at their meeting on 22 June 2011

D3, E3, L1, H1, H3 and I1 were averaged to give an overall landscape / visual score for the contiguous corridor 55 which comprises NE1 and SE1. The average scores for each aspect were then combined to give an overall numeric ranking for the contiguous corridor. This was undertaken for all criteria and all contiguous corridors in the analysis.

As described earlier, a number of weighting systems were to be used in the analysis. The best ten contiguous corridors for each of the seven weighting systems were then brought forward for further consideration. This resulted in 21 contiguous corridors[26]; the majority of which were to the east of Levin. At this stage, a further workshop was held with key members of the NZTA and the consultant team to confirm the process used to date, and to further reduce the number of options[27].

At this workshop it was decided to bring forward ten eastern contiguous corridors and three western contiguous corridors. Whilst it was acknowledged that the eastern contiguous corridors were found to be generally preferred through the analysis, it was considered important to retain some western contiguous corridors as these perform well in the assessment against project objectives.

To obtain these 13 contiguous corridors, each was ranked under each of three weighting systems; the weighting system agreed to at the first corridor workshop and the weighting systems which take cognisance of the RMA Section 6 and the RMA Part 2.

The contiguous corridors which ranked the best under these weighting systems and their rank at this stage of the analysis (out of the original 81), are shown in the table below:

Table 9-5 : Contiguous Corridors for Further Analysis

Contiguous Corridor	19	21	46	55	64	65	66	67	68	73	75	76	77
Northern	NW3	NW3	NW3	NE1	NE2	NE2	NE2	NE2	NE2	NE3	NE3	NE3	NE3
Southern	SW1	SW3	SW1	SE1	SE1	SE2	SE3	SE4	SE5	SE1	SE3	SE4	SE5
SH57 link	Sth	Sth	Nth										
MCA Rank	17	24	21	6	1=	8=	3	5	7	1=	4	8=	10

Plans of these contiguous corridors are shown in Appendix J.

9.9 Commentary

The Project Team was mindful of the need to be both systematic and rigorous in its selection and ranking of the corridors. The Area analysis had yielded 85 possible corridors and the team was anxious to use a rational methodology to reduce this to a manageable number.

The Multi-Criteria Analysis is an accepted methodology for weighing the merits of what may be conflicting criteria. The participants at the MCA Workshop were drawn from the broader Project Team and were considered to be expert in one or more of the criteria being considered. None of the contiguous corridors selected for further analysis was free of difficulty and the scores for the best ranked routes were similar. Thus there was no clearly preferred contiguous corridor.

The analysis showed a preference for the eastern contiguous corridors. This is consistent with more recent thinking on the location of a Levin by-pass (see Section 4.10), but the eastern routes may not be economically optimal. Accordingly, the three highest ranked western corridors were included for further consideration.

[26] Note that the preferred 10 contiguous corridors identified across the seven weighting systems which had been applied frequently involved the same corridors sections.
[27] Optimal Route Multiple Criteria Assessment Workshop, 28 July 2011 at MWH Wellington

10 Contiguous Corridors to Short List Options

The NZTA and the project team agreed that 13 contiguous corridors would be too many to take forward for analysis in a scheme assessment. Accordingly, an additional analysis process was required to reduce the number of corridors to a more manageable short list.

Further information was needed for the short-listing process, particularly relating to costs and benefits. To provide this information, indicative routes needed to be identified within all 13 corridors. These indicative routes were identified using conceptual alignment software.

10.1 Indicative Routes

The Trimble Quantm software was used to undertake route identification (horizontal and vertical alignment) by generating 3D corridors and alignments. Its route identification technology can generate millions of alternative alignments and returns the lowest cost options as preferred routes.

For the Ōtaki to north of Levin expressway project, 20m contour data and the constraint data that were collected in the Area phase were input into the software along with the boundaries of the contiguous corridors, unit cost data and design parameters commensurate with the assumptions reported in the Preliminary Design Philosophy Statement (see Section 12) and construction costs (see Section 13.1). These data were used to generate alignments and return the optimum route alignment options based on the limited data that were available at this stage.

It must be noted that as all constraint data have not yet been identified (e.g. individual houses and property boundaries) and that full survey information has not been collected, the alignments identified may not be the same as the alignments that will be identified once this additional information is collected analysed and further design undertaken. Nevertheless, the alignments returned at this stage provide an indicative optimum route within each contiguous corridor for which cost estimates and transportation modelling can be undertaken to enable comparison between contiguous corridors.

The alignments generated are shown in Appendix K.

10.2 Interchange Assumptions

No attempt has been made to determine the most appropriate location or form of interchanges. However, one potential configuration option needed to be developed at this stage to enable costs to be assessed and the traffic model to be run.[28]

As the routes are being compared to one another, the assumptions used at this stage are not important, it is only important that the same assumptions are applied to all options.

The current assumptions are presented in the Design Philosophy Statement in Section 12.3.2.

For both sets of options, local road overbridges or underpasses were assumed to be needed (as necessary) to enable connection of existing roads to the local road network.[29]

The number and length of service road needed has been ignored at this stage as no consideration has yet been given to individual properties as the exact alignment still needs to be identified.

[28] A decision on the configuration of interchanges and local road treatment would be made during the scheme assessment report after consideration of alternative locations, different types of interchanges and options for local road network integration.

[29] The number and length of service roads needed has been ignored (but not forgotten) at this stage as the exact alignment has not been identified.

10.3 Short List Criteria

Four aspects were considered at an additional workshop[30] held with the NZTA and project team members to select the options to progress further.

- MCA outputs.
- Cost.
- Number of houses affected.
- Transport model outputs.

Apart from the MCA outputs, these aspects are ones which were developed in more detail after the MCA stage. These are described below.

10.3.1 MCA outputs

For each of the 13 contiguous corridors, the MCA rank was reported along with the number of 4s and 5s (i.e. sections that rated very poorly in terms of a particular aspect – see Table 9-3) that were identified during the original analysis. The number of scores of 4 and 5 was considered important as it indicates the number of potentially significant impacts on the environment, cultural values, properties and construction cost. These figures are usually concealed when considering the multi-criteria analysis score or rank overall, but may be quite significant and material in the overall decision as to preference.

Table 10-1 : MCA rank and number of poor ratings per contiguous corridor

Contiguous Corridor	MCA		
	Rank	4s	5s
19	11	11	5
21	13	11	6
46	12	11	5
55	6	7	0
64	2	6	0
65	9	8	2
66	3	6	1
67	5	8	0
68	7	8	0
73	1	4	0
75	4	4	1
76	8	6	0
77	10	7	0

10.3.2 Cost

Whilst no elemental cost estimates were prepared at this stage, a number of inputs were used to determine the likely differences in cost between the options. The costs of the following elements were considered:

- Alignment – costs from Quantm were used for this aspect, although it is noted that this includes only the road carriageway and bridges. It does not take into account service roads, cycle facilities or road furniture.
- Culverts –additional costs were added for installing culverts across the alignment.
- Interchanges – indicative costs were developed for a typical full interchange, a typical half interchange and a local road overbridge.

[30] Optimal Route Multiple Criteria Assessment Workshop, 25 August 2011 at MWH Wellington

- Property – unit rates were applied to the peri-urban and rural land through which the alignment would run. For this exercise a 100 m corridor was assumed.
- Upgrading SH57 – an additional cost was included to account for the cost of upgrading SH57 to expressway standard to a point north of Levin. This is required for only the contiguous corridors that run west of Levin.

As the costs for the indicative routes were not based on elemental costs, their absolute value was not reported. Instead, an index was produced which gave the cheapest contiguous corridor a value of one and all other options were given a number which reflected how much more expensive they were; for example an option with a cost of 20 % more than the cheapest option was given an index of 1.20.

Table 10-2 : Cost index and rank per contiguous corridor

Contiguous Corridor	Cost	
	Index	Rank
19	1.40	12
21	1.48	13
46	1.15	9
55	1.08	5
64	1.08	4
65	1.11	6
66	1.04	2
67	1.16	10
68	1.17	11
73	1.04	3
75	1.00	1
76	1.12	7
77	1.13	8

10.3.3 Number of houses affected

The indicative alignments were widened to a nominal 200 m and applied to aerial photography to estimate the number of dwellings that may be directly affected by an expressway[31].

It is noted that this figure will be an over-estimate, as the overall corridor will generally not exceed 100 m, and for much of the distance may just be the width of the expressway itself, which is closer to 50 m. In addition, when the project team is considering route alignments in the scheme assessment stage, these dwellings will be taken into consideration and opportunities taken to reduce the number of dwellings affected wherever possible.

[31] Note – this is a different estimate from the overall estimate of number of dwellings in a corridor section as it looks at a 200m wide corridor rather than the entire section. This aspect does, to a certain extent, double-count information already in the multi-criteria analysis, meaning that social impacts are potentially over-emphasised.

Table 10-3 : Number of houses affected per contiguous corridor

Contiguous Corridor	Potential Houses Affected	
	Number	Rank
19	74	3
21	135	13
46	74	3
55	91	6
64	95	8
65	131	12
66	110	10
67	91	6
68	123	11
73	70	2
75	85	5
76	66	1
77	98	9

10.3.4 Transport Modelling

Due to the stage of project development, the transport model had not been fully calibrated and validated at the time of this exercise. However, the base network had been coded and travel demand matrices developed for the 2026 AM peak period. Accordingly, this year/period was used to determine the comparative differences between the contiguous corridors.

Each corridor was coded based on the length of the alignment and the interchange assumptions. The SATURN model was run with these new networks in place and the outputs collated. In accordance with the NZTA's Economic Evaluation Manual, the outputs of transient queues, over-capacity queues, link free flow time and link delays were used to calculate travel time costs (TTC). Vehicle operating costs (VOC) were calculated from fuel consumption. These were then combined to give an index of model outputs.

Table 10-4 : Model outputs per contiguous corridor

Contiguous Corridor	Travel Time and Vehicle Operating Costs	
	Index	Rank
19	1.02	2
21	1.03	3
46	1.00	1
55	1.23	12
64	1.23	11
65	1.11	6
66	1.15	9
67	1.12	8
68	1.23	13
73	1.09	4
75	1.11	5
76	1.11	7
77	1.16	10

10.4 Option Short List

The following table summarises the information collated and used to determine the contiguous corridors to carry through to the scheme assessment.

Table 10-5: Short List Evaluation

Contiguous Corridor				MCA Rank	MCA 4s	MCA 5s	Cost Index	Cost Rank	Houses (200m corridor) Number	Houses Rank	Transport Model (TTC and VOC) Index	Transport Model Rank
19	NW3	SW1	Sth	11	11	5	1.40	12	74	3	1.02	2
21	NW3	SW3	Sth	13	11	6	1.48	13	135	13	1.03	3
46	NW3	SW1	Nth	12	11	5	1.15	9	74	3	1.00	1
55	NE1	SE1		6	7	0	1.08	5	91	6	1.23	12
64	NE2	SE1		2	6	0	1.08	4	95	8	1.23	11
65	NE2	SE2		9	8	2	1.11	6	131	12	1.11	6
66	NE2	SE3		3	6	1	1.04	2	110	10	1.15	9
68	NE2	SE5		7	8	0	1.17	11	123	11	1.23	13
73	NE3	SE1		1	4	0	1.04	3	70	2	1.09	4
75	NE3	SE3		4	4	1	1.00	1	85	5	1.11	5
77	NE3	SE5		10	7	0	1.13	8	98	9	1.16	10
67	NE2	SE4		5	8	0	1.16	10	91	6	1.12	8
76	NE3	SE4		8	6	0	1.12	7	66	1	1.11	7

Notes: MCA rank in this table is the rank out of the 13 options. The overall rank of each contiguous corridor out of the 81 options is given in Table 9-5.
Maps of the contiguous corridors are shown in Appendix J.

The contiguous corridor options have been divided into three groups in the table above; the first three options are all corridors that traverse the Study Area to the west of Levin; the middle eight options are all eastern options that pass either east or west of the settlement of Manakau; the lower two options are also eastern options but these run up a remote valley behind a small hill range to the east of Manakau. The lightest colour shading highlights the most favoured options under all columns.

Based on the information presented above, the workshop participants identified four options for further evaluation for the routing of an expressway at the Route stage (or scheme assessment stage). These were:

- Contiguous Corridor 64
- Contiguous Corridor 66
- Contiguous Corridor 73
- Contiguous Corridor 75

These are the first four under the multi-criteria analysis. They have no, or a small number of aspects where a 4 or 5 was scored (representing potentially significant effects or degree of consenting difficulty). In terms of cost, they also are the four lowest, although in a different order. In terms of number of houses potentially affected, they include the lowest and one of the higher options[32]. They do not perform generally amongst the best in terms of the transport model, where the lesser distance of the western route options would be preferred.

Despite the decision not to proceed further with the other options, some may appear attractive for one or more reasons. It was decided to specifically document the reasons why two of these corridor options are not recommended to be taken further. This explanation is expected to become part of the material for public consultation in the Route Stage. The two options to be addressed in this way are contiguous corridors 46 and 76. All six corridors are discussed further in the next section and are carried forward into the assessment to enable a similar level of detail to be provided during public consultation.

[32] Investigation of the extent to which a specific route in a corridor could avoid or mitigate effects on dwellings is a task for the Route Stage in the ACRE model.

10.5 Short List Commentary

The study team consider that the four contiguous corridors identified through this process are reasonable and appropriate and represent the best corridors for a new expressway. Individual maps with the short listed contiguous corridors and the indicative routes within them are presented in Appendix L.

The prevalence of eastern routes over western ones is consistent with the more recent reports undertaken on options in this area and represents the increased awareness of the social, cultural, historical and environmental impacts of an expressway between Levin and Lake Horowhenua.

The absence of a route that follows the existing SH1 is also rational. This is because typical cross-sections developed for the study were up to around 100 metres wide, compared to the present highway which is about 20 metres wide. Widening is constrained by the railway, which runs parallel to the road over long lengths of the highway through and south of Levin, and by existing properties and businesses. Similarly, the option of a possible route through the centre of Levin is flawed. The impact of a four lane grade separated expressway through the centre of a small town was considered unacceptable on the grounds of the detrimental effects on businesses and property, social severance, noise, pollution and urban design. An additional consideration was the likely cost of such a route.

Stepping away from the MCA analysis procedure, the study team are confident that, of the eastern routes identified, the four eastern options that remain represent the options that have the potential to create the most direct, and therefore economically beneficial, route with the least number of serious adverse effects.

These four short listed contiguous corridors are shown together in Figure 10-1, along with the two corridors which are not preferred. All six corridors are described in greater detail in Section 11.

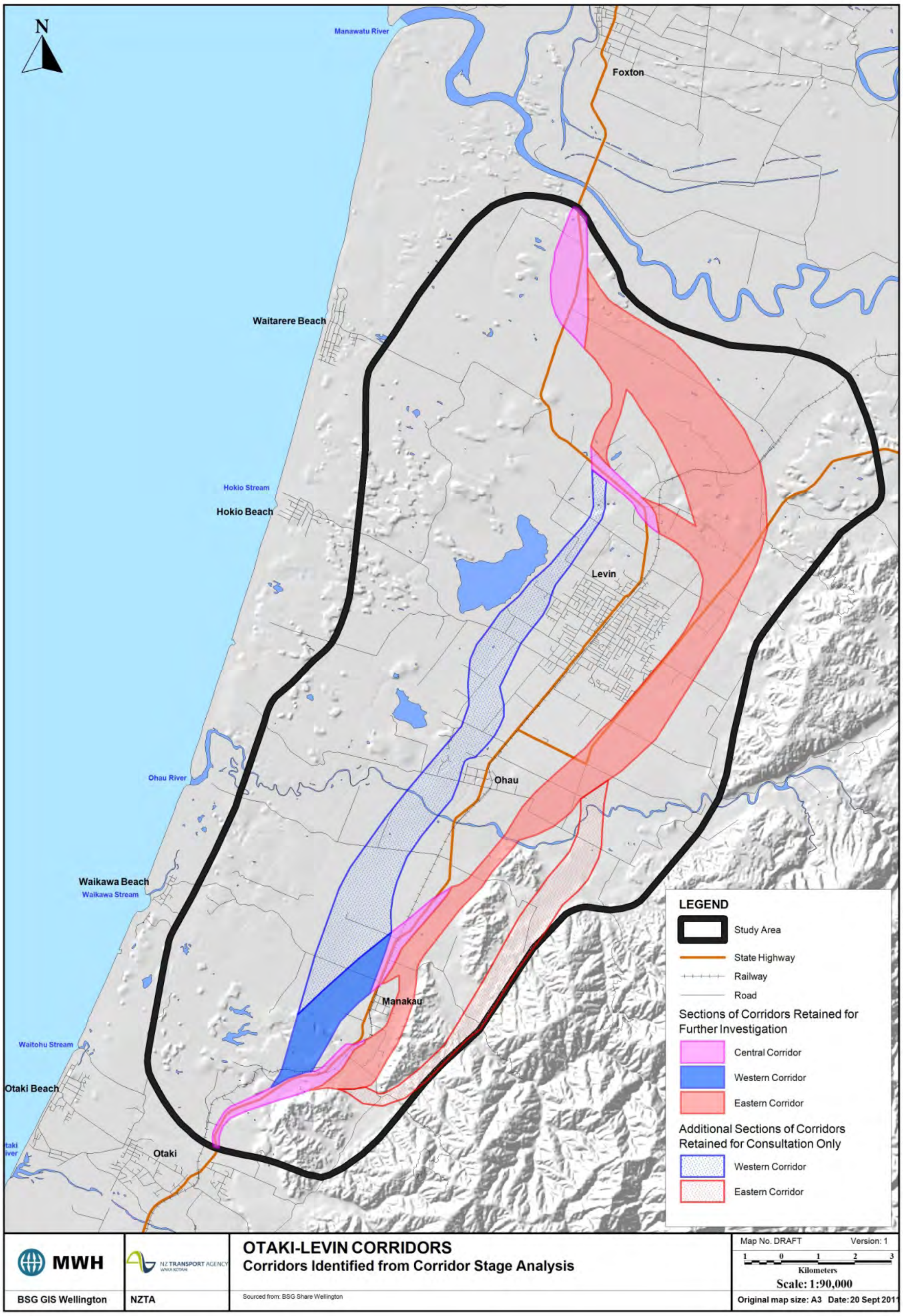


Figure 10-1: Corridors Identified from Corridor Stage Analysis

11 Short Listed Options

An outline of the short listed contiguous corridors is presented below to complement the maps provided in Appendix L.

11.1 Contiguous Corridor 64

This corridor commences at the northern termination of the Peka Peka to Ōtaki section of the Wellington RoNS. This is expected to be on or close to the alignment of the current SH1 at Taylors Road. The corridor width in this location is narrow. In the vicinity of Forest Lakes Road the corridor deviates northbound away from the existing state highway, crossing the North Island Main Trunk Railway Line (NIMT), to travel to the west of Pukehou. From here the corridor width is relatively wide as it continues to the west of SH1 and Manakau. North of Manakau the corridor turns north easterly crossing the NIMT and SH1 before continuing north to the east of Kuku. The corridor runs adjacent to the foothills, crossing the Ohau River in the vicinity of the existing quarry and continuing past Ohau towards SH57 Arapaepae Road.

The corridor runs parallel to Arapaepae Road, including the existing highway and a wide area to the east. This continues past Levin to the vicinity of Roslyn Road where the corridor turns towards the west before crossing the NIMT and roughly following the alignment of the current SH1 between Heatherlea East Road and Te Whanga Road. At this location, the corridor again moves away from the existing highway heading north towards Koputaroa Road and swinging back to the north west to meet SH1 south of the Manawatu River. The corridor is relatively narrow throughout this section but widens again on its approach to re-join SH1.

The indicative alignment investigated in this Scoping Report shows one of many possible routes through this corridor including a half interchange south of Manakau, linking to an upgraded Forest Lakes Road. This would cater for northbound expressway traffic wanting to access the towns of Manakau and Ohau and for southbound local traffic wanting access to the expressway for destinations to the south. A full interchange would be located at Queen Street East to provide for access into Levin and to an upgraded SH57. The integrity of the local road network would be retained by providing local road crossings of the expressway and new service roads where required.

11.2 Contiguous Corridor 66

From Taylors Road, this corridor roughly follows the existing alignment of the current state highway until south of Pukehou where it deviates to the east of Manakau, between the township and the foothills, before continuing north to the east of the current state highway and railway corridors.

This corridor then follows the same broad line as Contiguous Corridor 64 passing east of Levin then deviating towards the existing SH1 between Heatherlea East Road and Te Whanga Road before heading north again to re-join SH1 south of the Manawatu River.

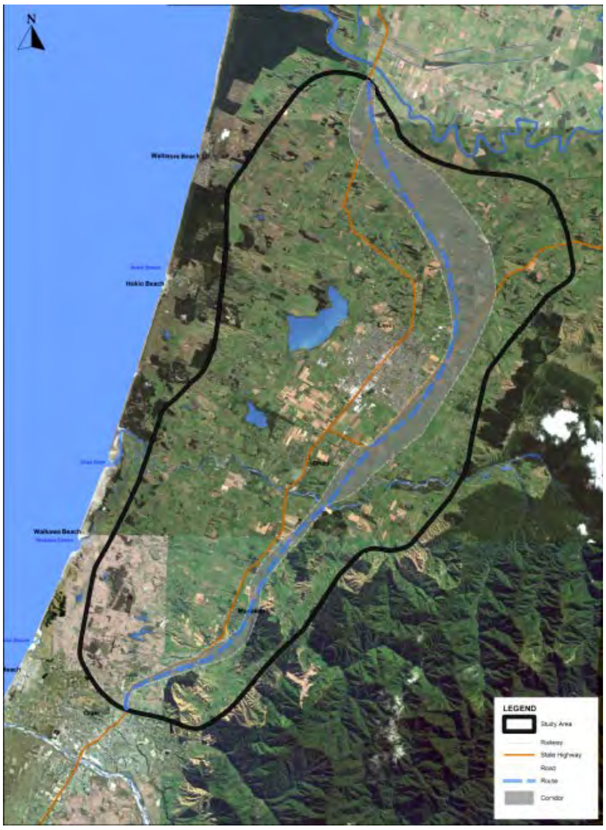
The indicative alignment for this corridor also includes a half interchange south of Manakau, but in this case linking to South Manakau Road, and a full interchange at Queen Street East, as included in contiguous corridor 64. Local road crossings and service roads would also be provided where necessary to preserve the integrity of the local road network.

11.3 Contiguous Corridor 73

This corridor follows the same line as Contiguous Corridor 64 between Taylors Road and Queen Street East. However, this corridor gently curves to the northwest from Roslyn Road through a wide corridor allowing multiple alignment options to be investigated. The corridor curves around to broadly follow the alignment of Koputaroa Road before joining up with the existing SH1 south of the Manawatu River.

The indicative alignment for this corridor includes the same interchange assumptions and local road crossings as Contiguous Corridor 64.

11.4 Contiguous Corridor 75



This corridor includes the southern part of contiguous corridor 66 and the northern part of contiguous corridor 73. It therefore runs to the east of Manakau, to the east of Levin, and gently curves west to join the existing state highway to the south of the Manawatu River.

The indicative alignment for this corridor includes the same interchange assumptions and local road crossings as Contiguous Corridor 66.

11.5 Other Corridors

The initial screening identified 81 corridors within which a future expressway could be located. The MCA ranked the 81 identified options based on a number of criteria and a “top 13” of the 81 were identified. Further analysis identified the four corridors most likely to be viable; these are described above. As presented in the previous chapter, two other options will continue to be developed further to enable a similar level of detail to be to be provided for these during public consultation. These comprise a western corridor and a far eastern corridor.

11.5.1 Contiguous Corridor 46

This is the westernmost corridor which, like contiguous corridor 64, deviates away from the existing state highway in the vicinity of Forest Lakes Road. It then continues north, within a relatively wide strip, west of Manakau and Ohau and east of Lake Papaitonga. The corridor then traverses the narrow gap between urban Levin and Lake Horowhenua, passing close to the wastewater treatment facilities, Donnelly Park and Lake Horowhenua Domain. Once past the Lake, the corridor continues north to cross the existing state highway near Te Whanga Road and utilising the same broad line as contiguous corridors 64 and 66 to meet up with SH1 south of the Manawatu River.

The indicative alignment for this corridor includes a half interchange at Forest Lakes Road and a full interchange at Queen Street (West). This corridor would also require a new link from the expressway to SH57. To this end another interchange would need to be provided north of Levin at the point where the expressway and the existing SH1 would cross. A new expressway link would be constructed broadly following the alignment of the existing SH1 and Heatherlea East Road before joining SH57.

Contiguous Corridor 73

11.5.2 Contiguous Corridor 76

This is the easternmost corridor. This corridor deviates away from the existing State Highway south of Pukehou but continues east to link up with a small valley running behind a set of foothills east of Manakau and Kuku. This valley traverses relatively mountainous terrain, but does have the advantage of being located away from settlements. The corridor emerges from this valley to cross the Ohau River and link into the corridor running east of Levin. The extent of the corridor north of this point is the same as contiguous corridors 73 and 75.

The indicative alignment for this corridor includes a half interchange south of Manakau and a full interchange at Queen Street East

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12 Preliminary Design Philosophy Statement

The preliminary design philosophy statement has been prepared to meet the project objectives by identifying the standards required for a four-lane expressway with appropriate connections to the adjoining network. It will be subject to change and re-scoping as the project progresses.

The design will provide a road environment and improved geometry that is consistent with the RoNS standards, other relevant standards and the adjoining RoNS projects on State Highway 1.

It is intended that all features such as barriers, stormwater treatment, utility relocation/placement, street lighting, landscaping, surfacing and signage will be consistent with the other expressway projects within the Wellington Northern Corridor.

Consultation is important to ensure the successful delivery of this project. Should disagreement occur between the project objectives and the key stakeholders over a design component, MWH will report to the NZTA with suggested solutions and assist with resolution as required. Similarly, if RoNS guidelines cannot be met, early identification and discussion with the NZTA will be undertaken.

12.1 Scoping Report Approach to Design

Given the ACRE process being used for this project, it was agreed with NZTA that the Scoping Report will consider indicative alignments within the wider corridors based on the conceptual alignment software Quantm. During the scheme assessment stage, further work will be done to identify and analyse routes using traditional methods, using Quantm as a basis.

12.2 Design Standards/Manuals, Guidelines and the Best Practice Design Methods

12.2.1 Standards Used

The indicative routes presented in this Scoping Report have been prepared in accordance with the NZTA document "RoNS Design Standards and Guidelines" (RoNS Guidelines). However as the design progresses the following additional standards and requirements will be considered and applied where appropriate:

- NZTA standard specifications and publications;
- Austroads publications including New Zealand supplements;
- Kapiti Coast District Council Subdivision and Development Principles and Requirements;
- Horowhenua District Council: Minimum Engineering Standards, Section 6 Roading and Traffic
- Horizons Regional Plan;
- Greater Wellington Regional Plan;
- The Building Act;
- Health and Safety in Employment Act;
- Resource Management Act;
- New Zealand Standards (NZS);
- KiwiRail Standards and Guidelines

Major specific components will be designed in accordance with the following:

- Geometric design - NZTA Standards, Guidelines and Manuals including the RoNS Standards and Guidelines and supplemented with the following Austroads guidelines where needed.
  - o Guide to Road Design Part 3: Geometric Design.
  - o Guide to Road Design Part 4: Intersections and Crossings – General.
  - o Guide to Road Design Part 4: Intersections and Crossings – General.
  - o Guide to Road Design Part 4a: Unsignalised and Signalised Intersections.
  - o Guide to Road Design Part 4b: Roundabouts.
  - o Guide to Road Design Part 4c: Interchanges.

- Guide to Road Design Part 6; Roadside Design, Safety and Barriers.
- Guide to Road Design Part 6a; Pedestrian and Cycle Paths.
- Guide to Road Design Part 6b; Roadside Environment.
- Cycling aspects of Austroads Guides.

- Urban design – NZTA Urban Design Professional Services Guide; Beyond the Pavement - RTA Urban and Regional Design Practice Notes.
- Earthworks - NZTA Standard Specifications and New Zealand Standards.
- Pavement design - Austroads Pavement Technology Part 2: Pavement Structural Design 2010 and the 2007 New Zealand Supplement to Austroads Pavement Design Guide.
- Surfacing – NZTA Chipsealing in New Zealand, NZTA Chipsealing and AC specifications
- Drainage - NZTA Standard Specifications; Australia/New Zealand Standards; NRB Highway Surface Drainage Manual;
- Culverts, Structures (bridges and retaining) - NZTA Bridge Manual.
- Safety barriers - NZTA Standard Specifications and New Zealand Standards.
- Traffic signs and road markings - NZTA Manual of Traffic Signs and Markings (MOTSAM) specifically Traffic Control Devices Manual Part10" Motorways and Expressways.
- Accommodation works - property agreements as advised by The Property Group.
- Landscaping - NZTA Guidelines for Highway Landscaping.
- Noise and Air Quality– Standards outlined in NZTA's Environmental Policy manual, Guidelines for the Management of Road Traffic Noise, and local authority standards
- Traffic Management – NZTA Code of practice for temporary traffic management (COPTTM)

12.2.2 Departures from Standards

At this stage of the investigation the design in its current form does not require departures from standards and/or best practice.

Departures from standards or best practice, if any, will be referred to the NZTA for resolution locally or at National Office as required.

12.3 Expressway

Depending on the scheme assessment investigations, the proposed expressway would be between 29 and 33 km long and will be designed as a divided four lane facility i.e. two lanes northbound and two lanes southbound. Access to the local road network will be provided by grade separated interchanges at locations yet to be determined.

The speed environment for the proposed expressway is 120 km/h and this is consistent with the 110 km/h absolute minimum design speed (as per RoNS Guidelines) for expressway. The posted legal speed limit will be 100 km/h.

12.3.1 Expressway Geometrics

Horizontal Geometry

The RoNS Guidelines propose an absolute minimum design speed of 110 km/h and minimum horizontal radius of 720 m. The horizontal geometry of the indicative routes has been drawn by hand on aerial photographs. To ensure compliance with the minimum standard and to allow for the inherent inaccuracies in the method used, a minimum radius of 750 m was adopted; however, this will be reassessed and adjusted as required in the preliminary design.

In addition, the horizontal alignment will be designed with a maximum warp rate of 2.5 % per second.

Vertical Geometry

The vertical alignment will be designed in accordance with RoNS Guidelines, with maximum vertical gradients of 6 %, minimum crest curve K values of 160 minimum sag curve K values of 81.

This may be further refined later in the investigation and preliminary design.

Expressway Cross-section

The expressway will consist of the following elements:

- Four traffic lanes each 3.5m wide (two in each direction).
- Central median width to be consistent with the other expressway sections of the Northern Corridor and confirmed prior to preliminary design. The RoNS Guidelines currently propose a 7.0m wide central median (9.0m between edge lines) although it is understood that other sections are proposing narrower medians. Within the central median area a TL-4 wire rope safety barrier is required. Refer to drainage and minimum radii requirements of narrow medians in Section 12.3.8
- 1m sealed shoulder adjacent to the central median.
- 2.5m outer sealed shoulders including feather edge slopes (increased to 3.0m where safety barrier is proposed).
- The feather edge will be a slope of 6H:1V.
- Batter slopes in cut will generally range from 3H:1V to 4H:1V but may be increased to 2H:1V depending on the surrounding environment. For low cuts, flatter slopes will be incorporated.
- Batter slopes in fill will generally vary from between 3H:1V to 4H:1V or flatter on low fills.
- A clear zone of 9.0m will be provided either side of the expressway or guardrail will be installed.
- The measures to provide for pedestrians and cyclists are yet to be determined; this could be within the expressway corridor or a parallel facility provided on the local roads and access roads.

Generally, the crossfall of the expressway will slope at 3 % towards the swale drains located next to the outside feathered edge and unsealed shoulder on either side of the divided carriageway. Where superelevation occurs along horizontal curves, crossfall on the outside two lanes of the curve will dip towards the central median swale, which will be subject to specific design.

The superelevation of the expressway carriageway will vary between 3 % and 6 % depending on the horizontal curve radius. The maximum allowable superelevation is 6% on RoNS recognised state highways/expressway projects.

Refer to drawings C100 – 102 attached in Appendix G for typical cross-sections of the expressway, access roads, local roads and bridges.

12.3.2 Interchanges / Grade Separation

At this early stage, no attempt has been made to determine the most appropriate location or form of interchanges or local road accesses. A potential configuration option did need to be developed at this stage to enable costs to be developed[33]. To this end, the following assumptions were made:

For the western options (refer to maps overleaf):

- A half interchange in the vicinity of Manakau to enable northbound expressway traffic to leave the expressway and access the settlements of Manakau and Ohau and for southbound local traffic to join the expressway to Ōtaki and beyond.
- A full interchange at the location that the new SH1 expressway would intersect with the new SH57 link.

[33] A decision on the configuration of interchanges and local road treatment will be made during the scheme assessment report after consideration of alternative locations, different types of interchanges and options for local road network integration.

- An intersection where the new SH57 link meets the current SH1 to provide connections to and from Levin.
- For the option with the new SH57 link north of Levin, a full interchange would be provided at SH1 / Queen Street
- For the option with the new SH57 link south of Levin, a half interchange north of Levin would be provided to enable southbound expressway traffic to leave the expressway and access Levin and for northbound local traffic to join the expressway for destinations further north.

For the eastern options; the following interchange assumptions were made:

- A half interchange in the vicinity of Manakau to enable northbound expressway traffic to leave the expressway and access the towns of Manakau and Ohau and for southbound local traffic to join the expressway to Ōtaki and beyond.
- A full interchange where the new expressway crosses Queen Street to the east of Levin, which would enable access to and from Levin and also the existing or upgraded SH57.

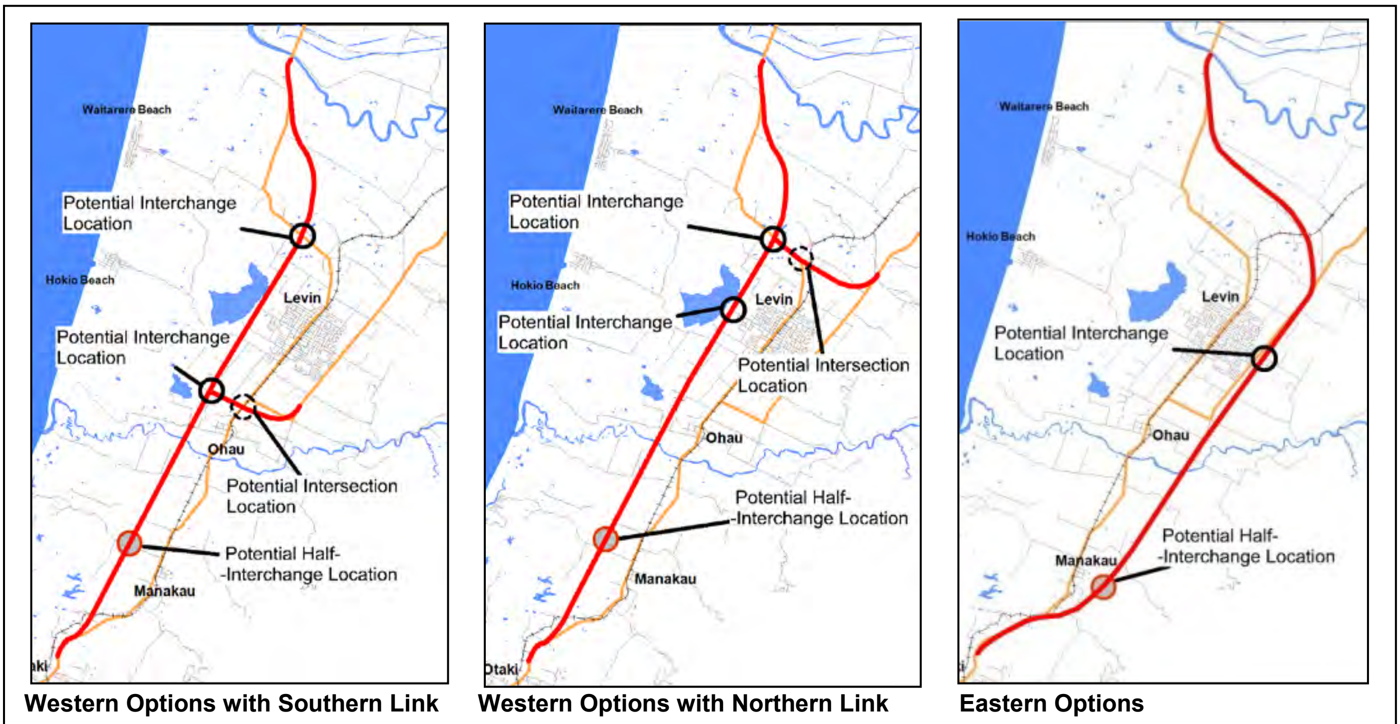

Figure 12-1: Indicative Interchange Locations

For both sets of options, local road overbridges or underpasses were assumed to be needed as necessary to enable connection of existing roads to the local road network.[34]

Notwithstanding the above preliminary nature of the interchange forms and locations at this stage in investigation, the safe positioning of interchange entrance and exit ramps where the exits can be seen in time and where entering drivers can merge safely with expressway traffic can be a key constraint on curvilinear expressway alignments. Fitting interchanges to alignments that have failed to take interchange positions into account during their development can involve unnecessary additional costs and can compromise the road safety and performance of the expressway. Therefore, interchange positions and layout will be considered in conjunction with the next phases of route development.

[34] The number and length of service roads needed has been ignored at this stage as no consideration has yet been given to individual properties, as the exact alignment has not been identified.

12.3.3 Clear Zones

Where safety barriers are not required, a clear zone of 9 m has been adopted for the conceptual design and will be applied in the scheme design. This width is consistent with the RoNS Guidelines.

Where clear zones cannot be provided, a TL-4 safety barrier system will be installed clear of the shy line as a proactive safety measure.

Zones clear of hazards are not necessarily a substitute for safety barriers. All safety hazards situated beyond the clear zone will be assessed on merit and safety barriers will be provided instead of clear zones where necessary in accordance with the Safe System approach.

12.3.4 Sight Distances

For the preliminary design, the stopping sight distance (SSD) for horizontal, vertical and intersections will be calculated using the criteria set out in Austroads GTRD Part 3: Geometric Design and applied as required. This is consistent with RoNS requirements which are based on a reaction time of 2.5 seconds (standard for rural areas).

12.3.5 Pavement Design and Surfacing

The pavement design for the expressway will be based on the Austroads Pavement Design Manual and the New Zealand Supplement for a pavement life of 30 years. The current typical cross-sections show an assumed pavement depth of 400 mm (150 mm basecourse and 250 mm sub-base) where full depth pavement is required.

The design of new granular pavements will be based on Traffic Loading Equivalent Standard Axles (ESA) and the subgrade CBR from the geotechnical investigations.

Surfacing design will be undertaken as part of the scheme design in accordance with NZTA's surfacing manuals and specifications. This will be consistent with adjoining expressway sections.

12.3.6 Structures and Culverts

All new bridges and other structures will be designed in accordance with the NZTA Bridge Manual (July 2005 Amendment). Structure widths, clearances, barriers, scour and seismic requirements will be in accordance with the appropriate sections and appendices of the NZTA Bridge Manual and as amended by the current RoNS Guidelines.

As stated in 16.1 of the NZTA *Standard Professional Services Specifications – Investigation and Reporting*, the *Preliminary Design Philosophy Statement* for the I&R phase shall satisfy Section 1 of NZTA's Bridge Manual (SP/M/022) requirements for a *Bridge Design Statement*. It will also incorporate the current RoNS design requirements as required.

The Bridge Design Statement, although typically completed following the Scheme Assessment phase, will initially be developed through the I&R phase of the project and early consideration will be given to at least the following elements:

- Factors which influence design (refer section 1.3(b) NZTA Bridge Manual, where applicable for this phase)
- Preliminary alternative design forms
- High level cost assessment

Further investigation into preferred geometry alignment, roadway widths, the need, requirements and constraints on construction and more refined cost assessments of the new structures will be further developed at the Scheme Assessment stage.

For existing bridges and other structures it is acknowledged that the level of service that older structures can provide would not conform to RoNS guidelines. In such cases, existing structures will have to be assessed in accordance with the current NZTA Bridge Manual (July 2005 Amendment) and the RoNS Design Standards and Guidelines for live load capacity, condition, clearances, widths, scour, seismic and barriers requirements.

Current requirements are to provide for cyclists on the rural expressway bridges by use of the sealed shoulder or on a separately constructed facility. New local bridges will accommodate cyclists and pedestrians on combined footpaths, or as required by the TLAs.

12.3.7 Noise and Vibration

A noise assessment and modelling will be undertaken in accordance with NZTA Guidelines, and any mitigation measures identified from the model will be incorporated into the design. This may include a noise barrier, a typical design of which is shown in the typical cross sections.

12.3.8 Stormwater Design

Stormwater drainage design will be based on providing flood protection to the road carriageway to a 100 year average recurrence interval (ARI) level of service as per NZTA Drainage specifications. Drainage design will consider climate change impacts as per Ministry for the Environment guidelines.

The road carriageway will be protected from flooding from direct rainfall through the provision of sumps and roadside drainage[35], and from runoff flows from catchments upgrade of the road alignment through the provision of culverts and bridges. Culverts across the road will be designed for minimal flood impacts upstream and downstream of the culverts, and the culverts will be designed for fish passage as per current best practice. The major river crossing at the Ohau River will include bridge scour mitigation and geomorphological assessment of the river bed.

Local authorities will be consulted during the design process to understand and consider local flood related issues. An erosion and sediment control plan will be developed for the construction phase, based on Regional Council guidelines.

12.3.9 State Highway 57

The geometrics (horizontal, vertical, and superelevation) of SH57 will be designed using Austroads for a design speed which is assessed as applicable when investigated at the SAR stage.

The design cross-section will consist of appropriate traffic lanes (standard nominal width being 3.5m), and a shoulder width up to 1.5m, and a clear zone of up to 9m, all dependent on predicted traffic volumes and NZTA standards at the time of design and construction. Cut and fill batters will range in gradient from 1V:3H to 1V:4H.

Sight Distances will be calculated using Austroads GTRD Part 3: Geometric Design and based on a reaction time of 2.5 seconds (standard for rural areas). Safe intersection sight distances (SIDI) will be derived from Austroads GTRD Part 4a: Unsignalised and Signalised Intersections and Austroads GTRD Part 4b: Roundabouts. SISD requirements will be based on the driver reaction time (2.0 seconds) and design speeds for cars approaching intersections.

The pavement design will be based on the AUSTROADS Pavement Design Manual and the New Zealand Supplement for a pavement life of 30 years. The design of new granular pavements will be based on Traffic Loading Equivalent Standard Axles (ESA) and the subgrade CBR from the geotechnical investigations.

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[35] If, for whatever reason, the median has to be narrowed, then the drainage of the median will become a key consideration. A median width of about 4 m between travelled ways almost precludes any curves that drain towards the median, and therefore superelevation cannot be applied and curve radii must be at least 1800 m. The larger radii may have a marked effect on the route selection.

Surfacing design will be undertaken as part of the scheme design in accordance with the NZTA's surfacing manuals and specifications.

All new bridges and other structures shall be designed in accordance with the NZTA Bridge Manual (July 2005 Amendment). Structure widths, clearances, barriers, scour and seismic requirements shall be in accordance with the appropriate sections and appendices of the NZTA Bridge Manual.

As the picture becomes clearer, through the SAR stage, around the changes required for SH 57, this PDPS will be expanded.

12.4 Local Roads

In order to maintain connectivity on the local road network a number of modifications will be required. Generally, the range of these modifications will vary from intersection tie-ins through to construction of new local road formations linking to the expressway interchanges.

The basis of design will be in accordance with Kapiti District Council Subdivision and Development Principles and Requirements and Horowhenua District Council: Minimum Engineering Standards, Section 6 Roading and Traffic. Both standards generally adopt Austroads standards for geometrics, intersections and pavement design.

The local road cross-section will be based on the design speed and traffic volumes for each individual road. Traffic lane widths may range from 3 to 3.5m; a shoulder width of 2.5 m will be included where provision for cyclists is required, and a clear zone of 3 m to 7 m will be provided where safety barriers are not required.

Local Road Sight Distances will be calculated using GTRD Part 3: Geometric Design and based on a reaction time of 2.5 seconds (standard for rural areas). Safe intersection sight distances (SIDI) will be derived from Austroads GTRD Part 4a: Unsignalised and Signalised Intersections and Austroads GTRD Part 4b: Roundabouts. SISD requirements will be based on the driver reaction time (2.0 seconds) and design speeds for cars approaching intersections.

The pavement design for local roads will be based on the AUSTROADS Pavement Design Manual and the New Zealand Supplement for a pavement life of 30 years. The current typical cross-sections show an assumed pavement depth of 300 mm (150 mm basecourse and 150 mm sub-base) where full depth pavement is required. The design of new granular pavements will be based on Traffic Loading Equivalent Standard Axles (ESA) and the subgrade CBR from the geotechnical investigations.

Surfacing design will be undertaken as part of the scheme design in accordance with the NZTA's surfacing manuals and specifications.

12.5 Travel Demand Management Measures

The checklist of TDM measures has been completed and is attached as Appendix H. This shows that only cycling, walking, traffic management / traveller information systems and freight management are applicable to this project. These aspects will be developed further during the scheme assessment phase.

12.6 Rail

Any modifications to the rail will be undertaken to KiwiRail standards and in consultation with them.

Any crossings of the railway will be future proofed to ensure any structures do not preclude double tracking and/or electrification of the railway.

12.7 Geotechnical Appraisal

In view of the limited available ground investigation data currently available extensive site investigations need to be carried out across the four short listed options in order to obtain more detailed data on the ground conditions beneath each option; and thereby enable an assessment and recommendation to be made on the most appropriate option from a geotechnical perspective.

The investigation proposed will comprise of the following activities:

- Desk study and geotechnical site reconnaissance
- Ground investigation which will include intrusive investigation, supervision and testing
- Reporting including both factual and interpretative geotechnical reporting

Upon completion of the fieldwork, design recommendations can be made on the following:

- Bearing pressure for shallow foundations at the recommended depths;
- Bored pier/pile types, bearing capacity, skin friction values for determining tension pullout values and negative skin friction;
- Lateral pile/bored pier capacity;
- The level of groundwater table
- Total, differential and tolerable settlement of foundations
- Atterberg Limits and grading curves for existing fill and road materials;
- Safe batter slope for excavation;
- Recommended earthwork construction methods for pavement works; and
- Excavatability of site earthwork for construction and the suitable use of excavated material for earthwork.
- Other Roads of National Significance, where practicable.

The further information in regards to the currently available geotechnical information and the proposed testing schedule are contained in Appendix M.

12.8 Urban Design and Landscaping

The following over-arching urban and landscape design principles will be followed for this project:

- Rather than using urban design and landscaping as a reactionary measure to mitigate adverse effects, the priority should be to avoid adverse effects and seek opportunities for positive effects. This is best achieved during route selection and alignment phases. Remediation and mitigation should be a second order measure carried out later in the design process.
- Urban and landscape design measures will be integrated with the other disciplines (including civil and structural engineering, stormwater and ecology) to achieve a cohesive integrated design.
- An urban and landscape design philosophy and concept will be developed for the project. To this end, some specific principles and guidance is provided in Appendix I. This will form the foundation for the 'Urban and Landscape Design Framework' to be developed at subsequent SAR and NoR phases.
- Urban and landscape design measures will ideally be carried out in collaboration with the communities along the route.
- The urban and landscape design measures will aim to be consistent with the other adjacent RoNS projects
- Design for the Ōtaki to north of Levin expressway should be consistent with the following NZTA documents:
    - Urban Design Policy
    - Urban and Landscape Design Frameworks
    - Urban Design Principles, Guidance Notes
    - Guidelines for Highway Landscaping
    - Urban Design Professional Services Guide

12.9 Utilities

Investigation and relocation of existing utilities will be undertaken as part of the scheme design.

Only large scale utility lifelines have been identified to date. These include 110 kV and 220 kV transmission lines, gas main trunk pipelines and water and waste water treatment facilities. There will also be other services present, which will be investigated further in the next stage of investigation.

Refer to Map 7 in Attachment C for these utility locations currently known.

12.10 Lighting

Lighting will be provided at key locations both on the expressway and local roads i.e. intersections, interchanges and roundabouts. Where there are high traffic volumes, lead in lighting will be provided to allow for recognising the presence of these road elements and possible traffic movements. Flag lighting will also be provided at all local road intersections to provide visual recognition.

It is expected that road lighting along the expressway, where proposed, will be designed to a V2 lighting category standard but this will be confirmed later in the scheme design. All road lighting will be compliant with AS/NZS1158.

12.11 Signs, Delineation and Pavement Marking

Regulatory, advisory, permanent warning and destination signage will be included in the scheme design. Expressway and ramp signs will be compliant with the Traffic Control Devices Manual, RSMA compliance standards, whilst local road signs will be compliant with local authority standards.

All pavement markings will be compliant with NZTA specifications M7, M20, P22 T12, T8 and the Traffic Control Devices Manual. Audio Tactile Pavement (ATP) will be applied to the edge lines of the expressway in accordance with NZTA Guidelines for Audio Tactile profiled (ATP) road marking. High performance markings in accordance with NZTA P/30 specification will be applied to the expressway and off ramp edge lines.

12.12 Safety Barriers

All new safety barriers will be designed in accordance with the NZTA standard specifications, in particular NZTA M/23, and comply with the TL-4 specification.

For the central median area a TL-4 wire rope barrier will be installed along the entire extent of the expressway interrupted only at the interchange structures, where piers may be positioned in the median. In such cases a suitable transition to rigid barrier surrounding the piers will be provided

The local road safety barriers will be based on TL-3 Austroads compliance; the locations of which are to be determined during scheme design.

12.13 Kerb and Channel

The extent of kerb and channel required will be determined in the scheme design. The profile and standard will be consistent with the NZTA and local authority standards.

12.14 Fencing

All new and reinstated fencing will be stock proof or pedestrian security fencing as appropriate and will be located outside of the clear zone.

12.15 Property Access

A number of accesses will need to be either re-established or constructed. The location and requirements of these accesses will be considered in the scheme design, designed in accordance with the appropriate local authority or NZTA standard.

12.16 Project Constructability and Traffic Management

An assessment of the constructability of the route options will be undertaken as part of the scheme design, to ensure that the project is feasible from a construction perspective. Crucial aspects of traffic management will be assessed in later project phases to ensure disruption to road users over the lengthy construction period is thoroughly assessed.

Temporary roads may be required where the proposed alignments cross or overlap with the existing state highway alignment. Where the expressway is green fields located, disruption to existing infrastructure can be kept to a minimum. Temporary roads will be considered as part of the scheme design.

Temporary traffic management for the new expressway, ramps, local roads, and temporary roads will comply with CoPTTM, level 3 for the expressway, level 2 for the current state highway and level 1 for the local roads.

Consideration of the staging and sequence of construction will be undertaken as part of the scheme design. A general sequence is outlined below:

- site establishment, including temporary traffic management
- adjoining landowner liaison
- construction of active and/or passive environmental control measures
- site clearance/tree removal (unless previously completed as enabling works)
- topsoil stripping to stockpile
- service relocation (unless previously completed as enabling works) and protection
- preparatory earthworks
- construct structures and interchanges
- stormwater drainage construction
- construct pavement and seal new carriageways (including accessways)
- construct safety barriers
- spread topsoil and grass
- install permanent road markings, delineation and signage
- construct new fences (if any)
- complete any landscaping works required
- disestablish site
- legal survey
- defects liability period
- as-builts and asset owner's manual.

13 Evaluation

This section outlines an assessment of the options against a number of criteria including cost, modelling results and economic efficiency.

13.1 Cost Estimates

Estimates have been prepared in accordance with the NZTA Cost Estimation Manual for all six indicative routes. The six routes include routes 46 and 76. These routes appeared not to be feasible through the MCA ranking process, but they have been included to ensure a consistent comparison of routes. It is stressed that the information and data available is such that there is still a high level of uncertainty, and this is reflected in the 95%ile totals.

A summary of the costs is presented in Table 13-1 below. More detailed estimate information is found in Appendix N.

Table 13-1 : Cost Estimates

Contiguous Corridor	Expected Estimate ($M)	95%ile Estimate ($M)
64	457	653
66	453	649
73	457	653
75	437	633
46	482	678
76	472	686

The costs are undiscounted and exclude escalation and GST[36].

The cost items which are most influential in the estimates for each of the indicative route corridors are;

- Earthworks
- Bridges, retaining walls, large culverts (including rail grade separation)
- Pavement and surfacing
- Safety barrier
- Drainage
- Property.

13.1.1 General

The estimates have been undertaken as feasibility level estimates to provide costs for comparison purposes for the various route options considered for the project.

The estimates (refer to Appendix N) have been prepared in accordance with the current NZTA 'Cost Estimation Manual' (SM014). This work aims to provide consistency of cost between options so that comparisons can be made to select the optimum route for the project.

Significant further work is necessary to refine these broad estimates during the Scheme Assessment stage of the project.

[36] Note that the 95th percentile estimate exceeds the expected estimate by between 41% and 45%.

13.1.2 Assumptions and Exclusions

The FE level estimates have been developed based on the various contiguous corridor options developed for this Scoping Report. The routes through the corridors have been assumed and thus there is a significant degree of uncertainty in the estimates. There is limited information about the site conditions and scope of work for each route option.

General Assumptions

In forming the FE a number of assumptions have been necessary in order to form a complete estimate. These are:

- NZTA managed costs have been allowed for costs associated with the project. These include estimates of fees for land acquisition and associated activities and fees associated with the investigation and reporting phase. Specifically the costs are not part of the NZTA's administration costs such as partnering, meetings, travel costs etc.
- No provision has been made for extraordinary circumstances which may arise such as Environment Court, and appeals.
- The project extents are on SH1 from Ōtaki (RP 995/3.30) to North of Levin (RP 967/0.50) and on SH57 from Kimberley Road (RS 0/0.00) to Rolston's Corner Rest Area (RP 0/14.31)

Exclusions

The following items have been excluded from the FEs:
- GST.
- Escalation beyond the time the estimate was prepared i.e. 3^{rd} quarter 2011
- Sunk costs.
- Operational costs associated with the project outcome.

13.1.3 Costs and Quantities

Costs

The estimates for indirect costs have been based on the SM014 Elemental Costing Database generally using percentages based on the Grafton Gully, a project similar in scale to the Ōtaki to North of Levin project. The percentages for these items are similar to percentages for indirect cost allowed for tendering (but estimated from detailed resources and quantities) on other projects and have been used in estimates for other NZTA development projects.

The estimates for direct cost have been based on the costs databases from recent tenders and of NZTA projects at various stages of development over the last 3 years. It should be noted that costs for larger projects have generally remained stable in this period.

Where a corresponding item was not available, the estimate rates have been generally derived from recent estimates but worked up specifically. They have been developed using known resource costs and using equipment & labour incorporating productivity levels that could be expected on a similar major project.

All costs have been derived from current cost data; they have not been obtained by escalating historic data.

Resources that are a significant part of the project have been based on current indicative quotations scaled or prorated to the requirements of each option estimated.

Quantities

The base quantities were originally derived so that initial comparisons between routes could be made. Route selection was undertaken using Quantm software. It is emphasized that these routes are indicative and only used for comparing costs between contiguous corridors. Route selection will be made following further investigations in the Scheme Assessment stage, including public consultation.

The quantities from the Quantm software are used for relevant parts of the estimates. They have been checked and found to be in the correct basic order of what could be expected on a project of this magnitude. They are considered appropriate for an FE with a suitable contingency for uncertainty.

It should be noted that the scoping of the project and the derived quantities needs considerable further investigation and design before the quantities can be used for any detailed costing that would lead to more precise estimates. Further, as the routes have not yet been determined (other than through software which has selected the optimum routes through the contiguous corridors based on limited criteria), it has not been possible to base the quantities on a detailed breakdown of all the construction elements and associated costs involved in a major infrastructure project of this magnitude. It is expected that this will be carried out during the Scheme Assessment stage, which will produce a more accurate outcome.

The quantities that were not derived from Quantm were estimated on a similar basis that would likely be used on other large scale projects. These were based on quantities used in recent tenders undertaken and in the preparation of estimates for the development of NZTA projects from the level of Option Estimates to Construction Estimates.

13.1.4 Property

Property acquisition costs have been estimated using estimated costs per hectare assessed under three categories: rural, lifestyle & semi urban with ranges of cost for each category. The land to be acquired along each route was assessed at 60 m wide and this width has been used as a basis for costing the land.

The rates allow for the nett property cost, including the cost of removal of each house, and include the value of land and improvements and injurious affection compensation but exclude accommodation works and acquisition fees (which are included in NZTA Managed Costs).

When the preferred route has been established, Land Acquisition Plans will be prepared and provided to NZTA. This will allow the NZTA's property consultants to determine more accurately the property costs to be included in the Scheme Estimate.

It is expected that in some instances the purchase of the whole of a parcel of land will be considered necessary to obtain the land required to construct the route, as opposed to only acquiring the route footprint within the parcel. An allowance has been made for this in the estimates.

No allowance has been made for land already acquired by the NZTA for the project; the extent of this is presently unknown, but is believed to be nil outside the present highway boundaries.

13.1.5 Whole Life Costs

It is expected that the whole of life costs will be similar for each of the various options as the type and number of the various structures on each option will be similar. This is not expected to be a differentiating factor between options.

13.1.6 Risk

A qualitative risk assessment has been completed, but this cannot be easily developed into a quantitative analysis and used to derive the Expected Estimate and 95th percentile estimate. For this reason, a separate analysis of the cost elements in the estimate has been carried out to estimate an assessed contingency and NZTA funding risk. The risk estimates were compared against parametric risk estimates, based on experience, and a comparison of previous Feasibility Estimates with outturn costs.

Whilst the cost estimates for the options differ, it was considered reasonable to keep the majority of the risk estimates at similar values for each option. This assumption was tested for each cost element and risk costs adjusted as was considered appropriate.

The allowances for risk in the estimates are considered reasonable for this level of estimate.

The risk register will be developed further during the Scheme Assessment and quantified, allowing the estimation of analysed contingency and funding risk.

13.2 Modelling

For this Scoping Report, traffic modelling was undertaken for the current/do-minimum road network and six network improvement options, assessing the morning peak, evening peak and inter-peak periods for the years 2011, 2016, 2026 and 2041.

More extensive and detailed results from the modelling are provided in Appendix O.

13.2.1 Do Minimum Network

The numbers of vehicle trips in the modelled network are shown in the table below. The trips are shown for both light vehicles and heavy vehicles, demonstrating the different growth rates between these classes. Perhaps most notable is the very low growth rate in trips, which is a result of the very low local growth rates in population and employment along with low and slow growing state highway volumes as a proportion of the overall trip totals. The state highway light vehicle volumes are projected to grow at 1.5% per annum and heavy vehicles at 2.0% per annum. The growth rates are broadly consistent with predicted growth rates further south on SH1, including Wellington City.

Table 13-2 : Number of Vehicle Trips

Year	Number of Trips								
	AM Peak			Inter Peak			PM Peak		
	LV	HV	Total	LV	HV	Total	LV	HV	Total
2011	6321	653	**6973**	5733	658	**6391**	7004	481	**7485**
2016	6390	661	**7050**	5786	669	**6455**	7076	489	**7565**
2026	6544	685	**7230**	5911	693	**6604**	7265	506	**7771**
2041	6776	729	**7504**	6086	729	**6815**	7525	533	**8059**

The following figures show the location and changes in traffic volumes on the modelled based road network (no changes) between 2011 and 2041 for the morning and evening peak periods. The green links indicate an increase in traffic and blue indicates a decrease in traffic. The network to the right hand side is a close up of the local Levin township network.

It is clear from these diagrams that the predominant growth is focussed on the state highway links. For the morning peak, there is a traffic volume growth between 2011 and 2041 of about 450-500 vph on SH1 south of Levin, about 200-220 vph north of Levin and about 250-300 vph on SH57 north of Levin. For the evening peak, there is a traffic volume growth between 2011 and 2041 of about 550 vph on SH1 south of Levin, about 220-230 vph north of Levin and about 300-320 vph on SH57 north of Levin. There is less than 100 vph growth on any urban links in Levin itself except on Oxford St (SH1) where there is an increase of about 200 vph.

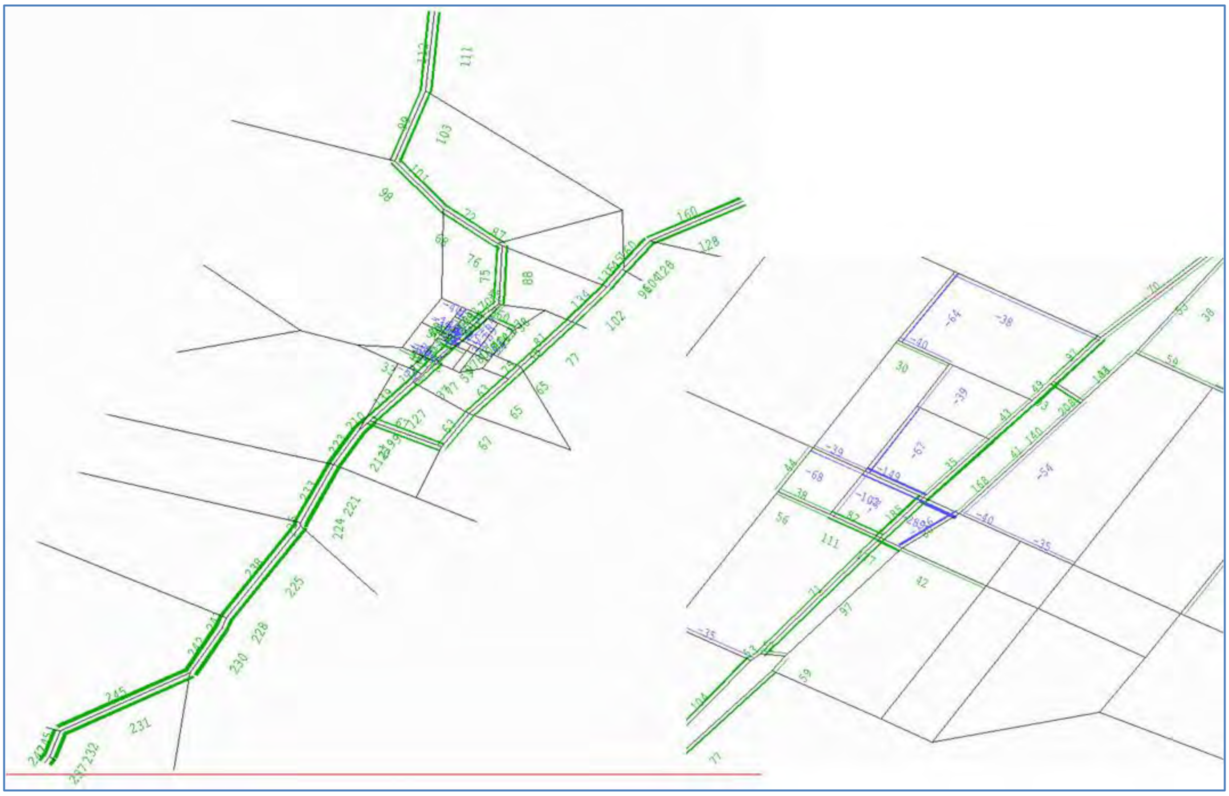

Figure 13-1: Change flow diagram 2011-2041 – Existing Network - AM peak

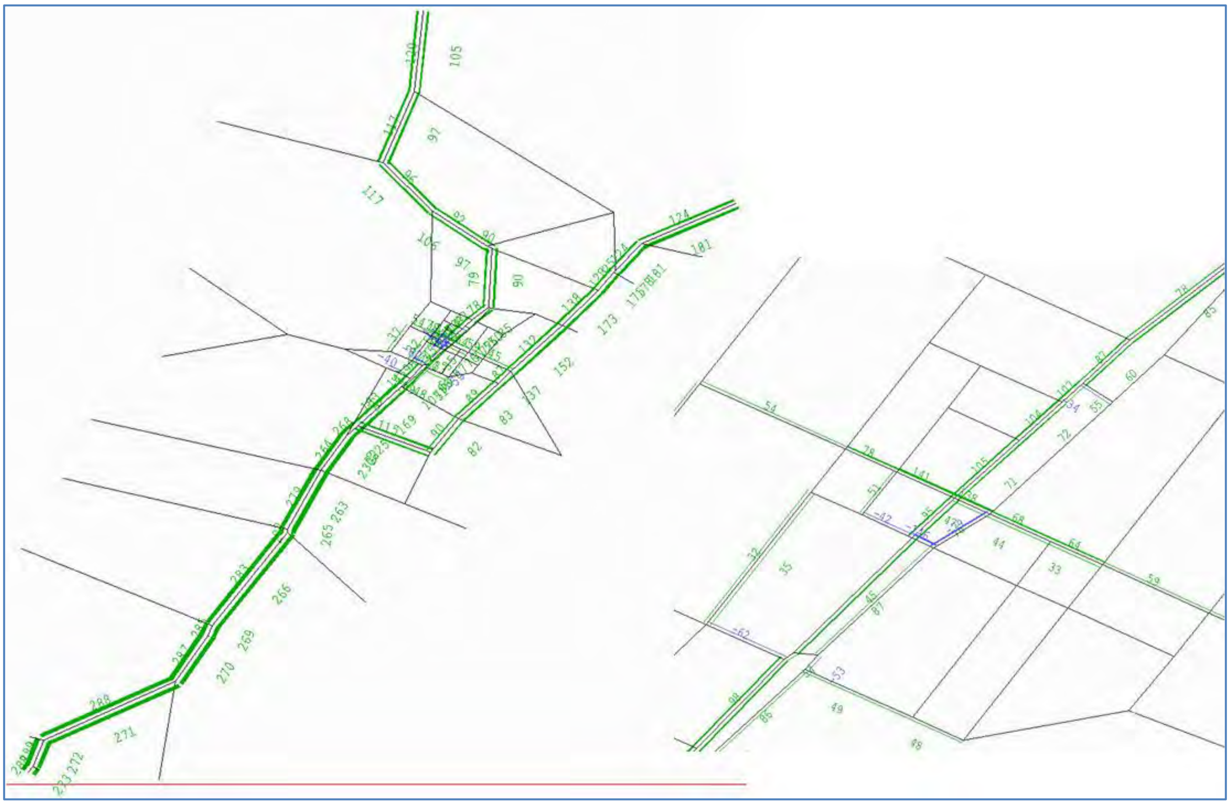

Figure 13-2: Change flow diagram 2011-2041 – Existing Network - PM peak

Level of Service (LoS) diagrams for the Base Network in 2011 show that the vast majority of the network is operating at LoS C or better. The exceptions to this are:

- the SH1 intersections with Muhunoa East/West Roads, Buller Road and Makomako Road, which operate at LoS D and E in peak periods (side road traffic delays); and
- the section of SH1 between Queen Street and Devon Street and the SH1/Queen Street intersection which operate at LoS F in the PM peak.

The model predicts that by 2041 some of the sections of SH1 between Taylors Road and Levin will operate at LoS D or E in the peak periods. A number of key intersections such as Waikawa Beach Road, Kuku East Road, Muhunoa East/West Roads and Buller Road are expected to deteriorate to LoS F in the peak hours. The network away from SH1 is expected to continue to operate efficiently.

Level of Service diagrams are provided in Appendix O.

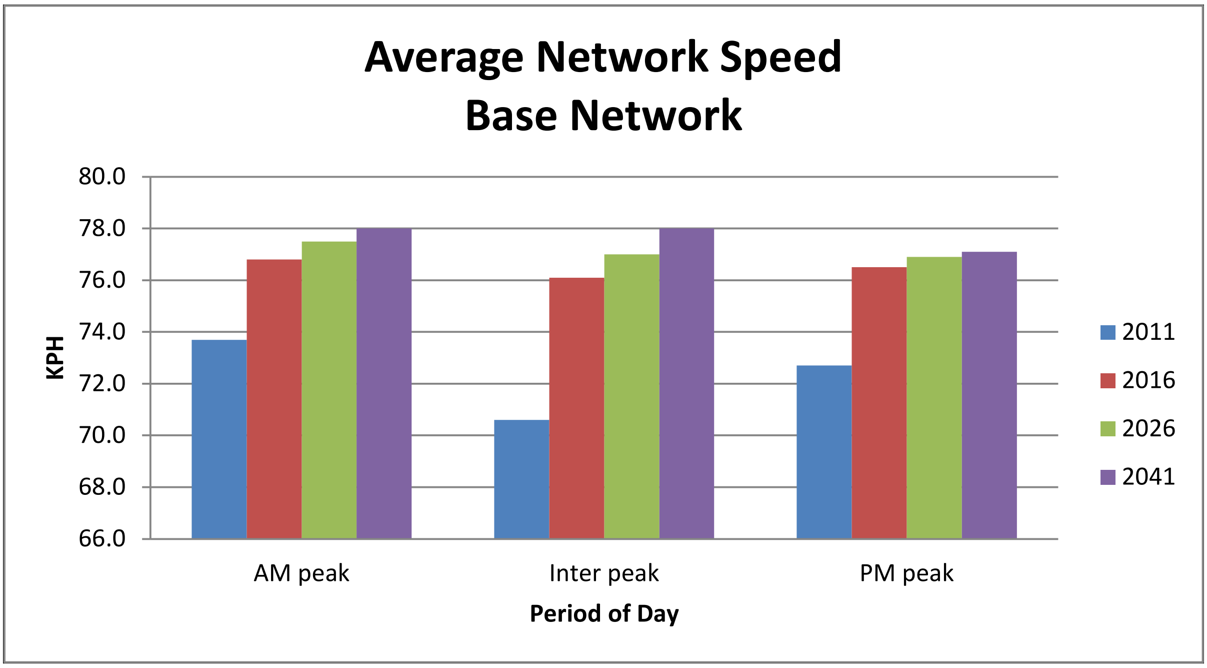

Figure 13-3: Average Network Speed – Base Network

The figure above indicates the change in average network speed for each of the three periods modelled over the years if no changes are made to the current road network. As noted previously, this is indicating that as the proportion of traffic on higher speed roads increases in the modelled network with relatively uncongested conditions, the average speed is increasing. However, it is worth noting that the rate of speed increase decreases (per annum) and decreases at faster rates for the periods with more traffic (evening peak, followed by morning peak and lastly inter-peak).

13.2.2 Options

The evening peak results for 2016 and 2041 (as the heaviest demands on the network) are presented in the tables and graphs below. Results for 2016 rather than 2011 are presented, because no option runs were undertaken for 2011 as the options were not likely to be constructed until at least 2016. It is these results for distance travelled and travel times which are key inputs to the economic evaluation, along with other inputs such as crash analyses done elsewhere but using model results for volumes on various road links.

Table 13-3 : PM Peak Model Results

Option	Output	2016	2041
Base network	Total Travel Time	372	458
	Total Distance Travelled	28455	35300
46	Total Travel Time	358	433
	Total Distance Travelled	28325	35165
64	Total Travel Time	394	497
	Total Distance Travelled	31413	38939
66	Total Travel Time	385	474
	Total Distance Travelled	30359	37350
73	Total Travel Time	380	460
	Total Distance Travelled	30047	36932
75	Total Travel Time	382	470
	Total Distance Travelled	30177	37123
76	Total Travel Time	386	468
	Total Distance Travelled	30694	37778

Table 13-4: PM Peak Model Results Comparison

		Base	46	64	66	73	75	76
Total Travel Time (Veh.h/h)	2016	372	358	394	385	380	382	386
	% of Base		96.2%	105.9%	103.6%	102.1%	102.7%	103.7%
	2041	458	433	497	474	460	470	468
	% of Base		94.5%	108.6%	103.4%	100.4%	102.5%	102.1%
Total Distance Travelled (Veh.km/h)	2016	28,455	28,325	31,413	30,359	30,047	30,177	30,694
	% of Base		99.5%	110.4%	106.7%	105.6%	106.1%	107.9%
	2041	35,300	35,165	38,939	37,350	36,932	37,123	37,778
	% of Base		99.6%	110.3%	105.8%	104.6%	105.2%	107.0%

Outputs for total travel time and distance travelled are consistent with the different lengths of the options compared with the present length. The western option (route 46) is shorter than the existing SH1. The eastern options are all longer than the existing SH1. These generalisations are modified by changes to the distance travelled by vehicles using SH57.

The total travel time of the options varies from slightly lower than base network in Option 46 with a 3.9 - 5.5% savings to 5.9 – 8.6% increases for Option 64. The total distance travelled results follow generally similar patterns to the travel time for all options, varying from a slight reduction 0.5 – 0.4% reduction for Option 46 up to increases of 10.4-10.3% for Option 64. Excepting options 46 and 64, the results for the remaining 4 options are clustered near each other with a range of 2-3% covering all of them. This is not particularly surprising given the generally similar nature of the networks modelled. It may be that there are opportunities to also improve the arrangement for option 64 to bring it closer to the other options (excepting 46) as well.

Only option 46 (running between Levin and Lake Horowhenua) provides total travel time and total distance travelled savings. This is primarily due to this option being the only one which provides shorter routes for longer distance traffic, but also provides the least disruption to the local road network. That disruption of the other options requires some traffic to re-route from currently more direct routes in situations where the proposed expressway would interrupt the local network connectivity or intersection arrangements. The other options bypassing Levin to the east, although providing faster roads for the State Highway 1 traffic require it to travel noticeably further; all options provide good options for efficient links between SH1 south and SH57 with little difference in corridor lengths.

The eastern options offer slighter shorter journey distances for vehicles using SH57 and increased efficiency by increasing travel speeds. This mitigates to some extent the longer journeys for vehicles using only SH1.

The average network speeds either hold steady or improve over the years for the options (with the exception of option 64), and this is due primarily to the overall balance of traffic in the modelled area moving towards state highway traffic, which travels longer distances on higher speed corridors on an uncongested network. All options introduce a higher speed set of options for route choice and hence the average network speeds are all higher than the base network which requires significant portions of state highway traffic to travel through the slower Levin network.

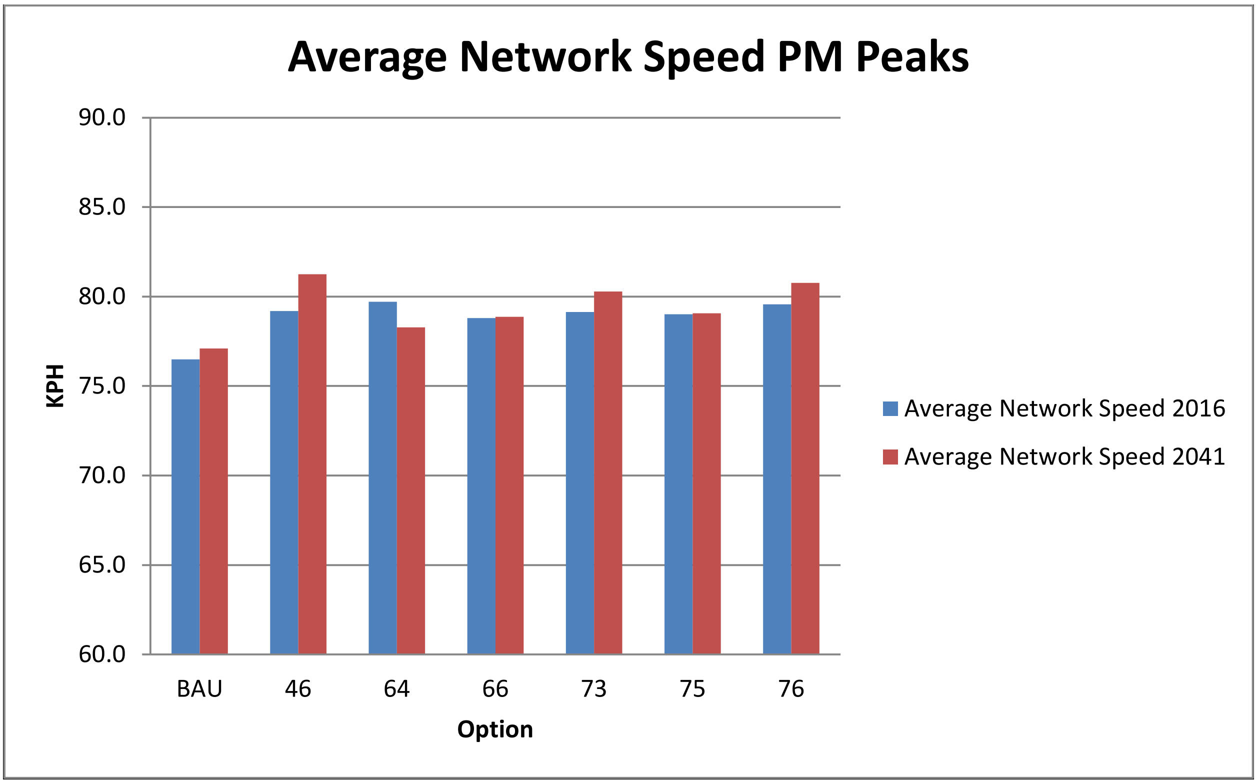

Figure 13-4: Average Network Speed – Options

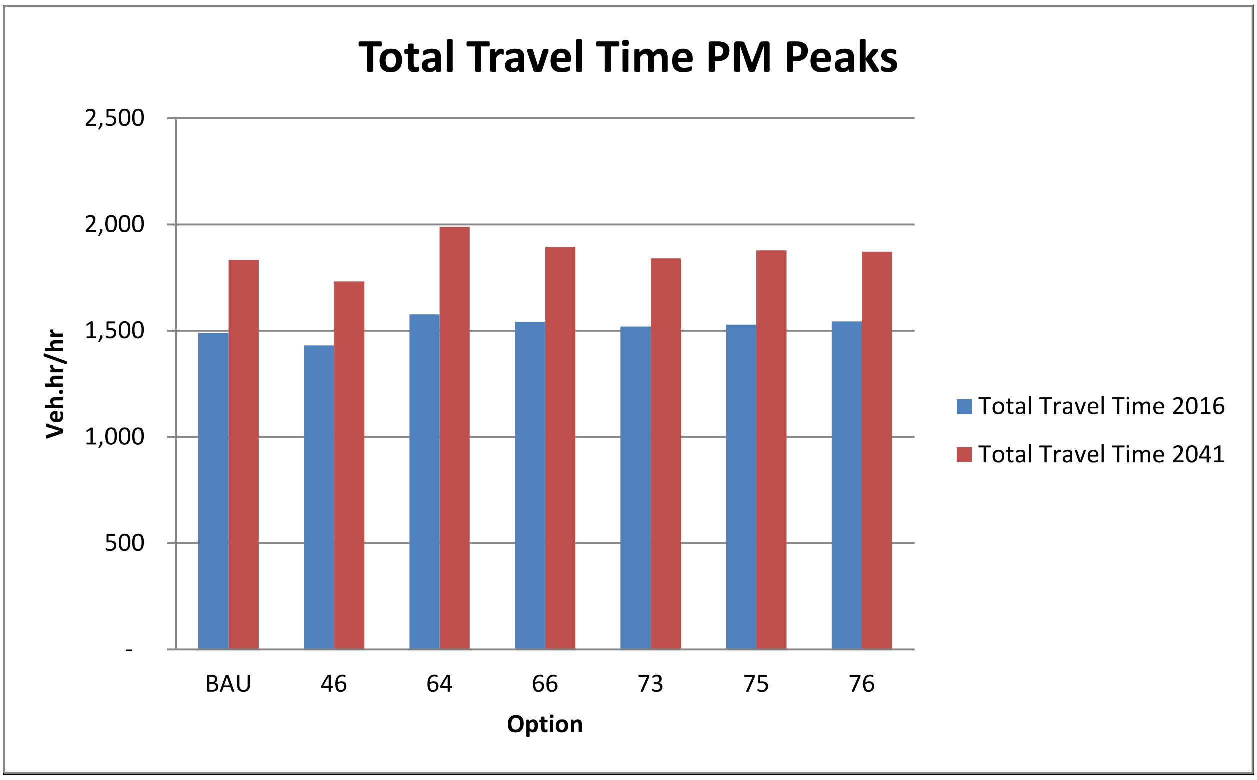

Figure 13-5: Total Travel Time– PM Peaks

The results from the modelling show very similar outputs for the four networks through the middle of the study area as well as the eastern option (76) due to the broadly similar network lengths and connectivity. These results would indicate that the network benefits for a benefit cost ratio (BCR) analysis will be relatively close and the BCRs will be driven mainly by the costs of the options.

The modelling results show that further work needs to be undertaken during the scheme assessment phase to improve the attractiveness of the expressway and reduce the travel distance needed to access key destinations. This will include investigation of different interchange locations and layouts.

A series of diagrams in Appendix O provide a graphical depiction of the performance of the options by indicating colour coding of the links and intersections according to the assessed level of service. These show the levels of service for a range of key model outputs, and provide an overview of the performance of the network. Traffic conditions can be assessed using Level-of-Service (LOS) ratings, with a grade from A (best, where traffic flows freely at or above the posted speed limit and motorists have complete mobility between lanes) to F (worst where traffic flow is forced, with frequent drops in speed to nearly stationary, and travel time is highly unpredictable). Factors such as weather, lighting, road surface conditions, parking activity, intersection spacing and volumes can affect roadway capacity and therefore along with the volume on the link, affect the level of service.

These Level of Service diagrams show that the options all provide a good and generally similar level of service to traffic and are unlikely to be considered sufficiently different at this Scoping Report stage to provide any strong indicator of one option being significantly better than others on this basis. The key use of these Level of Service figures and analysis at this point is to assist in identifying key areas for further refinement of options into the next Scheme Assessment stage where options will be developed and optimised for final decisions on a preferred option.

13.2.3 Route Travel Times

Whilst the above presents a network view of the proposed options, the model was also interrogated to determine the travel times that would be expected for key trips once the expressway was constructed. This is presented in the table below for the Do Minimum, a typical western option (46) and a typical eastern option (66). The absolute travel times are shown for the Do Minimum but the difference in travel time between the options and the Do Minimum is shown against each of the options.

Table 13-5: Route Travel Time Differences

			Travel Time or Travel Time Difference (seconds)					
			2016			2041		
Option	Route	Direction	AM	IP	PM	AM	IP	PM
Do Min	Route 1	Northbound	1339	1327	1337	1354	1338	1361
		Southbound	1310	1306	1314	1319	1315	1333
	Route 2	Northbound	771	765	767	783	772	787
		Southbound	765	767	770	775	774	790
	Route 3	Northbound	1060	1054	1061	1075	1063	1084
		Southbound	1055	1053	1064	1066	1060	1090
Corridor 46	Route 1	Northbound	-277	-265	-274	-291	-275	-298
		Southbound	-248	-244	-252	-256	-253	-270
	Route 2	Northbound	1	7	6	-11	0	-14
		Southbound	6	4	2	-3	-3	-18
	Route 3	Northbound	86	91	84	73	83	63
		Southbound	85	87	77	75	81	53
Corridor 66	Route 1	Northbound	-182	-170	-180	-197	-181	-203
		Southbound	-153	-149	-157	-162	-158	-175
	Route 2	Northbound	35	45	39	26	40	21
		Southbound	38	37	36	32	32	19
	Route 3	Northbound	-84	-80	-87	-94	-87	-107
		Southbound	-81	-80	-87	-89	-85	-106

Route 1: Taylors Road (SH1) to Manawatu River (SH1)
Route 2: Taylors Road (SH1) to Queen Street, Levin (SH1)
Route 3: Taylors Road (SH1) to Potts Hill (SH57)
Shaded cells indicate savings in travel times compared to the Do Min network

The table above shows that there would be route travel time savings of between 2½ and 5 minutes for vehicles using an expressway to travel through the study area on SH1 (Route 1 in the table).

A western option would provide similar travel times to the current route between Levin and SH1 north of Otaki and increased travel times (about 1 – 1½ minutes) for vehicles travelling between SH1 north of Otaki and Potts Hill on SH57. The opposite is true of an eastern option with benefits for SH57 traffic (about 1½ minutes) but increased travel time for SH1 vehicles with origins or destinations in central Levin.

13.3 Economic Evaluation

Economic analysis was carried out in accordance with NZTA's Economic Evaluation Manual (EEM) using the outcomes of the SATURN transportation model.

The following assumptions have been made in the calculation of the Benefit Cost Ratio. They are:

1. The base year is 2011, time zero is 2012, start of construction 2016, start of (28 years) benefits 2018.

2. The travel time and vehicle operating costs have been calculated from the SATURN transportation modelling. The travel time benefits were determined by using the queuing delays and link cruise times, and the vehicle operating cost benefits determined from the fuel use output.

3. As presented earlier in this report, the model was run for the years 2011, 2016, 2026 and 2041 and for the AM, Interpeak and PM periods. The daily benefits were calculated by using an assessed number of hours per day for each time period. Annual costs were linearly interpolated between modelled years.

4. The accident costs have been calculated for the Do-Minimum network and each corridor option by splitting the network into multiple sections (and key intersections) to enable detailed analysis of crashes for the principal routes (SH1, SH57, Queen St and the option expressway).

   The AADTs used in the accident analysis were estimated by applying factors of 2, 11.4 and 2 to the AM Peak, Inter-peak and PM Peak hour movement volumes, respectively. This is consistent with the figures used in the Opus Peka Peka to Otaki model.

   The methods adopted for calculating the accident costs are summarised in the table below:

   Method A: Accident by accident
   Method B: Accident rate analysis
   Method C: Weighted accident procedure

Section	Do min	Option
	Method	
Existing Highway	A	A, C
Proposed Expressway	-	B

5. No benefits associated with walking and cycling facilities, congestion reduction or driver frustration has been claimed at this stage. Furthermore, no wider economic benefits have been considered as these are being evaluated on the entire RoNS corridor.

6. Travel time benefits have been based on the uncongested and congested value of time pertaining to Rural Strategic. In future iterations, these will be modified to use the Urban Arterial congested value of time applied to the total queuing delay, and a composite uncongested value of time applied to the link cruise times base on the urban/rural approximate split in travel demand from examination of the model link flows.

   The Vehicle Operating Costs (VOC) were derived by applying the ratio of fuel to operating costs as given in the EEM for Rural Strategic. The CO_2 costs have been assessed as 4% of the VOC based on 10% heavy vehicles overall for the equations for light and heavy vehicles.

A summary of the economic analysis is detailed in the following sections.

13.3.1 Travel Time Savings

The SATURN model outputs were used to determine the overall travel time values for the Do-Minimum and each of the short listed options. The travel time benefits and dis-benefits for each option, when compared to the Do-Minimum are shown below.

Table 13-6: Travel Time Benefits

Option Description	Travel Time Savings ($million)
Contiguous Corridor 64	-38
Contiguous Corridor 66	-27
Contiguous Corridor 73	-20
Contiguous Corridor 75	-23
Contiguous Corridor 46	11
Contiguous Corridor 76	-24

The analysis shows that corridor 46 would provide the most travel time benefits; although these are relatively small. This is commensurate with the discussion in regards to model outputs in the previous section. The increased length of the expressway for the other options results in significant travel time dis-benefits.

13.3.2 Vehicle Operating Cost Savings

The vehicle operating cost savings for each option, when compared to the Do-Minimum, are shown below. Carbon dioxide emission benefits are included in the numbers reported in the table.

Table 13-7: Vehicle Operating Cost Savings and CO_2 Benefits

Option Description	Vehicle Operating Cost and CO_2 Savings ($million)
Contiguous Corridor 64	-29
Contiguous Corridor 66	-20
Contiguous Corridor 73	-16
Contiguous Corridor 75	-18
Contiguous Corridor 46	2
Contiguous Corridor 76	-20

Analysis of the total travel distance shows that again corridor 46 is the favoured option in terms of reduced vehicle operating costs.

13.3.3 Crash Cost Savings

The crash cost savings for each option, when compared to the Do-Minimum, are shown below.

Table 13-8: Crash Cost Benefits

Option Description	Crash Cost Savings ($million)
Contiguous Corridor 64	72
Contiguous Corridor 66	61
Contiguous Corridor 73	71
Contiguous Corridor 75	60
Contiguous Corridor 46	62
Contiguous Corridor 76	59

The crash analysis shows that corridor options 64 and 71 had the highest crash cost benefits of just over $70 million, while corridor 76 had the lowest crash cost savings at $59 million.

The options with the higher crash cost savings are typically those which attract more traffic away from the old state highways onto the new safer route for the entire length of the corridor.

13.3.4 Option Costs

The pre-construction costs were estimated from the project feasibility estimates (October 2011). These project costs were discounted into the years at which the costs would occur. It was assumed that there would be an approximate 40 percent reduction in current maintenance costs for the existing SH1 and SH57 sections bypassed by the option expressway due to the decreased traffic volumes, regardless of when or if they are revoked. A uniform maintenance cost per km for the expressway option was based on the annual maintenance costs in the latest Forward Works Program for SH1 and SH57 within the study area.

13.3.5 Benefit Cost Ratio Results

The benefit cost ratios for each option are shown below. The net present value (NPV) costs and benefits are also reported.

Table 13-9: Economic Analysis Summary

Option Description	NPV Costs ($mill)	NPV Benefits ($mill)	Benefit Cost Ratio
Contiguous Corridor 64	295	4	0.01
Contiguous Corridor 66	292	14	0.05
Contiguous Corridor 73	293	35	0.12
Contiguous Corridor 75	281	18	0.06
Contiguous Corridor 46	304	75	0.25
Contiguous Corridor 76	300	14	0.05

The analysis shows that the corridor 46 had the highest NPV benefits for $75 million with a BCR of 0.25.

An external peer review of the economic analysis was completed by Melanie Muirson of Aurecon. Modifications to the analysis were made, where required, following the reviewer's comments and agreement was reached. Subsequent to this peer review, the economics were updated with new information from the traffic model. These updated economics are what are presented above.

The details of the economic analysis along with the external peer review report are provided in Appendix P.

13.4 Social and Environmental Assessment

A Social and Environmental Screen (SES) has been prepared as presented in Appendix Q.

Due to the uncertainty in the location of the routes within the corridor, this has been undertaken on an overall project basis rather than a contiguous corridor basis. All options will have effects, but the exact extent of these will not be known until the routes have been determined.

Specialist Social and Environmental reports will be commissioned during the scheme assessment phase to investigate these aspects in more detail for all route options.

13.5 LTMA Compliance

All activities funded by the NZTA need to be assessed against the objectives and requirements of the Land Transport Management Act. These refer primarily to the five areas of:

- Economic Development
- Safety and Personal Security
- Access and Mobility
- Public Health
- Environmental Sustainability

The evaluation methodology used to date, via the Multi Criteria Analysis, has considered all of the above areas, based on the level of detail at this stage of the investigation. Furthermore the MCA includes other aspects, such as local policies and impacts.

As presented earlier in this report, the LTMA is currently the subject of a review in which the assessment criteria are likely to be altered and reduced. Accordingly, it is considered to be more appropriate to undertake a full LTMA assessment during the Scheme Assessment stage, where the level of detail of the options is improved and updated evaluation criteria is available.

14 Stakeholder Relationship Management and Consultation

14.1 Principles of Consultation

Consultation is the process of communicating with people or groups who may be interested in or affected by the project. Public participation is one of the key principles underlying the Resource Management Act 1991 (RMA). While the RMA does not require the applicant to consult, it does require the applicant to submit a record of any consultation undertaken and the responses received. This provides decision-makers the information they need to make well-founded decisions.

The NZTA has a policy on consultation and communication of which the development of a consultation plan forms the basis. Under the Land Transport Management Act 2003 (LTMA), NZTA has a specific obligation to consult, particularly on any proposed activity likely to affect Māori land, or Māori historical, cultural or spiritual interests.

A number of principles that help define the meaning of good consultation include:

- Consulting as early as possible when the proposal is still flexible and can address issues raised by interested and affected persons;
- Being transparent about what you want to achieve;
- Keeping an open mind to people's responses and to the benefits that might arise from consultation;
- Consultation is intended as an exchange of information and requires both the applicant and those consulted to put forward their points of view, and to listen to and consider other perspectives;
- While consultation is not an open-ended process, it should not be seen merely as a means to an end;
- Consultation may be on-going and may continue after the application has been lodged or even after a decision has been made;
- Consultation does not necessary mean that all parties have to agree to a proposal, although it is expected that all parties will make a genuine effort. While agreement may not be reached on all issues, points of difference will become clearer or more specific.

Consultation is an important component of the project and it forms the basis for building long term relationships with stakeholders. It improves outcomes through gaining local knowledge and incorporating tāngata whenua values and interests which could assist in reducing the impact of the proposal on the natural, physical, cultural and social environment.

Tāngata whenua (iwi, hapū, whānau) have a long-standing association with the natural environment and understanding these cultural values and interests can result in improved proposals. By identifying and addressing issues of interest to tāngata whenua groups, it also assists councils in assessing RMA requirements relating to māori and the Treaty of Waitangi.

Consultation for this project is managed through a consultation strategy which is set out in the Ōtaki to north of Levin Consultation Plan.

14.2 Consultation Plan

A Consultation Plan was prepared by the NZTA and MWH in March 2011. It is intended to be a living document which will be regularly updated to reflect further information and understanding of the project, the community it will affect, and any changes in approach to the project by the NZTA. All changes will be approved by the NZTA prior to implementation.

The aims of the Consultation Plan are to:

- Inform stakeholders and the wider community of the project scope and programme;
- Involve stakeholders and the wider community in identifying options for further investigation;
- Ensure that information from the consultation processes is incorporated in determining and refining the preferred option;
- Involve affected parties in refining the preferred option and identifying appropriate mitigation;
- Engage stakeholders at the appropriate time(s) in the overall project timetable using the most appropriate methods for the purpose, and particularly to meet the requirements of tikanga māori when consulting with māori groups and organisations;
- As far as possible to achieve "buy-in" to the preferred option from all parties consulted (noting that total acceptance by all parties is unlikely to be achieved);
- Protect and enhance the NZTA's reputation through open, honest, consistent and well-documented consultation procedures and processes.

The Consultation Plan was formulated in general accordance with NZTA's 2008 Public Engagement Strategy and has been tailored to meet the specific needs of the Ōtaki to north of Levin project.

The consultation and communication will fall into four stages, as set out below:

14.2.1 Consultation Stage 1 (Area / Corridor Stages)

The project is currently at this initial stage. It is an intense stage of information collection and active input is being sought from key stakeholders. The general public has been informed of the study and clarity on their role later in the project. While the public have offered information at this early stage and it has been welcomed, this is not actively sought at this stage as the level of detail available at the time of consultation did not include indicative routes. Some key organisations have been specifically contacted for information and input.

Details of stakeholder consultation are presented below.

14.2.2 Consultation Stage 2 (Route Options)

This stage of consultation will involve the release of the broad route options. It is characterised by the start of specific public/community input. It will be introduced by press releases and announcements of open days. The purpose of this stage of consultation is to elicit information held by people, and community input to the options to assist with later decision-making.

This consultation process comprises the first part of the Route stage and concludes with the close of receipt of feedback.

14.2.3 Consultation Stage 3 (Preferred Route)

This stage involves the release of the preferred route option. It is at this stage that those who are most likely to be affected by the preferred corridor/route will know (and those on other route options will be out of contention).

14.2.4 Consultation Stage 4 (Refinement of Preferred Route)

This stage involves on-going liaison with affected parties, discussions relating to any specific access and property agreements, exploration of and any agreements on mitigation; etc. It is expected that the bulk of the work undertaken in this stage will be via the NZTA's property consultants.

14.3 Key Stakeholders

The following have been identified as key stakeholders for the project:

Table 14-1 : Key Stakeholders

Category	Stakeholder
Political	Minister of Transport Associate Minister of Transport MP for Horowhenua MP for Kapiti Coast Opposition Spokesperson on Transport
Iwi	Muaupoko Ngati Raukawa ki Te Tonga Rangitane Other Iwi groups (including marae and hapū) as appropriate
Territorial Authorities/Organisations	Horowhenua District Council Horizons Regional Council Greater Wellington Regional Council (GWRC) Kapiti Coast District Council (KCDC) Regional Transport Committee Regulatory Authorities Technical Advisory Group (RATAG) Technical Working Group (TWG) Regional Authorities Executive Action Group (EAG)
Government agencies	Ministry for the Environment Department of Conservation New Zealand Historic Places Trust
Industry Groups	Road Transport Forum NZ NZ Road Transport Association Automobile Association (AA) NZ Heavy Haulage Association Federated Farmers
Infrastructure	KiwiRail Electra Vector Transpower
Interest Groups	Manakau District Community Association Cyclists/pedestrian groups Forest and Bird Fish and Game New Zealand Nature Coast Enterprise Ōtaki Māori Racing Club
Emergency Services	NZ Police NZ Fire Service Wellington Free Ambulance Civil Defence St John Ambulance
Community	Levin Residents Association Ōtaki Community Board Manakau District Community Association Affected/potentially affected property owners Affected business groups Affected residents groups Levin Business Networking Group Levin Business Association
NZTA	Peka Peka to Ōtaki project team NZTA's Network Maintenance Management Consultant
Approvals Management (EPA)	Environmental Protection Agency

Tāngata whenua have strong interests and concerns in the area. Issues of particular importance are Māori owned land, discharges to water bodies and activities that have the potential to affect natural resources such as freshwater species like inanga. Tāngata whenua also have concerns that extend beyond the purely physical and into spiritual, ancestral or historical realms, such as the location of burial grounds, and major battlefields.

This list of key stakeholders will be updated on a regular basis by MWH and the NZTA.

14.4 Stakeholder Meetings

14.4.1 First Collaboration Meeting with Stakeholders and Tāngata Whenua

The first collaboration meeting was held on Thursday 7th April 2011 at the Council Chambers, Horowhenua District Council Building, Levin. The purpose of the meeting was to share information between key participants in the project, and to establish a basis and relationships for future involvement in the project.

Those invited included the NZTA, the MWH NZ Ltd consultant team, representatives of the four local authorities whose areas are within the project, tāngata whenua representatives, the Department of Conservation, KiwiRail, and Historic Places Trust.

14.4.2 Second Stakeholder Meetings

A series of second meetings were held with stakeholders and iwi to build relationships, review constraints maps and share information. The meetings are listed below:

Table 14-2 : Stakeholder and Iwi Meetings

Date	Stakeholder/Iwi	Present
5th June 2011	Department of Conservation	Kris Erikson, Richard Gill, Rowan Oliver, David Cameron, Sylvia Allan
6th June 2011	Historic Places Trust	Ann Neill, Jo Draper, Sylvia Allan.
14th June 2011	Horizons Regional Council	Ann Sheridan, Pen Tucker, Ian Lowe, Wayne Wallace, Jo Draper, Sylvia Allan
14th June 2011	Horowhenua DC staff	Wally Potts, Dorstan Hayman, Ross Nicholson, Quentin O'Connor, Jo Draper, Sylvia Allan
14th June 2011	Horowhenua DC invited planners and surveyors group	Range of local/regional council and consultant planners, Jo Draper, Sylvia Allan
5th July 2011	Kapiti Coast DC	Gael Ferguson, Rowan Oliver
8th July 2011	KiwiRail	Phil Peet, Marten Oppenhuis, Walter Rushbrook, Steve Curry
8th July 2011	Muaupoko	Rob Warrington, Kevin Hill, Steve Hirini, John, Marokopa Wiremu-Matakatea, Jo Draper, Kevin MacFarlane, Roger Maxwell, Phil Peet, Marten Oppenhuis, Sylvia Allan, Morrie Love
8th July 2011	Raukawa	Rob Kuiti, Moira Patene, Te Waari Carkeek, Yvonne Wehipeihana-Wilson, Don Marsden, Andre Baker, Mark Wilson, Simon Austin, Rupene Waaka, Richard Orzecki, Marten Oppenhuis, Phil Peet, Jo Draper, Roger Maxwell, Kevin MacFarlane, Sylvia Allan, Morrie Love

Issues raised at the meetings have been detailed in the minutes. Minutes will be attached to the consultation database and follow up actions will be documented to be addressed at an appropriate stage in the project (such as identifying and clarifying constraints).

14.5 Public Information

14.5.1 Website

The NZTA website is a key element in the consultation process (building on the application of the two projects to the south). Information such as maps, press releases, links to Council websites and FAQs is used to populate the site, as well as information on who to contact as part of the consultation processes, the project processes and subsequent steps.

An email address has been set up to capture feedback from the public. Responses to public comments and queries are sent by the NZTA communications advisor with advice from the project team. This correspondence is currently being uploaded into the consultation database (see details below).

The project website is also has links to media releases and related documents on meeting notes, presentations at collaboration workshops and will be updated regularly in line with project investigations.

The website can be viewed at the following location: http://www.nzta.govt.nz/otaki-levin-project

14.5.2 Permanent Display

A permanent "shop front" display about the project is located at the Horowhenua District Council offices in Levin. This information is regularly updated. The material and information is similar to that on NZTA's website.

14.5.3 Project Update 1

The first Project Update, Issue 01 – May 2011, was sent out to the community and uploaded onto the NZTA website. Information included an introduction and scope of the project, maps showing the project in the context of the other RoNS projects, the Study area and the project programme. It also included an explanation of the ACRE process. A summary was included in Horowhenua's Community Connection newsletter which goes to all households.

Information was also provided on where to view the project website and contact details for the NZTA's project team.

14.5.4 Project Update 2

A further update was sent out in August 2011 (Issue 02) with information on the constraints that apply to the Study area. This update, in the form of a consultation newsletter, was issued to all households in the Study area by mail out during the week commencing 15 August.

Seven maps showing areas of constraint were presented as background information for this initial consultation phase. Maps relating to heritage, tāngata whenua, ecology, landscape, hazards, land ownership and land use were posted on the website and displayed at HDC. All these factors will inform the project team and stakeholders in identifying possible expressway route options. The public was informed that it was important that all constraints are identified during the early stages of the project, and once they are assessed and understood, the project team will be able to identify potential routes for the expressway and come back to the community for feedback on them.

The community was invited to provide feedback and comments on the constraints by 23 September 2011.

As at the end of September 2011, 26 items of feedback had been received, all of which were responded to within five working days. Five of these requested hard copies of maps to be mailed. Five identified areas of constraint, and these areas were checked with the planning team (Two areas of constraint identified were previously unknown to the project team or were not represented on maps, and have now been added; other areas of constraint were already known to the team). The remainder of inquiries either sought the final location of the proposed road (which is currently unknown), urged on-going consultation during the process, or generally supported the project.

14.5.5 Media Releases

Two media releases were sent out in May 2011 and August 2011. These are also available to view on the website.

14.6 Consultation Database

The consultation database to be used for the project will utilise the Darzin software. Darzin is data analysis software, created specifically for stakeholder engagement and community consultation. It is designed to record high volumes of public feedback and is currently being used on two other RoNS projects.

The consultation database has the following attributes:

- Ability to record all transactions in relation to one stakeholder or person (unique identity number).
- The ability to link persons to organisations or stakeholder groups.
- Geographic component (a link to Google Earth identifying the address or land parcel).
- Ability to do key word searches.
- Ability to attach and merge correspondence (in and out).
- Ability to be accessed by NZTA and range of consultants.
- Bring up dated flags for responses.

It also has the ability to create surveys/questionnaires and analyse the data. One of the principles of the database is the ability to classify issues. This classification system helps categorize data and will assist with reporting during the various stages of the consultation process. The recording of data where it is easy to access is also an important tool in understanding issues and assists in building relationships with stakeholders over the length of the project.

14.7 Conclusion

The consultation undertaken to date meets the expectations of the Consultation Plan. By consulting early in the process, the applicant, the stakeholder groups and the community have been able to exchange information and build relationships. Being transparent about what needs to be achieved and keeping people informed is important in maintaining these relationships, and ensuring that there are no surprises. An appropriate balance has been achieved between providing and seeking information and avoiding raising community anxiety at a stage where there are no precise plans.

15 Risk

Uncertainty is inherent in asset creation and asset management. Accordingly, it is vital to actively manage risk to limit any impact upon the NZTA's ability to meet its objectives, obligations, and stakeholder expectations in relation to all anticipated outcomes.

The risk management process used in this scoping study is consistent with the NZTA's Risk Management Process Manual (AC/Man/1).

A preliminary risk register was expanded for consideration at the collaboration meeting in Levin on 7th April 2011. Participants at the collaboration meeting made an assessment of the likelihood of each risk and its impact on the project.

Following the meeting, the risks were sorted into categories and formatted into the NZTA format, modified to suit the early stage of the I&R phase. Risk treatment plans were prepared for each of the categories for consideration and action during the remainder of the scoping phase. These are included in Appendix S.

The Route Options Workshop on 25th August assessed the six contiguous corridors to be considered further in the scheme assessment and the Route Risk Workshop on 8th September reviewed and updated the project risk register for one route only. MWH has assessed the risks for each of the other routes on a qualitative basis – higher or lower than the one route initially considered. These qualitative assessments will be used as one of the inputs to route selection during the scheme assessment stage. They are summarised in the Risk Register attached at Appendix R.

For the purposes of this Scoping Report, risk management has been undertaken at the project level, identifying and assessing risks to the project. This has included the development of risk treatment plans, grouping similar risks together unto categories and developing treatment plans by category rather than by individual risk.

The risks were assessed for one of the identified options and a further simple analysis rated each risk as it applied to the other options. The risks were rated 'higher', 'lower' or 'similar'.

The present risk assessments are qualitative. It is not intended to quantify risks until a preferred route is identified during the scheme assessment stage.

15.1 Largest risks

The qualitative analysis ranks risks by size. The five largest risks are as follows:

Māori owned land. This covers possible risks arising from the Te Ture Whenua Māori Act, Māori Reserves and land with multiple-owners. The risk has been placed in the highest risk category in both likelihood and consequence. The risk for all four short listed options (64, 66, 73 and 75) and the eastern option (Option 76) are broadly similar. The western route (Option 46) crosses large areas or Māori owned land and has a significantly higher risk, though this would not be reflected in a qualitative analysis.

Earthquake. Earthquake risk covers areas potentially vulnerable to earthquake hazards such as liquefaction, tsunami, and ground shaking. The risk has been placed in the highest risk category in both likelihood and consequence. Options 64, 66, 73 and 75 have broadly similar risks. Option 46 crosses softer sediments and has a higher risk of damage during ground shaking. It is also at a lower average elevation than the other options, so is more prone to inundation in a tsunami. Option 76 follows a fault valley (Ohariu Fault). Further work is required to identify the risk of earthquake in this corridor, but preliminary indications are that it will have a higher risk than the four short listed options. The higher risks will not be reflected in a qualitative analysis.

Loss of Access. This represents the risk arising from loss of access to property, schools, recreation areas, marae, urupa etc. This risk has a slightly lower rating for the four short listed options; it is expected that it would have a higher rating for the western route (Option 46), which has a large number of properties and links between them, but a lower rating for the eastern route (lower population, fewer accesses severed).

Iwi. This risk covers opposition to the preferred route from Iwi. The risk is considered similar for all options except Option 46, which traverses areas rich in cultural history and heritage.

Community Opposition. This risk arises from strong coordinated opposition to route from directly affected parties. The present level of analysis has determined that areas with residential properties and lifestyle blocks are the most likely to generate objections to the proposed expressway. The four short listed options and the western and eastern corridors traverse areas of residential settlement and areas subdivided for lifestyle blocks.

16 Conclusion and Recommendation

This Scoping Report has presented the complex process of carefully analysing numerous possible corridors for the location of a future expressway (81 in all) in terms of a range of considerations of intangible aspects (which cannot readily be reduced to cost considerations) by the means of a multi-criteria analysis process. Subsequent analyses included transport efficiency, cost considerations and social impact (using numbers of potentially affected dwellings as a proxy), which were then able to be combined in a way that enabled the identification of four short listed corridor options to proceed to the next stage, the Route Stage. In addition, an analysis has been undertaken of two of the options which are not included as preferred, but which will be included in future consultation.

The four short listed contiguous corridors include a range of recognised constraints and difficulties, which will need to be addressed and avoided or mitigated when identifying specific routes (approximately 200 meters in width) within them which will then be the basis for consultation with the public and stakeholders. It is also likely that the further investigations undertaken as part of the next stage will identify additional constraints to be addressed.

In summary, it is recommended that four corridors be brought forward for further investigation. Routes within these corridors need to be identified and analysed within a Scheme Assessment Report before selecting a preferred alignment to take through statutory approval processes.

The modelling results and BCR analysis indicate that further work needs to be undertaken to determine the ability to improve the economic performance of the expressway. This could include investigation into aspects such as:

- route optimisation;
- staging options;
- different interchange locations and layouts; and
- value engineering (i.e. scope and standards).

Further consultation with key stakeholders and the wider public also needs to be undertaken to present the corridors and to elicit information to assist with later decision making.