The Ngauranga Triangle Strategy Study:

The Technical Report

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The Ngauranga Triangle Strategic Study is a technical report, outlining potential long-term transport solutions for the Ngauranga Triangle transport network. The public release of the document means it is now available as an input into the Hutt and Western Corridor Plan reviews, which are scheduled to be undertaken by Greater Wellington Regional Council over the coming year.

As a technical report, the study has not been presented to the NZTA Board for its support, endorsement or approval. Accordingly, publication of the report does not constitute any form of commitment by NZTA to the recommendations contained in this report.

Quality Assurance Statement

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Revision Schedule

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Abbreviations:

AM	Morning
ATMS	Advanced Traffic Management System
BCR	Benefit cost ratio
DM	Do Minimum
EEM	NZTA Economic Evaluation Manual
EMUs	electric multiple units
GDP	Gross Domestic Product
GPS	Government Policy Statement
GWRC	Greater Wellington Regional Council
HCC	Hutt City Council
IRIS	Incident Reporting Information System
LTMA	Land Transport Management Act 2008
LTCCP	Long Term Council Community Plan
NIMT	North Island Main Trunk Railway
NSHS	National State Highway Strategy
NZTA	New Zealand Transport Agency
PM	Evening
PTMA	Public Transport Management Act 2008
PV	Present value
RLTS	Regional Land Transport Strategy
RMA	Resource Management Act
RoNS	Roads of National Significance
RTC	Regional Transport Committee
SH1	State Highway One
SH2	State Highway Two
SPPWF	Single Payment Present Worth Factor
TSLA	Transport Services Licensing Act 1989
vpd	Vehicles per day
WCC	Wellington City Council
WRS	Wellington Regional Strategy
WTSM	Wellington Transport Strategy Model

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1. Executive Summary

1.1. Introduction

The purpose of the Ngauranga Triangle Strategy Study is to develop an integrated long-term transport strategy for the "triangle" between State Highway One (SH1) Tawa - Ngauranga Gorge, State Highway Two (SH2) Dowse – Ngauranga and a possible link from the SH1 corridor to the SH2 corridor. The study also considers links from the SH2 corridor to Gracefield and the areas that surround these corridors. The findings of this study will become a key technical input into the Hutt Corridor Plan review. This study area is shown in Figure 1.1. The Strategy looks to:

- Improve safety, access and mobility
- Increase integration between the transport system and surrounding land uses
- Sustainably ease peak congestion on state highways and local roads.

In response to these needs, the New Zealand Transport Agency (NZTA), Hutt City Council (HCC) and Wellington City Council (WCC) have been working in partnership, with support from Greater Wellington Regional Council (GWRC), to develop a transportation plan to support activities and improve accessibility in the study area.

The preferred long term transport plan must satisfy the NZTA's statutory responsibilities under the Land Transport Management Act 2008 (LTMA), give effect to the Government Policy Statement (GPS) on land transport funding, and take account of the Wellington Regional Land Transport Strategy (RLTS) and its plans.

The development of the Ngauranga Triangle Strategy Study has resulted from specific actions identified in the Hutt Corridor Plan (2003) and the Western Corridor Plan (2006) for Transit NZ (now New Zealand Transport Agency), HCC and WCC relating to the investigation of projects with the study area.

In particular, both the Western Corridor Plan and the Hutt Corridor Plan have signalled the intent of providing a link road from SH1, north of Johnsonville, to SH2 in the vicinity of Petone. The Hutt Corridor Plan signals the need to link the Seaview-Gracefield industrial area efficiently to SH2, while the Regional Cycle Plan signals a desire to complete the off- road cycle facility between Petone and Ngauranga. This study seeks to confirm the merits of these proposals or otherwise.

1.2. Background

The Ngauranga Triangle Strategic Study area is one of the most critical parts of the greater Wellington region's transport network and is vital to its economic performance. The highways and rail system within the study area connect the region's fastest growing district, the Kapiti Coast, to the region's dominant employment hub in central Wellington. The Hutt Valley is the region's second largest population base and contains its primary industrial hub at Seaview-Gracefield, and this too is connected to Wellington City through the study area.

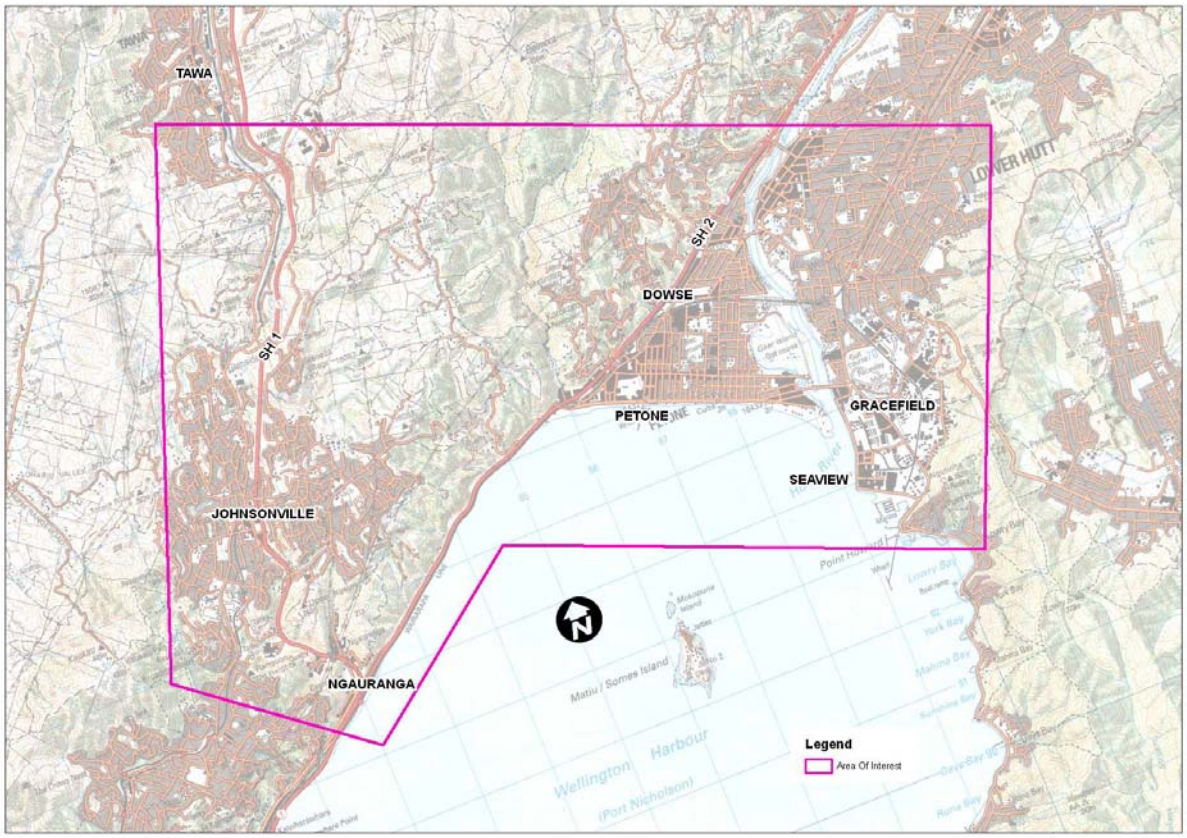


Figure 1.1: Ngauranga Triangle Strategic Study Area

Journey-to-work data from the 2006 Census and measured traffic volumes show that there is significant travel between northern Wellington (Johnsonville, Churton Park, Newlands etc), Tawa, Porirua and the Hutt Valley (including Seaview-Gracefield). For example, travel for commuting purposes from the 2006 Census data shows that 53% of employed residents of Porirua work in Wellington City and Lower Hutt, whilst in Lower and Upper Hutt around 31% of employed residents work in Wellington City. The current road and rail networks do not provide direct routes for travel between the Hutt Valley and SH1, north of Ngauranga Gorge.

The greater Wellington region is experiencing ongoing economic and population growth, which has exceeded Statistics New Zealand's medium projections in recent years. By 2026, regional population is expected to be 54,200 greater than the 2006 population, an increase of approximately 12 %.

In a report commissioned by Grow Wellington, the estimated total regional Gross Domestic Product (GDP) was $22.2 billion in 2008. This is the largest regional GDP per capita in New Zealand. In the 2006 Census the greater Wellington region had the greatest proportion of persons in the four highest income groups of any region. This means the Wellington regional economy is more dependent on higher value activities than other

regions in New Zealand. Tertiary sector[1] activities such as services, Government and finance are examples of such higher value activities. Growth in regional GDP during 2008 was 2.6 % per annum.

In the greater Wellington region, traffic growth is closely correlated with economic growth and in particular heavy vehicle volumes grow faster than economic growth. For example, the 2.6 % per annum growth in regional GDP experienced in 2008 was shown to deliver a growth in heavy vehicle volumes in excess of 3.9 % per annum. The Wellington Transport Strategy Model (WTSM) is forecasting an underlying growth in heavy vehicle numbers in the greater Wellington region of 4.25 % per annum from 2006 to 2026, based on medium growth projections. Given that recent growth has exceeded Statistics New Zealand's projections, this could lead to even higher numbers of heavy vehicles on the network if that trend continued.

As this transport plan has been developed for a 20-year time horizon, it is appropriate that growth forecasts are not overly influenced by the current recessionary times. Treasury forecasts developed in May 2009 for the 2009 budget anticipated a decline in national GDP for 2009 and 2010. Forecast GDP growth is 1.8 % in 2011, 2.9 % in 2012 and 4.0 % in 2013. Treasury's forecast indicates that the current recessionary period is a short-term phenomenon and in the near future, growth in national GDP can be expected to improve, growing strongly by 2012.

General traffic growth is a function of car ownership. Over the 2003 to 2007 period, Wellington regional light vehicle registrations increased by 2.6 % per annum and heavy vehicle registrations increased by 4.4 %. In summary, growth in regional travel demand is expected to outstrip population growth in the region into the future despite growing public transport use and higher fuel prices. This means that without increased road capacity in the Ngauranga Triangle Strategic Study Area, travel times can be expected to deteriorate over time.

The Local Authority study partners, HCC and WCC, who are jointly responsible for district planning within the study area, have identified development opportunities where careful integration of transport and urban form may produce improved outcomes, such as increased economic development, improved urban design and better integrated travel. These development opportunities include new development, significant regeneration or transformation of existing areas. Identified development opportunities in the study area are as follows:

Wellington City	☐ Lincolnshire Farm ☐ Johnsonville Town Centre
Hutt City	☐ Petone and foreshore ☐ Seaview-Gracefield (industrial and logistics hub).

Lincolnshire Farm is a residential and business park development of a large parcel of land located north of Grenada Village and west of Horokiwi. WCC, in conjunction with the developer, has undertaken a planning exercise to provide a structure plan to guide the future development of the area. The Petone-Grenada Link Road concept is intrinsically built into this development plan.

1 The tertiary sector of economy (also known as the service sector or the service industry) is one of the three economic sectors, the others being the secondary sector (largely manufacturing) and the primary sector (extraction such as mining, agriculture and fishing).

Redevelopment of the Johnsonville Town Centre is more than the redevelopment of the existing mall, although the mall development is very much part of this proposal. The town centre development includes the development of areas across Johnsonville Road from the mall. This raises an issue of how land uses east of Johnsonville Road can be better integrated into the town centre development, requiring careful consideration of how Johnsonville Road might function. WCC has undertaken a planning exercise that has provided a framework for the future development of the wider town centre. This framework is the Northern Growth Management Framework.

The continuing growth of the Churton Park area is expected to see the construction of an additional 1,100 dwellings over the next 20 – 30 years. Accessibility to the suburb will be significantly improved by the proposed extension of Westchester Drive to Middleton Road. The potential provision of a new and more direct route between this area and the Hutt Valley will not only improve accessibility but also alleviate severe congestion in Ngauranga Gorge on SH1 by the removal of around 12,000 vehicles per day (vpd) north of Johnsonville, improving the potential for economic development.

Heavy volumes of traffic, including large numbers of heavy vehicles, create a barrier between the Petone foreshore and the lower Hutt Valley. HCC has developed a vision for the wider Petone area which seeks to create:

- A unique heritage place
- An economically and environmentally sustainable environment
- A real place for people
- An attractive and vibrant village culture.

The construction of an improved road link between SH2 and Seaview will enable the desired improved connections between the foreshore and Petone and would enable a considerable improvement in amenity in the area. The value of land adjacent to the foreshore would be significantly enhanced by this amenity improvement and this could contribute to a significant economic regeneration in the area.

The Seaview-Gracefield area is identified in the Wellington Regional Strategy (WRS) as the greater Wellington region's primary industrial area. Growing congestion on The Esplanade increases the costs to business in the region and reduces the attractiveness of the area for further development. Efficient access between this area and SH2 will be important for its future development. Further, as the region's primary industrial area, it is important that this area is efficiently connected to SH1 to enable improved servicing of the lower North Island.

The implications of proposals arising from this study could have a profound impact, not only on transport, but also social and economic activities in the region. The strategic road and rail networks in the region are linear in form and provide for north-south movement in both the SH1 and SH2 corridors. This study not only considers measures that may improve the efficiency of these north-south movements but also considers measures that allow improved movements outside this linear north-south pattern such as east-west movements between SH1

to SH2, and SH2 to Seaview. This may lead to new opportunities and facilitate more effective agglomeration[2] of activities resulting from land uses in the SH1 corridor interacting more effectively with those in the SH2 corridor and lower Hutt Valley.

Of particular significance is the Seaview-Gracefield area. This is the greater Wellington region's primary industrial and logistics centre. The Seaview-Gracefield area generates significant travel demands, particularly for heavy vehicles, to and from Wellington City, the Port, Wellington's northern suburbs, Kapiti and further north. This study is concerned with improving access to and from this area to facilitate increased productivity and economic development.

1.3.Form and Function of the Transport Network

The primary strategic roads and rail lines within the study area include SH1, SH2, The Esplanade, the North Island Main Trunk Railway (NIMT) Line, and the Wairarapa Railway Line. These key transport routes make up the strategic transport network in the study area and are described in more detail below.

SH1 out of Wellington is classified as a National State Highway in NZTA's National State Highway Strategy 2007 (NSHS). The Government has identified this road, between Wellington and Levin, as one of seven Roads of National Significance (RoNS) and is therefore one of the country's most important road sections in terms of assisting national economic development. SH1 and the NIMT connect Wellington to the lower North Island and beyond. In this respect SH1and the NIMT have an important economic function of linking the lower North Island centres to the greater Wellington region urban areas for tourist, business and social reasons; while also connecting the lower North Island to the Port of Wellington for the export of logs, wood products and other resources.

Within the study area SH1 is a multi-lane divided highway that alternates between motorway and expressway standards. This part of SH1 carries between 45,000 vpd at Tawa and 70,000 vpd at Ngauranga. Traffic includes significant volumes of heavy vehicles making up 3 to 5 % of the daily vehicle numbers on SH1 in the Ngauranga Gorge.

The NIMT runs parallel to SH1. The line is double tracked within the study area and has the dual function of providing for passenger rail services, and delivering rail based freight. The passenger rail services include regular suburban rail services to the Kapiti Coast and long distance connections to Palmerston North and Auckland.

SH2 from Wellington is classified as a Regional State Highway in NZTA's NSHS. The segment of SH2 within the study area operates as a four-lane divided expressway and carries 34,000 vpd at Dowse and 67,000 vpd at

2 The phenomenon of economic activity congregating in or close to a single location, rather than being spread out uniformly over space.

Ngauranga. Like SH1, this traffic includes significant volumes of heavy vehicles on SH2 north of Ngauranga, making up approximately 10 % of the daily traffic flow.

The Wairarapa Line is adjacent to SH2, and is double tracked within the study area. This line has the dual function of providing for passenger rail services and delivering rail based freight to the Wairarapa. The passenger rail services include suburban rail services and long distance connections to the Wairarapa.

The Esplanade is classified as a Major District Distributor Road[3] in the Hutt City District Plan. The road serves as a major route for traffic wishing to gain access to SH2 from Petone, Gracefield and eastern parts of the Hutt Valley including Wainuiomata and the Eastern Bays. The Esplanade consists of a mixture of two-lane and one-lane sections with some on-street parking in each direction. During the morning (am) peak, a west-bound high occupancy vehicle and taxi lane operates. The Esplanade carries 32,000 vpd including large volumes of heavy vehicles travelling from Seaview and Gracefield (10 to 12 % of the daily traffic on The Esplanade).

SH1, SH2 and The Esplanade currently experience significant congestion at peak times leading to delay and travel time variability for drivers using these roads at these times because travel demand is close to capacity resulting in delays due to sheer volume of traffic on the link rather than a specific bottleneck. Forecast travel demand, using WTSM, indicates that congestion will worsen leading to increased delay, greater travel time variability and the lengthening of the peak periods if additional road capacity or new roads are not provided. This will add cost to business activities in the greater Wellington region making it less attractive to new businesses and reducing the potential for economic development.

Both the NIMT and Wairarapa lines have high ridership at peak times. There are approximately 4,100 passengers per day on the NIMT and 5,200 passengers per day on the Wairarapa line in the study area that travel southwards towards Wellington. It is expected that similar numbers of passengers would make the return trip. Capacity constraints outside the study area limit the possible improvement of levels of service on the rail network to a 15 minute frequency from Kapiti and Upper Hutt to Wellington at peak times. Higher peak period frequencies, without line improvements, would lead to a significant deterioration in service reliability. Increases in passenger rail service frequency would limit the opportunities for additional freight movements. Travel forecasts, using WTSM, indicate that passenger rail will experience increasing demand into the future within the study area.

1.4. Study Process

The study development process is shown in a flow diagram below (Figure 1.2). In summary the steps in the study process are as follows:

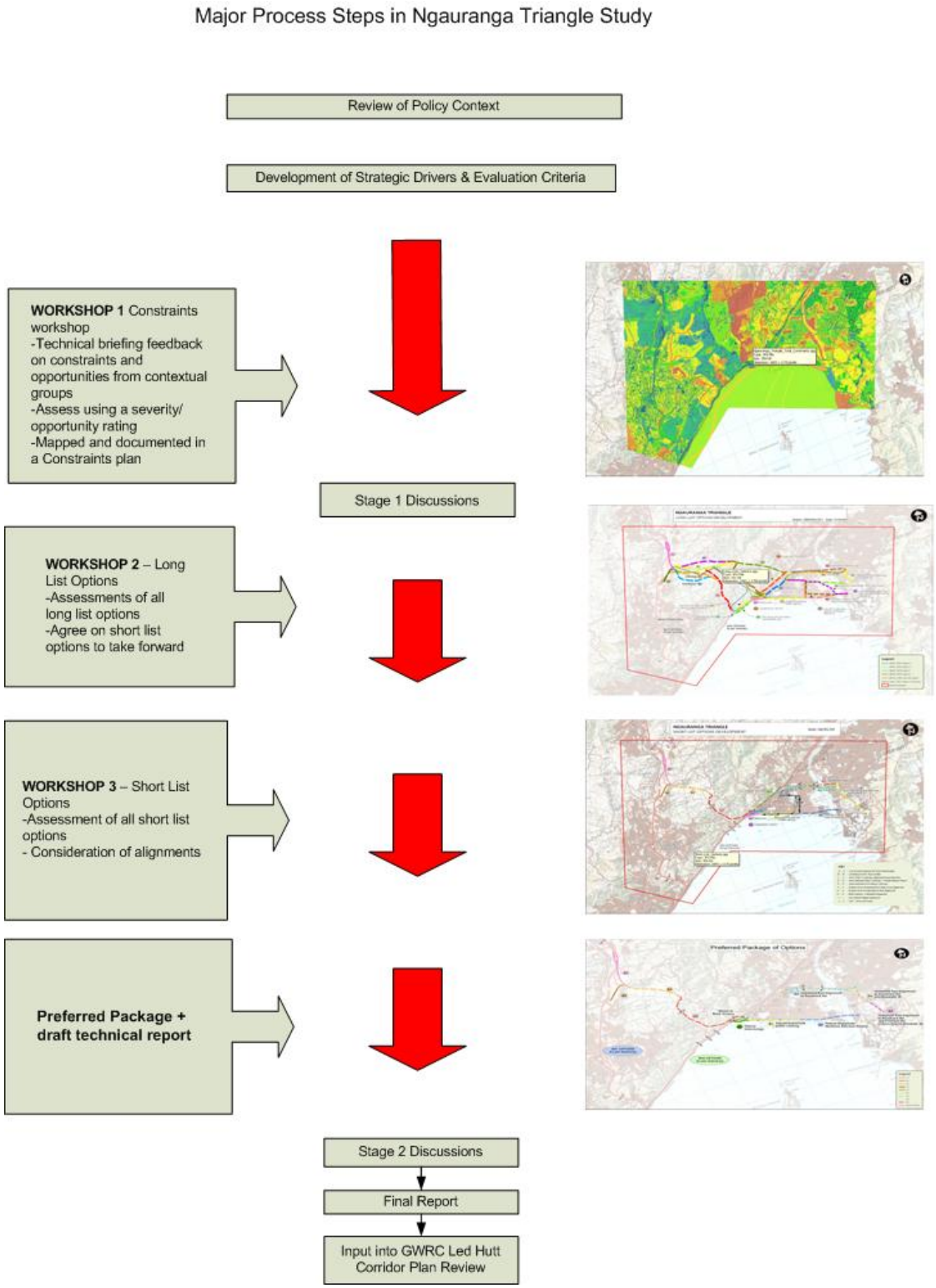
Policy Context Review	☐ This was a review of the relevant legislation and national policy documents, regional and local policy documents and other relevant non-statutory planning documents to provide a context in which this study was undertaken.

[3] A Major District Distributor is the second level in the road hierarchy, below State Highways. This indicates that this is a local road with a key through traffic moving function.

Development of Strategic Drivers and Evaluation Criteria	The strategic drivers for the study were developed to give effect to the policy context of the study and the study's objectives. The evaluation criteria are a set of objectives and performance measures for the study's potential projects that reflect the study's strategic drivers within the specific context of the issues and opportunities identified in the study area.
Constraints Plan	This is the identification of constraints and opportunities that may impact on potential project options in the study area. This includes a broad range of matters such as regulatory requirements, heritage, areas of cultural significance, noise sensitivity, sensitive ecological environments, difficult geotechnical ground conditions and others. This step also included the identification, assessment and mapping of constraints and opportunities. A multi-party and multi-disciplinary workshop was undertaken to facilitate this phase.
Early Discussions ("Fireside Chats")	A series of meetings were held with representatives of identified key existing stakeholders. Meetings were held with these groups so that they could identify the issues important to them, possible community constraints and potential options and alternatives.
Long List Options	An extensive list of potential transportation measures that address the strategic drivers were developed for the study. This list was subject to a coarse evaluation with the purpose of removing those options that performed poorly against the wider study objectives, or were seriously compromised by the identified constraints. This analysis was presented to, and reviewed by, a workshop involving Study Governance Group[4] members. A short list of options was agreed for further evaluation as an outcome of the workshop.
Short List Options	A detailed assessment of the remaining options was undertaken including a strategic assessment of cost, project economics and consentability. This included the identification of a preferred suite of key projects and their form. This phase was concluded with a workshop involving Governance Group members who reviewed the analysis.
Technical Report	Further technical work was undertaken on the remaining options including the refinement of route alignments. This was summarised in the Study's Technical Report. This report provides an extended executive summary of the Technical Report and the following sections detail each of the stages set out above.

After further discussions with key stakeholders, the Technical Report will be finalised and will become a key input to the GWRC-led review of the Hutt Corridor Plan scheduled to begin in early 2010, and local planning considerations. Full public consultation, including hearings, on the projects that make up the proposed study strategy, will be undertaken as part of the Hutt Corridor Plan review.

[4] The Study Governance Group was made up of senior officers from NZTA, WCC, HCC and GWRC.



■ **Figure 1.2: Ngauranga Triangle Strategic Study Process**

1.5. Policy Context Review

The first stage of the study was to review relevant legislation, national, regional and local policy and other relevant non-statutory documents to confirm the statutory context under which this study has been undertaken. The review assisted the development of evaluation criteria for the study which are consistent with existing policy. Further, this step helped identify potential projects put forward in relevant previous planning documents and studies that could help address identified issues in the study area over the short and long term.

Overall, it is recognised that the various policy documents and legislation support and encourage transport projects which:

- Integrate land use and transport planning
- Provide economic benefits for the area
- Improve the sustainability of the land transport system
- Improve the performance of land transport systems
- Limit the environmental impact of land transport systems on their surroundings
- Improve the safety, security and public health of the community
- Manage transport demand.

The recently released GPS highlights the importance of transportation to support economic development. The GPS states:

- *The government's priority is for land transport investment to support national economic growth and productivity.*

This means that proposals that facilitate economic development are an important outcome of this study. The GPS also identifies the section of SH1 in the study area as part of the Wellington-Levin corridor RoNS. From a Government perspective, this means that any proposals that improve the efficiency and reliability of SH1 will be of particular value.

1.6. Issue Identification

Following Stage One discussions and the constraints workshop, a number of issues were identified that relate to the current and future performance of the transport network within the study area. These issues, along with the key policy and planning documents, were used to inform the development of performance measures to support each of the objectives in the evaluation framework detailed below.

The "level of service" for the key roads is noted in the sections that follow. The definition of "level of service" is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. In general there are six levels of service, designated from A to F, with a level of service A representing the best operating conditions (i.e. free flow) and level of service F the worst (i.e. forced break-down flow). For reference, the level of service ratings are explained in more detail in Table 1.1 below.

Table 1.1: Level of Service Definitions

Level of Service (LoS)	Description
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience is excellent.
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of discomfort and convenience is a little less than with level of service A.
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream The general level of comfort and convenience declines noticeably at this level.
D	Close to the limit of stable flow and is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.
E	Occurs when traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause break-down.
F	Is in the zone of forced flow. With it, the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow break-down occurs, and queuing and delays result.

Ngauranga to Tawa	☐ Growing traffic volumes on SH1 leading to severe peak period congestion (LoS E) and travel time variability (NZTA travel time surveys indicate that peak travel times have stabilised which means increasing traffic demand will lead to a lengthening of the peak period) ☐ The level of crashes in the vicinity of Tawa Interchange (3 serious from 2004 to 2008) ☐ Placement/design of motorway access points creating congestion on Johnsonville Road ☐ Commuter buses getting caught in congested general traffic in Ngauranga Gorge leading to service delays in peak times ☐ Poor level of service for cyclists and pedestrians ☐ Current inadequate level of service for passenger rail at peak and non-peak times

Ngauranga to Dowse	☐ Growing traffic volumes on SH2 leading to severe peak period congestion (LoS E) and travel time variability, particularly on the on and off-ramps at peak times (NZTA travel time surveys indicate that peak travel times have stabilised which means increasing traffic demand will lead to a lengthening of the peak period) ☐ High level of crashes in the vicinity of Petone Interchange, resulting in safety issues and disruption to traffic flows (crash statistics show there were 89 injury crashes between Petone and Ngauranga on SH2 from 2004-08 of which eight were serious and 81 were minor. The majority of crashes, including minor, are associated with Horokiwi/SH2 intersection and the Petone interchange) ☐ Commuter buses getting caught in congested general traffic between Ngauranga and Petone leading to service delays in peak times ☐ Poor level of service for cyclists and pedestrians ☐ No direct link for pedestrians and cyclists crossing from the Petone foreshore to the Korokoro Valley and the Belmont Regional Park ☐ Current inadequate level of service for passenger rail at peak and non-peak times.
SH1 to SH2	☐ Poor connections/integration between the Western Corridor/SH1 and Hutt Corridor/SH2), leading to: - Lack of east – west social and economic integration - Poor freight connectivity of Seaview-Gracefield to lower North Island - Limited east – west passenger transport service opportunities
SH2 to Seaview-Gracefield	☐ Growing traffic volumes on The Esplanade leading to serious peak period congestion (LoS E) and travel time variability, community severance, decreased Petone foreshore amenity values and limited economic development (NZTA travel time surveys indicate that peak travel times have stabilised which means increasing traffic demand will lead to a lengthening of the peak period) ☐ Reducing quality of connectivity between the Seaview-Gracefield Industrial Area and SH2 as The Esplanade nears capacity ☐ Poor level of service for cyclists and pedestrians ☐ Aging infrastructure of Petone ramp bridges and Petone pedestrian bridge ☐ Increasing freight volumes which operate throughout the day.

1.7. Strategic Drivers and Evaluation Criteria

The strategic drivers for the study were collectively developed with the Governance Group using the policy context review as a basis. In this way, all the issues associated with different parts of the study area could be taken into account.

These drivers have underpinned the development of the project strategy and evaluation criteria, which have consequently guided decisions on which options to reject or take to the next stage of development. These drivers have also informed the urban design objectives and principles developed as part of the urban design framework for this study. The drivers are defined below:

- Improve connectivity for passenger transport
- Improve connectivity for general traffic
- Improve connectivity for freight traffic
- Improve connectivity for safe walking and cycling (and other active modes)
- Improve the amenity of Petone and foreshore to enable development of this area incorporating integration with the foreshore
- Improve the network security, resilience, and quality of the transport network between Wellington City and the Hutt Valley and the SH1 RoNS corridor within the study area
- Provide for the integration between transport and land use.

A high level evaluation framework and associated performance measures were developed based on the project objectives and strategic drivers detailed above. These evaluation criteria allowed a transparent evaluation of individual projects to identify the extent to which they contributed towards the study objectives, complied with legislation, national, regional and local policy, and provided benefits to the community.

This evaluation framework is based on the following objectives:

- Ensure environmental sustainability
- Assist economic development
- Assist safety and personal security
- Improve access and mobility
- Protect and promote public health
- Consentability.

The first five objectives are from the LTMA and are reflected in the RLTS. The last objective is a measure of the ability of projects, within a preferred strategy, to be implemented. A practical transportation plan for the Ngauranga Triangle area should concern itself with projects that can be implemented. This means a project should have some likelihood of gaining consent under the Resource Management Act 1991 (RMA).

As noted above, the GPS places particular importance on transportation infrastructure supporting economic development. In this study, economic development can be facilitated by:

- Improving the efficiency and reducing the cost of business related travel by reducing severe congestion and travel time variability
- Improving access to and from important economic activity centres such as the Seaview-Gracefield industrial hub and the Port
- Facilitating new development such as the Lincolnshire Farm area
- Supporting the renovation and economic regeneration of areas such as the Johnsonville town centre, Petone, the Petone foreshore
- Improving the efficiency and reliability of SH1 and SH2.

Each of the seven study objectives identified above have had a set of performance indicators developed for them that take into account the specific context of this study and the transportation issues and opportunities in the study area.

1.8. Constraints and Opportunities in the Study Area

Considering the size of the study area and variety of environments ranging from urban to rural areas, there are multiple constraints and opportunities. Key urban design considerations are outlined in the diagram below. These include identification of the key areas of employment and community activity areas, future development areas, important areas of open space and areas where amenity improvements are sought.

Study constraints are outlined below. These constraints relate to:

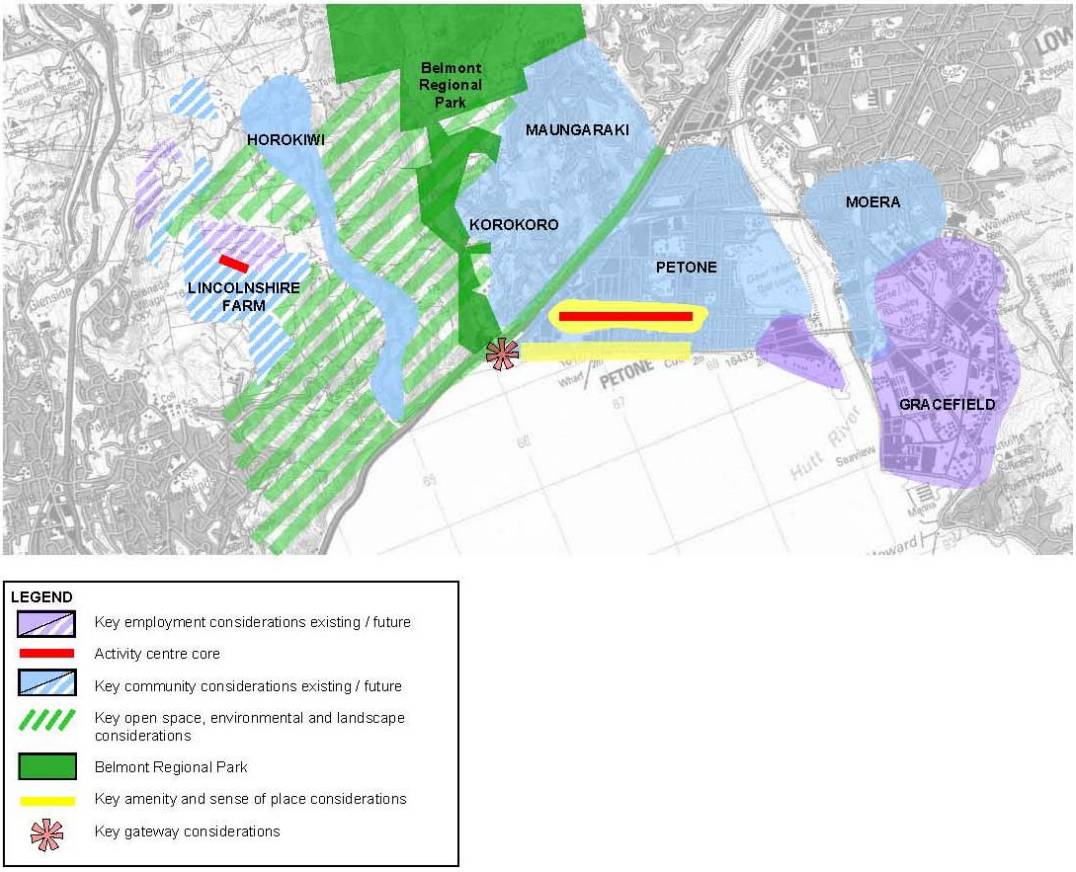
- Urban form
- Regional Parks and Department of Conservation Land
- Ecology
- Geotechnical conditions
- Hydrological science
- Landscape values
- Noise and air quality
- Contaminated land
- Climate change and sea level rise
- Community severance
- Iwi/Maori land and archaeological sites.

These constraints and opportunities are discussed in more detail in the Technical Report and for clarity, only those constraints related to the preferred strategy detailed below are shown in the map, over.

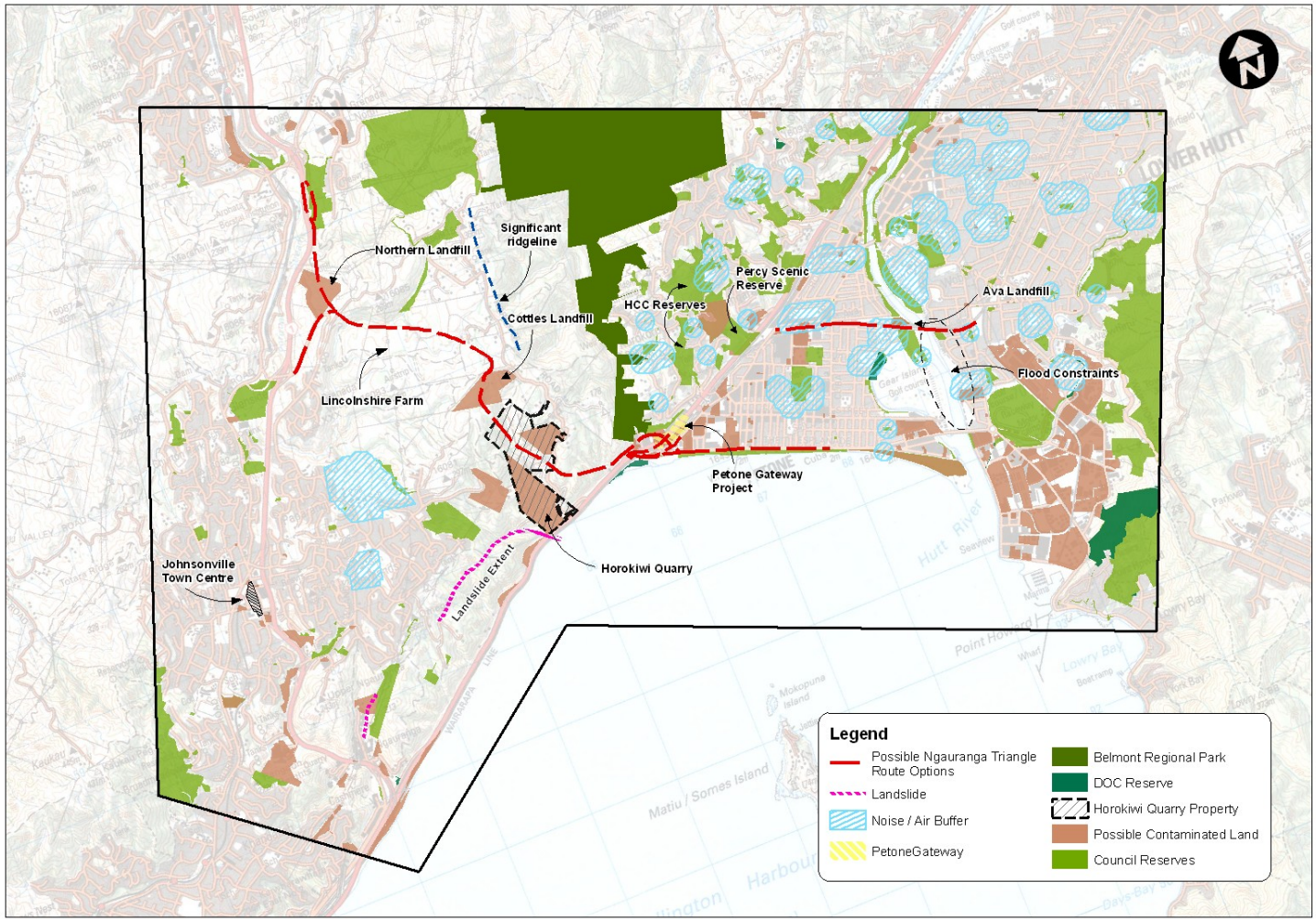
As this study is intended to consider the transportation needs of the Ngauranga Triangle Strategic Study area up to 30 years into the future, climate change and sea level rise are not considered to have a major impact on this study. Associated with the issue of climate change and sea level rise is the increased impact of storm surge.

The consensus of scientific thought indicates that sea level rise around New Zealand over the next 100 years is expected to be less than 1 metre[5]. This means that sea level rise and storm surge is unlikely to greatly impact on projects in the study area over the 30 year study period. However, it would be prudent that all major new infrastructure proposed in the preferred strategy be designed to accommodate sea level rise and increased storm surge over its design life.

[5] Coastal Hazards and Climate Change – A Guidance Manual for Local Government in New Zealand 2nd Edition July 2008. Ministry for the Environment



■ **Figure 1.3: Urban Design Considerations**



■ **Figure 1.4: Key Constraints**

1.9. The Preferred Strategy Components

This section sets out the proposed strategy components for the Ngauranga Triangle Strategic Study area. As this is a strategic study, more detailed investigations will be required to confirm the individual elements within the strategy as they are progressed. The study has carefully investigated transport solutions that include road, public transport, walking, cycling and freight needs.

In developing the preferred strategy the following key issues have been considered:

- Traffic, passenger and economic growth
- The effects of the wider transport network on the individual elements of the strategy
- The development opportunities identified above.

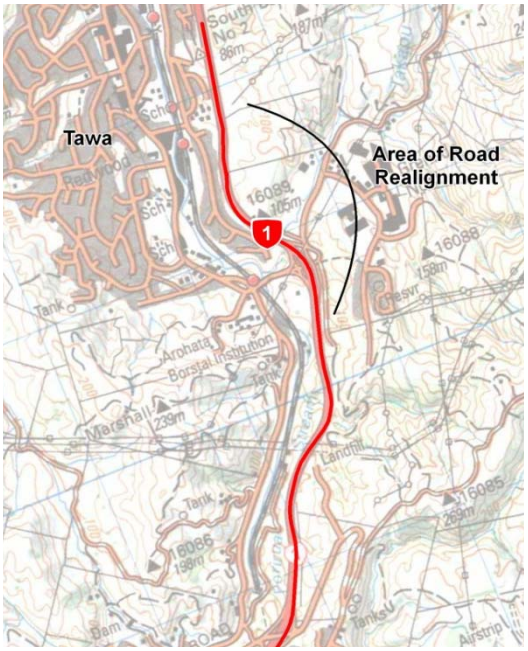
The components of the preferred strategy have been generally grouped according to the corridors to which they relate.

- **Ngauranga to Tawa**

- *Tawa Interchange Improvements*

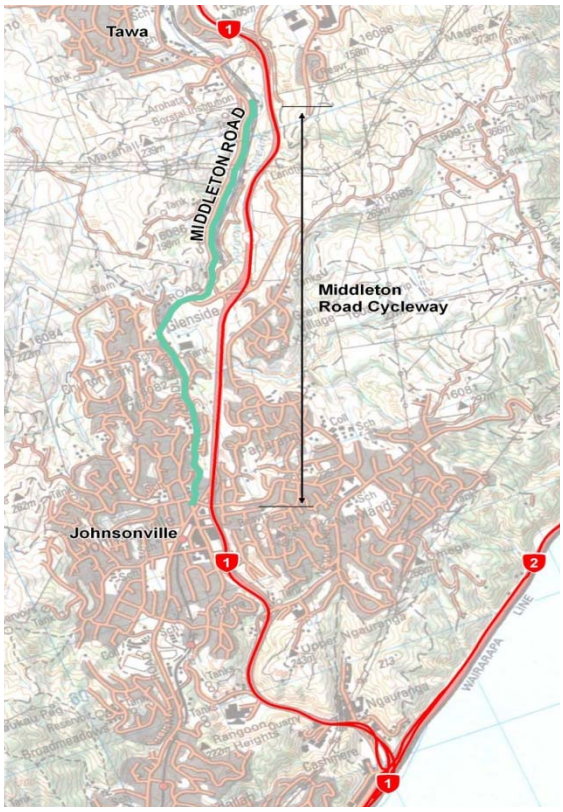
This project brings SH1 up to 100 km/h design standards and improves safety in the vicinity of Tawa Interchange which is an identified issue. This project is expected to cost $14 million and has an indicative benefit cost ratio (BCR)[6] of 1.8.

These improvements could proceed independently of the Petone-Grenada Link Road but it is proposed that this project be built in conjunction with the Petone-Grenada Link Road, as the link road will require alterations to the Tawa Interchange and building these together will result in less overall disruption to SH1 traffic.



[6] A BCR compares monetarised expressions of travel time savings, vehicle operating cost savings, crash savings, travel time reliability benefits and others with the project cost over time. A BCR greater than 1.0 indicates the project is worthwhile as benefits exceed costs. BCRs set out in this report are at a strategic level only and subject to further refinement during future project investigation phases.

- *Middleton Road Cycleway Improvements*



North of Johnsonville, pedestrians and cyclists must leave SH1 and travel north or south using Middleton Road. The road between Johnsonville and Tawa is narrow in many places and sections of the road operate at 70 km/h. There is no continuous footpath for pedestrians on this road. Over the period 2004 – 2008, crashes involving cyclists amounted to one serious and two minor crashes and one of these was a collision between two cyclists. Estimates of current levels of cycling along this route total 150 cyclists per day in both directions.

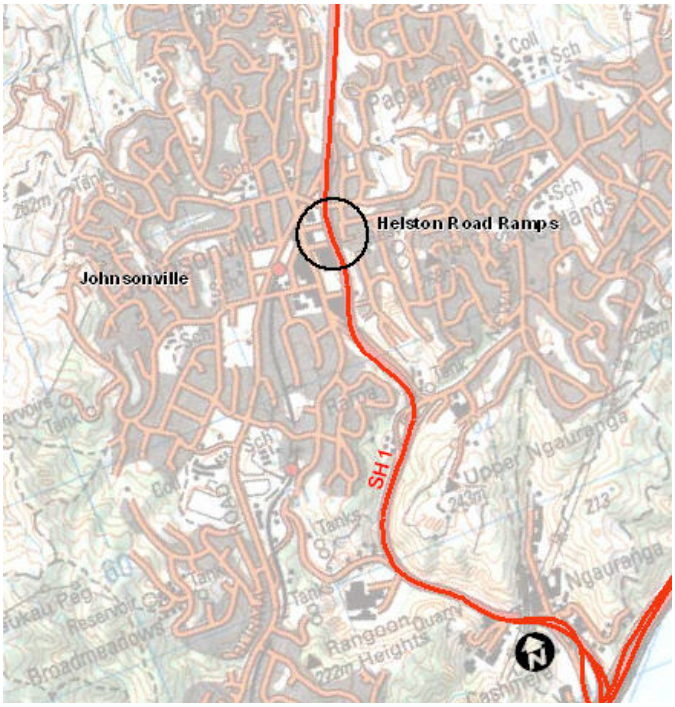
A purpose-built three metre wide facility to accommodate pedestrians and cyclists is expected to cost $5 million. The proposal will involve widening of existing footpaths towards the Johnsonville and Tawa ends of the project and providing a new cycleway by widening the road. Some parts of the cycleway, on the widened sections of road, would require retaining structures to be provided. It has been assumed that the cycleway will be provided on the open side of the gorge to avoid cutting into rock face on the opposite side.

As an estimate it is reasonable to expect that a new purpose-built cycling facility along Middleton Road would double the number of cyclists using this route to around 300 cyclists per day. Using the estimated cost of $5 million, the indicative BCR of the cycleway is 1.8.

This project is recommended to proceed as it will provide a cycle facility that will serve the existing demand on this road and further enhance cycling as a mode of travel in this area, whilst also providing a scheme that is economically justifiable.

- *Johnsonville Motorway Access Improvements*

South facing Helston Road ramps were considered to alleviate congestion on Johnsonville Road, assist development at the Johnsonville Town Centre and provide improved access to Churton Park. Such ramps would significantly reduce traffic on Johnsonville Road and allow it to be redeveloped in a manner consistent with a shopping street while improving pedestrian permeability.



The reduction of traffic on Johnsonville Road would prevent the tail of a queue from the Johnsonville northbound off-ramp stretching back on to SH1 in the evening (pm) peak. This situation occurs at times and is considered a significant safety risk. Closure of the Johnsonville ramps is not recommended as it would increase traffic volumes on SH1 between Johnsonville and Helston Road and result in congestion and safety impacts.

Providing the Helston ramps is forecast to reduce Johnsonville Road traffic volumes by approximately 7,000 vpd in 2016 but at the same time increase traffic volumes on the "Johnsonville Bypass" (SH1 at Johnsonville) by approximately 10,500 vpd.

As the proposed Petone-Grenada Link Road is forecast to reduce traffic volumes by approximately 12,000 vpd on SH1, the installation of new Helston ramps cause the relief to SH1, north of Johnsonville, provided by a new Petone-Grenada link to be reduced.

The Helston ramps have an estimated cost of $11 million. The cost of these ramps reflects the constrained and difficult environment in which the ramps would be built and the BCR of the project is negative, because the benefits gained by relieving the Johnsonville off-ramp and Johnsonville Road are more than offset by the additional delay incurred by road users on SH1 north of Johnsonville.

The development of this project should be subject to further investigations, including more detailed traffic modelling, and discussions between the NZTA and WCC to thoroughly examine the full range of benefits and costs of this project. Only the direct transportation related benefits of the project have been taken into account at present, and the provision of the Helston ramps may generate significant economic and development benefits in the Johnsonville Road area and surrounds which are not accounted for in the standard NZTA BCR calculations. Further work should be undertaken by WCC to quantify the amenity and economic regeneration benefits that will accrue to the Johnsonville area by building the Helston ramps.

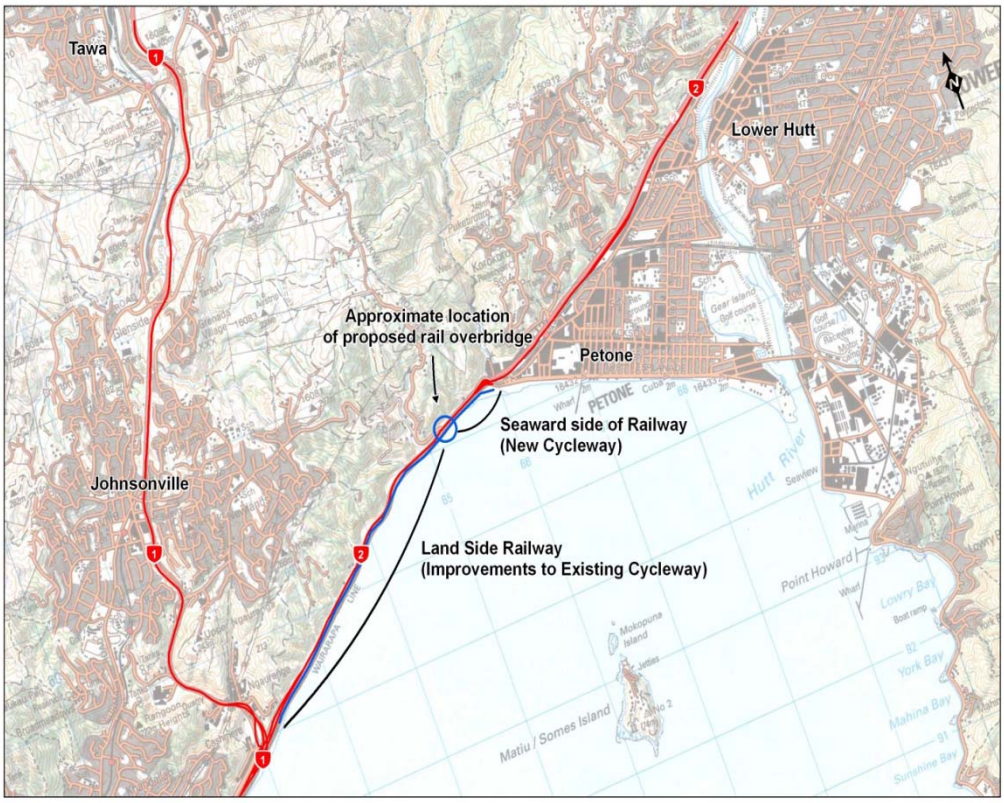
- **Ngauranga to Dowse**

The proposed Petone – Grenada Link Road (refer below) will reduce traffic pressure on SH2 by an expected 12,000 vpd south of the Petone ramps in the forecast year of 2016, which leaves residual cycling and pedestrian issues to be solved between Ngauranga and Petone.

- *Complete the Off-Road Pedestrian/Cycle Facility on SH2*

This project addresses the inadequate level of service to pedestrians and cyclists that currently exists, by completing the northern section of the pedestrian/cycle facility on SH2, between Horokiwi and Petone, following a route on the seaward side of the rail tracks north of the Horokiwi intersection.

As the railway lines are double tracked and at peak times, highly utilised from Petone to Ngauranga in this location, it is proposed that the project joins the new pedestrian/cycleway via a bridge over the rail tracks to the existing pedestrian/cycle facility adjacent to SH2. The proposed bridge will provide the best safety outcomes for pedestrians and cyclists and avoids potential disruption to daily rail movements that might be caused by an at-grade crossing. The provision of the proposed cycle/pedestrian facility, including the proposed bridge, will require the reclamation of approximately 400m of coastal land. Discussions have taken place with ONTRACK regarding an at-grade crossing of the rail tracks but it has strongly recommended against such a proposal.



This new section of pedestrian/cycleway can be thought of as the first stage of the "Great Harbour Way" concept and should be built to standards consistent with the vision for that concept (i.e. a 4m wide shared-use (cycle/pedestrian) facility). If measured demand on this new facility is sufficient it may provide further justification for completion of the "Great Harbour Way" between Horokiwi and Ngauranga.

The cost of improving the existing Ngauranga – Horokiwi section of the off-road cycleway within the constraints of the corridor and the completion of the northern section of this pedestrian/cycleway is expected to have a total cost of $16 million. This includes a bridge structure from the existing facility over the rail tracks to the seaward side of the tracks, the required reclamation and track formation. The indicative BCR for this project is 1.3. This project is not physically tied to any other projects nor is its timing.

This project is proposed because it addresses:

- An incomplete off-road pedestrian/cycling facility parallel to SH2
- Growing congestion on SH2 by providing an alternative for travel.

In a small way, the completion of this cycleway assists locking in the benefits of the Petone-Grenada Link Road. The Petone-Grenada Link Road will remove traffic from SH2 and therefore reduce congestion on this road between Ngauranga and Petone. Completion of the cycleway will also provide a higher level of service for pedestrians and cyclists in this area, reducing the risk of pedestrians and cyclists switching to travel by car. A completed cycleway will provide a higher standard alternative to assist in absorbing future growth in the demand for travel in the corridor.

- *"Beach to Bush"*

The construction of the Petone-Grenada Link Road will require the reconstruction and relocation of the existing Petone Interchange. This will release the Petone ramps overbridge from the existing interchange to provide a crossing over SH2 and the Wairarapa rail line providing a safe and convenient path for pedestrians and cyclists, connecting the Petone foreshore to the Korokoro Valley and the Belmont Regional Park – the "Beach to the Bush" concept. As this project largely re-uses existing infrastructure, it requires little funding.

An alternative to this proposal is to demolish the structures at the Petone Interchange so that a purpose-built "Beach to Bush" pedestrian and cycling facility could be built. This could be built with sufficient clearance to allow over dimensioned vehicles to travel north of Petone on SH2 which they cannot do at present due to the constraint at the overbridge.

The pedestrian and cycling demand served by the "Beach to Bush" project is approximately 90 per day based on surveys undertaken by Beca in 2007 as part of the Dowse to Petone improvements. Based on the level of use it would be difficult to produce a BCR that would support a purpose-built facility. In addition, over dimensioned vehicles on SH2 would still be limited by the clearances provided by the Normandale Bridge 3 km north on SH2.

- *Traffic Management on SH2*

This may include ramp signalling at Petone in the am peak and at Ngauranga in the pm peak to manage the amount of traffic allowed on to SH2 so that it operates more efficiently and improves the severe congestion encountered at these ramps at peak times.

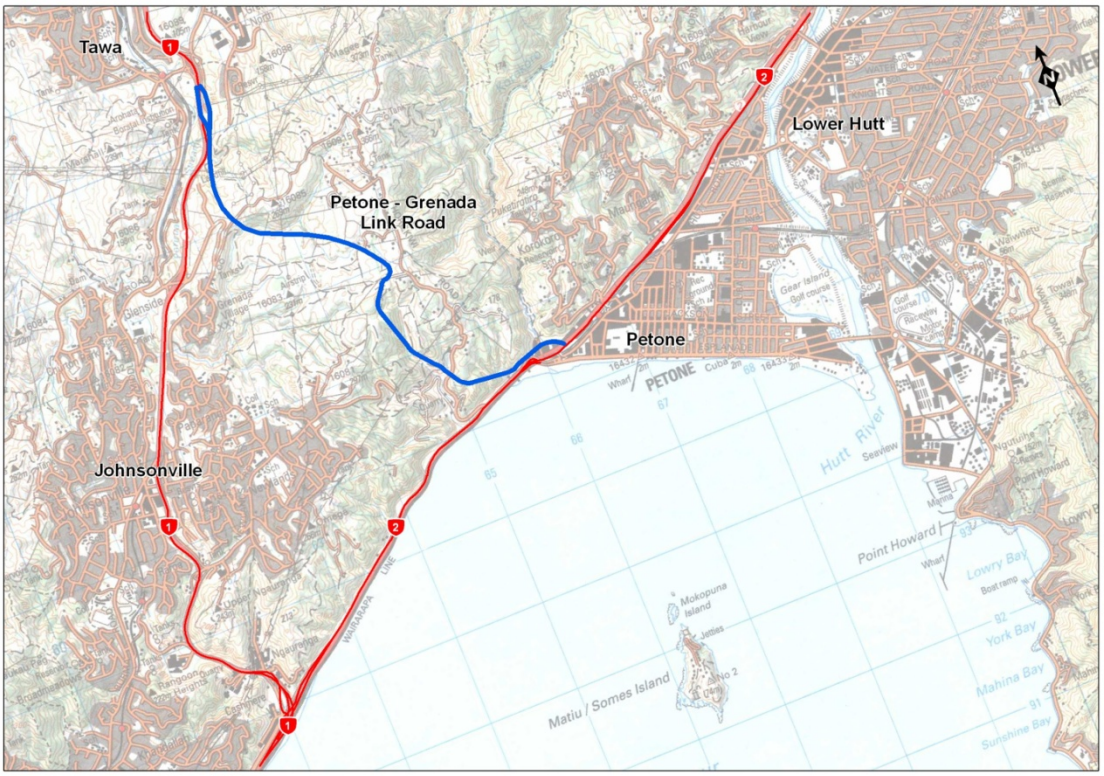
Ramp signalling involves the installation of traffic signals on the on-ramp that intermittently allows two vehicles per green phase to enter the mainline traffic stream. The frequency of the green phase is set to a level that provides optimal traffic conditions on the mainline flow.

Ramp signalling at Petone is expected to cost $850,000 and has a BCR of 1.7. Ramp signalling at Ngauranga has an expected cost of $700,000 and has an indicative BCR of 2.1. These projects lock in the benefits of the proposed Petone-Grenada Link Road and the Cross Valley Link by encouraging greater use of these roads rather than their alternatives. This is an application of travel demand management designed to sustain the benefits of these new roads. Further, these measures smooth the mainline traffic flow on SH2 at the respective peak times by managing the traffic stream entering the highway and therefore improve their efficiency.

- **SH1 to SH2 Link**

- *Petone-Grenada Link*

This is proposed to be a four-lane divided road with adequate shoulder width to allow for cyclist use, linking SH1 near Tawa to SH2 using a new Petone Interchange. It is designed to have a nominal operating speed of 70 km/h. The Petone-Grenada Road Link is expected to cost $250 million and has an indicative BCR of 1.3. This is a promising BCR for a project of this size. This project is integrally related to the development of Lincolnshire Farm.



The cost of the new Petone Interchange is included in the cost of this option. The reconstruction of this interchange is an essential part of linking the Petone-Grenada Link Road into SH2 and the Hutt City local road network. The aging structures that form the current interchange will require replacement within 20 years and this replacement will allow the alignment of SH2, which is currently substandard and the location of historic crash problems, to be improved to 100 km/h standards. The accommodation of the Petone-Grenada Link Road will allow the interchange to be relocated further north which will release a large parcel of land for potential community or economic development. It is expected that the Petone Interchange will be an elevated two lane roundabout similar to the roundabout at the new Dowse Interchange.

The Petone-Grenada Link Road is proposed because it addresses:

- Growing congestion (forecast to be at a severe level by 2016) on SH1 north of Ngauranga Interchange which is a RoNS
- Growing congestion (forecast to be at a severe level by 2016) on SH2 between Petone and Ngauranga and in particular at Petone and Ngauranga on-ramps
- Poor east-west connectivity between the SH1 and SH2 corridors (both by road and public transport) and road safety issues at Horokiwi.

The project supports development at:

- Lincolnshire Farm
- Johnsonville Town Centre
- Petone
- Ongoing development of the Seaview-Gracefield industrial area – which is recognised as the region's primary industrial hub and a regionally significant activity centre.

The project is particularly important as it serves a key direction of travel for freight that is currently not well provided for. This is travel in the direction of Seaview-Gracefield to northern Wellington and beyond. This project is important in fulfilling the GPS objective of encouraging economic development. The Petone-Grenada Link Road has an end-to-end journey distance of approximately 6 km compared to an equivalent journey using SH1 and SH2 of approximately 12.5 km representing a travel time saving of 8 minutes in peak periods and 3 minutes outside of peak periods.

The Petone-Grenada Link provides a new and direct connection between the region's primary industrial hub and the southern North Island via SH1 at Tawa. The link road provides significant relief to the existing State Highways, being SH1 and SH2. As SH1 is classified as a RoNS in the GPS, this is a key improvement especially as given the significant geographical constraints through the Johnsonville Bypass section of SH1. The construction of the Petone-Grenada Link is seen as a key way of reducing congestion on SH1 between Johnsonville and the Ngauranga merge and SH2. In the forecast year of 2016, traffic volumes on SH1 at Johnsonville are expected to reduce by 12,000 vpd and on SH2 south of the Petone ramps, by 12,000 vpd if the link road is built. The Petone-Grenada Link Road is expected to carry approximately 25,000 vpd.

The Petone-Grenada Link Road also provides some relief to SH58. In the forecast year of 2016, the traffic volumes on SH58 reduce by around 3,000 vpd with the link road in place to 12,000 vpd. Conversely, with Transmission Gully in place in 2016, traffic increases on SH58 by 2,000 vpd. The overall combined effect of the link road and Transmission Gully in 2016 is therefore roughly neutral, and with the overall volume of traffic at 15,000 vpd, this traffic volume is at a similar level to current traffic flows along SH58 and therefore no capacity upgrades to the road will be required. Further, when developed, the NZTA SH58 Strategic Study will address any safety issues identified on this route.

The Petone-Grenada Link Road will serve key regional freight movements particularly well and encourage economic development. This is because it offers direct benefits for freight travelling between the SH1 corridor and the SH2 corridor, providing travel time and travel distance savings. Approximately 2,500 heavy vpd are expected to use this route. The 9% grade on parts of the link would require additional testing, possibly using a micro-simulation modelling tool to establish any potential impact of slower moving HCVs. In addition, the Petone-Grenada Link Road reduces journey times on both the SH1 and SH2 corridors because of the relief it provides to those routes. By comparison, SH58 does not serve large numbers of freight vehicles because of a smaller demand and difficult alignment. Heavy vehicle usage of SH58 is approximately 500 vpd.

The construction of the Petone-Grenada Link Road is of primary importance for the greater Wellington region as it directly serves a large volume of heavy vehicles and provides relief to SH1 (a RoNS), and SH2. The removal

of east-west trips from the SH1-SH2 corridor frees up capacity on these links to be used by traffic travelling to and from Wellington City.

Presently, connections between the Ngauranga-Tawa and Ngauranga-Dowse corridor are provided by an interchange at Ngauranga and a signal controlled intersection at SH58. The construction of the Petone-Grenada Link Road increases the connectivity between the SH1 and SH2 corridors. Traffic modelling indicates that in 2016 traffic flows between these corridors will increase from 42,000 vpd to 51,000 vpd if the Petone-Grenada Link Road is built. This represents an increase of more than 20 % in traffic travelling between these corridors which will result in a significant increase in economic activity and social interaction between these corridors. This result indicates the important contribution that the Petone-Grenada Link Road potentially could make to economic development in the greater Wellington region.

The Petone-Grenada Link Road could also provide a safer and more convenient connection to Horokiwi Road. This would align with NZTA's consideration of closing the Horokiwi-SH2 intersection or reducing it to a 'left in-left out' junction, which would have safety benefits.

Another key contribution that the Petone-Grenada Link Road will make is that it provides an alternative route in the event of an incident on either SH1 or SH2. Currently, an incident that closes or severely restricts either SH1 or SH2 in the study area has a major impact on traffic movements on the network. A Petone-Grenada Link Road would significantly improve east-west strategic transport network resilience.

In the longer term, a possible link from Johnsonville north in the vicinity of Westchester Drive to the Petone-Grenada Link Road should be allowed for. Such a link is not yet justified by demand but would make the improved connectivity offered by the Petone-Grenada Link Road available to a larger catchment. Traffic modelling for the year 2016 indicates that the Johnsonville link would attract 10 % of the daily Petone-Grenada Link Road traffic but by 2026 this percentage would increase to near 15 %. In view of this it is recommended that the route designation for the road is pursued through the planning process.

The Petone-Grenada Link Road provides relief to both SH1 and SH2. Measures that lock in these benefits are important otherwise this relief will be eroded by persons switching from other forms of transport to use motor vehicles or eroded by ongoing traffic growth. Measures that discourage change in travel mode are the completion of the pedestrian and cycleway on SH2 and increased passenger rail frequency on both corridors (as addressed in the Regional Rail Plan). Ramp signalling of the Ngauranga on-ramp will also encourage greater use of the Petone-Grenada Link Road.

- *Bus Services on the Petone-Grenada Link Road*

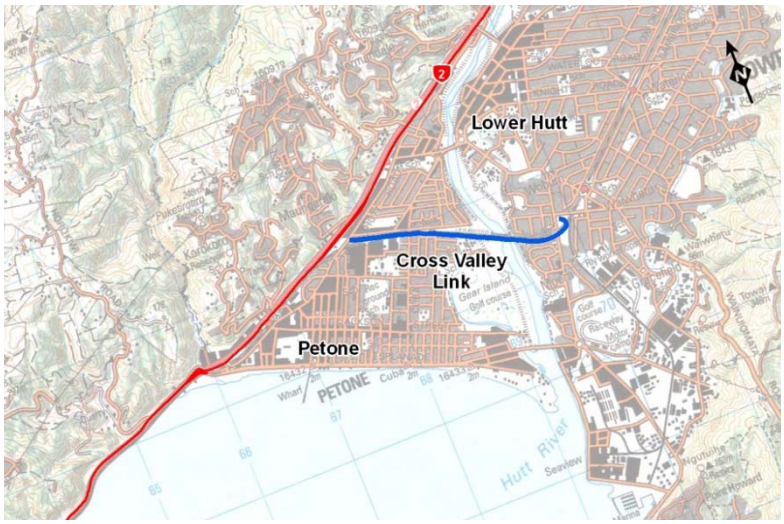
Bus services can be provided using Petone-Grenada Link Road. This will contribute to improving the public transport connectivity between the SH1 and SH2 corridors and assist sustaining the benefits of the Petone-Grenada Link Road. The bus services support:

- Improved east-west connectivity between SH1 and SH2; and
- The Lincolnshire Farm development.

Forecasts for 2016 indicate that over 1,500 persons per day might be expected to use buses between the catchments at either end of the Petone-Grenada Link Road. These estimates make no allowance for bus trips that might be generated in the Lincolnshire Farm development or might be generated in Horokiwi, which would be expected to further increase bus patronage. New bus services need to 'grow' their patronage. They are developed over time and should be integrated into the environment they serve. In this respect, trial services may need to start at a modest level and may even use mini buses until patronage levels build up in response to the service.

- **SH2 to Seaview-Gracefield**

- *Cross Valley Link*



This is a two-lane divided road with provision for cyclists that connects Seaview-Gracefield to SH2 at the new Dowse Interchange on SH2. The new Dowse Interchange has sufficient capacity to receive the traffic generated by the Cross Valley Link.

The Cross Valley Link follows Wakefield Street and then runs just west of the Hutt River adjacent to the Wairarapa Line to Randwick Road. The proposed road has a nominal operating speed of 70 km/h. The cost of this road is estimated at $76 million and has an indicative BCR of 0.5.

The Cross Valley Link is proposed because it addresses:

- Growing congestion on The Esplanade leading to increased delay and travel time variability
- Poor connectivity between the Seaview-Gracefield industrial area and SH2
- Enables improved amenity in Petone and the foreshore by reducing daily traffic volumes and community severance
- The additional traffic on The Esplanade delivered by the Petone-Grenada Link.

The Cross Valley Link supports:

- Petone Foreshore development
- Seaview-Gracefield industrial and logistics hub
- HCC Petone Vision document
- Connectivity to Wainuiomata.

The Cross Valley Link is forecast to attract 21,000 vpd in 2016. This will lead to a reduction in traffic on The Esplanade of approximately 10,000 vpd. This reduction in traffic will lead to a significant reduction in severance on The Esplanade and contribute to an improvement in amenity for this environment.

The volume of traffic attracted to the Cross Valley Link indicates that there will be substantial benefits to other parts of the Hutt City road network, in addition to The Esplanade, (such as the operation of Hutt Road), by constructing the Cross Valley Link. In effect, the Cross Valley Link provides significant east-west permeability for traffic and contributes to a more effective use of the new Dowse Interchange.

Currently the Cross Valley Link project has a BCR of 0.5. Only the direct transportation related benefits of the project have been taken into account at present. Further work is being undertaken by HCC to quantify the amenity and economic regeneration benefits that will accrue to the Petone foreshore and the Seaview-Gracefield area by building the Cross Valley Link and to recognise the economic disbenefits to Seaview-Gracefield of worsening congestion on The Esplanade if the Cross Valley Link is not built. A preliminary consideration of what might happen to land values in the foreshore area alone, suggests that such additional economic benefits would be considerable. In addition, the improvement of amenity in the area would be a large intangible benefit.

The Petone foreshore area could experience considerable benefits in the form of improved amenity if the Cross Valley Link was built. These benefits could be supported by appropriate traffic calming in the area, ramp signalling of Petone on-ramp on SH2 in the am peak and measures such as restrictions for heavy vehicles to access The Esplanade. This environment could facilitate enhanced community activity, in addition to economic activity. Such an environment could be designed to be attractive for walking, cycling and bus travel on The Esplanade as well as significantly increasing pedestrian permeability, opening up the foreshore to more recreational use. In addition, the “Beach to Bush” project and the SH2 pedestrian/cycleway completion would further enhance these activities.

As identified in the WRS, the Seaview-Gracefield area is the region’s primary industrial area. However, growing congestion on The Esplanade provides poor connectivity to SH2, those areas served by SH1 and the lower North Island. This poor connectivity adds to the cost of business undertaken in Seaview-Gracefield. An efficient Cross Valley Link would link this area of primary importance to the strategic transport network and allow these business activities to be more effective. This improved connectivity would not only assist the production and transportation of goods but would link employment to a greater labour pool. The building of the Cross Valley Link in conjunction with the Petone-Grenada Link Road would significantly improve Seaview-Gracefield’s connectivity to those areas served by SH1 such as northern Wellington, Tawa, Porirua and the lower North Island.

The Cross Valley Link would enable the populations of the Eastern Bays and Wainuiomata to be better integrated into the greater Wellington region. It would provide an efficient connection to SH2 and again, with the construction of the Petone-Grenada Link Road, would facilitate travel to those areas served by SH1 and further north.

Many of the benefits of the Cross Valley Link can be achieved by upgrading The Esplanade but the costs of this upgrade, to maintain and improve the level of service required for access to the region’s industrial hub at

Seaview-Gracefield, are as expensive, if not more expensive, than building the Cross Valley Link. An estimate of the cost of building a road on The Esplanade that would provide an equivalent level of service is $90 million with an indicative BCR of 0.5. The main elements including in this $90 million cost estimate include:

- Property costs - $10 million
- Design & construction supervision fees - $10 million
- Construction costs - $70 million (includes a new bridge at $7 million).

This would mean that to maintain reasonable access to the region's primary industrial hub, upgrading The Esplanade is unlikely to provide any savings in cost and the economic regeneration benefits for Petone and the foreshore would be forfeited as well as improved amenity. In the longer term, issues such as climate change and sea level rise would suggest that a Cross Valley Link would provide better security of access to the Seaview-Gracefield area than The Esplanade.

Small scale improvements maintaining the 50km/hr design speeds to the Esplanade but providing alldition traffic lanes were considered. However, these improvements provided little benefit in terms of reducing delays along the Esplanade.

The Petone-Grenada Link Road deposits additional traffic onto The Esplanade because of increased economic interaction and connectivity between the Hutt Valley and Wellington's northern suburbs. The traffic modelling indicates that although this leads to deterioration in the performance of The Esplanade, if the Cross Valley Link is not built, it is still more efficient and provides better overall access for travellers, particularly to Seaview-Gracefield, than not building the Petone-Grenada Link at all. This is demonstrated by an extra 3,000 vpd expected to use The Esplanade in 2016 when the Petone-Grenada Link Road is built. The modelling work undertaken to assess this impact shows that the increase in daily traffic will not significantly worsen current levels of congestion and delay.

Further, in the greater Wellington region recent travel time surveys undertaken by NZTA indicate that travel times and speeds are stabilising which leaves a response such as a lengthening peak period as the likely mechanism for absorbing increased traffic growth. This is likely to be also true for The Esplanade.

The proposed Cross Valley Link will lead to more traffic using Randwick Road. Forecasts for this road for 2016 are currently for traffic volumes of 21,000 vpd, including 4,000 vpd. In 2016 with the Cross Valley Link in place total daily flows increase to 23,000 vpd which includes 5,000 heavy vpd. This increase in traffic volumes will need to be managed to limit any adverse effect on the local community.

The construction of the Cross Valley Link will also impact on properties in Wakefield Street, and adjacent to the railway line on the eastern side of the river. Some property purchase may be necessary depending on the final alignment chosen, and detailed design. A new bridge over the Hutt River will also be necessary which will require cooperation with GWRC and ONTRACK with respect to flood protection and rail matters.

- ***The Strategy Components***

The elements discussed above are designed to operate as a complementary, but independent, suite of projects with a total cost of $360 million. The proposed strategy contains two large structural elements in the Petone-Grenada and Cross Valley Link Roads and a series of smaller proposals. The effectiveness of these two link roads is interrelated but they are not absolutely dependent on each other. That is, the improved accessibility and network benefits are greatest with both roads in place but the Petone-Grenada Link Road on its own still brings overall net benefits to the network and to the Seaview-Gracefield area. The Petone-Grenada Link Road improves the connectivity of urban areas supported by SH1 to those supported by SH2. The Cross Valley Link extends that connectivity to the Seaview-Gracefield, Wainuiomata and Eastern Bays areas. The Petone-Grenada Link Road brings relief to both SH1 (an identified RoNS), and SH2. The Cross Valley Link does not provide relief to these strategic State Highways.

A number of the smaller projects, which are included in the preferred strategy, such as completion of the SH2 pedestrian and cycleway provide benefits to forms of travel other than the private car and freight movements. These measures also assist in locking in the benefits of the larger projects as does the ramp signalling proposals and increasing the passenger rail frequency on both the NIMT and Wairarapa Rail Lines (as addressed in the Regional Rail Plan).

A key outcome of this strategy will be the support of economic development in the region. This is an important outcome sought by both the WRS and the GPS. The strategy components will do this by providing relief to SH1 and SH2. Further, the strategy components will improve the connectivity of key areas of economic activity such as Seaview-Gracefield to the wider region and the lower North Island. This will increase this area's catchment of business, reduce the cost of business in the area and better connect the area to a wider labour pool.

The strategy has identified measures that actively integrate into key development areas. These areas include Lincolnshire Farm, Johnsonville Town Centre, Churton Park, Petone, Petone Foreshore, and Seaview-Gracefield.

The analysis of this strategy has been undertaken using medium growth forecasts. Sensitivity tests have been undertaken which include:

- High growth forecasts
- Transmission Gully is built
- Passenger rail frequency is improved from the current levels (but includes an extension of electrified services to Waikanae) to a 15 minute frequency at peak from Waikanae and Upper Hutt to Wellington.

These sensitivity tests do not change the conclusions of this study nor the make- up of the preferred strategy. The impacts on the BCRs for the key projects are marginal.

The Ngauranga Triangle Strategic Study area has evolved over decades where populations and economic activities have had relatively convenient north-south travel along the Ngauranga to Tawa and Ngauranga to Dowse corridors. In the lower Hutt Valley, over the same period of time, relatively good east-west permeability has been provided along The Esplanade with a connection to SH2 at Petone, whereas the connection to SH2 at

Dowse has been supported by weak east-west permeability. The strategy will require ongoing consideration of integrating land uses with the transportation network and these projects.

The Petone-Grenada Link road is well supported by the Lincolnshire Farm Structure Plan and is the first step towards integrating the new transport network into the Ngauranga Triangle Strategic Study area. The Cross Valley Link will fundamentally alter access into and within the Hutt Valley and these needs to be addressed by HCC in formulating their future planning for this area.

For future development of the strategy components, consideration of how the wider urban areas at either end of this Grenada-Gracefield corridor interrelate (in particular how Seaview-Gracefield businesses respond to a significantly improved connectivity to the wider region and the lower North Island), should be given in future studies and structure planning.

1.10. Study Issues Not Addressed in the Recommended Strategy

It is noted that a number of issues identified for the study have been unable to be addressed in the study's recommended strategy components. These include:

- Buses getting caught in congestion on both SH1 and SH2
- Inadequate levels of service for pedestrians and cyclists in Ngauranga Gorge on SH1
- Current inadequate Level of Service for passenger rail at peak and non-peak times.

Buses getting caught in congestion on both SH1 and SH2	• Options were considered for buses on SH1 and SH2 including a separate bus lane facility. Analysis of these options showed that they were relatively expensive and had poor BCRs. In both cases, peak period bus numbers are low and would give the appearance that the lane is not justifiable given the number of passengers forecast (using WTSM) to use the facility. For example, in the case of a southbound bus lane in Ngauranga Gorge, the estimated cost was $34 million and the indicative BCR is 0.05. • This was expected given there are only 35 southbound buses in the am two hour peak whereas good practice would normally require at least 60 for a separate bus lane over the two hour peak period. The reallocation of road space to provide a bus lane results in disbenefits as insufficient road capacity exists to prevent unacceptable levels of service for general traffic. Another option was considered to allow heavy vehicles as well as buses into this lane, however this was only marginally better, achieving an indicative BCR of 0.08.
Inadequate levels of service for pedestrians and cyclists in Ngauranga Gorge on SH1	• The needs of pedestrians and cyclists travelling north of Johnsonville can be addressed through the proposed cycle path on Middleton Road. However, the options for improvements in Ngauranga Gorge are few. There is an existing footpath but this is often narrow and substandard and only localised improvements could be contemplated.

Current inadequate level of service for passenger rail at peak and non-peak times	☐ The issue regarding current inadequate level of service for passenger rail at peak and non-peak times is addressed outside of this study in the current regional rail upgrade programme and the Regional Rail Plan.

1.11. Implementation Plan

The proposed strategy contains a combination of large projects such as the Petone-Grenada Link Road and the Cross Valley Link, and smaller projects such as the completion of the SH2 pedestrian/cycleway and the Middleton Road cycleway. Large projects invariably have lengthy planning timeframes and require considerably more detailed work to be implemented.

Implementation of the proposed strategy components could proceed according to the following indicative programme:

Short Term (the next ten years)	☐ NZTA to undertake full investigation, reporting, design, consent and construction of the SH2 pedestrian/cycleway completion ☐ WCC to undertake full investigation, reporting, design, consent and construct a new Middleton Road cycle facility ☐ WCC/NZTA/HCC to undertake full investigation and reporting, design and gain consents for the Petone-Grenada Link Road including the Tawa and Petone Interchanges ☐ NZTA to investigate further traffic management projects (including possible ITS Expansion and SH2 Ngauranga on-ramp signalling) ☐ HCC to undertake additional economic regeneration benefit analysis of the Cross Valley Link and supporting policy/planning frameworks ☐ WCC/NZTA to further investigate Helston Ramps including further detailed traffic modelling and determination of the regeneration benefits that might accrue to Johnsonville Road ☐ WCC/NZTA to commence construction of the Petone-Grenada Link Road and associated Tawa and Petone Interchanges ☐ NZTA to commence construction of further traffic management projects such as ITS expansion and Petone on-ramp signalling NZTA to complete the Petone – Grenada Link Road and Petone Interchange, including the “Beach to Bush” connection ☐ HCC to undertake full investigation and reporting, design and gain consents for the Cross Valley Link.
Long Term (beyond ten years)	☐ HCC to construct the Cross Valley Link[7] ☐ WCC/NZTA to evaluate the Johnsonville link to the Petone-Grenada Link Road ☐ WCC to undertake refinement, consents, design and construct the Johnsonville link to the Petone-Grenada Link Road.

[7] If the additional work that HCC is undertaking further justifies this link road then consideration of bringing the Cross Valley Link forward should be given.

1.12. Next Steps

This report is a step in a larger regional strategic transport planning process. The findings of this report and the proposals it makes will be the subject of further stakeholder discussions and Council and NZTA Board consideration. At the conclusion of these tasks the study will be finalised and put forward as a significant technical input to the GWRC led Hutt Corridor Plan review where full public consultation and hearings will take place.

2. Introduction

The purpose of the Ngauranga Triangle Strategy Study is to develop an integrated long-term transport strategy for the "triangle" between SH1 Tawa - Ngauranga Gorge, SH2 Dowse – Ngauranga and a possible link from the SH1 corridor to the SH2 corridor. The study also considers links from the SH2 corridor to Gracefield and the areas that surround these corridors. The findings of this study will become a key technical input into the Hutt Corridor Plan review. This study area is shown in Figure 3.1. The Strategy looks to:

- Improve safety, access and mobility
- Increase integration between the transport system and surrounding land uses
- Sustainably ease peak congestion on state highways and local roads

In response to these needs, the NZTA, HCC and WCC have been working in partnership, with support from GWRC, to develop a transportation plan to support activities and improve accessibility in the study area.

The preferred long term transport plan must satisfy the NZTA's statutory responsibilities under the LTMA, give effect to the GPS on land transport funding, and take account of the Wellington RLTS and its plans.

The development of the Ngauranga Triangle Strategy Study has resulted from specific actions identified in the Hutt Corridor Plan (2003) and the Western Corridor Plan (2006) for Transit NZ (now New Zealand Transport Agency), HCC and WCC relating to the investigation of projects with the study area.

In particular, both the Western Corridor Plan and the Hutt Corridor Plan have signalled the intent of providing a link road from SH1, north of Johnsonville, to SH2 in the vicinity of Petone. The Hutt Corridor Plan signals the need to link the Seaview-Gracefield industrial area efficiently to SH2, while the Regional Cycle Plan signals a desire to complete the off- road cycle facility between Petone and Ngauranga. This study seeks to confirm the merits of these proposals or otherwise.

The purpose of this report is to document the study process and outcomes, together with recommendations of a Strategy for the whole of the study area. In addition, an implementation plan for the strategy has been developed and is outlined within this report.

The implementation strategy has been developed considering the following:

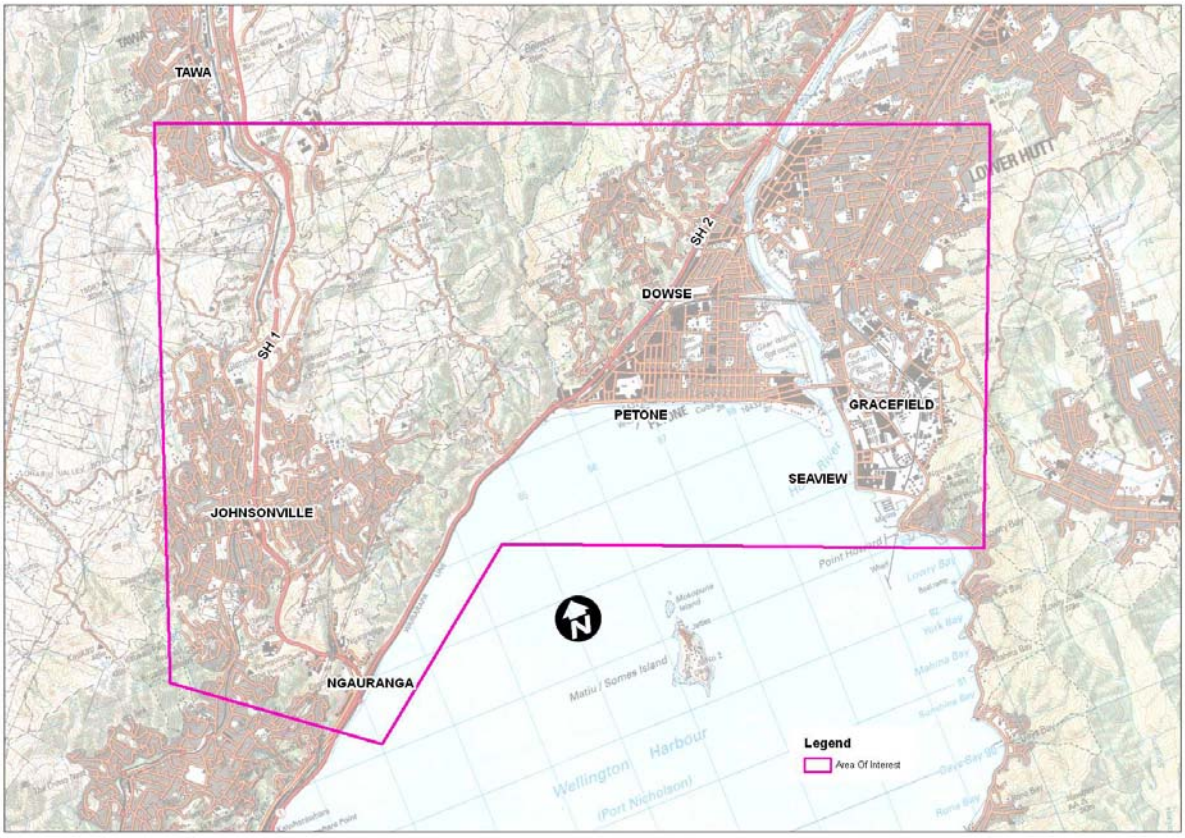
- Travel demand forecasts and interaction with other regional transport projects including TG
- Interaction with land use developments and urban regeneration
- The existing Regional Land Transport Programme.

The implementation plan is broken down into two stages setting out the projects to be taken forward in the next ten years and beyond ten years.

3. Background

The Ngauranga Triangle Strategic Study area is one of the most critical parts of the greater Wellington region's transport network and is vital to its economic performance. The highways and rail system within the study area connect the region's fastest growing district, the Kapiti Coast, to the region's dominant employment hub in central Wellington. The Hutt Valley is the region's second largest population base and contains its primary industrial hub at Seaview-Gracefield, and this too is connected to Wellington City through the study area.

Figure 3.1: Ngauranga Triangle Strategic Study Area



Journey to work data from the 2006 Census and measured traffic volumes show that there is significant travel between northern Wellington (Johnsonville, Churton Park, Newlands etc), Tawa, Porirua and the Hutt Valley including Seaview-Gracefield. For example, travel for commuting purposes data from the 2006 Census shows that 53% of employed residents of Porirua work in Wellington City and Lower Hutt, whilst in Lower and Upper Hutt around 31% of employed residents work in Wellington City. The current road and rail networks do not provide direct routes for travel between the Hutt Valley and SH1, north of Ngauranga Gorge.

The greater Wellington region is experiencing ongoing economic and population growth, which has exceeded Statistics New Zealand medium projections in recent years. By 2026 regional population is expected to be 54,200 greater than the 2006 population, an increase of approximately 12%.

In a report commissioned by Grow Wellington, the estimated total regional GDP was $22.2 billion in 2008. This is the largest regional GDP per capita in New Zealand. In the 2006 Census the greater Wellington region had the greatest proportion of persons in the four highest income groups of any region. This means the Wellington regional economy is more dependent on higher value activities than other regions in New Zealand. Tertiary sector activities such as services, Government and finance are examples of such higher value activities. Growth in regional GDP during 2008 was 2.6 % per annum.

In the greater Wellington region, traffic growth is closely correlated with economic growth and in particular, heavy vehicle volumes are likely to grow faster than economic growth. For example, the 2.6 % per annum growth in regional GDP experienced in 2008 was shown to deliver a growth in heavy vehicle volumes in excess of 3.9 % per annum. The WTSM is forecasting an underlying growth in heavy vehicle numbers in the greater Wellington region of 4.25 % per annum from 2006 to 2026 based on medium growth projections. Given that recent growth has exceeded Statistics New Zealand projections, this trend could lead to even higher numbers of heavy vehicles on the network.

As this transport plan has been developed for a 20 year time horizon it is appropriate that growth forecasts are not overly influenced by the current recessionary times. Treasury forecasts developed in May 2009 for the 2009 budget anticipated a decline in national GDP for 2009 and 2010. Forecast GDP growth is 1.8 % in 2011, 2.9 % in 2012 and 4.0 % in 2013. Treasury's forecast indicates that the current recessionary period is a short-term phenomenon and in the near future, growth in national GDP can be expected to improve to be growing strongly by 2012.

General traffic growth is a function of car ownership. Over the 2003 to 2007 period, Wellington regional light vehicle registrations increased 2.6 % per annum and heavy vehicle registrations increased 4.4 % per annum. In summary, growth in regional travel demand is expected to outstrip population growth in the region into the future despite growing public transport use and higher fuel prices. This means that without increased road capacity in the Ngauranga Triangle Strategic Study area, travel times can be expected to deteriorate over time.

The Local Authority study partners (HCC and WCC) who are jointly responsible for district planning within the study area, have identified development opportunities where careful integration of transport and urban form may produce improved outcomes, such as increased economic development, improved urban design and better integrated travel. These development opportunities include new development, significant regeneration or transformation of existing areas. Identified development opportunities in the study area are as follows:

Wellington City	☐ Lincolnshire Farm ☐ Johnsonville Town Centre ☐ Churton Park
Hutt City	☐ Petone and foreshore ☐ Seaview-Gracefield (industrial and logistics hub).

Lincolnshire Farm is a residential and business park development of a large parcel of land located north of Grenada Village and west of Horokiwi. WCC, in conjunction with the developer, has undertaken a planning

exercise to provide a structure plan to guide the future development of the area. The Petone-Grenada Link Road concept is intrinsically built into this development plan.

Redevelopment of the Johnsonville Town Centre is more than the redevelopment of the existing mall although the mall development is very much part of this proposal. The town centre development includes the development of areas across Johnsonville Road from the mall. This raises an issue of how land uses east of Johnsonville Road can be better integrated into the town centre development, requiring careful consideration of how Johnsonville Road might function. WCC has undertaken a planning exercise that has provided a framework for the future development of the wider town centre. This framework is the Northern Growth Management Framework.

The continuing growth of the Churton Park area is expected to see the construction of an additional 1,100 dwellings over the next 20 – 30 years. Accessibility to the suburb will be significantly improved by the proposed extension of Westchester Drive to Middleton Road. The potential provision of a new and more direct route between this area and the Hutt Valley will not only improve accessibility but also alleviate severe congestion in Ngauranga Gorge on SH1 by the removal of around 12,000 vpd north of Johnsonville, improving the potential for economic development.

Heavy volumes of traffic, including large numbers of heavy vehicles, create a barrier between the Petone foreshore and the lower Hutt Valley. HCC has developed a vision for the wider Petone area which seeks to create:

- A unique heritage place
- An economically and environmentally sustainable environment
- A real place for people
- An attractive and vibrant village culture.

The construction of an improved road link between SH2 and Seaview will enable the desired improved connections between the foreshore and Petone and would enable a considerable improvement in amenity in the area. The value of land adjacent to the foreshore would be significantly enhanced by this amenity improvement and this could contribute to a significant economic regeneration in the area.

The Seaview-Gracefield area is identified in the WRS as the greater Wellington region's primary industrial area. Growing congestion on The Esplanade increases the costs to business in the region and reduces the attractiveness of the area for further development. Efficient access between this area and SH2 will be important for its future development. Further, as the region's primary industrial area it is important that this area is efficiently connected to SH1 to enable improved servicing of the lower North Island.

The implications of proposals arising from this study could have a profound impact, not only on transport but also social and economic activities in the region. The strategic road and rail networks in the region are linear in form and provide for north-south movement in both the SH1 and SH2 corridors. This study not only considers measures that may improve the efficiency of these north-south movements, but also considers measures that allow improved movements outside this linear north-south pattern such as east-west movements between SH1

to SH2, and SH2 to Seaview. This may lead to new opportunities and facilitate more effective agglomeration of activities resulting from land uses in the SH1 corridor interacting more effectively with those in the SH2 corridor and the lower Hutt Valley.

Of particular significance is the Seaview-Gracefield area. This is the greater Wellington region's primary industrial and logistics centre. The Seaview-Gracefield area generates significant travel demands, particularly for heavy vehicles, to and from Wellington City, the Port, Wellington's northern suburbs, Kapiti and further north. This study is concerned with improving access to and from this area to facilitate increased productivity and economic development.

4. Form and Function of the Transport Network

The primary strategic roads and rail lines within the study area include SH1, SH2, The Esplanade, the NIMT Line, and the Wairarapa railway line. These key transport routes make up the strategic transport network in the study area and are described in more detail below.

4.1.SH 1 - Form and Function

SH1 out of Wellington is classified as a National State Highway in NZTA's NSHS. The Government has identified this road, between Wellington and Levin, as one of seven RoNS and is therefore one of the country's most important road sections in terms of assisting national economic development. SH1 and the NIMT connect Wellington to the lower North Island and beyond. In this respect SH1and the NIMT have an important economic function of linking the lower North Island centres to the greater Wellington region urban areas for tourist, business and social reasons; while also connecting the lower North Island to the Port of Wellington for the export of logs, wood products and other resources.

Within the study area, SH1 is a multi-lane divided highway that alternates between motorway and expressway standards. This part of SH1 carries between 45,000 vpd at Tawa and 70,000 vpd at Ngauranga. Traffic includes significant volumes of heavy vehicles making up 3 to 5 % of the daily vehicle numbers on SH1 in Ngauranga Gorge.

SH1 carries bus services from Johnsonville, Porirua and Kapiti and cyclists are catered for on SH1 as far north as Johnsonville where cyclists must exit the state highway and use the parallel local road network (i.e. Middleton Road).

Within the study area access to / from the State Highway is provided for in the following locations:

Hutt Road / Ngauranga Interchange	The SH1/SH2 Ngauranga Interchange provides high speed connections between SH1 south of Ngauranga and SH2. Southbound traffic from SH1 north of Ngauranga wanting to access SH2 must exit SH1 at Hutt Road and use the left turn slip lane for access to the northbound SH2 Ngauranga on-ramp. Southbound SH2 traffic wanting to access SH1 north must exit SH2 and use the signal controlled intersection with Hutt Road, Jarden Mile and SH1 southbound off-ramp to access the northbound SH1.
Newlands Interchange	The Newlands interchange provides all movement access to Newlands Road (Newlands and Paparangi).
Johnsonville Interchange	South facing connections are provided at the southern end of Johnsonville Road for access to SH1. North facing connections are provided at the northern end of Johnsonville Road. These connections provide access to Johnsonville, Broadmeadows and parts of Churton Park and Newlands.
Westchester Drive Interchange	The interchange provides all movements with access to Churtoin Park and Grenada Village (via the new Mark Avenue link).

Tawa / Grenada North Interchange	☐ The interchange provides all movements access to Tawa and Grenanda North industrial area.

Between Ngauranga and Johnsonville, SH1 is generally a six lane (3+3) divided carriageway that travels up the Ngauranga Gorge on a steep (8%) grade. Due to the unusual layout and close spacing of the Johnsonville and Newlands interchanges, there is a large amount of weaving that takes place. This section of highway is controlled by an Advanced Traffic Management System (ATMS) that varies the speed limit between 60 and 80 km/h depending on conditions.

Between the southern Johnsonville connections and the northern Johnsonville connections (this section is known as the "Johnsonville bypass") SH1 narrows to four lanes (2+2) and is also controlled by the ATMS. From Johnsonville to Tawa SH1 is generally a four lane (2+2) divided carriageway with a speed limit of 100km/h.

SH1 Traffic Volumes

In this section of the report, traffic flows are expressed in terms of AADT, volume /capacity ratios and a resultant Level of Service (LOS) in accordance with the Highway Capacity Manual. The "level of service" for the key roads is noted in the sections that follow. The definition of "level of service" is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. In general there are six levels of service, designated from A to F, with a level of service A representing the best operating conditions (i.e. free flow) and level of service F the worst (i.e. forced break-down flow). For the reader's reference the level of service ratings are explained in more detail in the table below.

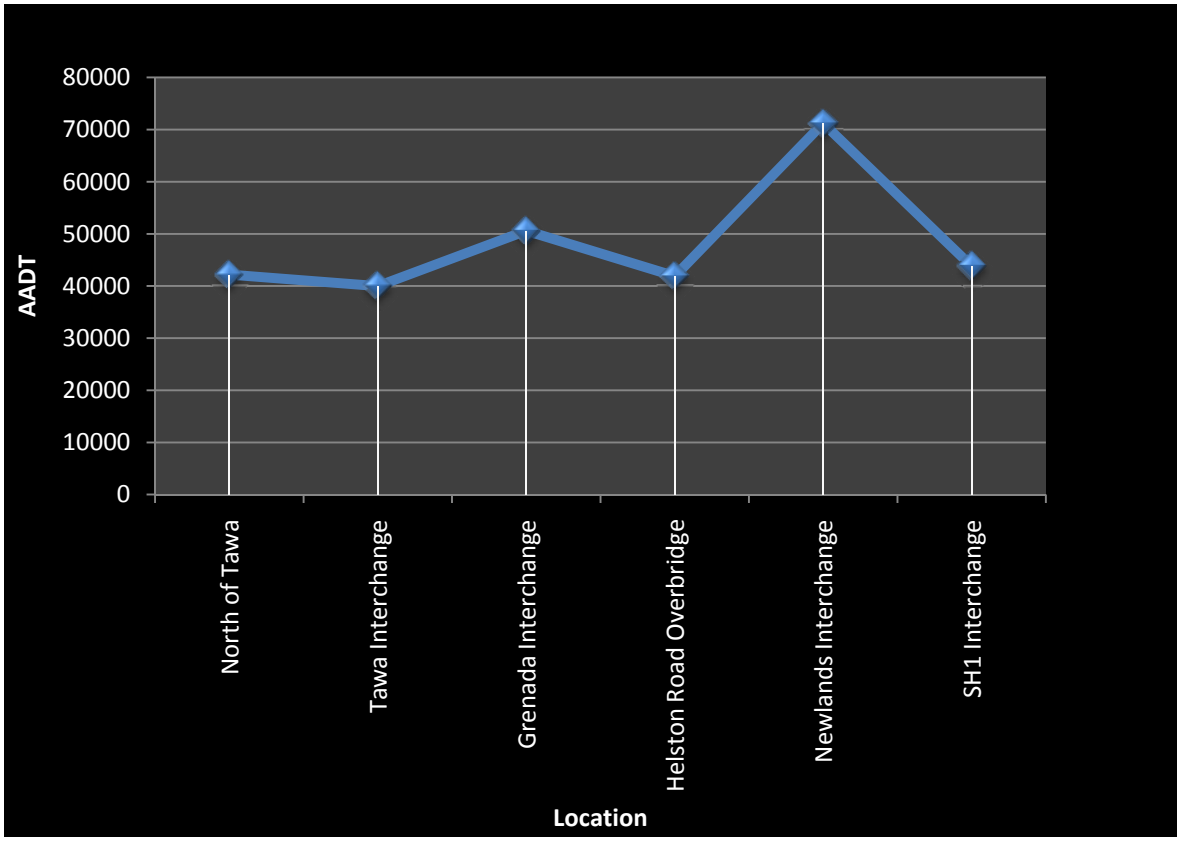
Table 4.1: Level of Service Definitions

Level of Service (LoS)	Description
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience is excellent.
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of discomfort and convenience is a little less than with level of service A.
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream The general level of comfort and convenience declines noticeably at this level.
D	Close to the limit of stable flow and is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.
E	Occurs when traffic volumes are at or close to capacity, and there is virtually no freedom to select

	desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause break-down.
F	Is in the zone of forced flow. With it, the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow break-down occurs, and queuing and delays result.

At the northern end of the study area in the vicinity of the Tawa interchange, daily traffic flows are recorded at around 40,000, traffic flows at the southern end of the study area at the Ngauranga Interchange are slightly higher at 44,000 AADT. Traffic flows are at their peak around the Newlands Interchange with AADT flows of 71,000. The AADT flows along the section of SH1 considered in the study are shown below in Figure 4.1.

Figure 4.1: SH1 Traffic Flows (2008 AADT Profile)



Traffic data has been sourced from the NZTA State Highway Traffic Volumes 2004-2008 document. Table 4.2 summarises the traffic flows within the study area on SH1 and provides an indicative level of service.

Table 4.2: SH1 AADT and Level of Service Summary

Location	AADT (2008)	V/C Ratio	LOS
Tawa Interchange	40,000	0.5	B

Grenada Interchange	51,000	0.6	C
Helston Overbridge	42,000	0.5	B
Newlands Interchange	71,000	0.80	D
Ngauranga SH1 Interchange	44,000	0.6	C

While the method used to calculate the LOS indicators is based solely on traffic flows and does not take into account terrain factors, it still gives an indication as to the general nature of the operational conditions on SH1. On SH1 around the mid-section of the Ngauranga Gorge, it is apparent that the road has some capacity issues which are further compounded by the gradient of the road in this area and the effect of the Ngauranga Gorge/SH1 merge heading towards Wellington. This is due to the volume of traffic and the variation in speeds at which vehicles are able to travel up and down the gorge. The volume of heavy vehicles on this section of SH1 is on average around 2,000 AADT and heavy vehicles struggle to maintain speed on the steep gradient.

The volume of daily cyclists on Middleton Road (which is the route parallel to SH1) has been calculated from recent surveys to be approximately 150 per day.

4.2.SH 2 – Form and Function

SH2 from Wellington is classified as a regional State Highway in NZTA's NSHS. The segment of SH2 within the study area operates as a four lane (2+2) divided expressway and carries 34,000 vpd at Dowse and 67,000 vpd at Ngauranga. Like SH1, this traffic includes significant volumes of heavy vehicles on SH2 north of Ngauranga making up approximately 10 % of the daily traffic volumes.

The road is sandwiched between steep hillsides and the Wairarapa railway line and coastline. Being located alongside the coast, the road has a flat vertical alignment along most of its length.

Cyclist and pedestrians are provided for between Hutt Road and Horokiwi Road by a shared footpath / cycleway in a segregated area between the railway line and the State Highway. Between the Horokiwi and the Petone Interchange, cyclists use the shoulder of the SH. A northbound cycle shoulder has recently been provided on the northbound carriageway between Hutt Road and Petone. South of the Ngauranga Interchange, cyclists are directed to use the Hutt Road cycle facilities into and out of Wellington CBD.

Access to SH2 within the study area is provided at Ngauranga Interchange, Horokiwi Road and Petone Interchange. Ngauranga Interchange is described above and provides access to SH1 north and Hutt Road as well as SH1 south. Horokiwi Road intersection is a priority intersection providing all movements except right turns out. Horokiwi Road provides access to a large quarry and the Horokiwi community. The Petone Interchange provides south facing connections from SH2 to Hutt Road and The Esplanade (Petone).

Between Ngauranga and Petone, the horizontal alignment is tight with some curves having design speeds less than the posted speed limit of 100km/h. This results in a relatively high number of "loss of control" type crashes in this area. Under the Petone Interchange there is a sharp right-hand curve. Chevron and advisory

signs are in place here recommending a maximum speed of 55km/h and this was a crash black spot prior to minor safety works including high friction surfacing being implemented.

The Dowse to Petone project is nearing completion and provides a grade-separated roundabout over SH2 at Dowse Drive. It will provide a connection to Hutt Road and Dowse Drive; an overbridge to replace the traffic lights at Korokoro connecting Petone and Korokoro; upgrading the section of SH2 between Korokoro and the Petone overbridges in the short-term by providing a raised central curbed median to separate north and southbound lanes. The improvement works also include the re-arrangement of the Petone Railway Station's existing Park-and-Ride car park and the provision of an access bridge over SH2 and service road through to Cornish Street that will provide access to the industrial area and Korokoro. No access is provided to private properties from SH2 between Korokoro and Petone.

There are a number of bus services that use SH2 in the study area that serve Petone, Eastbourne, Seaview, Central Hutt and Upper Hutt. Improving SH2 will help the movement of all motorised traffic on this route into Wellington. This also includes the large truck volumes that travel to and from Seaview.

The long-term upgrade for SH2 between Korokoro and Petone overbridges includes the construction of a median barrier on SH2, the closure of Cornish Street to SH2 and the upgrade of the Petone overbridge. This project will reduce delays and improve safety along SH2 through the lower Hutt Valley.

SH2 – Traffic Volumes

Traffic volumes on SH2 steadily build from the northern end of the study area from around 34,000 at Normandale Road to approximately 67,000 just prior to the Ngauranga Interchange. The flows along the section of SH2 considered in the study are shown in Figure 4.2 below.

Figure 4.2: SH2 Traffic Flows (2008 AADT Profile)

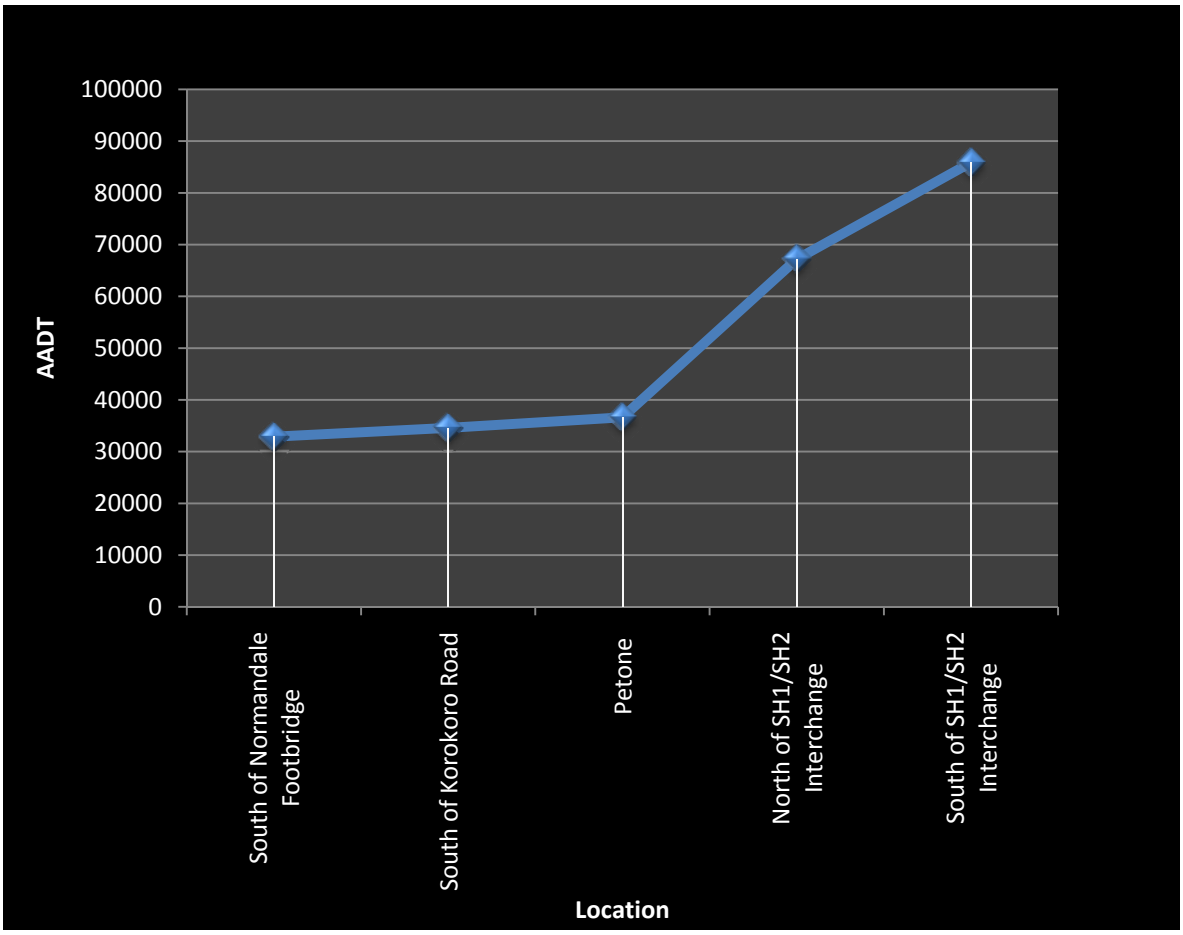


Table 4.3 below summarises the traffic flows within the study area on SH2 and provides an indicative level of service.

Table 4.3: SH2 AADT and Level of Service Summary

Location	AADT (2008)	V/C Ratio	LOS
South of SH1/SH2 Interchange	86,000	1.0	F
Ngauranga SH1 Interchange	42,000	0.5	C
North of Ngauranga	67,000	0.8	D
Petone	37,000	0.4	B
South of Korokoro Road	35,000	0.4	B
South of Normandale Footbridge	33,000	0.4	B

While the method used to calculate LOS indicators is based solely on traffic flows and does not take into account terrain factors, it still gives an indication as to the general nature of the operational conditions on SH2. The section of SH2 around the Ngauranga Interchange has some serious capacity issues. This is reflected in the experience of the travelling public in this area which can include long delays during the am peak periods as traffic heads into Wellington. As you travel further north on SH2 traffic flows ease and levels of service improve.

There are also delays at the Ngauranga Gorge northbound on-ramp in the pm peak due to the merge from Hutt Road and the variation in merging traffic speeds. The Petone off-ramp has a limited width and is over capacity in the pm peak leading to traffic backing up onto SH2. Delays also occur in the vicinity of the off-ramp on SH2 as a result of weaving traffic. The Petone on-ramp also suffers delay and congestion in the am peak as a result of a combination of large traffic volumes and restricted merge capacity onto SH2.

The volume of heavy vehicles on this section of SH2 ranges from approximately 4,000 -7,000 vpd. Cyclists on SH2, between Petone and Ngauranga number 430 cycles per day on average.

4.3. The Esplanade (Petone) – Form and Function

The Esplanade is classified as a Major District Distributor Road in the Hutt City District Plan. The road serves as a major route for traffic wishing to gain access to SH2 from Petone, Gracefield and eastern parts of the Hutt including Wainuiomata and the Eastern Bays. The Esplanade consists of a mixture of two-lane and one-lane sections with some on-street parking in each direction. During the am peak a west-bound high occupancy vehicle and taxi lane operates.

The road has a straight level alignment and has numerous side connections to roads that feed through to the seafront from the greater Petone area. To the east, the road crosses the Hutt River via a two lane road bridge and follows into a roundabout at the edge Moera/Gracefield area. Heading north from the roundabout leads to the central Hutt area travelling through a number of residential suburbs. Heading south you enter the industrial Gracefield/Seaview area and out to the eastern bays.

The Esplanade carries 32,000 vpd including large volumes of heavy vehicles travelling from the Seaview Gracefield industrial area (10 to 12 % of the daily traffic on The Esplanade). Several bus services operate along The Esplanade. These include the 83, 84 and 85 routes which serve most of Hutt City and the Eastern Bays. The airport flyer also uses The Esplanade operating from Upper Hutt through to Wellington Airport via Lower Hutt, Petone and Wellington Bus Station.

4.4. North Island Main Trunk Line – Form and Function

The NIMT runs parallel to SH1. The line is double tracked within the study area and has the dual function of providing for passenger rail services, and delivering rail based freight.

The passenger rail services include regular suburban rail services to the Kapiti Coast with stops provided at Paekakariki, Pukerua Bay, Porirua, Grenada, Tawa and Redwood. The current frequencies and journey times from Wellington are as follows:-

Frequencies	☐ 20 – 25 minutes (Mon – Fri Peaks) ☐ 30 minutes (Mon – Fri Inter Peak) ☐ 30 minutes (Sat & Sun) ☐ 60 minutes (Late Night) ☐ Churton Park
Journey Times	☐ Porirua 25 minutes

This line also carries the Capital Connection Train operating one train in the am peak and pm peak periods from Palmerston North to Wellington (am) and Wellington to Palmerston North (pm). This train is an express service stopping at Paraparaumu and Waikanae only. It is also a diesel powered service whereas the other regular passenger services in the study area are electric multiple units (EMUs). A daily service is also provided to Auckland.

The current situation, with ageing infrastructure and a historical lack of investment, results in poor reliability. This manifests in the form of frequent breakdowns and delays to services, and is obviously the key issue for rail users on this line. In addition, the existing sub-standard rail infrastructure, including platforms and station access, limit service levels as they have not been designed to support a modern rail service. There is also a lack of capacity on this line and more generally across the network. The trains on this line are well used with a high proportion of long distance commuters leading to crowded trains with an increasing demand. GWRC has determined that there is a current shortfall of more than 1,200 seats across the network during the am peak period with a projected shortfall of over 5,000 seats by 2016[8].

Due to the constraints to network capacity and limited number of trains there is an insufficient frequency of services, which means that the rail network in its current state cannot meet demand for higher frequency services in peak times. The ageing train fleet means that trains currently in operation need replacement or refurbishment. It is increasingly obvious that the maintenance demands are becoming onerous and the incidents of train breakdown and faults are becoming increasingly more regular.

Recent studies by GWRC have recognised the issues surrounding this rail line and have put measures in place to address the above. Work has begun to upgrade the infrastructure, rolling stock and rail stations and access on this line, which are aimed at improving the rail travel service and providing increased frequency.

There is not a significant volume of freight carried on this line, however, the inter-island ferry services are an essential link in the north-south movement of freight. Physical and timetable rail connections to and from the ferries are critical, as are the support facilities around the ferry operation. There is also a potential for greater conflict between the more regular higher speed commuter services and the slower moving freight trains.

[8] Wellington Regional Rail Plan (Draft) 2010-2035 – 'A Better Rail Experience' – GWRC

4.5. Wairarapa Rail Line – Form and Function

The Wairarapa Line is adjacent to SH2, and is double tracked within the study area. This line has the dual function of providing for passenger rail services and delivering rail based freight to the Wairarapa. The passenger rail services include suburban rail services and long distance connections to the Wairarapa. The Wairarapa Line is the most used line, in terms of passenger numbers in the region carrying about 45% of all passengers across the network.

The line operates frequent services throughout the day between Upper Hutt and Wellington with stop at 18 stations, which include Waterloo and Petone. There is also a spur line operating between the Melling Station in Hutt City and Wellington. This spur line joins the main line just before Petone Station. The services along this line are augmented by Tranz Metro's commuter service from Masterton in the Wairarapa, the Wairarapa Connection. It operates several times daily and is hauled mainly by DC class locomotives.

The current frequencies and journey times from Wellington are as follows:-

Frequencies	☐ 20 – 25 minutes (Mon – Fri Peaks) ☐ 30 minutes (Mon – Fri Inter Peak) ☐ 30 minutes (Sat & Sun) ☐ 60 minutes (Late Night)
Journey Times	☐ Upper Hutt 40 minutes ☐ Melling 20 minutes ☐ Petone 15 minutes

The issues for the Wairarapa Line are lack of capacity as per the rest of the network and a section of single track line from Trentham to Upper Hutt.

GWRC has plans to provide new train units progressively across the network in the short term and then carry out prioritised staged improvement rail packages across the network. The Upper Hutt line falls under the RS1 Rail package which has been given the highest priority. The works to the Upper Hutt line include the twin tracking of line between Trentham and Upper Hutt, redevelopment and upgrade of 'major stations' and other station improvements and safety improvements at level crossings. GWRC has established that the earliest practicable date for implementation of the above infrastructure works is 2013.

The Petone to Ngauranga section of the line has some deficiencies. The tightness of the curves limits train speeds to 70 km/h whereas on the valley floor trains are able to travel at 100 km/h. In the vicinity of Ngauranga Station, southbound trains can be delayed in severe weather conditions by storm surge. ONTRACK's Incident Reporting Information System (IRIS) database over the last four years shows that the coastal rail section of the Wairarapa Line between Wellington and Petone has experienced one major event requiring temporary line closure almost every year (i.e. August 2004, September 2005, April 2006 and June 2008). In these cases, heavy seas and strong southerly winds (sometimes combined with a high tide) resulted in overtopping of the sea wall defences with resultant washing of ballast onto the tracks.

Freight trains operate daily through the Hutt Valley between Wellington, Masterton, and Napier. Non-revenue services are also operated regularly to transfer equipment to and from the Hutt Workshops. All freight trains are operated by diesel locomotives.

5. Study Process

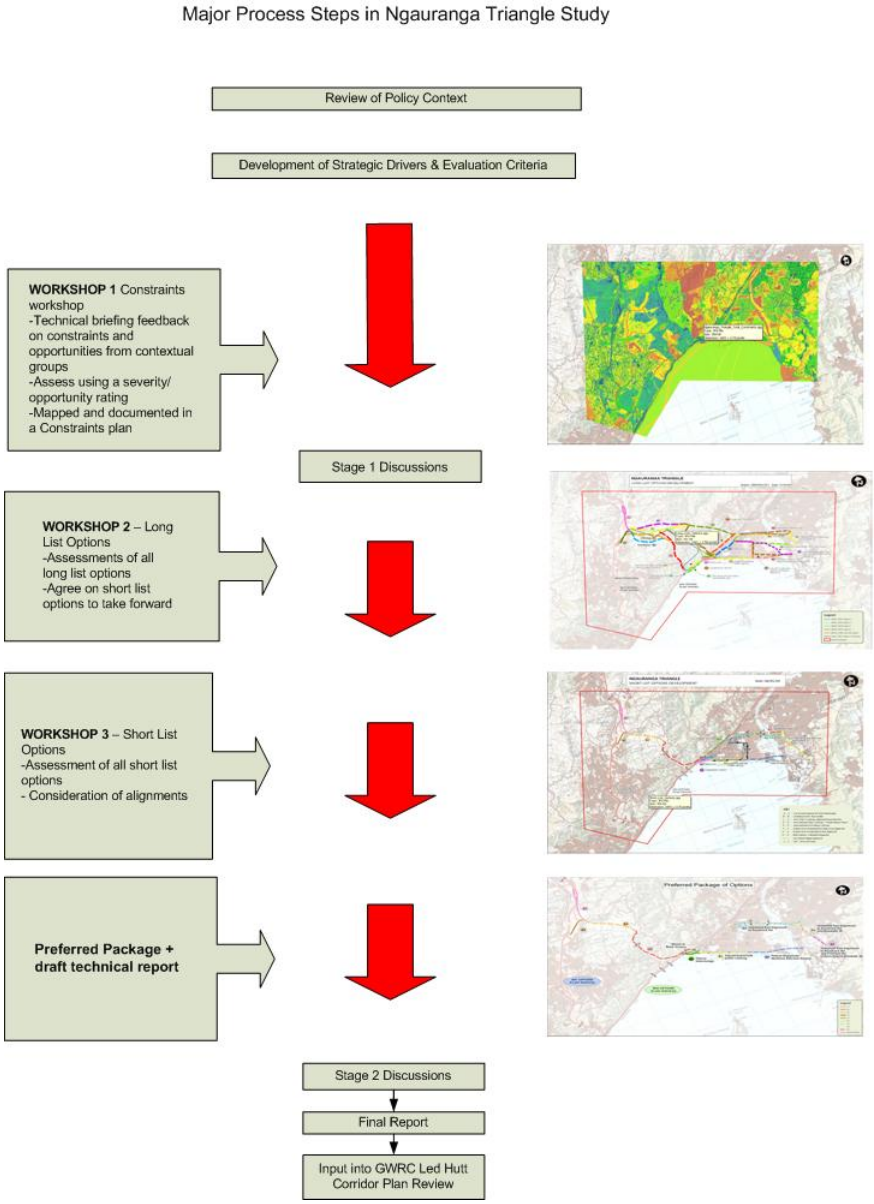
The study development process is shown in a flow diagram below. In summary the steps in the study process are as follows:

Policy Context Review	This was a review of the relevant legislation and national policy documents, regional and local policy documents and other relevant non-statutory planning documents to provide a context in which this study was undertaken.
Development of Strategic Drivers and Evaluation Criteria	The strategic drivers for the study were developed to give effect to the policy context of the study and the study's objectives. The evaluation criteria are a set of objectives and performance indicators for the study's potential projects that reflect the study's strategic drivers within the specific context of the issues and opportunities identified in the study area.
Constraints Plan	This is the identification of constraints and opportunities that may impact on potential project options in the study area. This includes a broad range of matters such as regulatory requirements, heritage, areas of cultural significance, noise sensitivity, sensitive ecological environments, difficult geotechnical ground conditions and others. This step also includes the identification, assessment and mapping of constraints and opportunities. A multi party and multi disciplinary workshop was undertaken to facilitate this phase.
Stage One Discussions ("Fireside Chats")	A series of meetings were held with representatives of identified key existing stakeholders. These meeting enabled stakeholders to identify the issues important to them, possible community constraints and potential options and alternatives.
Long List Options	An extensive list of potential transportation measures that address the strategic drivers were developed for the study. This list was subject to a coarse evaluation with the purpose of removing those options that performed poorly against the wider study objectives or were seriously compromised by the identified constraints. This analysis was presented to and reviewed by a workshop involving study Governance Group[9] members. A short list of options was agreed for further evaluation as an outcome of the workshop.
Short List Options	A detailed assessment of the remaining options was undertaken including a strategic assessment of cost, project economics and consentability. This included the identification of a preferred package of key projects and their form. This phase was concluded with a workshop involving Governance Group members who reviewed the analysis.

[9] The study Governance Group was made up of senior officers from NZTA, WCC, HCC and GWRC who oversaw the study process

Technical Report	☐ Further technical work was undertaken on the remaining options including the refinement of route alignments. This is summarised in this Technical Report.

The following sections detail each of the stages set out above. After further discussions with key stakeholders, the Technical Report will be finalised and will become a key input to the GWRC-led review of the Hutt Corridor Plan scheduled to begin in early 2010, and local planning considerations. Full public consultation, including hearings, on the projects that make up the proposed study strategy, will be undertaken as part of the Hutt Corridor Plan review.



■ **Figure 5.1: Major Process Steps in Ngauranga Triangle Strategic Study**

6. Policy Context Review

Analysis of the implications of transport and land use policy documents is important for every transport strategy. Each of the strategies and studies previously completed has been considered and has informed the development of the performance indicators, urban design objectives and evaluation framework for this study in determining a preferred package (shown in Table 6.1).

Table 6.1: Transport and Land Use Policy Documents

National Policy Documents	Regional/Local Policy Documents	Non-Statutory Documents
☐ Land Transport Management Act (2003) ☐ NZTS (2008) ☐ Government Policy Statement on Land Transport Funding (2008) ☐ National Efficiency and Energy Conservation Strategy (2001)	☐ Wellington Regional Policy Statement (1995) ☐ Proposed Wellington Regional Policy Statement (2009) ☐ Regional Land Transport Strategy 2007-1016 (2006) ☐ Hutt Corridor Plan (2003) ☐ Western Corridor Plan (2006) ☐ Ngauranga to Airport Corridor Plan (2008) ☐ Regional Freight Plan (2007) ☐ Regional Cycling Plan (2008) ☐ Regional Walking Plan (2008) ☐ Regional Travel Demand Management Plan (2005) ☐ Regional Passenger Transport Plan 2007-2016 (2007) ☐ Proposed Wellington Regional Rail Plan 2010-2035 'A Better Rail Experience' (2008) ☐ Wellington City District Plan (last amended 2006) ☐ Hutt City District Plan (last amended 2003/2004)	☐ Wellington Regional Strategy (2007) ☐ Regional Transport Programme 2006/7-2016 (2007) ☐ Wellington City Transport and Urban Development Strategy (2006) ☐ Northern Area a Framework for Growth Management ☐ Lincolnshire Farm Structure Plan (2006) ☐ Hutt City Cycling Plan (2006) ☐ Petone Vision ☐ WCC Walking Policy (2008) ☐ WCC Cycling Policy (2008)

The review revealed a general trend that the various policy documents support transport projects which:

- Integrate land use and transport planning
- Improve the sustainability of the land transport system
- Limit the environmental impact of land transport systems on their surroundings
- Provide economic benefits for the area
- Improve the safety, security and public health of the community
- Improve the performance of land transport systems
- Manage transport demand.

6.1. National State Highway Strategy

The NSHS takes a 30-year view and provides a link between various documents such as the NZTS, the LTMA (and other legislation), plans and policies and the State Highway Forecast. It addresses the need for integration between State Highway planning and local land use and multi-modal transport planning. The Strategy sets out eight principles for planning, building, operating and managing the State Highway network. The principles are; safety, operating the network, asset management, managing demand, environment and communities, integrated planning, education and continual improvement. Although the Strategy is currently being reviewed as a result of the 'Next Steps' review in the Transport Sector, the Strategy was useful for giving direction to the current strategy.

6.2. Government Policy Statement and Updated New Zealand Transport Strategy

The GPS has a shorter duration than the NZTS. The NZTS long-term targets have been translated into short to medium-term targets in the GPS and are generally expressed in terms of what the land transport sector is to achieve by 2015. The GPS can be interpreted as the short and medium-term tactical expression of the NZTS. The NZTA must give effect to the GPS in developing the National Land Transport Programme and take account of the GPS when approving funding for activities. Any RLTS must take account of the GPS, and Regional Land Transport Programmes must be consistent with the GPS. Again, the WCC and HCC are guided by these targets.

In May 2009, an updated version of the GPS was released which replaced the shorter-term targets provided in the original GPS (released in August 2008) with short to medium impacts that the Government expects to achieve, with priority given to national economic growth and productivity. These impacts are similar to the original GPS and do not change the focus of the Strategy; however, analysis of the updated GPS has been made to ensure that the preferred package is consistent with the updated GPS and its refreshed focus.

The short to medium impacts that the Government expects to achieve are summarised below:

Impacts That Contribute to Economic Growth and Productivity	□ Improvements in the provision of infrastructure and services that enhance transport efficiency and lower the cost of transportation through: - improvements in journey time reliability - easing of severe congestion - more efficient freight supply chains □ Better use of existing transport capacity □ Better access to markets, employment and areas that contribute to economic growth □ A secure and reliable transport network.
Other Impacts	□ Reduction in deaths and serious injuries as a result of road crashes □ More transport choices, particularly to those who have limited access to a car where appropriate □ Reductions in adverse environmental effects from land transport □ Contributions to positive health outcomes.

The findings from the original GPS review were determined before the GPS was superseded, therefore they are included as they influenced the Strategy. The targets for the original GPS are summarised below:

- □ Reduce kilometres travelled by single occupancy vehicles, in major urban areas on weekdays, by 10% per capita by 2015
- □ Increase the mode share of transporting freight by coastal shipping and rail by 2015
- □ No overall deterioration in travel times and reliability on critical routes by 2015
- □ Reduce fatalities and hospitalisations from road crashes by 2015
- □ Increase patronage on public transport by 3% per year through to 2015
- □ Increase number of walking and cycling trips by 1% per year through to 2015.

All of the above targets from the original GPS were directly relevant to travel patterns in the Ngauranga Triangle Strategic Study area. This means that proposals put forward in this study should contribute directly to these goals. As such, it is expected that the evaluation framework used in this study should also reflect these targets.

The NZTS sets out the Government's vision for transport to 2040 and the strategic approach to be taken. The vision is that: "People and freight in New Zealand have access to an affordable, integrated, safe, responsive, and sustainable transport system."

This vision is supported by five transport objectives:

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

In addition, the Government has established targets in the NZTS that support the delivery of the transport objectives and provide a focus for many of the Government's actions over the duration of the Strategy as shown in Table 6 2.

Table 6.2: NZTS Transport Targets

Objective	Associated Target
Ensuring Environmental Sustainability	☐ Halve per capita greenhouse gas emissions from domestic transport by 2040 ☐ Increase coastal shipping's share of inter-regional freight to 30% of tonne-kilometres by 2040[10] ☐ Increase rail's share of freight to 25% of tonne-kilometres by 2040 ☐ Become one of the first countries in the world to widely use electric vehicles ☐ Reduce the kilometres travelled by single occupancy vehicles, in major urban areas on weekdays, by 10% per capita by 2015 compared to 2007 ☐ Reduce the rated carbon dioxide (CO2) emissions per kilometre of combined average new and used vehicles entering the light vehicle fleet to 170 grams CO2 per kilometre by 2015, with a corresponding reduction in average fuel used per kilometre ☐ Increase the area of Crown transport land covered with indigenous vegetation.
Assisting Economic Development	For identified critical routes: ☐ Improve reliability of journey times ☐ Reduce average journey times.
Assisting Safety and Personal Security	☐ Reduce road deaths to no more than 200 per annum by 2040 ☐ Reduce serious injuries on roads to no more than 1,500 per annum by 2040.
Improving Access and Mobility	☐ Reduce serious injuries on roads to no more than 1,500 per annum by 2040 ☐ Increase use of public transport to 7% of all trips by 2040 (i.e. from 111 million boardings in 2006/7 to more than 525 million boardings in 2040) ☐ Increase walking, cycling and other active modes to 30% of total trips in urban areas by 2040.

[10] Relative to 2007 per capita emissions

Objective	Associated Target
Protecting and Promoting Public Health	Reduce the number of people exposed to health endangering noise levels from transport Reduce the number of people exposed to health endangering concentrations of air pollution in locations where the impact of transport emissions is significant.

The NZTS states that a 'business-as-usual' approach will not achieve the NZTS vision and sets out seven key components which need greater emphasis. These components will guide how transport is planned and delivered and include:

- Integrated planning
- Making best use of existing networks and infrastructure
- Investing in critical infrastructure and the transport sector workforce
- Increasing the availability and use of public transport, cycling, walking and other shared and active modes
- Considering options for charging that will generate revenue for investment in transport infrastructure and services
- Using new technologies and fuels
- Maintaining and improving international links.

For the purposes of this study, it should be appreciated that "integrated" has two dimensions that should be reflected in the study outcomes; that transport infrastructure and services should be integrated with land use; and that there should be integration between transport modes.

Integration of transport and land use requires the configuration of land development and transport in a manner that optimises the contribution to the LTMA principles and objectives, and other policies identified by the LTMA. Integration of transport modes requires the coordination between transport modes that again optimises the contribution to the LTMA principles and objectives, and other policies identified by the LTMA. Examples of coordination between transport modes include park-and-ride facilities and inter modal-freight transfer.

6.3. Wellington Regional Policy Statement and Proposed Regional Policy Statement

The RPS is a statutory document prepared under the RMA. The RPS provides high-level guidance for the Ngauranga Triangle Strategic Study in terms of how transportation proposals are expected to function and their impacts are to be managed.

The objectives from the Operative RPS relevant to this study are:

Objective 1	*"Urban areas, the built environment and transportation systems are developed so that they, and their associated activities, use resources efficiently and demand for the use of finite resources is moderated."*

Objective 2	*The adverse environmental effects that result from the use of urban areas, transportation systems and infrastructure are avoided, remedied or mitigated and, in particular, any effects that result from the concentration and scale of activities in urban areas are recognised and provided for."*

However, the current Wellington RPS is under review. A proposed RPS was notified on the 21 March 2009, with submissions closing on 8 June 2009. Depending on the final form of the proposed RPS, it may have new objectives, policies and methods that will be of relevance to future projects proposed from the Ngauranga Triangle Strategic Study.

The objectives and policies of the Proposed RPS relevant to this study are:

Objective 9	*"The region's energy needs are met in ways that:* *(a) improve energy efficiency and conservation;* *(b) diversify the type and scale of renewable energy development;* *(c) maximise the use of renewable energy resources;* *(d) reduce dependency on fossil fuels; and* *(e) reduce greenhouse gas emissions from transportation."*
Objective 10	*"The social, economic, cultural and environmental, benefits of regionally significant infrastructure are recognised and protected."*
Objective 21	*"A compact, well designed and sustainable regional form that has an integrated, safe and responsive transport network and:* *(a) a viable and vibrant regional central business district in Wellington city;* *(b) an increased range and diversity of activities in and around the regionally significant centres2;* *(c) sufficient industrial-based employment locations or capacity to meet the region's needs;* *(d) urban development in existing urban areas, or when beyond urban areas, development that reinforces the region's existing urban form;* *(e) strategically planned rural development;* *(f) a range of housing (including affordable housing);* *(g) integrated public open spaces;* *(h) Integrated land use and transportation;* *(i) improved east-west transport linkages; and* *(j) efficient use of existing infrastructure (including transport network infrastructure)."*

Policy 29	*"Maintaining and enhancing the viability and vibrancy of regionally significant centres – district plans"* *District Plans shall include policies, rules and/or methods that encourage a range of land use activities that maintain and enhance the viability and vibrancy of the regional significance:* *(a) Upper Hutt city centre* *(b) Lower Hutt city centre* *(c) Porirua city centre* *(d) Paraparaumu town centre* *(e) Masterton town centre* *(f) Petone* *(g) Kilbirnie* *(h) Johnsonville.*

A recent amendment to the RMA allows for an RPS to provide direction to a regional or district plan on how a resource management issue may be addressed. A potential outcome of the Proposed RPS is that the WRS would be required to be considered as part of an assessment of statutory applications. This is particularly relevant to the Ngauranga Triangle Strategic Study, as a statutory application would need to demonstrate how proposed works have considered Regional Focus Areas.

6.4.Regional Land Transport Strategy

The RLTS is a statutory document constituted under the Land Transport Act and referred to in the LTMA.

The vision of the Wellington RLTS is: 'to deliver, through significant achievements in each period, an integrated land transport system that supports the region's people and prosperity in a way that is economically, environmentally and socially sustainable'. Detailed aspirations are provided in this document but are not included in this overview.

The RLTS objectives are:

- Assist economic and regional development
- Assist safety and personal security
- Improve access, mobility and reliability
- Protect and promote public health
- Ensure environmental sustainability
- Ensure that the RTP is affordable to the regional community.

It should be noted that the first five of the six RLTS objectives are identical to those of the NZTS, and the principles outlined in the LTMA.

The key land transport outcomes and corresponding stretch targets sought by the RLTS are set out in Table 6.3.

Table 6.3: Key Outcomes and Targets

Key Outcome		2016 Stretch Target
1.1	**Increased peak period passenger transport mode share**	Passenger transport accounts for at least 25 million peak period trips per annum (18.3 million in 2005/06).
2.1	**Increased mode share for pedestrians and cyclists**	Passenger transport accounts for at least 21% of all region-wide journey-to-work trips (17% in 2006).
3.1	**Reduced greenhouse gas emissions**	Active modes account for at least 15% of region-wide journey-to-work trips (13% in 2006).
4.1	**Reduced severe road congestion**	Transport generated CO2 emissions will remain below 1,065 kilotonnes per annum (1,118 in 2005/06).
5.1	**Improved regional road safety**	Average congestion on selected roads will remain below 20 seconds delay per km travelled despite traffic growth (21 seconds in 2006).
6.1	**Improved land use and transport integration (in line with the WRS and local authority urban development strategies)**	There are no road crash fatalities attributable to roading network deficiencies.
7.1	**Improved regional freight efficiency**	All large subdivisions and developments include appropriate provision for walking, cycling and public transport.

The outcomes included in Table 6.3 clearly reflect the LTMA principles of integration, safety, and a sustainable land transport system. Furthermore, the GPS targets of increasing the mode share for walking, cycling and public transport are supported.

The link between Grenada and Gracefield is identified for funding and as a part of other transport corridor plans in the RLTS. The RLTS does not specify what this link is, neither in terms of its alignment, nor whether it functions as a road, a public transport corridor or other.

Section 8.8 of the RLTS identifies a programme of prioritisation and funding policies. Under this programme, "up to $45 million of C1 funds are available to assist the local share of the Grenada to Gracefield Stage 1 project (assistance to the level of half the local share), noting that this project is still subject to further investigations". Section 10.3.2 identifies the "proposed new east-west Link Road between Grenada and Gracefield" as a key feature of the Hutt Corridor Plan.

According to Section 11.1 which provides information about the types of available funding, under the C2 funding, there will be $255 million for the Western Corridor transport investment to address a number of initiatives, one of which is the new road from Petone to Grenada.

The RLTS includes summaries of three corridor studies relevant to the Ngauranga Triangle Strategic Study as detailed in the Corridor Plans presented in Sections 6.9.2 - 6.9.4.

The RLTS acknowledges the WRS:

> *'The WRS is a joint project involving Greater Wellington and the nine territorial authorities of the region, working together to build an internationally competitive Wellington. It is primarily an economic growth strategy with an outlook to 2025. The WRS is firmly based on the proposition that economic growth for the region is necessary and desirable. It is aimed at sustainable economic and population growth which will protect the region's sense of place, build competitiveness, increase our quality of life and protect the values and communities that contribute to making the Wellington region different from anywhere else. Transport outcomes identified in this strategy will play a significant part in facilitating the growth sought by the WRS. For example, new transport corridors, such as the Grenada to Gracefield Link Road and Johnsonville to Airport growth spine, will be key drivers for economic growth by improving connectivity between economic centres.'*

The corridor plans enable the Regional Transport Committee (RTC) to gain a region-wide perspective for each mode or interest area. These plans are standalone documents that sit alongside the RLTS and enable the RLTC to understand the interventions proposed in each corridor, and to assess how proposed interventions interact with each other and with the existing regional and local road network.

The RLTS provides specific guidance for the Ngauranga Triangle Strategic Study on what proposals should contribute towards in terms of objectives, targets and outcomes. Further, it identifies the need for the connections between Grenada and Petone and a further link to Gracefield. The RLTS identifies funding for these proposals.

6.5. Wellington Regional Strategy

The WRS is a non-statutory document which outlines the aspirations of local government in the region. However, as noted above, if the Proposed RPS is processed as notified, then the WRS regional focus areas will be required to be considered as stated under Policy 58 and Method 4 as part of statutory applications. This is to confirm that this study is consistent with the WRS as part of meeting the RPS.

The vision of the WRS is as follows:

> *"In 2025 the Wellington region's competitive advantage will be based around its capital status, global links and local geography. The two main corridors running the length of the area will create a feeling of free movement and intimacy in the region. You'll never feel far from the bush, the sea, work or home. A thriving entrepreneurial spirit of new ideas will be*

> *encouraged and drive the economy. People will live in safe, clean communities that celebrate the coming together of different cultures. Everyone will enjoy access to sport and active leisure, environmentally friendly outdoors and to thriving, cosmopolitan arts and entertainment."*

Investment in good regional form is identified as a key focus area. The WRS is "encouraging, in particular, the importance of east-west roading links in addition to proposed investment in north-south links. For example improved access to the port and airport from Seaview will aid business growth." The WRS states that their "research suggests economic benefits will result from better access to the port and airport, and improved east-west transport connections. This is especially relevant for integrating the eastern corridor of the Hutt Valley and Wairarapa with the western corridor of Porirua and the Kapiti Coast."

The WRS devotes a specific (though small) section to the Grenada to Gracefield "Change Area":

> *"The Seaview/Gracefield area has significant industrial and commercial redevelopment potential, while the Petone area lends itself to some intensive housing, albeit ensuring the area's character is retained. Proposals to explore broadening housing choice in some parts of the change area, and to address roading links, will proceed through local community based planning processes. Over the hill, there is opportunity for mixed use development in Grenada encompassing industrial-based employment and greater housing choice. There is also opportunity to link Grenada and Gracefield via an east-west link, providing traffic congestion relief, especially in the Ngauranga Gorge. Development of the Petone foreshore and reduction in Ngauranga traffic congestion has the added benefit of providing better port access for both the Grenada and Gracefield regions."*

The WRS describes the Seaview/Gracefield area in broad terms. It talks of linking Grenada to Gracefield and the need for access to the port. The WRS gives no information on the level of interaction of activities in Seaview/Gracefield with activities in the wider region, which are important for managing the supply chain or other fundamental questions of logistics. The WRS does not provide guidance on how the aspirations expressed might be achieved, nor does it provide guidance on what activities or trip purposes would need particular consideration in a study such as the Ngauranga Triangle Strategic Study to achieve economic growth aspirations. However, if the Proposed RPS is enacted, as part of Method 45, more detailed planning frameworks are to be developed allowing for a more coordinated framework for realising the visions of each focus area.

6.6. Wellington City Transport and Urban Development Strategy

The Wellington City Transport and Urban Development Strategy is a non-statutory document that seeks to achieve the following outcomes:

- Concentrate future population and employment growth along the Growth Spine, supported by a dedicated, high quality and high frequency public transport corridor, a high quality state highway route with dependable travel times, bus priority along connecting arterial routes and convenient and safe walking and cycling routes
- Limit commuter parking in the Central Area

- Improve access to the waterfront
- Comprehensive travel demand management programme.

Long-term outcomes identified in the strategy are summarised below:

More liveable	Wellington will be a great place to be, offering a variety of places to live, work and play within a high quality public environment.
More sustainable	Wellington's urban form will support an efficient and sustainable use of our rural and natural resources and promote prosperity and social well-being over the long term.
Better connected	Wellington will be easy to get around, pedestrian-friendly and offer quality transport choices on a highly interconnected public transport and street system.
More prosperous	Wellington's urban form, and flexible approach to land use planning in the central city, centres and industrial areas, will contribute to economic growth and prosperity
More compact	Wellington will have a contained urban form, with intensification in appropriate areas and mixed land-use, structured around a vibrant central city, key suburban centres and major transport corridors.
Safer	Wellington will be a safe place to be, with well-designed buildings, spaces and connections between them.
Stronger sense of place	Wellington will be a memorable, beautiful city, celebrating and building on its sense-of-place, capital city status, distinctive landform and landmarks, defining features, heritage and high quality buildings and spaces.

Within the Transport and Urban Development Strategy, the Petone-Grenada link is identified as a key road infrastructure improvement for which land development in the Lincolnshire Farm area will be supported. It also specifies that this road will be supplemented by local access roads and that the Petone-Grenada road link will enable the Lincolnshire Farm area to be serviced by bus.

6.7. District Plans & Structure Plans

The District Plans outlined below are of particular relevance as they set out matters relating to land use development and integration with transport infrastructure. They also outline other environmental management minimum standards and expectations as to how the environment should be managed. For example, they identify what activities are discretionary or non-complying activities. This is important to identify potential adverse effects and determine what assessments are required for any statutory approvals required under the Resource Management Act. This also helps to determine whether the NZTA is meeting its objective under the LTMA which includes exhibiting social and environmental responsibility.

6.7.1. Wellington City District Plan

Some of the potential projects to be included in the preferred package of projects are located within the jurisdiction of the Wellington City District Plan (last amended 2006). The main objectives and policies included

in the District Plan that require consideration in undertaking the Ngauranga Triangle Strategy study are outlined in Appendix A. In summary, the objectives and policies of relevance to this project look to contain urban development to existing urban areas and manage and enhance rural and open space areas to maintain and protect landscape and ecological values.

The District Plan also contains provisions for the Lincolnshire Farm Structure Plan to manage this area, as discussed in Section 14.

6.7.2. Hutt City District Plan

The Hutt City District Plan (2003/04) identifies the Petone foreshore as a special recreational area and the Seaview-Gracefield area as a special business area. There are a series of rules that manage land development in these respective areas. These include objectives and policies to allow for redevelopment at Petone incorporating higher density residential development around major transportation routes. The Plan also has provisions on flood risk management. Key objectives and policies are outlined in Appendix A.

In terms of planning provisions, within the Residential / Commercial / Business / Recreation & Open Space zoned areas, the creation of roading is a non-complying activity, as it is not specifically provided for.

Finally, it is important to note that under section 6A1.1.2 of the Hutt City District Plan, Main Entrance Routes, the gateway to Petone is referenced as follows:

> *"e) State Highway No. 2:*
>
> *The business areas at Cornish Street and Hebden Crescent are highly visible from State Highway No. 2. The effects generated by the activities need to be managed to enhance the visual appearance, amenity value and contribution to the image of the City. This involves attention to building design and appearance, landscaping and screening, signage and traffic generation."*

6.7.3. Lincolnshire Farm Structure Plan

The Lincolnshire Farm Structure Plan (2006) is a non-statutory document design to support the Wellington City District Plan. However, provisions associated with this Structure Plan have now been included in the District Plan.

Lincolnshire Farm encompasses a substantial area where the Petone-Grenada Link Road route is proposed. Moreover, the Lincolnshire Structure Plan includes the Link Road and the layout is largely dependent on this route. The Structure Plan includes a number of Development Land-Use Guides.

The Structure Plan contains a section devoted to movement and connectivity. Part of the section focuses on the importance of linkage with identifiable, quality spaces. According to the Structure Plan, "the movement network within the structure plan area will be made up by roads (with provision for walking, cycling, private

vehicles and public transport) and dedicated pedestrian / cycle links. These should interlink to create a safe, accessible and legible network which encourages sustainable forms of transport."

In terms of implementing the Link Road, the Structure Plan envisages that:

> *"The majority of funding for the Link Road will need to come from Transit New Zealand (now NZTA) or the Crown. A decision on when and how to fund the Link Road will depend on the Regional Land Transport Strategy and the priority that is given to other projects in the region in relation to available funding. As such, detailed investigations are unlikely to proceed until funding has been identified. Once funding is secured identification of the alignment, detailed design and implementation of the Link Road will require a partnership approach between the Council, the developer, Transit (now NZTA) and Hutt City."*

6.8. Petone Vision Statement

The Petone Vision Statement (Vision) has been released by the HCC and outlines the anticipated high level outcomes sought for this area by 2027. A number of these have relevance to this study. The desired outcomes are divided into four elements which are:

- Heritage protection
- Achieving economic/environmental sustainable growth
- Providing a place that has a strong sense of local community
- Providing an attractive and vibrant village culture at the heart of Petone.

Actions to achieve these elements under heritage protection include:

- Preserving and promoting heritage aspects; including re-establishing Iwi links to sites of importance/ protecting and celebrating these Maori roots in this area
- Ensuring that any change is sympathetic and reinforces the heritage look and feel
- Making sure the scale and nature of urban development is appropriate – particularly around residential and harbour, river, parks and hills.

For the management of growth within Petone, actions include:

- Increasing attractiveness of walking, cycling and public transport options
- Changing roading networks that improve the movement of residential and business traffic and add amenity value to areas such as the foreshore
- Providing proactive management and planning for future development – including managing changes in housing typologies beyond what is currently available in Petone. This includes medium density housing. However, this needs to be balanced with maintaining heritage character in Petone
- Providing more opportunities to work locally.

Actions to achieve a place that has a strong sense of local community include:

- Providing a safe community, such as through improving improved street lighting, utilizing CPTED principles and reducing traffic crashes
- Ensuring that improvements to Petone do not erode the sense of a diverse community
- Continuing to try to meet local needs locally.

Actions to achieve an attractive and vibrant village culture at the heart of Petone include:

- Retaining the mix of different socio-economic groups in the community and ensure a range of housing types are provided for
- Retaining small scale commercial activities and retailing as a defining feature of Petone and Jackson Street's character.

HCC has advocated that the Vision is achieved through a review of the District Plan provisions, particularly in relation to provisions on mixed use development issues, design guidelines and re-development and heritage protection for buildings and localities. It also seeks to have an update of the current Long Term Council Community Plan (LTCCP), Land Transport Strategies, Reserve Management Plans and Asset Management Plans in order to achieve the above elements. Alongside local government's role in achieving this Vision, community groups, business groups, investors, educational providers and Iwi are also identified to have roles in implementing this Vision.

6.9. Regional and Local Transport Studies / Strategies

6.9.1. Regional Transport Programme 2006/07 – 2016

The 10-Year Strategic Roading Programme contained in the Regional Transport Programme 2006/07 – 2016 (2007) identifies funding for the following projects within the Ngauranga Triangle Strategic Study area:

Grenada – Gracefield Stage 1, SH1 – Petone Link Road ($180M)	"The investigation of a new Link Road between Petone and Grenada was identified as a high priority in the Hutt Corridor Plan adopted in November 2003. If established, it will provide a more efficient link between the Hutt Valley and Porirua and shift traffic from the already congested Ngauranga – Petone and Ngauranga intersection. Links to the WRS and Western Corridor Study also need to consider Gorge routes. The project will also need to include a major upgrade to the SH2/Horokiwi with Petone-Ngauranga HOT lane and Cross Valley Link proposals."
Grenada – Gracefield Stage 2 CVL (Beyond 10 years)	"Establishment of a new Cross Valley Link (CVL) road between the (yet to be built) Dowse interchange and Randwick Road/Whites Line. Also involves traffic calming The Esplanade to discourage traffic. Links to Dowse to Petone upgrade. CVL has synergies with the Grenada to Gracefield stage 1 and the Petone- Ngauranga HOT lane proposals."

Petone – Ngauranga HOT Lane and Cycleway ($60M)	"Establishment of a new fifth lane between Petone and Ngauranga, to be managed as a tidal flow, possibly with a toll for low occupancy vehicles." The HOT lane proposal may require legal changes. However the concept is important for several reasons. First, there appears that there is sufficient room available to put such a lane in. Second, such a lane enables the volume of southbound traffic reaching the critical Ngauranga junction and the impact on adjacent rail services to be managed. Finally, the underlying vehicle occupancy rates on this segment of SH2 mean that a HOV lane concept is unlikely to be effective.

6.9.2. Hutt Corridor Plan

The Hutt Corridor Plan (2003) was developed prior to the LTMA legislation although many of the objectives used to develop the Hutt Corridor Plan are consistent with the LTMA. As it forms part of the RLTS, it has statutory effect.

The Hutt Corridor Plan is based on a multimodal approach to addressing issues through a multiple objective framework. The objectives used for the study were the RLTS objectives and a more detailed understanding of travel needs and possible solutions was sought to support the RLTS. A Planning Balance Sheet was used as the evaluation tool.

The Hutt Corridor Plan includes the following vision for the Hutt Corridor; "Along the Hutt Corridor from Ngauranga to Upper Hutt, SH 2 and the Wairarapa railway line will provide a high level of access and reliability for both passengers and freight. These primary networks will be supported effectively by local and regional connector routes. High quality rail and bus services will accommodate the majority of people using passenger transport to commute along this corridor during the peak period. Maximum use of the existing road network will be achieved through measures giving priority to buses and addressing severe traffic congestion. Comprehensive bus services and adequate park and ride facilities will provide additional access for the community. Effective safety measures on the road and rail networks will ensure that no one is killed or injured when travelling in this corridor. East-west connections between this corridor and other corridors and regional centres will be efficient, reliable and safe.

Table 6.4 as follows identifies the relevant projects planned as part of the Hutt Corridor Plan.

Action	Responsibility	Timing	Indicative Cost	Suggested Funding	Target	Performance Measures
Roading: Short to Medium Term Projects (2007 – 2016)						
Develop an implementation plan for Grenada to Gracefield links and the Petone – Ngauranga reversible HOT lane	Transit (lead)[11] GWRC, HCC, WCC	As soon as possible	To Be Determined	C2 L (GWRC, HCC, WCC)	Complete Implementation Plan by 2007 / 08	Implementation plan completed
Construct SH2 Dowse – Petone interchange	Transit (lead), HCC	To commence 2007/08	$73M	N	Open by 2008 / 09	Improvements completed
Investigate and construct a Link Road between Grenada and Petone (Stage 1 of Grenada – Gracefield)	Transit (lead) HCC, WCC	Stage 1 investigation to continue from 2006 /07	$180 M	C2 L (WCC)	Open by 2014 / 15	Road completed
Roading: Long Term Projects (beyond 2016)						
Construct a Link Road between Petone and Gracefield (Stage 2 of Grenada – Gracefield)	Transit (lead) HCC	Stge 2 to commence beyond 10 years	$60M	To be determined	Road opened	Progress reported to RLTC
Walking and Cycling: Short to Medium Term Projects (2007 – 2016)						
Scope and design a two-way cycle and pedestrian facility between Petone and Ngauranga on the seaward side of the rail line	Transit (lead) HCC, WCC	Underway	To be determined	N	Review complete by 2006 /07	Review reported to RLTC
Construct a two-way cycle and pedestrian facility between Petone and Ngauranga on the seaward side of the railway line. This is a requirement before the improvements on SH2 between Petone and Ngauranga can be completed	Transit TAs	As soon as possible	To be determined	To be determined	Construction complete	Facility open for use

■ **Table 6.4: Relevant Hutt Corridor Projects**

[11] Transit was the State Highway agency at the time of developing the Hutt Corridor Plan. Transit's functions have now been taken over by the New Zealand Transport Agency

The key issues identified in the Hutt Corridor plan include:

- Improving access between the Hutt Valley and Wellington City
- Improving access between the Hutt Valley and Wellington's northern suburbs, Porirua and further north
- Improving access across the Valley floor and in particular to the Seaview-Gracefield area.

Of particular significance is that this access is required for both people and goods. It is understood from measured data that freight movement, particularly to and from Seaview-Gracefield, is seen as an important issue for not only trips to the Wellington City but also to Wellington's northern suburbs, Porirua, and further north.

Providing improved access to Wellington is problematic. Significant enhancements to passenger rail in terms of train speed, frequency, and more effective use of the Melling line are important. The highway operation is constrained geographically and it is important to ensure that the impact of improvements on rail use and the highway network south of Ngauranga are taken into account. This is why the HOT lane concept is promoted as underlying vehicle occupancy would make a HOV lane ineffective and provide little benefit to freight. The construction of the Petone-Granada link is promoted for several reasons. These include:

- Providing relief to SH2 by removing traffic from Ngauranga to Petone
- Reducing the impact of the congestion inducing merges at the northbound merge on SH2 at Ngauranga and the southbound merge on SH2 at Petone
- Providing a more direct route from Petone to Grenada reducing travel time and distance for these trips
- Increase network resilience in SH2 which is prone to closures due to crashes and slips.

The Petone to Gracefield link is promoted to:

- Improve the efficiency of travel to and from SH2 to the Seaview-Gracefield area and beyond and in particular for freight traffic
- To support the integration of the Petone foreshore into the Petone area and reduce the severance created by traffic

All these issues are directly relevant to the Ngauranga Triangle Strategic Study.

6.9.3. Western Corridor Plan

The Western Corridor Plan (WCP) (2006) was developed under the LTMA and has statutory effect being part of the RLTS. The WCP is based on a multi-modal approach to addressing issues through a multiple objective framework. The objectives used for the study were the RLTS objectives and a more detailed understanding of travel needs and possible solutions was sought to support the RLTS. A Planning Balance Sheet was used as the evaluation tool. The Western Corridor study supplemented the Planning Balance Sheet with weightings for each objective. Different sets of weightings were obtained from different stakeholder groups to understand the effect of different stakeholder perspectives on the evaluation of proposals.

The long-term vision for the Western Corridor is described in the RLTS:

> *'Trunk railway line will provide a high level of access and reliability for passengers and freight travelling within and through the region in a way which recognises the important strategic regional and national role of this corridor. These primary networks will be supported effectively by local and regional connector routes. A high quality rail service will accommodate the majority of people using passenger transport to commute along this corridor during the peak period. Comprehensive bus services and adequate park and ride facilities will provide additional access for the community. Traffic congestion on State Highway 1 will be managed at levels that balance the need for access against the ability to fully provide for peak demands due to community impacts and cost constraints. Maximum use of the existing network will be achieved by removal of key bottlenecks on the road and rail networks. Effective safety measures on the road and rail networks will ensure that no one is killed or injured as a result of network deficiencies when travelling in this corridor. East-west connections between this corridor and other corridors and regional centres will be efficient, reliable and safe.'*

The Hearing Sub-committee's report associated with the Proposed WCP provides a funding plan for the amended WCP with relevant projects as indicated in Table 6.5.

Table 6.5: Relevant Projects Funding Plan for Amended WCP

Project	Estimated Cost of 2006–2025 Transport Programme ($m)	2006-15 Central Government Funding ($m)	2006-15 Local Government Funding ($m)	2016-25	2026-35
Grenada – Gracefield	180	135	45		

The WCP is primarily concerned with access from Kapiti to Wellington and access between the Western Corridor and the Hutt Valley. The plan envisaged significant frequency increases to passenger rail on the corridor plus extension of electrified commuter services to Waikanae. Track upgrades are required at the North-South Junction to enable increased passenger rail service frequency, increased rail based freight movements and the use of larger containers. In addition, consideration is given to whether a truckway and/or a bus lane can be provided in Ngauranga Gorge to assist am peak road haulage and bus use. This would require the construction of the Petone-Grenada link and the reallocation of road space in the gorge.

The Petone-Grenada link is further promoted to enable the efficient and direct travel from Wellington's northern suburbs to the Hutt Valley. Travel on this link would serve completely different customers than SH58. This link would provide relief to SH1 in Ngauranga Gorge at peak times. The Petone-Grenada link provides the opportunity to provide direct bus services between Wellington's northern suburbs and the Hutt Valley which is currently not provided for.

All of these matters are directly relevant to the Ngauranga Triangle Strategic Study.

6.9.4. Ngauranga to Airport Corridor Plan

The Ngauranga to Airport Plan (2008) sits within the RLTS and has been developed within the LTMA framework. Both the SH1 and SH2 corridors merge into a single corridor at Ngauranga and continue to destinations in Wellington central and beyond to other destinations such as the Airport. This includes significant volumes of people and goods. The provision of access for these people and goods is vital for the functioning of Wellington City.

The RLTS's vision for the Ngauranga to Wellington Airport Corridor is;

> *"Along the Ngauranga to Wellington Airport Corridor, access to key destinations such as CentrePort, Wellington City CBD, Newtown Hospital and the International Airport will be efficient, reliable, quick and easy. Priority will be given to passenger transport through this corridor, particularly during the peak period. Passenger transport will provide a very high quality, reliable and safe service along the Wellington City growth spine and other key commuter routes. The road network will provide well for those trips which cannot be made by alternative modes and will allow freight to move freely through the corridor. Traffic congestion through the corridor will be managed at levels that balance the need for access against the ability to fully provide for peak demands due to community impacts and cost constraints. Maximum use of the existing network will be achieved by removal of key bottlenecks on the road and rail networks."*

Relevant measures to be implemented as part of this plan are identified in Table 6.6.

Table 6.6: Relevant Measures of Ngauranga to Airport Corridor Plan

Measure	Responsibility	Timing	Indicative Cost	Performance Measures
Finalise and implement a Wellington City walking policy to promote walking trips that would otherwise be taken by car, including: ☐ Improving the walking environment ☐ Increasing the number of short trips to work or study ☐ Increasing walking in suburban centres by encouraging people to walk to their local services ☐ Investigate cycling and walking improvements between Ngauranga and Wellington City that provide high quality facilities connecting local networks and are consistent with the vision of the "Great Harbour Way"	WCC (lead) NZTA	Ongoing from 2008	To be determined	Increased pedestrian volumes Reduced crash rates Greater pedestrian satisfaction

Measure	Responsibility	Timing	Indicative Cost	Performance Measures
Finalise and implement a Wellington City cycling policy to make cycling safer and more convenient, including: - Improving the safety and convenience of cycling - Emphasising the quality and continuity of cycle routes - Providing better facilities for cyclists Investigate cycling and walking improvements between Ngauranga and Wellington City that provide high quality facilities connecting local networks and are consistent with the vision of the "Great Harbour Way"	WCC (lead) NZTA	Ongoing from 2008	To be determined	Reduced crash rates Greater cyclist satisfaction Maintained cyclist volumes
Reallocate existing general traffic lanes on Hutt Road between Ngauranga and Thorndon for bus lanes and possibly high occupancy vehicles; and construct peak period lanes on SH 1 between Ngauranga to Aotea Quay	NZTA (lead) WCC	Investigation from 2009/10 Construction from 2011/12	30	More passengers carried Improved Passenger transport journey times and reliability Reduced single occupant vehicle trips Reduced severe congestion

In one sense, south of Ngauranga is a generator of travel and travel choices but it is also the recipient of travel that commences on the SH1 and SH2 corridors. This means there needs to be a careful balancing of capacity between what is provided on the SH1 corridor and SH2 corridor, and what is provided south of Ngauranga.

This applies to all modes of travel, as for some modes such as public transport, walking, and cycling, the whole journey experience is part of the travel choice decision. This means the rail user from central Hutt or Tawa, for example, may be impressed with new upgrades to rail in their respective corridors north of Ngauranga but if this is not supported by a good service south of Ngauranga then the user may look to travel in a different way.

Because of this relationship of capacity and service between north and south of Ngauranga, the Ngauranga to Airport study is directly relevant to the Ngauranga Triangle Strategic Study.

6.9.5. Regional Freight Plan

The Regional Freight Plan (2007) is a subsidiary document that supports the RLTS.

The GWRC Regional Freight Plan recognises that:	*"efficient freight transport is a cornerstone of a prosperous region."*
This document acknowledges the importance of the Ngauranga Triangle Strategic Study area in terms of freight movement:	*"Particularly significant volumes of goods flow between the Wellington City CBD / CentrePort, Gracefield / Petone and Porirua. From a freight perspective, improvements to the road network should be focused on increasing efficiency between these areas."*
The Regional Freight Plan also states that:	*"the Gracefield / Seaview area of Lower Hutt contains around 50% of the industrial floor space in Lower Hutt and Wellington. While much of the Gracefield Spur railway line has been removed in recent years, it is appropriate that the rail corridor itself if protected to ensure its potential for future use is maintained. This is consistent with the WRS aim to improve transport connections between key commercial centres in the region."*

The following freight policies are included in the plan:

- Support rail freight initiatives where benefits exceed those of road freight
- Provide an appropriate transport network for freight and commercial needs
- Protect and develop rail infrastructure wagons and facilities for freight and forestry links between Masterton and Wellington
- Support the protection of the rail corridor to Gracefield/Seaview.

These policies are aimed to provide the following outcomes identified in the Freight Plan:

- Improved level of service for freight
- Improved freight linkages
- Improved rail and road freight efficiency.

These policies relate directly to issues in the Ngauranga Triangle Strategic Study area and suggest that the use of the now unused Gracefield spur line should be considered.

Additionally, priority freight projects are identified and linked with relevant corridor plans. The following projects are identified as freight priorities and relevant to the present study:

- Construct Grenada – Gracefield Stage 1: SH1 to SH2
- Construct Grenada – Gracefield Stage 2: Cross Valley Link
- Upgrade SH58.

This Freight Plan gives direction to key proposals that should be reflected in the Ngauranga Triangle Strategic Study. All three of these projects are linked to both the Western Corridor Plan and the Hutt Corridor Plan.

6.9.6. Regional Cycling Plan

The Regional Cycling Plan (2008) is a subsidiary document supporting the RLTS.

The Regional Cycling Plan (formerly known as the Regional Cycling Strategy) outlines a shared vision, for the region's key agencies involved in cycling, and sets objectives, desired outcomes, and monitoring for the promotion and development of cycling.

The vision of the Regional Cycling Plan is: "The evolution of a cycling culture where cycling is a recognised and valued transport mode that is safe, accessible and pleasant throughout the region."

Objectives include:

- Create an advocacy ethic that facilitates coordination among lead agencies
- Enhance cycling safety throughout the region through education initiatives and improved infrastructure
- Increase accessibility, integration, and safety for cycling
- Improve awareness of all forms of cycling – commuting, recreation and tourism.

The outcomes sought include:

- Improved level of service for cycling
- Increased mode share for cycling
- Improved perception of cycling safety, convenience and ease
- Increased safety for cyclists.

The routes along SH1 and SH2 are identified as strategic routes in the Wellington Cycling Network, and thus are important to this study. The present study will seek to achieve the objectives of the Regional Cycling Plan.

The plan includes support of the concept of a 'Great Harbour Cycle Way': This plan supports the "Great Harbour Way" concept '…that there will be a continuous, safe, signposted walkway and cycleway around the whole perimeter of Te Whanganui-a-Tara (Wellington Harbour) from Fitzroy Bay in the west to Sinclair Head in the east' . The long-term development of such facilities relies in the short term on the development of a

comprehensive plan, integrated across TA boundaries. It is recognised that the most significant gap in this route is the section between Petone - Ngauranga and this plan calls for this to be addressed as a priority.

In relation to this study an important inclusion is an action to 'investigate high quality improvements to active mode facilities between Petone and Ngauranga that connect the adjacent local networks consistent with the vision of the "Great Harbour Way". This is identified as being the responsibility of WCC, HCC and NZTA, but in terms of timing it is stated that "Active mode facility component of the Ngauranga Triangle Strategic Study reported by Aug 09".

Other key actions identified for the cycling action programme are:

- Improve the cycling network
- Improve cycling and public transport integration
- Provide for cyclists in land development
- Influence Central Government policy
- Seek adequate funding
- Support delivery of cyclist skills training programmes
- Facility information sharing
- Improve driver and cyclist awareness
- Improve Information for cycling
- Encourage participation in cycling
- Support development of the "Great Harbour Way".

6.9.7. Regional Walking Plan

The Regional Walking Plan (2008) is a subsidiary document supporting the RLTS.

The aspiration for walking and cycling as set out in the RLTS vision is:	*People will generally walk or cycle for short and medium length trips. Pedestrian and cycling networks will be convenient, safe and pleasant to use.*
In addition to the above RLTS targets, this implementation plan seeks to achieve the following in accordance with the national GPS and NZTS signals:	*An increase in total walking trip numbers in the region across all trip purposes*

The above applies generically to all of the Ngauranga study area. However, specific areas such as the disconnected adjacent to SH2 between Petone and Ngauranga and the pedestrian movements on The Esplanade are particularly relevant in this policy context.

6.9.8. Regional Travel Demand Management Plan

The Regional Travel Demand Management Plan (2005) is a subsidiary plan supporting the RLTS. However, the LTMA requires the RLTS to include travel demand management as a measure.

GWRC's Regional Travel Demand Management Plan's vision is: "To use travel demand management initiatives in achieving sustainable outcomes for the greater Wellington land transport system."

Objectives listed are:

- To ensure the most efficient use of existing transport infrastructure and services
- To increase public awareness of TDM and individual travel choices
- To encourage integrated land use and transport planning that seeks to maximise transport efficiency
- To encourage proactive advocacy that facilities coordination among lead agencies.

Outcomes sought include:

- Limited car traffic growth particularly at peak times, while maintaining accessibility
- Increased journey to work mode share for passenger transport and active modes
- Improved integration between transport modes
- Reduced greenhouse gas emissions
- Reduced fuel consumption
- Reduced road congestion
- Increased vehicle occupancy
- Increased resident satisfaction
- Improved land use and transport integration (as defined by the WRS)
- No adverse impact on economic development (as defined by the WRS).

With reference to the Ngauranga Triangle Strategic Study area, the objectives and outcomes all apply generically. Land use development at Lincolnshire Farm and the development of the Seaview-Gracefield area are of significant interest in the Ngauranga Triangle Strategic Study area.

6.9.9. Regional Passenger Transport Plan 2007-2016

The Public Transport Management Act 2008 (PTMA) (2007) is designed to give regional councils new tools to develop public transport systems to meet the needs of their communities. The PTMA repeals the Transport Services Licensing Act 1989 (TSLA), and sets the objective of helping regional councils and the NZTA obtain the best value for money in achieving an affordable, integrated, safe, responsive, and sustainable public transport system. In the Wellington context, there is significant interaction between State Highway use and passenger rail use at peak travel times. This is because the two modes are immediately adjacent to one another and both experience pressure at peak times. Hence, the two modes of travel have to be carefully balanced in the

Ngauranga Triangle Strategic Study area, both in terms of their interaction with one another, and with travel beyond the Ngauranga Triangle Strategic Study area.

Several direct bus services operate in the Hutt Valley connecting to Wellington. These are largely in areas that are not well serviced by rail such as the Eastern Bays, Wainuiomata, and parts of Upper Hutt.

The Regional Passenger Transport Plan sets out Greater Wellington's intentions for the regional passenger transport system over the next ten years. This document is consistent with, and gives effect to, the RLTS. It focuses on delivery of the strategic outcomes identified in the Strategy for passenger transport.

The vision identified for passenger transport is; "a sustainable passenger transport system that, through significant achievements in each period, is integrated, accessible and increasingly the mode of choice for a greater number of journeys." In terms of aim, "the vision gives the region something to aim for in the development of its passenger transport network and also delivers on the broader vision of the Regional Land Transport Strategy to deliver an integrated land transport system that supports, through significant achievements in each period, the region's people and prosperity in a way that is economically, environmentally and socially sustainable."

The document also identifies the following values and drivers:

"The main drivers for passenger transport in the region include the need to:

- *ensure access and mobility*
- *reduce congestion*
- *support environmental sustainability*
- *These drivers are influenced by the following values or principles that are important in achieving the ideal passenger transport system for the region:*
- *Equity*
- *Accessibility*
- *Reliability*
- *Quality*
- *Simplicity*
- *Affordability.*"

Passenger transport significantly influences in the activities in the Ngauranga Triangle area. Further, there are important passenger transport activities across the valley floor with both passenger rail and bus services that relate to the Petone, Seaview, Gracefield and areas beyond.

6.9.10. Wellington Regional Rail Plan - 2010 – 2035 'A Better Rail Experience'

The Wellington Regional Rail Plan (2008) has not yet been adopted, so this section deals with the draft version. If adopted, this document will be a subsidiary plan supporting the RLTS.

The governance group of the Ngauranga Triangle Strategy Study has advised that the passenger rail levels of service for the Ngauranga Triangle Strategy Study should be fixed at those determined by the GWRC's procurement plans and that the improvements envisaged in the Draft Rail Plan should be assumed to take place under all scenarios. Improvements to the rail programme are addressed in the Regional Rail Plan which 'provides for the long-term development of the region's rail network'. Its purpose is: "to maintain and grow rail's position as the key transport mode for long to medium distance and high volume transport services over the next 25 years."

Targeted outcomes of the plan are:

- Reliability
- Frequency
- Capacity
- Journey time
- Reach.

The improvements to the rail network assumed as part of this project will be consistent with the improvements articulated by GWRC's procurement programme.

6.9.11. Hutt City Cycling Plan

HCC has published a Cycling Plan (2006). This is a non-statutory document and provides relevant information on the Council's intentions regarding cycling. Hutt City seeks to have a continuous and integrated cycle network which includes a route along the Petone foreshore and routes parallel to SH2 north of Petone. Clearly the connectivity of the wider network will be enhanced by completing a Ngauranga to Petone cycle path and a Petone to Grenada cycle route.

6.9.12. Wellington City Council Walking Policy

The purpose of the Walking Policy (2008) is to provide a framework for initiatives to collaboratively improve the pedestrian walking environment in Wellington. With the primary focus of promoting walking trips that would otherwise be taken by car, the walking policy seeks to improve the walking environment and increase the number of short trips made by people to work or study, either as a single journey, or as part of a journey. The walking policy also seeks to increase walking activity in suburban centres by encouraging people to walk to their local services rather than taking the car. It also seeks to make walking to schools more attractive for children.

The walking policy has the overarching aim of promoting "walking for a purpose" as opposed to recreational walking which is recognised in the Council's Open Spaces Access plan (2004). The walking policy does, however, recognise that different types of walkers have varying needs and requirements of walking experiences and levels of provision. The walking policy is aimed at all walkers, whether they have special mobility requirements, have limited experience or are utility walkers (e.g. commuters). The walking policy will encourage walking to help ease pressure on the city's transport system and identify a prioritised network of pedestrian connections in the city and suburbs for protection and enhancement. The policy also promotes connectivity with the open space access network.

6.9.13. Wellington City Council Cycling Policy

The Cycling Policy (2008) forms part of the overall transport planning for Wellington set out in the Transport Strategy 2006. It provides more detail on cycling in Wellington and the context set by other policies and strategies. It also creates a framework for the development of infrastructure and measures to improve the safety and convenience of cycling and cycling facilities throughout our city.

In order to create an effective framework to provide a basis for action, the cycling policy sets out objectives and policies on how implementation should be approached. These include emphasising the importance of quality and continuity of cycle routes, including provision of consistent signage and recognising cycling as a means of commuting and as a form of recreation.

The cycling policy also details proposals both in general terms for ongoing support (e.g. promoting the health and recreational benefits of cycling) and as location-specific improvements to infrastructure. The focus of the latter is to create a safer and more convenient network in areas where existing provision is disjointed or does not allow access to key destinations. Providing better facilities for cyclists is also a key objective of the policy.

7. Issues Identification

Following the Stage One Discussions and the Constraints Workshop, a number of issues were identified that relate to the current and future performance of the transport network within the study area. These issues, along with the key policy and planning documents, were used to inform the development of performance indicators to support each of the objectives in the evaluation framework detailed below.

Ngauranga to Tawa	☐ Growing traffic volumes on SH1 leading to severe peak period congestion (LoS E) and travel time variability (NZTA travel time surveys indicate that peak travel times have stabilised which means increasing traffic demand will lead to a lengthening of the peak period) ☐ The level of crashes in the vicinity of Tawa Interchange (3 serious from 2004 to 2008) ☐ Placement/design of motorway access points creating congestion on Johnsonville Road ☐ Commuter buses getting caught in congested general traffic in Ngauranga Gorge leading to service delays in peak times ☐ Poor level of service for cyclists and pedestrians ☐ Current inadequate level of service for passenger rail at peak and non-peak times.
Ngauranga to Dowse	☐ Growing traffic volumes on SH2 leading to severe peak period congestion (LoS E) and travel time variability, particularly on the on and off-ramps at peak times (NZTA travel time surveys indicate that peak travel times have stabilised which means increasing traffic demand will lead to a lengthening of the peak period) ☐ High level of crashes in the vicinity of Petone Interchange, resulting in safety issues and disruption to traffic flows (crash statistics show there were 89 injury crashes between Petone and Ngauranga on SH2 from 2004-08 of which 8 were serious and 81 were minor. The majority of crashes, including minor, are associated with Horokiwi/SH2 intersection and Petone interchange) ☐ Commuter buses getting caught in congested general traffic between Ngauranga and Petone leading to service delays in peak times ☐ Poor level of service for cyclists and pedestrians ☐ No direct link for pedestrians and cyclists crossing from the Petone foreshore to the Korokoro Valley and the Belmont Regional Park ☐ Current inadequate level of service for passenger rail at peak and non-peak times.
SH1 to SH2	Poor connections/integration between the Western Corridor/SH1 and Hutt Corridor/SH2), leading to: ☐ Lack of east – west social and economic integration ☐ Poor freight connectivity of Seaview-Gracefield to lower North Island ☐ Limited east – west passenger transport service opportunities.

SH2 to Seaview-Gracefield	☐ Growing traffic volumes on The Esplanade leading to serious peak period congestion (LoS E) and travel time variability, community severance, decreased Petone foreshore amenity values and limited economic development. NZTA travel time surveys indicate that peak travel times have stabilised which means increasing traffic demand will lead to a lengthening of the peak period ☐ Reducing quality of connectivity between the Seaview-Gracefield Industrial Area and SH2 as The Esplanade nears capacity ☐ Poor level of service for cyclists and pedestrians ☐ Aging infrastructure of Petone ramp bridges and Petone pedestrian bridge ☐ Increasing freight volumes which operate throughout the day.

8. Constraints and Opportunities in the Study Area

The following information is taken from the Constraints Plan (see Figure 8.1) which provides an overall summary of the potential issues associated with the study area. Further detail on the potential effects on the Long List and Short List options is provided in the Long List and Short List Options Reports. Detailed analysis on each option, as part of the preferred strategy is provided in Section 15.

8.1. Regional Connectivity and Agglomeration

Transport links enable distinct economic activities to become more integrated within a region, enabling them to operate more effectively and efficiently, and becoming more economically integrated. Delay and congestion on the network disrupts this process and breaks down the ability of an area to act as an integrated economic entity.

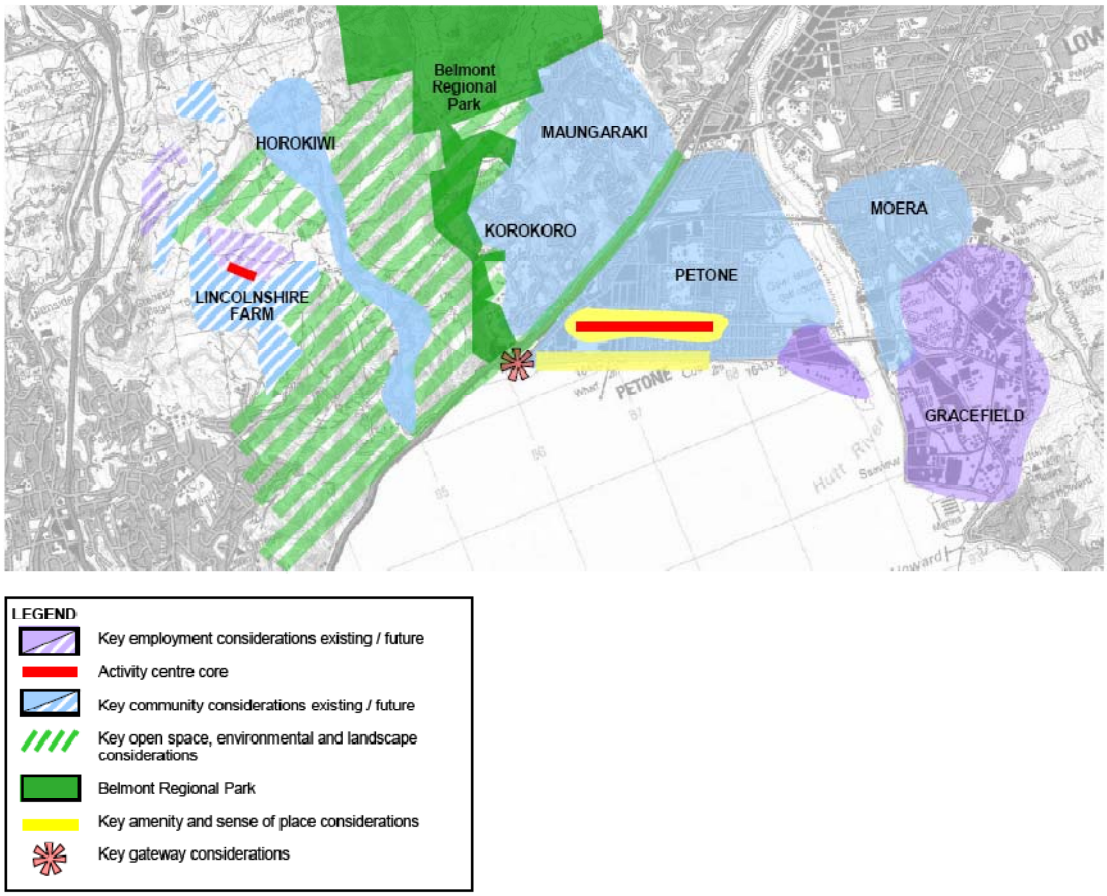
The local access function from the highways is critical to regional connectivity and agglomeration. Poor connectivity between settlements such as northern Wellington, Tawa, Porirua and the Hutt Valley has a significant negative impact on agglomeration of economic activities in these areas.

Lincolnshire Farm has been identified as a growth area in the vicinity of SH1 and this area will need good access to support land development. This will require planned connections to SH1, supported with an effective local road network, so that traffic can move safely and efficiently between these developments and State Highway.

8.2. Urban Form

For the options that run from Petone to Gracefield there are various constraints and opportunities from the physical layout of the area, particularly in terms of urban design. Figure 8.1 provides an overview of the urban form constraints/opportunities in the study area that has needed to be addressed.

Figure 8.1: Urban Form Constraints and Opportunities in the Study Area



To the west of the study area there is a strongly signalled intent from WCC to intensify development around the Johnsonville Town Centre. Future development of the Helston Road off/on-ramp would enable this development to occur.

The development of Lincolnshire Farm requires the future Petone-Grenada Link Road options to be put in place for the current design of the structure plan to work effectively. This new settlement could potentially provide up to 2,000 new jobs in a business park and neighbourhood centre and 800-900 new homes. For transport options that are identified there could be potential benefits in terms of operating a bus service connecting Newlands with Lincolnshire Farm. This could help support viability of employment and supporting access to a residential village. It would provide the Newlands area with greater regional connectivity, improve access to jobs and reduce social isolation.

In terms of potential future growth aspirations in the Hutt, the Petone area has been identified as an area for future development through the Hutt City Petone Vision Statement and the WRS. How this growth is managed will need to be carefully considered alongside redevelopment and the location of future traffic growth. One of

the constraints could be the adverse effect on the character, amenity and town centre function of the Jackson Street route as a result of increased traffic volumes.

There are many opportunities in this area such as redevelopment of The Esplanade route for medium density residential and recreational uses from Jackson Street to The Esplanade (3 blocks). The Hutt Road/Esplanade Intersection is also acknowledged as a significant gateway to Hutt City. The gateway area is defined in Figure 8.1.

There is also a Treaty claim on Nicholson Block by Wellington Tenths Trust, and master planning underway by Housing New Zealand Corporation to redevelop existing housing stock at the eastern end of The Esplanade.

With regards to other opportunities with land, after having discussions with HCC it was identified that Wainuiomata has land available for development, however this is unlikely to be developed in the foreseeable future. Eastbourne is considered unlikely to develop significantly. These assumptions are to be tested over the next year as vision statements are developed for each area.

8.3. Transport Network Efficiency

The traffic constraints and rail problems in this area include limited capacity on the rail mainline and merge speed restrictions for Hutt rail; along with demands of travel that are indirectly catered for such as Petone to Grenada. Given these issues there is a need to investigate a road connection to Seaview that is direct and convenient and serves these travel demands. A suitable route also needs to be considered against the aspirations of HCC to improve conditions in The Esplanade in terms of capacity and amenity.

SH1 through the Ngauranga Gorge suffers from congestion in the Wellington-bound direction in the am peak periods as a result of traffic backing up from the two-lane bottleneck merge with SH1 heading into Wellington City. This situation is also seen on the approach to the SH1/SH2 Interchange in the pm peak period with queues forming from the merge onto SH2 from SH1 north (Ngauranga Gorge).

Further along SH2, delays are also experienced at the Ngauranga on ramp and the off ramp at Petone Interchange in the pm peak due to weaving and capacity problems with the ramps. The Petone on ramp generates delays in the am peak due to weaving and merge capacity issues.

The Esplanade also has issues with congestion such as reduced route efficiency due to numerous access points and intersections along its length and inadequate capacity at Waione Street Bridge over the Hutt River. The queues resulting from the Petone on-ramp merge issues onto SH2 in the am peak back up onto The Esplanade and the general high traffic flows along with a high proportion of heavy vehicles (to and from Seaview) affect this road significantly. The road is an important distributor road as it also serves a main route to not just the lower Hutt Valley and Seaview-Gracefield industrial area, but also Wainuiomata and the eastern bays.

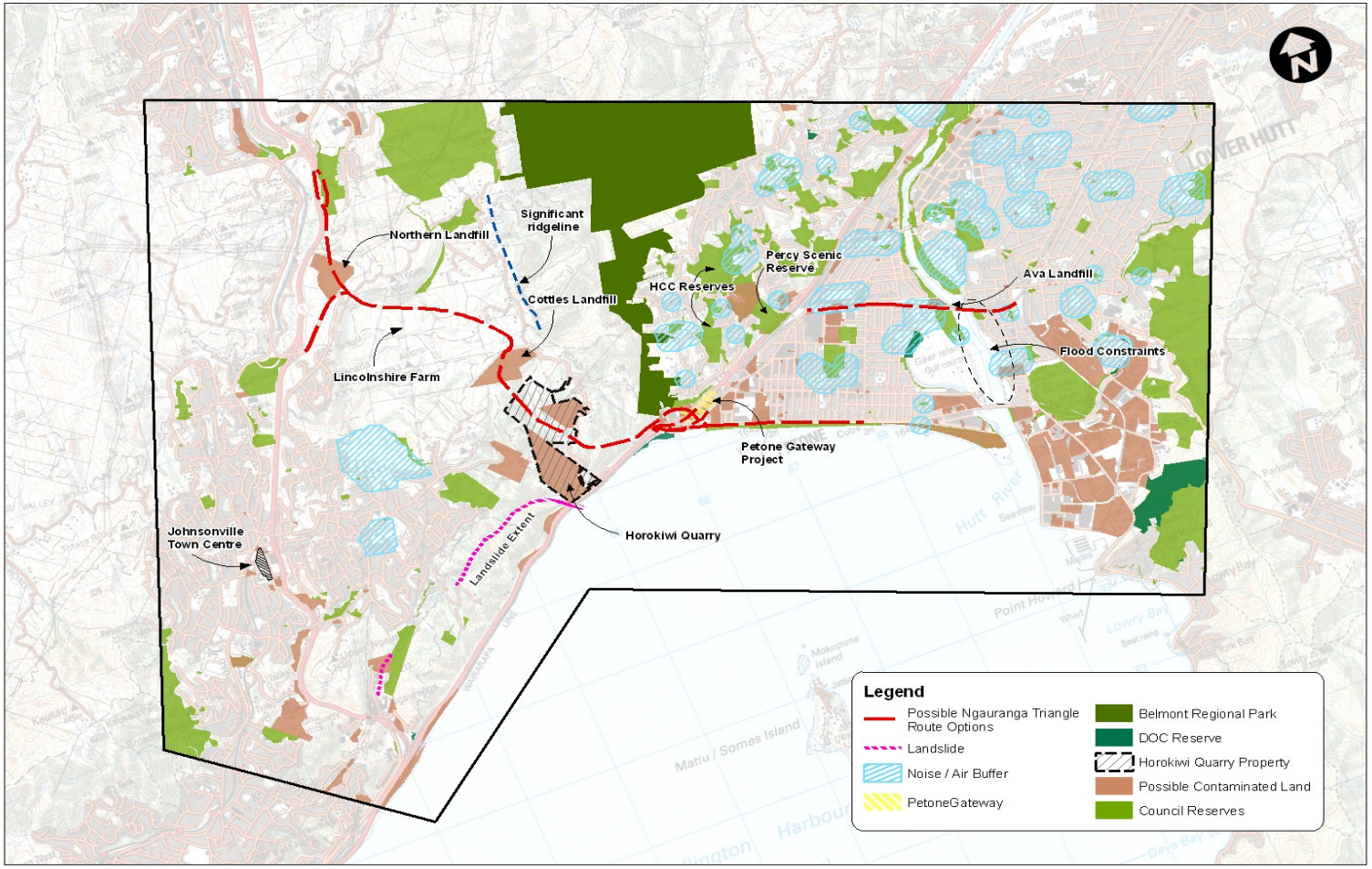
Building roads can be expensive and the steep terrain of the region generally increases these costs significantly. Incrementally constructed projects are generally easier to fund because of their lesser impact on the national funding programme. Incremental projects have their costs distributed over an extended time

period and are more manageable in terms of overall size. This means that strategic new routes involving large new roads are often difficult to fund.

8.4. Regional Parks and Department of Conservation Land

It became apparent early on in investigations that the Belmont Regional Park in the study area would be a major constraint to the plausible options, particularly in Korokoro Valley and to a lesser extent in Horokiwi. Along with the Regional Park, there are numerous conservation land and council reserves in the study area. See key constraints on the following page.

Figure 8.2: Key Constraints



Potential options identified early in the Study would impact on Belmont Regional Park impinging on landscape and geological features, soil and water resources including Korokoro Stream, ecosystems, and cultural heritage. As the regional park provides a place with rural character and high recreational, historical and ecological values so close to existing urban areas, the preservation of this character, values and recreation functionality is important.

Although the constraints posed by the Regional Park are high, there are some opportunities. The current Belmont Regional Park Management Plan has specific provision for park approach roads including from Horokiwi Road (Policy 2.2 pp 26-27). There is currently little access to the park from the western side of Horokiwi so there could be an opportunity to improve access to the park. Creating a major entrance to this western end of Belmont Regional Park would make it more accessible from Wellington and SH1 and would attract more visitors cycling, walking or driving to the park. There could possibly be a secondary entrance created along the western side of Korokoro Valley from Horokiwi. Improving access to the park would integrate with the opportunity to create a continuous integrated walking, running and cycling network from Ngauranga to Petone, linking with the Hutt Valley network. Development either side of SH2 would provide the opportunity to integrate a pedestrian/cycle bridge across SH2 as part of the development which could extend into Belmont Regional Park, linking the Petone foreshore and the valley floor with the regional park.

The management plan also states that "support for proposed works may be given [for construction of network utilities including roading developments] when there is no other alternative site or method, where the works are of direct benefit to the region or nation, and where their presence and location would not adversely affect the natural and cultural features of the park." (Policy 2.11(1) page 29, Belmont Regional Park Management Plan Part 1: Aims, Objectives and Policies, September 1996, Wellington Regional Council) Therefore, if an option was chosen which adversely affected the park, a thorough assessment of options would be needed to prove that no other alternatives are possible.

Should the Petone-Grenada Link Road pass through the Dowse Interchange area it would need to carefully consider impacts on Percy Scenic Reserve. Percy Scenic Reserve is one of the oldest scenic reserves in New Zealand and has important natural, cultural and historical features. The reserve is classified as a scenic reserve under the Reserves Act 1977. HCC has prepared a draft management plan, about to be finalised, which has attracted significant public interest.

The reserve forms the base of a Kohekohe gully with Percy Stream and is part of a bird corridor from Eastbourne to Belmont Regional Park. It is identified as a Significant Natural Resource (43) in HCC District Plan and is the site of nationally significant plant collections including native rare and endangered plant collections and "many plants not seen elsewhere in cultivation" (HCC District Plan Page E/11). The reserve is a popular destination for recreation, particularly walking in the bush setting, and is popular with young families.

The recent redevelopment of SH2 created an opportunity for a new entrance and car parking to the reserve off Dowse Drive. Any Petone-Grenada Link Road would not create any further opportunities for entrances or links and would have a severe impact on the reserve and on visitor experience of it.

8.5. Geotechnical

Geotechnical issues constrain the options available. For the area around Lincolnshire Farm, there is very steep topography and it would be likely that there would be a need for significant cut slopes, benching and slope retention systems. In the Horokiwi area there is also steep topography and colluvium bedrock depressions.

There is significant seismic risk in the study area, particularly around the crossing of the Wellington Fault over a steep escarpment, and the alluvial areas (which could be potentially affected by liquefaction). The 1855 Wairarapa earthquake activated a landslip of approximately 300,000m^3 of rock and debris that blocked the Wellington to Hutt Road. A significant seismic event on the Wellington fault may reactivate the slope. See Figure 8.2 for the location of the landslide extent. Any option that required nearby works would need to carefully consider this potential effect when carrying out cut and fill.

For options that have significant channel/stream crossings, it is likely that they will need to consider deep fill embankment requirements or bridge crossings, such as for the Belmont Stream. In the lower Hutt Valley area the constraint is settlement, particularly of fill embankments in the valley floor area. For options that affect the lower Hutt, another constraint is the foundations of any bridge crossing the Hutt River as there are likely to be constraints on driven piles due to the proximity to nearby residential areas and aquifer penetration.

8.6. Hydrological

The top of Korokoro Hill is an area susceptible to storms from the north and south resulting in high rainfall. This will affect the size and type of structures that can be built if a route is chosen in this area. In particular, stream crossings will be at risk and may generate significant erosion and sediment runoff issues which will require management. It is noted that culverts used to cross the Korokoro Stream are already undersized (in 1976 peak flows occurred which were estimated at 90m^3/s and this caused significant local flooding with resulting damage and disruption) and landslides are also a feature of steep slopes in the Korokoro catchment. The risk from landslides should be assessed when considering routes in the area and setbacks should be provided where possible.

In the lower Hutt Valley, hydrological constraints include the Hutt River and crossing structures that would need to be built (any new structure has to meet the 2800m^3/s requirement) and the Waiwhetu Stream (were any new structure has to meet the 60m^3/s requirement).

8.7. Landscape

Landscape concerns from the options include social aspects such as an altered sense of place, modification of landform changing shared and recognised values of the visual landscape as well as the physical landscape, changes to landscape character and land use. For example, rural areas could lose their sense of rural character or urban residential areas could change due to increased noise, lights, access and road visibility. Landscape heritage and sites of value to Tangata Whenua could be altered. Scenic reserves, such as Percy Scenic Reserve, require special sensitivity when considering options.

Opportunities open up through ideas such as creating a road corridor with multiple use and functions that follow good design principles e.g. following existing contours, avoiding a continuous ribbon of road by designing it so that it follows existing landform and disappears and reappears from view, avoiding ridge tops to protect ridgelines and visually dominant areas (such as Horokiwi and the ridgeline of the harbour escarpment), wetlands and gully floors and their associated water courses, contouring of cut and fill areas to match existing landform as much as possible and planting, although only in time will the vegetative cover mature.

8.8. Air Quality

Air quality in the study area is identified as good to excellent in Lower Hutt and Grenada (to SH2) as Lower Hutt is a mixed use area and Grenada is mainly a rural/rural residential area. It is inevitable that there will be constraints in keeping air quality at this level as new routes lead to greater road use and consequently greater exhaust fumes. Roadside monitoring in Wellington shows that PM10 is acceptable to good but at times is in the alert range (exceeding the NES), which is of concern.

The main constraints for the current strategy will be to provide, where practicable a 50 to 100m separation distance between the road and any residential properties, particularly sensitive receivers such as schools, sports facilities and child care centres such as those on the lower Hutt Valley floor. Identification of sensitive receivers is identified in Figure 8.2. Dust (and odour) impacts during the construction phase will also be important to consider. Steep gradients, such as those being considered as part of the Petone-Grenada Link Road may make air quality issues more significant.

8.9. Noise

One of the greatest sources of community annoyance from roads is noise. Accordingly, annoyance is particularly high for routes that are in close proximity to residential areas and depend on traffic volumes. Separation distances need to be maintained in options that effect sensitive receivers to avoid unreasonably increasing adverse effects, particularly increased noise levels at night and vibration impacts from heavy vehicles. See Figure 8.2 for identified areas of sensitive receivers. Other options for mitigating effects include using quieter road surfaces.

Particular noise constraints in the study area include the awareness that the Korokoro and Horokiwi communities may have issues with noise when currently the area has very low noise levels. This issue will be particularly high around the Belmont Regional Park. Steep gradients can increase noise effects (for routes that go either up Horokiwi/Lincolnshire Farm/Korokoro).

8.10. Contaminated Land

Contaminated land in the study area is a constraint, as a number of potentially contaminated sites have been identified along potential route options, in particular closed landfills. See Figure 8.2 for details. Northern Landfill which has recently closed may cause odour and leachate adverse effects if it is disturbed. Cottles Landfill, near Lincolnshire Farm, is known to have industrial waste of unknown origin and also landfill fires. Ava Landfill could also impact on options for crossing the Hutt River by the Hutt Rail Bridge. The knowledge as

to the extent and level of contamination at these sites is limited at this stage. The implications of this lack of knowledge on these sites could be significant if the routes pass through the sites. There are costs involved in investigating, mitigating and on-site treatment or disposal of the contamination.

8.11. Community Severance

Community severance issues arise when the connectivity of an area is altered which causes adverse effects on social interaction. Limiting the impact from this issue will provide greater community 'buy-in' during the process of designing the final proposals.

Options through Petone could potentially cause community severance along the valley floor. However, this could also become an opportunity for community living on The Esplanade.

Options which occur in Lower Hutt will need to avoid community severance issues from affecting the connectivity of residences to the many schools which reside along the Hutt Valley floor. Options which occur in Belmont could either sever or enhance recreational opportunities in Belmont, depending on the choice of route that progresses.

8.12. Integration and Responsiveness

The integration of land use planning with transport planning is a key issue for the study area, as the anticipated levels of population growth and land use changes will require significant investment in transport infrastructure. If these issues are not planned together, access and mobility problems would arise.

It should be recognised that all trip purposes and trip lengths do not have the same characteristics or needs. This requires the transport networks to be developed in parallel with land development so that pragmatic choices involving other modes can be made as appropriate.

8.13. Iwi/Maori Land and Archaeological Sites

Land and sites (which are highly valued by Iwi or for their historic or archaeological value) need to be avoided where possible. There are approximately 60 sites within the study area which are identified as Significant Natural, Cultural and Archaeological resources. This includes Maori sites of importance.

There are numerous historical tracks in Korokoro and Belmont which will need to be taken into account. Access may be able to be improved depending on road placement. Any exiting of a road from Cornish Street or roading affecting the lower Korokoro Valley floor is likely to impact the historic pipe-works that rundown from the Korokoro dam and possibly the historic stone wall which is remaining from the earlier woollen mills that used to occupy the site.

8.14. Infrastructure

The existing infrastructure in the study area is an important consideration in order to provide the best outcome by being aware of the constraints and opportunities that they pose to the Strategy. See the Constraints Plan for details.

At the bottom of the Ngauranga Gorge there is an ATMS project proposed along SH2 which would put fibre optics (an FX Network) into this area. Near the top of the Ngauranga Gorge there is also a trunk water main. The location of this main and the pumping stations are a constraint on some of the options. There are also significant pumping stations in the Hutt which are in the study area, the trunk watermain runs under SH2 (between Petone-Ngauranga) and the main watermain and gas line runs across the Waione Bridge. The main water trunk line and gas line are significant pieces of infrastructure that would require careful consideration as to how these will be managed and incorporated into any new bridge structures if they were to be moved or disrupted during construction of a route.

There are main transmission power lines running through Lincolnshire Farm which would be affected by a Petone-Grenada Link Road option. However, it has been identified as part of the Lincolnshire Farm structure plan that Council would like to look at raising funds to underground these wires. If this does not occur, building a new link underneath these wires will be problematic.

8.15. Ecology

The ecology of the study area provides many constraints, with some opportunities (see Figure 8.2 for details). One of the most significant adverse ecological impacts is the sedimentation impacts during construction on Wellington Harbour, any crossing of the Belmont, Korokoro, Waiwhetu and Horokiwi Streams and their tributaries, and the Hutt River, although there are mitigation measures available. There are current and planned ecological restoration efforts in several of these areas.

There could be a loss of terrestrial habitat forest and regenerating scrub, especially in Korokoro Valley (refer to the section above on Belmont Regional Park). It is likely that there will be adverse terrestrial and freshwater impacts from a Grenada to Petone link, regardless of the route chosen. There is also significant vegetation in Ngauranga Gorge.

The adverse effect of pollution, through the transport of heavy metals in waterways from vehicle use could potentially occur through certain routes.

In the Hutt District Plan there is no statutory protection of significant natural resources although their existence is considered in resource consent hearings; in general protection and ecological management of these resources is required. Currently WCC does not have statutory protection of identified indigenous forest remnants. Improved identification and documentation of these remnants is currently underway and may lead to statutory protection.

GWRC's proposed Regional Policy Statement for Wellington contains policies that would oblige territorial authorities to identify indigenous ecosystems and habitats with significant indigenous biodiversity values, and

protection of these ecosystems and habitats from inappropriate development. The Hutt River and Korokoro Streams are identified in the proposed RPS as rivers with significant indigenous ecosystem values, to which several proposed policies apply.

There could be an opportunity in any options which provide foreshore/esplanade redevelopment in Petone as amenity and ecological values could be lifted through restoring significant lost habitats. An ecological corridor could also be created or enhanced through a route.

8.16. Consentability

Routes that require regional consents as well as a new Notice of Requirement, alteration to boundary or changes to conditions will prove most difficult (routes that disturb rivers, lakes, foreshore and seabed, or soils, or involve removal of vegetation). Routes that involve culturally significant Maori and heritage sites will require a much higher level of consultation, particularly with Iwi and the Historic Places Trust.

Consenting issues could be significant for some of the options, or could result in fatal flaws for a project where major effects on the environment could occur when other reasonable alternative routes exist. The level of consenting risk for each route does vary depending on the potential effect and also whether the project falls within a corridor identified as a road of national significance. Options with projects within existing designations will potentially still require an Outline Plan of Works and or possibly regional consents.

9. Strategic Drivers and Evaluation Criteria

The strategic drivers for the study were collectively developed with the Governance Group using the policy context review as a basis. In this way, all the issues associated with different parts of the study area could be taken into account.

These drivers have underpinned the development of the evaluation criteria, which have consequently guided decisions on which options to reject or take to the next stage of development. These drivers have also informed the urban design objectives and principles developed as part of the urban design framework for this Study. The urban design framework can be found in Appendix B. The drivers are defined below:

Improve connectivity for passenger transport	☐ Reduce average whole journey times (wait time, travel time and interchange) and improve travel time reliability for these key desire lines. ☐ Reducing journey times and improving travel time reliability contributes towards the NZTS targets to improve PT mode share by increasing PT competitiveness with other transport modes. This will contribute to improved accessibility, providing travel choices for individuals and accommodates all socioeconomic groups.
Improve connectivity for general traffic	☐ Maintain or reduce average peak period journey times and improve journey time reliability for these desire lines. This will contribute to improved accessibility and economic development. One option might provide a more direct route for movements between Wellington North and the southern part of the Hutt Valley, reducing VKT, emissions and the number of crashes. This would contribute to targets for emission and crash reductions.
Improve connectivity for freight traffic	☐ Improved connectivity may; reduce average journey times, improve travel time reliability (all day) and HCV operating costs for these desire lines. Improved connectivity for freight traffic will contribute to economic development.
Improve connectivity for safe walking and cycling (and other active modes)	☐ Safe and attractive facilities should be provided for walking and cycling along The Esplanade which is an urban area and has an important function in providing pedestrian access. Safe facilities should be provided for walking, running and commuter cycling between Petone and Ngauranga and between Grenada and Petone where the non-recreational pedestrian demand is likely to be smaller because of the greater distances involved. ☐ The outworking of this principle has the potential to complete the pedestrian and cycling facility between Ngauranga and the Petone as anticipated by the Regional Cycle Plan, and complement other walking and cycling facilities nearby. This will contribute to improved safety and public health, and towards meeting NZTS targets to increase walking, cycling and other active modes in urban areas.

Improve the amenity of Petone and foreshore to enable development of this area incorporating integration with the foreshore	☐ HCC has a long-term vision to reduce the impact of traffic on The Esplanade which creates severance between the Petone community and the waterfront. The volume, the fleet makeup and the speed of traffic on The Esplanade cause severance. Study proposals should reduce and manage remaining traffic on The Esplanade to allow reintegration of the community with the coastal asset.
Improve the network security, resilience, and quality of the transport network between Wellington City and the Hutt Valley and the SH1 RoNS corridor within the study area	☐ SH1, SH2 and The Esplanade are critical routes in the Wellington area. Crashes and natural events, such as storms, floods, earthquakes or tsunamis, may close (or partially close) these critical routes for extended periods. This can be a problem for all modes of transport on the Ngauranga Triangle. This study should consider proposals that enhance the security, resilience and quality of the transport network in the Ngauranga Triangle.
Provide for the integration between transport and land use	☐ The primary opportunities, to ensure the integration between transport and land use are at Seaview-Gracefield and Lincolnshire Farms areas. However, there are other opportunities including the residual land left over from the Korokoro-Dowse project. This goal supports the objectives of the WRS, including improved access to the northern Wellington Growth Area and the Gracefield Growth Area. Integration of transport and land use is a principle of the NZTS.

A high-level evaluation framework and associated evaluation criteria were developed based on the project objectives and strategic drivers detailed above. These evaluation criteria allowed a transparent evaluation of individual projects to identify the extent to which they contributed towards the study objectives, complied with legislation, national, regional and local policy, and provided benefits to the community.

The framework was used to undertake the high-level assessment of the “Long List” of options and filter these to derive a “Short List” of options, which were in turn investigated in more detail. The same evaluation framework has been used for the Short List evaluation and subsequent fine-tuning of the preferred package. The detailed analysis carried out on the Short List Option Assessment has involved developing an indicative high-level economic evaluation and costing for the options.

This evaluation framework is based on the following objectives and partnering evaluation criteria:

Ensure Environmental Sustainability

Primarily, the text for each of the evaluation criteria was derived from the NZTA Environmental Plan and issues selected from the plan were determined by their relevance to the study area constraints and the stage of the project in terms of level of information available.

As this study is intended to consider the transportation needs of the Ngauranga Triangle Strategic Study area up to 30 years into the future, climate change and sea level rise are not considered to have a major impact on this study. Associated with the issue of climate change and sea level rise is the increased impact of storm surge.

The consensus of scientific thought indicates that sea level rise around New Zealand over the next 100 years is expected to be less than 1 metre[12]. This means that sea level rise and storm surge is unlikely to greatly impact on projects in the study area over the 30-year study period. However, it would be prudent that all major new infrastructure proposed in the preferred strategy be designed to accommodate sea level rise and increased storm surge over its design life.

The evaluation criteria used is outlined below:

- Enhance and contribute to community cohesion
- Proactively limit the disturbance of significant cultural and heritage features along state highways
- Ensure no net loss of native vegetation, wetlands, critical habitat or endangered species
- Plan and design new state highway infrastructure to avoid or reduce adverse noise and vibration effects
- Identify areas susceptible to erosion and sediment deposition and implement control measures appropriate to each situation with particular emphasis on high-risk areas
- Manage increased hazards of climate change impacts on state highway infrastructure.

Assist in Economic Development

The text for each of the evaluation criteria which relate to this objective stem from objectives and targets from high level documents such as the NZTS and GPS targets. Specific site constraints were then considered in order to produce evaluation criteria which would evaluate the options best.

Assisting economic development was of particular importance due to the updated GPS. The GPS places particular importance on transportation infrastructure supporting economic development. In this study, economic development can be facilitated by:

- Improving the efficiency and reducing the cost of business related travel by reducing severe congestion and travel time variability
- Improving access to and from important economic activity centres such as the Seaview-Gracefield industrial hub and the Port
- Facilitating new development such as the Lincolnshire Farm area
- Supporting the renovation and economic regeneration of areas such as the Johnsonville town centre, Petone, the Petone foreshore
- Improving the efficiency and reliability of SH1 and SH2.

[12] Coastal Hazards and Climate Change – A Guidance Manual for Local Government in New Zealand 2nd Edition July 2008. Ministry for the Environment

The evaluation criteria used is outlined below:

- Maintain or reduce average peak period journey times and improve journey time reliability particularly between SH1, SH2 and the Seaview / Gracefield area
- Support redevelopment of the Seaview / Gracefield area
- Support development of the Lincolnshire Farm area
- Improve amenity of The Esplanade to enable redevelopment of the area and integration with the foreshore
- Reduce all day average journey times; improve travel time reliability and HCV operating costs between SH1, SH2 and the Seaview / Gracefield area.

Assist Safety and Personal Security

The evaluation criteria which relate to safety and personal security have been developed to reflect network-wide exposure to crashes (vehicle-kilometres travelled) and to take into account specific site constraints. There is an awareness of safety issues surrounding the large number of heavy vehicles on The Esplanade. Recognition of options which would reduce that number was considered important for the current strategy.

The evaluation criteria used is outlined below:

- Reduce vehicle kilometres travelled
- Reduce the volume of the heavy vehicles on The Esplanade.

Improve Access and Mobility

Improving access and mobility was important for the strategy, particularly in regards to the current policy direction which encourages improving transport conditions for public transport modes, pedestrians and cyclists.

The evaluation criteria used is outlined below:

- Increase Public Transport mode share within the Ngauranga Triangle
- Increase the number of walking and cycling trips within the Ngauranga Triangle
- Maintain or reduce the average peak period journey times and journey time
- Provide alternative routes within the Ngauranga Triangle Area.

Protect and Promote Public Health

Policy related to public health refers to reducing the adverse environmental effects of noise and air pollution, as well as encouraging walking and cycling. Reducing heavy vehicles along The Esplanade was considered to positively impact on noise and air pollution because of the recreational opportunities it provides and therefore the potential to impact upon people.

The evaluation criteria used is outlined below:

- Reduce volumes of heavy vehicles on The Esplanade
- Increase the numbers of walking and cycling trips within the study area.

Benefit Cost Ratios

High-level indicative BCRs were calculated for the Short List options and a possible range provided. Approximate cost estimates have been developed based on previous studies where possible and are presented as present value (PV) costs. Where previous cost estimates have not been available, high level cost estimates have been produced.

Assumptions made as part of cost analysis include:

- Single Payment Present Worth Factor (SPPWF) from the NZTA Economic Evaluation Manual (EEM) are used to account for one off payment in 2016
- Costs updated with 3% yearly increase for years before 2006, and update factors out of EEM for cost updates from 2006 onwards.

Where applicable, benefits have been generated from traffic models. The benefits are based on the following assumptions:

- Based on Total Travel Time, Delays and Travel Distance from network statistics and used the difference between an option and the DM (Test 1)[13]
- Multiplied respective Value of Time factor out of the EEM to account for congestion and respective update factor
- Benefits summed up for each time period and multiplied by respective time period factor (2 for AM & PM, 12.4 for IP) to achieve daily benefit
- Multiply by 350 to achieve yearly benefit
- Use USPWF out of EEM to achieve 30-year benefit.

Where benefits were not available from the traffic models, high-level calculations were carried out based on the EEM.

Consentability

A high-level consentability assessment was undertaken to identify which projects may have difficult statutory approval processes or projects that may have a fatal flaw. The ranking system used was done with a “coarse sieve” approach, whereby a project received a ranking based on the complexity of statutory approval required, whether the effects could be mitigated and likely public opposition. See Appendix C for the consenting methodology and ranking provided for each project.

[13] See Appendix G for the full modelling reports.

The first five objectives are from the LTMA and are reflected in the RLTS. The last two objectives are a measure of the ability of projects within a preferred strategy to be implemented. A practical transportation plan for the Ngauranga Triangle Strategy Study area should concern itself with projects that can be implemented. This means a project should have some likelihood of being funded and of gaining consent under the RMA.

An example of the tables used in the evaluation of the projects is shown below in Figure 9.1.

- **Figure 9.1: Example of Assessment Table Form and Function of the Study Area**

Objectives	Ensure Environmental Sustainability											
	Enhance and contribute to community cohesion.		Proactively limit the disturbance of significant cultural and heritage features along state highways.		No net loss of native vegetation, wetlands, critical habitat or endangered species.		Plan and design new state highways to avoid or reduce adverse noise and vibration effects.		Identify areas susceptible to erosion and sediment deposition and implement erosion and sediment control measures appropriate to each situation with particular emphasis on high-risk areas.		Manage increased hazards of climate change impacts on state highway infrastructure.	
	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments	Score	Comments
Impacts on the Ngauranga to Tawa corridor if the Grenada to Petone Link Road (GP Link) is constructed	0		0		0		0		0		0	
Peak period bus lane constructed by reallocation of lanes within existing infrastructure	+	Benefit of improved public transport services between Tawa and Ngauranga, therefore creating better connectivity for people and access to employment/community facilities.	0	Bus lane will be within the existing road corridor so will not disturb any significant features.	0	Bus lane will be on existing road reserves so there will be no net loss in vegetation etc.	0	Noise and vibration effects are likely to be neutral based on the existing high volume of traffic already using the route.	0	No new cuts will be required that could cause potential erosion or sediment deposition.	0	Provision of a bus lane will have no impact on susceptibility of infrastructure to climate change impacts, as it is not increasing any existing hazards or structures that are susceptible to hazards such as surface flooding.
Peak period bus lane constructed by reallocation of lanes within existing infrastructure and the inclusion of the Grenada to Petone Link Road	+	Benefit of improved public transport services between Tawa and Ngauranga, therefore creating better connectivity for people and access to employment/community facilities.	0	Bus lane will be within the existing road corridor so will not disturb any significant features.	0	Bus lane will be on existing road reserves so there will be no net loss in vegetation etc.	0	Noise and vibration effects are likely to be neutral based on the existing high volume of traffic already using the route.	0	No new cuts will be required that could cause potential erosion or sediment deposition.	0	Provision of a bus lane will have no impact on susceptibility of infrastructure to climate change impacts, as it is not increasing any existing hazards or structures that are susceptible to hazards such as surface flooding.
Peak period truck way constructed by reallocation of lanes within existing infrastructure	0	N/A	0	Truck way will be on existing road reserve so will not disturb any significant features.	0	Truck way will be on existing road reserves so there will be no net loss in vegetation etc.	0	Noise and vibration effects are likely to be neutral based on the existing high volume of traffic already using the route.	0	No new cuts will be required that could cause potential erosion or sediment deposition.	0	Provision of truck way will have no impact on susceptibility of infrastructure to climate change impacts, as it is not increasing any existing hazards or structures that are susceptible to hazards such as surface flooding.
Peak period truck way constructed by reallocation of lanes within existing infrastructure and the inclusion of the Grenada to Petone Link Road	0	N/A	0	Truck way will be on existing road reserve so will not disturb any significant features.	0	Truck way will be on existing road reserves so there will be no net loss in vegetation etc.	0	Unlikely that potential vibration will be increased.	0	No new cuts will be required that could cause potential erosion or sediment deposition.	0	Provision of truck Lane will have no impact on susceptibility of infrastructure to climate change impacts, as it is not increasing any existing hazards or structures that are susceptible to hazards such as surface flooding.
Peak period two person (or greater) high occupancy vehicle lane constructed by reallocation of lanes within existing infrastructure	0	N/A	0	Will be on existing road reserves so will not disturb any significant features.	0	Will be on existing road reserves so there will be no net loss in vegetation etc.	+	Unlikely that potential noise and vibration will be increased. Potential for a small reduction in noise and vibration effects from reduced volumes on the state highway.	0	No new cuts will be required that could cause potential erosion or sediment deposition.	0	Provision of high occupancy lane will have no impact on susceptibility of infrastructure to climate change impacts, as it is not increasing any existing hazards or structures that are susceptible to hazards such as surface flooding.

9.1. SATURN Traffic Model

A strategic SATURN transport model was developed to undertake a high level assessment of the traffic effects of implementing the recommended strategy. The model scope and network effects are fully described in the "Long List Options Assessment Report" and "Short List Options Assessment Report". The SATURN model was developed from, and is consistent with, the region's four stage strategic multi-modal transport model WTSM. This allowed matrices to be developed which reflected the impact of the base rail strategy. These matrices allowed the trip redistribution effects of the Petone-Grenada and Cross Valley Link roads to be considered so that the SATURN modelling reflects this.

The transport model provided data about how the strategy would cater for forecast travel demands, how traffic would use the network and travel time changes on the road network.

The transport model was calibrated to 2006 traffic flows, and then forecasts for future years developed. Both am and pm peak periods along with weekday inter-peak periods were modelled. A Do Minimum (DM) scenario was used as the base for comparison in the year 2016 and 2026. The DM scenario includes all committed developments and planned upgrades to the transportation network within the network model area. Of particular relevance to this study are the inclusion of the Dowse Interchange, Korokoro Road Intersection, Melling Interchange, Kennedy Good Bridge, SH2/SH58 Interchange upgrades and Transmission Gully.

Modelling work was undertaken for the Long List options and the Short List options and full details of this are contained within these earlier reports. As part of the Long List option assessment, high level modelling was carried out to give an overview of the impacts that each option will have on the performance of the network. This is summarised in Appendix G. A high-level assessment was also carried out where the transport effects outside of the model were considered. These included benefits to walking and cycling and other effects that cannot necessarily be quantified but none the less can be considered to form part of the overall assessment.

Further modelling work was undertaken for Short List options assessment. This modelling work further refined that already undertaken for the Long List of options and included some additional tests to reflect the more detailed nature of the assessment.

10. Long List Option Assessment

After identifying the issues, constraints and opportunities associated with the project, and following initial stakeholder discussions, approximately 50 options were developed to address improving the transportation system. A summary map of the options considered for the Long List is provided in Appendix D.

Once the Long List of options for Ngauranga Triangle was completed, an initial assessment was undertaken using the evaluation framework described in Section 9 focussing on the first five objectives. The initial evaluation was tested at the Long List Options Workshop with the Governance Group including representatives from NZTA, HCC, WCC and GWRC.

The Long List evaluation primarily focused on eliminating options with 'fatal flaws' or serious poor performance against any of the objectives. In the area of 'fatal flaws', issues of consentability and the identified constraints were taken into account.

It was agreed with the Governance Group that the issue of current inadequate level of service for passenger rail at peak and non-peak times would be addressed outside of this study in the current regional rail upgrade programme and the Regional Rail Plan. Therefore no options for rail improvements were considered further in the study.

More information on the Long List evaluation is provided in the Long List Options Assessment Report.

Particular aspects that differentiated between options included:

Road Safety Improvements	☐ Tawa interchange would form part of SH1 safety improvements, may also improve access for local communities such as Lincolnshire Farm and Horokiwi. Safety improvements may also accommodate cyclists and pedestrians which would be a positive benefit. ☐ Realignment of SH2 to 120km/h design speed will help improve the poor safety record. It could also result in reductions in travel time for vehicles. Improvements could also provide for cycleway and rail realignment. ☐ Petone interchange improvements would allow for cyclist and pedestrians and would remove tight horizontal curves on SH2. Increases in the number of lanes may also reduce crashess and ease congestion at this bottleneck. ☐ Traffic management works to The Esplanade and prohibition of HCVs will aim to improve safety and amenity, and aid regeneration of the Petone and foreshore area.
Passenger Transport:	☐ Rail network improvements were only considered to the extent their effect is limited in the immediate area of Ngauranga Triangle. Improvements to rail frequency provide a wider benefit outside of the study area (to be addressed in the Regional Rail Pan). ☐ Rail realignment of the Hutt Line scores well as it will result in reduced travel time for rail users and may attract a small number of current motorists on to rail thereby reducing delay on SH2. ☐ The bus lane on SH1 (between Hutt Road and Newlands) scores better than bus lanes and High Occupancy Vehicles (HOV) lanes on SH1 and SH2. This is mainly as a result of no loss

	of road capacity for the bus lane on SH1 as opposed to the other options considered which used the existing infrastructure. □ A Newlands Rail Station was considered prohibitively expensive and would add unacceptable delay onto the existing rail network.
Cycling and Walking:	□ A cycleway provided on SH2 alongside the realigned (120km/h) road and at Petone Interchange scored well for potential increases in travel by this mode. □ The "Beach to Bush" crossing of SH2 was considered beneficial as it would provide access to the regional parks via a safe and convenient route and would also link the communities of Korokoro and Petone. □ A no change scenario for cyclists on SH2 was not considered to be beneficial to safety, nor was the use of the shoulders of SH2. Banning cyclists from SH2 was other option but it was felt that this would have negative impacts on cycling numbers. □ A cycle route cut into the hillside along SH2 was rejected due to unsuitable vertical and horizontal alignments and possible visual impact effects.
Wider Network Connectivity and resilience for General Traffic:	□ Truck lanes provided within the existing carriageway on SH1 and SH2 were discounted due to the reduced road capacity for general traffic causing unacceptable congestion. □ Cross Valley Links that avoided sensitive land use areas were considered to be higher ranked than those which were routed through sensitive areas. □ The route options for a new road from the Petone to Grenada area were considered against a number of points. Generally the combined route that did not significantly affect the following were taken forward to the Short List: - Sensitive land use areas and existing communities - The environment - Potential effective linkages to Lincolnshire Farm - Costs due to land topography - Directness, travel time and delay.

10.1. Long List Option Assessment Recommendations

The outcome of the Long List assessment and the Long List Workshop was that the following options were carried forward from the Long List to the Short List for further development and evaluation during the Short List stage:

Ngauranga to Tawa	□ Tawa Interchange improvements □ Additional southbound bus shoulder

Ngauranga to Dowse	☐ Road, rail and cycleway realignment between Ngauranga and Petone and construction of a seaward cycleway ☐ "Great Harbour Way" - seaward cycleway ☐ Completion of the off-road pedestrian/cycle facility on SH2 ☐ "Beach to Bush" ☐ Petone Interchange rebuild ☐ Traffic management on SH2
SH1 to SH2 Link	☐ Petone-Grenada Link
SH2 to Seaview-Gracefield (Cross Valley Link Options)	☐ Traffic calming works on The Esplanade ☐ The Esplanade multi-lane efficient arterial ☐ Wakefield Street to rail alignment ☐ Wakefield Street to Whites Line alignment ☐ Gracefield multi-modal hub ☐ Udy Street "Wiggle" ☐ Two Way Pairs – Petone Esplanade and Udy Street "Wiggle"

11. Short List Option Assessment

The Short List options set out above were further refined during the Short List option assessment. This refinement included development of an alignment for the Petone-Grenada Link Road and Cross Valley Link options as these were the most significant projects and covered large geographic areas. The refinement enabled indicative costs to be developed and a high level assessment to be undertaken to confirm whether the options were still feasible. Further modelling was also undertaken to confirm the transportation benefits of each option.

Following an initial assessment by the study team, a Short List Workshop was held with the Governance Group. This involved an enquiry-by-design process to confirm the options to go forward and whether modifications to the options were required. The final options had further assessment and refinement undertaken based on the outcomes of the workshop and the preferred Ngauranga Triangle Strategy components were then confirmed with the Governance Group.

The following sections of the report provide a brief summary description of each of the options that were considered in the Short List Options Assessment Report. Appendix E provides a summary map of the options. A number of options included below were not considered in the initial Short List Options Assessment Report but were developed by the Governance Group and study team after the Short Options assessment. To simplify the reporting they are also described below. The projects included after the Short List Options Assessment Report are:

- Middleton Road Cycleway Improvements; and
- Johnsonville Motorway Access Improvements

11.1. Ngauranga to Tawa

Tawa Interchange Improvements	This proposal brings SH1 up to 100 km/h design standards and improves safety in the vicinity of Tawa Interchange which is an identified issue. It involves realignment of three curves on SH1: one immediately north and one immediately south of the interchange and the third at the interchange. A number of crashes have been reported along this section of the highway related to the tight horizontal and vertical alignment of the road (3 serious from 2004 to 2008).
Middleton Road Cycleway Improvements	North of Johnsonville, pedestrians and cyclists must leave SH1 and travel north or south using Middleton Road. The road between Johnsonville and Tawa is narrow in many places and sections of the road operate at 70 km/h. There is no continuous footpath for pedestrians on this road. Over the period 2004 – 2008, crashes involving cyclists amounted to one serious and two minor crashes and one of these was a collision between two cyclists. Estimates of current levels of cycling along this route total 150 cyclists per day in both directions. A purpose-built three metre wide facility to accommodate pedestrians and cyclists is proposed including widening of existing footpaths towards the Johnsonville and Tawa ends of the project and providing a new cycleway by widening the road. Some parts of the

	cycleway, on the widened sections of road, would require retaining structures to be provided. It has been assumed that the cycleway will be provided on the open side of the gorge to avoid cutting into rock face on the opposite side. This will provide a purpose-built cycle facility between Tawa and Johnsonville, without the need to use SH1, which will serve the existing demand and further enhance cycling as a mode of travel in this area.
Additional Southbound Bus Shoulder	☐ This project provides a southbound bus shoulder along SH1 between the Newlands Interchange ramps and Hutt Road. This lane will provide an express route for buses travelling down the Ngauranga Gorge and will join the proposed bus lane at Hutt Road. This will contribute to providing an express bus route between the Newlands Interchange and Wellington City catering for Porirua, Johnsonville and Newlands bus services.
Johnsonville Motorway Access Improvements	☐ South facing Helston Road ramps were considered to alleviate congestion on Johnsonville Road, assist development at the Johnsonville Town Centre and provide improved access to Churton Park. Such ramps would significantly reduce traffic on Johnsonville Road and allow it to be redeveloped in a manner consistent with a shopping street while improving pedestrian permeability. ☐ The reduction of traffic on Johnsonville Road would prevent the tail of a queue from the Johnsonville northbound off-ramp stretching back on to SH1 in the pm peak. This situation occurs at times and is considered a significant safety risk.

11.2. Ngauranga to Dowse

Road, Rail and Cycleway Realignment between Ngauranga and Petone and Construction of a Seaward Cycleway	☐ This project realigns sections of SH2 and rail between Ngauranga and Petone to a design speed of 120 km/h. A seaward cycleway may also be constructed as part of this option. The primary reason for a realignment of the highway is to improve the safety for motorists and the efficiency of the rail network. ☐ The rail network has several sections which are currently designed with 70km/h curves; by realigning the road these curves can be straightened out so that the rail line can be configured to accommodate operating speed of 105km/h. This would result the section of rail line being consistent with the operating speed of the rest of the Hutt Line. ☐ There will also be some small improvements to travel times for motorists on SH2. A seaward cycleway will have a number of benefits in terms of safety and accessibility
"Great Harbour Way" - Seaward Cycleway	☐ This option involves the construction of a cycleway on the seaward side of the railway between Ngauranga and Petone (with the possibility of continuing between Petone and Seaview) and would form part of the "Great Harbour Way – Te Whanganui-a-tara"[14] : a facility that would be a "continuous, safe, signposted walkway and cycleway around the whole perimeter of Te Whanganui-a-Tara – Wellington Harbour from Fitzroy Bay in the east to Sinclair Head in the west". ☐ The new cycleway would serve a number of purposes including providing a two way, high speed track for commuter cyclists. One of the key "problems" with the wider scheme is

[14] http://www.greatharbourway.org.nz/index.shtml - Note: this report only considers the section of the "Great Harbour Way" between Ngauranga and Petone.

	the section between Ngauranga and Petone. There is a cycleway between Ngauranga and Petone, but it is of low standard (drainage, surfacing and maintenance) and terminates approximately 1km south of the Petone overbridge. • The proposed "Great Harbour Way" would replace the existing cycleway with a new walking and cycling track on the seaward side of the railway. With the "Great Harbour Way" on the seaward side of the highway, cycling could be banned from the state highway reserve; this would allow the highway to be considered for re-designation as a motorway.
Completion of the Off-road Pedestrian/Cycle Facility on SH2	• The current cycleway terminates approximately 1km south of the Petone Interchange where cyclists are forced to travel along the shoulder of SH2. This project addresses the inadequate level of service to pedestrians and cyclists that currently exists, by completing the northern section of the pedestrian/cycle facility on SH2, between Horokiwi and Petone. It involves upgrading the existing length of cycleway and constructing a new section of cycleway on the seaward side of the rail tracks north of the Horokiwi intersection. • As the railway lines are double tracked and at peak times, highly utilised from Petone to Ngauranga in this location, it is proposed that the project joins the new pedestrian/cycleway via a bridge over the rail tracks to the existing pedestrian/cycle facility adjacent to SH2. The proposed bridge will provide the best safety outcomes for pedestrians and cyclists and avoids potential disruption to daily rail movements that might be caused by an at-grade crossing. • This new section of pedestrian/cycleway can be thought of as the first stage of the "Great Harbour Way" concept and should be built to standards consistent with the vision for that concept (i.e. a 4m wide shared-use (cycle/pedestrian) facility).
"Beach to Bush"	• The construction of the Petone-Grenada Link Road will require the reconstruction and relocation of the existing Petone Interchange. This will release the Petone ramps overbridge from the existing interchange to provide a crossing over SH2 and the Wairarapa rail line providing a safe and convenient path for pedestrians and cyclists, connecting the Petone foreshore to the Korokoro Valley and the Belmont Regional Park – the "Beach to the Bush" concept.
Petone Interchange Rebuild	• This option involves upgrading the Petone Overbridge. In the vicinity of the existing overbridge there is an "S" bend with a posted speed limit of 70km/h. This bend has been associated with a number of crashes over the past five years and the design of the on-ramps and acceleration lanes contributes to significant delays during peak times. • The current Petone Overbridge has a number of design deficiencies which compromise the integrity of the structure. The Petone Overbridge option involves either upgrading the existing Petone Overbridge or constructing a new Petone Interchange. • Either project will aim to remove the "S" bend and increase the design speeds as well as improving current Levels of Service. Work would be carried out to improve the on-ramps with the possibility of improved safe access for cyclists.

Traffic Management on SH2	▯ This may include ramp signalling at Petone in the am peak and at Ngauranga in the pm peak to manage the amount of traffic allowed on to SH2 so that it operates more efficiently and improves the severe congestion encountered at these ramps at peak times. ▯ Ramp signalling involves the installation of traffic signals on the on-ramp that intermittently allows two vehicles per green phase to enter the mainline traffic stream. The frequency of the green phase is set to a level that provides optimal traffic conditions on the mainline flow.

11.3. SH1 to SH2 Link

Petone-Grenada Link	▯ This is a new link road connecting SH1 to SH2, providing an alternative route for vehicles to travel between northern Wellington and the Hutt Valley without the need to travel via the Ngauranga Interchange or SH58. This is proposed to be a four-lane divided road with adequate shoulder width to allow for cyclist use, linking SH1 near Tawa to SH2 using a new Petone Interchange. It is designed to have a nominal operating speed of 70 km/h. ▯ The proposed route will connect at the Tawa Interchange where it will continue south to the boundary of the Lincolnshire Farm Area. The road then passes through Lincolnshire Farm following the path designated by the "Lincolnshire Farm Structure Plan" and continues in a south east direction towards SH2 between Horokiwi Road and the Horokiwi Quarry. Approximately 150m from the intersection of SH2, it will head north east, running parallel to SH2 where it will connect to the Petone interchange via a new grade separated interchange. The exact form and location of connections to the Petone-Grenada Link from Horokiwi and Lincolnshire Farm would be discussed with the community and key land owners at the Scheme Assessment stage. ▯ The Petone-Grenada Link Road has an end-to-end journey distance of approximately 6 km compared to an equivalent journey using SH1 and SH2 of approximately 12.5 km representing a travel time saving of 8 minutes in peak periods and 3 minutes outside of peak periods. ▯ Bus services can be provided using Petone-Grenada Link Road. This will contribute to improving the public transport connectivity between the SH1 and SH2 corridors and assist sustaining the benefits of the Petone-Grenada Link Road.

11.4. SH2 to Seaview-Gracefield (Cross Valley Link Options)

Traffic Calming Works on The Esplanade	▯ This option involves the construction of traffic calming devices along The Esplanade and Jackson Street West to encourage motorists to use alternative links and reduce the traffic volumes on The Esplanade. The project can be implemented as a "stand alone" project or be used to complement other cross valley projects described in below.
The Esplanade Multi Lane Efficient Arterial	▯ This option would involve the upgrading of The Esplanade to a multi lane efficient arterial. This would involve upgrading so that two lanes are provided in each direction and turning bays are provided at key intersections with traffic signals prioritised for through traffic. To ensure that the arterial is as efficient as possible, it is recommended that intersections be designed (where possible) as left in left out to limit delays.

Wakefield Street to Rail Alignment	▯ This project involves construction of a two lane, 70km/h design speed link between SH2 and Randwick Road. Due to the extent of the proposed road reserve properties may need to be purchased in several locations along the route however this would need to be confirmed through more detailed design. ▯ The proposed link would follow the alignment of the railway corridor with generally level grades. There will be a need for a small climb at the eastern end of road in order to rise above the stop bank and gain access to a proposed road bridge across the Hutt River. Once across the river there will be a similar fall in grade down to connect with Randwick Road. The intersections at either end of the proposed link, and possibly those along the route, will need to be upgraded to have sufficient capacity for the traffic expected on the road. To ensure that link is as efficient as possible, there will be a need to limit access to side streets from the proposed link. ▯ Part of this proposal is to design and install traffic calming measures along The Esplanade in Petone. Traffic calming measures such as a posted speed limit of 30km/h along The Esplanade (between Hutt Road and Cuba Street) and Jackson Street west. A permit based access system for HCVs would increase the travel times between the Seaview area and SH2 and encourage drivers to use alternative routes – such as the rail corridor route. This will lead to the reduction of traffic volumes and HCVs along The Esplanade and allow for redevelopment and integration of the foreshore. ▯ The key objectives for implementing traffic calming along these routes is to reduce speeds and encourage motorists to use alternate routes, thereby reducing traffic volumes.
Wakefield Street to Whites Line Alignment	▯ This project involves construction of a two lane, 70km/h design speed link between SH2 and Randwick Road. Due to the extent of the proposed road reserve a number of properties may need to be purchased on the eastern end of Wakefield Street and along Whites Line West depending on the final alignment chosen and detailed design. ▯ The proposed link would follow the alignment of Wakefield Street and have grades similar to what currently exists. There will be a need for a climb at the eastern end of Wakefield Street in order to rise above the stop bank and gain access to the bridge. There will be a similar fall in grade back down to the level of Whites Line East with a connection onto Randwick Road. The intersections at either end of the proposed link, and possibly those along the route, will need to be upgraded to have sufficient capacity for the traffic expected on the road. To ensure that link is as efficient as possible, there will be a need to limit access to side streets from the proposed link. ▯ This link will provide an alternative route for accessing the Seaview area, and will assist in reducing the volumes of traffic on The Esplanade. Implementation of the previously discussed traffic calming measures along The Esplanade and Jackson Street west will further assist in reducing traffic volumes and encouraging motorists to use the proposed link. This link will provide a high capacity, less congested link to and from the Seaview area improving accessibility during peak times. This will lead to the area being more attractive for development.
Gracefield Multi Modal	▯ This option integrates road, rail and sea as a means of moving freight to and from the

Hub	Seaview/ Gracefield area. As freight movement decisions are driven by commercial cost, this option will happen if it is commercially viable. From an economics perspective, a 'kick start' subsidy may be an investment with a high return to ensure transfer of freight between modes occurs as efficiently as possible. The option is largely low cost and relies on good logistics planning.
Udy Street "Wiggle"	The Udy Street "wiggle" is a route that provides a purpose-designed link between SH2 and Seaview by upgrading the existing roads. This will avoid a new crossing of the Hutt River (however there will be a need to increase the capacity of the existing structure). The link proceeds along Udy Street to the intersection with Cuba Street. It then proceeds along Cuba Street to The Esplanade, where it continues along The Esplanade to Waione Street. Each of the roads mentioned above were initially considered as four lane roads with intersections reconfigured to ensure that the Udy Street "Wiggle" traffic is given priority. Excessive property purchase requirements for the four lane roads proposal resulted in the roads being reduced to two lane roads. The two-lane options were re-examined in the transport models and this analysis showed that the two-lane options would operate satisfactorily. The link was been designed to accommodate pedestrians with 1.5m footpaths on each side of the road, cyclists have no dedicated provision along this route as it was envisaged that The Esplanade would be promoted as the preferred cycle route. All parking lanes were removed from the route to provide the most efficient use of road space and avoid property purchases. The road has been designed to accommodate right turn bays to maintain through traffic flows. Traffic calming would also be recommended to be provided on The Esplanade in conjunction with the development of this project.
Two Way Pairs – Petone Esplanade and Udy Street "Wiggle"	This option provides a two-direction link between Seaview and SH2 without the need for the construction of a new bridge (although the existing structure will need to be upgraded to provide sufficient capacity). Traffic travelling from Seaview to SH2 will continue to travel westbound along The Esplanade, which will be improved to provide two lanes in the westbound direction between the western abutment of the bridge and the Hutt Road roundabout. Traffic travelling from SH2 to Seaview will travel north up the Hutt Road, East along Udy Street, south along Cuba Street and then connect to The Esplanade where it will travel eastbound to the existing bridge. Improvements will be made to the infrastructure along this route to accommodate two lanes in this direction (the other side of each of these streets will remain single lane). The section along The Esplanade and the bridge will have a speed of 70km/h, but the rest of the route will be 50km/h to limit adverse impacts on the adjoining community. Traffic calming techniques will be implemented along The Esplanade between Hutt Road and Cuba Street to discourage vehicles from travelling along this link. This option will provide a solution that does not require the construction of a new bridge over the Hutt River while still reducing the volumes of vehicles along the key sections of The Esplanade. Reducing the traffic volumes along The Esplanade will assist the integration of the community with the foreshore and may attract development in the area. Walking and cycling can be accommodated by providing cycle paths along The Esplanade where not already provided.

11.5. Projects Not Taken Forward to the Preferred Strategy

After the Short List workshop and further supplementary assessments to test ideas developed at the workshop, the preferred strategy components were agreed with the Governance Group. The evaluation of the preferred elements is detailed in the following Section. The remaining projects were rejected from the Short List or incorporated into other projects.

The following projects were rejected or incorporated into other projects:

Additional Southbound Bus Shoulder	☐ This option showed that it was relatively expensive and had a poor BCR. Peak period bus numbers are low and would give the appearance that a dedicated lane is un-justifiable given the number of passengers forecast to use the facility by the WTSM model. ☐ The cost of the southbound bus lane in Ngauranga Gorge was estimated to be $34 million and the indicative BCR is 0.05. This was expected as there are only 35 southbound buses in the am two hour peak whereas good practice would normally require at least 60 for a separate bus lane over the two hour peak period. ☐ Another option was considered to allow heavy vehicles as well as buses into this lane, however this was only marginally better, achieving an indicative BCR of 0.08.
Road, Rail and Cycleway Realignment between Ngauranga and Petone and Construction of a Seaward Cycleway	☐ Although there are a high number of crashes along SH2 between Ngauranga and Petone, it is expected that the key safety issues will be addressed through the implementation of other projects (the Petone Overbridge and the Horokiwi right turn), and as a consequence the realignment of SH2 will not provide any significant safety benefits. Because of this, this project has not been considered any further.
"Great Harbour Way" - Seaward Cycleway	☐ At this stage, it is not considered economical to proceed with the investigation and construction of the "Great Harbour Way" cycleway. As part of the strategy for the corridor between Ngauranga and Petone, it is considered important to provide a completed cycleway, but this can be done through improvements and completion of the existing cycleway. ☐ The best option for the cycleway completion will be through the construction of an overbridge across the railway then the then reclamation of a 380m length of land on the seaward side of the railway. This option would be future proofed to allow for a possible connection to the "Great Harbour Way".
Petone Interchange Rebuild	☐ A grade separated interchange at Petone is integral to the Petone-Grenada Link Road project. Therefore the interchange reconstruction including realignment of SH1 has been incorporated in that project.
Traffic Calming Works on the Esplanade	☐ This project will complement the Cross Valley Link Option and implementation of traffic calming will be considered as part of that project.

The Esplanade Multi Lane Efficient Arterial	□ Many of the benefits of the Cross Valley Link can be achieved by upgrading The Esplanade but the costs of this upgrade, to maintain and improve the level of service required for access to the region's industrial hub at Seaview-Gracefield, are as expensive, if not more expensive, than building the Cross Valley Link. An estimate of the cost of building a road on The Esplanade that would provide an equivalent level of service is $90 million with an indicative BCR of 0.5. The main elements including in this $90 million cost estimate include: - Property Costs - $10 million - Design & Construction supervision fees - $10 million - Construction Costs - $70 million (includes a new bridge at $7 million). □ This would mean that to maintain reasonable access to the region's primary industrial hub, upgrading The Esplanade is unlikely to provide any savings in cost and the economic regeneration benefits for Petone and the foreshore would be forfeited as well as improved amenity. In the longer term, issues such as climate change and sea level rise would suggest that a Cross Valley Link would provide better security of access to the Seaview-Gracefield area than The Esplanade.
Wakefield Street to Whites Line Alignment	□ After comparing this option with the Wakefield to Rail alignment option it was found that the transport benefits are very similar. □ By comparison, this option has significant negative community impacts and as such it has been concluded that the Wakefield to rail alignment which would have less impact on the community would be the preferable option.
Gracefield Multi Modal Hub	□ As freight movement decisions are driven by commercial cost, this option will happen if it is commercially viable. It is not recommended that this option is included within the Strategy, but could be progressed by KiwiRail should they consider it commercially viable.
Udy Street "Wiggle"	□ Traffic modelling results indicates that the benefits from this project will be minor, as traffic is being diverted from a more direct route. Although the project will provide community and environmental benefits by reducing the traffic on The Esplanade and improving access to the Petone foreshore, it will have a significant negative impact on Udy and Cuba Street. Increasing the volumes on these routes will sever the local communities. As a consequence, this project has significant negative impacts with very few benefits. For this reason it was not considered to form part of the Strategy.
Two Way Pairs – Petone Esplanade and Udy Street "Wiggle"	□ As with the Udy Street Wiggle, although the project will provide community and environmental benefits by reducing the traffic on The Esplanade and improving access to the Petone foreshore, it will still have a negative impact on Udy and Cuba Street, increasing the volumes on these routes, severing the local communities. □ Although this project does have some benefits, the benefits for those travelling eastbound are minor. As a consequence, the overall benefits are not high enough to mitigate the negative impacts on the community. For this reason it was not considered to form part of the Strategy.

12. Preferred Strategy Components Evaluation

The preferred Strategy components were chosen from the Short List options assessment process summarised above. For each project included in the preferred Strategy, a summary evaluation is provided below. A full summary of Short List Options considered is included in the Short List Option Assessment Report.

The summary focuses on the key positive and negative attributes associated with each project option. Further more detailed analysis will be required to confirm these assessments during the investigation stage.

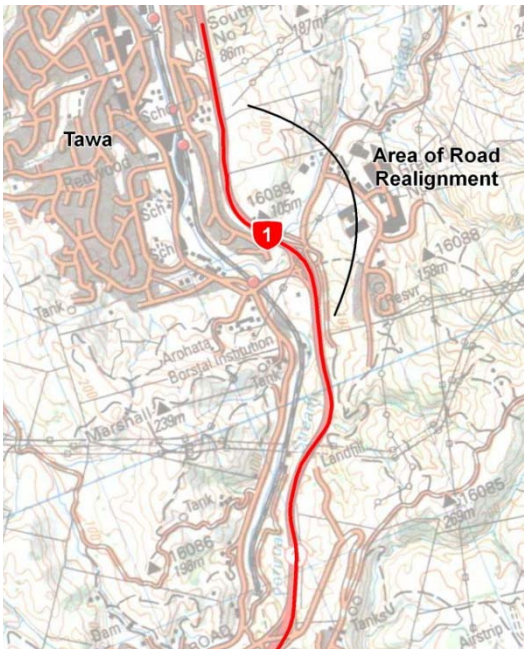
12.1. Ngauranga to Tawa

12.1.1. Tawa Interchange Improvements

Summary

This project brings SH1 up to 100 km/h design standards and improves road safety in the vicinity of Tawa Interchange which is an identified issue. This project is expected to cost $14 million and has an indicative BCR of 1.8.

These improvements could proceed independently of the Petone-Grenada Link Road but it is proposed that this project be built in conjunction with the Petone-Grenada Link Road, as the link road will require alterations to the Tawa Interchange and building these together will result in less overall disruption to SH1 traffic.



Design Assumptions

- Curve realigned to 100km/h design speed
- Road cross section - 2 x 1.5m wide shoulders (as existing), four 3.5m wide lanes (two in each direction), 2m wide central raised median
- Designed to tie into the existing motorway in the area
- Design based on MWH project feasibility report dated 2006
- Design to accord with State Highway Geometric Design Manual, Austroads and other relevant documentation.

Urban Planning and Environmental Assessment

There are potential benefits in terms of improving access across SH1, which may also support local economic activity at Tawa and Grenada North through increasing the potential retail catchment and improving movement benefits to freight and business traffic, from the design speed increase to 100km/hr (although these will be small).

There would be some loss of planted and regenerating native vegetation alongside the northern and southern curves. This vegetation has habitat and amenity value but effects could be mitigated by appropriate planting. Erosion and sedimentation effects are likely to remain neutral, however further investigation would be required to determine any potential impact during construction. In terms of long term landscape issues, aligning the three curves would result in similar landform and visual landscape values to the existing.

There could be some potential noise effects on surrounding residents, if the distance between the road and receivers were halved and the other factors remain unchanged. This is likely to be a minor effect. However, if the realignment causes noise sensitive locations (such as residences, especially in Taylor Terrace) to be more exposed to the road due to changes in vertical alignment, changes in speed, or embankments being removed, the adverse effects could be increased. Further investigations would be required to confirm the scale of the effects and the appropriate mitigation measures.

In terms of overall consentability, an Outline Plan of Works would be required for the Grenada section and an Alteration to Designation would be required for the Tawa Interchange section. Regional Consents may also be required for erosion and sediment control.

Transportation and Economics Assessment

The Tawa Interchange improvements are a series of curve realignments designed to improve safety on SH1. The curve radii should be enlarged to provide an appropriate design speed of 100km/h. These improvements are not expected to have an impact on the capacity of this section of highway nor deliver substantial travel time savings.

The improvement of this interchange provides an opportunity for it to be designed to link with the proposed Petone-Grenada Link Road. The interchange improvements should be designed either to allow for a future Petone-Grenada Link Road or be developed as part of the Petone-Grenada Link Road.

The estimated 2008 capital cost for this project is $14.1 million. The calculation of the safety benefits suggests that the indicative BCR for the project is 1.8. This indicates that the project is economically viable and should be part of the Ngauranga Triangle Strategy.

Table 12.1: Assessment of the Tawa Interchange Project

Project Objectives	Project Benefits
Ensure Environmental Sustainability	The project is considered unlikely to have significant adverse impacts on the environment. There may be minor effects from a noise and landscape perspective, but these effects should be able to be mitigated. This will need to be confirmed through further assessment and will depend on the final alignment.
Assist Economic and Regional Development	If the Petone-Grenada Link Road is constructed it will improve access to the Lincolnshire Farm and Horokiwi areas, although these benefits will be minimal. There may be some minor improvements to the "throughput" of vehicles in the immediate area with the improved design speed (but this will be small).
Assist in Safety and Personal Security	Improved design speeds and safer alignments are likely to result in a reduction in crashes at this identified crash black spot. The new alignments will be designed to comply with the appropriate design standards.
Improve Access, Mobility and Reliability	A higher design speed will have a minor impact on the throughput of vehicles.
Protect and Promote Public Health	There will be safety benefits as a consequence of improved horizontal and vertical alignment.
Conclusion This project appears to be economically viable and delivers primarily safety benefits. This project can be built as a stand-alone project in which case it should be built to allow for a connection to the proposed Petone- Grenada Link Road. Alternatively this project can be built in conjunction with the proposed Petone-Grenada Link Road.	

12.1.2. Middleton Road Cycleway Improvements

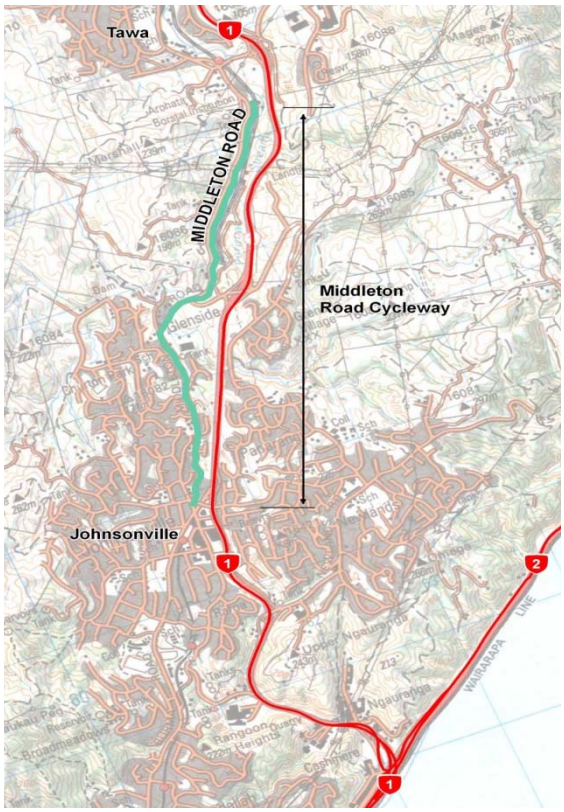
Summary

North of Johnsonville, pedestrians and cyclists must leave SH1 and travel north or south using Middleton Road. The road between Johnsonville and Tawa is narrow in many places and sections of the road operate at 70 km/h. There is no continuous footpath for pedestrians on this road. Over the period 2004 – 2008, crashes involving cyclists amounted to one serious and two minor crashes and one of these was a collision between two cyclists. Estimates of current levels of cycling along this route total 150 cyclists per day in both directions.

A purpose-built three metre wide facility to accommodate pedestrians and cyclists is expected to cost $5 million. The proposal will involve widening of existing footpaths towards the Johnsonville and Tawa ends of the project and providing a new cycleway by widening the road. Some parts of the cycleway, on the widened sections of road, would require retaining structures to be provided. It has been assumed that the cycleway will be provided on the open side of the gorge to avoid cutting into rock face on the opposite side.

As an estimate, it is reasonable to expect that a new purpose-built cycling facility along Middleton Road would double the number of cyclists using this route to around 300 cyclists per day. Using the estimated cost of $5 million, the indicative BCR of the cycleway is 1.8.

This project is recommended to proceed as it will provide a cycle facility that will serve the existing demand on this road and further enhance cycling as a mode of travel in this area, whilst also providing a scheme that is economically justifiable.



Design Assumptions

- 3m wide shared used pedestrian/cycle facility
- Located on east side of Middleton Road
- Involves widening works and supporting structural elements.

Urban Planning and Environmental Assessment

The proposed cycleway seeks to improve safety and accessibility for cyclists travelling between Johnsonville and Tawa and improve continuity of pedestrian access. This would have a positive impact in terms of encouraging the use of sustainable modes of transport along a key part of the regional cycling network. As well as improving the safety for existing cyclists, these improvements could result in a significant increase in the number of cyclists commuting between Johnsonville and Tawa (and then potentially on to the Wellington CBD). This would have environmental benefits in terms of reduced congestion and greenhouse gas emissions.

Depending on the detailed design of the cycleway, where the road is narrow, the cycleway may impinge into neighbouring residential properties, requiring the removal of some fences, hedges and garages and possible land take. Car parking spaces may also be impacted. Further assessment would be required to determine the final design and alignment of the route that minimises the need for this to occur.

As the project proposes to follow the existing road layout visual and landscape effects will be minor for the majority of the route. The works would result in the loss of some vegetation and will require retaining structures and cuts to banks in some parts. Additional planting and appropriate design of new structures will be required to mitigate these effects. The proposal would also be required to take into account the location of three heritage buildings within 100m to 200m of Middleton Road.

The cycleway will require earthworks and structures alongside the banks of the Porirua Stream. This stream is not identified for its ecological or natural character significance in the GWRC Freshwater Plan. However, further assessment would be required to determine whether the works are within the bed of the stream. Mitigation of any discharge and works near the stream is likely to be necessary.

In terms of overall consentability, consent for works outside the existing road reserve, particularly where these impinge on residential properties could be difficult to obtain and would require community consultation. Regional consents may be required for works near the Porirua Stream.

Transportation and Economics Assessment

Over the period 2004 – 2008, crashes involving cyclists amounted to one serious and two minor crashes and one of these was a collision between two cyclists. Current levels of cycling along this route total 150 cyclists per day in both directions.

A purpose-built three metre wide facility to accommodate pedestrians and cyclists is expected to cost $5 million. The proposal will involve widening of existing footpaths towards the Johnsonville and Tawa ends of the project and providing new cycleway by widening the road. Some parts of the cycleway, on the widened sections of road, would require retaining structures to be provided. It has been assumed that the cycleway will be provided on the open side of the gorge to avoid cutting into rock face on the opposite side.

As an estimate it is reasonable to expect that a new purpose-built cycling facility along Middleton Road would double the number of cyclists using this route to around 300 cyclists per day. Using the estimated cost of $5 million, the indicative BCR of the cycleway is 1.8.

This project is recommended to proceed as it will provide a cycle facility that will serve the existing demand on this road and further enhance cycling as a mode of travel in this area, whilst also providing a scheme that is economically justifiable.

Table 12.2: Benefits of Finishing Cycleway between Johnsonville and Tawa

Project Objectives	Project Benefits
Ensure Environmental Sustainability	The provision of a useable, efficient cycleway will encourage more people to cycle rather than taking other transport modes such as cars. This will reduce greenhouse gas emissions and fuel usage.
Assist Economic and Regional Development	More novice cyclists currently using private vehicle may consider cycling. This may have a minor effect on commuter trips by motor vehicles.
Assist in Safety and Personal Security	Improved cycling facilities will reduce crashes for cyclists. Attracting people from private motor vehicle onto cycles will reduce the overall VKT and therefore crash exposure.
Improve Access, Mobility and Reliability	More novice cyclists, currently using private vehicles, will consider cycling. This will increase accessibility by alternative modes.
Protect and Promote Public Health	Improvements to cycling facilities with a dedicated facility between Johnsonville and Tawa will attract new cyclists (both commuter and recreational) resulting in health benefits.
Conclusion This project is expected to generate amenity and safety benefits for cyclists and is likely to induce new cyclists. The exact level of inducement of new cyclists is uncertain but an assumed doubling of cyclist numbers generates an indicative BCR that indicates that the project is economically viable.	

12.1.3. Johnsonville Motorway Access Improvements

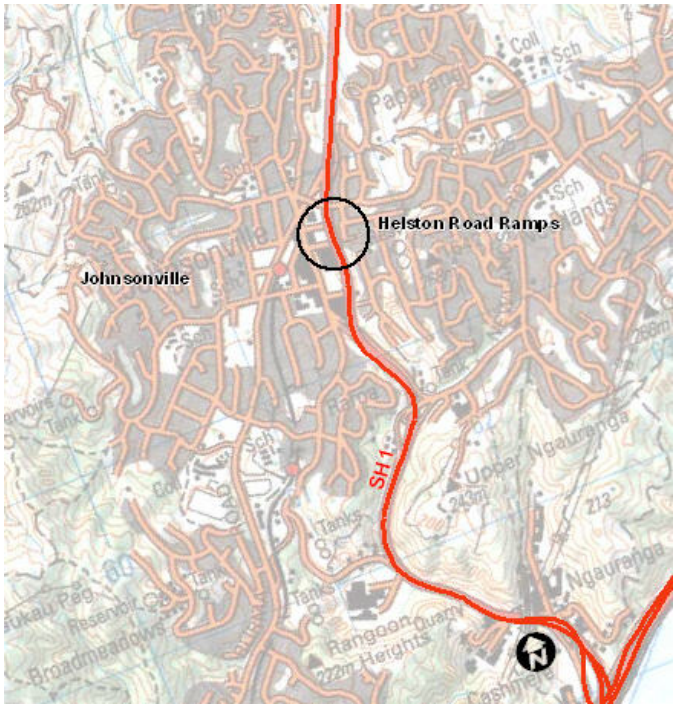
Summary

South facing Helston Road ramps were considered to alleviate congestion on Johnsonville Road, assist development at the Johnsonville Town Centre and provide improved access to Churton Park. Such ramps would significantly reduce traffic on Johnsonville Road and allow it to be redeveloped in a manner consistent with a shopping street while improving pedestrian permeability.

The reduction of traffic on Johnsonville Road would prevent the tail of a queue from the Johnsonville northbound off-ramp stretching back on to SH1 in the pm peak. This situation occurs at times and is considered a significant safety risk. Closure of the existing south facing Johnsonville connections is not recommended as it would increase traffic volumes on SH1 between Johnsonville and Helston Road and result in congestion and safety impacts.

The Helston ramps have an estimated cost of $11 million. The cost of these ramps reflects the constrained and difficult environment in which the ramps would be built and the indicative BCR of the project is negative, because the benefits gained by relieving the Johnsonville off-ramp and Johnsonville Road are more than offset by the additional delay incurred by SH1 through traffic.

The development of this project should be subject to further investigations, including more detailed traffic modelling, and discussions between the NZTA and WCC to thoroughly examine the full range of benefits and costs of this project.



Design Assumptions

- Deceleration/acceleration lengths 100km/h to/from 50km/h
- Gradient of 1:20 (5%)
- Flat Section of 100m
- Ramp length of 200m, - 70m on fill and 130m concrete structure
- Off-ramp 2 x 3.5m lanes
- On-ramp 1 x 3.5m lane
- Design to accord with State Highway Geometric Design Manual, Austroads and other relevant documentation.

Urban Planning and Environmental Assessment

The Helston Road ramps will improve the strategic connection to Johnsonville and facilitate economic and employment growth in Johnsonville / Wellington North. The Johnsonville Town Centre Plan (released by WCC in November 2008) outlines the framework for the future development of Johnsonville and went through a full public consultation process to agree the future vision for the area. The Helston Road project proposed as part of this study is consistent with the Johnsonville Town Centre Plan Objectives. The interchange is also included in the Transport Plan for the Johnsonville Town Centre Plan and at this stage is considered to be consistent with the Council vision for improving the town centre.

This project will improve the strategic connection to Johnsonville, and facilitate economic and employment growth in Johnsonville / Wellington North. The ramps should also help to reduce pm peak traffic congestion in the Ngauranga Gorge (caused by queuing traffic from Johnsonville Road) and better enable efficient local and strategic movement in Johnsonville.

The project will reduce through traffic on Johnsonville Road and could provide additional capacity to cope with expected traffic growth resulting from the mall redevelopment and also help pedestrian permeability.

Traffic travelling on the ramps could also subject neighbouring properties to additional noise effects from accelerating/decelerating vehicles. Freeflow traffic noise may increase by around 1 dB. Removal of existing buffer vegetation along the eastern side of the motorway to allow for ramp construction is an issue. The loss of property may create opportunities for planting of buffer trees between the ramp and neighbouring properties, although such vegetation would take time to mature.

There is potential for some of the properties in this area to be subject to historic contamination and contaminated site investigations would be required to be undertaken accordingly to determine whether or not contaminated soil was present and the extent of that contamination.

Consultation with the directly affected community would be required as well as the wider community to ensure they understood why the project was happening and the necessary loss of properties to create enough room for the on and off ramps.

In terms of statutory approvals, an alteration to designation would most likely be required to accommodate the additional space for the ramps. This could be difficult, as it would require consultation with the surrounding neighbours and community and WCC buy in. However, as the works are consistent with the Council's vision for the Town Centre, the project should be viewed positively by Council.

Transportation and Economics Assessment

The current placement of the Johnsonville ramps means that large volumes of through traffic currently utilise Johnsonville Road. This is detrimental to the shopping street character of the road.

Placing south-facing ramps at Helston Road has been examined in the context of a proposed redevelopment of the Johnsonville Mall. Compared to the Do-minimum, providing the Helston ramps is forecast to reduce Johnsonville Road traffic volumes by approximately 7,000 vpd in 2016 but at the same time increase traffic volumes on the "Johnsonville Bypass" (SH1 at Johnsonville) by approximately 10,500 vpd (assuming that the Petone-Grenada Link Road is also constructed in both scenarios).

Again, assuming that the Petone-Grenada Link Road is in place, the modelled southbound am peak hour traffic flow increases from 3,250 vph to 3,500 vph with the Helston ramps in place in 2016. This increased traffic volume increases the V/C ratio from 81% to 87% and increases the southbound travel times on SH1 by 33 seconds. The 2006 base model has a V/C ratio of 91% and a travel time 11 seconds longer than forecast in 2016 when the ramps are in place.

The modelled pm northbound traffic flow increases from 2,350vph to 3,050 vph with the Helston ramps in place in 2016. This increased traffic volume increases the V/C ratio from 58% to 76% and increases the northbound travel times on SH1 by 4 seconds. This increase is small due to the V/C being below the point at which congestion typically occurs due to sheer volume of traffic. This compares with a 2006 base model V/C ratio of 67% which has a travel time which is 26 seconds longer[15] than forecast in 2016 when the ramps are in place.

This analysis indicates that the impact of the new ramps on SH1 through the Johnsonville Bypass area provides network performance similar to existing conditions if they are constructed in conjunction with the Petone-Grenada Link Road.

This information suggests that construction of the Helston Road ramps provides useful benefits in supporting the shopping street character of Johnsonville Road. The reduction in traffic on Johnsonville Road would help prevent the likelihood of a tail of a queue from the Johnsonville northbound off-ramp stretching back on to SH1 in the pm peak. This situation occurs at times and is considered a significant safety risk.

However, when the ramps are in place, much of the benefits derived from the Grenada Petone Link Road are eroded by the additional traffic using SH1 between the southern Johnsonville ramps and the new Helston Road ramps. This additional traffic imposes additional delay on through traffic offsetting the benefit to Johnsonville and Churton Park traffic using the new ramps.

This proposal would result in very closely spaced ramps. This situation is not ideal as it can lead to operational issues with weaving movements. One solution could be to close the existing south-facing connections at the southern end of Johnsonville Road. If the Helston ramps are provided and at the same time the Johnsonville ramps are closed, an increase in traffic on SH1 between Johnsonville and Helston ramps of 28,800 vpd is expected in 2016. The reduction in traffic on Johnsonville Road is then only 4,500 vpd in 2016. This smaller reduction in flows on Johnsonville Road (compared with not removing the Johnsonville ramps) is due to additional traffic from the south and west which previously used the Johnsonville ramps which now has to travel up Johnsonville Road to access SH1 at the Helston ramps.

Closure of the Johnsonville ramps is not recommended as it would increase traffic volumes on SH1 between Johnsonville and Helston Road even further and result in congestion and safety impacts. This may require the Johnsonville Bypass to be widened from four to six lanes.

The proposed Petone-Grenada Link Road is forecast to reduce traffic volumes by approximately 11,500 vpd on SH1 north of Johnsonville in comparison to the DM. This reduction incorporates not only rerouting traffic from SH1 to the proposed link, but also any redistribution effects implicit in the use of a different trip matrix from WTSM.

[15] The travel time in the base model is longer because the V/C north of Johnsonville is approximately 85%, compared with 76% in the scenario with Petone-Grenada Link Road in place. This reduces travel time over the northern section of SH1compared to the base.

If the model incorporating Helston ramps and the Petone-Grenada Link Road is compared to the DM (with neither the Link Road or the ramps) then the effect is a reduction of approximately 1,700 vpd on the section of SH1 between the proposed Helston ramps and the existing Johnsonville south-facing ramps. By closing the Johnsonville south-facing ramps, this 1,700 vpd reduction becomes a 16,700 vpd increase.

Proposals to introduce the Helston ramps would also have significant impacts on the operation of the Moorefield/Johnsonville roundabout. It is likely that this would need upgrading to cater for the increased volumes to and from Helston Road. The Helston ramps have an estimated cost of $11 million. The cost of these ramps reflects the constrained and difficult environment in which the ramps would be built and the indicative BCR of the project is negative, because the benefits gained by relieving the Johnsonville off-ramp and Johnsonville Road are more than offset by the additional delay incurred by existing road users on SH1.

The development of this project should be subject to further investigations, including more detailed traffic modelling, and discussions between the NZTA and WCC to thoroughly examine the full range of benefits and costs of this project. Only the direct transportation related benefits of the project have been taken into account at present, and the provision of the Helston ramps may generate significant economic and development benefits in the Johnsonville Road area and surrounds which are not accounted for in the standard NZTA BCR calculations. Further work should be undertaken by WCC to quantify the amenity and economic regeneration benefits that will accrue to the Johnsonville area by building the Helston ramps.

Table 12.3: Benefits of Helston Road Ramps

Project Objectives	Project Benefits
Ensure Environmental Sustainability	Based on the assessment undertaken, the project is considered unlikely to have significant adverse impacts on the environment. There may be minor effects from a noise and landscape perspective, Thorough consultation with the community, council and neighbouring properties will be necessary.
Assist Economic and Regional Development	This project could significantly reduce through traffic on Johnsonville Road (which is proposed as the main street of the Town Centre) and could provide additional capacity to cope with expected traffic growth resulting from the Mall redevelopment.
Assist in Safety and Personal Security	Improved access to Johnsonville/Newlands will reduce queuing on SH1 at Johnsonville off-ramp reducing risk of rear end type crashes. The new ramps will be designed to comply with appropriate design standards.
Improve Access, Mobility and Reliability	Improved access options to the Johnsonville area and more reliability in reducing the traffic load at the Johnsonville off-ramp will have a positive effect.
Protect and Promote Public Health	There will be safety benefits as a consequence of improved horizontal and vertical alignment.

Project Objectives	Project Benefits

Conclusion

This project performs satisfactorily against the key drivers but provides a negative indicative BCR, because the benefits gained by relieving the Johnsonville off-ramp and Johnsonville Road are more than offset by the additional delay incurred by SH1 through traffic. However, the calculation of these transportation benefits should be further investigated, including more detailed traffic modelling, and discussions between the NZTA and WCC to thoroughly examine the full range of benefits and costs of this project.

12.2. Ngauranga to Dowse

12.2.1. Completion of the Off-road Pedestrian/Cycle Facility on SH2

Summary

This project addresses the inadequate level of service to pedestrians and cyclists that currently exists, by completing the northern section of the pedestrian/cycle facility on SH2, between Horokiwi and Petone. The proposed cycleway follows a route on the seaward side of the rail tracks north of the Horokiwi Intersection.

As the railway lines are double tracked and at peak times, highly utilised from Petone to Ngauranga in this location, it is proposed that the project joins the new pedestrian/cycleway via a bridge over the rail tracks to the existing pedestrian/cycle facility adjacent to SH2. The proposed bridge will provide the best safety outcomes for pedestrians and cyclists and avoids potential disruption to daily rail movements that might be caused by an at-grade crossing. The provision of the proposed cycle/pedestrian facility, including the proposed bridge, will require the reclamation of approximately 400m of coastal land. Discussions have taken place with ONTRACK regarding an at-grade crossing of the rail tracks but it has strongly recommended against such a proposal.

This new section of pedestrian/cycleway can be thought of as the first stage of the “Great Harbour Way” concept and should be built to standards generally consistent with the vision for that concept (i.e. a 4m wide shared-use (cycle/pedestrian) facility). If measured demand on this new facility is sufficient, the successful project may provide further justification for completion of the “Great Harbour Way” between Horokiwi and Ngauranga.

The cost of improving the existing Ngauranga – Horokiwi section of the off-road cycleway within the constraints of the corridor and the completion of the northern section of this pedestrian/cycleway is expected to have a total cost of $16 million. This includes a bridge structure from the existing facility over the rail tracks to the seaward side of the tracks, the required reclamation and track formation. The indicative BCR for this project is 1.3. This project is not physically tied to any other projects nor is its timing.

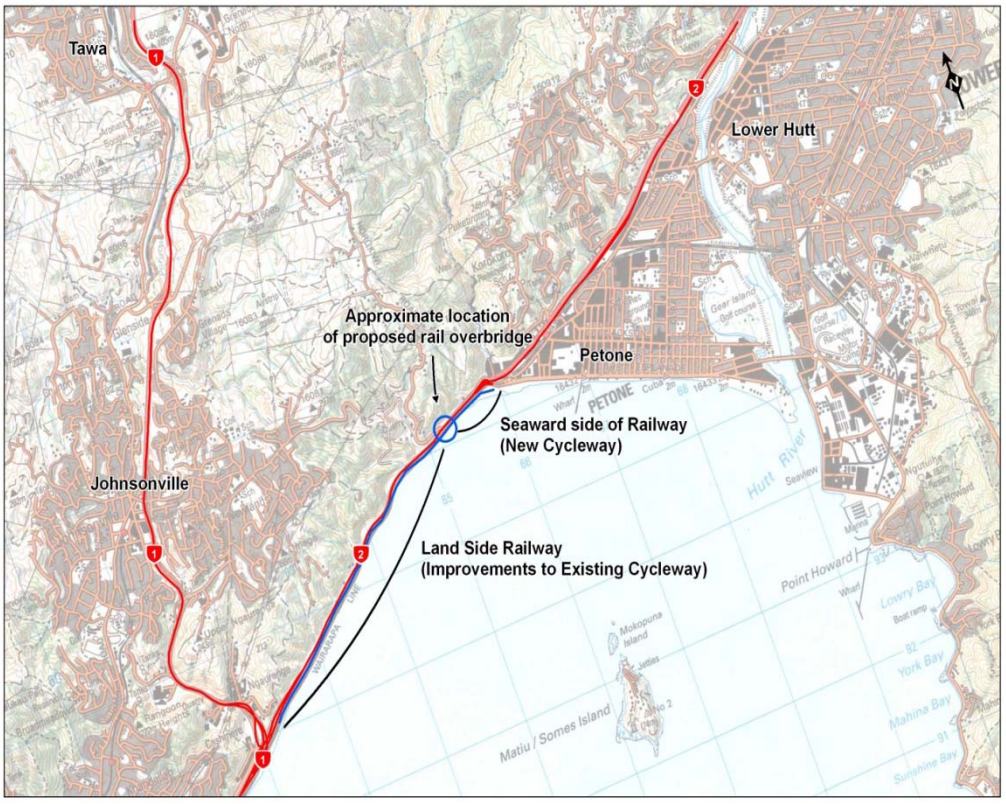
This project is proposed because it addresses:

- An incomplete off-road pedestrian/cycling facility parallel to SH2
- Growing congestion on SH2 by providing an alternative for travel.

In a small way, the completion of this cycleway assists locking in the benefits of the Petone-Grenada Link Road. The Petone-Grenada Link Road will remove traffic from SH2 and therefore reduce congestion on this road between Ngauranga and Petone. Completion of the cycleway will also provide a higher level of service for pedestrians and cyclists in this area, reducing the risk of pedestrians and cyclists switching to travel by car. A completed cycleway will provide a higher standard alternative to assist in absorbing future growth in the demand for travel in the corridor.

The connection from the Petone roundabout to the rowing club will be located on vacant Crown-owned land. The proposed path would be constructed at approximately existing ground level and be 4 metres wide. Existing redundant piers will be utilised to make a crossing of Korokoro stream.

An alternative option could be to construct another bridge structure instead of using the reclamation land. Using a rate for such a structure of $\$1900/m^2$, a rough order of costs for a 380 metre long and 4 metre wide structure would be $2.8 million. This is very similar to reclamation costs but does not take into account maintenance costs. Because of the less favourable whole of life costs and potential in the future to enable the "Great Harbour Way" project, reclamation is the preferred method.



Design Assumptions

- 4m wide two way shared use cycle path and footpath, some on 380m of reclaimed coastal land within a 5m corridor
- 11m wide rail corridor (twin tracked)
- Allowance for cycle path/footpath to be lit
- Design assumptions based on Opus "Ngauranga to Petone Cycleway Scheme Assessment Report 2006.

Urban Planning and Environmental Assessment

Completing the cycleway would provide an improved cycling and walking route between Petone and Ngauranga (and then to Wellington). This is a positive effect particularly for cyclists who are not confident cycling on the shoulder to make the journey between the two destinations. It will give greater movement provision and safety to cyclists through a improved cycle track which will help to reduce commuter trips made by private vehicles (which in turn reduces congestion and carbon emissions), and will contribute to achieving healthier lifestyles. However, there is also the possibility that modal shift may occur from taking cyclists off trains and buses.

Preference has been given to retaining the existing number of traffic lanes along SH2 i.e. keeping within the designation to avoid unnecessary destruction of the embankment and vegetation. The project does require reclamation of the coast though. The project also provides an opportunity to improve the entrance to Petone and the Hutt Valley for cyclists, link with the "Beach to Bush" project, and make Belmont Regional Park more accessible from the Wellington metropolitan area.

Providing the proposed cycleway through reclamation means the facility has the potential to be affected by the combination of future sea level rise and storm surge. Use of the landward side was considered but may increase the potential for slips from increased storms over time. The highway is also prone to flooding, so this risk may increase. The future structures would need to take these potential impacts into consideration to ensure these effects are avoided, remedied or mitigated.

As part of the 2006 Scheme Assessment Report completed by Opus on this project, it was identified that the Department of Conservation, GWRC and Iwi have indicated that the stretch of coastline that would be subject to reclamation is of low significance and they expressed no concerns about reclamation works. It is also likely that even if the cycleway does not proceed, further protection works may be required to repair and protect the railway formation in this area.

As outlined in the Scheme Assessment Report, the resource consent requirements include resource consent from GWRC under Rule 1 of Regional Coastal Plan for reclamation work. Discharge consent is also likely to be required to cover any discharges into the marine area during construction works (Rule 57); and consent for the deposition of material on the foreshore and seabed (Rule 48). As reclamation works is a restricted coastal activity it must be publicly notified under section 117 of the RMA. The crossing of Korokoro Stream to link the cycleway with Hutt Road will be permitted under Rule 31 of the Regional Freshwater Plan if it is less than 6 metres in total length, however, it is likely to be over 6 metres and be a Controlled Activity. Minor earthworks to construct a bridge will be permitted by both the Railway and Transit designations but they will be required to submit an Outline Plan of Works.

Transportation and Economics Assessment

This project completes the pedestrian/cycleway by taking a bridge over the railway tracks and then continues north on the seaward side of the railway track and is in effect the first stage of the "Great Harbour Way" as the new facility is built to standards consistent with the "Great Harbour Way" concept.

This completed cycleway/walkway will provide an attractive extension for pedestrians. Many of the more confident cyclists will continue to use the hard shoulder of SH2. However, it is expected that this completion of the cycleway will lead to greater use by cyclists. This facility would link into the cycleway on the Old Hutt Road and the various cycle paths in the vicinity of Petone.

The benefits of this scheme are increased cycling and improved safety for cyclists. The increase in cycling numbers may include inducing a number of current car users to cycle. This would lead to a small reduction in traffic on SH2 and a small improvement in travel time and travel time reliability.

The cost of improving the existing Ngauranga-Horokiwi section of the off-road cycleway is estimated to cost approximately $2 million. The 2008 capital cost of the rest of the scheme is approximately $14.0 million. If an assumption is made that on completion of the cycleway cycle numbers double from the present 430 per day, then an indicative BCR for this inducement of cyclists is 1.3. This does not allow for additional safety benefits to cyclists or the small travel time savings to motorists on SH2.

The doubling of cyclist numbers is an optimistic assumption. It is a matter of judgement based on the current incomplete facility requiring pedestrians and cyclists to use the hard shoulder on SH2 to complete their journey. SH2 is a heavily trafficked high speed environment and would certainly be intimidating for many pedestrians and cyclists. This is evidenced by the responses to the latest survey of cyclists using this route. The report[16] found that the four greatest concerns of recent users of the route are:

- Pathway surface is uneven (72%)
- Risk of flat tyre when cycling (69%)
- The existing pathway is too narrow (52%)
- It is currently unsafe or dangerous (22%).

This would suggest that completion of the pedestrian/cycling facility on SH2 could be expected to induce a significant number of new users.

Despite the uncertainty of the number of new users, indications are that this scheme is likely to be economically viable. This is further reinforced by the understanding that safety benefits to cyclists and travel time savings to SH2 motorists have not been allowed for.

[16] Short Trip Active Mode Research 2009 Update Survey – Report prepared for GWRC by Peter Glen Research (June 2009).

Table 12.4: Benefits of Finishing Cycleway Between Ngauranga and Petone

Project Objectives	Project Benefits
Ensure Environmental Sustainability	The provision of a useable, efficient cycleway will encourage more people to cycle rather than taking other transport modes such as cars.
Assist Economic and Regional Development	More novice cyclists currently using private vehicle may consider cycling. This may reduce the number of motor vehicles and may slightly improve travel times. A completed cycleway will from part of a "greater" cycle facility.
Assist in Safety and Personal Security	The dedicated facility will contribute to cycle safety. Attracting people from private motor vehicle onto cycles will reduce the overall VKT therefore reducing crash exposure.
Improve Access, Mobility and Reliability	More novice cyclists, currently using private vehicles, will consider cycling. This will increase accessibility by alternative modes.
Protect and Promote Public Health	Improvements to cycling facilities with a completed link between Petone and Hutt Road will attract new cyclists (both commuter and recreational) with attendant health benefits.
Conclusion This project completes the separate pedestrian/cycleway adjacent to SH2 by bridging the railway line in the vicinity of the Horokiwi intersection. This will complete the existing facility as well as connect facilities south of Ngauranga and north of Petone. A new facility is provided on the seaward side that completes the facility to Petone. This is provided to a standard consistent with the "Great Harbour Way" concept. This project is expected to generate amenity and safety benefits for cyclists and is likely to induce new cyclists. New cyclists will provide a minor reduction in travel time for motorists on SH2. The level of inducement of cyclists is uncertain but a doubling of cyclist numbers generates an indicative BCR that indicates that the project is more than viable. This project can be understood as the first stage of the "Great Harbour Way" along SH2.	

12.2.2. "Beach to Bush"

Summary

The "Beach to Bush" crossing is a crossing of SH2 that would connect Belmont Regional Park area on the western side of SH2 to Petone and the foreshore on the eastern side of the highway. There is an existing crossing across the railway track which does not cross SH2 and is nearing the end of its design life. The proposed facility would be designed as a recreational walking and cycling path. The alignment would be designed to provide a safe path for both cyclists and walkers.

The construction of the Petone-Grenada Link Road will require the reconstruction and relocation of the existing Petone Interchange. This will release the Petone ramps overbridge from the existing interchange to provide a crossing over SH2 and the Wairarapa Rail Line providing a safe and convenient path for pedestrians and cyclists.

Due to the significant number of projects that will impact on the development of this project; and the possible options available for its construction, a BCR calculation has not been undertaken. However, if built in conjunction with the Petone-Grenada Link Road interchange, positive benefits will be achieved with limited expenditure.

Design Assumptions

- This would provide safe and efficient access between the foreshore and Belmont Regional Park
- Recreational Walking/cycling path 3m wide with 0.5m clearance on both sides
- Incorporated as part of the proposed Petone Interchange.

Urban Planning and Environmental Assessment

Overall, community cohesion effects of this option are considered to be positive. The crossing over SH2 would provide a safe access for both cyclists and pedestrians, which is a positive step towards community cohesion. This option may encourage local economy spend in Petone from the recreational walkers and cyclists travelling to/from the Regional Park.

The proposal would also provide a safe link between Belmont Regional Park and Petone without the need to cross SH2. It would significantly improve access to Korokoro Valley and Belmont Regional Park for recreation, link the Valley to the Petone foreshore reserve areas and could significantly enhance ecological corridors and habitat along walkways from the foreshore to Belmont Regional Park. There is also an opportunity to improve

the visual landscape and create spaces that link the Petone foreshore and reserve areas with Korokoro Valley and stream and development of coastal landscape character at this end of the foreshore.

In terms of statutory approvals, depending on the design, only an Outline Plan of Works should be required. However, if the over bridge footprint is outside the designation then an alteration to designation will be required. In terms regional consents, drainage consents may be required.

Transportation and Economic Assessment

As part of the construction of the Petone-Grenada Link Road, a new interchange will be constructed to accommodate traffic from SH2 (both northbound and southbound), the Petone-Grenada Link Road and traffic coming to and from Petone via the Hutt Road and The Esplanade. The new interchange will be constructed to the north of the existing Petone overbridges and will leave the current facilities redundant.

One option to provide a "Beach to Bush" crossing facility would be to utilise the SH2 off-ramp over bridge as the crossing. This would require the bridge to be moved to a new pier (that is currently not used) so that the highway below could be realigned and the connection to the State Highway would be closed and a connection created into the Belmont Regional Park.

A second option would be the construction of a new facility (similar to the existing walkway bridge) which would span across the Hutt Road, the railway line and SH2. Connections would be made from the Hutt Road and the Regional Park side of SH2. Connections could also be made to the railway side of SH2. A new facility would need to consider access to The Esplanade, foreshore and Belmont Regional Park. It is understood that the existing facility is approaching the end of its design life and significant works would be required to upgrade and extend the facility to cross SH2.

The existing facility does not integrate well with The Esplanade, and a number of roads must be crossed to gain access to Petone foreshore. Due to the short design life left on the existing structure and the connectivity issues, this option is considered unacceptable and has not been considered any further.

There is a possibility of connecting a walking and cycling route onto the existing Petone overbridges. This option allows walkers and cyclists to travel across SH2 and the railway but does not offer a connection directly to The Esplanade. The current facility would need to be retained in order to provide access across Hutt Road and allow connections onto the railway side of SH2.

This project will deliver economic benefits but these are very difficult to quantify due to the low numbers of estimated users for this facility. Based on surveys undertaken by Beca in 2007 as part of the Dowse/Petone works it has been estimated that the pedestrian and cyclist demand for the proposed "Beach to Bush" crossing is approximately 90 per day. However, if this project is delivered as part of the improvement to the Petone Interchange the quantified economic benefits may not be relevant.

Table 12.5: Benefits of "Beach to Bush" Crossing Option

Objective	Summary
Ensure Environmental Sustainability	This crossing would promote active mode access to regional parks and potentially improve community cohesion.
Assist in Economic and Regional Development	With possible improvements to the foreshore and a purpose-built crossing to the regional park, the area can be promoted as a recreational facility.
Assist in Safety and Personal Security	Provide a safe route for walkers and cyclists across SH2 and will improve access to the regional park.
Improve Access, Mobility and Reliability	Will attract walkers and cyclists and will give improved access to the regional park from the Petone side of SH2. Access will be improved to the Korokoro community. Access for alternative modes will be improved.
Protect and Promote Public Health	Will improve access to the regional park and promote walking and cycling in the region.
Conclusion The "Beach to Bush" project provides access across SH2 and the Hutt line to connect the Petone foreshore to Korokoro Valley and Belmont Regional Park for pedestrians and cyclists. This project is difficult to quantify in terms of an economic analysis but can piggy back on the back of the Petone Interchange improvements as these improvements release existing structures that span SH2 and the Hutt line.	

12.2.3. Traffic Management on SH2

Summary

This may include ramp signalling at Petone in the am peak and at Ngauranga in the pm peak to manage the amount of traffic allowed on to SH2 so that it operates more efficiently and improves the severe congestion encountered at these ramps at peak times.

Ramp signalling involves the installation of traffic signals on the on-ramp that intermittently allows two vehicles per green phase to enter the mainline traffic stream. The frequency of the green phase is set to a level that provides optimal traffic conditions on the mainline flow.

Ramp signalling at Petone is expected to cost $850,000 and has an indicative BCR of 1.7. Ramp signalling at Ngauranga has an expected cost of $700,000 and has an indicative BCR of 2.1. These projects lock in the benefits of the proposed Petone-Grenada Link Road and the Cross Valley Link by encouraging greater use of these roads rather than their alternatives (SH1 and SH2). This is an application of travel demand management designed to sustain the benefits of these new roads. Further, these measures smooth the mainline traffic flow on SH2 at the respective peak times by managing the traffic stream entering the highway and therefore improve their efficiency.

Design Assumptions

- Design based upon existing facilities in Auckland modified to suit local conditions and operational experience
- Located at Petone and Ngauranga SH2 on-ramps to address am and pm peak "bottlenecks" respectively
- Design to accord with State Highway Geometric Design Manual, Austroads and other relevant documentation.

Urban Planning and Environmental Assessment

Improved traffic flows associated with this project may provide additional benefits in terms of improved accessibility and reduced journey times contributing to the economic development of surrounding land uses that rely on commuter traffic. As the ramps are on SH2 at Ngauranga and Petone this should provide for an appropriate method for managing traffic flow on SH1, SH2 and The Esplanade. Ramp signalling can favour outlying areas as longer distance travel is given priority over shorter distance travel and may result in less sustainable remote development which requires more travel.

In terms of environmental effects, this project may reduce air pollution and greenhouse gas emissions. In terms of statutory approvals, the Ngauranga on-ramp project would most probably be packaged with the Link Road and Petone Interchange and the Petone on-ramp project packaged with the Cross Valley Link project so it would be assessed as part of these applications.

Transportation and Economics Assessment

Ngauranga On-ramp SH2

Ramp signalling constrains the volume of traffic on an on-ramp permitted to enter the main traffic stream. This provides a mechanism for smoothing the mainstream flow at the merge of the on-ramp increasing the throughput of traffic on the main road and reducing the delay and travel time variability of the main traffic

stream. This comes at the expense of increased delay for on-ramp traffic. As the mainstream flow is usually much larger than the on-ramp flow this would normally result in a net benefit for the network.

In the case of the proposed Ngauranga on-ramp on SH2, the pm peak flow is sufficient to significantly interrupt the mainline SH2 flow resulting in delay and travel time variability. Traffic using the on-ramp has travelled from the Hutt Road or has come down SH1.

The time period where this project is likely to have benefit is the pm peak. The traffic flow on the on-ramp during the pm peak hour is expected to be approximately 1,200 vph in the 2016 modelling year under a Do-minimum scenario. Ramp signalling at a rate of two vehicles every five seconds provides a capacity of 1440 vph permitted to enter the traffic stream. As the on-ramp demand exceeds 85% of the metered capacity this is likely to lead to significant queuing.

Under the scenario where the Petone-Grenada Link Road is in place, traffic flow on the on-ramp during the pm peak hour is expected to be 1,000 vph in the 2016 modelling year. Under this scenario, ramp signalling could be at a rate of two vehicles every 5 to 7 seconds and the queues generated would be acceptable.

There is a synergy between the Ngauranga on-ramp signalling and the Petone-Grenada Link Road. The construction of the Link Road allows the ramp signalling to be a feasible option. Further, the ramp signalling provides an encouragement for otherwise SH1/SH2 users to use the Petone-Grenada Link Road to travel between Grenada and Petone.

The Ngauranga on-ramp on SH2 currently has a long length of pavement with a generous width. This means the installation of ramp signalling is unlikely to be expensive. The 2008 capital cost for this project is estimated to be $700,000. Calculation of the travel time benefits of this scheme reveals that this project has an indicative BCR of 2.1 and is economically viable.

Petone On-ramp SH2

In the case of the proposed Petone on-ramp on SH2 the am peak flow is sufficient to significantly interrupt the mainline SH2 flow resulting in delay and travel time variability. Traffic using the on-ramp has travelled from Railway Avenue or The Esplanade.

The time period where this project is likely to have benefit is the am peak. The traffic flow on the on-ramp during the am peak hour is expected to be 1000 vph in the 2016 modelling year under a do-minimum scenario. The congestion at this on-ramp is primarily due to the large through volume on SH2 and the weaving that follows after the merge. Ramp signalling at a rate of two vehicles every five seconds provides a capacity of 1440 vph permitted to enter the traffic stream. As the on-ramp demand is significantly less than 85% of the metered capacity this is not likely to lead to significant queuing.

Ramp signalling at a rate of 2 vehicles every six seconds would provide a permitted on-ramp flow of 1200 vph. At this level the actual demand is less than 85% of the metered capacity which would not lead to significant queuing.

Under the scenario where the Cross Valley Link is in place the traffic flow on the on-ramp during the am peak hour is expected to be largely unchanged in the 2016 modelling year. Under this scenario ramp signalling could be at a rate of two vehicles every six seconds and the queues generated would be acceptable.

Under the scenario where the Cross Valley Link and traffic calming on The Esplanade is in place, the traffic flow on the on-ramp during the am peak hour is expected to be largely unchanged in the 2016 modelling year. Under this scenario ramp signalling could be at a rate of two vehicles every six seconds and the queues generated would be acceptable. The lack of change in the on-ramp traffic flows is due to a significant residual flow of traffic still remaining on The Esplanade at peak times. A significant volume of traffic approaches the on-ramp from Railway Avenue due to the increase delay on SH2 between Petone and Dowse.

There is a synergy between the Petone on-ramp signalling and the Cross valley Link and The Esplanade traffic calming. The construction of the Link Road and the traffic calming allows the ramp signalling to be a feasible option. Further, the ramp signalling provides an encouragement for users of The Esplanade to use the Cross Valley Link to travel between Seaview/Gracefield and SH2.

The Petone on-ramp on SH2 currently has a long length of pavement with a generous width. This means the installation of ramp signalling is unlikely to be expensive. The 2008 capital cost for this project is estimated to be $850,000. Calculation of the travel time benefits of this scheme reveals that this project has a BCR of 1.7 and is economically viable.

Table 12.6: Benefits of Ramp Signalling

Objective	Summary
Ensure Environmental Sustainability	Limited impact, there could be a small reduction in emissions created from smoother traffic flows.
Assist in Economic and Regional Development	Ramp signalling can provide more reliable and consistent travel times and increase throughput, this will make travelling in the area more reliable. This will reduce travel costs and may attract future development.
Assist in Safety and Personal Security	Allows more controlled and safer merging. In past studies there has been a reduction in crashes as a result of the implementation of ramp signalling.
Improve Access, Mobility and Reliability	Will provide more efficient merging into the highway traffic streams and improve throughput and travel time reliability.
Protect and Promote Public Health	Negligible Impact
Conclusion This project constrains the on-ramp capacity at Ngauranga on SH2, and Petone on SH2. It provides useful travel time and travel time reliability benefits for mainline traffic in the pm peak for Ngauranga and in the am peak for Petone. This comes at the expense of increased delay for the users of the on-ramp. The Ngauranga project has synergies with the Petone-Grenada Link proposal as it discourages extensive through traffic on The Esplanade in the am peak. Without the Petone-Grenada Link delays at the Ngauranga on-ramp are unacceptable in the pm peak.	

The Petone project has synergies with the Cross Valley Link proposal as it discourages extensive through traffic on The Esplanade in the am peak. Without the Cross Valley Link delays at the Petone on-ramp are unacceptable in the am peak.

Ramp signalling at both Ngauranga and Petone is economically justified.

12.3. SH1 to SH2 Link

12.3.1. Petone-Grenada Link

This is proposed to be a four-lane divided road with adequate shoulder width to allow for cyclist use, linking SH1 near Tawa to SH2 using a new Petone Interchange. It is designed to have a nominal operating speed of 70 km/h. The Petone-Grenada Road Link is expected to cost $250 million and has an indicative BCR of 1.3. This is a promising BCR for a project of this size. This project is integrally related to the development of Lincolnshire Farm.

The cost of the new Petone Interchange is included in the cost of this option as it is integral to its operation. The reconstruction of this interchange is an essential part of linking the Petone-Grenada Link Road into SH2 and the Hutt City local road network. The aging structures that form the current interchange will require replacement within 20 years and this replacement will allow the alignment of SH2, which is currently substandard and the location of historic crash problems, to be improved to 100 km/h standards. The accommodation of the Petone-Grenada Link Road will allow the interchange to be relocated further north which will release a large parcel of land for potential community or economic development. It is expected that the Petone Interchange will be an elevated two lane roundabout similar to the roundabout at the new Dowse Interchange.

The Petone-Grenada Link Road is proposed because it addresses:

- Growing congestion (forecast to be at a severe level by 2016) on SH1 north of Ngauranga Interchange which is a RoNS
- Growing congestion (forecast to be at a severe level by 2016) on SH2 between Petone and Ngauranga and in particular at Petone and Ngauranga on-ramps
- Poor east-west connectivity between the SH1 and SH2 corridors (both by road and public transport) and road safety issues at Horokiwi.

The project supports development at:

- Lincolnshire Farm
- Johnsonville Town Centre
- Petone
- Ongoing development of the Seaview-Gracefield industrial area – which is recognised as the region's primary industrial hub and a regionally significant activity centre.

The project is particularly important as it serves a key direction of travel for freight that is currently not well provided for. This is travel in the direction of Seaview-Gracefield to northern Wellington and beyond. This project is important in fulfilling the GPS objective of encouraging economic development. The Petone-Grenada

Link Road has an end-to-end journey distance of approximately 6 km compared to an equivalent journey using SH1 and SH2 of approximately 12.5 km representing a travel time saving of 8 minutes in peak periods and 3 minutes outside of peak periods.

The Petone-Grenada Link provides a new and direct connection between the region's primary industrial hub and the southern North Island via SH1 at Tawa. The link road provides significant relief to the existing State Highways, being SH1 and SH2. As SH1 is classified as a RoNS in the GPS, this is a key improvement especially given the significant geographical constraints through the Johnsonville Bypass section of SH1. The construction of the Petone-Grenada Link is seen as a key way of reducing congestion on SH1 between Johnsonville and the Ngauranga merge and SH2. In the forecast year of 2016, traffic volumes on SH1 at Johnsonville are expected to reduce by 12,000 vpd and on SH2 south of the Petone ramps, by 12,000 vpd if the link road is built. The Petone-Grenada Link Road is expected to carry approximately 25,000 vpd.

The Petone-Grenada Link Road also provides some relief to SH58. In the forecast year of 2016, the traffic volumes on SH58 reduce by around 3,000 vpd with the link road in place to 12,000 vpd. Conversely, with Transmission Gully in place in 2016, traffic increases on SH58 by 2,000 vpd. The overall combined effect of the link road and Transmission Gully in 2016 is therefore roughly neutral, and with the overall volume of traffic at 15,000 vpd, this traffic volume is at a similar level to current traffic flows along SH58 and therefore no capacity upgrades to the road will be required. Further, when developed, the NZTA SH58 Strategic Study will address any safety issues identified on this route.

The Petone-Grenada Link Road will serve key regional freight movements particularly well and encourage economic development. This is because it offers direct benefits for freight travelling between the SH1 corridor and the SH2 corridor, providing travel time and travel distance savings. Approximately 2,500 heavy vpd are expected to use this route. . The 9% grade on parts of the link would require additional testing, possibly using a micro-simulation modelling tool to establish any potential impact of slower moving HCVs. In addition, the Petone-Grenada Link Road reduces journey times on both the SH1 and SH2 corridors because of the relief it provides to those routes. By comparison, SH58 does not serve large numbers of freight vehicles because of a smaller demand and difficult alignment. Heavy vehicle usage of SH58 is approximately 500 vpd.

The construction of the Petone-Grenada Link Road is of primary importance for the greater Wellington region as it directly serves a large volume of heavy vehicles and provides relief to SH1 (a RoNS), and SH2. The removal of east-west trips from the SH1-SH2 corridor frees up capacity on these links to be used by traffic travelling to and from Wellington City.

Presently, connections between the Ngauranga-Tawa and Ngauranga-Dowse corridor are provided by an interchange at Ngauranga and a signal-controlled intersection at SH58. The construction of the Petone-Grenada Link Road increases the connectivity between the SH1 and SH2 corridors. Traffic modelling indicates that in 2016 traffic flows between these corridors will increase from 42,000 vpd to 51,000 vpd if the Petone-Grenada Link Road is built. This represents an increase of more than 20 % in traffic travelling between these corridors which will result in a significant increase in economic activity and social interaction between these corridors. This result indicates the important contribution that the Petone-Grenada Link Road potentially could make to economic development in the greater Wellington region.

The Petone-Grenada Link Road could also provide a safer and more convenient connection to Horokiwi Road. This would align with NZTA's consideration of closing the Horokiwi-SH2 intersection or reducing it to a 'left in-left out' junction, which would have safety benefits.

Another key contribution that the Petone-Grenada Link Road will make is that it provides an alternative route in the event of an incident on either SH1 or SH2. Currently, an incident that closes or severely restricts either SH1 or SH2 in the study area has a major impact on traffic movements on the network. A Petone-Grenada Link Road would significantly improve east-west strategic transport network resilience.

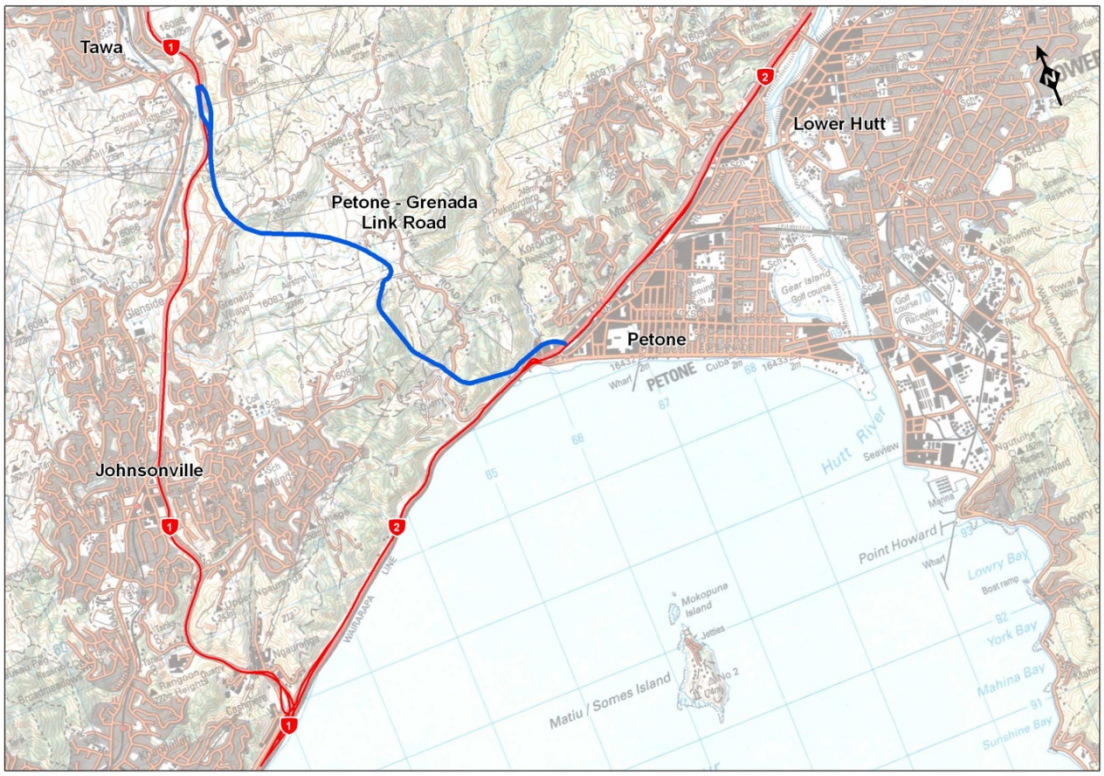
In the longer term, a possible link from Johnsonville north in the vicinity of Westchester Drive to the Petone-Grenada Link Road should be allowed for. Such a link is not yet justified by demand but would make the improved connectivity offered by the Petone-Grenada Link Road available to a larger catchment. Traffic modelling for the year 2016 indicates that the Johnsonville link would attract 10 % of the daily Petone-Grenada Link Road traffic but by 2026 this percentage would increase to near 15 %. In view of this it is recommended that the route designation for the road is pursued through the planning process.

The Petone-Grenada Link Road provides relief to both SH1 and SH2. Measures that lock in these benefits are important, otherwise this relief will be eroded by persons switching from other forms of transport to use motor vehicles or eroded by ongoing traffic growth. Measures that discourage change in travel mode are the completion of the pedestrian and cycleway on SH2 and increased passenger rail frequency on both corridors (as addressed in the Regional Rail Plan). Ramp signalling of the Ngauranga on-ramp will also encourage greater use of the Petone-Grenada Link Road.

Bus services can be provided using Petone-Grenada Link Road. This will contribute to improving the public transport connectivity between the SH1 and SH2 corridors and assist sustaining the benefits of the Petone-Grenada Link Road. The bus services support:

- Improved east-west connectivity between SH1 and SH2
- The Lincolnshire Farm development.

Forecasts for 2016 indicate that over 1,500 persons per day might be expected to use buses between the catchments at either end of the Petone-Grenada Link Road. These estimates make no allowance for bus trips that might be generated in the Lincolnshire Farm development or might be generated in Horokiwi, which would be expected to further increase bus patronage. New bus services need to 'grow' their patronage. They are developed over time and should be integrated into the environment they serve. In this respect, trial services may need to start at a modest level and may even use mini buses until patronage levels build up in response to the service.



Design Assumptions

Petone – Grenada Link Road

- 70km/h design speed
- Road cross section – total road reserve width of 31.5m. 2 x 3m wide sealed shoulders/cycleway, 2 x 3.75m wide lanes (3% crossfall), 3m wide median with barrier
- Road lighting provided
- 1 in 4 graded cut and fill slopes
- 8m clear zones on both sides containing 3.5m wide swale drains
- 9.5% maximum vertical gradient (avoiding the need for tunnels)
- Bridges provided in areas of fill in excess of 25m in height
- Maximum super elevation of 8% with a horizontal radius of 120m
- Footpaths have not been explicitly provided for but connections to off-road tracks and areas of significant interest can be provided
- Public transport can be provided along the route, with only further improvements required including bus shelters and stops
- Horokiwi and Lincolnshire Farm community access
- Design to accord with State Highway Geometric Design Manual, Austroads and other relevant documentation.

Petone Interchange Upgrade

- Connections between SH2, Hutt Road, The Esplanade and the proposed Petone-Grenada Link Road
- Walking and cycling connections from Hutt Road, The Esplanade; SH2 and the Belmont Regional Park
- Safer access to Petone for northbound and southbound cyclists heading from Wellington City along SH2
- Wide shoulders and painted areas across on and off-ramps for cyclists who wish to travel along SH2
- A realignment of SH2 beneath the existing Petone overbridges
- Better connections to SH2 from The Esplanade and Hutt Road
- This would meet all the Level of Service requirements not currently met
- Design to accord with State Highway Geometric Design Manual, Austroads and other relevant documentation.

The proposed link takes account of a number of issues, including:

- Avoiding an identified historic landslide on Hutt Road
- Avoiding (as much as possible) native vegetation
- Avoiding major disturbance to Horokiwi Residents
- Avoiding Belmont Regional Park.

At this stage only limited preliminary discussions have been undertaken to identify issues to be considered in route selection. Previous work for the Lincolnshire Farm Structure plan and the constraints plan was used as the basis for identifying a route alignment for the western section of the Link Road. Ensuring the link integrates well with Lincolnshire Farm in terms of access and minimising disturbance on the surrounding environment were key considerations.

In terms of the eastern section of the Link Road a site walkover was undertaken with Horokiwi residents to identify possible route selections.

Summary of Horokiwi Residents Issues

During the “fireside chats” discussion and subsequent walkover, the Horokiwi residents identified a number of issues regarding a potential Petone-Grenada Link Road:

- Loss of native vegetation in the Horokiwi area
- A number of residents had concerns regarding how close the road may come to their dwellings
- Access to and from the Horokiwi settlement was also a significant issue that was identified by the Horokiwi residents.

As a consequence of discussions on the site walkover, a route has been identified that keeps a satisfactory buffer between the road and residents while avoiding all other identified constraints.

Although no access has been designed at this stage, should the project progress to the Scheme Assessment stage, discussions would be held with the Horokiwi residents to identify where they wish to have access to the

link. To minimise potential conflict points, and avoid stopping vehicles on the steep gradients, a grade-separated access should be developed to allow access to and from the Horokiwi settlement in both directions on the Petone-Grenada Link Road.

Horokiwi Quarry

The proposed road will pass through the northern part of the quarry (where the main branch of the Horokiwi Stream is piped underground), but it is understood that in this area work is nearing completion and fill is underway.

Access to and from the quarry will be an important consideration when designing the link road. Discussions will be required with the quarry operators. Initial concepts have been discussed within the design team based on normal transportation requirements from quarry operators. However, this will need to be confirmed through consultation and investigation at Scheme Assessment stage to gauge the type of access they require for their vehicles, to integrate this into the route design. It is envisaged that the route alignment recommended will be able to provide satisfactory access for the quarry operators.

The Petone-Grenada Link Road will also provide a number of benefits for vehicles travelling to and from the quarry by removing the unsafe "priority" intersection at SH2, providing better access to SH1 and providing more options for accessing SH2 (i.e. the proposed Petone Interchange allows access in both the northbound and southbound directions).

Design Criteria

The Petone-Grenada Link Road will be designed with an operational speed of 70km/h and will meet the requirements of the State Highway Geometric Design Manual, Austroads, and other supporting documents where possible. The link will have two lanes in each direction and will accommodate cyclists within the wide shoulders. Footpaths have not been explicitly designed for but there are options for connections to off-road "tracks" and areas of significant interest. A cross-section and route alignment of the proposed road can be found in Appendix F.

Due to the steep terrain that this road will negotiate, significant earth works and the construction of a number of bridges will be required. The maximum gradient along the link is designed to be 9.5%, and although this is high it will avoid the need for tunnels. The gradient should not pose any significant safety issues as this will be a multi-lane dual carriageway road. A long section of the proposed road can be found in Appendix F.

There are a number of possible connections at either end of the road. At the northern end there will be a connection to SH1 in the vicinity of the Tawa Interchange with the possibility of a connection to the Grenada Interchange. At the eastern end, a connection can be made at SH2 Petone. Basic layout designs of the proposed interchange have been carried out. Traffic modelling has also been carried out on each of the links and is addressed in Appendix G. A connection directly at Dowse Interchange was discounted because of the potentially severe environmental impacts this option would have on Percy's Reserve. Any connection involving disturbance of Percy's Reserve would have significant adverse ecological effects and major consenting issues. Percy's Reserve is identified as a Significant Natural Area in the Hutt City District Plan, is a scenic reserve and is

also an important recreational area. The reserve was recently affected by the SH2/Dowse Interchange upgrade and this involved significant redesign and mitigation.

Public transport can also be developed along this route with no further infrastructure requirements other than bus shelters and bus stops. This option connects the northern suburbs of Wellington such as Johnsonville, Churton Park, Newlands, Grenada, Linden and Tawa with the Hutt City suburbs of Petone, Seaview, Gracefield, Eastern Bays, Wainuiomata, Alicetown, Hutt CBD, Woburn and Waterloo. It integrates and provides access to the Lincolnshire Farm development and Horokiwi. The provision of bus services on this road has a positive benefit in reducing the emissions and noise caused by motor vehicles on the surrounding community. The bus services increase the connectivity between the southern Hutt Valley and northern Wellington, as well as integrating Lincolnshire Farm and Horokiwi.

This route reduces the travel distances by approximately 6km for vehicles travelling between Grenada and Petone. This reduction in travel distance and corresponding decreases in travel times will have an impact on development along the route (especially the Lincolnshire Farm area) and also promote development in Grenada and Gracefield.

Urban Planning and Environmental Assessment

The Petone-Grenada Link Road provides a connection between SH1 and SH2 and may provide a direct route between Grenada and Petone. This should support greater accessibility to employment areas and corresponding business and industrial development. The Petone-Grenada Link Road will allow for efficiency in the through movement function between Grenada to Gracefield. Specifically it is assumed that the link will provide local connectivity and access to the effective main street (Principal Road) from major intersections through the area (for interchanges as detailed in the Lincolnshire Farm Structure Plan). The proposed layout will provide ease of access and connection to the employment areas in Lincolnshire Farm. The viability of business and industrial activity in the planned development area is protected as a consequence of this proximity and access to the movement economy. The route opens up new employment areas and opportunities at Lincolnshire Farm.

The proposed option could be positive to local development as the link would assist in providing a direct connection between Tawa and Petone, as well as possibly Grenada and the Lincolnshire Farm development. Depending on the design and proximity to planned development, the interchange may support local economic activity at Tawa and Grenada through increasing the potential retail catchment capture. Effort has been made to avoid passing through Areas of Protection and planned open space reserves which have higher landscape, ecological or recreational values.

In the Lincolnshire Farm location, creating viable retail as a setting for other employment opportunities beyond larger scale industrial uses is paramount. The Lincolnshire Farm link has the potential to have a meaningful relationship to the node condition by encouraging local connectivity to the effective main street. There are two main employment areas planned within the Lincolnshire Farm structure plan area in addition to a neighbourhood centre. They are located close to the Petone-Grenada Link Road and two major intersections with an internal principal 'spine' road through the area. The connection follows the Petone-Grenada Link Road route and supports new local employment growth by providing good commercial access and visibility close to

interchanges. The route can potentially help connect Newlands residents with employment opportunities in the wider area.

Other options canvassed had run through planned residential or reserves which may create unfavourable economic outcomes for the settlement and sever the node. This would be a consequence of the potential reduction in the ongoing viability of retail in the centre and employment areas as the potential movement economy is redirected away. The noise, vibration and air pollution effects are likely to discourage intensification away from the high frequency route, or lead to poor urban frontage conditions. Therefore, the preferred option avoids these effects and provides the best urban regeneration and intensification opportunities. This option would also assist in making Seaview more accessible from SH1, making the area more attractive for development.

It may support the integration of communities (existing and future) at Tawa and Grenada. 800-900 new households are planned for at Lincolnshire Farm in addition to community uses within the neighbourhood centre. The Petone-Grenada Link Road follows the alignment found within the Lincolnshire Farm Structure Plan and avoids disconnecting residential areas. Safety, amenity and access can be maintained within sensitive development areas.

From Lincolnshire Farm, the route circumnavigates Horokiwi Road to the south to connect directly to the urban area at the Petone Interchange. The route may negatively impact on some rural residential land uses where it crosses Horokiwi Road.

Native Vegetation and Habitats

The northern portion of the proposed Petone-Grenada Link Road would largely pass through currently pastoral land. The most significant ecological effect would be the crossing of the northern branch of the Belmont Stream near Westchester Drive East. The stream has significant ecological values[17]. This section of the stream is already crossed by an earth dam; any further crossing would have a very significant adverse effect on the biodiversity of the stream. Alternatively, ability to use the existing crossing would remove a major ecological constraint for the proposed Grenada-Petone Link Road. Further impacts of the road on the Belmont Stream could be largely avoided by best practice construction methodology. No significant effects on wetlands or endangered species are expected. There would be some loss of regenerating native vegetation in the vicinity of the northern Horokiwi Quarry fill site, and the route would cross some tributaries of the Korokoro Stream. These losses could be mitigated by appropriate planting and stream restoration.

Subject to further investigations and design, the southern part of the route is likely to result in the loss of native vegetation where it crosses from the Horokiwi Stream towards and along the coastal escarpment, particularly as there are areas of vegetation zoned as Open Space B and identified in WCC inventories as primary forest and bush areas, which are significant ecological resources. The route could also affect vegetation included in Hutt City Significant Natural Areas. Adverse effects on the Korokoro Stream would be minimised if the crossing point was within or close to current commercial areas in Cornish Street.

[17] Boffa Miskell 2004, Northern Growth Management Framework – Belmont Stream Ecological Investigation, Report for Wellington City Council.

Noise and Vibration

Noise and vibration effects associated with the proposed Grenada-Petone Link Road are likely to be negative particularly in the northern and southern end of the route as the alignment options could be in close proximity to Horokiwi residential areas. Based on the NZTA Guidelines, even at a 500m distance, there is potential for adverse noise effects to be more than minor without mitigation in place. The effects will be dependent on the gradient of the road, topography, landscaping and choice of road surface such as Open Grade Porous Asphalt (OGPA). The noise and vibration effects of the middle section of the route is however, likely to be neutral as it passes industrial and suburban centre land, rather than residential.

Erosion and Sediment Control

Erosion and sediment effects are anticipated to be negative due to issues relating to the proposed route running through a number of streams, three sites identified on the GWRC's Selected Land Use Register as being potentially contaminated land (Northern Landfill, Cottles Landfill and Horokiwi Quarry) and having significant gradient in parts of the proposed route. Construction of the link would have a significant impact on the natural drainage channels and terrain. Careful design and construction would need to be carried out to minimise sedimentation effects on waterways and ensure that there are no long term erosion issues. In addition, dust could also be a significant issue that needs to be considered due to the existence of power lines over the proposed route.

Climate Change Adaptation

The effect of the proposed Link Road on climate change impacts is likely to be neutral on the majority of the route; however it is considered that further investigation would still be required to determine any actual or potential effect. Climate change impacts on the southern end of the proposed route could however be negative as increased storms could result in increased landslides by the ridge which the route would need to pass through.

Contaminated Land

Extensive investigations would be required to be completed to determine the level and extent of contamination present at each of the sites identified along the route and to determine what remedial actions are required. This could be a relatively expensive exercise depending on how the excavated material has to be treated for disposal. Cottles Landfill could be highly contaminated due to the previous activities carried out at the site. It was effectively a landfill with limited control where commercial, industrial and hazardous waste was disposed and open burning of waste occurred. The contaminants that could be present are extensive and could be quite difficult to manage, they could include polycyclic aromatic hydrocarbons, metals, dioxins and potentially asbestos.

Odour from excavations into waste in the Northern Landfill and Cottles Landfill will need to be assessed and relevant discharge consents acquired. Cutting into buried waste at the Northern Landfill, which will be in an anaerobic state, will result in the integrity of the landfill capping to be broken and therefore allowing landfill gas (a significant odour source) to be released. Odour from the landfill will be a key issue during its

consenting process. Engineering solutions will be required for any cuts through the landfill in order to reinstate the integrity or equivalent of the landfill cap and reduce odour impact. Special controls may be required during the period the landfill is open to prevent odour nuisance to residential properties on Middleton Road.

Landscape – Visual Assessment

The Link Road itself and changes to landform with areas of cut and fill and removal of vegetation, will have a permanent visual impact and will bring about changes to experience of place. The degree of change will depend on:

- The extent of landform change
- Removal of existing vegetation
- Distance from the viewpoint
- Degree of movement and noise
- The background against which the road is viewed
- Changes to character
- Mitigation of these changes.

A preliminary assessment of the visual impact of the Link Road has been undertaken and is shown in Appendix H. In summary the there will be a strong localised impact at all stages along the route. These impacts can be mitigated, but not removed. Mitigation includes contouring of cut and fill areas to match existing landforms, planting or other techniques such as tunnelling.

Geotechnical Issues

Due to the significant geotechnical issues associated with this route, the following assessment has been provided. From the alignment to the south east of Horokiwi Quarry, there is a hazard of 3 (moderate) to 4 (between moderate and high) as the alignment runs in an east-west direction. Geotechnical implications of this section may include:

- Significant cut slopes with benching or slope retention systems
- Potential bridge over the buildings on Cornish Street
- Significant fill embankments
- Potential slope instability in the overlying soils or within the greywacke.

The middle of the alignment skirts the eastern side of Horokiwi Quarry, where the earthquake induced slope failure hazard map indicates a hazard of 3 (moderate) to 5 (high) around the eastern Horokiwi Quarry slopes. The alignment crosses Horokiwi Road and an existing quarry access road. To the north of the quarry, the alignment traverses a land filled area. The contamination and geotechnical properties of the fill material are unknown and would require assessment.

Geotechnical implications of this section may include:

- Significant cut slopes with benching or slope retention systems
- Potential half bridging of carriageways
- Fill embankments
- Bridges over existing roads/realignment of existing roads
- Potential slope instability in the overlying soils or within the greywacke
- Differential settlement and potential contamination issues over land filled area. Ground improvement may be required.

Leaving the quarry to the north, the alignment climbs through the side of a gully to a former land filled area. The alignment then follows generally flat high ground, crossing Lincolnshire Road and a second unnamed track though a second land filled area, joining SH1 just before the Takapu Road junction. Geotechnical implications of this section may include:

- Slope instability within the gully just north of the quarry in the overlying soils or within the greywacke cut slopes and/or half bridging of carriageways through the gully
- Cut slopes with benching or slope retention systems
- Fill embankments
- Differential settlement and potential contamination issues over land filled areas. Ground improvement may be required.

An extensive geotechnical investigation should be carried out to aid the design of the road to minimise these geotechnical risks.

Consenting Issues

The potential route has been identified in the Lincolnshire Farm Structure Plan; however a new Notice of Requirement and Regional resource consents will be required. Multiple resource consents will also be required. Compared to the rejected Long List options, this option is positive, however, overall statutory approvals are assessed to be the most difficult to achieve due to the complexity of issues that need to be managed. In terms of environmental issues to be managed, the proposed route would cut through a number of potential contaminated sites list on GWRC's Selected Land Use Register including the closed Northern Landfill, closed Cottles Landfill and Horokiwi Quarry and odour and air discharge consents would be required. The landscape assessment will be an important issue to be addressed, as well as erosion and sediment control, noise and geotechnical issues.

Transportation and Economics Assessment

The Petone-Grenada Link Road provides a direct road link between Petone and Grenada. The Grenada link is really a link up to the Tawa Interchange. Variations on this proposal allow for a connection also to SH1 in the

vicinity of Johnsonville utilising Westchester Drive and a connection to SH2 north of Petone. It is intended that this be a four lane road which operates at 70 km/h.

This road has a broad set of benefits to road users. Road users who travel between Petone and Grenada have a direct route which provides considerably shorter travel times and travel distances. This is of particular advantage to heavy vehicles. Journey lengths are approximately 6 km using the Link Road compared to 12.5 km using SH1 and SH2. At free flow speeds this represents a travel time saving of 8 minutes during peak times and 3 minutes outside peak periods.

Traffic modelling of this road indicates that it will carry approximately 25,000 vpd in 2016 and 28,000 vpd in 2026.

This road will provide benefits to motorists on SH1 and SH2 as traffic is reduced on these roads due to the Petone-Grenada Link Road providing a more attractive alternative for some travellers. On SH1 traffic volumes are reduced by 11,500 vpd in 2016 and 12,000 vpd in 2026. On SH2 traffic volumes are reduced by 11,000 vpd in 2016 and 13,000 vpd in 2026.

This leads to an am peak SBD travel time savings of 2 minutes per vehicle in 2016 on SH1 between Tawa and Ngauranga and 3 minutes per vehicle in 2026. In the pm peak the NBD travel time savings are minor in 2016 and 2026 on SH1 between Tawa and Ngauranga.

On SH2 between Dowse and Ngauranga the time savings generated are offset by the additional delay between Petone and Dowse. This is due to increased traffic volumes on this segment of road.

In addition to these travel time savings it is expected that the Petone-Grenada Link Road will improve the travel time reliability on both SH1 and SH2. Additionally, in the event of an incident on either SH1 or SH2 in the study area this road provides an alternative route that will significantly improve the network resilience.

The Petone-Grenada Link Road enables direct bus services between northern Wellington, Tawa and the lower Hutt Valley to be provided. In addition these services could serve and support the development of the Lincolnshire Farm area and service Horokiwi. The Petone-Grenada Link Road also provides an opportunity to close the Horokiwi Road intersection on SH2

The construction of the Petone-Grenada Link Road will reduce traffic volumes on SH58. These reductions are estimated to be 3,000 vpd in 2016 to 12,000 vpd. Conversely, with Transmission Gully in place in 2016 traffic increases on SH58 by 3,000 vpd. The overall combined effect of the Petone-Grenada Link Road and Transmission Gully in 2016 is neutral, and with the overall volume of traffic at 15,000 vpd. This traffic volume is at a similar level to current traffic flows along SH58 and therefore no capacity upgrades to the road will be required. Further, when developed, the NZTA SH58 Strategic Study will address any safety issues identified on this route.

The Petone-Grenada Link will improve the connectivity between northern Wellington, Tawa and the lower Hutt Valley. The connectivity between SH1 and SH2 is only provided by Ngauranga Interchange and SH58 in the DM scenario. However, if the Petone-Grenada Link Road is provided a further means of connecting these areas is

available. The transportation modelling shows that if this Petone-Grenada Link Road is provided then daily traffic flows increase from 48,000 vpd in the DM to 57,000 vpd with the link for travel between SH1 and the Hutt Valley in 2016. The increase is from 48,000 vpd in the DM to 57,000 vpd with the Petone-Grenada Link Road in place in 2016.

This is typically an increase of traffic between these areas of 21 to 35% over the DM. This is a direct measure of the increase in connectivity that this Link Road provides. This increase in connectivity will result in greater social cohesion and increased economic interaction.

As discussed earlier, there are synergies between the Petone-Grenada Link Road and several other projects. These include the Tawa and Petone Interchanges, the "Beach to Bush" project and the Ngauranga on-ramp signalling.

The 2008 capital cost estimate for the Petone-Grenada Link Road is $250 million giving a BCR of 1.3.

In the longer term a possible link from Johnsonville north in the vicinity of Westchester Drive to the Petone-Grenada Link Road should be allowed for. Such a link is not yet justified by demand but would make the improved connectivity offered by the Petone-Grenada Link Road available to a larger catchment. Traffic modelling for the year 2016 indicates that the Johnsonville link would attract 10% of the daily Petone-Grenada Link Road traffic but by 2026 this percentage would increase to near 15%. In view of this it is recommended that the route designation for the road is pursued through the planning process.

Table 12.7: : Objectives Met With Development of the Proposed Link Road

Objective	Summary
Ensure Environmental Sustainability	Route travel distance shortened improving community cohesion and potentially reducing environmental impacts (air and noise impacts) on SH 1 and 2. However, there are multiple adverse impacts that need to be mitigated including locating the road so as to ensure contaminated land is not too much of an issue, landscape values are not adversely impacted and impacts on surrounding landforms, streams and vegetation are able to be avoided, remedied or mitigated.
Assist in Economic and Regional Development	A direct link between SH1 and SH2 will assist in reducing the travel time and travel time variability between SH1, SH2 and the Seaview area, and reduce overall travel times on the network. Reducing travel to Seaview may attract new development in the area. A direct route will reduce the travel costs and increase the efficiency of production; this will save money and will allow for reinvestment and increases in the economic activity. The route will travel through Lincolnshire Farm and will assist in promoting development. An interchange will be constructed in the vicinity of the quarry; this will reduce waiting times for trucks. This link will assist in regional agglomeration.

Objective	Summary
Assist in Safety and Personal Security	The Link Road will provide a shorter travel distance (approximately 6km less) between SH2 and SH1; this will assist in reducing the overall VKT on the network and reduce crash exposure on a VKT basis.
Improve Access, Mobility and Reliability	Provides an alternative route between SH1 and SH2, adding resilience to the network and reduces travel times and travel time reliability. Travel time reduction on the rest of the network as congestion decreases. The link will travel through Lincolnshire Farm providing access to the industrial area and also travels in the vicinity the quarry. The link will be designed to accommodate cyclists and walking tracks to and from areas of interest (historical areas, regional parks etc). Importantly it provides opportunity for direct bus services between Wellington north and the southern Hutt Valley
Protect and Promote Public Health	As described above, this link will be designed to accommodate cyclists and may attract people from private vehicles to bicycle. Access to the regional parks will be improved, and this may be complemented by walkways to and from this and other areas of interest such as historical and cultural locations.

Conclusion

The Petone-Grenada Link Road is an economically viable proposal that directly links SH1 to SH2. This project provides travel time and route shortening benefits for road users travelling between these locations. In addition, this project provides relief to SH1 and SH2 in the study area with consequential travel time and travel time reliability benefits. Further, this project improves overall network resilience in this area of the network as it provides an alternative route in the event of some incident either on SH1 or SH2.

This project provides an opportunity to reconfigure on and off-ramps in the Johnsonville area so that Johnsonville Road can be reconfigured as a shopping street. This project has synergies with the Tawa and Petone Interchange projects and consequently the “Beach to Bush” facility for pedestrians and cyclists. The Petone-Grenada Link Road supports the Lincolnshire Farm development. This project is most effective when linked with the Cross Valley Link.

The Petone-Grenada Road Link is economically viable. It has a good indicative BCR for a project of this scale. Further development of this project may include a link to SH1 in the vicinity of Johnsonville/Westchester Drive in the longer term.

12.4. SH2 to Seaview-Gracefield

12.4.1. Cross Valley Link (Wakefield Street to Rail Alignment)

Summary

This is a two-lane divided road with provision for cyclists that connects Seaview-Gracefield to SH2 at the new Dowse Interchange on SH2. The new Dowse Interchange has sufficient capacity to receive the traffic generated by the Cross Valley Link.

The Cross Valley Link follows Wakefield Street and then runs just west of the Hutt River adjacent to the Wairarapa Line to Randwick Road. The proposed road has a nominal operating speed of 70 km/h. The cost of this road is estimated at $76 million and has an indicative BCR of 0.5.

The Cross Valley Link is proposed because it addresses:

- Growing congestion on The Esplanade leading to increased delay and travel time variability
- Poor connectivity between the Seaview-Gracefield industrial area and SH2
- Enables improved amenity in Petone and the foreshore by reducing daily traffic volumes and community severance
- The additional traffic on The Esplanade delivered by the Petone-Grenada Link.

The Cross Valley Link supports:

- Petone Foreshore development
- Seaview-Gracefield industrial and logistics hub
- HCC Petone Vision document
- Connectivity to Wainuiomata.

The Cross Valley Link is forecast to attract 21,000 vpd in 2016. This will lead to a reduction in traffic on The Esplanade of approximately 10,000 vpd. This reduction in traffic will lead to a significant reduction in severance on The Esplanade and contribute to an improvement in amenity for this environment.

The volume of traffic attracted to the Cross Valley Link indicates that there will be substantial benefits to other parts of the Hutt City road network, in addition to The Esplanade, (such as the operation of Hutt Road), by constructing the Cross Valley Link. In effect, the Cross Valley Link provides significant east-west permeability for traffic and contributes to a more effective use of the new Dowse Interchange.

Currently, the Cross Valley Link project has a BCR of 0.5. Only the direct transportation related benefits of the project have been taken into account at present. Further work is being undertaken by HCC to quantify the amenity and economic regeneration benefits that will accrue to the Petone foreshore and the Seaview-Gracefield area by building the Cross Valley Link and to recognise the economic disbenefits to Seaview-Gracefield of worsening congestion on The Esplanade if the Cross Valley Link is not built. A preliminary consideration of what might happen to land values in the foreshore area alone, suggests that such additional economic benefits would be considerable. In addition, the improvement of amenity in the area would be a large intangible benefit.

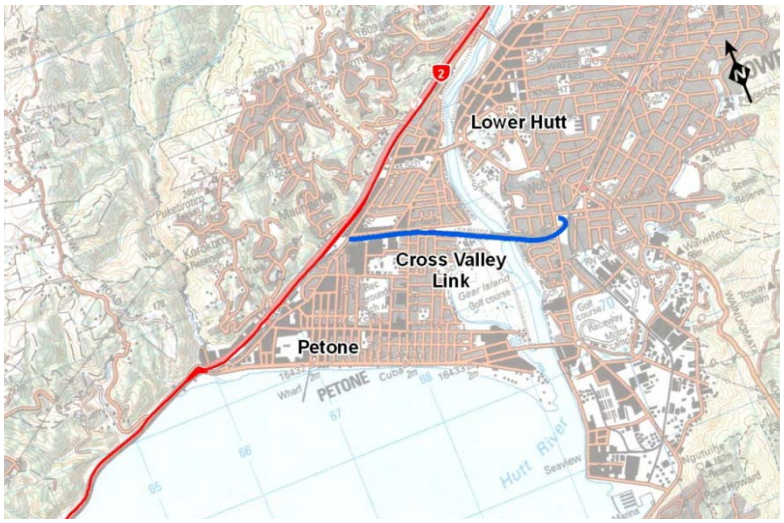
The Petone foreshore area could experience considerable benefits in the form of improved amenity if the Cross Valley Link was built. These benefits could be supported by appropriate traffic calming in the area, ramp signalling of Petone on-ramp on SH2 in the am peak and measures such as restrictions for heavy vehicles to access The Esplanade. This environment could facilitate enhanced community activity, in addition to economic activity. Such an environment could be designed to be attractive for walking, cycling and bus travel on The Esplanade as well as significantly increasing pedestrian permeability, opening up the foreshore to more

recreational use. In addition, the "Beach to Bush" project and the SH2 pedestrian/cycleway completion would further enhance these activities.

As identified in the WRS, the Seaview-Gracefield area is the region's primary industrial area. However, growing congestion on The Esplanade provides poor connectivity to SH2, those areas served by SH1 and the lower North Island. This poor connectivity adds to the cost of business undertaken in Seaview-Gracefield. An efficient Cross Valley Link would link this area of primary importance to the strategic transport network and allow these business activities to be more effective. This improved connectivity would not only assist the production and transportation of goods, but would link employment to a greater labour pool. The building of the Cross Valley Link in conjunction with the Petone-Grenada Link Road would significantly improve Seaview-Gracefield's connectivity to those areas served by SH1 such as northern Wellington, Tawa, Porirua and the lower North Island.

The Cross Valley Link would enable the populations of the Eastern Bays and Wainuiomata to be better integrated into the greater Wellington region. It would provide an efficient connection to SH2 and again, with the construction of the Petone-Grenada Link Road, would facilitate travel to those areas served by SH1 and further north.

The construction of the Cross Valley Link could have an impact on properties in Wakefield Street and adjacent to the railway line on the eastern side of the Hutt river. Some property purchase may be necessary depending on the final alignment chosen, and detailed design. A new bridge over the Hutt River will also be necessary which will require cooperation with GWRC and ONTRACK with respect to flood protection and rail matters.



Design Assumptions

- Design speed is 70km/h
- Road cross section - 2 x 3.5m wide lanes (one in each direction), 2 x 2.2m wide shoulders, 1.8m wide raised central median (no barrier)

- Crash barrier provided to rail line in front of new 1.8m high chain mesh fence
- Clearance from rail line is 5m from mesh fence
- 3% crossfall
- Road is provided with lighting
- Traffic Calming – The Esplanade and Jackson Street West with a target speed of 30km/h (85th percentile) is an option to support this project
- New bridge will need to provide the required 2800m³/s flood conveyance with an additional 900mm clearance to allow for uncertainties
- The bridge abutments will need to maintain the integrity of the flood defences and maintain the existing flow path.
- Provision will be needed to allow continued maintenance of the flood banks and the GWRC will need to be involved in any design process.

Urban Planning and Environmental Assessment

A bridge adjacent to the railway line would provide better connectivity between the communities on either side of the river, and will have lesser impact on the community than the Whites Line alignment option because the route aligns with the railway and not through existing built fabric. The proposed alignment along Wakefield Street is likely to have a negative effect on community cohesion in the immediate vicinity of the route. Having a high volume of traffic along this route will provide a degree of severance between the southern part of Petone (including the waterfront and main street area) from the community north of Wakefield Street. Access and land use management will be required to mitigate the adverse effects from the intense movement function of attracting traffic along Wakefield Street.

If this route is combined with traffic calming of The Esplanade then it will have the least local social and environmental impact on Petone while at the same time enhancing the efficiency of freight movements as it avoids passing through urban areas which potentially slows movement.

The proposed option would be a positive to local development as the routes (especially at the Hutt River crossing) would add capacity between SH2 and Seaview, helping to decrease the volume of HCVs travelling on The Esplanade. This will improve amenity on The Esplanade and enable redevelopment of the Petone waterfront area to better integrate the urban environment (including the Jackson Street retail core) with the foreshore.

Noise Effects

This option would increase traffic through the Wakefield Street residential area, which could have adverse noise and vibration effects on community facilities in the vicinity, such as local schools. This could have an adverse effect on noise sensitive properties, though the effect is considered to be minor.

However, if additional lanes required the removal of houses currently adjacent to the street then the houses behind these properties could be exposed to additional traffic noise. This is because they would currently be receiving a 5 dB or more traffic noise reduction as a result of the existing houses providing a noise buffer. Whether mitigation is required for this is unclear at this stage.

Air Quality

Due to increased vehicle numbers on the proposed route there could be an increase in local air quality impacts on residential properties along the route. The level of impact will depend on the level of increase in vehicle numbers. These impacts would need to be assessed in detail during an investigation stage.

Erosion and sediment control

It is anticipated that there may be some erosion and sediment deposition issues during construction, particularly by the Hutt River. These effects should be able to be minimised through best practice construction processes. These impacts would need to be assessed in detail during an investigation stage.

Contaminated Land

An old landfill to the north of Ava Rail Bridge is a listed on GWRC's Selected Land Use Register as a potentially contaminated site which may need to be investigated depending on the final alignment. Due to the age of the waste material present, landfill gas should not be a large issue, but investigations will be required to confirm the types and concentration of contaminants present. If the landfill is affected by construction it could increase the seriousness of the potential sediment deposition issue.

Landscape Issues

This option should not greatly affect Wakefield Street or the river corridor, but will have significant impact on the residential character and sense of place of properties on Randwick Crescent and Trevethick Grove.

There are several reserves along or near the railway line on Wakefield Street. Impacts on the existing character of the Wakefield Street section would be less because of the existing rail corridor and associated landscape character.

The main areas of open space along this route are reserves along either side of the Hutt River, a major area of open space in the Hutt Valley. A new bridge over this area would not affect the use of the Hutt River trail which already crosses underneath several bridges along its path. The reserves are currently open grassed areas and bridge construction would not result in a loss of vegetation.

Awamutu Stream runs underneath the railway line where it joins reserve running along the Hutt River and eventually meets the river itself. The proposal has potential to impact upon the character of the stream, either negatively or positively, and on HCC strategies to over time improve the natural qualities of streams including their ecological health and indigenous character and to provide linear access to Hutt River.

Another reserve, to the east and close to the Ava Rail Bridge, is an open grassed area with trees which provides access between Randwick Crescent and the footbridge over the Gracefield branch railway. Another accessway on the northern side of the railway line links to Richmond Grove. Maintaining these pedestrian linkages is considered especially important.

Hutt River Crossing

The existing rail bridge is some 90 years old and presents a major constraint to the passage of flood flows. The bridge deck is too low to pass the design flood event and the ten bridge piers are not well aligned with the river flow direction causing significant afflux. It is understood that this bridge only has some 20 years of residual life.

The river reach in the vicinity of the rail bridge and any new crossing is protected by flood defence embankments. GWRC is in the process of completing a major upgrade of these defences to provide for protection against a 2800m^3/s (440 year return period) flood event. It is not envisaged that there will be any realignment of these defences.

Any new bridge will need to provide the required 2800m^3/s flood conveyance with an additional 900mm clearance to allow for uncertainties. The bridge abutments will need to maintain the integrity of the flood defences and maintain the existing flow path. Provision will be needed to allow continued maintenance of the flood banks and the GWRC will need to be involved in any design process.

Any new bridge should have a minimum number of piers in the flood channel. Piers will need to be aligned with the river flow, but also need to account for the position of the existing rail bridge piers. The Hutt River can cause considerable scour and the pier foundation depth will need to account for this. Deep piers will have the potential to impact on the aquifer below and mitigation measures will be required to avoid creation of flow paths from the river to the aquifer.

The bridge approaches will also need to be graded for the expected traffic and rail requirements. GWRC would prefer that the approaches are kept as near to natural ground level as possible to avoid the creation of new floodplain barriers. Elevated approaches may need some provision for cross flow to prevent elevated flood levels in the event of a flood defence beach.

The confluence of Black Creek is on the left bank just upstream of the existing rail bridge. This confluence is fitted with flood gates and an over pumping system. Any new bridge alignments should avoid interference with this area.

Through discussions with GWRC, it has also been identified that there is a whitebait spawning area to the south of the existing rail bridge. If a road bridge beside the rail bridge is pursued then this could be affected. Freshwater species in the river may also be impacted if a second river crossing is pursued. Any concern would be centred on the river crossing. Effects will be determined by the pier placement, materials (cladding) used on banks and whether riparian planting is possible.

Geotechnical Constraints

The alignment is generally underlain by Alluvium which is underlain by Petone Marine Beds, except for a 150m section of Petone Marine Beds 400m south of the start (north) of the section.

Reference to the GWRC geological hazard maps has indicated the following constraints are within or close to the proposed option:

- Combined earthquake hazard of 3 (moderate) then 4 (moderate to high) 100m north of Elizabeth Street
- Liquefaction hazard variable then high 100m north of Elizabeth Street
- Ground shaking earthquake hazard of 4 (moderate to high).

The potential impacts of these geohazards on the design and construction are:

- Road and bridge construction in Alluvium and Petone Marine Beds susceptible to liquefaction, lateral spreading, cutting instability and low bearing strength for foundation construction
- Construction in the vicinity of contaminated land mobilising contamination.

Statutory Approvals

Statutory approvals for this route are considered to be difficult to obtain, but positive compared to the White Lines route option. There are potential impacts on the surrounding urban areas in terms of reduced amenity and increased noise, air and vibration effects could be significant depending on the design of the route. A new Notice of Requirement would be required depending on how much land is required, a new bridge and whether the effects are no more than minor.

Regional consents may also be required related to a new bridge and potentially contaminated land. Based on advice from GWRC, if a second bridge is required next to the railway (as opposed to combined with), this would not be seen favourably by Council and could result in further delays in gaining statutory approval.

Transportation and Economics Assessment

A two-lane road built to design standards for a limited access 70 km/h operating speed provides an efficient connection from the Seaview/Gracefield area to SH2 and also serves the residential areas of Wainuiomata and the eastern bays. It was proposed the road would run along Wakefield Street. At the Cuba Street overbridge, it would diverge away from the existing street and transverse adjacent to the rail reserve. It would continue towards the Hutt River (between the rail and the existing properties), crossing the river and then connect in at Randwick Road. The cross section and route alignment of the Cross Valley Link can be found in Appendix I.

The proposed road will have similar grades to that currently existing on Wakefield Street. A climb will be required at the eastern end to rise above the stop bank and gain access to the bridge. There will be a similar fall in grade back down to a connection onto Randwick Road. The intersections at both ends and those along the link will need to be upgraded to accommodate the increased traffic volumes. For this route to be an efficient and attractive alternative option for travelling between SH2 and the Seaview area, access to and from the side streets should be minimised. If an access cannot be closed completely (i.e. there is no alternative access) left in, left out access would be recommended.

There is an existing railway bridge that extends across the Hutt River. Ontrack has advised that this railway bridge has at least another 20 years before it reaches the end of its design life; as such there will no requirement for a replacement in the foreseeable future. There is potential for a combined rail/road bridge or a separate stand alone structure. The preferred option would need to be agreed with Ontrack during an investigation stage.

The alignment developed for this project is indicative and is considered feasible in terms of its geometric requirements but takes no account of the impact of services in the area. The alignment is also subject to change as a result of public discussions.

If the Cross Valley Link is provided, traffic volumes on it are forecast to be 21,000 vpd in 2016 and 22,500 vpd in 2026. With the link in place, traffic volumes on The Esplanade are forecast to be 22,000 vpd in 2016 and 25,500 vpd in 2026. If traffic calming is applied on The Esplanade west of Cuba Street consistent with a 30 km/h operating speed, then traffic volumes on the Cross Valley Link increase to 23,000 vpd in 2016 and 24,500 vpd in 2026 and reduce to 17,500 vpd in 2016 and 20,500 vpd in 2026 on The Esplanade. Traffic volumes in the order of 10,000 to 15,000 vpd are considered consistent with a more community-focused environment.

Currently, the Cross Valley Link project has a BCR of 0.5. Only the direct transportation related benefits of the project have been taken into account at present. Further work is being undertaken by HCC to quantify the amenity and economic regeneration benefits that will accrue to the Petone foreshore and the Seaview-Gracefield area by building the Cross Valley Link and to recognise the economic disbenefits to Seaview-Gracefield of worsening congestion on The Esplanade if the Cross Valley Link is not built. A preliminary consideration of what might happen to land values in the foreshore area alone, suggests that such additional economic benefits would be considerable. In addition, the improvement of amenity in the area would be a large intangible benefit.

The above analysis is based on a two-lane road being provided. However, the daily traffic volumes forecast by the traffic model indicate that this link is close to needing four lanes to avoid congestion.

Many of the benefits of the Cross Valley Link can be achieved by upgrading The Esplanade but the cost of this upgrade, to maintain and improve the level of service required for access to the region's industrial hub at Seaview-Gracefield, is as expensive, if not more expensive, than building the Cross Valley Link. An estimate of the cost of building a road on The Esplanade that would provide an equivalent level of service is $90 million with an indicative BCR of 0.5. The main elements including in this $90 million cost estimate include:

- Property costs - $10 million
- Design & construction supervision fees - $10 million
- Construction costs - $70 million (includes a new bridge at $7 million).

This would mean that to maintain reasonable access to the region's primary industrial hub, upgrading The Esplanade is unlikely to provide any savings in cost and the economic regeneration benefits for Petone and the foreshore would be forfeited as well as improved amenity. In the longer term, issues such as climate change

and sea level rise would suggest that a Cross Valley Link would provide better security of access to the Seaview-Gracefield area than The Esplanade.

The Petone-Grenada Link Road deposits additional traffic onto The Esplanade because of increased economic interaction and connectivity between the Hutt Valley and Wellington's northern suburbs. The traffic modelling indicates that although this leads to deterioration in the performance of The Esplanade, if the Cross Valley Link is not built, it is still more efficient and provides better overall access for travellers, particularly to Seaview-Gracefield, than not building the Petone-Grenada Link at all. This is demonstrated by an extra 3,000 vpd expected to use The Esplanade in 2016 when the Petone-Grenada Link Road is built. The modelling work undertaken to assess this impact shows that the increase in daily traffic will not significantly worsen current levels of congestion and delay.

In the greater Wellington region, recent travel time surveys undertaken by the NZTA indicate that travel times and speeds are stabilising which leaves a response such as a lengthening peak period as the likely mechanism for absorbing increased traffic growth. This is likely to be also true for The Esplanade.

The proposed Cross Valley Link will lead to more traffic using Randwick Road. Forecasts for this road for 2016 are currently for traffic volumes of 21,000 vpd, including 4,000 heavy vpd. In 2016 with the Cross Valley Link in place, total daily flows increase to 23,000 vpd which includes 5,000 heavy vpd. This increase in traffic volumes will need to be managed to limit any adverse effect on the local community.

Additional investigation work has been carried out on the possibility of relocating the existing railway to allow sufficient room for the Cross Valley Link without the need for any property purchase. The investigation found that it may be possible to construct the Cross Valley Link without the need for private property acquisition. A more detailed investigation would need to be carried out in conjunction with consultation to confirm the viability of this option.

- **Table 12.8: Benefits of the Cross Valley Link (Wakefield Street to Rail Alignment)**

Project Objectives	Project Benefits
Ensure Environmental Sustainability	This route could provide for future redevelopment of the Petone waterfront. Following the rail alignment also provides for reduced effects on the surrounding community up to the bridge. If the combined rail/road bridge option is pursued this would also reduce effects on the river. However, there could be significant localised community disruption along the new route where property purchase may be required depending on the final alignment chosen and the detailed design.
Assist Economic and Regional Development	Improve access and capacity for vehicles accessing the Seaview and Gracefield area. Added capacity and increased speed may lead reduce travel times during peak periods. Provide alternative route to The Esplanade and improve the amenity of the foreshore area. This route provides for agglomeration of the Seaview area into the wider region.

Project Objectives	Project Benefits
Assist in Safety and Personal Security	This project (especially if implemented in conjunction with traffic calming) will assist in removing traffic from The Esplanade, allowing safer access to the foreshore area and provide traffic using Wakefield Street a purpose-built road designed to be safe.
Improve Access, Mobility and Reliability	Removing HCVs from The Esplanade will improve access for those wanting to make use of the foreshore area. The route will also improve capacity and travel time to the Seaview area.
Protect and Promote Public Health	Removing vehicles from The Esplanade will mean that the foreshore is more accessible to the community; this may lead to increases in walkers and cyclists.
Conclusion This option needs further work to prove that it is economically viable. This will require the quantification of the amenity and economic regeneration benefits for The Esplanade and Seaview/Gracefield. This project clearly provides greater transport efficiencies to the network and enables the redevelopment of the foreshore for more of a community focus.	

12.4.2. Low Cost Upgrade of The Esplanade

As an alternative to the Cross Valley Link a high level investigation was carried out for low cost upgrade of The Esplanade. The high level cost estimate for this project is in the order of $11.7million based on a minimal design that retained the existing footways and included reconstruction of the raised grass median and some localised widening of the carriageway towards the sea and alongside the median. Milling and resurfacing of the complete carriageway was assumed together with provision for upgrading the existing signalised intersection at Cuba Street. No provision has been made for replacement of existing stormwater and provision of any treatment devices, replacement of existing road lighting and provision of additional columns or landscaping. During the investigation it was found that the key delays are at the existing interchange and merge onto SH2. As a consequence upgrading The Esplanade will provide no significant benefits. In addition, the 2016 AM and PM peak models indicate that there are no significant delays at the Seaview end (i.e. along Waione Street and at the Bridge).

12.5. The Preferred Strategy Components

The elements discussed above are designed to operate as a complementary strategy. The proposed strategy has a cost in the order of $360 million and contains two large structural elements in the Petone-Grenada and Cross Valley Link Roads and a series of smaller proposals. The effectiveness of these two link roads is interrelated but they are not absolutely dependent on each other. That is, the improved accessibility and network benefits are greatest with both roads in place but the Petone-Grenada Link Road on its own still brings overall net benefits to the network and to the Seaview-Gracefield area. The Petone-Grenada Link Road improves the connectivity of urban areas supported by SH1 to those supported by SH2. The Cross Valley Link extends that connectivity to the Seaview-Gracefield, Wainuiomata and eastern bays area. The Petone-Grenada Link Road brings relief to both SH1, an identified RoNS, and SH2. The Cross Valley Link does not provide relief to these strategic State Highways.

A number of the smaller projects, which are included in the preferred Strategy, such as completion of the SH2 pedestrian and cycleway provide benefits to forms of travel other than the private car and freight movements. These measures also assist in locking in the benefits of the larger projects as do the ramp signalling proposals and increasing the passenger rail frequency on both the NIMT and Wairarapa rail lines (as considered in the Regional Rail Plan).

A key outcome of this package will be the support of economic development in the region. This is an important outcome sought by the GPS. The package helps relieve growing congestion (forecast to be at a severe level by 2016) on SH1 north of Ngauranga Interchange which is a RoNS and to SH2. Further, the package will improve the connectivity of key areas of economic activity such as Seaview-Gracefield to the wider region and the lower North Island. This will increase this area's catchment of business, reduce the cost of business in the area and better connect the area to a wider labour pool.

The package has identified measures that actively integrate into key development areas. These areas include Lincolnshire Farm, Johnsonville Town Centre, Churton Park, Petone Foreshore and Seaview-Gracefield.

The analysis of this package has been undertaken using medium growth forecasts. Sensitivity tests have been undertaken which include:

- High growth forecasts
- Transmission Gully is built
- Passenger rail frequency is improved from the current levels (but include an extension of electrified services to Waikanae) to a 15 minute frequency at peak from Waikanae and Upper Hutt to Wellington.

These sensitivity tests do not change the conclusions of this study nor the make-up of the preferred Strategy. The impacts on the BCRs for the key projects are marginal.

The Ngauranga Triangle Strategy Study area has evolved over decades where populations and economic activities have had relatively convenient north- south travel along the Ngauranga to Tawa and Ngauranga to Dowse corridors. In the lower Hutt Valley, over the same period of time, relatively good east-west permeability has been provided along The Esplanade with a connection to SH2 at Petone. The Strategy will require ongoing consideration of integrating land uses with the transportation network and these projects through the statutory planning processes of the Councils.

The Petone-Grenada Link Road is well supported by the Lincolnshire Farm Structure Plan and is the first step towards integrating the new transport network into the Ngauranga Triangle Strategic Study area. The Cross Valley Link will fundamentally alter access into and within the Hutt Valley and this needs to be addressed by HCC in formulating its future planning for this area.

For future development of the Strategy, consideration of how the wider urban areas at either end of this Grenada-Gracefield corridor interrelate; and in particular, how Seaview-Gracefield businesses respond to a significantly improved connectivity to the wider region and the lower North Island, should be given in future studies and structure planning.

12.6. The Relationship of the Proposed Package with the Study's Functional Goals

The functional goals for this study are outlined earlier in this report. It is important that the proposed package contains elements that support these goals. Table 12.9 below shows the relationship between the study's functional goals and projects proposed in the package.

Table 12.9: Functional Goals and Proposed Projects

Functional Goal	Projects That Support This Goal
Improve connectivity for passenger transport for all desire lines on the Ngauranga Triangle and the extension to Seaview-Gracefield	Direct bus services from northern Wellington, Tawa and the lower Hutt valley utilising the Petone-Grenada Link Road
Improve connectivity for general traffic for all desire lines on the Ngauranga Triangle and the extension to Seaview-Gracefield	Petone-Grenada Link Road Cross Valley Link Ramp signalling of the SH2 Petone on-ramp Ramp signalling of the SH2 Ngauranga on-ramp
Improve connectivity for freight for all desire lines on the Ngauranga Triangle and the extension to Seaview-Gracefield	Petone-Grenada Link Road Cross Valley Link Ramp signalling of the SH2 Petone on-ramp Ramp signalling of the SH2 Ngauranga on-ramp
Improve connectivity for walking and cycling for all desire lines on the Ngauranga Triangle and the extension to Seaview-Gracefield	"Beach to Bush" Completion of the SH2 pedestrian/cycleway Middleton Road cycleway Petone-Grenada Link Road
Improve the amenity of The Esplanade to enable re-development of this area incorporating integration along the foreshore	Cross Valley Link Ramp signalling of SH2 Petone on-ramp
Improve network security, resilience and quality of the transport network between Wellington City and the Hutt valley and the SH1 corridor within the study area	Petone-Grenada Road Link Cross Valley Link
Provide for the integration between transport and land use	Petone-Grenada Road Link Cross Valley Link Ramp signalling of the SH2 Petone on-ramp

13. Locking in the Benefits

The outcome of this project is to provide a transportation plan that effectively contributes to the objectives of this study and more broadly, to the urban form of this study area. This transportation plan also aims to contribute to the WRS as part of achieving the study objectives. To do this, the transportation and land use benefits gained from future projects need to be confirmed and locked in.

For example, benefits can be eroded when new road capacity is provided or a transport measure generates relief to an existing road. This generally occurs in two ways. The first is through an instantaneous response. The new road capacity can reduce travel costs for trip makers and additional car based trips are induced. Examples of this mechanism are mode change, trip redistribution and trip retiming. The second mechanism occurs over a longer time frame and includes land use location decisions and general traffic growth resulting from increases in population, vehicle ownership and economic activity.

This means that if the benefits of a transportation plan are to be truly "locked in" then both mechanisms with their different timeframes must be addressed. Further, the variables that are responsible for eroding the benefits of a transportation plan are multiple. Therefore the means of locking in the benefits should involve a number of measures.

In the Ngauranga Triangle Strategic Study area there are two examples of roads that lead to the relief of existing infrastructure. These roads and the relief they offer are identified in Table 13.1.

Table 13.1 Road Capacity relief provided by Road Schemes

Road Link	Relief Provided
Petone-Grenada Link Road	SH1 – Tawa to Ngauranga SH2 – north of Petone to Ngauranga Johnsonville Road
Cross Valley Link	The Esplanade (removing HCVs from The Esplanade)

The relief provided to Johnsonville Road arises from providing on and off-ramps at Helston Road, thereby reducing the volume of through traffic on Johnsonville Road.

Both the Petone-Grenada Link Road and the Cross Valley Link are also identified as new roads where sustaining the level of service on these roads could be considered.

Table 13.2: Projects for Locking in the Benefits of the Petone-Grenada Link Road

Projects	Impact Area	Rationale	Comment
Ramp signalling SH2 Ngauranga on-ramp	SH1 & SH2	Increases travel costs for motorists using SH1 & SH2	Encourages motorists to use the Petone-Grenada Link instead of SH1&SH2. This is largely a measure designed to deal with congestion on SH2, particularly the merge from the on-ramp at Ngauranga and the weaving prior to the off-ramp at Petone in the pm peak
Completion of SH2 cycleway	SH2	Improves level of service for cyclists	Encourages cyclists to continue cycling as there is an improved level of service
Integrate the Lincolnshire Farm Development into the Petone-Grenada Road Link	SH1 & SH2	Lower travel costs for users of Petone-Grenada Link, provide improved service for Lincolnshire Farm residents.	Travel incentives for use of Petone-Grenada Link instead of SH1& SH2
Provide ramps at Helston Road on SH1	Johnsonville Road	Lower travel costs for using SH1 rather than Johnsonville Road	Reduces through traffic volume on Johnsonville Road

It is recommended that all projects outlined above be developed further as a means of 'locking in the benefits' of the Petone-Grenada Link Road.

Table 13.3: Measures for Locking in the Benefits of the Cross Valley Link Road

Measure	Rationale	Comment
Ramp signalling SH2 Petone on-ramp	Increases travel costs for motorists using The Esplanade	Encourages motorists to use the Cross Valley Link instead of The Esplanade. This measure will also generate some benefits for SH2
Bylaw to regulate heavy vehicle access to The Esplanade	Regulates heavy vehicle use of The Esplanade	Reduces the volume of heavy vehicles on The Esplanade as current heavy vehicle volumes are perceived to be most incompatible with a community focused environment.
Integrate the Seaview/Gracefield area with the Cross Valley Link	Lower travel costs for users of Cross Valley Link	Land use in the Seaview/Gracefield area needs to develop in a manner that ensures efficient access to the Cross Valley Link.

Measure	Rationale	Comment
Ensure the Cross Valley Link provides a high level of service	Lower travel costs for using the Cross Valley Link rather than The Esplanade	This encourages road users to use the Cross Valley Link as it will be the more attractive option. This is facilitated by having a high standard road, an operating speed of 70km/h and minimising the number of intersections on the Cross Valley Link.
Strengthen the priority for road users to Parkside Road	Reduces total travel costs for road users using the Cross Valley Link	Provides an efficient connection from Wainuiomata to the Cross valley Link.

It is recommended that all projects outlined above be developed further as a means of 'locking in the benefits' of the Cross Valley Link Road.

The measures above are designed to encourage the use of the Petone-Grenada and Cross Valley Links thereby providing relief to SH1, SH2, Johnsonville Road and The Esplanade. There is a risk that successful implementation of these measures may compromise the level of service on these link roads. However, the traffic modelling undertaken on this project indicates that is unlikely to be an issue for some years. Nevertheless, it is appropriate that measures be put in place to ensure the long term sustainability of these roads.

Measures proposed to 'lock in' the benefits generated by the Link Roads are outlined in Table 13.4.

Table 13.4: Measures for Locking in the Benefits of the Petone-Grenada Link Road and the Cross Valley Link Road

Measure	Impact Area	Rationale	Comment
Bus services on the Petone-Grenada link linking Wellington North to the lower Hutt Valley	Petone-Grenada Link and to a lesser extent the Cross Valley Link	Lower travel costs for users of these services	Reduces the numbers of road users on these link roads
Integrated planning of Lincolnshire Farm and Horokiwi	Petone-Grenada Link Road	Configures land use to encourage use of alternative modes and reduce trip generation	Ensures that bus use, walking and cycling are safe and efficient alternatives to the private car and may reduce total trip generation in the area
Integrated planning of Seaview/Gracefield	Cross Valley Link	Configures land use to encourage use of alternative modes and reduce trip generation	Ensures that bus use, walking and cycling are safe and efficient alternatives to the private car and may reduce total trip generation in the area

It is recommended that all measures outlined above be developed further as a means of sustaining the level of service of the Petone-Grenada and Cross Valley Link.

14. Study Issues Not Addressed in the Recommended Package

It is noted that a number of issues identified for the study have been unable to be addressed in the study's recommended package. These include:

- Buses getting caught in congestion on both SH1 and SH2
- Inadequate levels of service for pedestrians and cyclists in Ngauranga Gorge on SH1
- Current inadequate Level of Service for passenger rail at peak and non-peak times.

Buses getting caught in congestion on both SH1 and SH2	Options were considered for buses on SH1 and SH2 including a separate bus lane facility. Analysis of these options showed that they were relatively expensive and had poor indicative BCRs. In both cases, peak period bus numbers are low and would give the appearance that the lane is not justifiable given the number of passengers forecast, using WTSM, to use the facility. For example, in the case of a southbound bus lane in Ngauranga Gorge the estimated cost was $34 million and the indicative BCR is 0.05. This was expected given there are only 35 southbound buses in the am two hour peak whereas good practice would normally require at least 60 for a separate bus lane over the two hour peak period. The reallocation of road space to provide a bus lane results in disbenefits as insufficient road capacity exists to prevent unacceptable levels of service for general traffic. Another option was considered to allow heavy vehicles as well as buses into this lane, however this was only marginally better, achieving an indicative BCR of 0.08.
Inadequate levels of service for pedestrians and cyclists in Ngauranga Gorge on SH1	The needs of pedestrians and cyclists travelling north of Johnsonville can be addressed through the proposed cycle path on Middleton Road. However, the options for improvements in Ngauranga Gorge are few. There is an existing footpath but this is often narrow and substandard and only localised improvements could be contemplated. An option exists to use the space that has been considered for a southbound bus lane discussed above.
Current inadequate level of service for passenger rail at peak and non-peak times	The issue regarding current inadequate level of service for passenger rail at peak and non-peak times is addressed outside of this study in the current regional rail upgrade programme and the Regional Rail Plan.

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15. Implementation Plan

Following the evaluation of the Short List of options and confirmation of the Strategy components, the next phase of the study was to determine an implementation plan for the Ngauranga Triangle Strategy. This was undertaken in a two stage process. Firstly, the economic benefits and operational issues for each project were reviewed. Secondly, the statutory processes required to progress the preferred package of projects was identified. This process is described in more detail below.

15.1. Selection Process

The policy background described earlier in this report emphasised that the Strategy needed to focus on both the movement of goods and traffic and the needs of the communities served by the new infrastructure. This included not just looking at motorised vehicle travel but the whole range of travel modes that would be expected to use the network, the full range of travel purposes and how each route would integrate with surrounding land uses.

Due to the scale of the Strategy and complex interactions between Strategy components and funding constraints, the Governance Group and project team identified that the implementation would need to be carried out in stages with a ranking order based upon route importance and economic benefits. The implementation plan also needed to recognise that this section of SH1 is now defined as a 'RoNS (this being a focus for investment, as defined by the May 2009 GPS).

All projects in the recommended Strategy have been assessed based upon their consistency with the overall study objectives, which in turn were largely based upon alignment with national and regional transportation policy positions. For this reason, consistency with the study objectives was not a major consideration in the determination of the appropriate sequencing for these projects.

15.2. Defining the Operational and Infrastructure Requirements

The recommended projects were ranked, based upon a preliminary assessment which took into account likely scheme costs, economic benefits, traffic impacts and social / environmental impacts. The following projects were ranked highest:

- SH1 Tawa Interchange - either as a standalone project providing safety and efficiency benefits or a full interchange including connection to the proposed Petone-Grenada Link Road
- Petone-Grenada Link and Petone Grade Separated Interchange (including "Beach to Bush" through re-use of existing Petone Ramps)
- Middleton Road Cycleway
- Cycle track Completion along SH2.

These four top projects can also be combined with sub-projects. Examples of these include the SH1 connection in the vicinity of Westchester Drive /Johnsonville or the connection to SH2 north of Petone for the Petone-Grenada Link Road. The Petone-Grenada Link Road requires the reconfiguration of the Petone

Interchange which also allows the realignment of SH2 under the current interchange. A new interchange at Petone also provides an opportunity to re-use the existing ramp structures to provide cycle and pedestrian access across SH2 which can be used to provide the "Beach to Bush" crossing.

Further, the development of the Petone-Grenada Link Road would enable the development of direct bus services between northern Wellington / southern Porirua, and the lower Hutt Valley, also providing connectivity to the Horokiwi community and the Lincolnshire Farm development area. Preliminary analysis suggests that such bus services would generate a sufficiently high BCR to warrant more detailed investigation.

On-going residential growth in Churton Park and at Lincolnshire Farm, the extension of Westchester Drive to the motorway, the development of the Johnsonville Town Centre, the need to resolve access issues to Horokiwi and the heightened status of SH1 as a RoNS together add urgency to the Petone-Grenada Link Road and may warrant bringing this project forward in time.

The completion of the cycle track on SH2 and the Middleton Road Cycleway are both economically justified and should proceed. The work to the cycle track on SH2 would complete the current facility and provide significant safety benefits. There is no economic justification to build a facility to the standard of the "Great Harbour Way", though the achievement of the "Great Harbour Way" proposals in the longer term would not be precluded by the cycle track project.

Following the above four projects in terms of ranking were:

- Helston Road Ramps
- Cross Valley Link Road.

The Cross Valley Link relies on The Esplanade and Jackson Street (west of Cuba Street) being traffic calmed to allow safe pedestrian activities and local traffic circulation on these streets. This allows a significant improvement in amenity and provides for potential redevelopment of the surrounding land uses in these streets and may encourage activities in the area conducive to HCC's vision for the area.

It is envisaged that the Cross Valley Link will utilise Wakefield Street and then run parallel to the rail alignment, connecting to the Randwick Road roundabout. A subsequent stage of the project could then provide a connection on top of the Gracefield line to Parkside Road. As HCC is improving the linkages from Parkside Road to Wainuiomata Hill Road, this connection will improve accessibility to and from Wainuiomata.

An economic evaluation completed for this study suggests that the Cross Valley Link would not be economically justified in the shorter term. However, this is sensitive to the assessed scale of potential amenity benefits in Petone and foreshore area, and further work is required to quantify these.

The following supplementary projects have been identified:

- Ramp signalling at Ngauranga on SH2
- Ramp signalling at Petone on SH2.

Ramp signalling the northbound on-ramp at Ngauranga and the southbound on-ramp at Petone on SH2 have been identified as supplementary options. These would be economically justified and are designed to support other options. Ramp signalling at Ngauranga would provide a further incentive for users of SH1 to use the Petone-Grenada Link Road to travel to the Hutt Valley and so would aid in 'locking in' the benefits associated with this project. Ramp signalling of the Petone on-ramp would provide an incentive for travellers from the eastern part of the lower Hutt Valley to use the Cross Valley Link instead of The Esplanade and is therefore a measure that would 'lock in' the benefits of the Cross Valley Link.

Implementation of the proposed package could proceed according to the following indicative programme:

Short Term **(the next ten years)**	□ NZTA to undertake full investigation, reporting, design, consent and construction of the SH2 pedestrian/cycleway completion □ WCC to undertake full investigation, reporting, design, consent and construct a new Middleton Road cycle facility □ WCC/NZTA/HCC to undertake full investigation and reporting, design and gain consents for the Petone-Grenada Link Road including the Tawa and Petone Interchanges □ NZTA to investigate further traffic management projects (including possible ITS Expansion and SH2 Ngauranga on-ramp signalling) □ HCC to undertake additional economic regeneration benefit analysis of the Cross Valley Link and supporting policy/planning frameworks □ WCC/NZTA to further investigate Helston Ramps including further detailed traffic modelling and determination of the regeneration benefits that might accrue to Johnsonville Road □ WCC/NZTA to commence construction of the Petone-Grenada Link Road and associated Tawa and Petone Interchanges □ NZTA to commence construction of further traffic management projects such as ITS expansion and Petone on-ramp signalling □ NZTA to complete the Petone – Grenada Link Road and Petone Interchange, including the "Beach to Bush" connection □ HCC to undertake full investigation and reporting, design and gain consents for the Cross Valley Link.
Long Term **(Beyond ten years)**	□ HCC to construct the Cross Valley Link[18] □ WCC/NZTA to evaluate the Johnsonville link to the Petone-Grenada Link Road □ WCC to undertake refinement, consents, design and construct the Johnsonville link to the Petone-Grenada Link Road.

[18] If the additional work that HCC is undertaking further justifies this link road then consideration of bringing the Cross Valley Link forward should be given.

Project	Timeframe					Influences on the Project
	0-10 Years			Beyond 10 Years		
	0-3 Years	3-6 Years	6-10 Years	10-20 Years	20-30 Years	
Tawa Interchange	Detailed Investigation – I&R, SAR, Statutory Approvals & Detailed Design.	Construction				GPS 2009
Petone-Grenada Link, Petone Interchange (inc. "Beach to Bush")	Update of WRS, Confirm Structure Plan timeframes. Detailed Investigation – I&R, SAR & Consenting	Detailed Design/Construction	Construction			Lincolnshire Farm structure plan timeframes Wellington RPS, Wellington Regional Land Transport Strategy Wellington Regional Strategy GPS 2009
Cycle track Completion (SH2)	Detailed Investigation – I&R, SAR, Statutory Approvals & Detailed Design	Construction				Regional Walking and Cycling Strategies
Cross Valley Link	Evaluation of Land Use and Business. Economic Benefits Analysis	Possible Detailed Investigation.	Detailed Investigation – I&R, SAR, Statutory Approvals & Detailed Design	Construction	Construction	Evaluation of wider land use benefits and development of a planning framework to lock in and deliver potential benefits. Wellington Regional Strategy, Wellington Regional Land Transport Strategy, LTCCP. Hutt City Council, District Plans, OnTrack,
		Detailed Investigation – I&R, SAR, detailed consenting.	Construction	Construction		
Ramp Signalling (Petone Interchange)	No Action	Detailed Investigation – I&R, SAR, Statutory Approvals & Detailed Design	Construction			
Ramp Signalling (Ngauranga Gorge/SH2 Interchange)	No Action	Detailed Investigation – I&R, SAR, Statutory Approvals & Detailed Design	Construction			
Middleton Road Cycleway	Detailed Investigation – I&R, SAR, Statutory Approvals & Detailed Design	Construction				Can be progressed independent of other projects

Table Key

No progression on project — Evaluation and analysis phase — Detailed design and Construction phase — Possible Investigation Phase

Indicates next step in project phase — Possible project over-run into next time period — Project may switch phases in a cyclic pattern

15.3. Preferred Strategy Implementation Requirements

The following sections briefly summarise the project packages that will go forward for implementation and describes what statutory approvals are required.

Tawa Interchange SH1	Where works are outside the current designation an alteration would be required and where within the designation an Outline Plan of Works would be required.
Petone-Grenada Link Road and Petone Interchange	Prior to any statutory approvals, an amendment to the Wellington RLTS and WRS would be desirable to ensure these proposed works are added into the area for change. Simultaneously, the Lincolnshire Farm structure plan and current provisions provided in the WCC District Plan should be reviewed to incorporate any modifications required to the route alignment in the structure plan. In addition work with HCC should continue to address how the Petone interchange can be taken into account with the proposed gateway project at Petone. This is to confirm and lock in future land use benefits from this new route. Any future WCC and Hutt City Growth Strategies should then ensure that the route and associated land use changes are acknowledged and taken into account. Following this, statutory approvals for the new route should be sought once detailed investigations for the route is complete. A new Notice of Requirement and regional resource consents will be required. Multiple resource consents will also be required.
Middleton Road Cycleway	Prior to any statutory approvals, an amendment to the Wellington RLTS and WRS would be desirable to ensure these proposed works are added into the area for change. Any future WCC work on the Johnsonville Town Centre Plan should ensure that the route is acknowledged and taken into account. Following this, statutory approvals for the new route should be sought once detailed investigations for the route is complete.
Cycle Track Completion SH2	Complex statutory approvals will be required, including Alteration to Designation and regional resource consents for construction, erosion and sediment control and possibly Restricted Coastal Activity approval for the occupation and reclamation of the Coastal Marine Area. These consents may be complicated primarily because of the reclamation of the harbour required to complete the route. A high level of environmental assessment would be required to confirm the effects on the Coastal Marine Area can be mitigated. Due to the complexity regarding these consents it is recommended regional consents are sought at the same time as the alteration to Designation to confirm statutory approvals and any potential constraints on the design and construction of the cycle track
"Beach to Bush"	An outline plan of works or alteration to designation would be required and possibly regional consents for construction and erosion and sediment control. This project could be linked with the Petone Interchange so the timing of these projects and statutory approvals could occur at the same time.

Ramp Signalling	The ramp signalling implementation would need to be linked to the implementation of the Petone-Grenada Link Road as signalling would discourage use of the Ngauranga Interchange. Similarly Ramp signalling at the Petone Interchange would need to be implemented at the same time as the Cross Valley Link as signalling would discourage use of The Esplanade.
Cross Valley Link	Following approvals by the NZTA Board, HCC and WCC and prior to any statutory approvals the WRS and Wellington RLTS and Petone Vision Statement should desirably be updated. As part of the WRS a planning framework should be developed for this focus area for Petone to understand redevelopment drivers and to evaluate the potential benefits of this route taking place. If the benefits are high enough this planning framework should be finalised and the Hutt City District Plan should be updated to lock in the benefits. Following these complex statutory approvals will be required to secure a designation and regional consents for the river crossing and to address other effects such as erosion and sediment control.

16. Next Steps

This report is a step in a larger regional strategic transport planning process. The findings of this report and the proposals it makes will be the subject of further stakeholder discussions and Council and NZTA Board consideration. At the conclusion of these tasks the study will be finalised and put forward as a significant technical input to the GWRC led Hutt Corridor Plan review where full public consultation and hearings will take place.