Cross Valley Transport Connections

PROGRAMME BUSINESS CASE

Prepared by Cardno for
Hutt City Council

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Cardno

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TE AWA KAIRANGI

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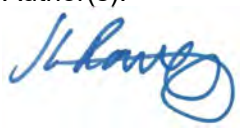

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Glossary of Terms

Term	Definition
BCR	Benefit Cost Ratio
DSI	Death and Serious Injury
EEM	Economic Evaluation Manual
FAR	Funding Assistance Rate
GWRC	Greater Wellington Regional Council
HCC	Hutt City Council
HCV	Heavy Commercial Vehicle
HILP	High Impact Low Probability Event
IAF	Investment Assessment Framework
ILM	Investment Logic Mapping
ITS	Intelligent Transport Systems
KPI	Key Performance Indicator
LIHP	Low Impact High Probability Event
LTP	Long Term Plan
LoS	Level of Service
MCA	Multi Criteria Assessment
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NZTA	Waka Kotahi NZ Transport Agency
ONRC	One Network Road Classification
PBC	Programme Business Case
PESTLE	Political, Economic, Social, Technological, Legal and Environment
PIKB	Planning and Investment Knowledge Base
PSG	Project Steering Group
PT	Public Transport
RLTP	Regional Land Transport Plan
RPTP	Regional Public Transport Plan

Term	Definition
RMA	Resource Management Act
SSBC	Single Stage Business Case
SMART (objectives)	Specific, measurable, assignable, realistic and time-related
TDM	Travel Demand Management
TREIS	Traffic Road Event Information System - Transport Agency incident database that records reported events that disrupt highway traffic
VPD	Vehicles per day

1 Executive Summary

1.1 Introduction

This Programme Business Case (PBC) sets out the investment case for improving the transport system in southern Lower Hutt (the Project Study Area) for the next 20 years.

Hutt City Council (HCC) commenced development of the PBC in 2019, following the development of a strategic case in 2016 and the Lower Hutt Growth Story in 2018. A key feature of its development has been the contributions made by stakeholders and representatives from Waka Kotahi NZ Transport Agency (NZTA) and Greater Wellington Regional Council (GWRC) at various workshops / meetings.

Through the PBC process, problems, benefits and programmes (or packages) of transport improvements were identified and assessed. Ultimately, an emerging preferred programme was identified for further and more detailed business case assessment.

1.2 Problems, Benefits and Investment Objectives

The key problems, benefits and investment objectives were identified through a stakeholder workshop process as well as through direct engagement with NZTA and GWRC. Through this engagement process it was agreed that the problem and benefit statements identified in the Petone Esplanade Strategic Case (2016) needed updating. It was also agreed that investment objectives needed to be identified to support the development of the PBC.

The problems

The first problem identified through the engagement process is as follows:

Problem Statement One: Lack of transport network resilience (75% weighting)

Southern Lower Hutt's transport network lacks resilience to major natural events, future sea level rise, and regular network interruptions, which will cause economic and / or social disruption for Lower Hutt and the Wellington region.

The majority of the Project Study Area is at significant risk from large earthquakes and earthquake related risks, such as, liquefaction and tsunami. Flooding and sea level change have also been identified as significant risks for the Project Study Area. The evidence supporting this problem statement identified that if any of these risks were to occur, it was likely that the transport system would be significantly damaged or out of action for an extended period. In the case of a large earthquake, it is predicted that the road network within the Project Study Area would take weeks or months to be repaired. Such an outage would have significant impacts on the Area's ability to recover from both a lifeline, social and economic perspective.

The Wellington Lifelines PBC (2019), estimated that a 7.5 magnitude movement on the Wellington Fault line would render key transport connections within the Project Study Area, such as The Esplanade, unusable for weeks, due to the physical damage that would be sustained. Such an outcome would greatly hinder lifeline emergency service responses in the short term. In the longer term, social and economic recovery would be significantly delayed for the local communities within the Project Study Area, as well as for its surrounding communities (e.g. Eastbourne and Wainuiomata).

The economic losses following a large earthquake event in the Wellington region have been estimated to be significant. For example, the Wellington Lifelines PBC estimated that such an

event would result in the New Zealand economy losing about $16B over a 5-year period. It is likely that a significant proportion of this predicted economic loss would result from severed transport connections within the Project Study Area.

Significant social and well-being impacts could also be expected following a large earthquake. Such impacts would result from restricted access to lifeline / community services as well as people becoming isolated from families and friends for long periods of time.

The second problem identified through the engagement process is as follows:

Problem Two: Limited access (25% weighting)
The existing transport system in southern Lower Hutt:

- *limits modal choice*
- *constrains access to social and economic opportunities*
- *creates safety issues for active mode users*

For Problem Statement Two, the supporting evidence indicates that high traffic volumes on the key arterials within the Project Study Area at peak travelling times is causing travel time variability issues for all transport modes. In particular, travel times for buses, heavy commercial vehicles and private motor vehicles is unpredictable. The evidence identifies that Hutt Road, and in particular The Esplanade, are the main arterials that have the most unpredictable travel times. For The Esplanade, travel time variability is expected to further deteriorate over time due to population and employment growth, and it is currently predicted that this road's level of service (affecting all road based modes of transport) will decline from E to F by 2036.

Despite the travel time variability issues on key arterial roads, travel by private motor vehicle remains the preferred mode of choice (e.g. 73 percent of journey to work trips are made by car). Key reasons why travel by car remains the first choice include:

- Lack of alternative travel options
- Layout of the existing transport network
- Connectivity with public transport and multi-modal travel options
- Public transport is seen as less attractive in comparison to the private vehicle, particularly during peak times, when public transport services are often operating at or above capacity. As such, the private vehicle is seen as more affordable, reliable and convenient.

Through the development of the PBC, key stakeholders identified that unpredictable travel times were resulting in the Project Study Area becoming less attractive as a place for potential residents and businesses to remain in or to re-locate to. This is because travel time variability impacts directly on people's commute times (whether they are travelling to or from work or to community services), and on businesses commercial bottom lines. To this end, HCC has expressed concern that if travel time variability on key arterials is not addressed, it may lead to a decline in residential / business investment in the Project Study Area.

For vulnerable road users, the PBC identified that The Esplanade was a key crash "hot spot" for cyclists and to a lesser extent pedestrians. A key contributing factor in many of the crashes has been the high number of private motor vehicle turning movements on The Esplanade. Through development of the PBC, it has been highlighted that high traffic volumes on The Esplanade has led to a perception that the road is unsafe for walking and cycling. In turn, discouraging people from walking, cycling and / or using micro-mobility devices to travel either along or across The

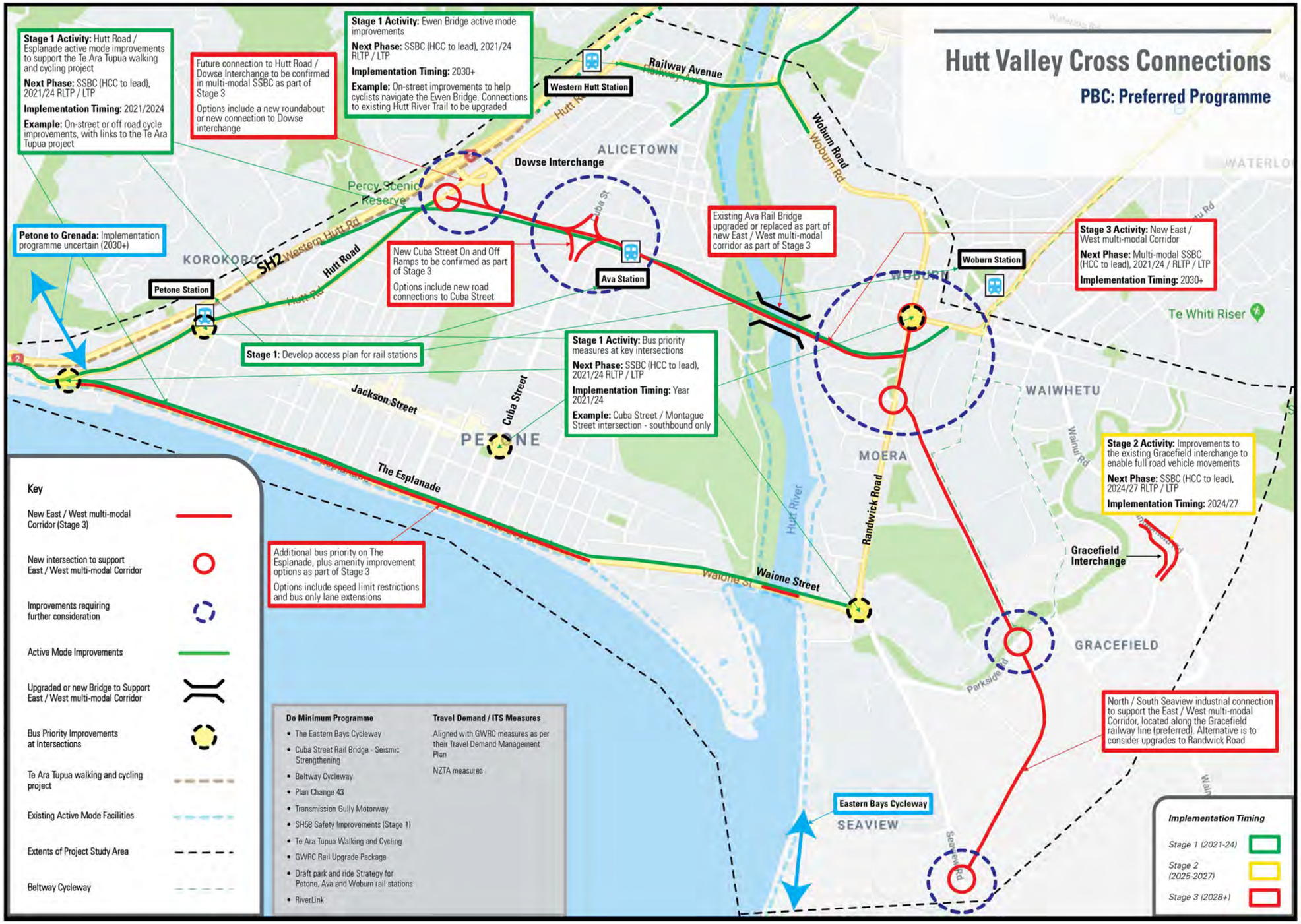
Esplanade or to access the Petone Foreshore. In addition, the PBC also identified that a lack of active mode options for crossing the Hutt River and Hutt Valley Rail Line was preventing the greater uptake of walking and cycling within the Project Study Area.

Estuary (Waione Street) Bridge

Through the problem statement development process, the Estuary (or Waione) Bridge was identified as being susceptible to both resilience and access problems. For example, the Wellington Resilience PBC 2018 identified that this bridge would be subject to significant lateral movement (and therefore damage) following a large earthquake. In addition, the evidence collected for this PBC has identified that the limited capacity of the bridge was causing a "bottleneck" on the road network, which was expected to deteriorate in the future, and the existing active mode facilities on the bridge were considered to be of poor quality.

Figure 1 summarises the key problems affecting the transport network in the Project Study Area.

Figure 1 Key Problems, Risks or Issues



Through the engagement process, the following key benefit statements were identified:

- *Improved transport network resilience (50% weighting)*
- *Improved transport choices to encourage mode shift (25% weighting)*
- *Improve accessibility and safety (15% weighting)*
- *Improved development opportunities for urban growth areas in southern Lower Hutt (10% weighting)*

The Investment Objectives

Following development of the problem and benefit statements, two investment objectives were identified through the engagement process. These included:

- *To improve the resilience of southern Lower Hutt by enhancing the transport networks ability to withstand and respond in a timely manner to HILP and LIHP events*
- *To improve access to and from key destinations and key urban growth areas in southern Lower Hutt*

1.3 The Opportunities

The Project Team identified the following opportunities for the Project Study Area, if the above resilience and access problems were to be addressed:

- Lower Hutt and the wider Wellington region would be better prepared for High Impact Low Probability (HILP) events, such as large earthquakes, and for the long-term effects of climate change (e.g. sea level rise). Preparing for such events will help to mitigate their likely adverse economic impacts, improve people's access to lifeline services, and reduce the likely social costs that will result from long-term isolation from friends and family
- Lower Hutt would be better prepared for Low Impact High Probability (LIHP) events such as crashes, road accidents (spills) and construction works. Increasing the redundancy of the transport network throughout the Project Study Area would help to mitigate the economic impacts and network delays that can be expected from such an event
- Improved travel time reliability on the key arterial roads for buses, heavy commercial vehicles and general traffic is likely to further support economic development in Lower Hutt, and encourage increased use of bus services
- More viable / reliable transport choices for people within the Project Study Area, including reducing travel obstacles that some people may experience (e.g. elderly and lower socio-economic cohorts).

Addressing the resilience and access problems will also help to realise the vision, objectives and goals of key strategic documents, such as, HCC's Petone Spatial Plan 2040 and the Wellington Lifelines PBC 2019.

1.4 Developing Responses to the Challenges

To address the problems and to realise the investment objectives, a long list of transport improvement alternatives / options was first identified. The long list included network optimisation through to physical improvements. The long list was then subjected to a Stage 1 multi-criteria assessment (MCA) evaluation process in order to identify a short list of options.

The short listed alternatives / options were then packaged into four "themed" programmes, as well as identifying a do-minimum programme. Each programme's theme was based on an "anchor resilience project" – an additional crossing of the Hutt River to improve both resilience and east-west multi modal connections. Additional multi modal interventions that weren't already included in the do-minimum were then added to each programme in order to ensure all aspects of the investment objectives were achieved. Each programme was then assessed through a Stage 2 MCA evaluation process, which ultimately resulted in an emerging preferred programme – or package of transport improvements - being identified as the best performing combination of alternatives / options.

There were two key features of the Stage 2 evaluation process. Firstly, it was recognised that there were a number transport improvement activities identified in the do-minimum programme that were "already in place" to improve the transport system within the Project Study Area. As such, the emerging preferred programme needed to build upon these activities, rather than to replicate or duplicate them. Secondly, following the identification of the preferred programme, it was recognised that a number of the individual interventions that had been included in the lesser performing programmes could add value in achieving the investment objectives. Accordingly, these "value add" interventions were included in the emerging preferred programme.

1.5 The Emerging Preferred Programme

The emerging preferred programme is proposed to be staged over a 20-year time frame. The programme is expected to address the problems and achieve the investment objectives, whilst strategically supplementing the transport improvements that are already being developed – the do-minimum programme.

In addition to aligning with the committed improvements within the Project Study Area, the emerging preferred programme also aligns with the broader transport improvements that are being considered. For example, the staging of the programme aligns with the timing of NZTA's potential improvements to the Ngauranga Triangle state highway network, and in particular the Petone to Grenada Link Road project. If this project is to be progressed as the preferred solution, then significant additional benefits, beyond those identified in this PBC, could be expected from the emerging preferred programme.

Table 1 outlines the emerging preferred programme and its proposed staging.

Table 1 Emerging Preferred Programme Staging

Stages	Timing	Key activities
Stage 1	2021/22 to 2024/25	Active mode improvements on The Esplanade, Hutt Road and Ewen Bridge (Jacobs Micromobility SSBC) New active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project
		Bus priority improvements at following key intersections: ► The Esplanade / Hutt Road ► Hutt Road / Jackson Street ► Jackson Street / Cuba Street ► Randwick Road / Waione Street ► Randwick Road / Whites Line East
		Train station access plans to improve active mode and micro-mobility access to the Petone, Ava and Woburn Train Stations

Stages	Timing	Key activities
Stage 2	2025/26 to 2027/28	Improvements to the existing Gracefield Interchange to allow for full movements for all road based vehicles
Stage 3	2028/29+	New east / west multi-modal transport corridor on a Wakefield Street to Whites Line / Randwick Road alignment, including: ► An upgraded or replaced Ava Rail Bridge ► New or upgraded road connections to Seaview / Gracefield ► Cuba Street connections (e.g. on / off ramps) ► Connections to the Dowse Interchange / Hutt Road ► Bus priority (e.g. bus lanes) on The Esplanade (once the new east-west multi-modal transport corridor is in place).

A key feature of Stage 3 is the recommendation that its implementation coincides with the implementation of major improvements to the "Ngauranga triangle state highway system",[1] such as, the P2G Link Road project. The key reasons for this recommendation are as follows:

- the transport benefits (resilience, access and increased capacity) of the new east-west multi-modal transport corridor are not likely to be fully realised until the level of service improves on SH2, between the Melling and Ngauranga Interchanges, during peak traveling times
- without a new east-west multi-modal transport corridor in place, east-west through traffic will continue to use The Esplanade, which in turn significantly limits the ability to implement major bus priority measures (or placemaking measures) in Petone.

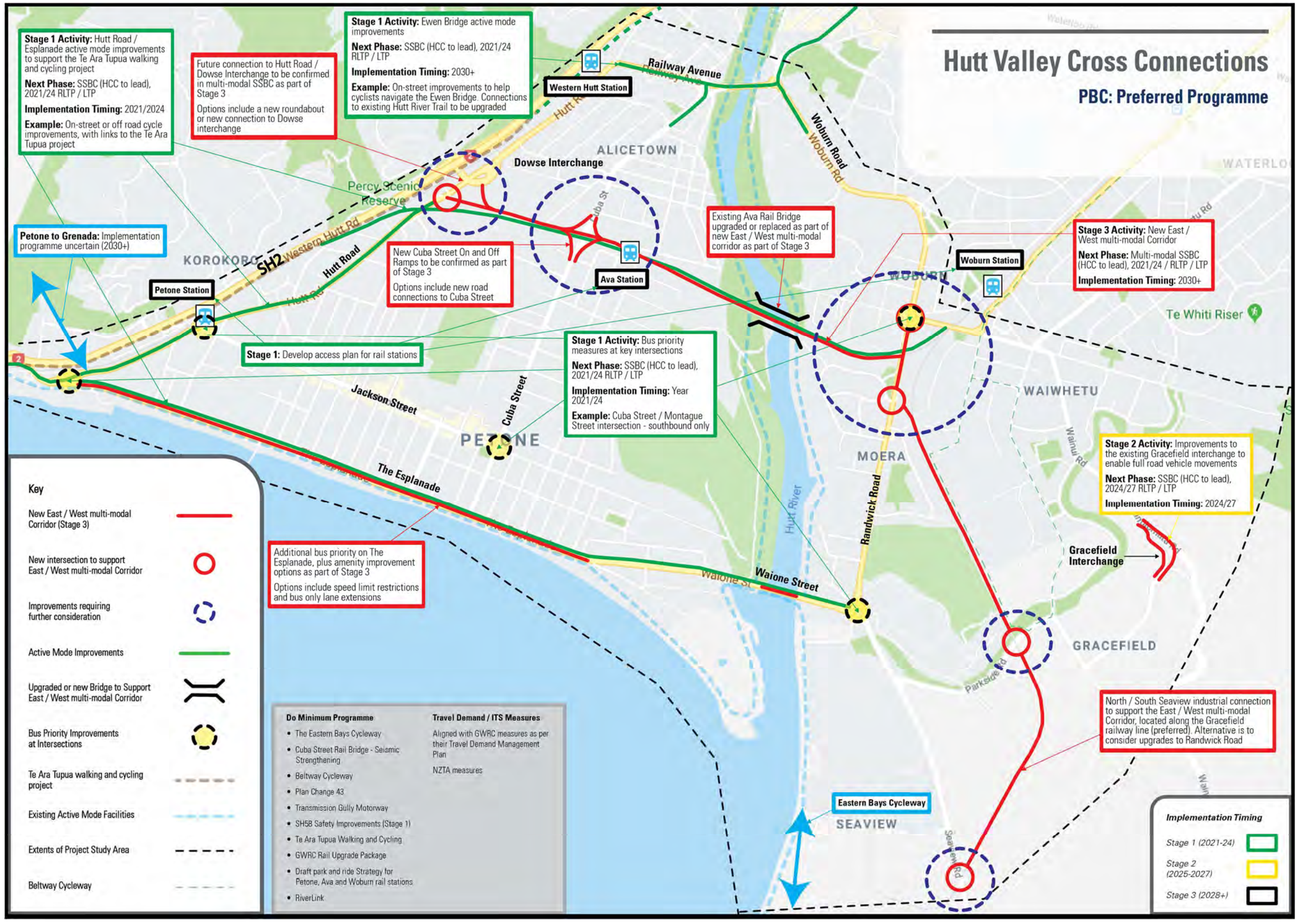
Taking a staged approach allows for each phase of the programme to be evaluated / assessed by the investment partners before committing to the next stage (e.g. Stages 2 and / or 3).

Taking such an approach also provides the investment partners with the option to bring forward a component of Stage 2 or 3 if required. For example, if NZTA decide to advance its business case for improving the Ngauranga Triangle state highway system, then the business case(s) identified for Stage 3 could also be brought forward. Despite generating standalone transport benefits, it is also noted that taking a staged approach provides the investment partners with the option of progressing both Stages 2 and 3 as a package rather than separately as currently proposed.

Figure 2 summarises the emerging preferred programme.

[1] The Ngauranga triangle state highway network currently comprises of SH2 (between the SH58/2 and Ngauranga interchanges), SH1 (Ngauranga and Plimmerton) and SH58

Figure 2 Emerging Preferred Programme



1.6 What will the Emerging Preferred Programme cost?

The cost to implement the entire emerging preferred programme is estimated to be between $100M and $160M.

Table 2 sets out the expected and 95th percentile cost estimates (i.e. risk adjusted) for each stage of the emerging preferred programme.

Table 2 Expected and 95th Cost Estimates for the Emerging Preferred Programme

Stage	Expected Cost	95th Cost Estimate
Stage 1 - Activity mode and bus priority improvements	$17,000,000	$26,000,000
Stage 2 – Gracefield Interchange upgrades	$8,000,000	$15,000,000
Stage 3 – New multi-modal transport corridor and wider bus priory improvements	$75,000,000	$114,000,000
Emerging preferred programme cost	**$100,000,000**	**$160,000,000**

It is important to note that the cost estimates for implementing the emerging preferred programme are indicative only. Confidence in the programme costs will be improved following the completion of each investigation stage.

1.7 What are the Transport and Economic Benefits?

The emerging preferred programme's benefit cost ratio (BCR) ranges between 3.6 and 5.3. The higher BCR including wider economic benefits (WEBs), land value uplift and resilience benefits.

Sensitivity testing was undertaken to ensure the BCR was robust under different scenarios. This testing process showed that the sensitivity of the standard BCR (i.e. 3.6) ranged from 2.2 to 8.3, and the sensitivity of the BCR with WEBs ranged from 3.2 to 12.1.

1.8 The Key Investment Outcomes

Table 3 sets out how each stage of the emerging preferred programme is expected to address each investment objective.

Table 3 Anticipated Investment Outcomes

Key investment outcomes	How the investment outcomes will be achieved?	Investment Objective 1	Investment Objective 2	Improved transport network resilience	Improved transport choices to encourage mode shift	Improved accessibility and safety	Improved development opportunities for urban growth areas in southern Lower Hutt
Stage One							
► Improved walking and cycling facilities, including ensuring connections to and from the Te Ara Tupua Walking and Cycling Project are safe and efficient. Such an outcome will also provide health and climate change benefits ► Key "crash hot spots" for vulnerable road users, such as cyclists, will be improved ► East-west travel time variability improved as a consequence of improved / new bus priority measures at key intersections ► Walking, cycling and micro-mobility access improvements at the	► By improving active mode facilities along The Esplanade, Hutt Road and across Ewen Bridge. In addition, a new active mode route could be provided that will connect with the Te Ara Tupua walking and cycling project ► By reducing the number of pedestrian (75) and cycling (77) crashes that have been recorded over the past 5 year period. This will be achieved through addressing the key causal factors for these crashes ► By improving bus travel time variability through implementing new or additional bus priority at key locations, including; Randwick Road / Whites Line East, Randwick Road / Waione Street, Jackson Street / Cuba Street, Jackson Street / Hutt Road and The Esplanade / Hutt Road		✓		✓ ✓	✓ ✓	✓

Key investment outcomes	How the investment outcomes will be achieved?	Investment Objective 1	Investment Objective 2	Improved transport network resilience	Improved transport choices to encourage mode shift	Improved accessibility and safety	Improved development opportunities for urban growth areas in southern Lower Hutt
Petone, Ava and Woburn Train Stations. Such an outcome will also provide health and climate change benefits	► By completing Train Station Access Plans to improve the ability of people to walk, cycle or use micro-mobility devices to access train stations within the Project Study Area				✓		
Stage Two							
► Improved travel efficiency for all road based vehicles travelling to and from Wainuiomata as a result of enabling full movements to occur at the Gracefield Interchange	► By improving travel times between Wainuiomata and Gracefield	✓	✓	✓		✓	
Stage Three							
► Improved response and recovery to HILP events through providing additional network redundancy (including ensuring that access to	► By creating a new east-west multi-modal transport connection (outside of the HILP risk areas) will enable Lower Hutt and the wider Wellington region to better respond to, and recover from, HILP events. There is the option of connecting the new east-west	✓	✓	✓		✓	✓

Key investment outcomes	How the investment outcomes will be achieved?	Investment Objective 1	Investment Objective 2	Improved transport network resilience	Improved transport choices to encourage mode shift	Improved accessibility and safety	Improved development opportunities for urban growth areas in southern Lower Hutt
vital lifeline services, such as, the Seaview Fuel Depot, is resilient) ► Assists in responding to the predicted impacts of long-term sea-level change ► Improves active mode and micro-mobility access to the Petone Foreshore (which has health benefits and climate change benefits) ► Improves access to and through Petone (in particular, The Esplanade), Seaview / Gracefield and North Park. It also improves access to the Wainuiomata and Eastbourne areas, which are heavily reliant on the performance of the transport connections through the Project Study Area	route through to Seaview / Gracefield, which would provide additional resilience benefits for this area as well as for Eastbourne and Wainuiomata ► By providing a new east-west multi-modal transport connection, travel times on the new road, as well as on the existing network (i.e. The Esplanade) are expected to be more predictable and reliable ► By improving safety for all transport modes using The Esplanade as well as improving access to the Petone Foreshore. These benefits will be realised as it is expected that vehicle traffic will transfer from The Esplanade to the new east-west multi-modal transport connection				✓	✓	✓

In addition to the outcomes identified above, the emerging preferred programme will give effect to the development and growth aspirations set out in various HCC strategic documents, such as, the Petone Spatial Plan 2040. It also helps to give effect to the objectives and recommendations identified in the Wellington Lifelines and Wellington Transport Resilience PBCs.

1.9 What are the key Programme Risks?

Technical, operational, financial and stakeholder risks were identified during development of the PBC. Most of these risks stem from the high-level nature of the PBC assessment in general. As such, there will be an improved understanding of these risks once they undergo more detailed examination during the next steps of the prescribed business case process.

It is recommended that further stakeholder engagement is undertaken prior to finalising the emerging preferred programme. This will help to ensure that stakeholders are in full support of the final business case.

1.10 Where to Next?

The next steps for the emerging preferred programme are summarised in Table 4. The exact timing of the next steps is subject to future funding decision making processes, including those to be made through the future HCC's long-term plans, GWRC's regional land transport plans, and NZTA's national land transport plans.

Table 4 Emerging Preferred Programme Implementation Strategy

Stage	Next Business Case Stage (including leads)	Expected Implementation Timing
Stage 1	2021-2024: Active Mode and Bus Priority Single Stage Business Cases (HCC to lead) 2021-2024: Train Station Access Plans for the Petone, Ava and Woburn Train Stations (GWRC / HCC to lead)	2024 to 2027 2021 - 2024
Stage 2	2024-2027: Gracefield Interchange Single Stage Business Case (HCC to lead)	2028 to 2031
Stage 3	2028-2030 (plus): East-West Multi-Modal Transport Corridor Single Stage Business Case, including Bus Priority on The Esplanade (HCC to lead)	2029+ (to align with "Ngauranga Triangle" state highway improvement projects)

The next immediate step is to develop detailed scopes for the proposed Bus Priority SSBC and train station access plans, and then to include their relevant funding requirements in both HCC's Long Term Plan and GWRC's Regional Land Transport Plan to be developed in late 2020. For the Active Modes SSBC, it is noted that Jacobs are currently undertaking a micromobility SSBC for the Lower Hutt region. The proposed active mode options / alternatives identified on The Esplanade, Hutt Road and Ewen Bridge in this PBC, will be aligned and included within Jacobs micromobility SSBC. In addition, it will be important to monitor the progress of the resource consent process for the Te Ara Tupua Walking and Cycling Project (for the Petone to Ngauranga section), and timing of when NZTA might re-start its investigation work for improving the Ngauranga Triangle state highway system (specifically Petone to Grenada Link Road).

In addition, it is recommended that a governance group (consisting of HCC, NZTA and GWRC) be established to oversee delivery of the emerging preferred programme.

2 Part A The Strategic Case

2.1 Introduction

This Programme Business Case (PBC) sets out the case for investment for the Cross Valley Transport Connections Project (the Project) for the next 20 years.

The purpose of the PBC is as follows:

- revisit the strategic context for the Project, including previous problem statements
- re-examine the evidence base for the key problems and rationale for investing
- identify and assess options and alternatives to address the problems, and achieve the investment objectives
- recommend a programme or package of activities to be further investigated in the next stages of the business case process.

2.1.1 Project Study Area

As set out in Figure 3, the PBC's Project Study Area covers the southern part of Lower Hutt City.

Figure 3 Boundary of the Project Study Area

As agreed during the point of entry (PoE) discussions with NZTA, the Project Study Area would be enlarged from the area originally considered for the Petone Esplanade Strategic Case (2016).

2.1.2 PBC Time Horizon

The PBC, and in particular the development and identification of the emerging preferred programme, has been developed to be staged over a 20-year period.

2.2 Strategic Context

The development of this PBC has been predicated on The Petone Esplanade Strategic Case (2016) as well as the Lower Hutt Growth Story (2018).[2]

This section outlines key elements of The Petone Esplanade Strategic Case. The key elements of the Lower Hutt Growth Story are detailed in Section 2.6.3 of this report.

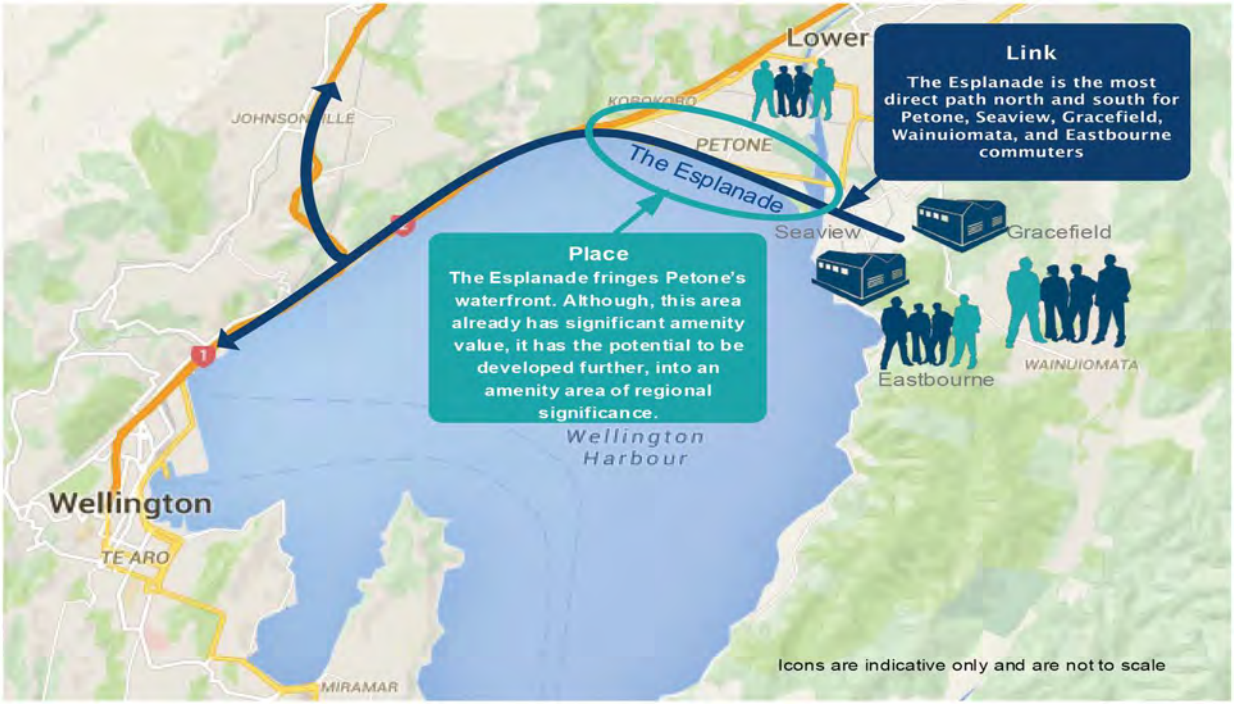
2.2.1 Petone Esplanade Strategic Case

In 2016, HCC and NZTA jointly developed The Petone Esplanade Strategic Case. As agreed at the time, the geographical scope for this strategic case was limited to The Esplanade.

The strategic case identified the following key matters:

- The Esplanade sits in a strategically valuable location
- The Esplanade has two distinct functions (see Figure 4):
  - it is a major arterial, conveying over 25,000 vehicles per day (vpd), and provides an essential 'link' between Lower Hutt's southern areas, the rest of the Wellington region, and New Zealand
  - it provides access for all transport modes to the Petone Foreshore, and is of significant value as a 'place' to visit and enjoy for Lower Hutt and the wider Wellington region.

Figure 4 Petone Esplanade Strategic Location and Key Functions

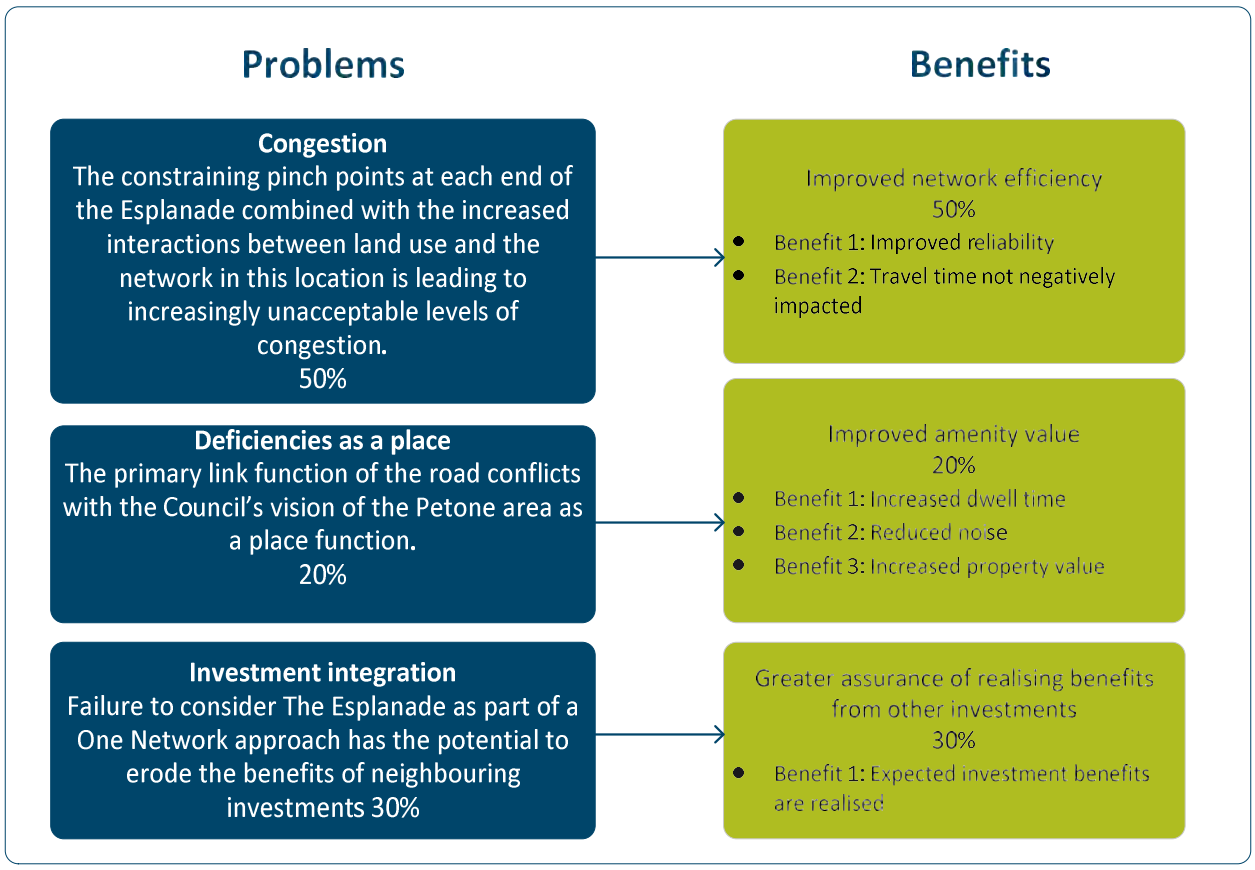


[2] See - http://iportal.huttcity.govt.nz/Record/ReadOnly?Tab=3&Uri=5055959

2.2.1.1 Problem and Benefit Statements

Figure 5 below sets out the problem and benefit statements identified in The Petone Esplanade Strategic Case.

Figure 5 Petone Esplanade Strategic Case Problem and Benefit Statements



The key evidence that supported the original Problem Statement One is summarised as follows:

- Google travel times along The Esplanade showed unpredictable travel times during peak periods as well as variable travel times across other time periods
- NZTA's travel time surveys showed low average speed when travelling along The Esplanade in the morning peak, including a number of stop start movements
- Comparing travel times from travel time surveys showed an increase in travel times across The Esplanade, including the 2014 survey showing the maximum congestion calculable with the given methodology.

The key evidence that supported original Problem Statement Two is summarised as follows:

- The Esplanade negatively impacts on the amenity of The Esplanade by means of severance
- Stakeholder surveys indicated that the transport performance of The Esplanade is considered to be detrimental for Petone
- HCC strategic planning documents seek to maximise the amenity value of the Petone foreshore.

The key evidence that supported original Problem Statement Three is summarised as follows:

- At the completion of the Strategic Case (in 2016), there were eight transport projects being investigated, all within a 15km radius of the Petone Foreshore
- Projects, such as the Melling Interchange and Petone to Grenada (P2G) Link Road (if progressed as the preferred solution), would directly influence the movement of transporting goods and people across the Hutt Valley, including along The Esplanade.

2.2.1.2 Key Recommendations

The Petone Esplanade Strategic Case identified that there was a case for change, and in particular there was an opportunity to improve the overall social, economic and transport outcomes for Lower Hutt.

The report also identified that there was growing realisation that maintaining a "do nothing" approach beyond the medium term would be unsustainable, and predicted the following results were likely to occur within ten years if this approach was to continue:

- Increasing congestion along The Esplanade
- Lost opportunities for developing The Esplanade's amenity potential
- Benefits to be generated from other elements of the transport network may not be optimised
- The regional network may be end up being sub-optimally configured.

At the time of approval, the Petone Esplanade Strategic Case identified that the problems and benefits were aligned with the strategic direction of both HCC and NZTA. The strategic business case recommended that the next business case phase be an indicative business case.

2.3 Partners and Key Stakeholders

2.3.1 Investment Partners

Table 5 sets out the key investment partners involved in development of the PBC.

Table 5 Investment Partners for the PBC

Investment Partner	Focus Areas
HCC	HCC is responsible for planning, maintaining and operating the local road and active mode networks within Lower Hutt City, including within the Project Study Area (as detailed below). Its responsibility also covers provision of key public transport infrastructure, such as bus stops and bus lanes. HCC is an Approved Organisation under the Land Transport Amendment Act 2003. As such, along with NZTA, HCC is a co-investor in the Project Study Area's road and active mode transport system. Its investment processes are identified through its long term and annual planning processes as well as through regional land transport planning processes. It is noted that any investment proposed by this PBC, would ultimately need to be included in these plans and processes in order to be advanced. HCC is also responsible for the urban development planning of Lower Hutt City, including decision-making processes under the Resource Management Act (RMA).
Waka Kotahi NZ Transport Agency	Under the Land Transport Amendment Act 2003, Waka Kotahi NZ Transport Agency (NZTA) is responsible for planning and investing in the transport system (e.g. through the national land transport programme), including planning, operating and maintaining the state highway network. A key focus for NZTA is on providing an integrated land transport system to help people get the most out of life and to support business. It has identified three strategic responses – system response, a people-centric response, and a community response – in order to deliver value for New Zealand. As an investment partner to this PBC, NZTA is interested with the extent to which any investment from the national land transport programme creates a safe, resilient, well-connected multi-modal transport system. As such, NZTA will be a co-investor in any transport improvements recommended by this PBC. It is also concerned with how the emerging preferred programme will integrate with the operations of SH2, and wider state highway system.

Investment Partner	Focus Areas
GWRC	GWRC is the lead agency for the provision of public transport services within the Wellington region, including within the Project Study Area. It is responsible for developing and operating the Wellington Regional Transport Plan, Wellington Public Transport Plan and Wellington Transport Strategy Model. For this PBC, GWRC is responsible for the passenger rail services (and rail stations) as well as for the Metlink bus services operating in the Project Study Area. As such, GWRC will be a key public transport investment partner for this PBC. It is noted that any new investment proposals identified in this PBC's emerging preferred programme (requiring national land transport programme funding), will need to be included in the Wellington Regional Transport Plan in the first instance.
KiwiRail	KiwiRail is responsible for planning, maintaining and operating rail infrastructure in the Wellington region, including providing the rail infrastructure needed to operate GWRC's rail services through the Project Study Area. KiwiRail also operates a freight rail service on the Hutt Valley Rail Line, and has a rail yard located in Gracefield and is accessed via the Gracefield Rail Line. In addition to obtaining funding through commercial sources for its rail infrastructure, KiwiRail secures funding through the national land transport programme.

2.3.2 Key Stakeholders

Table 6 sets out the key stakeholders involved in the PBC workshops.

Table 6 Key Stakeholders Involved in Development of the PBC

Key Stakeholder	Focus Areas
Petone Community[3]	To provide feedback on the likely view of the Petone community
Active Mode Representatives	To provide feedback on the likely views of cyclists and walkers
Automobile Association	To represent the views of road users
Road Transport Association	To represent the views of road freight operators

2.4 Changes from the Petone Esplanade Strategic Case

This section summarises the key strategic context changes between the Petone Esplanade Strategic Case and this PBC.

2.4.1 Point of Entry (PoE)

The Petone Esplanade Strategic Case proposed the next stage of the business case process be an indicative business case, However, following approval of the Petone Esplanade Strategic Case (and development of the Lower Hutt Growth Story) both HCC and NZTA agreed the geographical scope of the Project Study Area should be expanded significantly, to cover most of southern Lower Hutt. As such, the point of entry for the next stage of the business case process was upgraded from indicative to programme business case. Petone Esplanade Strategic Case

3 Represented at PBC Workshop One by David Basset who was the Deputy Mayor from 2010 to 2019

In addition, it was also agreed that a Project Steering Group (PSG) would be established to oversee the development of the PBC. This PSG was to comprise of senior managers from HCC, NZTA and GWRC.

2.4.2 Problem and Benefit Statement Changes

The Petone Esplanade Strategic Case and the Lower Hutt Growth Story problem and benefit statements were reviewed at PBC Workshop One (April 2019). The geographical scope of the PBC was also reviewed at this workshop.

After considering, the geographical scope for the PBC along with strategic and technical information, workshop attendees agreed that the problem and benefit statements identified in the Petone Esplanade Strategic Case and the Lower Hutt Growth Story needed to be updated. The new problem and benefit statements developed are detailed below in Sections 2.6 and 2.7 of this report.

2.5 Programme Context

This section outlines the key background context for the Project Study Area. In particular, it focuses on the geographic, environmental, economic, social, and transport context that are considered relevant to the PBC.

2.5.1 Geographic and Environmental Context

Key geographical and environmental features of the Project Study Area include:

- Hutt River – located through the centre of the study area
- Petone Foreshore and the Wellington Harbour – located to the south of the study area
- Wainuiomata Hill – located to the east of the study area
- Belmont Regional Park – located to the west of the study area
- Coastal regions within the study area are predicted to be affected by long term sea level rise

2.5.1.1 Geomorphology

The Hutt Valley is dominated by Wellington belt greywacke, and the area has been subjected to folding and faulting through numerous earthquake events over a long period of time. The degree of weathering and strength of the greywacke rock varies across the Hutt Valley.

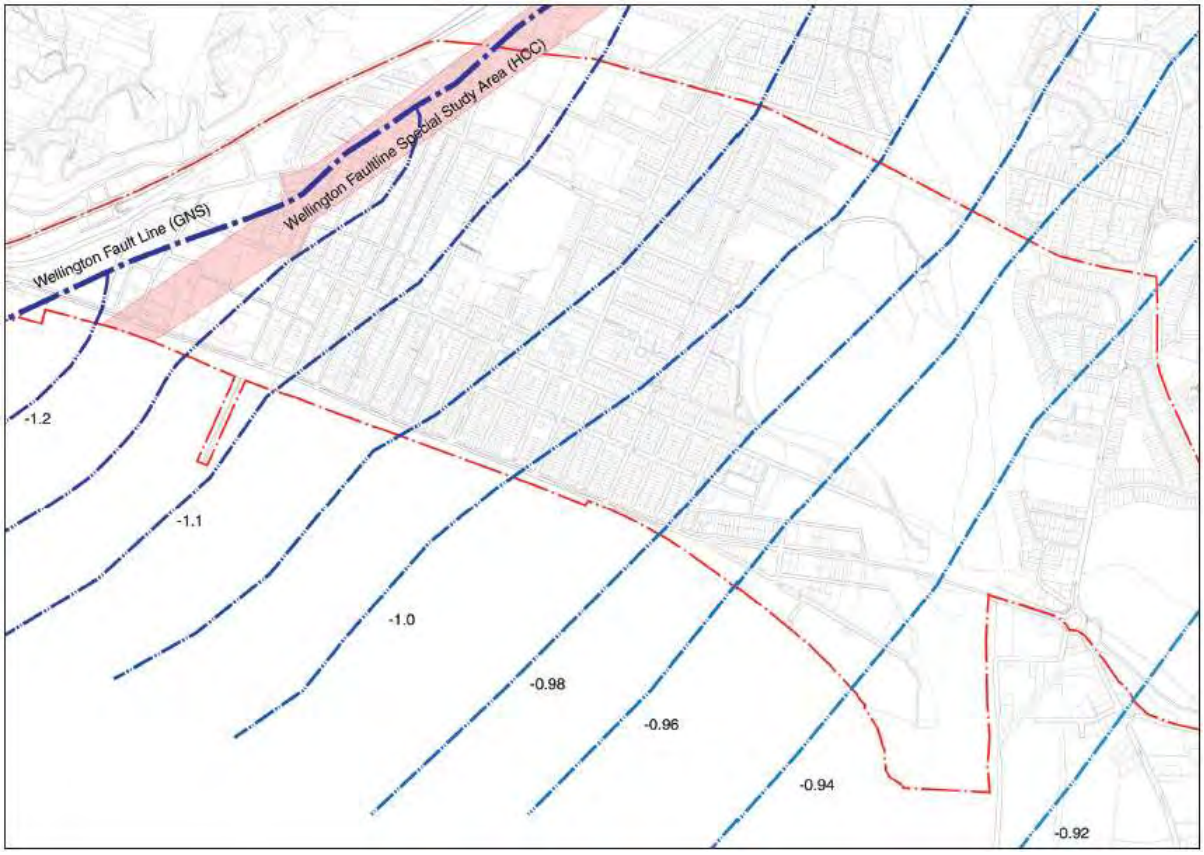
There is a variety of sedimentary basins within the Project Study Area (and its immediate surrounds) with the largest being the Lower Hutt - Port Nicholson basin, which is bound to the west by the Wellington Fault line and consists of a variety of sedimentary sequences up to a depth of 600m. Contained within this sequence is a complex aquifer system, with the main aquifer system within the Project Study Area being the Waiwhetū Artesian Gravels aquifer. This aquifer is a vital source of potable water for the Wellington region.

2.5.1.2 Seismicity

The Wellington region has experienced a number of earthquakes overtime, which have typically been caused by the convergence of the Pacific and Indian-Australian tectonic plates. Some of these earthquakes have induced severe faulting and earth movements resulting in a series of tilted blocks that now characterise the Wellington regional landscape. There are five known principal faults in the Wellington region – the Wellington, Ōhāriu , Wairarapa, Carterton and the Masterton fault lines. These faults are all active and capable of generating large earthquakes in the order of 7.5 to 8+ magnitude.

As set out in Figure 6, the Wellington Fault line is located along the western boundary of the Project Study Area.[4] The figure below also shows the approximate locations of the subduction zones associated with this fault line.

Figure 6 Location of the Wellington Fault line and subduction zones within the Project Study Area



The Wellington Fault line has a recurrence interval of 1,100 years for a 7.5 magnitude earthquake event.

It is noted that the HCC District Plan has specifically designated the Wellington Fault line as a special study area, which is 150m wide. Within this area any new buildings are required to be located at least 20m away from the fault line.

2.5.2 Social Context

2.5.2.1 Population

Lower Hutt City is the second largest population centre in the Wellington region. Lower Hutt City's population in Census 2018 was 104,532, which is an increase of 6,294 (or 6.4% growth) since Census 2013. Stats NZ is predicting that the City's population will exceed 108,000 by 2033.[5]

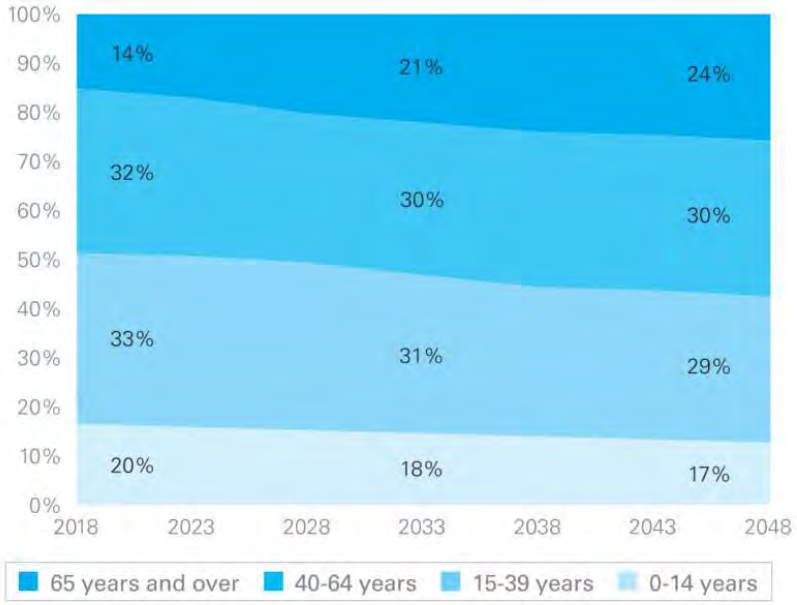
[4] Petone Spatial Plan 2040, 2017, page 68
[5] Based on Stats NZ's medium population projection. See - http://nzdotstat.stats.govt.nz/wbos/Index.aspx?_ga=2.14237438.833157035.1562031195-288954809.1538599571#. At the time of issuing this document, StatsNZ still only has projections from 2013.

In terms of the Project Study Area, Census 2018 recorded that about 18,100 people were living in the Project Study Area, which is an increase of 1440 people (or 8.7% growth) since Census 2013.

2.5.2.2 Age Distribution

As set out in Figure 7, an aging population is one of Lower Hutt City's key demographic trends.

Figure 7 Projected Age Distribution in Lower Hutt between 2018 and 2048[6]



As indicated in Figure 7, the number of people aged 40 or over is expected to increase from 46 to 54% by 2048. Correspondingly, people below the age of 40 is expected to reduce from 53% to 46% by 2048. Figure 7 also suggests that almost one in four Lower Hutt residents will be aged 65 years or older by 2048.

HCC's Infrastructure Strategy (2018-2048) suggests this demographic change is likely to increase the number of one and two person households in the future, and there will be a reduction in average household size from 2.7 people today to 2.6 by 2048.[7]

2.5.2.3 Employment

Lower Hutt is the second largest employment centre in the Wellington region. The 2013 Census showed that there were around 37,200 jobs in Lower Hutt City, with 12,600 (or 34%) located in the Project Study Area.[8]

In terms of the Project Study Area, in 2015 there were approximately 1,000 businesses operating in Petone and around 450 businesses operating in the Seaview / Gracefield area.[9]

The percentage of industry types for the Petone and Gracefield areas, based on Census 2013, is tabulated in Table 7

[6] Hutt City Council Long Term Plan, 2018-2028, page 131. At the time of issuing this document, StatsNZ still only has projections from 2013.
[7] Infrastructure Strategy (2018-2048), 2018, page 26
[8] It is noted that employment data from Census 2018 has yet to be released by StatsNZ
[9] Economic development Plan, November 2015, page 30

Table 7 Industry Types in Study Area

Area	Manufacturing	Construction	Wholesale, Retail and Food	Transport and Warehousing
Petone	23%	11%	20%	12%
Gracefield	18%	10%	27%	5%

Area	Professional and Technical Services	Education	Finance, Insurance and Admin. Services	Other
Petone	16%	0%	5%	11%
Gracefield	8%	6%	10%	16%

2.5.2.4 Schools

There are a number of primary / intermediate schools located within the Project Study Area and include; Petone, Wilford, Sacred Heart, Hutt Central and Randwick schools. Hutt Valley High School is also located on the northern boundary of the Project Study Area (it has a student roll of about 1,600).

In terms of tertiary education, the Wellington Institute of Technology is based in Petone. It has a student roll of over 8,500 students (which is equivalent to about 4,000 full-time students).

2.5.2.5 Hospitals

There are no major hospitals located within the Project Study Area. The Hutt Hospital is located to the north of the Hutt CBD (and outside of the Project Study Area).

2.5.3 Economic Context

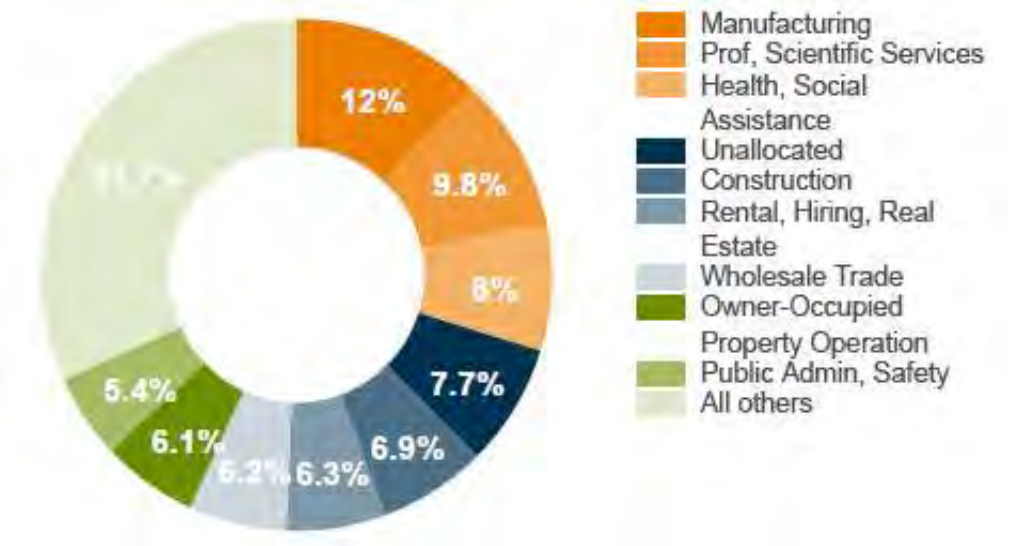
Lower Hutt City Annual Economic Profile 2018[10] identified the following for Lower Hutt:

- GDP in Lower Hutt measured $4.9B for the year ending March 2018, up 2% from a year earlier (it is noted that New Zealand's GDP increased by 3.2% over the same period)
- Economic growth in Lower Hutt has averaged 0.3% per annum over the past 10 years compared with an average of 2.1% per annum for the national economy
- Lower Hutt City accounted for 2.1% of national GDP in 2018 (and was 16% of the entire Wellington GDP in 2015).[11]

Figure 8 sets out the industry proportion of GDP in Lower Hutt City for 2018.

[10] Ibid, page 2
[11] The Wellington Region Situation analysis 2015: A snapshot, February 2016 (see - http://www.gw.govt.nz/assets/WRS-files/The-Wellington-Region-Situation-Analysis-2015_2.pdf)

Figure 8 Industry Proportion of GDP (March 2018)



As indicated above in Figure 8, manufacturing was the largest industry type in Lower Hutt, accounting for 12% of GDP. The second largest type was professional, scientific and technical services (accounting for 9.8% of GDP) followed by health care and social assistance (accounting for 8%).

In terms of the Project Study Area, big box retail in western Petone attracts up to 30% of Wellington region's annual big box spend.[12]

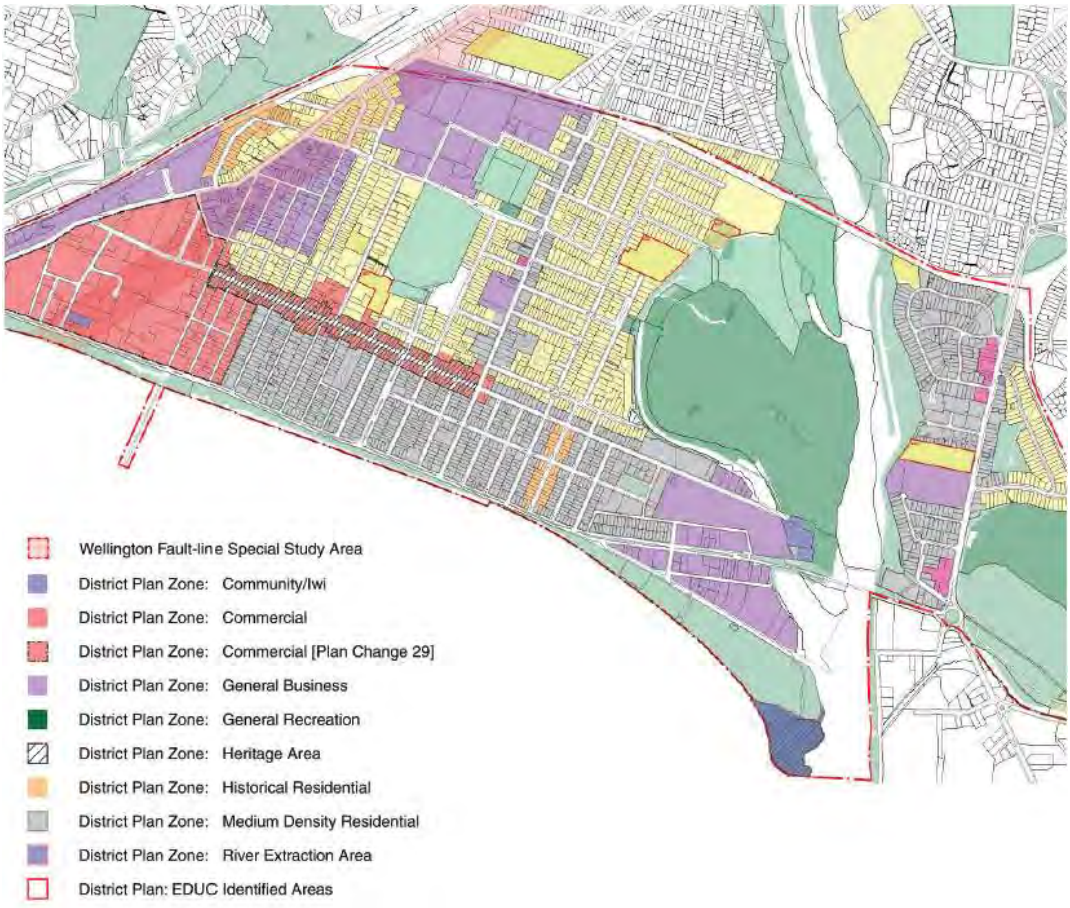
2.5.4 Land Use Context

2.5.4.1 Petone / Morea

The suburbs of Petone and Morea are fully located within the Project Study Area. Figure 9 sets out the key land uses identified in the HCC District Plan for both suburbs. In summary, commercial / industrial, residential and mixed uses are the main land use activities in these suburbs.

[12] Lower Hutt Story Growth Story, 2018, page 3

Figure 9 HCC District Plan's Map of Petone[13]



Jackson Street has well established retail / commercial activities facilities (including big box retail), as well as a number of cafés, restaurants and pubs. As indicated in Figure 9, Jackson Street (from Victoria to Cuba Street) is a Heritage Area in the HCC District Plan.

There are a number of recreational facilities located throughout Petone and Morea, including: The Petone Recreation Ground, Memorial / Sladden Parks, McEwan Park and the Hutt Park (which includes access to the Top 10 Holiday Park).

The Petone Foreshore is also a well-established local and regional recreational attraction. In addition to the foreshore itself, other key features of this location include the Honiana Te Puni and Hīkoikoi Reserves and the Petone Settlers Museum (Te Whare Whakaaro o Pito-one). A number of accommodation facilities are located along The Esplanade.

2.5.4.2 Seaview / Gracefield

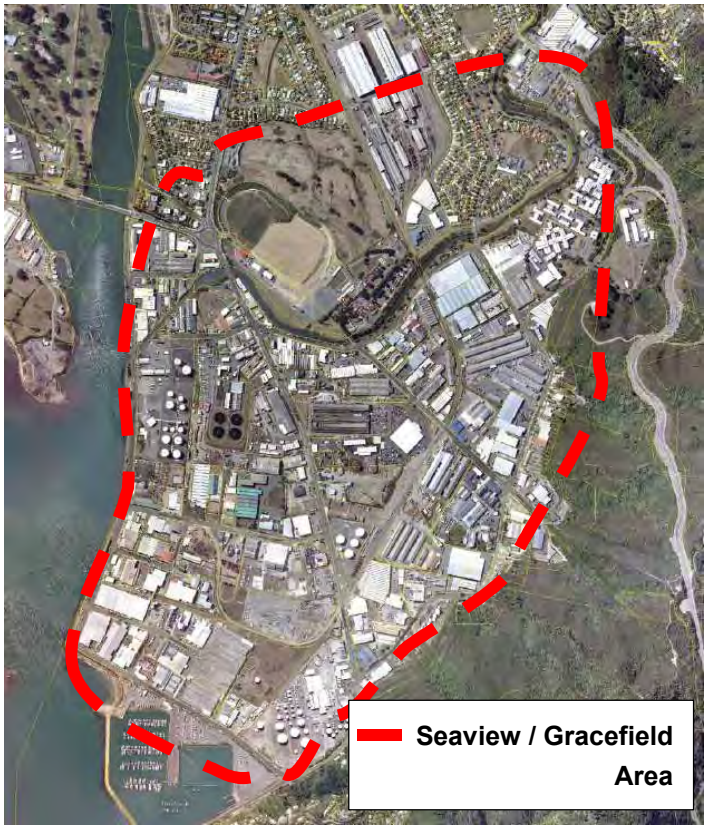
The Seaview / Gracefield area is fully located within the Project Study Area (see Figure 10). The area is dominated by commercial, science and industrial activities.

It is noted that the Seaview / Gracefield area is also the location of the Seaview Wharf, and the Wellington region's fuel distribution centre. It is noted that this is Wellington's only fuel distribution centre. Each year, 340,000 tonnes of fuel is barged to Wellington from Marsden Point and 374,000 tonnes is imported from overseas. Refined fuel is then distributed from Wellington by

[13] Petone 2040 (Petone Spatial Plan), 2017, page 13

road within the region and to other regions as far away as Hawke's Bay, Nelson and Canterbury[14] Wellington Water's Seaview Wastewater Treatment plant is also located within this area.

Figure 10 Seaview / Gracefield Area



2.5.4.3 Alicetown

The southern section of the Alicetown suburb is located in the west / north area of the Project Study Area. This area is characterised by a mixture of residential and commercial / industry land use activities.

2.5.4.4 Woburn

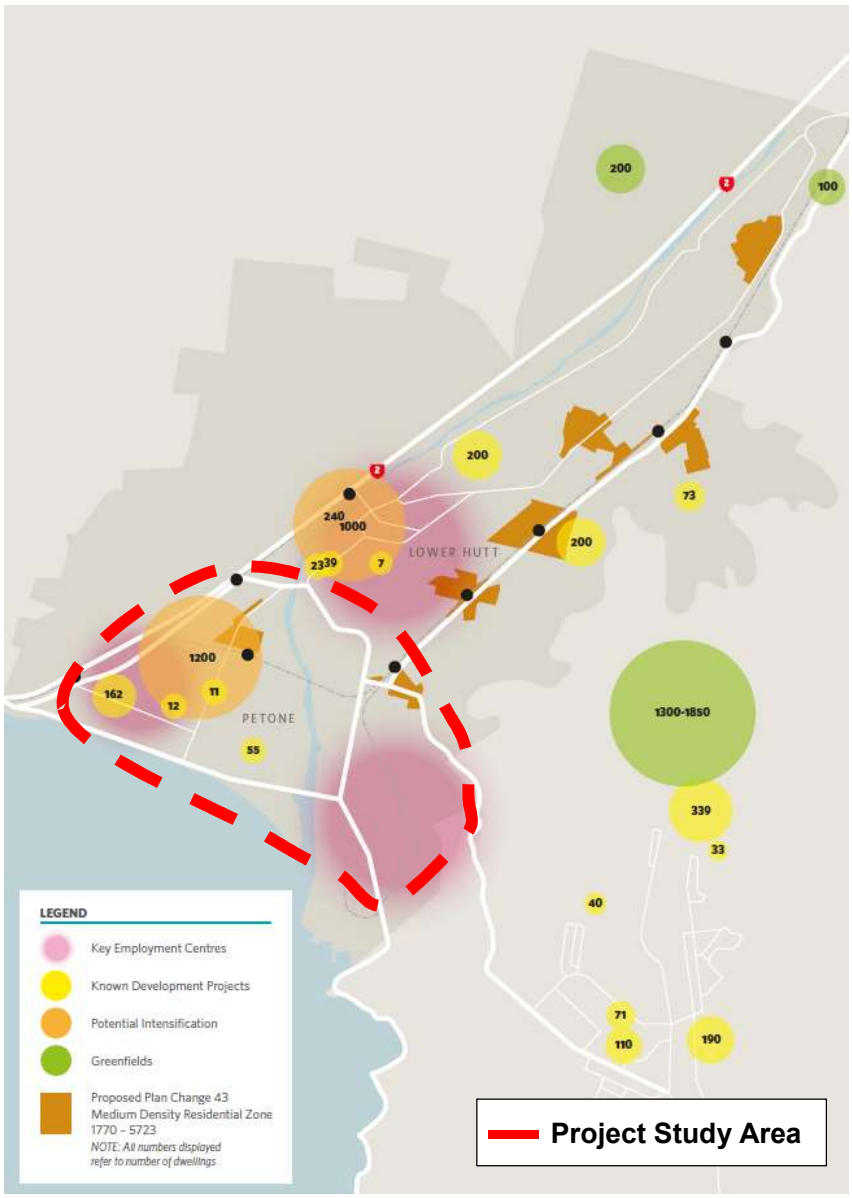
The southern section of the Woburn suburb is located in the east / north area of the Project Study Area. This area is characterised by a mixture of residential land use activities.

2.5.4.5 Future Land Use Growth Areas

The key residential and employment growth locations for Lower Hutt are set out below Figure 11.[15]

[14] Wellington Regional Land and Transport Plan 2015, Attachment 2 to Report 15.157
[15] Lower Hutt Story Growth Story, 2018, page 8

Figure 11 Lower Hutt City's Key Growth Areas



About 80% of future residential growth for Lower Hutt City is expected to occur through intensification. The remaining 20% of growth is expected to be provided via greenfield development in Wainuiomata and in the northern parts of the city.16

As set out in Figure 11 above, the Lower Hutt Growth Story shows that Petone West has been identified for potential residential intensification. However, it is noted that Petone may not be the best place for residential development, particularly given its vulnerable location to HILP events, as well as issues surrounding future sea-level rise.

Since the Lower Hutt Growth Story was published, there has been a proposed change to the District Plan. The proposed District Plan change 43 has reviewed the General Residential Activity Area provisions, and proposed two new activity areas . This plan change provides opportunities for both, medium density residential and suburban mixed use development in target areas by:

[16] Lower Hutt Growth Story, 2018, page 4

- Providing for mixed use and medium density residential development in eight targeted areas. The targeted areas are mostly in locations with train stations and suburban commercial centres. However, there are also targeted areas at the Wainuiomata and Stokes Valley suburban centres
- Enabling comprehensive residential development on larger sites
- Enabling a greater level of traditional infill throughout the General Residential Activity Area, including through minor additional dwellings.

As part of Plan Change 43, none of the targeted areas are in Petone. HCC decided not to include targeted areas in Petone as there was insufficient information of natural hazard risk. While a targeted area was initially proposed for Alicetown, this was ultimately removed in response to concerns on the capacity of stormwater infrastructure, flooding risk and potential effects on traditional character of buildings in the area.

Instead, Plan Change 43 proposes two new zones:

- Plan Change 43 introduces two new activity areas or zones:The Suburban Mixed Use Activity Area introduces a building height standard of 12 metres (three to four storeys), accommodating shops and cafes on the ground floor, with apartments or offices above.
- The Medium Density Residential Activity Area is located next to Suburban Mixed Use Activity Area. It allows buildings of up to 10 metres (plus one metre for the roofline), while restricting building height closer to the rear and side boundaries to reduce shading effects using recession planes and boundary setbacks.

These zones are located across eight areas; Stokes Valley, Taitā , Naenae, Avalon / Park Ave, Epuni, Waterloo, Waiwhetū /Woburn and Wainuiomata.

2.5.5 Transport Context

There are a number of multi-modal transport services located within the Project Study Area as set out below.

2.5.5.1 Road Network

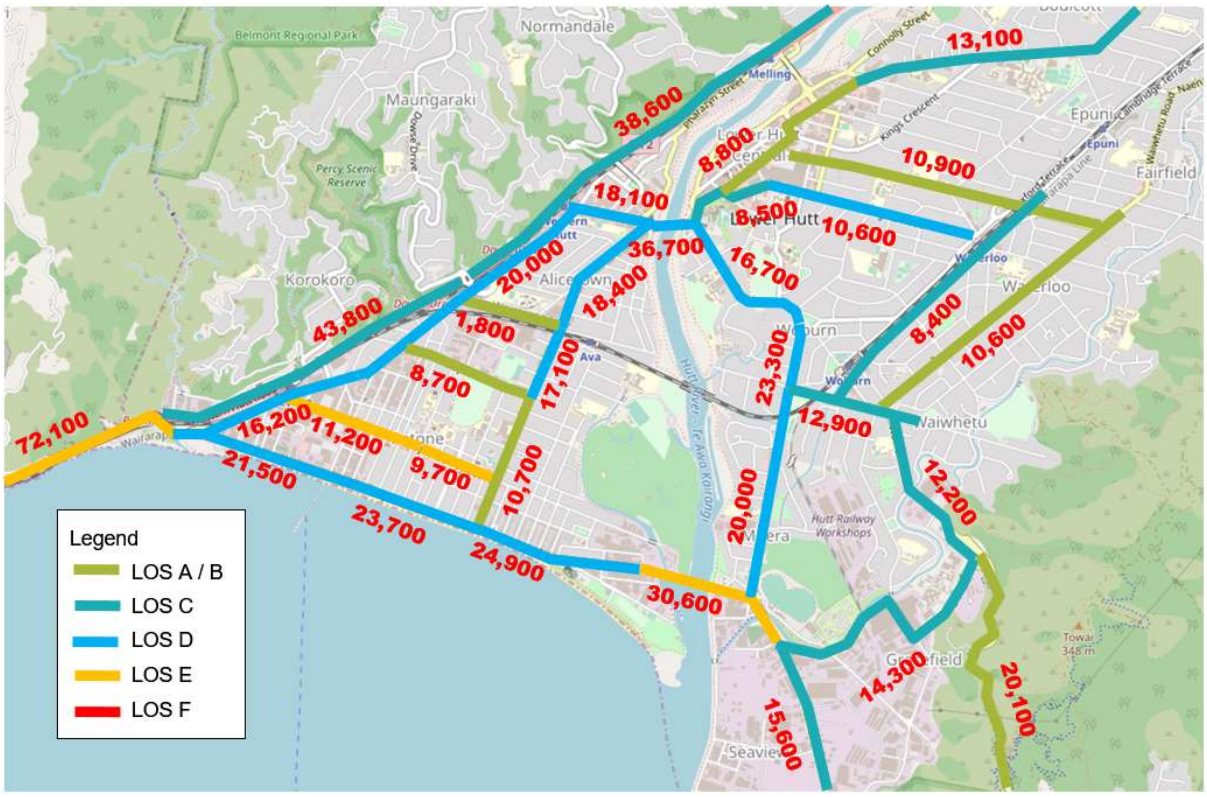
The road network within the Project Study Area enables the movement of various modes of transport, including general vehicles (cars and freight vehicles), buses, as well as providing access for active modes.

Figure 12 sets out the vehicles per day for all modes of transport that use the key local roads in the Project Study Area.[17] This figure also sets out the current level of service experienced on these key roads.[18]

[17] The vehicles per day analysis is premised on HCC's RAMM data for 2019

[18] The term level of service (LoS) characterises the operational conditions within a traffic stream. Six levels of service are defined with "A" representing the highest level, and F the worst. A LoS of F is considered to be unacceptable. As traffic volumes increase, the level of service decreases. The level of service assessment used for the Project Study Area is based on the volume to capacity ratio using the road classification in the HCC District Plan roading hierarchy. Jackson Street is an exception to this, as although it is classified as an Arterial Road, it functions more like a local road.

Figure 12 2019 Traffic Volumes and Level of Service



2.5.5.1.1 The Esplanade / Waione Street

The Esplanade / Waione Street route is located in the southern section of the Project Study Area. The route is mostly a two or three lane 50km/h road.

The Esplanade / Waione Street route is classified as an arterial route under the One Network Classification (ONRC) system. Its primary functions are to provide for east / west movement between the Seaview / Gracefield area (as well as Eastbourne, and Wainuiomata), and SH2, as well as providing local access to Petone and the Petone Foreshore.

The Esplanade carries about 21,000 vpd at its western end and up to 30,000 vpd at the Estuary (Waione Street) Bridge (which provides connectivity over the Hutt River to Seaview / Gracefield, Wainuiomata and Eastbourne and to the Hutt River Trail), including about 3,500 heavy commercial vehicles per day, or, 11.5% of total daily traffic volumes. The current level of service experienced by general traffic along this route during peak periods varies between D and E.

Key features of this route includes, two westbound lanes provided between The Esplanade / Victoria Street intersection and The Esplanade / Hutt Road roundabout, with the right hand lane being used for buses and turning vehicles only between 7:00 and 9:00 on weekdays. A raised median exists along the majority of The Esplanade between the Hutt Road and Estuary (Waione Street) Bridge, which prevents right turns at around 13 of the 25 intersections along the route. It is noted that bus priority phasing also occurs as part of The Esplanade / Sydney Street traffic pedestrian crossing (i.e. for buses turning right onto The Esplanade from Sydney Street).

Pedestrian footpaths are generally provided on both sides of the route, with the exception of the Estuary (Waione Street) Bridge and Petone Overbridges, which only have pedestrian facilities located on their southern sides. A shared path is also provided on the southern side of The Esplanade (as part of the Petone Foreshore). There are a number of formal pedestrian crossings located along the route.

On-road cycle facilities are provided at certain locations. For example, along The Esplanade, on-road facilities are provided between the two East Street intersections, and for the westbound left-hand lane approach to the Petone Overbridge (i.e. the intersection to the Honiana Te Puni Reserve). An advanced stop box is provided for cyclists at The Esplanade / Cuba Street intersection.

2.5.5.1.2 Hutt Road / Railway Avenue

The Hutt Road / Railway Avenue route is located on the western and northern boundaries of the Project Study Area. It is a two-lane 50km/h route, with a flush painted median provided along the majority of the route to separate opposing traffic.

The Hutt Road / Railway Avenue route is classified as an Arterial under the ONRC. One of this route's primary functions is to provide access onto SH2 via the Dowse Interchange and Petone Overbridge as well as local access. Hutt Road also crosses over the Hutt Valley Rail Line via the Hutt Road Bridge.

Hutt Road (north of the Dowse Interchange) carries up to 20,000 vpd, including up to 1,000 heavy commercial vehicles per day. The current level of service on this route during the peak periods is D. Railway Avenue connects with the Ewen Bridge, which provides connectivity over the Hutt River to the Lower Hutt CBD and to the Hutt River Trail. It carries up to 18,000 vpd, including up to 900 heavy commercial vehicles per day. The current level of service experienced by general traffic along this route during peak periods is D.

It is noted that movement between the Project Study Area and the suburbs of Maungaraki and Korokoro is reliant on Hutt Road. For Maungaraki, access to Hutt Road is via the SH2 Dowse Interchange. For Korokoro, access to Hutt Road is via the Korokoro Bridge. In addition, the Korokoro Bridge provides the only access for general traffic between Korokoro (including the Korokoro commercial / industrial area) and SH2 south. Additional vehicular access to the Petone Train Station's park and ride facility is via the Korokoro Bridge.

Pedestrian footpaths are generally provided on both sides of Hutt Road and Railway Avenue. The pedestrian access between Maungaraki and Hutt Road is via the Dowse Interchange. For Korokoro, pedestrian access is provided via the Korokoro Bridge or the Petone Train Station's pedestrian overbridge. There are a number of formal pedestrian crossings located along both Hutt Road and Railway Avenue.

A shared path facility exists on the western side of Hutt Road (between the Hutt Road / Jackson Street intersection and the Petone Overbridge), which connects to the shared path facility located on SH2 (via the Petone Overbridge).

Advanced stop boxes for cyclists are provided at the Hutt Road / Jackson Street and Hutt Road / Petone Avenue intersections. Apart from the on-road markings for westbound cyclists on the Ewen Bridge, no other on-road cycle facilities are provided along this route.

2.5.5.1.3 Randwick Road / Ludlam Crescent / Woburn Road

The Randwick Road / Ludlam Crescent / Woburn Road route is located near the eastern boundary of the Project Study Area. It is a two-lane 50km/h route, with a flush painted median provided along most of the route to separate opposing traffic.

The Randwick Road / Ludlam Crescent / Woburn Road route is classified as an Arterial under the ONRC. In addition to providing local access (including to the Moera Village), it also serves as the main east / west route between Lower Hutt City and Wainuiomata. Other key features of

the route include the Randwick Bridge that crosses over the Hutt Valley Rail Line, and its associated connections to the Whites Line East Bridge via the Randwick Road roundabout.

The route carries up to 23,000 vpd, including about 1,200 heavy commercial vehicles per day. The current level of service experienced by general traffic along this route during the AM and PM peak periods is D.

Pedestrian footpaths are generally provided on both sides of the Randwick Road / Ludlam Crescent / Woburn Road route. Exceptions include the Whites Line East Bridge where pedestrian footpaths are only provided on one side. There are several formal pedestrian crossings located along the route.

No formal on-road cycle facilities are provided along this route.

2.5.5.1.4 Cuba Street / Victoria Street

The Cuba Street / Victoria Street route is located through the middle of the Project Study Area. It is a two-lane 50km/h route, with a flush painted median provided along the majority of the route to separate opposing traffic.

The Cuba Street / Victoria Street route is classed as an Arterial under the ONRC. The route provides north / south movement between the Ewen Bridge (including to the Lower Hutt CBD) Alicetown, Petone, and the Petone Foreshore. This route crosses over the Hutt Valley Rail Line via the Cuba Street Bridge.

Cuba Street carries up to 17,000 vpd, including about 1,000 heavy commercial vehicles per day. Victoria Street carries up to 18,000 vpd, including up to 1,000 heavy commercial vehicles per day. The current level of service operating on Cuba Street (north) and Victoria Street route for general traffic during peak travelling times is D.

Bus priority is provided on this route, at the Victoria Street / Montague Street traffic signals. Priority is for southbound buses only.

Pedestrian footpaths are provided on both sides of Cuba Street and Victoria Street, including on the Cuba Street Bridge.[19] There are a number of informal (e.g. pedestrian refuges) and formal pedestrian crossings (including pedestrian traffic signals) located along the route.

An advanced stop box for cyclists is provided at the Cuba Street / Jackson Street intersection. No other on-road cycle facilities are provided along this route.

2.5.5.1.5 Jackson Street

Jackson Street is located in the middle of the Project Study Area. It is a two-lane 50km/h road. With the exception of the retail / commercial area on Jackson Street, a flush painted median is generally provided along the majority of the route for separating opposing traffic streams.

Jackson Street (west) is a Primary Collector / Arterial road under the ONRC. It has a number of functions including providing movement to and from the retail / commercial area of Jackson Street, as well as east/west movement across the Project Study Area. The eastern section of Jackson Street accommodates residential activities.

[19] It is noted that page 11 of the Seaview Links Project Feasibility Report (2015) advises that the Cuba Street Bridge had an expected remaining design life of 40 to 45 years

Jackson Street (west) carries up to 11,000 vpd in its commercial / retail section (including around about 600 heavy commercial vehicles per day). The current level of service for general traffic during AM and PM peak travelling times for this section of Jackson Street is D.

Pedestrian footpaths are provided on both sides of Jackson Street. There are a number of formal pedestrian crossings located along Jackson Street, including raised pedestrian crossing facilities within the commercial / retail area.

An advance stop box for cyclists is provided at the Jackson Street / Cuba Street intersection. No other on-road cycle facilities on-road are provided along Jackson Street.

2.5.5.1.6 State Highway 2

State Highway (SH2), although located outside of the Project Study Area, is considered to have significant influence on the movement of people and freight through the study area. It is located to the immediate west of the Project Study Area's boundary.

SH2 is a four-lane median divided 100km/h state highway, and is classified as a National High Volume Route under the ONRC. It is connected to the Project Study Area's road network via the Petone Overbridge, Dowse Interchange and indirectly via the Korokoro Bridge (for northbound access only).

In 2019, daily traffic volumes on SH2 ranged from 43,000 vpd (south of the Dowse Interchange) to 72,000 vpd (along the section of SH2 between Petone and Ngauranga). The level of service experienced on SH2 (between Petone and Ngauranga) by general traffic during peak travelling periods equates to E.

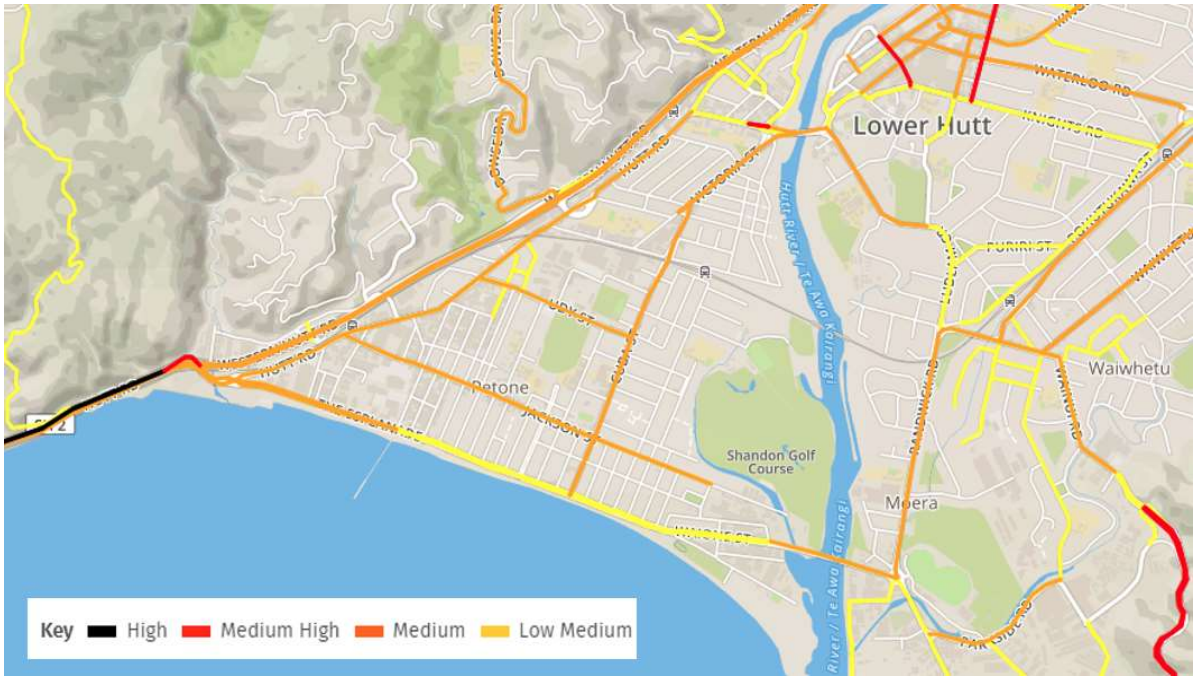
2.5.5.2 Safety

2.5.5.2.1 Urban KiwiRAP

The urban KiwiRAP collective risk safety rating[20] for the key roads in the Project Study Area is set out in Figure 13.

[20] Collective Risk is a measure of the total number of fatal and serious injury crashes per kilometre over a section of road. Collective risk can also be described as the crash density

Figure 13 Urban KiwiRAP Ratings for the Project Study Area



As set out in Figure 13, the majority of the roads in the Project Study Area have a medium collective safety rating, and in some cases, a low medium rating. The exception being the section to the immediate west of the Ewen Bridge, which has a medium high rating.

2.5.5.2.2 Crash history

Table 8 sets out the crash history for the Project Study Area for 2014 to 2018.[21]

Table 8 Reported Crashes for 2014-2018

Year	Fatal	Serious injury	Minor injury	Non-injury	Total
2014	0	9	32	117	**158**
2015	0	4	37	126	**167**
2016	0	4	37	153	**194**
2017	0	10	45	169	**224**
2018	0	7	50	157	**214**
Total	**0**	**34**	**201**	**722**	**957**

As set out in Table 8, there were 957 reported crashes between 2014-2018, including 34 serious injury crashes. The worst year was 2017 with 224 reported crashes, including 10 serious injury crashes.

Figure 14 sets out the location of crashes within the Project Study Area.

[21] The data identified in this table is sourced from NZTA's Crash Analysis System (CAS) as at May 2019

Figure 14 Crashes in the 2014-2018 period within the Project Study Area

The reported cyclist crashes between 2009 and 2018 are set out in Table 9.

Table 9 Cyclist Crashes within the Study Area between 2009 and 2018 (inclusive)

Year	Fatal	Serious injury	Minor injury	Non- injury	Total
2009	0	1	3	2	**6**
2010	0	1	7	4	**12**
2011	0	1	8	0	**9**
2012	0	2	7	0	**9**
2013	0	1	4	4	**9**
2014	0	2	3	1	**6**
2015	0	0	4	0	**4**
2016	0	0	4	0	**4**
2017	0	4	5	3	**12**
2018	0	1	4	1	**6**
Total	0	**13**	**49**	**15**	**77**

As set out in Table 9, of the 77 crashes reported between 2009 and 2018, there were 13 serious crashes and 49 minor injury crashes. The location of the crashes are further discussed in Section 2.7.4.1.4 below in relation to Problem Statement Two.

The reported pedestrian crashes between 2009 and 2018 are set out in Table 10.

Table 10 Pedestrian crashes within the study area between 2009 and 2018 (inclusive)

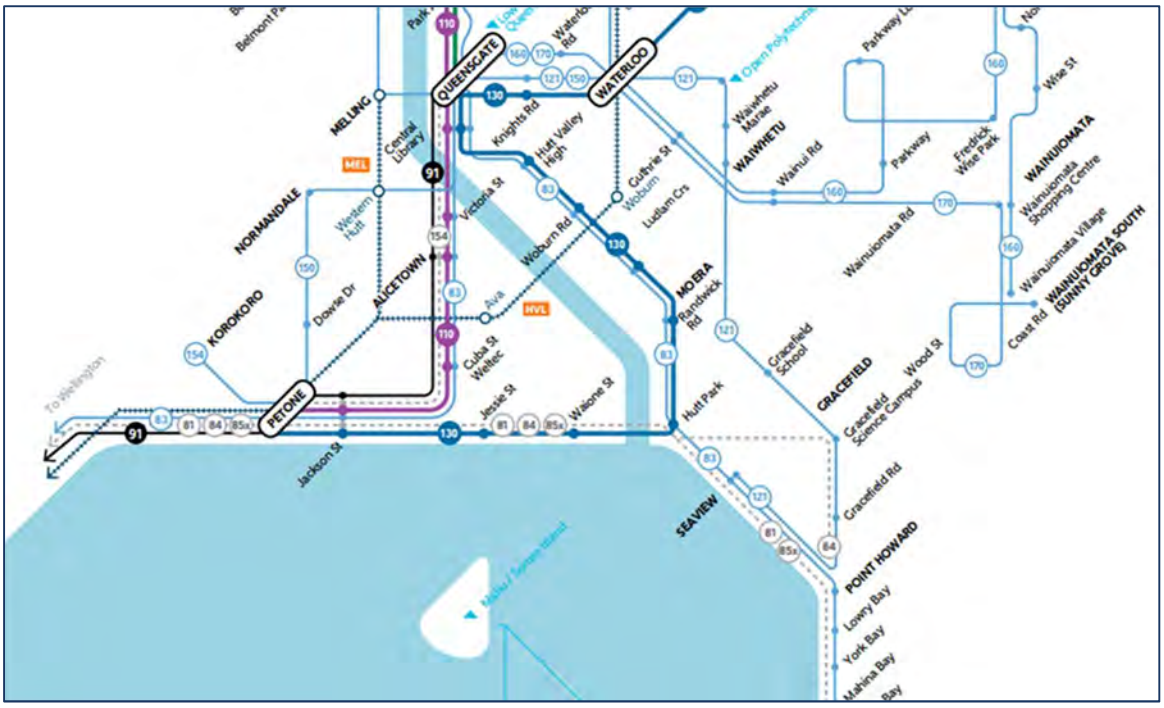
Year	Fatal	Serious injury	Minor injury	Non- injury	Total
2009	0	1	5	1	**7**
2010	0	1	8	1	**10**
2011	0	2	5	1	**8**
2012	0	2	6	0	**8**
2013	0	2	5	1	**8**
2014	0	2	2	0	**4**
2015	0	1	4	0	**5**
2016	0	2	7	1	**10**
2017	0	2	5	1	**8**
2018	0	2	3	2	**7**
Total	0	**17**	**50**	**7**	**75**

As set out in Table 10, 17 of the 75 pedestrian accidents reported between 2009 and 2018 were classed as serious accidents and 50 were classed as minor injuries. The location of the accidents is further discussed in Section 2.7.4.1.4 below in relation to Problem Statement Two.

2.5.5.3 Bus services

Figure 15 sets out the Metlink bus service routes that currently operate on the road network within the Project Study Area.[22]

Figure 15 Metlink Bus Service Routes within the Project Study Area



[22] See - https://www.metlink.org.nz/assets/Uploads/Hutt-Valley.pdf

The key Metlink bus services are summarised in Table 11.

Table 11 Metlink Bus Services in the Project Study Area

Route No.	Route Name	Key Roads
81	Eastbourne – Wellington	Waione Street, Jackson Street, The Esplanade
83	Eastbourne – Lower Hutt – Wellington Randwick Road	Randwick Road, Woburn Road, Ewen Bridge, Cuba Street, Jackson Street
84	Gracefield – Wellington	Waione Street, The Esplanade
85	Eastbourne Express	Waione Street, The Esplanade
110	Upper Hutt - Petone	Cuba Street, Jackson Street
130	Petone – Naenae	Woburn Road, Randwick Road, The Esplanade, Jackson Street
154	Korokoro - Petone	Hutt Road

Route 80is a commercial bus service which is provided by NZ Coach Services and operates between Wainuiomata and Wellington during the AM / PM peak period. It runs along The Esplanade between Cuba Street and Hutt Road.

The Airport Flyer service (operated by NZ Bus) also travels through the Project Study Area via Cuba Street, Jackson Street and The Esplanade. It stops on Jackson Street and at the Alicetown shops.

The Seaview Links Project Feasibility Report (2015) forecasted future bus patronage volumes for the key bus routes operating within the Project Study Area for 2031.[23] Table 12 sets out the passenger volumes for 2011 and those predicted for 2031.[24]

Table 12 Predicted Bus Service Passenger Volumes for 2031

Road	Direction	2011		2031	
		AM	IP	AM	IP
The Esplanade (West of Fitzherbert Street)	Westbound	400	10	700	140
Estuary (Waione Street) Bridge	Westbound	310	40	380	20
	Eastbound	80	30	60	30
Jackson Street (West of Richmond Street)	Westbound	420	290	370	70
	Eastbound	220	200	320	350
Randwick Road	Northbound	60	80	50	50
	Southbound	80	80	50	80
Cuba Street	Northbound	180	210	230	340
	Southbound	200	260	370	210
Hutt Road (South of Jackson Street)	Northbound	210	180	280	330
	Southbound	160	250	70	40

[23] Seaview Link Project Feasibility Report, 2015, page 24

24 The Seaview Links Project Feasibility Report's patronage volume forecast for 2031 was premised on the bus patronage data that was available in 2015 as well as the transport modelling undertaken at the time of the report's preparation

As set out in Table 12, bus passenger numbers on the bus routes were forecasted by the Seaview Links Project Feasibility Report to increase by 24% in the AM peak and interpeak by 2031.

2.5.5.3.1 Bus Stop Walk Zones

The majority of residents within the Project Study Area are located within an 800m walk zone of a bus stop.

It is noted that HCC is responsible for the bus stops and bus priority measures operating within the Project Study Area.

2.5.5.4 Rail Network – Commuter Services

Two commuter rail services operate within the Project Study Area, these are the Hutt Valley commuter rail service (which runs on the Hutt Valley Rail Line) and the Melling commuter rail service (which runs on the Melling Rail Line). Both commuter rail services are provided by Metlink.

2.5.5.4.1 Hutt Valley Commuter Rail Services

The Hutt Valley rail services are provided via the Hutt Valley Rail Line. Within the Project Study Area, the Hutt Valley Rail Line passes underneath a number of road-bridges and traverses the Hutt River via the Ava Rail Bridge (which also provides a pedestrian facility that connects the eastern and western sections of the Hutt River Trail together).

Hutt Valley commuter rail services are provided at regular frequencies over the course of a seven-day week. During peak hours, express services run between Upper Hutt and Taitā (and vice-a-versa).

Based on GWRC's 2017 Rail Survey Analysis Report (Rail Survey Report), approximately 37,500 Hutt Valley commuter rail trips are made weekly in the AM peak, and 24,000 trips are made weekly in the PM peak.[25]

2.5.5.4.2 Melling Commuter Rail Services

The Melling rail services are provided via the Melling Rail Line (no rail freight is carried on this rail line).

Melling commuter rail services operate during the weekday (approximately 6am and 7pm). There are no weekend services.

Based on the Rail Survey Report, approximately 4,500 commuter rail trips are made weekly on the Melling Rail Line during both the AM and PM peaks.[26]

2.5.5.4.3 Railway Stations

Within the Project Study Area there are four railway stations. The Petone Train Station serves all rail commuter trips made on the Hutt Valley and Melling Rail Lines. The Ava and Woburn Train Stations only serve Hutt Valley commuter rail services. The Western Hutt Train Station only serves the Melling commuter service.

[25] Greater Wellington Regional Council, Rail Survey Analysis, March 2018, page 12 (Table 3)
[26] Ibid, page 12 (Table 3)

Table 13 identifies that daily AM and PM peak boarding and alighting for the four train stations based on the Rail Survey Report's 2017 analysis.

Table 13 Daily passenger boarding and alighting (2017)

Train Station	Boarding		Alighting	
	AM	PM	AM	PM
Petone	919	328	324	709
Ava	380	84	4	219
Woburn	680	16	5	385
Western Hutt	117	0	176	0

GWRC research for its Metlink commuter rail network (Wellington region-wide) indicates that about 53% people access train stations via private motor vehicle, with the remaining 47% accessing the stations by active mode.[27]

Most residential areas within the Project Study Area are located within a 1200m walk-zone of a train station.

2.5.5.4.4 Park and Ride Facilities

There are dedicated park and ride facilities at Petone, and Woburn Train Stations. The Petone Train Station park and ride facility has 448 dedicated parking spaces, and is typically at 85% occupancy by 8:15am during the weekdays (leaving only off-street parking available). The Woburn Train Station has 119 dedicated parking spaces, and is typically at 85% occupancy by 8:05am during the weekdays (leaving only off street parking available).

There is no dedicated park and ride facility at the Western Hutt Train and Ava Train Stations. However, it is noted that there is an informal parking facility located to the immediate north of the Western Hutt Train Station.

2.5.5.5 Active Mode Route Preferences

As noted above, there are various pedestrian and cycling facilities provided on the road network. In addition, there are two key off-road shared path facilities provided within the Project Study Area as follows:

- The Hutt River Trail shared path is located on both sides of the Hutt River, and forms part of the NZ / Remutaka River Trail (in 2014, over 2,100,000 cyclists used the trail[28])
- The Petone Foreshore shared path located along the southern side of The Esplanade.

There is no current active mode count data available for assessment for the key routes in the Project Study Area. However, active mode data was able to be extracted from the Strava fitness app[29] to provide insights into active mode route preferences. It is noted that although the Strava

[27] See - https://www.researchgate.net/figure/Rail-station-weekday-morning-peak-access-mode-car-vs-walk-bus-cycle-from-1996-to-2017_fig3_332138442

[28] Walk and cycle the Hutt (2014-2019), page 14. See - http://iportal.huttcity.govt.nz/Record/ReadOnly?Uri=3677441

[29] Strava is a social fitness network that is primarily used to track people cycling and running using GPS. Strava depends on the GPS functionality of the local mobile networks as well as the mobile phone to record supported activities, which can be shared among users, followers or publicly. If an activity is publicly shared, Strava automatically groups activities together. Strava then uses this information to develop maps for the number of users for a particular route. It is important to note that the Strava heat map is only a sample of cyclists and does not include the population groups that are unlikely to use Strava, such as infants or seniors

data is a useful source of information, it does favour users of the app who tend to be confident cyclists and walkers / runners (as such, its cycling and walking / running data may not be truly reflective of active mode movement along key retail / commercial routes, such as Jackson Street).

Based on the data collected by the Strava fitness app data, heatmaps have been created to identify preferred routes for cycling and walking / running.

2.5.5.5.1 Strava App Cyclists

Figure 16 sets out the Strava heatmap for cycling. The brighter the orange lines show on the map, the more cycling activity there is being represented. For example, more cycling is represented on The Esplanade than on Jackson Street.

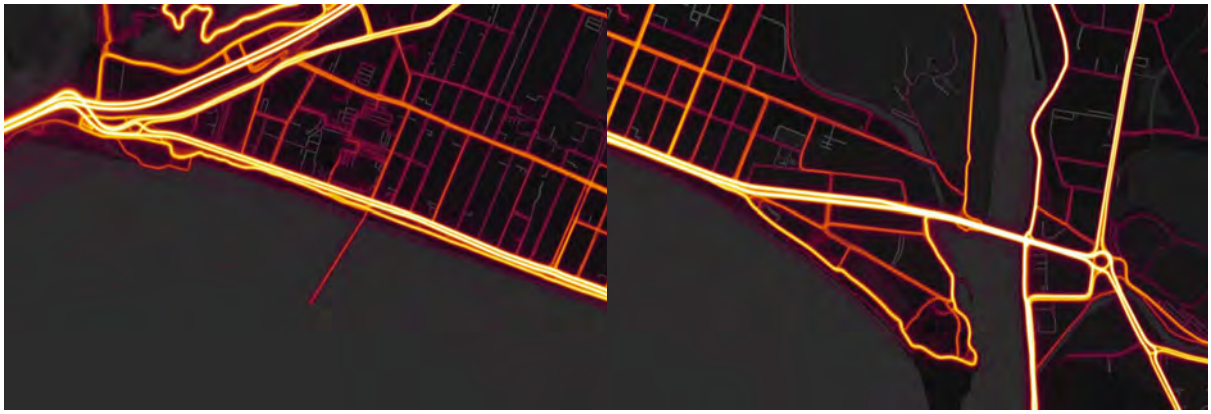
Figure 16 Strava App Cycling Heatmaps

Key observations from Figure 16 for Strava app cycling are as follows:

- The Estuary (Waione Street) Bridge is the most popular bridge for cyclists, followed by the Ewen Bridge.
- The Hutt River Trail is favoured over Randwick Road, and the eastern side of Hutt River Trail is more popular than the western side
- Both Hutt Road, and The Esplanade / Waione Street route are popular cyclist routes
- The Ava Rail Bridge is the least popular bridge for cycling.

Figure 17, provides a close up of Strava app cycling along the Petone Foreshore. It shows that The Esplanade's on-road facilities tend to be favoured over the Petone Foreshore's shared path facility.

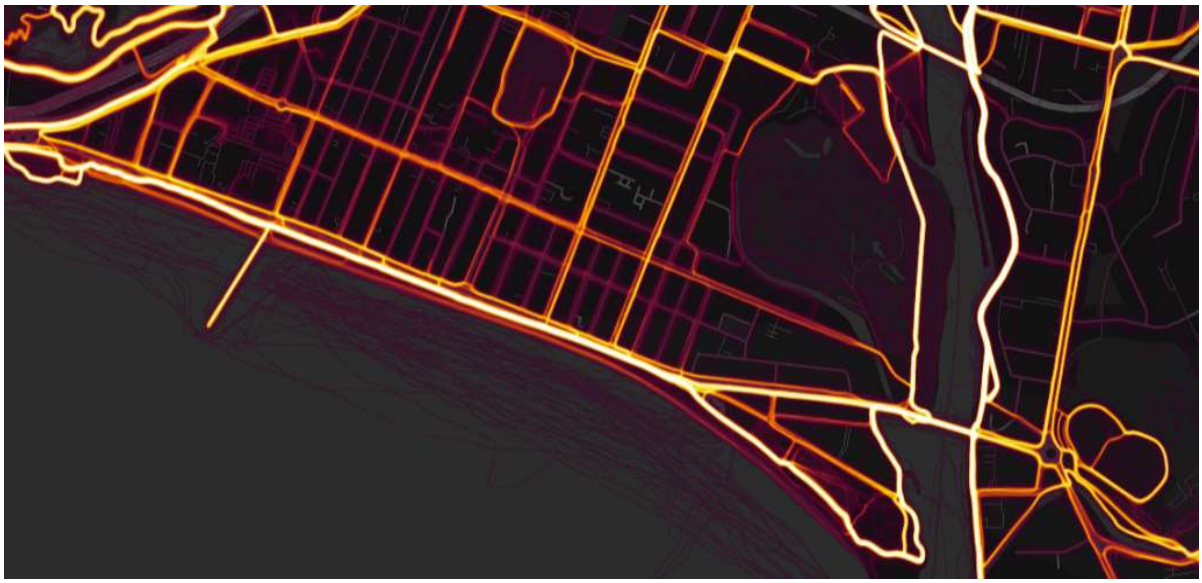
Figure 17 Strava App Cycling Preferences for The Esplanade / Waione Street Route



2.5.5.5.2 Strava Walking / Running

Figure 18 sets out the heatmap for walking / running as recorded by the Strava App. Again, the brighter than orange line is shown on the map, the more walking / running is being represented.

Figure 18 Strava App Walking / Running Preferences for The Esplanade / Waione Street Route



Key observations from Figure 18, for walking / running as recorded by the Strava App are as follows:

- Most walking and running activities are centred around The Esplanade and Hutt River Trail
- The Ava Rail Bridge is a key location for crossing over the Hutt River
- The eastern side of the Hutt River Trail is preferred over the western side
- Petone Foreshore's shared path facility is favoured over The Esplanade

2.5.5.6 Freight Movements

As set out in Figure 19 below, the movement of freight along The Esplanade / Waione Street forms part of the Wellington region's core freight network. This is the network that caters for the most significant inter-regional freight movements within the Wellington region. [30]

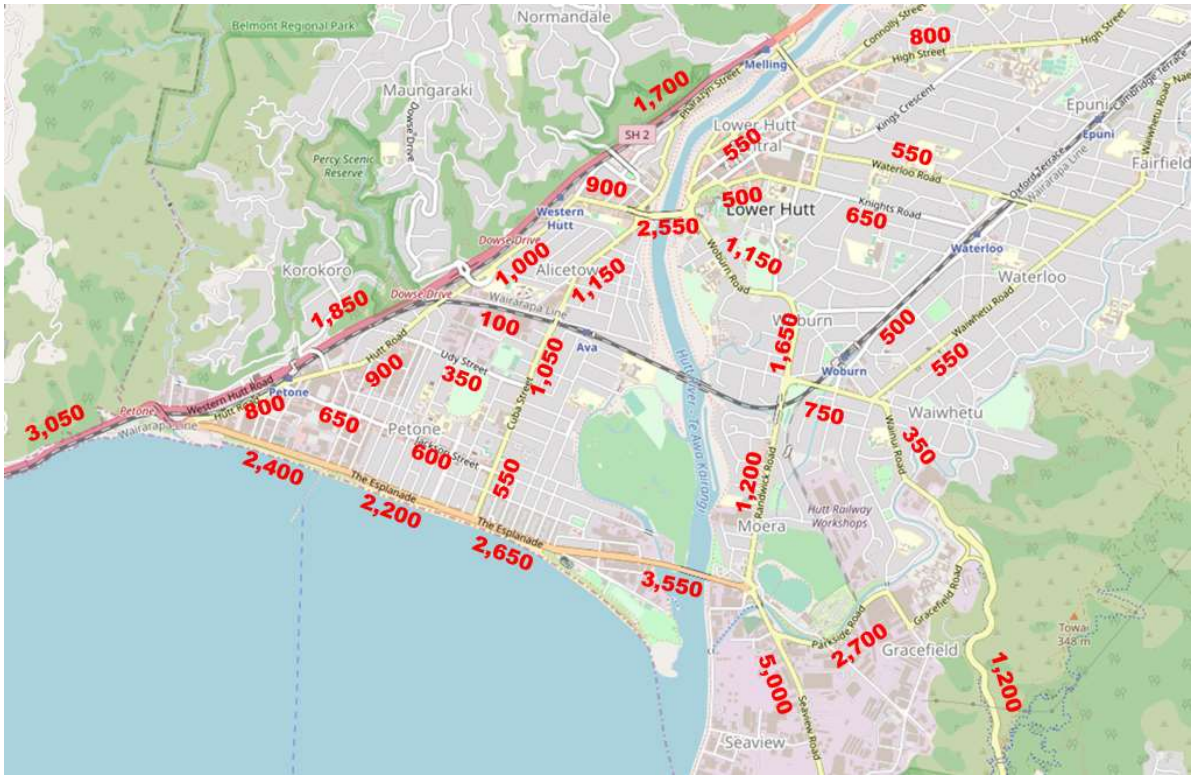
Figure 19 Wellington's Core Freight Network

In terms of the Project Study Area, The Esplanade / Waione Street route provides for road freight movements between the Seaview / Gracefield area and CentrePort as well as to other parts of the Wellington region.

Figure 20 below shows daily heavy commercial vehicle volumes on the key roads in the Project Study Area. It is noted that Seaview Road carries the highest volume of freight at around 5,000 heavy commercial vehicles per day, followed by the Estuary (Waione Street) Bridge at 3,500 heavy commercial vehicles per day. SH2 (south of Petone) also carries significant volumes at around 3,050 heavy commercial vehicles per day.

[30] Wellington Regional Land Transport Plan, 2015, page 90

Figure 20 2019 Daily Heavy Commercial Vehicle Volumes



In terms of freight destinations, the Seaview Links Project Feasibility Report (2015) identified that 50% of freight was transported to destinations within Lower Hutt, and 50% was transported to other destinations.[31]

The Hutt Valley Rail Line is also used for moving freight by KiwiRail, and in particular, forestry logs from the Wairarapa. The Gracefield Rail Line is used for moving trains and carriages in need of maintenance to the KiwiRail operational facilities located in Gracefield.

In terms of future freight demands, the Wellington Regional Land Transport Plan (WRLTP) 2015 advises that freight tonnage in the Wellington region is expected to increase from 8 to 14 million tonnes by 2042. The WRLTP notes that the majority of freight movement within the Wellington region occurs over short travelling distances (i.e. 20 kilometres or less) with 98%[32] of this movement occurring on the road network.

A freight demand study for the Hutt Valley, which included the Project Study Area, was completed by GWRC in 2019. As part of this report, a heatmap for the routes most used by heavy commercial vehicles was created. This heatmap is set out in Figure 21[33]. It provides an indication of where heavy commercial vehicle volumes are the highest (i.e. the thickest white lines).

[31] Seaview Links Project Feasibility Report, 2015, page 36
[32] Ibid, page 74
[33] Work completed by BECA – Distribution of Freight O-D Trips – developed from E-ruc data.

Figure 21 GWRC Freight Demand Study – Hutt Valley Heavy Commercial Vehicle Heat Map

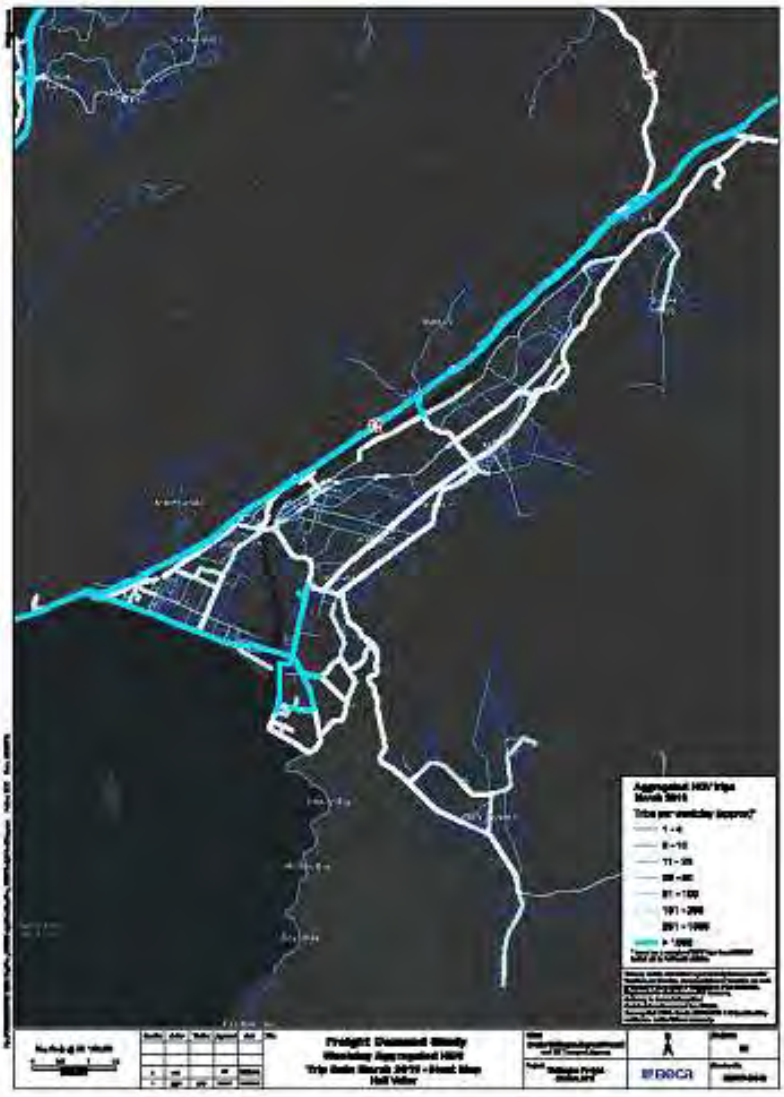


Figure 21 above shows that The Esplanade, Randwick Road and Seaview Road are the routes with the highest volumes of heavy commercial vehicles in the Project Study Area.

2.5.5.7 Ferry Services

There are no ferry services currently operating between the Project Study Area and Wellington City. However, there is a daily commuter ferry that operates between Eastbourne and Wellington City. It departs and arrives from the Day's Bay wharf in Eastbourne.

2.5.5.8 Evolving transportation modal choices

Transportation modal preferences are evolving as a result of technological changes and increased climate change awareness. Changes in preferences are likely to have an impact on the way the transport network within the Project Study Area is used and / or operated in the future. For example, the introduction and uptake of e-bikes and e-scooters is likely to impact on the design requirements of the road and footpath networks. Similarly, the increase in electric vehicles could result in more charging stations being installed. In the longer term, the requirements of autonomous vehicles (self-driving vehicles) may also need to be incorporated into the design of the road network.

2.5.5.9 Transport Improvement Projects

Table 14 sets out the key transport improvement projects that are likely to have a direct or indirect impact on the transport system in the Project Study Area. The expected impacts of these projects on the transport system in the Project Study Area are included in the uncertainty log below (see Table 20).

Table 14 Transport Projects that may Impact on the Project Study Area

Project	Stage or Status	Project Descriptions
Transmission Gully Motorway	Construction (due for completion in 2020)	This is a new 27km four-lane medium divided motorway between MacKays and Linden. Interchanges will be provided at State Highway 58 (SH58) and at James Cook (which will provide access to Porirua City and Whitby) in addition to the Interchanges to be provided at MacKays and Linden
State Highway 58 (SH58) Safety Improvements	Stage One – 2019 (construction underway) Stage Two – 2020 (construction start)	This project comprises of a number of safety improvements on SH58 between Haywards Interchange and Transmission Gully / SH58 Interchange. Stage One includes widening the seal, median barriers and crawler lanes. Stage Two includes key intersection improvements
Wairarapa Upgrades	Implementation from 2020	A $193M funding package to renew key sections of the Hutt Valley Rail Line to improve safety, resilience and to increase capacity. A key element of the investment focus is on making a series of network infrastructure improvements, including double tracking between Trentham and Upper Hutt. In turn, double tracking will enable timetable changes to be made to improve passenger rail travel times
Beltway Cycleway	Detailed design	This project is a new cycleway between Seaview and Taitā. It will include links to the Hutt River Trail and to the new Wainuiomata Hill Shared Path
Eastern Bays Shared Path	Resource consent lodged in June 2019	This is a shared path proposed for Marine Drive, and includes a seawall replacement to improve protection from storm events
RiverLink and SH2 Melling Interchange	RiverLink: Currently in consenting Construction of the SH2 Melling Interchange is from 2026	The RiverLink project is a combined transport, urban transformation and flooding improvements project located to the immediate north of the Project Study Area. The project includes replacement of the existing at-grade intersection at the Melling Interchange with a new grade separated Interchange. A new road bridge and a separate active mode bridge are also proposed to be provided
Te Ara Tupua Walking and Cycling Link (Te Ara Tupua)	Ngauranga to Petone section: Fast tracked consenting process Petone to Melling: Construction underway in 2020	The project includes a new shared pathway facility between Ngauranga to Petone (to be located on the seaward side of the Hutt Valley Rail Line), and a new cycle only link between Petone and Melling (to be located between SH2 and the Melling Rail Line)

Project	Stage or Status	Project Descriptions
Let's Get Wellington Moving	Emerging preferred programme of Investment (complete) Detailed multi-modal investigations to commence from 2020	This is a multi-modal transport investment proposal for Wellington City and the Urban Motorway. Of particular note are proposals for a new rapid transit system in Wellington City, public transport optimisation, various active mode improvements and improvements to the state highway system (through central Wellington City). Improvements are to be phased over the next 20 years, with priority given to improving public transport and active mode movement
P2G Link Road	Detailed business case (on hold) Construction funding to be considered from 2028/2029 onwards	The P2G Link Road is a proposed new east / west transport connection between Petone and Tawa. It includes a new Interchange at Petone to replace the Petone Overbridge. The project was re-evaluated in 2018. The re-evaluation process recommended that the project take a step back and consider additional options for improving resilience, safety and improving east / west transport choices across the Ngauranga Triangle state highway network
Great Harbour Way Walking and Cycling Project (Te Aranui o Pōneke)	To be progressively staged over time	This project aims to have a dedicated walking and cycling route around the Wellington Harbour, from Baring Head in the east to Sinclair Head in the west. This project is to be staged and completed in sections
Multi User Ferry Terminal	Programme business case completed. Decisions on next steps to be determined.	The PBC includes a programme of investment for upgrading the ferry terminals located in CentrePort
Bus Network Review - Metlink	Metlink are currently reviewing the outcomes of network changes made in July 2018	Major changes to the Wellington regional bus network were completed to: create a more efficient network design, provide high-frequency routes, more services, more effective transfers and improved off-peak services.

2.5.6 Journey to Work

2.5.6.1 Journey to Work Trips

Table 15 sets out the total journey trips to work undertaken through the Project Study Area. The data in this table is sourced from Census 2013 and is based on the residential address, workplace address, and normal mode of travel to work. It does not include school trips or recreational trips, including shopping. It is noted that Census 2018 transport data is not yet available for assessment.

Table 15 Total Journey to Work Trips in the Project Study Area (Census 2013)

Direction	Car (number of trips and %)		Public Transport (number of trips and %)		Cycle (number of trips and %)		Walking (number of trips and %)	
Westbound split	3909	68%	1656	29%	120	2%	45	1%
Eastbound split	2115	85%	213	9%	69	3%	96	4%
Both ways	6024	73%	1869	23%	189	2%	141	2%

The following observations can be made from the 2013 Census journey to work movements:

- Around 16,500 return trips are made over the Ewen and Estuary (Waione Street) Bridges every day for work purposes
- Of these, 73% are made by car, 23% by public transport and 4% by active modes
- Around 70% of work trips are made to workplaces west of the Hutt River, and 30% to workplaces east of the river

2.5.6.2 Origin Destination Data

Figure 22 sets out the origin and destination suburbs for vehicles specifically using the Estuary (Waione Street) Bridge. This traffic will be predominantly journey to work focus, but will also incorporate recreational trips on the network. The high number of journey to work trips being shown below highlights further the heavy reliance on the private vehicle through the study area.

Figure 22 Origin Destination via the Estuary (Waione Street) Bridge (Census 2013)

Figure 22 shows that of the 11,100 trips going to or from Seaview and using the Estuary (Waione Street) Bridge, 2,100 go to Petone and 9,000 go to SH2. Similarly, of the 14,000 going to or from Wainuiomata and using the Estuary (Waione Street) Bridge, 5,100 go to Petone and 8,900 go to Wellington.

Figure 23 shows the origin and destinations for trips crossing the Ewen Bridge. The green boxes show the approximate locations north of the bridge and the blue boxes show the approximate locations south of the bridge. The black box shows the sum of vehicles travelling north / south on the Ewen Bridge, again suggesting a high dependence on private vehicle use through the study area.

Figure 23 Origin / Destination via the Ewen Bridge (Census 2013)

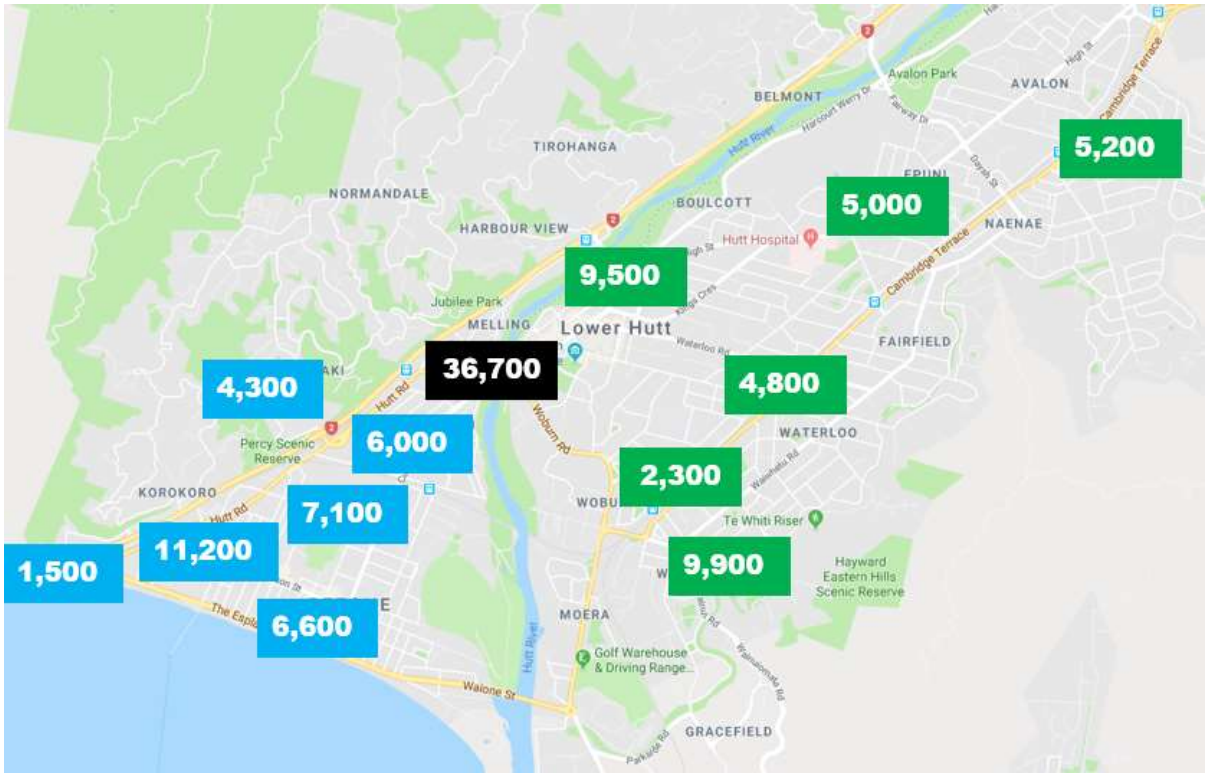


Figure 23 above shows that about 36,700 daily trips were made over the Ewen Bridge, and the origins and destinations of these vehicles are widespread through the Project Study Area.

These high numbers of private vehicle use through the study area is likely to be the result of a lack of public transport and active mode transport services / facilities providing an attractive and competitive alternative. Reasons for the uncompetitive nature of public transport and active modes is likely to include:

- Services and facilities perceived to be indirect
- Unreliable timetables
- Expensive (comparatively)
- Congested due to limited services
- Lack of services / facilities
- Perceived and real Safety concerns
- Less flexible

2.6 Strategic Assessments – Outlining the Need for Investment

2.6.1 Defining the Problem

At PBC Workshop One (April 2018), and using investment logic map (ILM) principles, investment partners and stakeholders re-visited the problem statements identified in the Petone Esplanade Strategic Case and the Lower Hutt Growth Story to determine whether the problem statements needed to be updated.

The first step in the process was to undertake a PESTLE, which is a scan of the key political, economic, social, technological, legal, and environment factors that might be relevant to development of the PBC. Feedback on the PESTLE is summarised in Table 16.

Table 16 PESTLE Analysis

Dimension	Remarks / Comments
Political	▶ New Government Policy Statement (GPS) settings – Safety, Access, Environment, Value for Money ▶ Network resilience – part of GPS under Access ▶ Wellbeing component being woven into all aspects of funding and decision-making ▶ Increased focus on public transport and alternative transport modes to encourage positive health and climate change benefits ▶ Political includes both local and national dimensions – important that the impact of decisions made at the local level is understood
Economic	▶ Recognition that do nothing has an economic cost ▶ Impact of an inactive population needs to be included in an economic evaluation ▶ Regional competitiveness and complementarity – avoid duplication and / or centralisation (e.g. Seaview creates risk for the entire region) ▶ Lack of a regional spatial plan that prioritises developments and trade-offs (e.g. between Lower Hutt and other centres) ▶ Affordability – need to consider other costs associated with development (e.g. availability of insurance for commercial premises) ▶ Recognition of a limited rating base to support big economic programmes
Social / Cultural	▶ Walking can define a community (e.g. walking over Wainuiomata Hill is now common place) ▶ More people living in smaller dwellings, closer together – expectations about public transport will be different ▶ More people cycling – Lower Hutt should be a mecca for cyclists but lots of death traps due to poor mode separation and planning (e.g. at roundabouts). This limits the positive health and climate change benefits that can currently be realised through active mode travel
Technological	▶ Block chain – driving all levels of interactions, including commercial, transactional etc. ▶ More mode options (e.g. electric scooters, autonomous vehicles, shared electric vehicles) ▶ More travel – fewer vehicles being used more efficiently ▶ Increase in freight deliveries due to online shopping, with fewer individual journeys ▶ Better access to online data, and better analytics to extract knowledge and understanding ▶ Increased use of AI to determine traffic trends and reasons for journeys ▶ No change to economics of rail freight – e.g. viable for long haul, bulk transport
Legal / Legislative	▶ Changes to legislative and regulatory principles – rationale for intervention, risk-based regulation that can be enforced, encouragement of behavioural change, proportional interventions ▶ Legislation to set minimum standards on air quality, water quality, biodiversity, noise pollution, light pollution etc.

Dimension	Remarks / Comments
Environment	► Existing transport infrastructure is old and at risk from climate change and natural disasters ► Need to build resilience at a community-wide level ► Need for education on what climate change means at a community and individual level – it's a people problem, not an environmental problem ► Heightened risk of floods, tsunamis etc. – insurance companies already limiting their exposure to coastal properties ► Greater emphasis on more efficient land use, e.g. for housing rather than transport corridors

After developing the PESTLE, workshop attendees then considered the PBC's new geographical scope and key transport information, and agreed that the problem statements from the Petone Esplanade Strategic Case needed to be updated. In particular, they sought that the problem statements be re-focused on a lack of resilience and the accessibility limitations of the transport system. Following completion of the workshop, HCC and the Project Team further refined the problem statements, and ultimately confirmed the following two problem statements:

► **Problem statement one**

Lack of Transport Network Resilience (75%)

Southern Lower Hutt's transport network lacks resilience to major natural events, future sea level rise, and regular network interruptions, which will cause economic and / or social disruption for Lower Hutt and the Wellington region

► **Problem statement two**

Limited Access (25%)

The existing transport system in southern Lower Hutt:

- limits modal choice
- constrains access to economic opportunities
- creates safety issues for active mode users

Appendix One sets out the investment logic map for problem and benefit statements in their entirety.

2.6.2 Benefits of Investment

Attendees at PBC Workshop One also agreed the benefit statements from the Petone Esplanade Strategic Case and the Lower Hutt Growth Story needed to be updated to align with the new problem statements.

Following completion of PBC Workshop One, HCC and the Project Team developed the following benefit statements and associated key performance indicators (KPIs):

► **Benefit one**

Improved Transport Network Resilience (50%)

KPI 1: Increase the number of high impact routes with viable alternative routes from one, to two

KPI 2: Maintain a LOS between D and E on the new route, when the network experiences a road closure

KPI 3: Maintain the ability to access essential services (e.g. food, water, health care, fuel depots) during major natural events

- **Benefit two** — **Improved Transport Choices to Encourage Mode Shift (25%)**

  KPI 1: Increase in the percentage of public transport mode share by 5%, five years after opening

  KPI 2: Decrease in the percentage of single occupancy vehicle mode share by 5%, five years after opening

  KPI 3: Increase walking and cycling mode share by 5%, five years after opening

- **Benefit three** — **Improved Access and Safety (15%)**

  KPI 1: Increase the number of people accessing the Petone foreshore by active modes

  KPI 2: Reduce the number of cycling and walking deaths and serious injuries by a total of five, five years after opening

  KPI 3: Increase the availability of safe and convenient pedestrian and cycle routes to key destinations

- **Benefit four** — **Improved Development Opportunities for Urban Growth Areas in Southern Lower Hutt (10%)**

  KPI 1: Achieve the development aspirations as set out in Petone 2040

  KPI 2: Maintain the current levels of employment growth

The ILM benefits map is attached as **Appendix Two**.

It is noted that the PSG endorsed the direction of the problem and benefit statements, and the investment objectives (as discussed below), at its May 2019 meeting.

2.6.3 Alignment to Existing Strategies / Organisational Goals

Table 17 sets out the alignment of the benefits sought by the PBC with the outcomes and objectives of HCC's key strategic documents.

Table 17 Alignment with Hutt City Council's Key Strategic Outcomes and Objectives

Strategy Document	Remarks / Comments
Hutt City Long Term Plan (LTP) 2018-28	The PBC's benefits align with the LTP's vision to be a *"great place to live, work and play"*. The PBC benefits also align with the LTP's community outcomes, and in particular, a safe community; a strong and diverse economy; an accessible and connected city; and a healthy and attractive built environment. The LTP identifies that the effects of earthquakes, storms, and sea level rise are key issues for the Petone and Gracefield / Seaview area. It signals plans for further residential intensification in the Project Study Area (e.g. low-rise residential apartments on Jackson Street), and further implementation of the Vision Seaview Gracefield 2030. The LTP also signals that HCC will continue to investigate and design the Cross Valley Link (from SH2 to Seaview), and sets aside $1M for investigating this project. It also has identified $140M for construction of this project in the longer term.
Infrastructure Strategy (2018-2048)	The PBC's benefits align with the Strategy's vision for infrastructure that meets the *"needs of today and tomorrow"*. The PBC benefits also aligned with the following goals of the Strategy: ► To increase the resilience, sustainability and long term adaptability of the infrastructure ► To improve the design, development and management of infrastructure to serve the community needs, desires and aspirations

Strategy Document	Remarks / Comments
	► To upgrade the infrastructure to reinforce the growth of our strong, diverse and innovative economy ► To strengthen the reliability, efficiency and effectiveness of the infrastructure networks. The Strategy has identified the key infrastructure issues for Lower Hutt are the effects of natural hazards and climate change; growth and demand variations (e.g. increase demand for inner city living), and technological advancement. In terms of the Project Study Area, the Strategy has also identified the need for major improvements in roads connecting the central city and Seaview / Petone to SH2 to address capacity constraints, to accommodate the predicted growth (e.g. from the Eastern Bays, and Wainuiomata), and to improve the resilience of the major strategic roads. It identifies that the road capacity issues occur during peak hours on The Esplanade, and on Jackson Street. It also promotes provision of infrastructure for active modes.
Urban Growth Strategy (2012-2032)	The PBC's benefits align with the Strategy's vision for Hutt City to be *"the home of choice for families and innovative enterprise"*, and supports its key goal of enabling a city that is connected, driving opportunities for commerce, living and playing. In terms of the Project Study Area, the Strategy identifies Petone (and the central city) as a key location that has residential intensification and economic development potential. It identifies that a key advantage of Petone is its proximity to public transport routes and SH2. The Strategy identifies that there are opportunities to improve the transport network through development of cycling networks, improving the city's connections to SH2, better east-west connections across the southern half of the city (i.e. Project Study Area). With respect to The Esplanade, the Strategy identifies that developing an efficient east-west route across the lower half of the city (i.e. Project Study Area) to be a key aspiration, and has specifically identified the following outcomes for a road that would cross southern Lower Hutt: ► Reduction in costs imposed on the city's businesses, helping make it easier to grow, and more attractive for new businesses to establish ► Improved amenity and recreation values of Petone Beach and The Esplanade, and reduce community separation ► Increase in residential and commercial development potential of The Esplanade, Jackson Street and western area of Petone ► Improved walking and cycling facilities that are consistent with the Great Harbour Way concept.
Economic Development Plan (2015 – 2020)	The PBC's benefits align with the Plan's vision to grow the wealth of the City, and its objective of increasing the number of commercial and industrial developments in Lower Hutt. In particular, the Plan has identified that investigating the Cross Valley Transport Connections, improving transport access to Seaview / Gracefield, and encouraging mixed use development and amenity in Petone are key actions to be implemented. The Plan also recognises that east-west connections across southern Lower Hutt (i.e. the Project Study Area) are required to improve the city's development potential. It notes that congestion on The Esplanade impacts on Petone Foreshore's amenity value and makes it difficult for businesses to connect to the wider region.

Strategy Document	Remarks / Comments
Climate Change Target	HCC has set a climate change target to reduce the city's greenhouse gas emissions to net zero by 2050. HCC has also declared a climate change emergency, which requires all decision-making to consider the impacts on climate change including the need to achieve emission reductions. Part of the decision-making processes includes requiring resilience and climate change adaptation measures to be considered in future transport projects. Both resilience and climate change adaptation are key issues identified for the Project Study Area.
Petone Spatial Plan 2040	The PBC's benefits align with the outcomes sought by the Spatial Plan. The Plan's principles and key transport proposals are discussed in detail at section 2.6.3.1. It is noted that the Plan has identified flooding from the Hutt River and Korokoro Stream, tsunami, earthquake subduction (e.g. a 1.2m drop in Petone West), liquefaction and sea level rise as key constraints for Petone. The Plan has also identified that developing eastern and western gateway entrances into Petone; improving cross valley transport connections, providing high quality active mode connections, and improving the Petone Foreshore's amenity to be key opportunities to be investigated.
Vision Seaview Gracefield 2030	The PBC's benefits align with the Vision's base needs, including the need for good transport access into the Seaview / Gracefield area. These outcomes also align with the Vision's key aspirations for the area for 2030 including: improving traffic efficiency (with a focus on overweight and over-dimensioned vehicles); provision of safer roads for pedestrians and cyclists (as the area links the Eastern Bays to the greater Lower Hutt area) and, provision of good public transport services.
Central City Transformation Plan	The Plan sets out a strategy for development and design of Lower Hutt's central city, which is located to the immediate north of the Project Study Area. The Plan identifies a number of transformation principles including consolidating the central area as the 'City's core' and improving east-west links. It also identifies the Project Study Area as a key gateway into Lower Hutt.
Lower Hutt Growth Story	In 2018, both HCC and NZTA developed the 'Lower Hutt Growth Story'. The Story provides a summary of the urban growth, land use, transport and resilience goals and activities identified for Lower Hutt. Among other matters it identifies the following: ► Coastal areas face increased climate change impacts (e.g. increased storm surges and sea level rise) ► Lower Hutt is at risk of severance in the event of a major seismic event and could be cut off for three months or more ► The Esplanade provides critical lifeline access to communities and resources with a high resilience criticality rating ► Both road and rail infrastructure is near capacity ► SH2 often operates as part of the local road network, and local roads often operate as part of the highway network. The PBC's problem statements align with the Story's problem statements, i.e. poor resilience, poor multi-modal performance and poor land use opportunities. The PBC's benefits are also aligned with the Story's aspirations to enable growth, to facilitate housing, to protect communities, to improve resilience, make it easier to get around and to make walking and cycling safer and public transport easier. The Story identifies the following transport, land use and resilience priorities:

Strategy Document	Remarks / Comments
	► RiverLink / SH2 Melling Interchange, P2G and the Cross Valley Transport Connections ► Supporting regional rail and bus service improvement initiatives ► Continuing with the rollout of the Urban Cycleway Programme, including improving the Hutt River Trail ► Central city residential intensification ► Residential intensification (Plan Change 43) and greenfield development ► North Park Gateway ► RiverLink flood protection works ► Eastern Bays shared path ► Climate change planning.

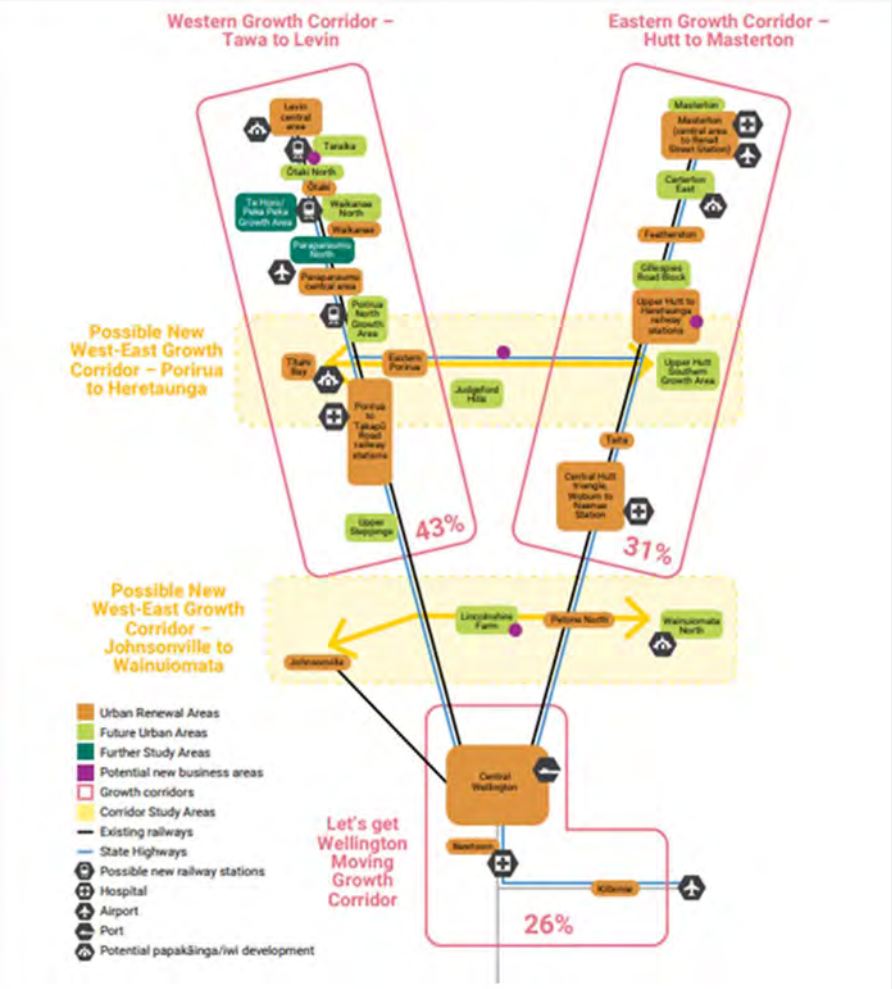
Table 18 sets out the alignment of the benefits sought by the PBC, with the outcomes and objectives of the key national and regional transport strategic documents.

Table 18 Alignment with National and Regional Key Strategic Outcomes and Objectives

Strategy Document	Remarks / Comments
Government Policy Statement (GPS) on Land Transport Funding 2018-21	The PBC's benefits align with the GPS's strategic priorities for access. Specifically, the outcomes / benefits identified for the area will help to increase access to economic and social opportunities, and to provide increased transport choice and improved resilience. Improved safety outcomes are also sought for the Project Study Area.
NZTA Statement of Intent 2018-2021	The PBC's benefits will help NZTA achieve its vision of creating great journeys that are easy, safe and connected, as well as progressing towards the provision of one integrated land transport system. In particular, it will support NZTA's key goals to improved transport inclusive access, liveable communities, and access.
Waka Kotahi Arataki	The PBC has been prepared to specifically complement the Arataki. This document outlines Waka Kotahi's key drivers for delivering long-term outcomes and the PBC is aligned with the Arataki in the following ways: ► Improves urban form – the preferred programme will improve multi-modal travel options, which in turn can support increased levels of urban growth. Additional health and climate change benefits will also be realised ► Transforms urban mobility – improvements in journey times through the study area will improve the reliability and punctuality of road based public transport ► Reduces harm – health and safety – vulnerable user facilities will be significantly improved for east-west vulnerable road user travel. New facilities will also be provided to the most recent safety specifications, providing an improved safety environment for all users ► Tackles climate change impacts – resilience improvement from HILP events will be improved by providing a new river crossing in a more resilient location and built to relevant specifications. Reduced levels of traffic are expected along Petone foreshore which means if sea inundation did occur here, then less vehicles would be impacted. The provision of new active mode user facilities will result in reduced carbon emissions whilst realising additional health benefits ► Supports regional development – improving the transport system within the study area will provide an environment that is more accessible and

Strategy Document	Remarks / Comments
	therefore more attractive to future development and relocation of goods and services
NZTA Resilience Framework 2018	The resilience outcomes sought for the Project Study Area will help NZTA give effect to the key principles of its Resilience Framework. These include: prevention; mitigation and preparedness ahead of an event; avoid exposure to risk where possible; reduce the impact of risks where they cannot be prevented; and be well-prepared and practised ahead of an event).
Wellington Regional Land Transport Plan (WRLTP) 2015 (updated in mid-2018)	The PBC's benefits align with the following WRLTP strategic priorities: ► A high quality, reliable public transport network ► A reliable and effective strategic road network ► An effective network for the movement of freight ► A safer system for all users of our regional transport network ► An increasingly resilient transport network ► A well planned, connected and integrated transport network ► An attractive and safe walking and cycling network ► An efficient and optimised transport system that minimises the impact on the environment. The benefits sought by this PBC are also consistent with the Hutt Corridor Strategy's long term vision for improved east-west connections (i.e. to be efficient, reliable and safe, providing resilient options for all trips) and the benefits sought for the corridor (i.e. economic growth supported, improved resilience, and improved resilience). The outcomes are also consistent with the Corridor's following strategic principles: ► A reliable, high capacity, modern and attractive rail corridor supported by effective bus services ► Good east-west connections linking SH2 with SH1 to the west and the Seaview / Gracefield industrial area to the east ► A resilient transport corridor, with good route options and alternatives ► Well connected, safe and convenient walking and cycling networks, with good north-south and east-west links between centres. One of the key strategic actions identified for the Hutt Corridor is to improve east-west connectivity. With regard to the Project Study Area it specifically states: *"Improving access between SH2 and the Seaview / Gracefield industrial area in the shorter term will be addressed through improvements to the Petone Esplanade to maximise traffic efficiency and improve pedestrian and cyclist access to and along the foreshore. In the medium term the options for increasing capacity are a major upgrade of the Petone Esplanade or an alternative route further inland, known as the Cross Valley Link. The preferred option is the new inland Cross Valley Link as this is likely to be most effective and is most consistent with other community outcomes relating to amenity and use of the Petone foreshore. The timing of this new road should be closely linked to the construction of the P2G Link Road."* Other strategic actions identified for the Hutt Corridor that are relevant to the Project Study Area include implementing rail improvements [including park and ride improvements at Petone (now complete)], improving walking and cycling networks including the Hutt River Trail, and Great Harbour Way. The WRLTP 2018 mid-term review confirmed the strategic direction of the WRLTP remained fit-for-purpose, and identified public transport, resilience, and walking and cycling as key areas of focus over the next three years. It

Strategy Document	Remarks / Comments
	is noted that the Hutt City's Cross Valley Transport Connections project is Priority 2 on the mid-term review's investment priority list. The WRLTP is due to be updated in 2021 (with development processes commencing in late 2020).
Wellington Regional Public Transport Plan (GWRC)	The PBC's benefits align with the following key objectives for the Plan: ► An integrated approach to the public transport network – including the planning and provision of services, infrastructure and information ► High quality, reliable, safe and customer-focused public transport services using modern vehicles and infrastructure. It is noted that the Plan identifies the following key rail improvements (which are referred to as rail scenarios [RS]): ► RS 1 – includes new electric vehicles, increasing seating capacity and more frequent services ► RS 2 – includes providing a regular 10-minute service between Upper Hutt and Wellington during peak time ► RS A – includes improving journey times through introducing faster rail services between Upper Hutt / Waikanae / Johnsonville / Masterton and Wellington. The Plan is proposed for a major review in 2020.
Draft Park and Ride Strategy (GWRC)	Increasing travel mode choice in the Project Study Area is likely to align with the outcomes sought by this draft Strategy. The draft Strategy notes that most park and rides are at 85% occupancy before 7.30am, and nearly a quarter of users drive less than 1 km to reach the park and ride facility. Among other actions, the draft Strategy seeks to make better use of existing park and ride facilities and for more people to be walking, cycling, scootering and catching buses to train stations.

Strategy Document	Remarks / Comments
Draft Wellington Regional Growth Framework (GWRC)	The draft Framework 2020 is a 30-year spatial plan for the Wellington-Horowhenua region. It identifies how the region might accommodate a future population of 760,000 and an additional 100,000 jobs in the next 30 years. This represents an additional 200,000 people living in the region over the next 30 years. About 88% housing growth over the next 30 years is expected to be located in areas identified in the draft Framework (the other 12% will be from 'business as usual' infill). Just over 30% of this is expected to be accommodated in the eastern growth corridor from Tawa to Levin as set out in the figure below:  The draft Framework identifies Petone North as a priority urban renewal area. It also proposes a new West-East Growth Corridor (Johnsonville to Wainuiomata) which encompasses the Project Study Area and is to be supported by improved multi modal connections.

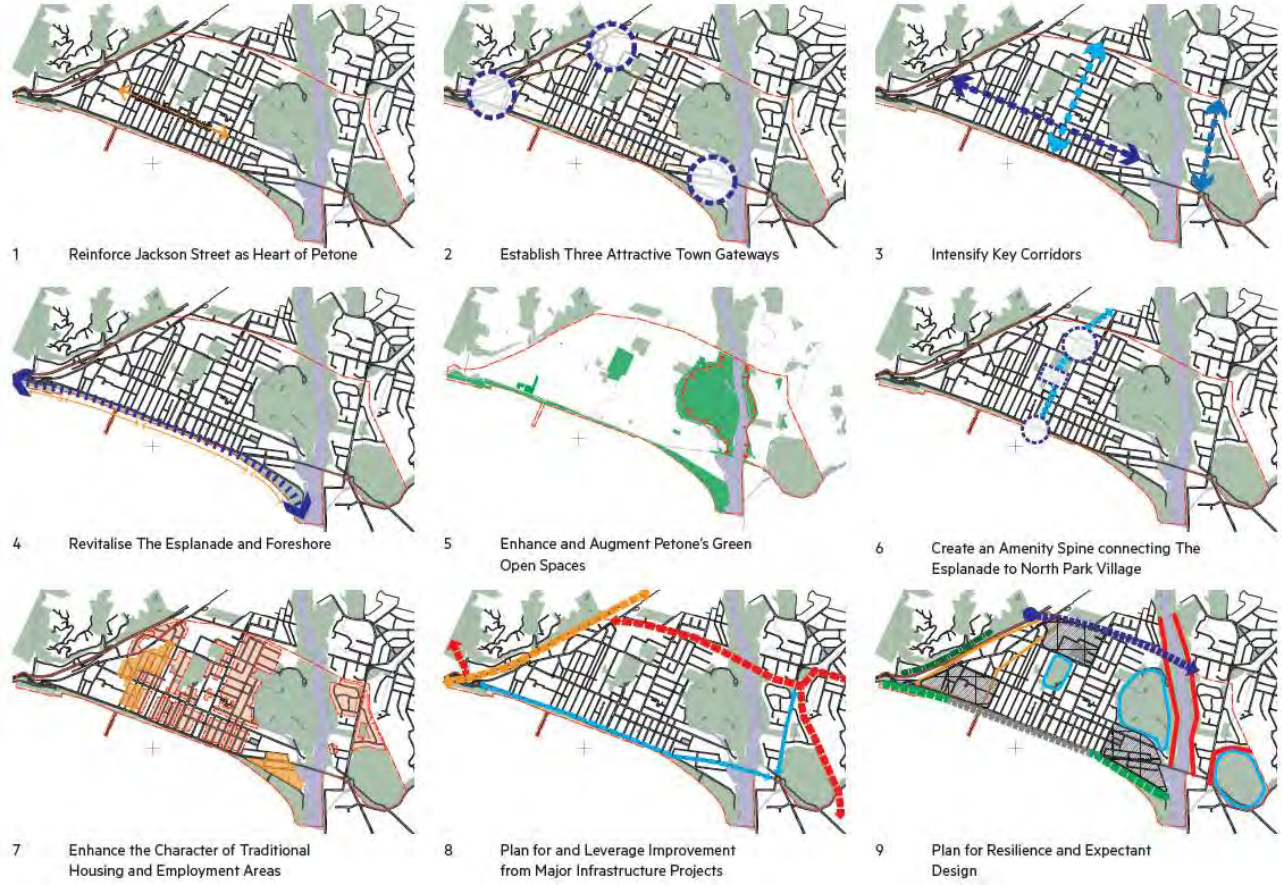
2.6.3.1 Petone Spatial Plan 2040

Development of the PBC has specifically considered the requirements of the Petone Spatial Plan 2040 (P2040), and in particular its principles, and recommendations for the transport system. A brief summary of the principles and recommendations for the transport system is set out below.[34]

[34] See - http://www.huttcity.govt.nz/Your-Council/Projects/petone-2040/p2040-spatial-plan-chapters/#Part-2

Figure 24 sets out P2040's planning principles.[35]

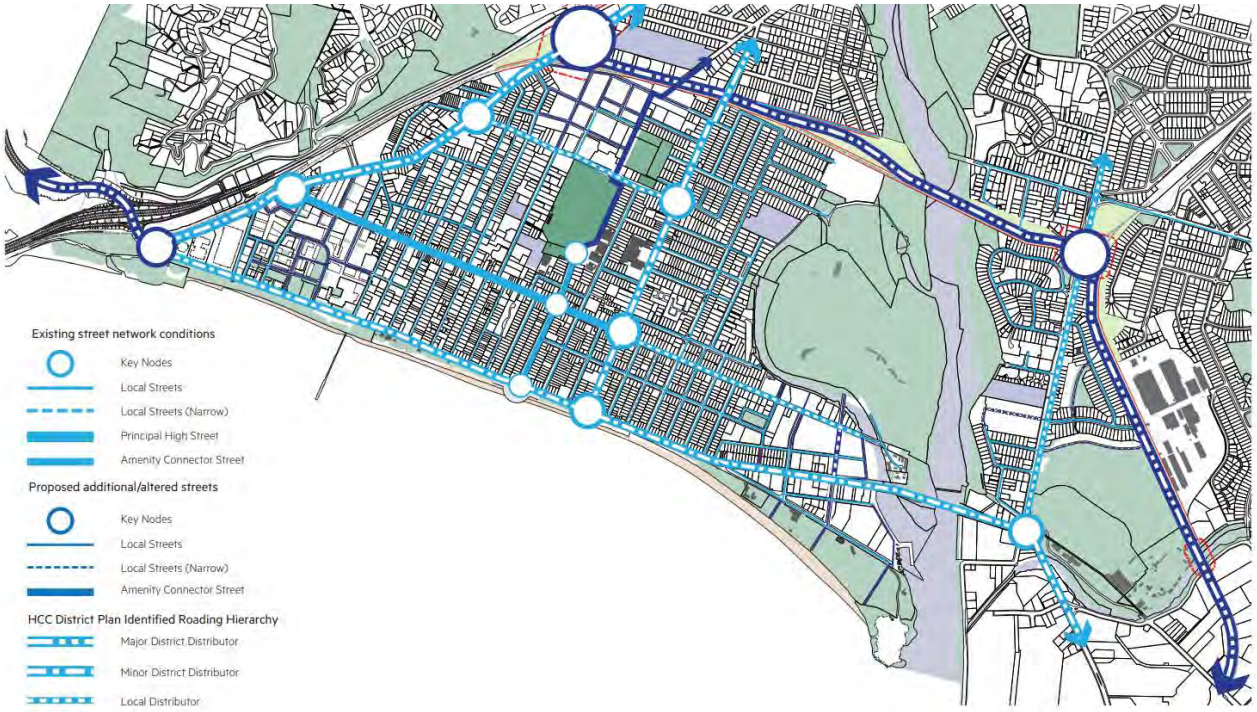
Figure 24 P2040 Planning Principles



In terms of improvements to the transport network, P2040 identifies a plan for the Project Study Area as set out in Figure 25.[36]

[35] P2040, 2017, page 80
[36] Ibid, page 95

Figure 25 P2040 Proposed Movement Network



In terms of improvement activities, P2040 proposes the following *roading improvements*[37]:

- P2G Link Road will provide connections from SH2 to The Esplanade and Hutt Road
- CVL will provide an east-west transport connection along the railway corridor between SH2 / Hutt Road and Randwick / Whites Line East Roads, with a river crossing)
- Seaview / Gracefield connections are proposed along the railway yards / rail line rather than along Randwick Road
- Petone West: A local street system and new block structure opening up access between Jackson Street and The Esplanade and providing new east-west links
- North Park Village: A local street system and new block structure north of Udy Street with new east-west connections between Cuba Street and Hutt Road, including a new train station and bus connection on Cuba Street
- Petone East: principally new north-south streets connecting Hīkoikoi Reserve north across Waione St to Jackson St east and Te Mome Stream
- De-tuning of The Esplanade (reduced vehicle movements including heavy commercial vehicle traffic) and streetscape upgrades including more frequent pedestrian crossings
- Reinforcing the importance and quality of Buick Street (with shared surface connections across P2G Link Road and new links into North Park Village), and Jackson Street (east of Cuba).

P2040 proposes the following *public transport* improvements:[38]

- Pedestrian accessibility improvements to the Petone Rail Station
- Petone Rail Station environs are proposed to be upgraded with a new Station Square and better links to Jackson Street
- Improvements to the Ava Rail Station overbridges
- A new rail station at the North Park Village to serve the existing Ava station catchment and also the new North Park Village precinct

[37] Ibid, page 94
[38] Ibid, page 96

- Bus services to be included in any new cross valley link connection
- Bus route extension along Udy Street and Britannia Street to improve access to the new North Park Village precinct.

P2040 proposes the following *active mode* improvements:[39]

- The quality and extent of pedestrian and cycle links along The Esplanade / Foreshore to be improved to provide for a range of recreational activities and to encourage greater public occupation of the sea front. These improvements should integrate with new crossing facilities leading north towards Jackson Street. This route should connect through the Hīkoikoi Reserve into the Hutt River Trail with a better route through the Boat Sheds area up to the Estuary (Waione Street) Bridge
- Enhancements to Honiana Te Puni Reserve to provide connections to the Te Ara Tupua Walking and Cycling Link
- Pedestrian and cycle connections between Buick Street, The Esplanade, Petone Recreation ground and North Park (including a new pedestrian bridge link into Alicetown)
- Improvements to the existing links across and along the edges of Petone Rec (including the access points on Udy Street)
- New active mode routes to be included in the Cross Valley Transport Connection between the western intersection at Hutt Road / SH2 and a new eastern link over a new Hutt River Bridge to Randwick Road.

2.6.4 Uncertainty Log

This section sets out the uncertainty log for the PBC. It documents the key uncertainties identified by HCC and the Project Team, and lists a number of factors that could affect transport demand and supply.

Table 19 sets out the definitions of the probabilities for the uncertainty log. Table 20 sets out the uncertainty log for the PBC.

Table 19 Definitions of Probabilities for the Uncertainty Log

Probability	Status
Near certain - the outcome will happen or there is a high probability that it will happen	► Policy or funding approval ► Tenders let ► Under construction
More than likely - the outcome is likely to happen but there is some uncertainty	► Submission of planning consent application imminent ► Adopted plans
Reasonably foreseeable - the outcome may happen, but there is significant uncertainty	► Adopted plans ► Draft plans ► Development conditional upon interventions going ahead
Hypothetical - there is considerable uncertainty whether the outcome will ever happen	► A policy aspiration

[39] Ibid, page 96

Table 20 Uncertainty Log

Factor	Timing	Probability	Impacts on Programme
Factors affecting demand			
Intensification of residential areas in Petone and Hutt Central	2020 +	Near certain	High. As envisaged in the P2040, further residential intensification of Petone is likely to take place. This is likely to increase pressure on the transport network, and in particular the road network. Some intensification has already occurred on Jackson Street and Cuba Street.
Commercial growth in Wellington	2020 +	Near certain	Medium. Commercial growth in the Wellington CBD is likely to continue. This will increase commuter demand on the Hutt Valley Rail Line and on SH2. This increase in demand is likely to place further pressure on key access / connection points in the Project Study Area, such as the Petone Train Station and the Petone and Dowse Interchanges.
Further Big Box Development	2020 +	More than likely	Medium. Big box retail development is likely to continue to take place in Petone West. Such developments will place further pressure on the transport network, and in particular on the road network. It is noted that HCC District Plan rules for Petone West are designed to facilitate big box development.
Commercial growth in central Lower Hutt	2020 +	More than likely	Medium. As envisaged in the Central City Transformation Plan, residential intensification / mixed use development is being encouraged for central Lower Hutt. Such growth is likely to increase commuter demand to the north of the Project Study Area. The speed of the development is likely to be linked with the progress of the RiverLink project.
Factors affecting supply			
Changes to the bus routes and timetables through bus reviews	2020	Near certain	Medium. Changes are likely to affect bus patronage.
Transmission Gully Motorway	2020 / 2021	Near certain	High. Completion of the Transmission Gully Motorway is expected to change traffic flows on the state highway system, including flows in and out of the Hutt Valley (and the Project Study Area) as well as on SH58.
Te Ara Tupua Walking and Cycling Project	2022	Near certain	High. Consenting and construction funding has been confirmed to complete this project. The Petone to Melling section is now under construction. Once complete, this project may increase north-south active mode travel between Ngauranga and Melling. This outcome is may also increase active mode flows through the Project Study Area.
Hutt Valley commuter rail capacity improvements	2020+	Near certain	Medium. The frequency of north / south passenger rail services through the Project Study Area may increase, which in turn may encourage more use of the commuter rail service.

Factor	Timing	Probability	Impacts on Programme
RiverLink and SH2 Melling Interchange	2026+	Near certain	Medium. The new Melling Interchange will improve the northern access to the Project Study Area, and may result in traffic flow changes. The flood protection works will also reduce flooding risk for the Project Study Area.
Increased access to railway stations	2020 +	More than likely	Medium. GWRC has put in place a draft park and ride strategy that is expected to help manage the future use of park and ride facilities in the Wellington region. Access improvements to the Waterloo Railway Station have been recently completed (December 2019). Improvements to Petone, Ava and Woburn park and ride facilities are proposed.
P2G Link Road	2030 +	Reasonably foreseeable	High. If the P2G Link Road proceeds as currently envisaged, it is likely to impact on traffic volumes / patterns within the Project Study Area. In particular, it is likely to impact on traffic volumes along The Esplanade and Hutt Road, as well as on SH2 between the Petone and Dowse Interchanges.
Let's Get Wellington Moving	2020 +	Reasonably foreseeable	Low. Has the potential to increase transport demands to and from the Project Study Area.
Eastern Bays Shared Path	2022	Reasonably foreseeable	Medium. Once complete this project is likely to significantly increase north-south active mode travel to and from Eastbourne. This in turn is likely to increase active mode flows through the Project Study Area, which will have the secondary impact of realising positive health and climate change benefits
Beltway Shared Path	2022	Reasonably foreseeable	Medium. Once complete this project is likely to significantly increase north-south active mode travel north of the Project Study Area. This in turn is likely to increase active mode flows through the study area.
Multi User Ferry Terminal	2030+	Reasonably foreseeable	Low. An improved ferry facility at the Wellington port may impact on traffic demands and flows through the Project Study Area.

2.7 Problem Statements Evidence Base

This section sets out the evidence base for the two problem statements identified through the ILM process. It is noted that the ILM process included detailed problem mapping analysis to help identify the root causes, effects and the consequences of the problems.

2.7.1 Problem One: Lack of Transport Network Resilience

Problem Statement One is as follows:

Southern Lower Hutt's transport network lacks resilience to major natural events, future sea level rise, and regular network interruptions, which will cause economic and / or social disruption for Lower Hutt and the Wellington region.

Problem Statement One has been afforded a 75% weighting.

2.7.1.1 The Evidence

The Wellington Regional Land Transport Resilience PBC 2018 (the Wellington Transport Resilience PBC)[40] defines the resilience of the transport system as follows:

The ability of network infrastructure to deal with a range of significant disruptions and situations, from natural disasters to changing demographics or economic shocks. Resilience is defined, for the purpose of this study, as the combination of the loss of service of the transport system (from normal levels) and the time required for full recovery.[41]

PBC Workshop One attendees identified that the transport system in the Project Study Area was vulnerable to a range of Low Impact High Probability (LIHP) and High Impact Low Probability (HILP) events.

2.7.1.1.1 Low Impact Low Probability Events

For the Project Study Area, the evidence indicates that the key LIHP risk relates to minor unplanned events on the road network, such as crashes or disruption caused by minor flooding.

In terms of road crashes, and as set out in Table 8 above, there were 957 crashes that occurred on the road network in the Project Study Area between 2014 and 2018. Despite not having event outage records for these accidents, it is likely that many of them, and in particular the 34 serious injury crashes, would have resulted in lengthy outages for users of the road network.

2.7.1.1.2 High Impact Low Probability Events

The Project Study Area is susceptible to a range of HILP events including large earthquakes, and earthquake associated hazards, such as, liquefaction, ground shaking and tsunamis. The Project Study Area is also subject to flooding risks, and in the longer term, sea level rise as a consequence of climate change processes.

Earthquake HILP events

The Project Study Area lies within an area of the Wellington region that is exposed to a high level of seismicity. As set out in Figure 6 (see Section 2.5.1.2), the Project Study Area is particularly vulnerable to a movement on the Wellington Fault line, which runs north-south along its western boundary. This fault line has a predicted recurrence interval of 1,100 years, and it has been

[40] It is noted that the Wellington Resilience PBC was endorsed by the NZTA Board in July 2019
[41] Wellington Regional Land Transport Resilience PBC, 2018, page 9

estimated that a 7.5 magnitude earthquake on this fault line could see ground surface displacements of up to 5-metres horizontally and 1-metre vertically.

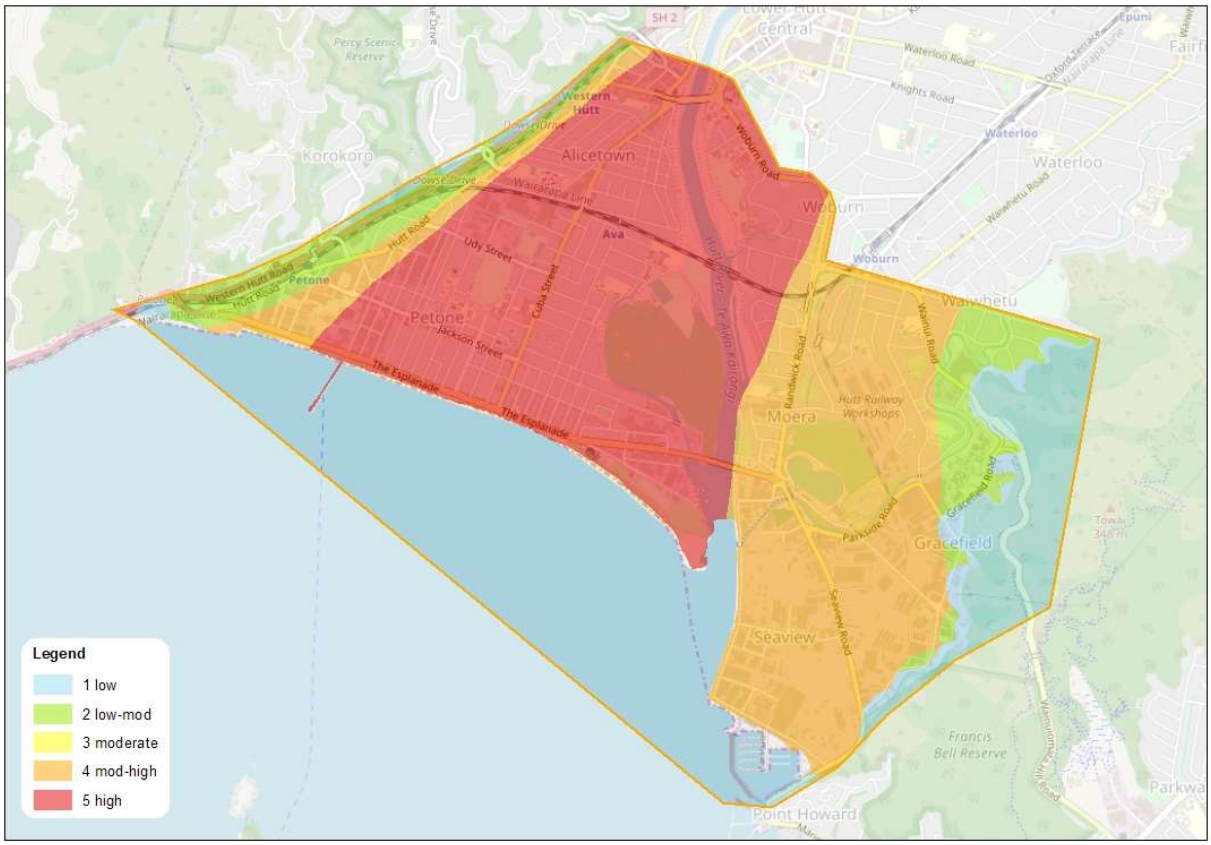
Earthquake related events

The Project Study Area is at risk from the following earthquake related events:

- Ground shaking

Figure 26 sets out the areas within the Project Study Area that are likely to be subject to significant ground shaking as part of a HILP event. As can be seen in this figure, a significant portion of the Project Study Area will be subject to high ground shaking following a large HILP event.

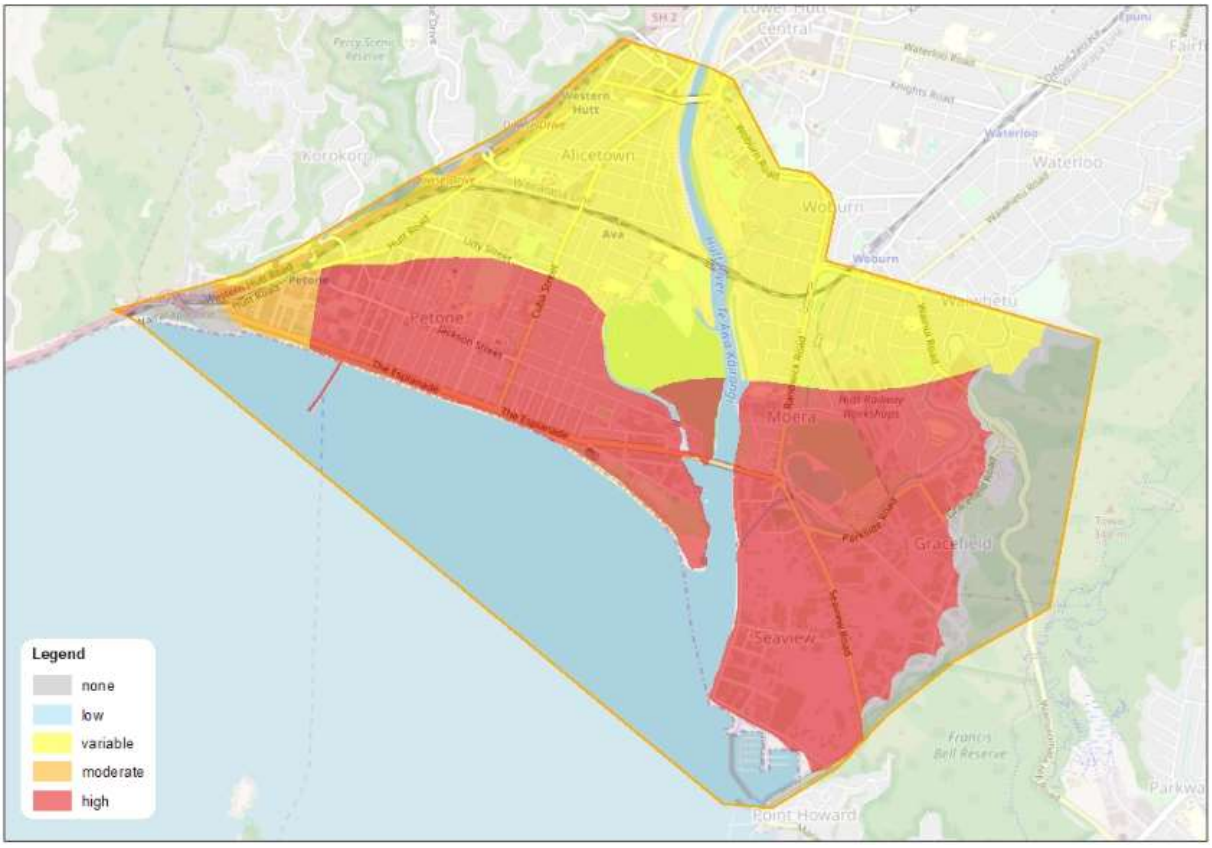
Figure 26 Ground Shaking Risk Areas



- Liquefaction

  Figure 27 below sets out the areas of the Project Study Area that are vulnerable to liquefaction following a HILP event. Petone and Seaview are all located in high risk (red) liquefaction areas.

Figure 27 Liquefaction Risk Areas



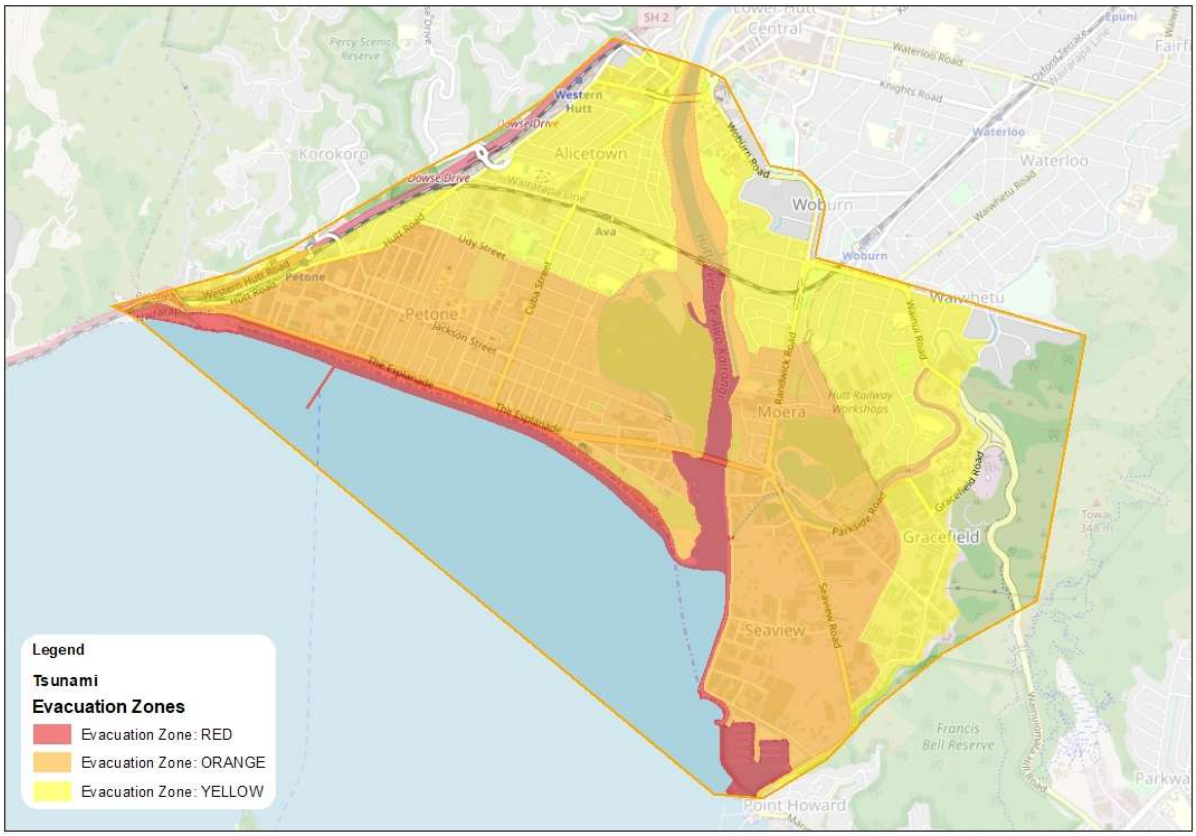
- Tsunami

  The Project Study Area is at risk from the following tsunami types:

  - Local - from earthquakes or landslides in the Cook Strait and Wellington Harbour
  - Regional - generated from events in the Kermadec Trench
  - Distant source - generated from events in the Pacific Ocean, particularly those in South America.

  The vulnerability of the Project Study Area to a tsunami event depends on the source of the tsunami. Figure 28 shows that most of the Project Study Area would be affected by a tsunami.

Figure 28 Tsunami Risk Areas

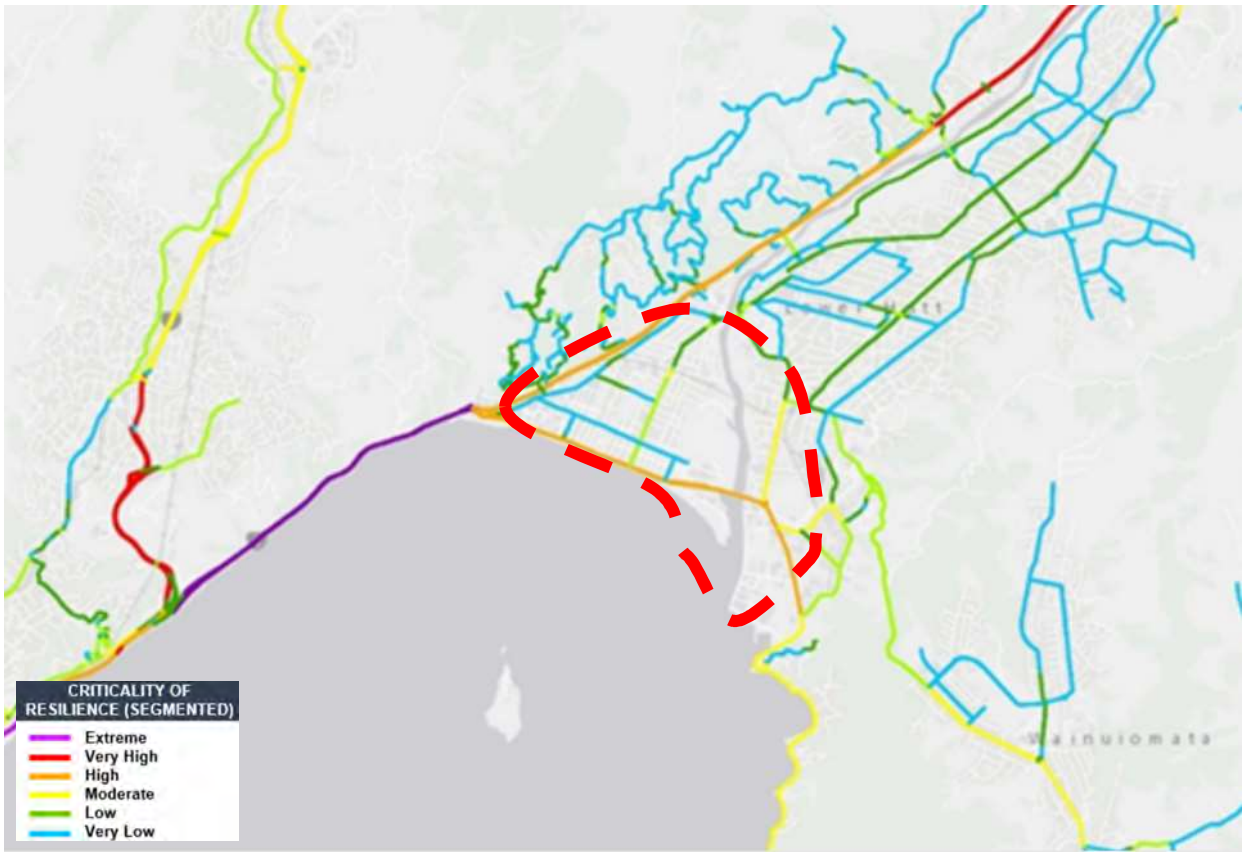


Criticality ratings and transport system outage predictions following an earthquake HILP event

The Wellington Resilience PBC includes a Regional Resilience Risk Register (Risk Register) that identifies the sections of the Wellington region's transport system that are considered to be most at risk from HILP events. The Risk Register was based on an assessment of the importance of the relevant sections of the transport system, and its availability[42] and disruption states[43]. Through establishment of the Risk Register (which is a combination of the importance and disruption state assessments), this PBC was able to identify criticality ratings for the key sections of the Wellington region's transport system. For the Project Study Area, the relevant criticality ratings are set out in Figure 29 below.

42 Considers the transport system's degree of outage (e.g. all lanes closed or partially closed)
43 The combined assessment of predicted availability and outage lengths

Figure 29 Criticality Ratings for the Project Study Area



As set out in Figure 29 both The Esplanade / Waione Street route and Seaview Road have been identified as having high criticality ratings. Table 21 describes the nature of the vulnerability of these two routes in more detail.[44]

Table 21 Criticality Ratings for The Esplanade / Waione Street and Seaview Road

Network Segment	Vulnerability EQ	Tsu	Storm	Nature of Vulnerability
The Esplanade - Waione Street	Yes	Yes	No	Critical route to provide access to the Seaview fuel supply terminals and industrial area. Also provides access to eastern suburbs of Lower Hutt, Wainuiomata and Eastbourne. This waterfront route is vulnerable to closure in a ~M7.5 earthquake due to liquefaction / lateral spreading, tsunami and storm surges in a major storm. This will take weeks to recover and possibly many months if the bridge collapses. The Estuary (Waione Street) bridge approaches are prone to collapse from lateral spreading. This corridor also carries bulk water main into Wellington from Hutt Valley and Wainuiomata water sources.
Seaview Road	Yes	Yes	No	Key route to access fuel supply terminals in Seaview. In a major ~ M7.5 earthquake, likely to be affected by liquefaction and lateral spreading towards the Waiwhetū Stream and also failure of the Seaview Road bridges. This will take many weeks to months to restore access.

[44] Wellington Regional Land Transport Resilience PBC, 2018, Appendix C

As set out above in Table 21, the outage times predicted for The Esplanade / Waione Street route and Seaview Road range from weeks to months. It is also noted (from Figure 29) that the section of SH2 between Petone to Ngauranga, including the Petone Overbridge, has been identified as having an extreme critical rating with a predicted outage period (for both road and rail) of between 6 and 12 months.

The Wellington Resilience PBC also considered the social consequences of a significant earthquake HILP event.[45] It considered that most of the communities in the Wellington region were at high risk of social isolation following such an event – in particular Eastbourne and Wainuiomata. It is noted that both communities are reliant on the Project Study Area's transport system for access to and from Lower Hutt and the wider Wellington region.[46]

Economic consequences following a major earthquake

The Wellington Lifelines PBC predicted that it would take decades for the Wellington region to recover to pre-quake levels-of-service following a major movement on the Wellington Fault line.[47] To help put the economic consequences of such an outcome into context, the Wellington Lifelines PBC made the following economic predictions / observations for the Wellington region and for New Zealand:

- Under the "do-nothing" scenario, the expected economic loss to the national GDP is likely to be in the order of $16B over a five year period.[48] It is noted that this estimate excluded recovery costs and building repairs, which have been estimated to be in the order of $16B in a separate report by GNS Science[49]
- A loss of one to two per cent from the national GDP per year, which is equivalent to a net present value of $30-$40B.[50]
- Modelling undertaken by Deloitte NZ, for similar earthquakes to those which occurred in Christchurch in 2010 and 2011, but instead occurring in Wellington, showed that national GDP was likely to reduce by up to $29B by 2030.[51]

Although specific economic modelling hasn't been undertaken for an HILP event that damages the Project Study Area's transport system, the economic consequences predicted for the Wellington region by the Wellington Lifelines PBC suggests that the economic losses from a severely damaged system within the study area is also likely to be significant.

It is also noted from a short-term recovery perspective, access to, through and from the Project Study Area will be critical, and in particular, access to the regional fuel supply facilities located in Gracefield / Seaview. Connectivity will also be important for accessing the potable water (e.g. Gear Island Water Treatment Plant) and wastewater (e.g. Seaview Wastewater Treatment Plant) facilities located within the Project Study Area.

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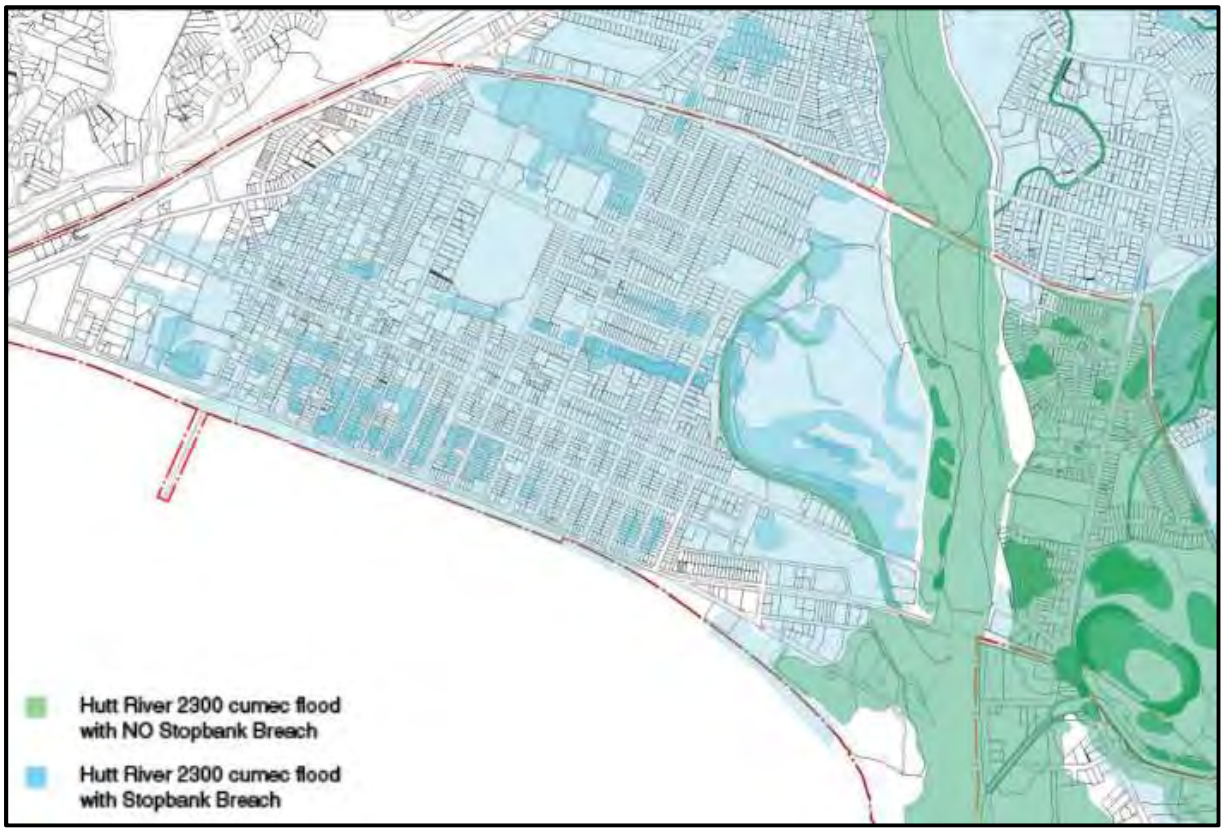
[45] The methodology adopted to undertake this assessment was based on the proximity of social services (e.g. access to medical centres/hospitals, to supermarkets (or equivalent), schools and employment
[46] Wellington Regional Land Transport Resilience PBC, 2018, pages 81 to 82
[47] Wellington Lifelines Project, *Protecting Wellington's economy through accelerated infrastructure investment programme business case*, 2018, page 7
[48] Ibid, Page iv
[49] GNS Science, *Estimated earthquake and tsunami risks from large earthquakes affecting the Wellington Region*, 2014, Table 3.2, page 19. It is noted that this estimate is based on a combined 7.5 magnitude and tsunami HILP event. It is also noted that the $16B estimate is in 2014 dollars
[50] Wellington Lifelines Project, *Protecting Wellington's economy through accelerated infrastructure investment programme business case*, 2018, page 10
[51] Ibid, page 10

Flood Risks

P2040 identifies that there are three water courses that are likely to create flood hazards for Petone (and the northern sections of the Project Study Area), including the Hutt River, Korokoro Stream and Waiwhetū Stream. All three rivers / streams have a history of flooding in the Project Study Area and subsequently disrupting its transport system.

Figure 30 sets out the extent of 2300 m^3/s flood risk (i.e. the 1:440 year flood event) from the Hutt River for the Petone area.[52]

Figure 30 Hutt River 1:440 Year Flood Risk Extents

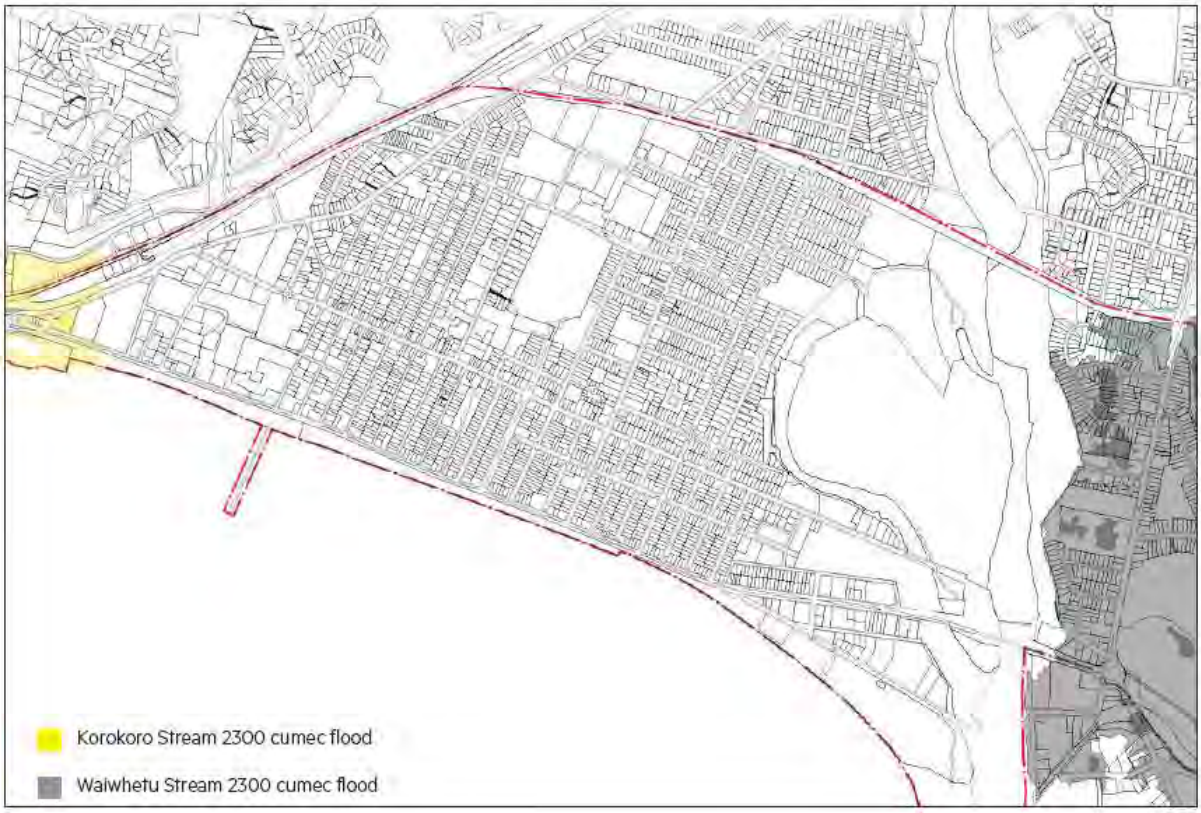


As can be seen from Figure 30, widespread flooding is predicted to occur if the Hutt River stopbank was to be breached. If the stopbank was not breached, the likely flooded areas would be confined to the Gracefield / Seaview area. Both scenarios would result in severe disruption to the transport network.

Figure 31 sets out the extent of 2300 m3/s flood risk (i.e. the 1:440 year flood event) from the Korokoro and Waiwhetū Streams for the Petone area.[53]

[52] P2040, 2017, page 67
[53] Ibid, page 67

Figure 31 Korokoro Stream / Waiwhetū Stream 1:440 Year Flood Risk Extents



As can be seen from Figure 31 above, flooding is predicted to occur in the Petone West area and in the Seaview / Gracefield area disrupting the transport system.

Bridge capacity risks

Table 22 sets out the flood capacity for the bridges that cross the Hutt River.[54]

Table 22 Flood Capacity of the Hutt River Bridges

Bridge	Passing 1,900m^3/s	Passing 2,300m^3/s	Passing 2,800m^3/s
Ewen	Yes	Yes	No
Ava Rail Bridge	Yes	No	No
Estuary (Waione Street) Bridge	Yes	Yes	Yes

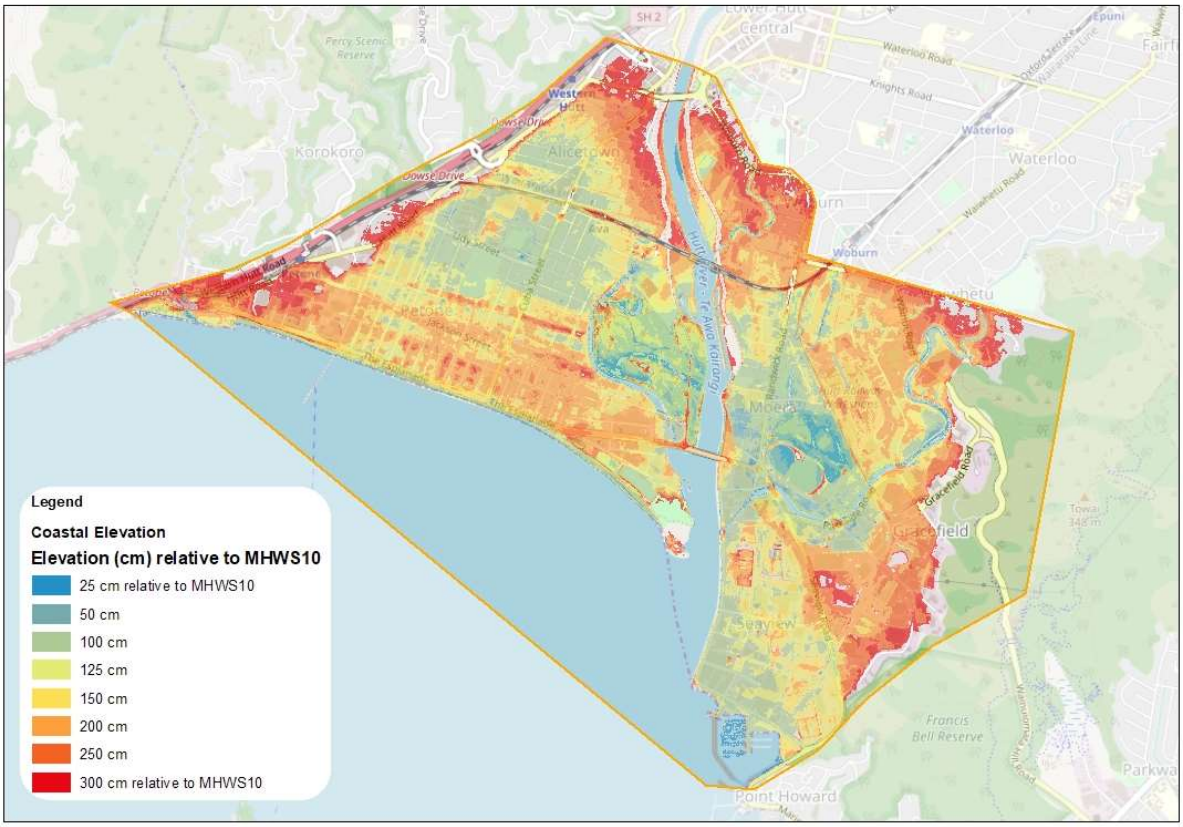
As set out in Table 22 above, the Ava Rail Bridge has been identified as being at-risk from a 1:440 flood event (i.e. a 2,300 m3/s flood).

Long Term Sea Level Rise

Figure 32 sets out the predicted locations and impacts of long-term sea-level rise on the Project Study Area.

[54] Bridge capacity risks are based on GWRC's Hutt River Flood Management Plan (see - http://www.gw.govt.nz/assets/Our-Services/Flood-Protection/Hutt/FP-Hutt-River-FMP.pdf)

Figure 32 Sea Level Rise Predictions for the Project Study Area



As indicated above in Figure 32, long term sea level rise is likely to have a widespread impact on the Project Study Area. Particularly vulnerable locations include the Petone West, Petone South, Seaview and Alicetown areas where sea level rise is predicted to be as much as 300cm. In terms of the transport system, the study area's most vulnerable sections are The Esplanade (west), and the road and rail network in and around The Esplanade / Hutt Road roundabout. GWRC's 2019 assessment of coastal vulnerability to climate change and sea level rise also identified that the Seaview and Petone areas were amongst the most vulnerable to the effects of sea level rise in the Wellington region.[55]

Combined Hazard Map Overlay

P2040 includes a combined (notional) hazard overlay map for Petone and the northern areas of the Project Study Area.[56] This map, which is shown at Figure 33, identifies three natural hazard risk zones, ranking them high, medium and low.[57]

[55] *Greater Wellington, Preparing Coastal Communities for Climate Change, Assessing coastal vulnerability to climate changes, sea level rise and natural hazards*, June 2019, page 51 (see - https://www.scribd.com/document/420897103/Preparing-Coastal-Communities-for-Climate-Change#from_embed)
[56] P2040, 2017, page 69
[57] It is noted that the overlay map zones are based on P2040's "no stop bank breach" flood scenario

Figure 33 Petone Combined Hazard Map Overlay

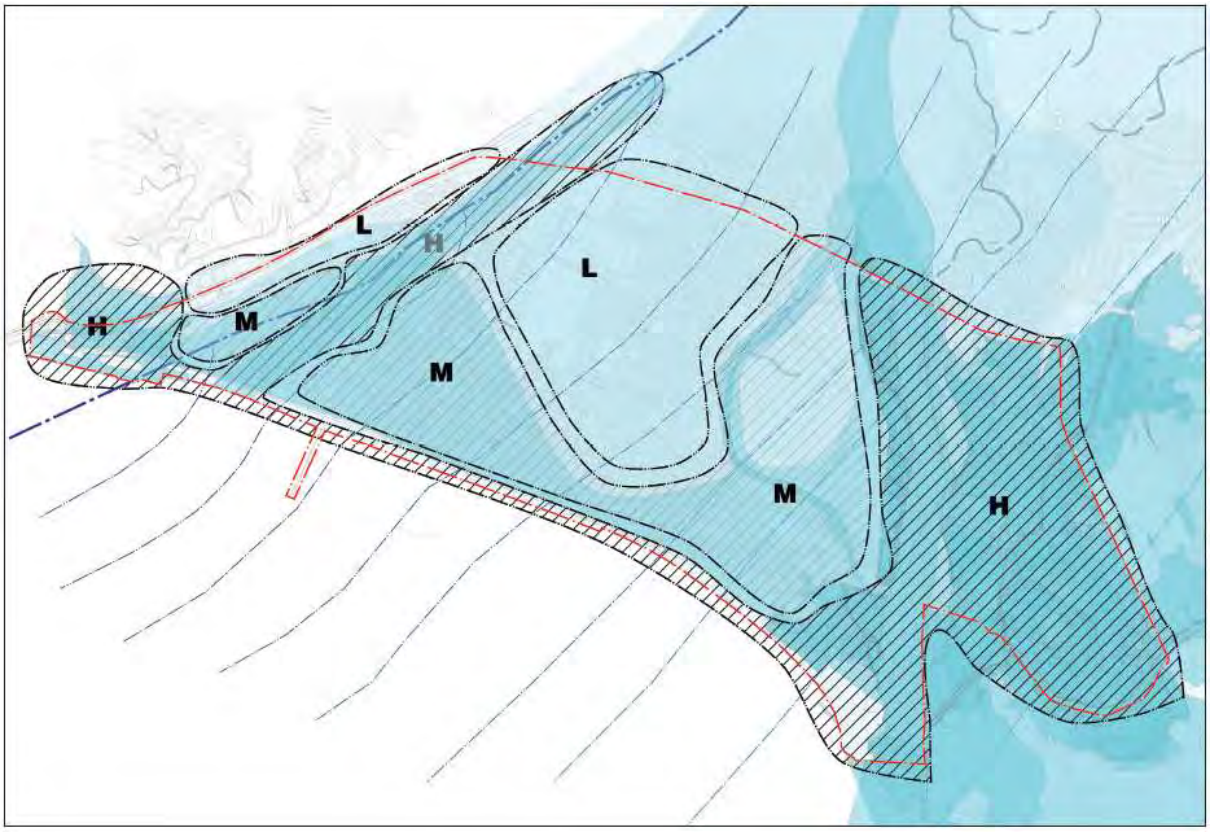


Figure 33 identifies the Petone West (including the Petone Overbridge area), Petone Foreshore and Seaview / Gracefield areas to be at most risk from natural hazards. It is noted however that large parts of central Petone have been afforded a medium or low risk.

2.7.2 Implications of the Evidence

Based on the evidence, the transport system within the Project Study Area is extremely vulnerable to HILP events. However, the evidence indicates that it is much less vulnerable to LIHP events.

The Wellington Lifelines PBC (2019), estimated that a 7.5 magnitude movement on the Wellington Fault line would render key transport connections within the Project Study Area, such as The Esplanade, Waione Street and Seaview Road, unusable for weeks or even months. As such, an earthquake of this magnitude would leave a number of the Project Study Area's communities, and / or nearby communities (e.g. Eastbourne and Wainuiomata) isolated for potentially long periods of time.

Both The Esplanade / Waione Street route and Seaview Road have been identified as being particularly vulnerable. Both have received high criticality ratings in the Wellington Resilience PBC 2018, due to the predicted liquefaction / lateral spreading, tsunami and flooding risks. The Estuary (Waione Street) Bridge is particularly vulnerable to lateral spreading.

A number of Wellington lifeline utilities are also dependent on The Esplanade / Waione Street route and Seaview Road for response and recovery purposes. For example, bulk water supply connections are located on the Estuary (Waione Street) Bridge, and if damaged could leave the communities within the Project Study Area and the wider Wellington region without a potable water supply for a number of days or months. In addition, if access along The Esplanade / Waione Street route and Seaview Road is restricted following a major HILP event, then access to

the Wellington region's fuel supplies will be hindered, which will significantly impact on short term recovery processes.

Flooding is also a key issue for the Project Study Area. Under P2040's stop bank breach scenario, extensive flooding from the Hutt River and Korokoro / Waiwhetū Streams within the study area can be expected to damage the transport system (and hinder the movement of people and freight). Under a no-breach scenario, flooding would be confined to the Gracefield / Seaview area.

Long term sea level rise is also expected to affect the Project Study Area's transport system. Sea level rise in certain locations could be as high as 300cm. Particular areas of concern from this perspective include Petone West, Petone (south), Seaview and Alicetown.

A number of economic loss scenarios have been calculated or modelled for a damaging HILP event for the Wellington region. Many of these cost modelling scenarios run into billions of dollars. For example, the Wellington Lifelines PBC 2019 has predicted that the economic loss to the national GDP could be in the order of $16B over a five-year period following a 7.5 magnitude movement on the Wellington Fault line. It also predicted that there is potential for significant loss of life and displacement of people following such an event.

Although specific economic modelling hasn't been undertaken for an HILP event that damages the Project Study Area's transport system, the economic consequences predicted for the Wellington region suggest that the economic losses from a severely damaged system within the study area is also likely to be significant.

In conclusion, there is clear evidence that there are a number of HILP event resilience risks that are likely to disrupt and / or severely damage the transport system located within the Project Study Area if they were to occur. The evidence also suggests that there is a need to take action in order to address the study area's resilience risks.

2.7.3 Investment Objective

Following PBC Workshop One, the following investment objective was identified for the resilience problem statement:

- *To improve the resilience of southern Lower Hutt by enhancing the transport networks ability to withstand and respond in a timely manner to HILP and LIHP events*

2.7.4 Problem Two: Limited Access

Problem statement two is as follows:

The existing transport system in southern Lower Hutt:

- limits modal choice
- constrains access to economic opportunities
- creates safety issues for active mode users

Problem Statement Two has been afforded a 25% weighting.

2.7.4.1 The Evidence

PBC Workshop One attendees identified that the operational performance and design of the existing transport system was creating access issues for people and freight movement in and through the Project Study Area. Consequently, transport modal choice was constrained, economic development hindered, and real and / or perceived safety issues created for vulnerable road users (e.g. cyclists).

2.7.4.1.1 Transport system's operational performance

The following elements have been considered when evaluating the operational performance of the Project Study Area's transport system:

- Travel time variability on key roads, and in particular the implications this variability has on all vehicle mode movements, and economic development within the Project Study Area
- Passenger rail performance.

2.7.4.1.2 Travel Time Variability

Travel time variability, and in particular its impacts on people and freight movement in and through the Project Study Area, has been documented in a number of the strategic documents as set out above in Table 17 and in Table 18 (see Section 2.6.3). For example:

- The Hutt Urban Growth Strategy identified that heavy commercial vehicle traffic volumes create congestion on The Esplanade that was limiting access and constraining development in the Gracefield / Seaview area[58]
- The WRTLP's Hutt Corridor Plan identified that there were conflicting demands for freight and commuter trips on key roads, and improved east / west connectivity was required[59]
- Petone Esplanade Strategic Case, identified that the congestion indicator, as determined by the Travel Time Survey process, was 4+ (i.e. over 4 minutes of delay per kilometre)[60]
- Lower Hutt Growth Strategy identified that key road (and rail) infrastructure was operating at, or near capacity, especially during peak travelling hour.[61]

All of these documents identified that The Esplanade / Waione Street route was particularly problematic from a travel time variability perspective.

Increasing Traffic Volumes

Table 23 sets out the traffic volumes and resulting level of service changes for the key routes / roads within the Project Study Area for 2012 and 2019 as well as for 2036 (as noted above in Sections 2.5.5.3 and 2.5.5.6, all of these routes are key routes for bus services and for freight movements).

[58] Urban Growth Strategy, 2012, page 40
[59] WRLTP, 2015, page 62
[60] Petone Esplanade, Strategic Case, 2016, page 8
[61] Lower Hutt Growth Strategy, 2016, page 6

Table 23 Traffic Volumes for 2012, 2019 and 2036

Routes	2012 (vpd)[62]	2019 (vpd)	2036 (forecast vpd)	Forecast LoS[63] change between 2019 and 2036
The Esplanade (at Cuba Street)	24,000	24,900	28,700	Remains D
The Esplanade (including the Estuary (Waione Street) Bridge)	27,000	30,600	35,880	Deteriorates from E to F
Cuba Street (south of the Cuba Overbridge)	13,000	10,700	12,500	Remains C / D
Hutt Road (north of Dowse Interchange)	17,000	20,000	23,300	Remains D
Randwick Road (Morea)	17,000	20,000	23,300	Remains D
Jackson Street (west)	No count	11,200	13,000	Remains E

As set out in Table 23, and with the exception of Cuba Street (south)[64], traffic volumes on the key routes within the Project Study Area increased between 2012 and 2019, and are likely to increase further by 2036 (assuming 1% growth per annum between 2019 and 2036). However, the level of service for the roads / routes identified in the above table are predicted to largely remain the same, with the exception of Waione Street, and in particular the Estuary (Waione Street) Bridge, where the level of service is predicted to deteriorate from E to F by 2036.

It is noted that increasing traffic volumes on SH2, and in particular at the Petone Overbridge on-ramp, also impact on the operational performance of The Esplanade and Hutt Road, particularly during the AM peak. The downstream impacts of increasing traffic volumes on SH2 on both of these roads can cause long queues to form during peak travelling times, which in turn encourages rat running along Jackson Street and other residential streets in Petone.

Travel Time Variability Analysis

To analyse travel time variability, average travel speeds at peak travelling times (as an indicator of variability) were analysed by using Google Map travel speeds from May 2019.[65] Travel speeds were assessed for typical weekdays at half hour intervals for the key routes within the Project Study Area. The travel times for these speeds were then compared against a 50km/h free flow situation.

For The Esplanade / Waione Street route, it was possible to compare the 2016 travel speeds identified in the Petone Esplanade Strategic Case with the travel speeds identified for 2019 in order to assess any travel speed / variability changes that might have occurred in the interim. However, this was not possible for the other routes / roads analysed within the Project Study

[62] The 2012 traffic volume data is based on the information provided in the Seaview Links Project Feasibility Report (2015 – see page 12). It is noted that this data was based traffic counts taken at the time by HCC
[63] LoS stands for level of service
[64] It is noted that traffic volumes on Cuba / Victoria Street (i.e. to the north of the Cuba Street Overbridge) are higher than to the south (i.e. volumes to the north are approximately 17,000 vpd, and this route is operating at a level of service of D during peak travelling times
[65] The methodology used to assess travel speeds and travel time variability is detailed in Appendix C of the Petone Esplanade, Strategic Case (2016)

Area, as Google map data was not collected for these routes for development of the Petone Esplanade Strategic Case.

The Esplanade

Figure 34 considers the westbound average travel speeds on The Esplanade / Waione Street route[66] for the AM peak period for 2016 and 2019 (in terms of the colours used in both Figure 34 and Figure 35 below, red indicates a deterioration in travel speed, and green indicates an improvement in speed).

Figure 34 Lowest average speeds across The Esplanade over the AM peak (westbound)

	2016					2019				
Time	Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday
5:00	51	44	51	51	51	51	51	51	51	51
5:30	44	39	44	44	44	51	51	51	44	51
6:00	35	35	39	39	39	51	44	44	35	44
6:30	35	30	35	35	35	39	35	35	35	35
7:00	25	25	25	22	25	18	16	18	16	18
7:30	22	18	20	18	20	15	13	14	14	15
8:00	22	18	18	20	20	14	13	14	13	16
8:30	25	22	20	20	30	15	13	16	14	20
9:00	30	25	25	30	39	25	20	22	16	25
9:30	39	35	39	39	44	35	30	35	30	35
10:00	44	44	44	44	44	39	35	39	35	35

For 2019, Figure 34 indicates that travel speeds in the AM peak varied from an average speed of 51km/h at 6:00am to as low as 13km/h (8:00am), which is a 38km/h speed variation. From a travel time perspective, the 5km vehicle trip along The Esplanade / Waione Street route would normally take around about 5 minutes to complete when travelling at 50km/h. However, this same 5km vehicle trip undertaken at 13km/h takes about 23 minutes to complete, thus representing a travel time variation of about 18 minutes between a free flow situation and the worst AM peak period. It is noted that in 2016 the lowest travel speed recorded was 18km/h (which was 5km/h faster than the lowest speed recorded in 2019). As such, the 5km vehicle trip took about 16 minutes to complete in 2016 (which represented a variation of 11 minutes between a free flow situation and the worst AM peak period 2016).

Accordingly, based on the Google Map travel speed data, there has been a reduction in travel speeds between 2016 and 2019 in the AM peak, which indicates that travel times on The Esplanade / Waione Street (westbound) route would have also deteriorated over this time period.

Figure 35 considers the eastbound average speeds on The Esplanade / Waione Street route [67] for the PM peak period for 2016 and 2019.

[66] The section of The Esplanade / Waione Street route assessed is for a 5km westbound trip between the Seaview / Parkside roundabout and the southern end of the Petone Overbridge on-ramp

[67] The section of The Esplanade/Waione Street route assessed is for a 5km eastbound trip between Petone Overbridge off-ramp and he Seaview / Parkside roundabout

Figure 35 Lowest average speeds across The Esplanade in the PM peak (eastbound)

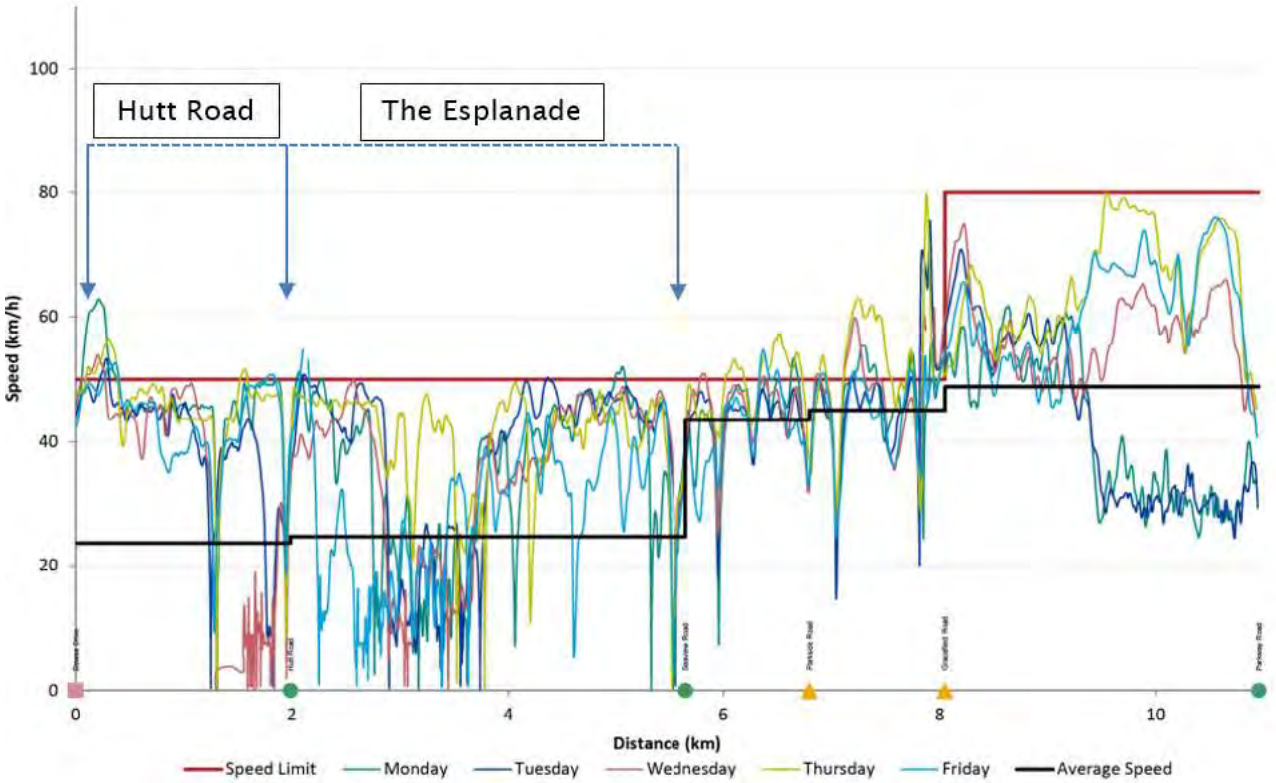
	2016					2019				
Time	Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday
15:00	40	40	36	40	36	30	26	26	26	23
15:30	40	36	36	36	30	30	26	26	26	20
16:00	36	30	30	30	30	26	23	23	23	20
16:30	36	30	26	30	26	23	23	20	23	23
17:00	36	30	26	30	30	23	20	20	23	23
17:30	30	30	30	36	30	23	20	23	23	26
18:00	30	30	36	30	36	30	26	30	30	30
18:30	36	36	36	36	36	36	30	36	30	36
19:00	45	40	36	40	45	40	40	40	36	40
19:30	45	45	40	45	45	45	40	40	40	40

For 2019, Figure 35 indicates that travel speeds are also highly variable. The lowest travel speed recorded was 20km/h, which is 30km/h lower than the free flow speeds of 50km/h (acknowledging that this speed is not actually reached at any time during the PM peak). This represents a travel time variation of 15 minutes between a free flow situation and the worst AM peak period. It is noted that in 2016 the lowest travel speed recorded was 26km/h (which is 6km/h faster than recorded in 2019), which was taking about 11 minutes to complete (representing a variation of 6 minutes between a free flow situation and the worst AM peak period in 2016).

As with the AM peak, between 2016 and 2019 there has been a reduction in travel speeds in the PM peak, which indicates that travel times on The Esplanade / Waione Street (eastbound) route have also deteriorated over this time period.

Further evidence on travel speed, and therefore travel time variability, for The Esplanade / Waione Street route is set out in Figure 36. This figure, which is taken directly from the Petone Esplanade Strategic Case, shows travel speeds for the eastbound trips from the Dowse Interchange to Wainuiomata via Hutt Road and The Esplanade during the PM peak are variable.

Figure 36 Hutt Road to Wainuiomata Road (eastbound)



Other Roads

The key observations from the Google Map travel speed and travel time variability analysis, for the other roads in the Project Study Area during 2019, are as follows:

- Cuba and Victoria Streets - travel speeds in the southbound direction are generally at 50km/h free flow, with the only noticeable speed reduction being between 8:00am to 8:30am. Northbound traffic showed more variation, with speeds reducing below free flow from around 12:00pm
- Jackson Street - travel speeds were below 50km/h free flow throughout the weekday, with speeds more noticeably slower in the westbound direction (near the Jackson Street / Gear Street intersection) when compared to the eastbound direction
- Randwick Road - travel speeds showed no significant travel speed variability in either direction during the AM and PM peaks
- Hutt Road / Railway Avenue – for this route travel speed / travel time variability analysis was undertaken for the trip between Ewen Bridge to the Dowse Interchange. The analysis undertaken for the eastbound AM peak trip indicated that it was taking up to 20 minutes to complete, compared to the 5 minutes it would normally take to complete during a 50km/h free flow situation. This represents a travel time variation of up to 15 minutes between the 50km/h free flow situation and the AM peak. The analysis also indicated that travel times for the westbound trip in the PM peak were variable as well, taking up to 10 minutes to complete (representing a 5 minute variation between the 50km/h free flow situation and the PM peak).

The Consequences of Vehicular Travel Variability

Increasing traffic volumes and travel time variability on key routes / roads is likely to be impacting on bus, freight and private vehicle movements on the key routes within the Project Study Area.

For bus services, analysis of the performance of Metlink bus services on the key routes shows that punctuality is a problem, with GWRC classing its current services as either been unsatisfactory or needing improvement (average bus punctuality ranges between 86 and 94%).[68] The one route that was classed as satisfactory was the bus service to and from Korokoro, which had an average punctuality of 96%. The Hutt Valley Chamber of Commerce's business confidence survey undertaken in June 2019 also indicated that businesses were concerned with public transport reliability.[69]

Ultimately, it is likely that travel time variability for buses, combined with bus vehicle capacity constraints, and the time it takes for passengers to board / alight will be discouraging people from using bus services within the Project Study Area – particularly at peak travelling times. It is also noted that at this point in time, there are no bus priority measures proposed to help improve bus reliability on the road network within the Project Study Area.

For freight movements, variable travel times, and particular variability on The Esplanade / Waione Street route is problematic. HCC has consistently received feedback from heavy commercial vehicle operators advising that travel time variability on The Esplanade / Waione Street route and on Randwick Road was considered to be a major risk for their business or was constraining their development opportunities in the Seaview / Gracefield area.[70] Consultation undertaken to support development of the Seaview Links Project Feasibility Report in 2015 supported this feedback. This report included the following statement:[71]

[68] See - https://www.metlink.org.nz/on-our-way/performance-of-our-network/
[69] Hutt Valley Chamber of Commerce - Business Confidence Survey - June 2019, page 38
[70] Seaview Links Project Feasibility Report, 2015, page 9.
[71] Ibid, page 9

"Congestion on The Esplanade during both AM and PM peaks is a significant concern for businesses with regard to development and investment in the Seaview / Gracefield area;

- *The port aims to have efficient cargo movement therefore congestion influences their business decisions.*
- *Port has a large amount of developable land in Seaview but its growth will be influenced by congestion."*

The Hutt Valley Chamber of Commerce's 2019 business confidence survey also indicated that businesses were concerned about the impacts caused by unexpected delays on the road network. Such delays often resulted in late deliveries to customers, increased transportation costs, staff time being spent on transport-related tasks rather than on business productivity, and employees being late to work. The majority of responders to the 2019 business survey said they would be changing roads / routes and / or changing travel times in response to congestion issues.[72]

Currently there appears to be no economically feasible alternative to the road network for the transportation of freight to and from the Seaview / Gracefield area. It is noted that KiwiRail has previously ruled out re-opening the Gracefield Rail Line for moving freight for the following reasons: [73]

- due to the short travelling distance between Seaview / Gracefield and CentrePort, freight companies were unlikely to use the line as it was uneconomic from a commercial freight perspective
- transporting extra freight on the Hutt Valley Rail Line would conflict with Hutt Valley commuter rail services using the Line, and commuter rail services would receive priority over freight trains, disadvantaging just-in-time deliveries.

For private motor vehicles, variable travel times impact on the movement of people in and through the Project Study Area. For example, it often results in people being late for work, which in-turn can lead to business productivity losses.

2.7.4.1.3 Commuter Rail Performance

The Lower Hutt Growth Story identified that key rail (and road) infrastructure was operating at, or near, capacity especially during peak travelling hours. PBC Workshop One attendees also identified that Hutt Valley commuter rail services may be nearing capacity.

It is unclear from available data as whether Hutt Valley commuter rail services are operating at capacity during peak travelling times. There is anecdotal evidence to suggest trains are near capacity (e.g. standing room only) when departing from the Petone Train Station during the AM peak, and as noted above in Section 2.5.5.4.4, the Petone and Woburn Train Station's park and ride facilities are generally at capacity by 8.15am, which also indicates that trains might be nearing capacity at peak travelling times.

GWRC has identified that train punctuality requires improving. Punctuality was measured at 88% across Metlink's Wellington regional network in 2017/18, significantly below its target of 95% punctuality by 2025.[74]

GWRC have a number of initiatives underway to improve the performance of Hutt Valley commuter rail services, including a $193M infrastructure package to upgrade the Hutt Valley Rail

[72] Hutt Valley Chamber of Commerce - Business Confidence Survey - June 2019, page 38
[73] Seaview Links Project Feasibly Report, 2015, page 22
[74] 2017/18 Annual Monitoring Report on the Regional Land Transport Plan, March 2018, page 26 (see - http://www.gw.govt.nz/assets/councilreports/Meeting_Documents/7504_Agenda_Regional%20Transport%20Committee%2027%20November%202018,%20Order%20Paper.pdf)

Lines. One of the key outcomes from this package is the likelihood of improved timetabling for Hutt Valley commuter rail services, which in turn is expected to enable service frequency to be increased at peak travelling times. GWRC are also developing a park and ride strategy, which is expected to focus on developing plans to increase people walking, cycling and / or catching buses to train stations. These initiatives will help to address capacity problems, and to make commuter rail services more attractive. However, these improvements won't address the issue of buses been adversely affected by travel time variability issues on the road network.

2.7.4.1.4 Design of the Transport Network

PBC Workshop One attendees identified that the design of the transport system within the Project Study Area was limiting transport choices and / or creating safety and community severance issues (both real and perceived). In particular, the following key issues were broadly identified:

- High traffic volumes, combined with concerns over road layouts for cyclists, was discouraging people from cycling, for both commuting and recreational purposes
- Limited opportunities to cross the Hutt River and the Hutt Valley Rail Line, combined with the road layout and high traffic volumes on The Esplanade, was generating community severance issues which in turn was encouraging more people to drive, and in particular to drive short distances.

It is noted that P2040 has also identified some key transport design problems, including:

- Poor connections between Jackson Street and the Petone Train Station;
- Poor walking and cycling connections on the Estuary (Waione Street) Bridge;
- Poor connections between the Hutt River Trail and local road network (including poor lighting)
- The overall (transport) customer experience along The Esplanade transport corridor is poor.[75]

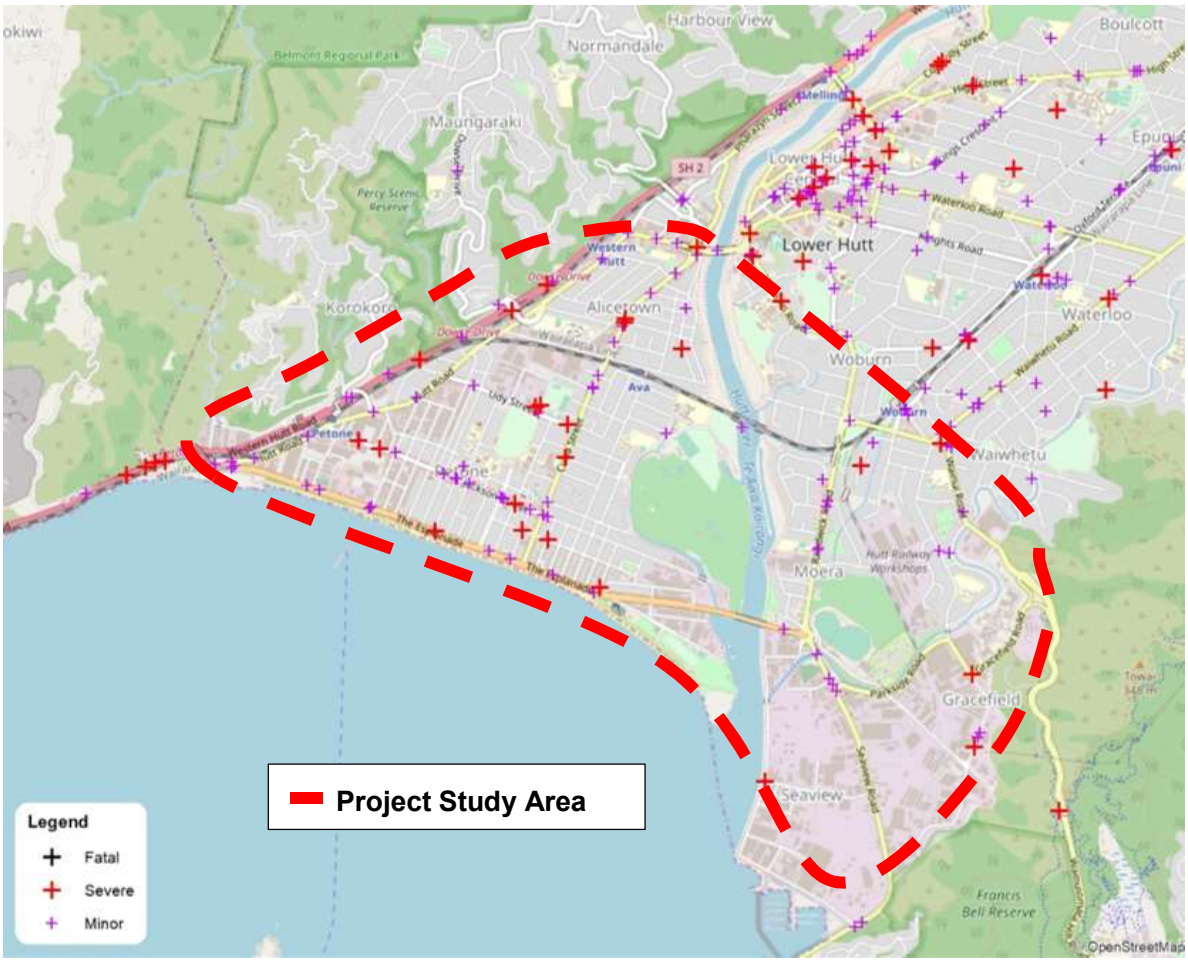
Active Mode Safety Issues

The Lower Hutt Growth Story identified that there was need to reduce the number of road crashes resulting in injury to vulnerable users, such as, cyclists and pedestrians.[76] Feedback from PBC Workshop One indicated that cycling safety along the Estuary (Waione Street) Bridge and The Esplanade was considered to be a particular problem.

As set out above in Table 9 and Table 10 (see Section 2.5.5.2.2), between 2009 and 2019 there were 77 and 75 reported cycling and pedestrian accidents respectively in the Project Study Area. Figure 37 sets out the key locations for these active mode crashes.

[75] P2040, 2017, page 11.
[76] Lower Hutt Growth Strategy, 2018, page 8

Figure 37 Active Mode Crashes in the Project Study Area between 2009 and 2019[77]



As set out in Figure 37, the majority of serious and minor injury active mode crashes have occurred on Udy Street, Cuba Street, Jackson Street and The Esplanade.

In terms of cycling, 50% of cycling crashes that have occurred since 2009 have occurred on Hutt Road and on The Esplanade. When evaluating some of the reasons for the crashes, nearly half of these crashes involved lane changing, or turning in front of other road users. Half of the crashes occurred at intersections.

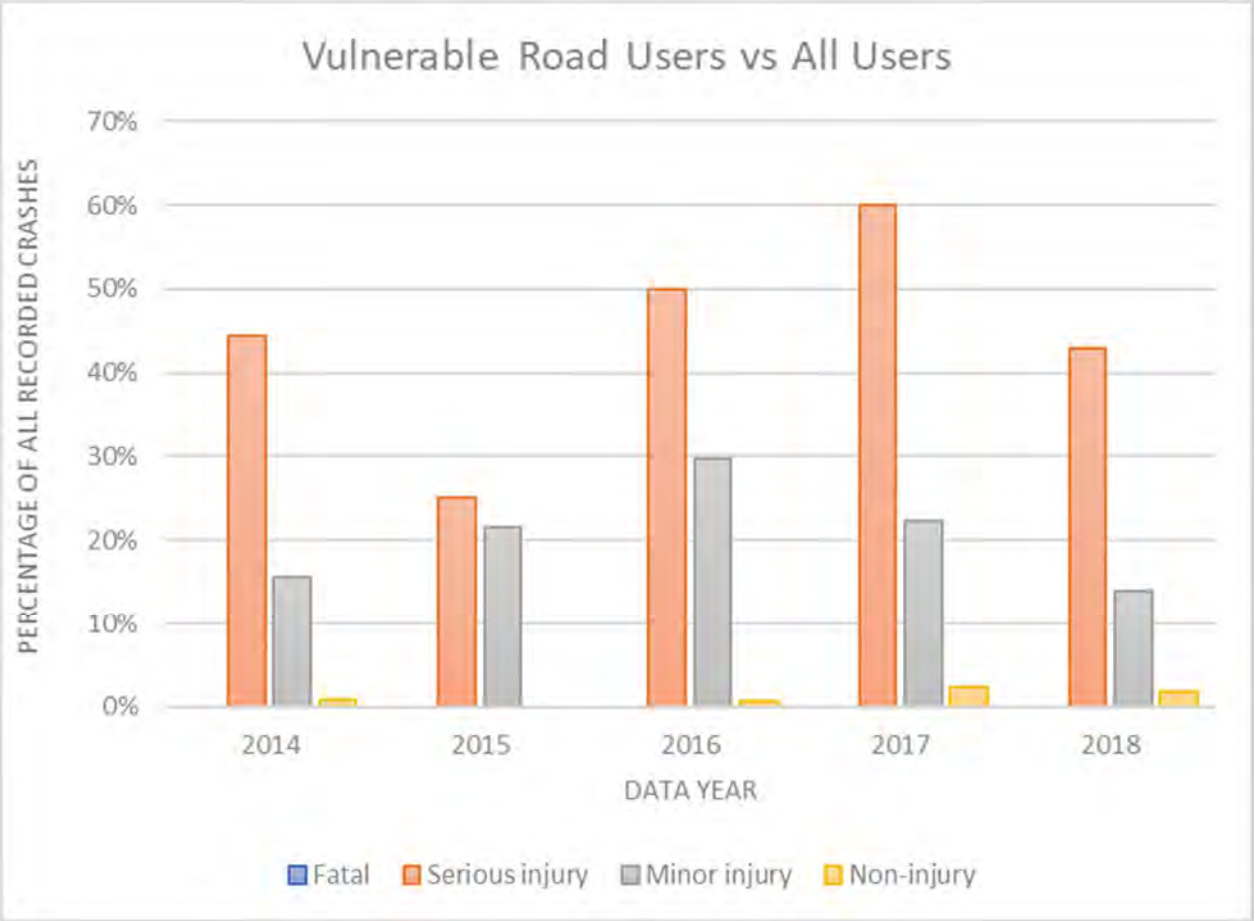
In terms of pedestrians[78], about 30% of the 75 accidents since 2009 have occurred on Jackson Street and / or Cuba Street. The majority of these accidents were mid-block accidents. There were 20 accidents at intersections, and 10 at pedestrian crossings.

As set out in Figure 38 below, on average, 44% of all serious crashes, and 20% of all minor injury crashes within the Project Study Area involved vulnerable road users.

[77] Data collection does not include all of 2019 as data was collected as a snap shot and not all data for 2019 was available

[78] In recent news (09 June 2020), a pedestrian was killed in a collision with a vehicle on Hutt Road. The fatality was caused when a pedestrian travelling northbound crossed from the western footpath, to the eastern footpath. The vehicle struck the pedestrian on the passenger side when passing. The crash took place in the early hours of the morning (approximately 6:00am) and the conditions were dark. Further details at this stage are not yet available.

Figure 38 Vulnerable Road User Safety Statistics



The number of cyclists and pedestrians travelling to and / or through the Project Study Area is set to increase following the completion of the Te Ara Tupua Walking and Cycling project in 2023. HCC's Beltway and Eastern Bays shared path projects are also likely to result in walking and cycling volumes increasing within the Project Study Area.

Of note is the likelihood of increased commuter cycling to and / or through the Project Study Area following completion of the Petone to Ngauranga section of the Te Ara Tupua Walking and Cycling Project. For this project, NZTA is currently predicting that circa 2,700 persons will use the facility at time of opening (average weekday use). By 2030, these numbers are expected to reach circa 4,300, and then rising to circa 7,300 by 2050. Given SH2's close linkages with the Project Study Area's transport system, it is likely that commuter cycling in the Project Study Area will also increase. If such an increase was to occur, and given that commuter cyclists have a preference for cycling along The Esplanade, rather than using the existing shared path facility, there is likely to be an increase in commuter cyclists mixing with general traffic on The Esplanade following this project's completion.

Community Severance

Crossing the Hutt River and Hutt Valley Rail Line

PBC Workshop One attendees indicated that people are discouraged from walking and cycling across the Hutt River and Hutt Valley Rail Line due to the standard of existing crossing facilities, as well as the lack of crossing opportunities. Examples provided of key design limitations that are considered to be discouraging active mode use are as follows:

- Hutt River crossings:
  - Ava Rail Bridge – has a very narrow footpath that generally only allows for one person to pass at a time, and is considered to be largely unsuitable for cyclists
  - Estuary (Waione Street) Bridge – as there are no cycle lanes on this bridge, cyclists are required to either mix with general traffic or use the narrow footpath located on the bridges southern side. Both cyclists and pedestrians using the footpath are often required to mix with recreational fishers
- Hutt Valley Rail Line crossings:
  - Petone Overbridge - provides for southbound cyclists via an off-road path. However, northbound cyclists are required to mix with general traffic (high volume) creating real and / or perceived safety concerns
  - Petone Train Station's pedestrian overbridge – is generally considered to be too narrow for cyclists. If it is used by cyclists, they are required to mix closely with pedestrians, which creates real and / or perceived safety issues)
  - Hutt Road Bridge – as there are no cycle lanes on this bridge, cyclists are required to mix with general traffic. Due to the limited space available, real and /or perceived safety concerns are created. The existing footpaths are narrow for pedestrians
  - Cuba Street Bridge – as there are no cycle lanes on this bridge, cyclists are required to mix with general traffic. Due to the limited space available, real and /or perceived safety concerns are created. The existing footpaths are narrow for pedestrians
  - Randwick Road Bridge – as there are no cycle lanes on this bridge, cyclists are required to mix with general traffic. Due to the limited space available, real and /or perceived safety concerns are created The existing footpaths are narrow for pedestrians and are located on one side only
  - Whites Line East Bridge – as there are no cycle lanes on this bridge, cyclists are required to mix with general traffic. Due to the limited space available, real and /or perceived safety concerns are created. The existing footpaths are narrow for pedestrians and are located on one side only.

Crossing The Esplanade to Access the Petone Foreshore

A number of HCC's strategic documents have identified that the road layout (e.g. large carriageway width, poor streetscape design) of The Esplanade, combined with its high traffic volumes, discourages people from crossing from Petone (on the north side) to the Petone Foreshore (on the south side). As a result, people either choose not to cross the road, or chose to drive to the foreshore. For example, the Urban Growth Strategy identified that congestion reduced the amenity value of Petone Foreshore and The Esplanade, and discouraged active modes.[79] P2040 also identified that The Esplanade was a barrier for active modes accessing the Petone Foreshore,[80] and the quality of the customer experience along the transport corridor was problematic.[81]

The Petone Esplanade Strategic Case included the diagram below in Figure 39 in order to demonstrate that The Esplanade was a barrier between the Petone community and the Petone Foreshore as it "*runs in an unbroken line for the length of the waterfront*."[82]

[79] Urban Growth Strategy (2012-2032), 2012, page 40
[80] P2040, 2017, page 22
[81] Ibid page 9
[82] Petone Esplanade, Strategic Case, 2016, page 10

Figure 39 Separation Between Petone and Petone Foreshore on The Esplanade

2.7.5 Implications of the Evidence

There is sufficient evidence to demonstrate that travel time variability on key roads within the Project Study Area is a key problem for all modes of transport. The key routes most affected appear to be those providing east-west connectivity or connectivity to SH2.

All of the routes analysed in the Project Study Area, had varying travel time variability problems, with this problem being most evident on The Esplanade / Waione Street route. On this route travel times can vary up to 18 minutes in the AM morning peak, and up to 16 minutes in the PM peak (when compared to the 50km/h free flow situation). Furthermore, the evidence suggests that travel time variability has deteriorated since 2016 – it now takes two minutes longer to travel in the AM Peak. It is also evident that the AM and PM peak periods are now spreading, with the AM peak extending past 10am, and PM peak starting as early as 3.30pm. Observational evidence suggests that the peak period is also spreading during the weekends, that is, the AM peak on Saturday starts around 10am and finishes around 4pm in the afternoon.

It is also likely that daily traffic volumes on the key roads / routes in the Project Study Area will also continue to grow over time under the do-minimum situation. The key hot spots for increasing traffic volumes are the Estuary (Waione Street) Bridge and The Esplanade. In particular, at the Estuary (Waione Street) Bridge location, daily traffic volumes are predicted to exceed 35,000 vpd by 2036 under the do-minimum scenario. If this predicted growth does occur, and given its capacity is limited to two lanes, the level of service at this location is expected to deteriorate from E to F by 2036.

Potential Implications for the Different Transport Modes

For bus services, travel time variability on the road network will continue to affect bus service arrival and departure times, and based on GWRC's performance records for the Metlink services operating within the Project Study Area, punctuality is already a problem. Travel time variability generated by the operational performance of the road network, combined with limited seating capacity and length of time it takes to board or to alight, suggests the bus reliability will continue to be a problem for the bus services operating on the main bus routes within the Project Study Area. Although it is unclear whether Metlink's Hutt Valley commuter rail service is at capacity or not, there does appear to be opportunities to improve rail services. For example, service frequency improvements and improved access to park and ride facilities).

Travel time variability has consistently been recognised as a problem for freight movements through the Project Study Area. In particular, variability problems, and the need to address these problems on The Esplanade / Waione Street route and on Randwick Road has been a consistent

theme identified in key regional and HCC strategic transport documents over the past 10 to 20 years. Freight operators have also consistently expressed concern that high traffic volumes during peak travelling times impacted negatively on their businesses, and that poor overall east-west connectivity was limiting the economic development potential of the Seaview / Gracefield area. Feedback from PBC Workshop One attendees also suggested that the potential for further residential / accommodation development along The Esplanade was being hindered by high traffic volumes.

Travel time variability also impacts on movement by private vehicles within the Project Study Area. For example, travel time variability during the AM peak results in people arriving late for work, which in turn can lead to productivity losses, or being late for a train connection.

The design of the road network, combined with high traffic volumes, can also influence the way people move around the transport network. For active modes, there are limited east / west opportunities to cross the Hutt River and Hutt Valley Rail Line, which is likely to result in people choosing to drive rather than to walk or cycle. For most of the crossing points (i.e. bridges), a number of the existing footpaths are either very narrow or located on just one side of the bridge. In many cases, cyclists are forced to mix with general traffic, creating real and perceived safety issues as there is limited space between them and passing vehicles. The completion of future cycle projects, and in particular the Te Ara Tupua Walking and Cycling project, is likely to increase cyclists within the Project Study Area. It is likely that many of these future cyclists will be commuter cyclists who will have a preference to cycle on the road rather than use off-road facilities.

The Petone Esplanade Strategic Case highlighted that the design and high traffic volumes on The Esplanade severed Petone from the Petone Foreshore, which resulted in people choosing to either not access this important local / regional amenity, or choosing to drive to the Petone Foreshore.

With specific regard to the function of The Esplanade, the Petone Esplanade Strategic Case, identified in 2016 that it was:

"*struggling to balance the competing demands placed on it – that is, providing 'link' functions and 'place'*."[83]

Based on the evidence gathered for this report, it can be concluded that The Esplanade continues to struggle balancing these competing demands.

In conclusion, there is clear evidence that there are problems affecting the transport system's accessibility within the Project Study Area that require addressing.

2.7.6 Investment Objective

Following completion of PBC Workshop One, the following investment objective for Problem Statement Two was developed:

- *To improve access to and from key destinations and key urban growth areas in southern Lower Hutt*

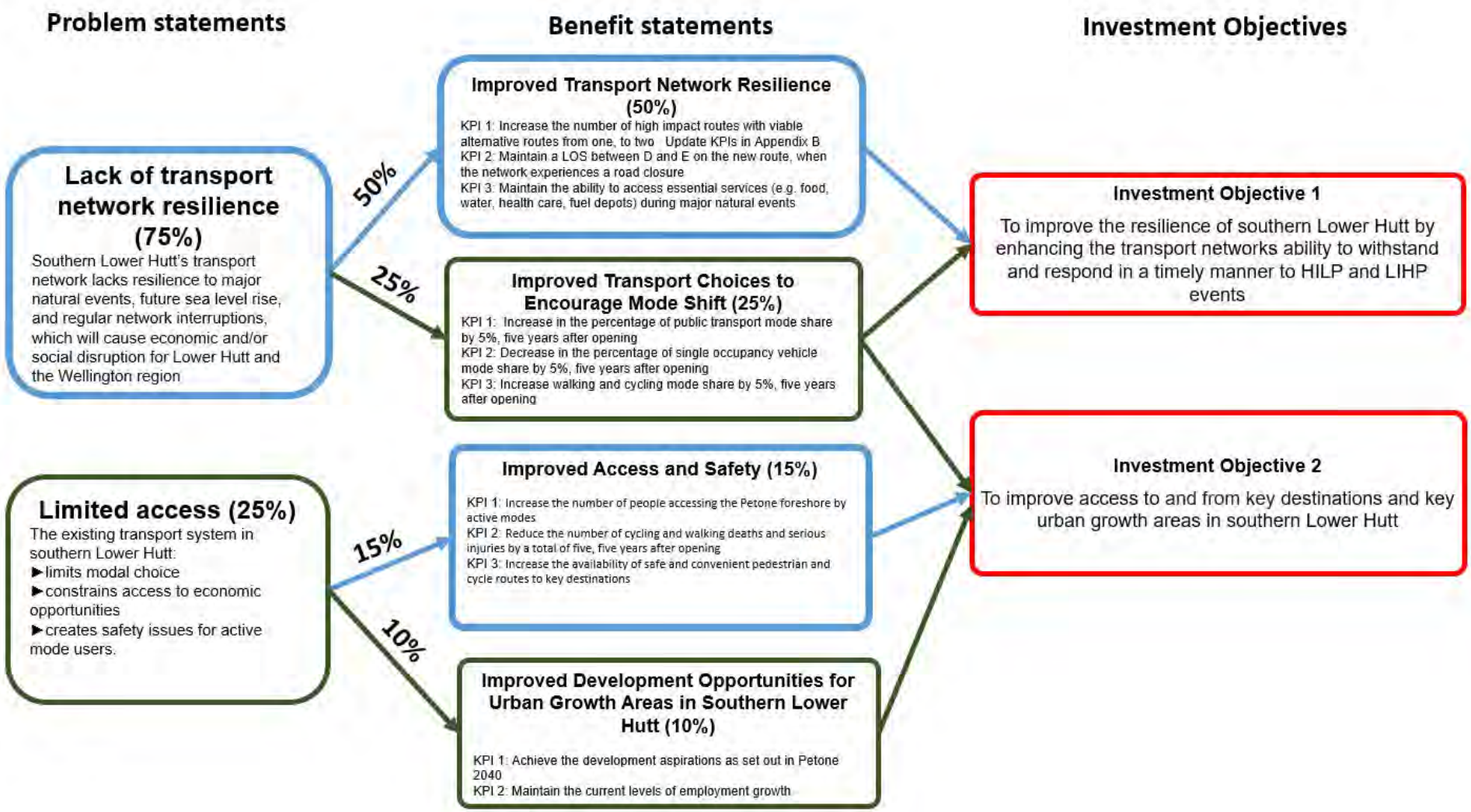
The investment objective aims to improve access of the transport system located within the Project Study Area.

[83] Petone Esplanade, Strategic Case, page 3

2.8 Combining the Problem and Benefit Statements and Investment Objectives

Figure 40 Problem and Benefit Statement and Investment Objectives sets outs the problem and benefit statements and the investment objectives developed for this PBC.

Figure 40 Problem and Benefit Statement and Investment Objectives



2.9 The opportunities

The Project Team identified the following opportunities for the Project Study Area, if the above resilience and access problems were to be addressed:

- Lower Hutt and the wider Wellington region would be better prepared for HILP events, such as large earthquakes, and for the long-term effects of climate change (e.g. sea level rise). Preparing for such events will help to mitigate their likely adverse economic impacts, improve people's access to lifeline services, and reduce the likely social costs that will result from long-term isolation from friends and family
- Lower Hutt would be better prepared for LIHP events such as crashes, road accidents (spills) and construction works. Increasing the redundancy of the transport network throughout the Project Study Area would help to mitigate the economic impacts and network delays that can be expected from such an event
- Improved travel time reliability on the key arterial roads for buses, heavy commercial vehicles and general traffic is likely to further support economic development in Lower Hutt, and encourage increased use of bus services
- More viable / reliable transport choices for people within the Project Study Area, including reducing travel obstacles that some people may experience (e.g. elderly and lower socio-economic cohorts).

Addressing the resilience and access problems will also help to realise the vision, objectives and goals of key strategic documents, such as, HCC's Petone Spatial Plan 2040 and the Wellington Lifelines PBC 2019.

3 Part B Developing the Programme

3.1 Introduction

Part A has identified that the transport system within the Project Study Area is experiencing network resilience and limited access problems. This section outlines the multi-criteria analysis (MCA) evaluation processes undertaken to develop and assess the alternatives, options and the programmes identified for this PBC.

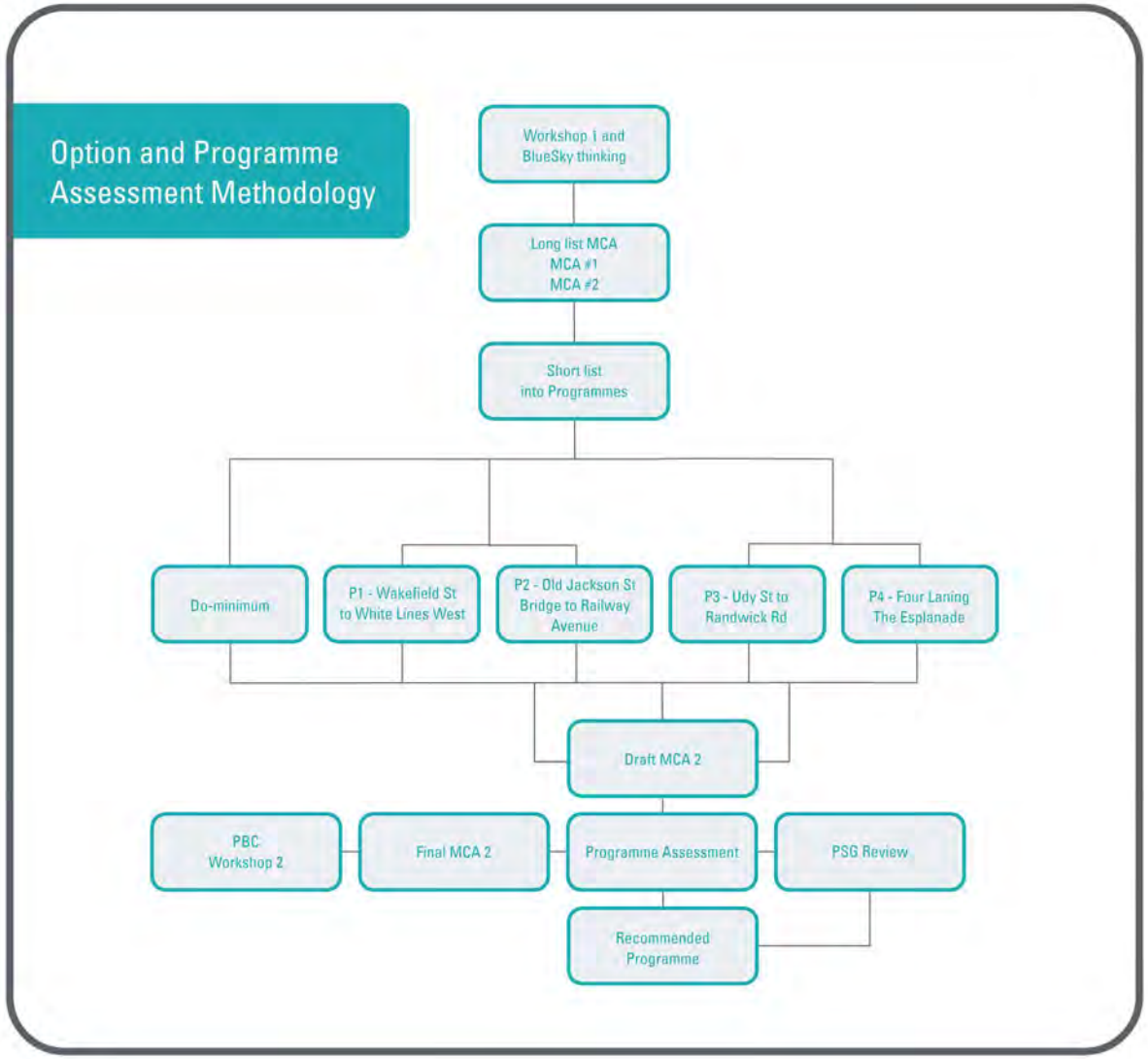
A key feature of the process was the direct involvement of Hutt City Council (HCC), Greater Wellington Regional Council (GWRC), Waka Kotahi NZ Transport Agency (NZTA) and a number of strategic stakeholders through MCA workshop processes. The MCA workshops were premised on the decision conferencing process, whereby decisions were arrived at through discussion and consensus between stakeholders and informed by expert opinion.

The option assessment and development processes undertaken, in order to identify an emerging preferred programme, are summarised as follows:

- Long list alternative / option identification – options were generated through PBC Workshop One and a Project Team blue-sky thinking workshop
- A long to short list alternative / option process – using an MCA evaluation process to select the short list of alternatives / options
- Packaging the short listed alternatives / options into four programmes of transport improvements and developing a do-minimum programme
- Assessment of the four programmes (and the do-minimum) using MCA evaluation processes and technical expert evaluation
- The programmes and draft MCA results were presented to attendees at PBC Workshop Two and to the PSG at Workshop Three for feedback
- Update the MCA (following Workshop Three) and completing technical development of the preferred programme

Figure 41 provides a diagrammatical summary of the option development and assessment processes followed by the Project Team.

Figure 41 Option and Programme Assessment Methodology



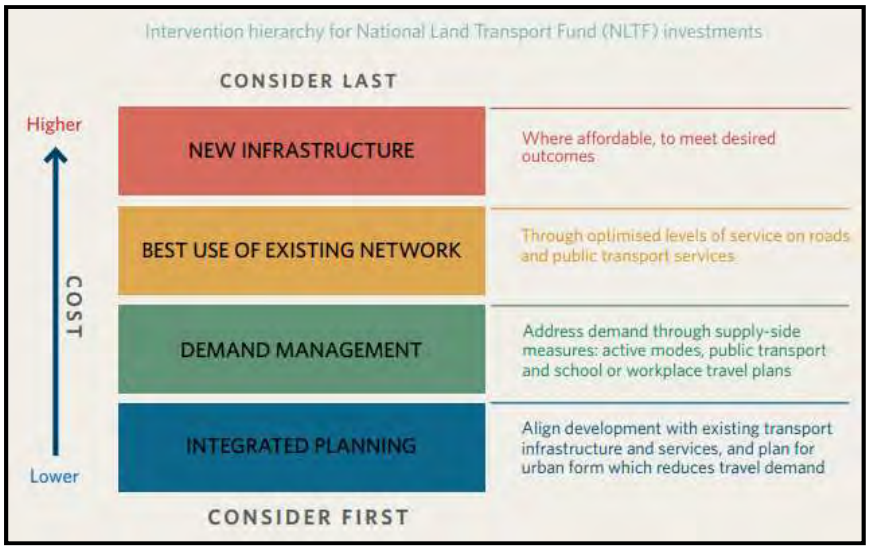
3.2 Long List Option Identification and Assessment

The MCA evaluation steps undertaken in order to identify a preferred programme for consideration by HCC are set out below.

3.2.1 Step 1: Long List of Alternative / Option Identification

The first step was to identify a long list of alternatives / options that could address the problems and achieve the investment objectives for the Project Study Area. This step was undertaken in accordance with NZTA's intervention hierarchy, as shown in Figure 42 below.

Figure 42 NZTA's Intervention Hierarchy



To generate alternatives / options for the long list, the following activities were undertaken by the Project Team:

- A review of existing transport and land use strategic documents to identify transport options that have been previously considered (these documents are identified in full in Part A of the PBC)
- Alternatives / option generation session at PBC Workshop One
- A Project Team blue-sky thinking workshop held to generate further alternatives / options for the long list

In total, 60 long list options were identified. The long list of alternatives / options considered by the Project Team is provided in the MCA Report (see **Appendix Three**).

3.2.2 Step 2: Evaluating the Long List Alternatives / Options

Step 2 involved the Project Team (using various evaluation expertise[84]) evaluating each alternative and option against the investment objectives, other success factors (e.g. feasibility, potential affordability and likely BCRs) and key impacts (e.g. likely stakeholder / public acceptability and potential environmental / social impacts). See the MCA Report for a full description of the long listing process.

[84] The evaluation team comprised of a transport planner, traffic engineer, transport economist, design manager and environmental planner

3.2.3 Long List Evaluation Results

At the completion of the long list evaluation process the Project Team were able to make the following key conclusions / observations:

- Any alternative / option that was unlikely to achieve either of the investment objectives was removed from further consideration
- Any travel demand measures (TDM) that were considered to fall within GWRC's TDM remit – that is, they are required to be implemented on a regional or national basis (e.g. road pricing) to be effective, was assumed to be part of the do-minimum programme (and not considered further as part of the PBC). This approach was discussed with HCC officers, who confirmed that the council's approach to TDM was to proactively support GWRC's regional TDM initiatives, rather than to develop such interventions for specific areas of Lower Hutt City, including the Project Study Area
- The ability to distinguish between alternatives / options based on likely affordability at the long list stage was slightly ambiguous. That is, alternatives and options above $10M were all assigned the same score (-3). Accordingly, it was not possible to remove alternatives / options based solely on potential affordability
- A tunnel along the western side of the Hutt River was assessed as poor performing due to its likely high construction costs. However, despite providing a worst-case scenario in terms of cost, this option was retained for further assessment as it was considered to be innovative (e.g. provided an alternative technological solution that could address the problems).

As a consequence of the Project Team's long listing evaluation process, the original long list of alternatives / options of 60 was short listed to 45 alternatives / options. The decisions regarding which alternatives / options to include or exclude are indicated in the table in the MCA Report.

3.3 Programme Identification

Firstly, the Project Team determined that none of the 45 alternatives / options on their own would address the problems or achieve the investment objectives. Accordingly, the Project Team determined that a programme approach (i.e. package of interventions) would be needed in order for the problems to be addressed, or for the investment objectives to be achieved.

3.3.1 Do-Minimum Programme

The first step in developing the alternative programmes was to identify a do-minimum programme for benchmarking purposes.

In collaboration with HCC officers and the CVTC Project Steering Group (PSG), a package of committed transport improvements / projects with implementation funding identified or considered to be near certain to be implemented was identified.

The do-minimum programme that was ultimately agreed with HCC for the PBC was as follows:

- Implementation of the HCC Long Term Plan 2018-21, including the:
  - Eastern Bays Cycleway (consenting underway)
  - Seismic strengthening of the Cuba Street Rail Bridge (which was part of HCC's Low Cost Low Risk programme)
  - Beltway Cycleway – priority to be confirmed
- Plan Change 43
- RiverLink, including a new Melling Interchange (consent applications are now being prepared, and construction funding is approved for 2026 onwards)
- SH58 Safety Improvements Stage 1 (which is now in construction) and Stage 2
- Transmission Gully Motorway (operational in late 2020 or 2021)

- Te Ara Tupua Walking and Cycling Project (Te Ara Tupua) – both the Petone to Ngauranga and Petone to Melling sections (with the former section now in consent preparation, and the latter section now in construction)
- GWRC Rail Upgrade Package (e.g. double tracking between Upper Hutt and Trentham and timetable changes)
- GWRC Draft Park and Ride strategy for Petone, Ava and Woburn Train Stations
- GWRC travel demand measures, in line with the Regional Travel Demand Management Plan (2009)[85]
- Wellington Region Emergency Management Plan – Tsunami blue lines, social media, community emergency hubs, community response plans and emergency compost toilet trials

The Project Team, HCC officers and the PSG identified that the above do-minimum programme comprised of a large package of committed transport improvements. It identified that these improvements were inclusive of several different modes of transport through the Project Study Area. As such, it determined that development of the alternative programmes, and the subsequent preferred programme would build upon these committed transport improvements (and would not be "repeated" in the alternative programme) .

3.3.2 Allocating the Alternatives / Options into Programmes

Next, the Project Team arranged the remaining 45 alternatives / options into programmes.

The first step in the allocation process involved identifying an anchor resilience project that crossed the Hutt River for each programme. Identification of an anchor resilience project was fundamental in order to address the resilience problem statement and achieve the resilience investment objective.

Based on the location of the proposed river crossing, it was possible to characterise each programme by a "river crossing" theme. For example, a northern river crossing, a southern river crossing and a central river crossing were incorporated into the programme theme to reflect the location within the Project Study Area at which they crossed the Hutt River.

The second phase involved allocating 45 alternatives / options to an anchor project to create a programme (or package) of interventions. The allocation processes were based on each alternatives / options relevance to the anchor resilience project and their likely contribution they would make towards achieving the investment objectives.

As a result of the allocation process, the Project Team identified four alternative programmes.

3.3.3 The Four Alternative Programmes

The four alternative programmes identified by the Project Team, their descriptions, and the individual alternatives / options included within each are set out below Table 24. Location maps for each programme are provided as attachments to the MCA report.

Table 24 Four Alternative Programmes

Programme	Description Summary	All alternatives / options included in the programme
Programme 1: Wakefield Street to Whites Line West	This programme provides a new bridge crossing to the north, utilising Wakefield Street to	► New Wakefield Street Bridge ► Whites Line West Upgrade

[85] See - http://www.gw.govt.nz/assets/Transport/Regional-transport/RLTS/RegionalTDMPlan2009.PDF

Programme	Description Summary	All alternatives / options included in the programme
Connection – Northern River Crossing	provide a new east-west connection to Whites Line West. The other key features of this programme included: ► Connections from Wakefield Street to Hutt Road and SH2 via the Dowse Interchange ► A new active mode path across the Hutt River from Buckley Street to St Albans Street, with connections to Woburn Road, Bellevue Road, Laings Road and Bloomfield Terrace ► Full movements allowed at the Gracefield / Wainuiomata Hill Road Interchange to improve connections for people travelling between Seaview and Waiwhetū	► Wakefield Street Upgrade ► Wakefield Street connection to Dowse Interchange ► Whites Line West connection to the roundabout ► Allow full movements at Gracefield Road / Wainuiomata Hill Road Interchange ► Active mode connection from Buckley Street to St Albans Grove ► Active mode track upgrade on St Albans Grove ► Active Mode track upgrade on Woburn Road ► Active mode track upgrade on Bellevue Road / Laings Road / Bloomfield Terrace ► Wakefield Street and Hutt Road roundabout ► Existing Estuary (Waione Street) Bridge retained
Programme 2: Old Jackson Street Bridge to Railway Avenue Connection – Southern River Crossing	This programme provides a new bridge crossing to the immediate north of the Estuary (Waione Street) Bridge, with the ability to connect into Wakefield Street and Railway Avenue. The other key features of this programme include: ► Tunnelled roads along the western side of the Hutt River ► Restrictions on The Esplanade (e.g. speed limit reductions and bus only lanes) to encourage vehicles to use the new Hutt River crossing ► A new connection between Railway Avenue and SH2 ► An active mode (only) bridge over the Hutt River connecting to Barber Grove.	► Railway Avenue connection ► Road / active mode bridge from the South of Memorial Park to Randwick Crescent / Barber Grove ► New bridge to the immediate north of the Estuary (Waione Street) Bridge, which is decommissioned ► Second active mode path on Waione Street Bridge ► Road under flood bank from Waione Street to Memorial Park ► Road under flood bank from Memorial Park to Wakefield Street ► Road under flood bank from Wakefield Street to Railway Avenue ► Improved cycling links at Ewen Bridge ► Restrictions on The Esplanade
Programme 3: Udy Street to Randwick Crescent Connection – Central River Crossing	This programme provides a new central river crossing with connections to SH2 and Udy Street. Access to and from SH2 will be for traffic travelling southbound from Udy Street and for traffic travelling northbound from SH2.	► South facing Interchange at end of Udy Street ► Interchange on Udy Street to SH2 ► Improve Udy Street ► Multi-modal bridge from the south of Memorial Park to Randwick Crescent / Barber Grove ► Road extension of Udy Street to the Hutt River

Programme	Description Summary	All alternatives / options included in the programme
Programme 4: Four Laning The Esplanade – Unlocking Capacity through existing infrastructure	This programme provides an additional eastbound and westbound traffic lane along The Esplanade (i.e. to provide two lanes in both directions). The other key features of this programme include: ► A new active mode connection to the Petone to Melling section of the Te Ara Tupua Walking and Cycling Project for active mode users between Woburn and SH2	► Widening / adding capacity and strengthening the Estuary (Waione Street) Bridge (e.g. four lanes) ► Add a second active mode path on Estuary (Waione Street) Bridge ► New active mode connection between the Petone to Melling section of the Te Ara Tupua Walking and Cycling Project and Woburn ► Four laning The Esplanade.

3.3.4 Programme Evaluation

The evaluation of the four programmes, plus the do-minimum programme, was undertaken in two stages involving two decision conferencing workshops.

Stage 1 was completed as part of PBC Workshop Two, whilst Stage 2 was completed with the PSG at Workshop Three[86]. The stage undertaken in the evaluation process is set out below.

3.3.5 Stage 1 evaluation process

Stage 1 of the MCA evaluation process comprised the Project Team[87] undertaking an initial evaluation of the four programmes and the do-minimum programme, prior to workshopping the draft evaluation scores with PBC Workshop Two attendees. The Stage 1 MCA process evaluated the programmes against the investment objectives, success factors (i.e. safety, Implementability, affordability, likely BCR and the Investment Assessment Framework) and impacts (i.e. social / environmental and economy). The Stage 1 MCA process is described in more detail in the MCA Report.

The Project Team's initial programme evaluation scores and rankings were presented to attendees at PBC Workshop Two.[88] Although, workshop attendees were generally supportive of the programmes and the MCA evaluation process being undertaken, they did request that the assessment criteria be further refined before completing the MCA evaluation.

As a result of feedback from attendees at PBC Workshop Two, the following amendments were made to the assessment criteria:

- The term redundancy was added to reflect the number of additional crossing points achieved
- Accessibility was changed to modal choice, to better represent options that reduced single vehicle occupancy and achieve secondary health and climate change benefits as a result
- Resilience was re-framed to refer to the improvements that would be obtained by moving vital infrastructure away from vulnerable locations – tsunami, earthquakes and flooding

[86] It is noted that PBC Workshop One was used to update and confirm the problem statements and investment objectives from the 2016 Strategic Case. Therefore, no assessment work / MCA was undertaken as part of PBC Workshop One

[87] Using the same evaluation experts as used for the long list evaluation process

[88] Attendees included representations from HCC, NZTA, GWRC, AA, walking and cycling representatives and the Chamber of Commerce. It is noted that Iwi and the Road Transport Forum were invited but they declined the invite / did not attend

- Safety was split into two, specifically referencing active modes and vehicles
- Economic impacts were removed as it was considered that these impacts were covered holistically in the BCR criteria
- Social and environmental impacts were split into two assessment criteria. Furthermore, social was replaced with amenity impacts, to better review the impacts to the desirability of an alternative / option on the local population
- The Investment Assessment Framework (IAF) assessment criterion was removed as it was considered short term and would be replaced in 2020 / 21. In addition, the intent of the IAF criterion was already covered in the investment objectives.

3.3.6 Stage 2 programme evaluation process

Based on the feedback from the PBC Workshop Two attendees, the programme assessment criteria was updated by the Project Team (using the same evaluators) and workshopped with the PSG at Workshop Three.

The updated assessment criteria is set out in Table 25. It is also noted that a seven-point scoring system[89] was used to evaluate the programmes, which is set out further below in Table 26.

Table 25: Stage 2 Evaluation Assessment Criteria

Assessment criteria	Description
Investment Objectives	
Investment Objectives One and Two	This is an assessment against the programmes ability to achieve the investment objectives: Aligns with both investment objectives +3 Aligns with one investment objective 0 Does not align with investment objective -3
Success Factors	
Redundancy	This assessment involved asking, how much does the programme improve redundancy in the network for road, rail and active modes: Adds an additional / improves a river crossing +3 Status Quo 0 Removes an existing river crossing -3
Resilience (IO1)	This assessment involved asking, how resilient is the new programme when considering the effects of earthquakes, tsunami and flooding: Earthquakes and resulting liquefaction: Network moved away from liquefaction prone area +3

[89] It is note that same scoring system was also used for the Stage 1 and long list evaluation process

Assessment criteria	Description	
	Status quo	0
	Network moved closer to liquefaction prone area	-3
	Tsunami:	
	Network moved away from tsunami prone area	+3
	Status quo	0
	Network moved closer to tsunami prone area	-3
	Flooding:	
	Network moved away from flood prone area	+3
	Status quo	0
	Network moved closer to flood prone area	-3
Modal choice (IO2)	This is an assessment as to whether the programme improves access to different modes, beyond the private single occupancy vehicle:	
	Improves more than one type of mode other than the private vehicle	+3
	Improves one type of mode other than private vehicles	0
	Does not improve modal choice	-3
Safety – general traffic	This is an assessment for how likely it is that the programme will improve the safety environment for general traffic through the study area:	
	Options that avoid high crash areas – Udy Street, Cuba Street, Jackson Street and the Esplanade	+3
	Options that avoid one or two of either Udy Street, Cuba Street, Jackson Street and the Esplanade	0
	Options that include Udy Street, Cuba Street, Jackson Street and the Esplanade	-3
Safety – active modes	This is an assessment for how likely it is that the programme will improve the safety environment for active mode users through the study area:	
	Provides three or more cycle facilities and avoids Hutt Road and The Esplanade	+3

Assessment criteria	Description	
	Provides one or two cycle facilities and avoids either Hutt Road or The Esplanade	0
	Provides no additional cycle facilities and does not avoid Hutt Road or The Esplanade	-3
Implementability	This is an assessment for how easy the different alternatives / options within the programme will be to construct:	
	Easily constructed using standard construction methods	+3
	Can be implemented, with some advanced construction techniques required	0
	Extremely difficult to build and will require significant works / cause significant disruption	-3
Likely BCR	This is an assessment of the likely BCR for the different programmes:	
	BCR is over 1	+3
	BCR is between 0 and 1	0
	BCR is less than 1	-3
Impacts		
Amenity	This is an assessment for how likely it is that the programme will impact upon residential areas, increasing severance and reducing amenity value:	
	Percentage of the proposed route is less than 30% through residential areas	+3
	Percentage of the proposed route is between 30% and 60% through residential areas	0
	Percentage of proposed route through residential areas is higher than 60%	-3
Environmental impacts	This is an assessment for how likely it is that the programme will impact the immediate environment:	
	Percentage of the proposed route is less than 30% through recreational and landscape protected areas	+3
	Percentage of the proposed route is between 30% and 60% through recreational and landscape protected areas	0

Assessment criteria	Description	
	Percentage of proposed route through recreational and landscape protected areas is higher than 60%	-3

Table 26: Seven-point Scoring System

Rating	Definition	Score
Significantly positive	Significant positive impact, likely resulting in long term improvements	+3
Moderately positive	Moderate positive impact, which may provide improvements and opportunities	+2
Slightly positive	Minor positive impact	+1
Neutral	Similar impact to the do minimum	0
Slightly adverse	Minor adverse impact, which can be mitigated or managed	-1
Moderately adverse	Moderate adverse impact, that may be managed or mitigated	-2
Significantly adverse	Significant adverse impact with serious long-term effects	-3

Based on the evaluation assessment criteria and seven-point scoring system, the overall programme evaluation scores are shown at Table 27 below.

Table 27: Stage 2 (Final) Programme Evaluation Scores

		Criteria			Do-minimum	Programme 1: Wakefield St to Whites Line West	Programme 2: Old Jackson St Bridge to Railway Avenue	Programme 3: Udy Street to Randwick Road	Programme 4: Four Laning The Esplanade
		3	0	-3					
Investment Objective Alignment		Aligns with both investment objectives	Aligns with one investment objective	Does not align with investment objective	0	3	0	3	-3
Redundancy	**Road**	Additional / improved river crossing	Status Quo	Removal of existing crossing	0	3	3	3	0
	Rail	Additional / improved river crossing	Status Quo	Removal of existing crossing	0	3	0	0	0
	Active Modes	Additional / improved river crossing	Status Quo	Removal of existing crossing	0	3	3	3	3
Resilience	**Earthquakes - liquefaction**	Network is moved away from liquefaction prone area	Status Quo	Network closer to liquefaction prone areas	0	3	-3	0	-3
	Tsunami	Network is moved away from tsunami risk area	Status Quo	Network closer to tsunami prone areas	0	3	-3	0	-3
	Flooding	Network is moved away from flood prone area	Status Quo	Network closer to flood prone areas	0	3	-3	-3	-3
Modal Choice		Improves more than one type of mode other than private vehicle (i.e. bus, cycle and rail)	Improves one type of mode other than private vehicle	Does not improve modal choice	0	3	3	3	3
Safety	**General Traffic**	Options that avoid Udy Street, Cuba Street, Jackson Street and The Esplanade	Options that include one or two of either Udy Street, Cuba Street, Jackson Street and The Esplanade	Options that include Udy Street, Cuba Street, Jackson Street and The Esplanade	0	3	3	-3	-3
	Active Modes	Provides 3 or more separate cycle facilities and avoids Hutt Road and the Esplanade	Provides between 1 and 2 cycle facilities and avoid either Hutt Road or The Esplanade	Provides no additional cycle facilities and does not avoid Hutt Road or The Esplanade	0	3	3	0	0
Implementability		The option is easily implemented using standard construction methods	This option can be implemented and is not overly complex. Some advanced techniques may be required but will constitute a small percent of the project	The option is extremely difficult to build and will require significant works such as grade separation and	0	0	-3	0	3
BCR		If the BCR is over 1	If the BCR is between 0 and 1	if the BCR is less than 0	0	0	-3	0	3
Amenity		The percentage of the proposed route is less than 30% through residential areas	The percentage of the proposed route is between 30% and 60% through residential areas	The percentage of the proposed route is higher than 60% through residential areas	0	0	3	-3	0
Environment		The percentage of the proposed route is less than 30% through recreational and landscape protected areas	The percentage of the proposed route is between 30% and 60% through recreational and landscape protected areas	The percentage of the proposed route is higher than 60% recreational and landscape protected areas	0	0	-3	0	0
Total					0	30	0	3	-3

3.3.7 Summary of Evaluation Scores and Rankings

Table 28 summarises the programme evaluation and ranking results (it is noted that the potential scores for the Stage 2 evaluation ranged from -42 to +42).

Table 28 Stage 2 – Scores and Ranking

Programme	MCA Score	Ranking
Programme 1 – Wakefield Street to Whites Line West Connection – Northern River Crossing	+30	1st
Programme 2 – Udy Street to Randwick Crescent Connection – Central River Crossing	+3	2nd
Programme 3 – Old Jackson Street Bridge to Railway Avenue Connection – Southern River Crossing	0	3rd
Do-minimum	0	4th
Programme 4 – Four-laning The Esplanade – Unlocking Capacity Through Existing Infrastructure	-3	5th

As set out above in Table 28, Programme 1 (i.e. the Wakefield Street programme) was ranked first. It is also noted that this programme was ranked first following completion of the Stage 1 evaluation process.

In summary, Programme 1 was ranked first for the following key reasons:

- It was the best performing programme from a redundancy and resilience perspective (i.e. Investment Objective 1). That is, a new northern river crossing would be less vulnerable to earthquakes, liquefaction, tsunami and flooding, when compared to the other river crossings that were considered
- It was equal best performing from a multi-modal perspective (Investment Objective 2)
- It was equal best performing from amenity and environmental perspective, due to it impacting less on local amenity and having less impacts on recreational / residential areas
- It was considered the best performing programme from an implementation perspective.

The Project Team also made the following observations regarding the less preferred programmes:

- Programme 3 (i.e. the Udy Street to Randwick Crescent Connection) was ranked second, mostly due to its redundancy and multi modal benefits. However, it performed poorly in terms of resilience benefits and in the other assessment criteria. In particular it was highlighted that it would have adverse amenity effects on Udy Street, including creating severance between the communities on either side of this street
- Programme 2 (i.e. The Old Jackson Street Bridge to Railway Avenue Connection) was ranked third due mostly to its multi modal and redundancy benefits. However, it performed poorly from a BCR perspective due to the high costs associated with constructing a tunnel. In addition, the likely environmental impacts that a central river crossing would have on wetland environments was assessed as being significantly negative
- Programme 4 (i.e. Four-laning the Esplanade) was ranked fifth (i.e. behind the do-minimum programme). It performed particularly poorly from a resilience perspective. It was also observed that it was likely to further increase community severance between Petone and the Petone Foreshore.

It is noted that following a peer review of the MCA process, it was recommended that the unweighted (i.e. raw) MCA scores as set out above in Table 27, be subjected to a weightings process for sensitivity testing purposes.

The weightings process involved assigning weightings to the problem statements, investment objectives and other criteria. Ultimately, the weightings MCA process supported the outcomes of the unweighted MCA process, with programme 1 remaining as the emerging preferred programme. See **Appendix Three** for the full methodology and results of the weightings assessment process.

3.3.8 Gracefield Rail Line or Randwick Road connection

Following identification of Programme 1 as the emerging preferred programme, attendees at the PSG Workshop Three discussed connectivity options between the Wakefield Street and the Seaview / Gracefield area. The two options considered were:

- A new road running along the Gracefield Rail Line
- An upgrade of Randwick Road.

A preference was identified for the Gracefield Rail Line option as it was considered to have less community severance effects and amenity value impacts when compared with the Randwick Road option. In terms of the latter, HCC officers noted that the Randwick Road option was unlikely to be able to accommodate any significant increases in general traffic (including heavy vehicle traffic) following construction of a new Wakefield Street bridge. HCC officers also noted that the Gracefield Rail Line option was consistent with the alignment identified in the Petone Spatial Plan 2040.

Workshop attendees acknowledged that although they had identified a preference for the Gracefield Rail Line option, both options would need to be further considered as part of any future investigations into Programme 1. It was also identified that KiwiRail had yet to be re-engaged on utilising the rail line alignment for a new road.

3.3.8.1 New or Upgraded Wakefield Street Bridge

Following the identification of Programme 1 as the emerging preferred programme, and following completion of Workshop Three, the Project Team and HCC officers asked themselves the following two questions:

1. should a new and separate multi-modal bridge be built north of the existing Ava Rail Bridge (but not provide for rail and therefore the Ava Rail Bridge would be retained); or
2. should the Ava Rail Bridge be upgraded or replaced with a new multi-modal bridge (providing for rail, active modes and general traffic).

Transport benefits were identified for both options, however, and to ensure that a preferred bridge was identified for inclusion in the emerging preferred programme, an option comparison, or mini MCA, of the two bridge options was undertaken. More information on the two options and the associated MCA process can be found in the MCA Report.

Bridge Option A utilised an alignment from Wakefield Street to White Lines West and comprised construction of a new bridge to the north of the Ava Rail Bridge (Question 1). Bridge Option B utilised an alignment from Wakefield Street to Randwick Road and comprised either upgrading or replacing the existing Ava Rail Bridge (Question 2)[90].

[90] It is noted that KiwiRail will be completing an engineering assessment of the bridge in 2022. At present, no significant maintenance activities have been recorded as being required.

The MCA criteria shown at Table 29 was used to compare Bridge Options A and B.

Table 29 Wakefield Street Bridge Assessment Criteria

Assessment Criteria	Description
Success Factors	
Redundancy	This assessment involved asking, which bridge option improves redundancy for road transport: Adds an additional river crossing +3 Status Quo 0 Removes an existing river crossing -3 This assessment involved asking, which bridge option improves redundancy for rail transport: Adds an additional rail crossing +3 Upgrades existing rail crossing 0 No change -3 This assessment involved asking, which bridge option improves redundancy for active modes: Includes and additional active mode crossing +3 Status quo 0 Removes an existing active mode river crossing -3
Resilience	This assessment involved asking, how resilient is each bridge option when considering the effects of earthquakes, tsunami and flooding: Earthquakes resulting in liquefaction: Network moved away from liquefaction prone area +3 Status quo 0 Network moved closer to liquefaction prone area -3 Tsunami: Network moved away from tsunami prone area +3 Status quo 0 Network moved closer to tsunami prone area -3 Flooding:

Assessment Criteria	Description	
	Network moved away from flooding prone area	+3
	Status quo	0
	Network moved closer to flooding prone area	-3
Modal choice	This is an assessment as to which bridge option improves access to different modes beyond the private single occupancy vehicle:	
	Improves more than one type of mode other than private vehicle	+3
	Improves one type of mode other than private vehicles	0
	Does not improve modal choice	-3
Safety – general traffic	This assessment evaluated each bridge options potential to reduce the number of general traffic deaths and serious injuries (DSIs) within the study area:	
	Highly likely to reduce DSIs	+3
	Likely to reduce DSIs	0
	Not likely to reduce DSIs	-3
Safety – Active Modes	This assessment evaluated each bridge options potential to reduce the number of active mode deaths and serious injuries (DSIs) within the study area:	
	Highly likely to reduce DSIs	+3
	Likely to reduce DSIs	0
	Not likely to reduce DSIs	-3
Amenity	This is an assessment for how likely it is that the programme will impact upon residential areas, increasing severance and reducing amenity value, specifically relating to how the bridge options connect into the existing road infrastructure	
	Improves amenity	+3
	Maintains current amenity	0
	Reduces amenity	-3
Implementability	This is an assessment for how easy the different alternatives / options within the programme will be to construct:	
	Easily constructed using standard construction methods	+3
	Can be implemented, with some advanced construction techniques required	0
	Extremely difficult to build and will require significant works	-3
Improves existing	This is an assessment of whether the bridge option improves the existing damaged / inadequate infrastructure	

Assessment Criteria	Description	
damaged / inadequate infrastructure	Improve existing damaged / inadequate infrastructure	+3
	N/A	0
	Does not improve damaged / inadequate infrastructure	-3
Consentability	This is an assessment of how easy it is likely to be to achieve resource consent for each bridge option:	
	Resource consent easy to achieve	+3
	N/A	0
	Resource consent difficult to achieve	-3

The MCA evaluation resulted in Bridge Option A scoring +1 and Bridge Option B scoring +12 (out of a possible +39). Therefore, Bridge Option B was preferred through the MCA evaluation process. Although the Project Team, in consultation with HCC officers, concluded that the latter bridge option should be included in the emerging preferred programme, it was acknowledged that future business cases may elect to re-visit this particular preference.

In addition, the Project Team recognised that particular aspects of the alignment for Option B would require further option development and assessment in subsequent business cases. This included determining the preferred connections (i.e. form and function) at the following locations:

- SH2/Dowse Interchange
- Hutt Road
- Cuba Street (including to the north and south)
- Randwick Road / Whites Line West
- Parkside Road
- Seaview Road

3.3.9 Identifying the Emerging Preferred Programme

In addition to supporting the need for the anchor resilience project to address the resilience problem, attendees from both PBC and PSG workshops, identified a number of options from the less preferred programmes that would be helpful in contributing to achievement of the investment objectives. These included:

- Active mode improvements on:
  - The Esplanade
  - Hutt Road
  - A new active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project
- Improvements to the existing Gracefield Interchange to allow full movements for all road based vehicles
- Cuba Street connections (e.g. on / off ramps)
- Bus priority (e.g. bus lanes) on The Esplanade (once the new east-west multi-modal transport corridor is in place).

Furthermore, through discussions with the PSG at Workshop Three, it was decided that train station access plans should be specifically included in the emerging preferred programme (noting that these plans were not part of the do-minimum programme).

This mixing and matching process (i.e. bottom up approach) resulted in the following options being identified for inclusion in the emerging preferred programme:

- Bus priority improvements at the following intersections:
  - The Esplanade / Hutt Road
  - Hutt Road / Jackson Street
  - Jackson Street / Cuba Street
  - Randwick Road / Waione Street
  - Randwick Road / Whites Line East
- Bus priority (e.g. bus lanes) and amenity improvements on The Esplanade
- Active mode upgrades on The Esplanade and Hutt Road (and through the wider Project Study Area if required) to respond to the increases in walking and cycling that is predicted by the Te Ara Tupua Walking and Cycling Project
- Train station access plans for the Petone, Ava and Woburn Train Stations
- Inclusion of an active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project
- On-road cycle improvements on Ewen Bridge to improve safety and connectivity to the Hutt *River* Trail
- Gracefield Interchange improvements to enable full movements to be made by all on-road based vehicles
- Connections from the new Wakefield Street river crossing alignment to Cuba Street and the Dowse Interchange / Hutt Road.

It is noted that where road improvements were proposed, both the attendees at PBC Workshop Two and PSG Workshop Three recommended that such improvements incorporate active mode facilities and also cater for micro-mobility transport modes. This recommendation would ensure that all works will have at least, secondary benefits of improving health and reducing future climate change impacts in the Project Study Area. Workshop attendees also recognised that options identified through the additional MCA and subsequent mixing and matching processes, would need to be staged from an affordability and wider transport system design perspective.

3.4 Emerging Preferred Programme

3.4.1 Overview

It is proposed that the emerging preferred programme be advanced in three stages over a 20-year timeframe. Taking a staged approach recognises that both HCC and NZTA are likely to have funding constraints over this time period that were likely to prevent the entire programme from being funded all at once. Taking a staged approach also enables the monitoring and evaluation of the progress of the extensive do-minimum programme and the interventions proposed to be implemented as part of Stage 1 of the emerging preferred programme. In particular, a staged approach enables the implementation of the emerging preferred programme's east-west multi-modal connection to be aligned with the current timing for the major SH2 improvements, such as, the P2G Link Road.

Table 30 below sets out the proposed stages for the emerging preferred programme. It is noted that before Stage 1 in the table below commences, it has been assumed that the do-minimum programme will have been delivered.

Table 30 Emerging Preferred Programme Stages

Stages	Timing	Key activities
Stage 1	2021/22 to 2024/25	Active mode improvements on The Esplanade, Hutt Road and Ewen Bridge (Jacobs Micromobility SSBC) New active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project
		Bus priority improvements at following key intersections: ► The Esplanade / Hutt Road ► Hutt Road / Jackson Street ► Jackson Street / Cuba Street ► Randwick Road / Waione Street ► Randwick Road / Whites Line East
		Train station access plans to improve active mode and micro-mobility access to the Petone, Ava and Woburn Train Stations
Stage 2	2025/26 to 2027/28	Improvements to the existing Gracefield Interchange to allow for full movements for all road based vehicles
Stage 3	2028/29+	New east / west multi-modal transport corridor on a Wakefield Street to Whites Line / Randwick Road alignment, including: ► An upgraded or replaced Ava Rail Bridge ► New or upgraded road connections to Seaview / Gracefield ► Cuba Street connections (e.g. on / off ramps) ► Connections to the Dowse Interchange / Hutt Road ► Bus priority (e.g. bus lanes) on The Esplanade (once the new east-west multi-modal transport corridor is in place).

Stage 1 provides for active mode, minor bus priority and train station access improvements to be implemented in the short term. These improvements are not dependent on other elements of the emerging preferred programme (or the do-minimum programme) and will realise transportation, economic, health, and climate change benefits on their own accord.

Stage 2 provides for upgrades to the existing Gracefield Interchange so that full movements can be made by all road based vehicles. Currently, vehicles are only able to turn right from Gracefield Road on to Wainuiomata Road and left from Wainuiomata Road on to Gracefield Road. Upgrading this Interchange will reduce travel variability problems for vehicles travelling between Gracefield and Waiwhetū (south and north respectively). Completing this upgrade prior to implementing Stage 3 will also help to minimise any disruption caused by the eventual construction of the new east-west multimodal corridor.

Stage 3 is comprised of several multi-modal transport improvements, including the development and implementation of a new east-west multi-modal transport corridor. In turn, the new corridor will help to realise major bus priority and potentially placemaking opportunities in Petone (e.g. improved access to the Petone Foreshore or key urban development areas).

A key feature of Stage 3 is the recommendation that its implementation coincides with the implementation of major improvements to the "Ngauranga triangle state highway system",[91] such as, the P2G Link Road project. The key reasons for this recommendation are as follows:

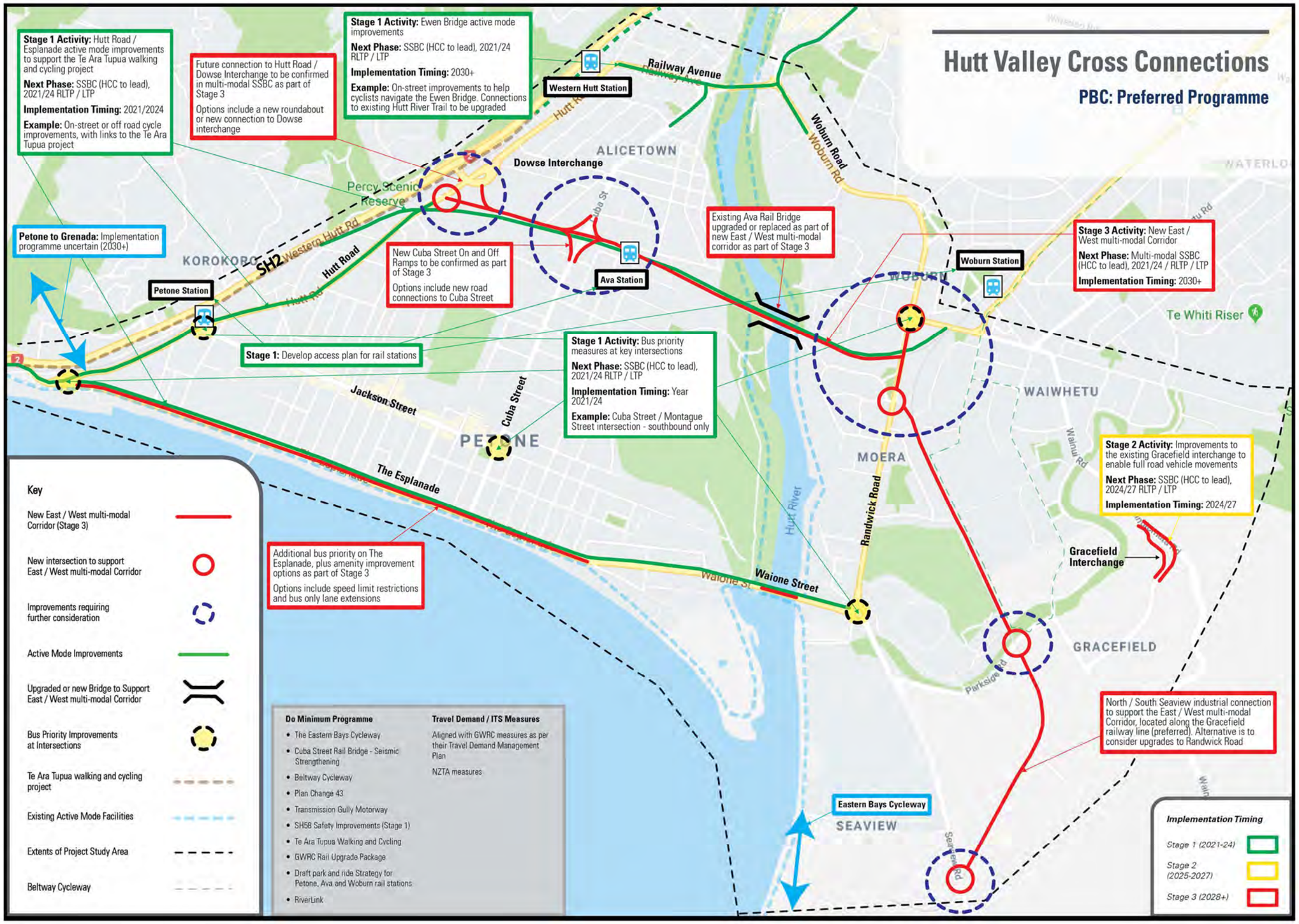
- the transport benefits (resilience, access and increased capacity) of the new east-west multi-modal transport corridor are not likely to be fully realised until the level of service improves on SH2, between the Melling and Ngauranga Interchanges, during peak traveling times
- without a new east-west multi-modal transport corridor in place, east-west through traffic will continue to use The Esplanade, which in turn significantly limits the ability to implement major bus priority measures (or placemaking measures) in Petone.

It is noted that no improvements are proposed for Jackson Street as part of the emerging preferred programme The Project Team, in consultation with HCC officers, arrived at this conclusion as it was considered that the opportunity to implement significant changes on Jackson Street would be limited until a new east-west multi-modal transport corridor was in place and new travel patterns and / or behaviours had been established and well understood. It is also noted that the option of removing parking from Jackson Street to improve active mode access and to provide additional placemaking opportunities had been considered during the long list process, but had been discarded at this point due to the likely adverse effects on local businesses. To further understand what these effects could be, HCC are undertaking an Innovative Streets trial on part of Jackson Street. When the effects on the commercial viability through this trial are understood as a result of reduced parking, it may be possible to include some micromobility initiatives within the SSBC that is being completed by Jacobs.

The emerging preferred programme, and its staging, is summarised below in Figure 43.

[91] The Ngauranga triangle state highway network currently comprises of SH2 (between the SH58/2 and Ngauranga interchanges), SH1 (Ngauranga and Plimmerton) and SH58

Figure 43 Preferred Programme



3.4.2 Programme Outcomes

The anticipated transport outcomes for the Project Study Area are set out below for each stage.

Implementing **Stage 1** is expected to result in the following outcomes:

- Improved transport choices through upgraded active mode facilities, including ensuring that cycling connections to and from the Te Ara Tupua Walking and Cycling Project are safe and efficient (which will in turn help to realise the transport benefits predicted for this project)
- Improved east-west bus travel time reliability, which in turn should encourage bus patronage growth and reduce reliance on single occupancy travel
- Improved vulnerable road user facilities, which in turn will reduce the likelihood of their involvement in crashes (especially with motor vehicles)
- Improved access to the Petone, Ava and Woburn Train Stations, which in turn should encourage more people to walk, cycle and / or use micro-mobility options to access the Hutt Valley and Melling Rail Line services
- Improved resilience through the Wellington Region Emergency Management Office (WREMO) will be achieved by building capacity, increasing connectedness and fostering cooperation.

Implementing **Stage 2** is expected to result in the following outcomes:

- Reduction in travel time variability problems for road based vehicles travelling between Gracefield and Waiwhetū (south and north respectively). When Stage 3 is complete, further resilience benefits are achieved through improved connectedness to a new and more resilient route.

Implementing **Stage 3** is expected to result in the following outcomes:

- Improved local road network redundancy and mitigation provision for the impacts of long-term climate change. In particular:
  - Recovery and response times for HILP events will be significantly improved, including mitigating some of the $16B predicted to be lost to the national economy by the Wellington Lifelines PBC (2019) following a 7.5 magnitude earthquake. Access to and from vital lifeline services in Seaview / Gracefield is more likely to be maintained following a significant earthquake event
  - Reduces the impact of LIHP events through improved network redundancy (i.e. an alternative route)
  - Helps to prepare for the sea level changes predicted for the lower parts of Petone, particularly for The Esplanade
  - Reduces reliance on the Estuary (Waione Street) Bridge, which has been identified as being vulnerable to HILP events and is considered a bottleneck on the road network.
- Reduces east-west travel variability by establishing a new east-west multi-modal transport corridor (including a new or upgraded Ava Rail Bridge)
- Provides opportunities for urban amenity / public realm improvements, particularly along The Esplanade and on Jackson Street (i.e. through a reduction in heavy commercial vehicle traffic and general traffic volumes)
- Improves flood resilience at the Ava Rail Bridge, which is currently experiencing through capacity issues during high flow scenarios. A new bridge will mitigate this issue through carefully considered design
- Improves active mode and micro-mobility access to the Petone Foreshore
- Improves access to urban development areas (e.g. North Park).

The emerging preferred programme also gives effect to the aspirations of key HCC strategic documents, such as P2040, and is consistent with the implementation timing recommended in the Wellington Lifelines PBC (2019) for the Cross Valley Link.

Table 31 summarises the anticipated investment outcomes against each of the problem /benefit statements and investment objectives.

Table 31 Anticipated Investment Outcomes

Key investment outcomes	How the investment outcomes will be achieved?	Investment Objective 1	Investment Objective 2	Improved transport network resilience	Improved transport choices to encourage mode shift	Improved accessibility and safety	Improved development opportunities for urban growth areas in southern Lower Hutt
Stage One							
► Improved walking and cycling facilities, including ensuring connections to and from the Te Ara Tupua Walking and Cycling Project are safe and efficient. Such an outcome will also provide health and climate change benefits ► Key "crash hot spots" for vulnerable road users, such as cyclists, will be improved ► East-west travel time variability improved as a consequence of improved / new bus priority measures at key intersections ► Walking, cycling and micro-mobility access improvements at the Petone, Ava and Woburn Train Stations. Such an outcome will also provide health and climate change benefits	► By improving active mode facilities along The Esplanade, Hutt Road and across Ewen Bridge. In addition, a new active mode route could be provided that will connect with the Te Ara Tupua walking and cycling project ► By reducing the number of pedestrian (75) and cycling (77) crashes that have been recorded over the past 5 year period. This will be achieved through addressing the key causal factors for these crashes ► By improving bus travel time variability through implementing new or additional bus priority at key locations, including; Randwick Road / Whites Line East, Randwick Road / Waione Street, Jackson Street / Cuba Street, Jackson Street / Hutt Road and The Esplanade / Hutt Road ► By completing Train Station Access Plans to improve the ability of people to walk, cycle or use micro-mobility devices to access train stations within the Project Study Area			✓	✓	✓ ✓	✓
Stage Two							
► Improved travel efficiency for all road based vehicles travelling to and from Wainuiomata as a result of enabling full movements to occur at the Gracefield Interchange	► By improving travel times between Wainuiomata and Gracefield	✓	✓	✓		✓	
Stage Three							
► Improved response and recovery to HILP events through providing additional network redundancy (including ensuring that access to vital lifeline services, such as, the Seaview Fuel Depot, is resilient) ► Assists in responding to the predicted impacts of long-term sea-level change ► Improves active mode and micro-mobility access to the Petone Foreshore (which has health benefits and climate change benefits) ► Improves access to and through Petone (in particular, The Esplanade), Seaview / Gracefield and North Park. It also improves access to the Wainuiomata and Eastbourne areas, which are heavily reliant on the performance of the transport connections through the Project Study Area	► By creating a new east-west multi-modal transport connection (outside of the HILP risk areas) will enable Lower Hutt and the wider Wellington region to better respond to, and recover from, HILP events. There is the option of connecting the new east-west route through to Seaview / Gracefield, which would provide additional resilience benefits for this area as well as for Eastbourne and Wainuiomata ► By providing a new east-west multi-modal transport connection, travel times on the new road, as well as on the existing network (i.e. The Esplanade) are expected to be more predictable and reliable ► By improving safety for all transport modes using The Esplanade as well as improving access to the Petone Foreshore. These benefits will be realised as it is expected that vehicle traffic will transfer from The Esplanade to the new east-west multi-modal transport connection	✓ ✓	✓ ✓	✓	✓ ✓	✓ ✓	✓ ✓

3.4.3 Emerging Preferred Programme Risks

The key development and implementation risks for the emerging preferred programme are as follows:

Technical

- There is uncertainty as to how the new east-west multi-modal transport corridor will tie into the road network, particularly at Randwick Road, Hutt Road and at the Dowse Interchange. High level assessments indicate that making connections at these locations will be highly complex from both a design and constructability perspective
- The form and function of the proposed on / off ramps at the Cuba Street location requires further investigation. High level assessments indicate that providing connections at this location will be highly complex from both a design and constructability perspective
- Investigations into the possible use of the Gracefield Rail Line for a road connection have been undertaken at a high level. It is understood that this rail line is in-use for rolling stock maintenance purposes. Therefore, its ability to be used as a road corridor requires further investigation and may include considering the option of upgrading Randwick Road
- Population changes within and surrounding the Project Study Area, combined with future technology changes, means that future travel demands may differ to those currently predicted.

Operational

- There is uncertainty as to what operational impacts the Transmission Gully Motorway will have on travel demands through the Project Study Area (especially for heavy commercial vehicle travel to and from Seaview / Gracefield), over the short and long term. It is noted that whilst traffic modelling regarding the impacts of the Transmission Gully Motorway on the wider state highway network has been undertaken by NZTA, no modelling has been undertaken of its impacts on the local road network within the Project Study Area.

Financial

- The current assessment of estimated costs for the emerging preferred programme is at a high level, and therefore indicative only. Whilst adopting a high-level cost estimating approach is considered appropriate for a PBC, further and more detailed cost analysis (and peer reviews) will be required to improve the understanding of the costs that should be expected for the emerging preferred programme
- The timing of future business cases and implementation phases for each stage of the emerging preferred programme is dependent on sufficient funding being available from future NLTPs and LTPs. It is likely that both of these transport funding sources will continue to be constrained into the future
- Implementing the emerging preferred programme of works is dependent on receiving financial contributions from the investment partners. It is highly unlikely that implementation of the emerging preferred programme could be funded solely from HCC
- It is noted that KiwiRail are the funders and asset owners of the Hutt Valley and Gracefield Rail Lines. KiwiRail have yet to be consulted on the PBC, and in particular, the proposals for the Ava Rail Bridge and Gracefield Rail Line. There is potential that KiwiRail could be a co-funder for key elements of the programme.

Stakeholder / Public

- Limited stakeholder engagement has been undertaken during the PBC process – the engagement undertake has been via PBC Workshop's One and Two. As such, there has been no public engagement on the programme options or the emerging preferred programme. Further consideration as to how and when this engagement should occur is required
- No Iwi engagement has taken place to date. Further consideration as to how and when this engagement should occur is required

- No KiwiRail engagement has been completed. With the proposal to upgrade / replace the Ava Rail Bridge, future conversation will need to be had with KiwiRail on this point

Environmental and Social Impacts

- Only high-level environmental assessments on the implementation effects of the emerging preferred programme have been undertaken. In particular, the environmental effects from constructing the new east-west multi-modal transport corridor have yet to be assessed in detail; further environmental effects assessments will be required
- The emerging preferred programme has been designed to improve community access within the Project Study Area. However, the social impacts from constructing the new east-west multi-modal transport corridor have yet to be assessed in detail, and therefore further social impact assessments will be required
- There are likely to be historic and cultural sites impacted by the emerging preferred programme. Further assessment and evaluation will be necessary to ensure that such effects can either be avoided or mitigated.

Safety

- Safety improvements and forecast DSI reductions resulting from the implementation of the emerging preferred programme will not be delivered on day one. This is due to the emerging preferred programme's staging strategy. Only once the emerging preferred programme has been fully implemented, will all of the safety benefits be realised

Economy

- At this stage, the economic analysis that has been undertaken to date is only at a high level. This analysis provides a snapshot in time and does not take into consideration future market and economy fluctuations.

3.4.4 Economic Analysis

A Benefit Cost Ratio (BCR) for the emerging preferred programme has been prepared in accordance with Economic Evaluation Manual (EEM). Its preparation has included consideration of the programme's three recommended stages, as well as its potential to generate wider economic benefits (WEBs). Further information on the economic analysis, including NZTA's EEM worksheets, for the emerging preferred programme can be found in **Appendix Four**.

3.4.4.1 BCR Assumptions

The conventional BCR has been prepared based on the following assumptions:

- Time Zero is 1 July 2019
- Stages 1, 2 and 3 will be constructed in 2022, 2026 and 2030 respectively
- Duration of construction for Stages 1 and 2 is 12 months, and is 24 months for Stage 3
- Analysis period is 40 years
- Discount factor is 6%
- Traffic Growth is 1.3% per annum based on traffic growth at the Petone on and off ramps between 2012 and 2018.

The WEBs calculations (i.e. agglomeration, imperfect competition and increased labour benefits) for the emerging preferred programme have been developed in accordance with the EEM, and the methodologies used to calculate the WEBs for the Let's Get Wellington Moving and P2G Link Road projects.

In addition, land value uplift and resilience benefits have been calculated for the emerging preferred programme. The benefits to be generated by land value uplift have been calculated in accordance with the Let's Get Wellington Moving project, and the resilience benefits have been calculated in accordance with the P2G Link Road project methodology.

3.4.4.2 BCR Calculations

A breakdown of the individual benefits and costs that have been used to calculate the emerging preferred programme's conventional BCR and the BCR with WEBs is set out below in Table 32.

Table 32 Benefit / Cost breakdown for Benefit /Cost Type

Benefit / Cost Type	Benefits / Costs ($)
Travel time savings	221,990,522
Vehicle Operating Costs	4,311,391
Crash cost savings	485,115
Vehicle Emissions Savings	215,570
Pedestrian and Cycle	2,443,969
Sub Total - Traditional Benefits	**229,446,567**
Agglomeration	22,678,703
Imperfect Competition	11,339,351
Increased Labour	11,339,351
Land Value	22,678,703
Resilience	34,018,054
Sub Total - WEBs	**102,054,163**
TOTAL BENEFITS	**331,500,730**
Construction Cost (expected programme costs discounted)	62,984,269

3.4.4.3 Emerging Preferred Programme BCR

Based on the benefit / cost breakdown outlined above, the conventional BCR for the emerging preferred programme is **3.6**. The BCR increases to **5.3** when WEBS are included.

The BCR is based on all of the elements of the emerging preferred programme being implemented in accordance with its proposed staging. Tony Brennand from Waka Kotahi was provided the detailed analysis completed to calculate the BCRs shown in Table 32. Tony was satisfied that the methodology used and the results obtained, were robust and accurate with sufficient sensitivity testing built in.

3.4.5 Sensitivity Analysis

Sensitivity tests have been undertaken to test the conventional BCR by adjusting the various parameters used in the economic assessment analysis and the results are summarised in Table 33 below.

Table 33 BCR Sensitivity Tests

	Parameter Changed	Base Parameter	Used Parameter	BCR no WEBs	BCR with WEBs
1	Base BCR			3.6	5.3
3	Discount factor	6%	4%	5.2	7.5
4	Discount factor	6%	8%	2.6	3.8
5	Construction cost	100%	120%	3.0	4.4
6	Construction cost	100%	80%	4.6	6.6
7	Traffic and cycle growth	1.3%	1.1%	2.7	3.9
8	Traffic and cycle growth	1.3%	1.5%	4.4	6.4
9	Peak hour conversion factor	22.94	20	8.3	12.1
10	Peak hour conversion factor	22.94	25	2.2	3.2
11	WEBs	45%	30%	3.6	4.7
12	WEBs	45%	60%	3.6	5.8
13	Analysis period	40 years	50 years	4.3	6.2
14	Flows transferred to new bridge	11,645	8,000	3.1	4.4
15	Flows transferred to new bridge	11,645	10,000	3.4	5.0
16	Flows transferred to new bridge	11,645	15,000	3.9	5.7

As set out above in Table 33, the conventional BCR has a sensitivity test range of between 2.2 and 8.3. The BCR including WEBs has a sensitivity test range of between 3.2 and 12.1.

3.4.6 Indicative IAF Profile

An indicative assessment of the emerging preferred programme, against the criteria of the 2018-21 Investment Assessment Framework (IAF)[92], was undertaken by the Project Team for information purposes.

Based on the Project Team's own IAF assessment, the proposed Results Alignment for the emerging preferred programme was assessed to be **High**. A more detailed report on the Project Team's results alignment assessment is provided in **Appendix Five**.

[92] See - https://nzta.govt.nz/planning-and-investment/planning-and-investment-knowledge-base/2018-21-nltp-investment-assessment-framework-iaf/about-the-2018-21-nltp-investment-assessment-framework/

The Project Team's Results Alignment assessment combined with a conventional BCR of 3.6 indicates that the emerging preferred programme is likely to have a **High / Medium** IAF profile.

3.5 Programme Financial Case

This section sets out the likely affordability of the emerging preferred programme, and what elements are proposed to be funded by the investment partners.

3.5.1 Indicative Programme Cost

The emerging preferred programme's expected and the 95th percentile costs for each stage are set out in Table 34. The total expected cost for the emerging preferred programme is $100M with a 95th percentile cost of $160M.

Table 34 Expected and 95th Percentile Emerging Preferred Programme Cost Estimates

Stage	Expected Cost	95th Cost Estimate
Stage 1 - Activity mode and bus priority improvements	$17,000,000	$26,000,000
Stage 2 – Gracefield Interchange upgrades	$8,000,000	$15,000,000
Stage 3 – New multi-modal transport corridor and wider bus priory improvements	$75,000,000	$114,000,000
Emerging preferred programme total cost	**$100,000,000**	**$160,000,000**

More details on the programme cost range can be found in the Cost Estimate Report attached at **Appendix Six**.

It is noted that the costs set out in Table 34 have been reviewed by Terra Consultants. Terra Consultants undertook a risk based analysis to understand outstanding risks associated with the proposed options / alternatives that may result in the costs outlined above increasing. Further information and the findings from the work Terra Consultants completed is held at **Appendix 6.**

3.5.2 Funding Arrangements

Implementation of the emerging preferred programme will require funding from HCC, NZTA and the other investment partners.

The next step for implementing the emerging preferred programme is to undertake single stage business cases (SSBC) for Stage 1. The funding arrangements for this business case is expected to be set out in the Wellington Regional Land Transport Plan 2021-2024 that is to be developed from mid-2020 onwards.

3.5.3 Affordability

The overall programme is generally considered to be affordable as it is programmed to be investigated and implemented over a 20-year period. Nevertheless, the affordability of each individual element will need to be considered in more detail following the completion of each SSBC.

4 Part C Delivering and Monitoring the Programme

4.1 Management Case

This section of the PBC provides information on the development of the emerging preferred programme's SSBCs for Stages 1, 2 and 3.

4.1.1 Investment to be Progressed Now

If this PBC is approved, the next key step for each of the emerging preferred programme's stages is to undertake investigation works in accordance with the timeframes outlined below in Table 35.

Table 35 Indicative Delivery Programme for SSBCs

Investigation - Next Step	Timing	Key Focus of Investigations	Investment Partner (Lead)
Active Mode SSBCs (as part of Jacobs Micromobility SSBC)	2021/22 to 2024/25	The Esplanade and Hutt Road active mode improvements	HCC
		Ewen Bridge active mode improvements	
		Active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project	
Bus Priority SSBC		Bus priority improvements at identified intersections	HCC / GWRC
Train Station Access Plans		Train station access plans to improve active modes and micro mobility access to the Petone, Ava and Woburn Train Stations	HCC / GWRC
Gracefield Interchange SSBC	2025/26 to 2027/28	Improvements to the existing Gracefield Interchange to allow for full movements for all road based vehicles	HCC
East / West Multi-Modal Corridor SSBC (subject to the timing of NZTA's major SH2 improvements programme)	2028/29+	New east / west multi-modal transport corridor, including: ► an upgraded or replaced Ava Rail Bridge ► new or upgraded road connections to Seaview / Gracefield ► Cuba Street connections (e.g. on / off ramps) ► Connections to the Dowse Interchange / Hutt Road ► Bus priority (e.g. bus lanes) on The Esplanade	HCC

For Stage 1, it is proposed to undertake up to three separate SSBCs in order to investigate the proposed active mode and bus priority improvements. It is noted that the active mode SSBC that is proposed will be captured as part of the Micromobility SSBC that Jacobs are currently

undertaking. In addition, it is also proposed that train access plans are developed for the Petone, Ava and Woburn Train Stations.

Therefore, the next immediate steps for developing the Stage 1 SSBCs and Access Plans is as follows:

1. HCC and GWRC to develop project plans for delivery of each SSBC and Access Plan
2. Ensure the SSBCs and Access Plans are identified in HCC's next LTP and in the Wellington RLTP 2021/24
3. Subject to funding being secured, HCC and GWRC to procure professional services to deliver the SSBC and Access Plans.

4.1.2 Programme Governance and Reporting

The responsibility for overseeing the implementation of the programme lies with HCC. This is because HCC is one of the principal funding organisations, as well as the asset owner of the local road and active mode networks located within the Project Study Area. However, the emerging preferred programme will also require investment from NZTA and GWRC (i.e. for the Train Station Access Plans). KiwiRail are also the asset owner of the Hutt Valley Rail Line and the Ava Rail Bridge. As such, KiwiRail is not only an affected party, but also a potential co-investor in the emerging preferred programme.

HCC will be responsible for establishing the governance arrangements and reporting on progress of the next stages of the emerging preferred programme (e.g. SSBCs). A summary of the investment partners and their roles and responsibilities are set out in Table 36 below.

Table 36 Roles and responsibilities

Who	Role	Responsibility
HCC	Programme Lead	Joint-funder of the emerging preferred programme. Will manage the roll out of the SSBCs identified for Stages 1, 2 and 3 (including the train station access plans) Will work with other investment partners and stakeholders to ensure all of their needs are managed in an appropriate and timely manner.
NZTA	Investment Partner	Potential joint-funder of the emerging preferred programme through the financial assistance rate system. SH2 asset owner and system design lead for the state highway network (i.e. SH2).
GWRC	Investment Partner	Potential co-funder of certain elements of the emerging preferred programme, including being responsible for delivery of bus services within the Project Study Area. Will lead the development of the RLTP and Regional Public Transport Plan
KiwiRail	Investment Partner	Potential co-funder of the emerging preferred programme (e.g. Ava Rail Bridge upgrade / replacement).

4.1.3 Stakeholder Engagement and Communications Plan

It is recommended that stakeholder engagement and communications plans be developed for each respective SSBC (and resulting implementation phases), including identifying the specific outcomes to be sought from engagement and communications.

4.1.4 Programme Performance and Review

A monitoring programme will be established to track the progress of the emerging preferred programme towards achieving this PBC's investment objectives. It is recommended that the investment objectives be measured in accordance with the KPIs identified for each of the benefits statements as outlined in Table 37 and again at **Appendix Two**.

Table 37 Monitoring programme

Investment Objective	Key Indicator	Targeted Outcomes
To improve the resilience of southern Lower Hutt by enhancing the transport networks ability to withstand and respond in a timely manner to HILP and LIHP events	Availability of a viable alternative to the high-risk and high-impact route (The Estuary (Waione Street) Bridge)	Currently there is one road across the Hutt River. The target is two roads
	Network redundancy	When closures are experienced, currently the LoS experienced is between E and F. The target is to achieve a LoS, during closure, between D and E on the new route
	Level of service and risk	Due to one viable route being available during closure, access to essential services is mainly removed. The target is to provide an alternative route to improve access to essential services during closure
To improve access to and from key destinations and key urban growth areas in southern Lower Hutt	Spatial coverage – resident population – public transport	The target is to increase the percentage of people choosing to use public transport by 5%, five years after opening
	Spatial Coverage – Employment – single occupancy vehicle use	The target is to decrease the percentage of people choosing to travel in single occupancy vehicles by 5%, five years after opening
	Spatial Coverage – cycle lanes and paths	The target is to increase the percentage of people choosing to walk and cycle by 5%, five years after opening
	Level of service and risk	The target is to increase the number of people accessing the Petone foreshore by active modes to realise additional health and climate change benefits
	Death and serious injuries	The target is to reduce the number of cycling and walking deaths and serious injuries by a total of 5, five years after opening, when compared to the current baseline
	Transport choice	The target is to reduce the number of cycling and walking deaths and serious injuries by a total of 5, five years after opening, when compared to the current baseline

	Economic opportunities	The target is to achieve the development aspirations as set out in P2040
	Employment opportunities	The target is to maintain the current levels of employment growth

It is recommended that a hold point be established at the end of Stage 1 to revisit the above performance and review measures. One of the main purposes of this hold point would be to ensure the impacts of the Stage 1 improvements are well understood before making final decisions on the timing of the SSBCs for Stages 2 and 3.

For Stage 1, it will be important to monitor the progress and timing of the Te Ara Tupua walking and cycling resource consents (for the Petone to Ngauranga section). It may be necessary to adjust the emerging preferred programme if there are any material changes to this project as a result of the consent process.

For Stage 3, it will also be important to closely monitor the timing of the future P2G Link Road investigation works (or any other Ngauranga Triangle state highway investigations works that may be undertaken). If these investigation works are brought forward, then consideration should also be given to bringing forward the east / west multi-modal transport connection SSBC to ensure the planning for both projects are well aligned.

Cross Valley Transport Connections

Investment Logic Map

HUTT CITY
TE AWA KAIRANGI

Problems

75%

Lack of transport network resilience

Southern Lower Hutt's transport network lacks resilience to major natural events, future sea level rise, and regular network interruptions, which will cause economic and/or social disruption for Lower Hutt and the Wellington region.

25%

Limited access

The existing transport system in Southern Lower Hutt:

- limits modal choice
- constrains access to economic opportunities
- creates safety issues for active mode users

Benefits

50%

Improved transport network resilience

KPI 1: Increase the number of high impact routes with viable alternative routes from one, to two. Update KPIs in Appendix B

KPI 2: Maintain a LOS between D and E on the new route, when the network experiences a road closure

KPI 3: Maintain the ability to access essential services (e.g. food, water, health care, fuel depots) during major natural events

25%

Improved transport choices to encourage mode shift

KPI 1: Increase in the percentage of public transport mode share by 5%, five years after opening

KPI 2: Decrease in the percentage of single occupancy vehicle mode share by 5%, five years after opening

KPI 3: Increase walking and cycling mode share by 5%, five years after opening

15%

Improve accessibility and safety

KPI 1: Increase the number of people accessing the Petone foreshore by active modes

KPI 2: Reduce the number of cycling and walking deaths and serious injuries by a total of five, five years after opening

KPI 3: Increase the availability of safe and convenient pedestrian and cycle routes to key destinations

10%

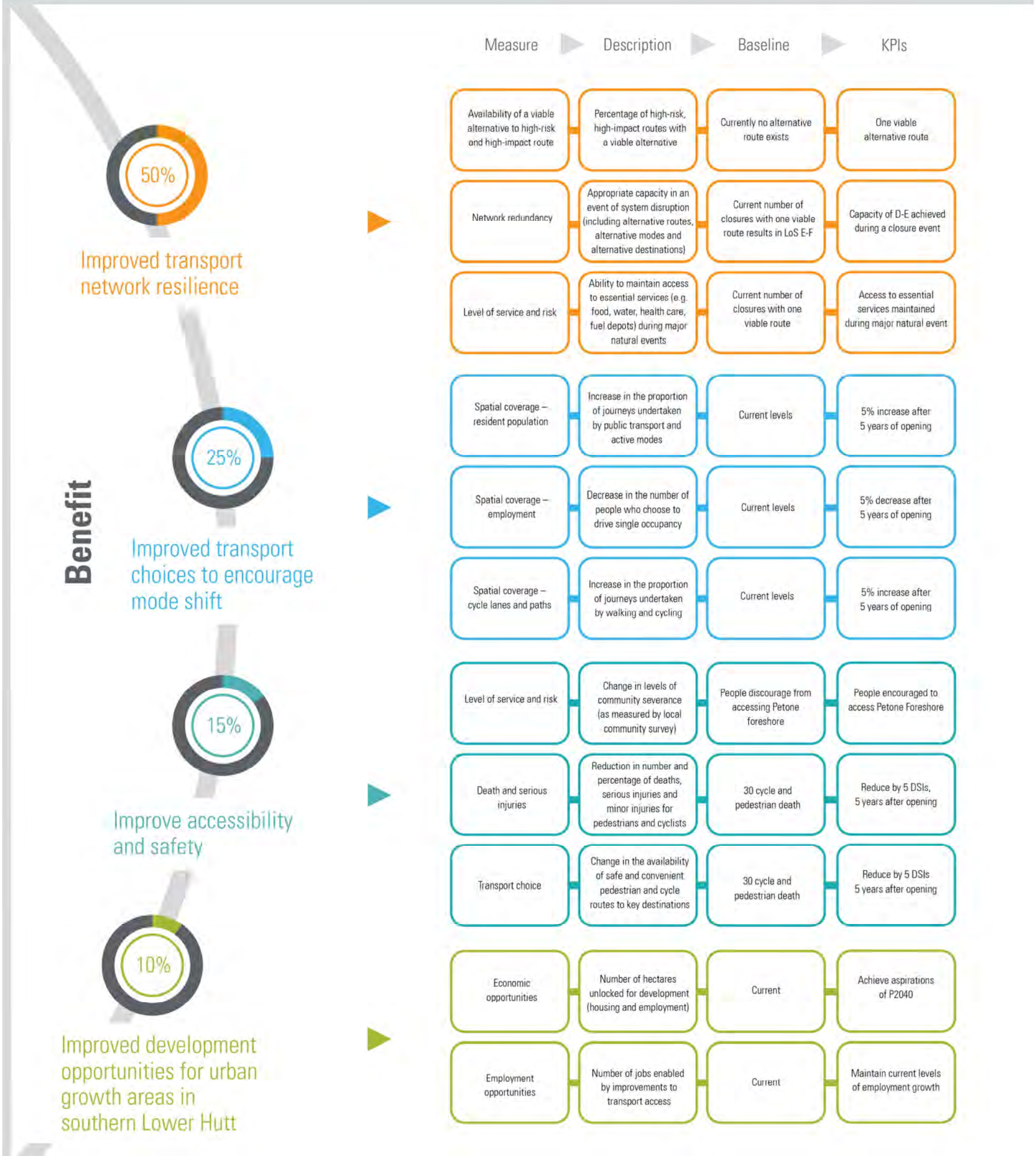
Improved development opportunities for urban growth areas in southern Lower Hutt

KPI 1: Achieve the development aspirations as set out in Petone 2040

KPI 2: Maintain the current levels of employment growth

Cross Valley Transport Connections PBC

Benefit Map



Appendix Three Cross Valley Connections Programme Business Case - Multi Criteria Assessment Report

Purpose

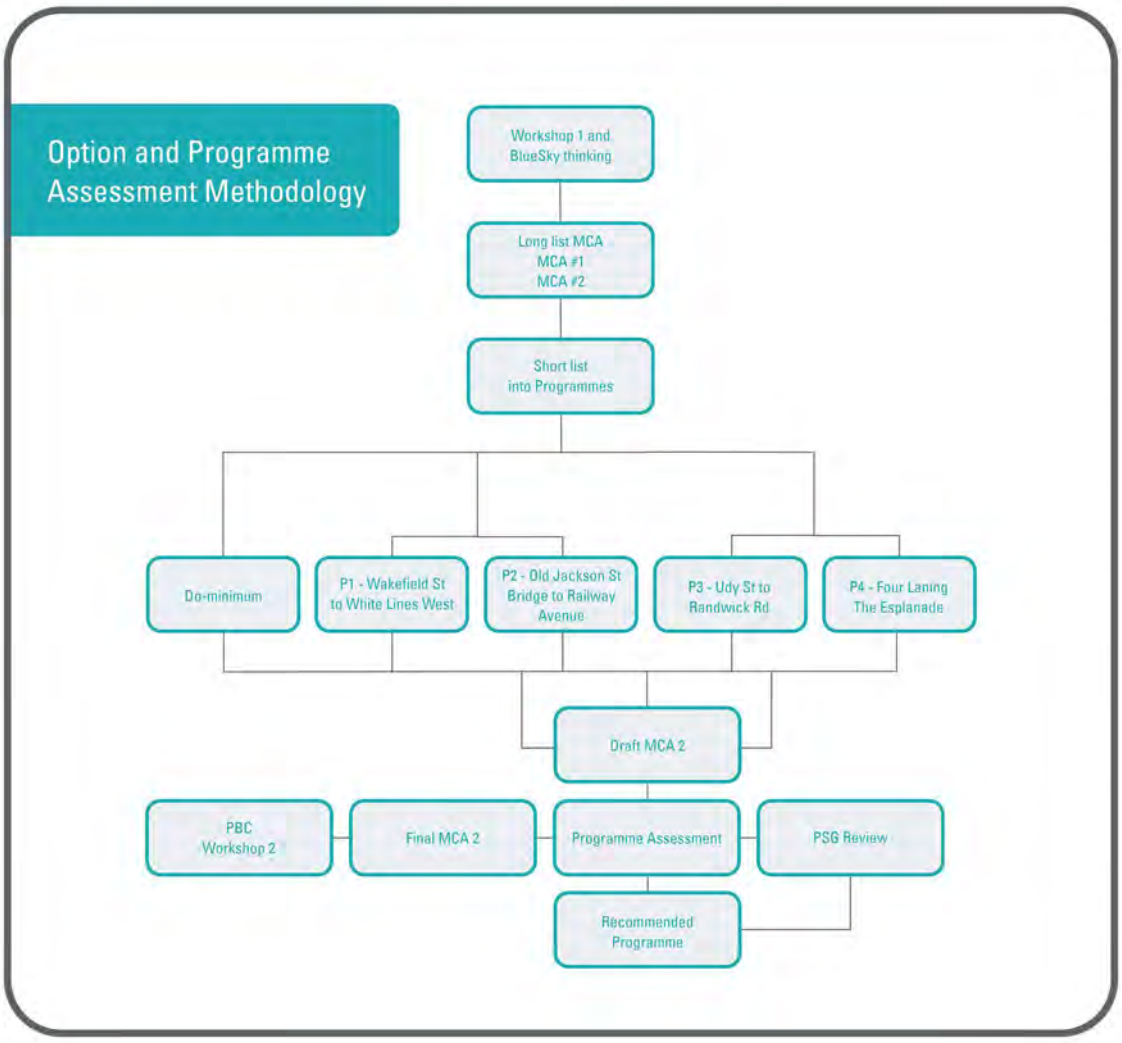
This Appendix outlines the multi-criteria analysis (MCA) evaluation processes undertaken to develop and assess the alternatives, options and the programmes identified for the Cross Valley Transport Connections Programme Business Case (PBC).

A key feature of the process was the direct involvement of Hutt City Council (HCC), Greater Wellington Regional Council (GWRC), Waka Kotahi NZ Transport Agency (NZTA) and a number of strategic stakeholders through MCA workshop processes. The MCA workshops were premised on the decision conferencing process, whereby decisions were arrived at through discussion and consensus between stakeholders and informed by expert opinion.

The option assessment and development processes undertaken, in order to identify an emerging preferred programme, are summarised as follows:

- Long list alternative / option identification – options were generated through PBC Workshop One and a Project Team blue-sky thinking workshop
- A long to short list alternative / option process – using an MCA evaluation process to select the short list of alternatives / options
- Packaging the short listed alternatives / options into four programmes of transport improvements and developing a do-minimum programme
- Assessment of the four programmes (and the do-minimum) using MCA evaluation processes and technical expert evaluation
- The programmes and draft MCA results were presented to attendees at PBC Workshop Two and to the PSG at Workshop Three for feedback
- Update the MCA (following Workshop Three) and completing technical development of the preferred programme

Figure 1 Option and Programme Assessment Methodology



Problems and investment objectives

The key purpose of the MCA is to help identify an emerging preferred programme that will help to address the problems and achieve the investment objectives identified in the PBC. The endorsement or approval of the preferred programme is however a matter for HCC (and its investment partners).

The problems and investment objectives identified in the PBC are summarised below:

Problem Statement One: Lack of transport network resilience (75% weighting)

Southern Lower Hutt's transport network lacks resilience to major natural events, future sea level rise, and regular network interruptions, which will cause economic and / or social disruption for Lower Hutt and the Wellington region.

Problem Statement Two: Limited access (25% weighting)

The existing transport system in southern Lower Hutt:

- *limits modal choice*
- *constrains access to social and economic opportunities*
- *creates safety issues for active mode users*

The investment objectives were defined as:

- *To improve the resilience of southern Lower Hutt by enhancing the transport networks ability to withstand and respond in a timely manner to HILP and LIHP events*
- *To improve access to and from key destinations and key urban growth areas in southern Lower Hutt*

It is noted that the problem statements and investment objectives have been developed to give effect to the objectives[93] of the Government Policy Statement on Land Transport (2018 to 21). For the MCA process, this has ensured that the process undertaken to identify the long and short lists for the PBC was always aligned with the GPS strategic priorities.

Long list alternative / option development and evaluation processes

The MCA evaluation steps undertaken in order to identify a preferred programme for consideration by HCC is set out below.

Step 1: Long list of alternatives / options identification

The first step was to identify a long list of alternatives / options that could address the problems and achieve the investment objectives for the Project Study Area. This step was undertaken in accordance with NZTA's intervention hierarchy, as shown in Figure 2 below.

Figure 2 NZTA's intervention hierarchy

[93] The strategic objectives of the GPS are safety, access, environment and value for money

To generate a long list of alternatives / options, the following activities were undertaken by the Project Team:

- A review of existing transport and land use strategic documents to identify transport options that have been previously considered (these documents are identified in full in Part A of the PBC)
- Alternatives / option generation session at PBC Workshop One
- A Project Team blue-sky thinking workshop held to generate further alternatives / options for the long list.

In total, 60 long list alternatives / options were identified for the Project Study Area. These interventions are listed in **Attachment A**.

Step 2: Evaluating the long list alternatives / options

Step 2 involved evaluating each alternative and option against the assessment criterion set out in Table 1 below. Information on the seven point scoring system used to evaluate the alternative / options is provided at Table 2 below.

Table 1 Long list assessment criteria – description and summary

Assessment criteria	Description and summary of assessment approach
Investment objectives	
Investment Objectives One and Two	This is an assessment against the alternative / option's likely contribution to achieving the two investment objectives. The following criteria was used to evaluate the objectives: Achieves both investment objectives +3 Achieves one investment objective 0 Does not achieve any of the investment objectives -3
Other success factors	
Feasibility	This is an assessment of how feasible it is to implement the alternative / option. To undertake this evaluation, the following question: "*how straightforward would it be to implement this option?"* was asked. Key considerations in the evaluation included the likely scale of property acquisition, connection requirements to existing infrastructure and the likelihood of severance. The following criteria was used to evaluate each option: Feasible +3 Feasible, but with difficulties (such as, monetary and severance implications) 0 Not feasible -3
Potential affordability	High level cost estimates were developed by the Project Team's cost estimator). A bottom-up methodology was used for estimating the cost range for each alternative / option.

Assessment criteria	Description and summary of assessment approach
	For road-based options, the following criteria was used to score the potential affordability for each road based option: Less than $1M +3 Between $1M and $10M 0 Over $10M -3 For non-road-based options, the following criteria was used to score each non-road-based option: Up to $500K +3 Between $500K and $1M 0 Over $1M -3
Likely BCR ranges	Using professional judgement, a high level BCR assessment was undertaken by the Project Team's transport economist to identify whether the alternative / option was likely to result in a BCR score above 1, between 0 and 1 or below 1. The following criteria was then used for scoring the BCR ranges: A BCR over +1 +3 A BCR between 0 and 1 0 A BCR below 0 -3
Impacts	
Public / stakeholders acceptability	This is an assessment of how the community was likely to receive the alternative / option. The following criteria was then used to evaluate each option: Well received +3 Indifferent 0 Poorly received -3
Environmental and social impacts	This is a high level assessment of the potential social and environment impacts[94] of the alternative / option. The following criteria was then used for scoring each option: Positive outcomes +3 Neutral outcomes 0 Negative outcomes -3

[94] Climate change adaption impacts were considered as part of the environmental assessment. For example, options that resulted in a higher level of response to impacts of climate change, such as, sea level rise, were scored higher than options that provided a lesser response.

Table 2 Seven-point scoring system

Rating	Definition	Score
Significantly positive	Significant positive impact, likely resulting in long term improvements	+3
Moderately positive	Moderate positive impact, which may provide improvements and opportunities	+2
Slightly positive	Minor positive impact	+1
Neutral	Similar impact to the do minimum	0
Slightly adverse	Minor adverse impact, which can be mitigated or managed	-1
Moderately adverse	Moderate adverse impact, that may be managed or mitigated	-2
Significantly adverse	Significant adverse impact with serious long-term effects	-3

The evaluation of each long list alternatives and options was undertaken by the following key members of the Project Team:

- Transport planners – evaluated the investment objectives, feasibility and public acceptability and likely social impacts
- Environmental planners / ecologists – evaluated the likely environmental impacts
- Transport economist – evaluated the likely BCR ranges for the alternatives and options
- Cost estimator – evaluated the potential affordability for the alternatives and options

Long list evaluation results

During the long list evaluation process the following key observations were made:

- Any alternative / option that was unlikely to achieve either of the investment objectives was removed from further consideration
- Any travel demand measures (TDM) that were considered to fall within GWRC's TDM remit – that is, they are required to be implemented on a regional or national basis (e.g. road pricing), to be effective, was assumed to be part of the do-minimum programme (and not considered further as part of the PBC). This approach was discussed with HCC officers, who confirmed that the council's approach to TDM was to proactively support GWRC's regional TDM initiatives, rather than to develop such interventions for specific areas of Lower Hutt City, including the Project Study Area
- The ability to distinguish between alternatives / options based on likely affordability at the long list stage was slightly ambiguous. That is, alternatives and options above $10M were all assigned the same score (-3). Accordingly, it was not possible to remove alternatives / options based solely on potential affordability
- A tunnel along the western side of the Hutt River was assessed as poor performing due to its likely high construction costs. However, despite providing a worst-case scenario in terms of cost, this option was retained for further assessment as it was considered to be innovative (e.g. provided an alternative technological solution that could address the problems).

As a consequence of the long list evaluation process, the original long list of 60 was short listed to 45 alternatives / options. The decisions regarding which alternative / option were included or excluded are indicated at **Attachment A.**

Programme identification

Firstly, the Project Team determined that none of 45 alternatives / options on their own would address the problems or achieve the investment objectives. Accordingly, the Project Team identified that a programme approach (i.e. package of interventions) would be needed to address the problems and / or achieve the objectives.

Do-minimum programme

The first step in developing the alternative programmes was to identify a do-minimum programme for benchmarking purposes.

In collaboration with HCC officers and the CVTC Project Steering Group (PSG), a package of committed transport improvements / projects with implementation funding identified or considered to be near certain to be implemented was identified.

The do-minimum programme that was ultimately agreed with HCC for the PBC was as follows:

- Implementation of the HCC Long Term Plan 2018-21, including the:
  - Eastern Bays Cycleway (consenting underway)
  - Seismic strengthening of the Cuba Street Rail Bridge (which was part of HCC's Low Cost Low Risk programme)
  - Beltway Cycleway – priority to be confirmed
- Plan Change 43
- RiverLink, including a new Melling Interchange (consent applications are now being prepared, and construction funding is approved for 2026 onwards)
- SH58 Safety Improvements Stage 1 (which is now in construction) and Stage 2
- Transmission Gully Motorway (operational in late 2020 or 2021)
- Te Ara Tupua Walking and Cycling Project (Te Ara Tupua) – both the Petone to Ngauranga and Petone to Melling sections (with the former section now in consent preparation, and the latter section now in construction)
- GWRC Rail Upgrade Package (e.g. double tracking between Upper Hutt and Trentham and timetable changes)
- GWRC Draft Park and Ride strategy for Petone, Ava and Woburn Train Stations
- GWRC travel demand measures, in line with the Regional Travel Demand Management Plan (2009)[95]
- Wellington Region Emergency Management Plan – Tsunami blue lines, social media, community emergency hubs, community response plans and emergency compost toilet trials

The Project Team, HCC officers and the PSG identified that the above do-minimum programme comprised of a large package of committed transport improvements. It identified that these improvements were inclusive of several different modes of transport through the Project Study Area. As such, it identified that development of the alternative programmes, and the subsequent preferred programme would build upon these committed transport improvements (and would not be "repeated" in the alternative programme).

Allocating the alternatives / options into programmes

Next, the Project Team arranged the remaining 45 alternatives / options into programmes.

The first step in the allocation process involved identifying an anchor resilience project that crossed the Hutt River for each programme. Identification of an anchor resilience project was fundamental in order to address the resilience problem statement and achieve the resilience investment objective.

[95] See - http://www.gw.govt.nz/assets/Transport/Regional-transport/RLTS/RegionalTDMPlan2009.PDF

Based on the location of the proposed river crossing, it was possible to characterise each programme by a “river crossing” theme. For example, a northern river crossing, a southern river crossing and a central river crossing were incorporated into programme themes to reflect the location within the Project Study Area at which they crossed the Hutt River.

The second phase involved allocating 45 alternatives / options to an anchor project to create a programme (or package) of interventions. The allocation processes were based on each alternatives / options relevance to the anchor resilience project and their likely contribution they would make towards achieving the investment objectives.

As a result of the allocation process, the Project Team identified four alternative programmes.

The four alternative programmes

The four alternative programmes identified by the Project Team, their descriptions, and the individual alternatives / options included within each are set out below Table 3. Location maps for each programme are provided in **Attachment B.**

Table 3 Four alternative programmes

Programme	Description Summary	All alternatives / options included in the programme
Programme 1: Wakefield Street to Whites Line West Connection – Northern River Crossing	This programme provides a new bridge crossing to the north, utilising Wakefield Street to provide a new east-west connection to Whites Line West. The other key features of this programme included: ► Connections from Wakefield Street to Hutt Road and SH2 via the Dowse Interchange ► A new active mode path across the Hutt River from Buckley Street to St Albans Street, with connections to Woburn Road, Bellevue Road, Laings Road and Bloomfield Terrace ► Full movements allowed at the Gracefield / Wainuiomata Hill Road Interchange to improve connections for people travelling between Seaview and Waiwhetū This programme would be in addition to the do-minimum programme.	► New Wakefield Street Bridge ► Whites Line West Upgrade ► Wakefield Street Upgrade ► Wakefield Street connection to Dowse Interchange ► Whites Line West connection to the roundabout ► Allow full movements at Gracefield Road / Wainuiomata Hill Road Interchange ► Active mode connection from Buckley Street to St Albans Grove ► Active mode track upgrade on St Albans Grove ► Active Mode track upgrade on Woburn Road ► Active mode track upgrade on Bellevue Road / Laings Road / Bloomfield Terrace ► Wakefield Street and Hutt Road roundabout ► Existing Estuary (Waione Street) Bridge retained
Programme 2: Old Jackson Street Bridge to Railway Avenue Connection – Southern River Crossing	This programme provides a new bridge crossing to the immediate north of the Estuary (Waione Street) Bridge, with the ability to connect into Wakefield Street and Railway Avenue. The other key features of this programme include: ► Tunnelled roads along the western side of the Hutt River ► Restrictions on The Esplanade (e.g. speed limit reductions and bus only lanes) to encourage vehicles to use the new Hutt River crossing ► A new connection between Railway Avenue and SH2 ► An active mode (only) bridge over the Hutt River connecting to Barber Grove. This programme would be in addition to the do-minimum programme.	► Railway Avenue connection ► Road / active mode bridge from the South of Memorial Park to Randwick Crescent / Barber Grove ► New bridge to the immediate north of the Estuary (Waione Street) Bridge, which is decommissioned ► Second active mode path on Waione Street Bridge ► Road under flood bank from Waione Street to Memorial Park ► Road under flood bank from Memorial Park to Wakefield Street ► Road under flood bank from Wakefield Street to Railway Avenue ► Improved cycling links at Ewen Bridge ► Restrictions on The Esplanade
Programme 3: Udy Street to Randwick Crescent Connection – Central River Crossing	This programme provides a new central river crossing with connections to SH2 and Udy Street. Access to and from SH2 will be for traffic travelling southbound from Udy Street and for traffic travelling northbound from SH2. This programme would be in addition to the do-minimum programme	► South facing Interchange at end of Udy Street ► Interchange on Udy Street to SH2 ► Improve Udy Street ► Multi-modal bridge from the south of Memorial Park to Randwick Crescent / Barber Grove ► Road extension of Udy Street to the Hutt River
Programme 4: Four Laning The Esplanade – Unlocking Capacity through existing infrastructure	This programme provides an additional eastbound and westbound traffic lane along The Esplanade (i.e. to provide two lanes in both directions). The other key features of this programme include: ► A new active mode connection to the Petone to Melling section of the W2HV Walking and Cycling Project for active mode users between Woburn and SH2 This programme would be in addition to the do-minimum programme	► Widening / adding capacity and strengthening the Estuary (Waione Street) Bridge (e.g. four lanes) ► Add a second active mode path on Estuary (Waione Street) Bridge ► New active mode connection between the Petone to Melling section of the W2HV Walking and Cycling Project and Woburn ► Four laning The Esplanade.

Programme evaluations

The evaluation of the four programmes, plus the do-minimum programme, was undertaken in two stages involving two decision conferencing workshops.

Stage 1 was completed as part of PBC Workshop Two, and Stage 2 was completed as part of PSG Workshop Three[96].

Stage 1 evaluation process

Stage 1 of the MCA evaluation process comprised the Project Team undertaking an initial evaluation of the four programmes and the do-minimum programme, prior to workshopping the draft evaluation scores with PBC Workshop Two attendees.

Each programme was assessed against the evaluation criteria set out in Table 4. It is noted that the evaluation criteria was updated following initial feedback from the workshop attendees, who reviewed the evaluation criteria outlined above at Table 1.

Table 4 Stage 1 evaluation assessment criteria

Assessment criteria	Description	
Investment objectives		
Investment objective one - Resilience	This assessment involved assessing the number of river crossings that would be present with the introduction of a programme of works:	
	Road:	
	Two road crossings	+3
	One road crossing	0
	No road crossing	-3
	Rail:	
	One rail crossing	+3
	No rail crossing	0
	Removal of rail crossing	-3
	Active Mode:	
	One active mode crossing	+3
	No active mode crossing	0
	Removal of active mode crossing	-3

[96] It is noted that PBC Workshop One was used to update and confirm the problem statements and investment objectives from the 2016 Strategic Case. Therefore, no assessment work / MCA was undertaken as part of PBC Workshop One

Assessment criteria	Description
Investment objective one - Accessibility	This assessment involved assessing how likely it would be that a programme of works would improve accessibility through improved mode choice: Improves more than one type of mode other than private vehicle +3 Improves one type of mode other than private vehicles 0 Does not improve modal choice -3
Success Factors	
Safety	This assessment evaluated each programme's potential to reduce the number of deaths and serious injuries (DSIs) within the study area, with specific focus on active mode users: Highly likely to reduce DSIs +3 Likely to reduce DSIs 0 Not likely to reduce DSIs -3
Implementability	This is an assessment for how easy the different alternatives / options within the programme will be to construct: Easily constructed using standard methods +3 Can be constructed, with some advanced construction techniques required 0 Extremely difficult to build and will require significant works / cause significant disruption -3
Affordability	This assessment evaluated the affordability of each programme against a high cost estimate (95th percentile) and the low cost estimate. The cost ranges used were: $0 - $100 million +3 $100 - $200 million 0 >$200 million -3
Likely BCR	This is an assessment of the likely BCR of the different programmes: BCR is over 1 +3 BCR is between 0 and 1 0 BCR is less than 1 -3
Investment Assessment Framework (IAF)	This assessment evaluated the alignment with the GPS (results alignment) and the efficiency of the proposed investment (cost-benefit appraisal – cost vs benefit):

Assessment criteria	Description	
	Aligns with the GPS and provides efficient investment	+3
	Aligns with the GPS or provides efficient investment, not both	0
	Does not align with the GPS, nor does it provide efficient investment	-3
Impacts		
Social and environmental impacts	This assessment evaluated social connectivity / cohesion and the ability to reduce future impacts of climate change	
	Improves social connectedness / mitigates the impacts of climate change	+3
	Maintains current levels of social connectedness and impacts of climate change	0
	Reduces social connectedness and worsens the impacts of climate change	-3
Economy	This assessment evaluated the programme's ability to boost economic growth by faster, easier and more resilient access	
	Increases economic growth	+3
	Maintains current economic growth	0
	Reduces current economic growth	-3

The Project Team who undertook the Stage 1 evaluation of the programmes against the above assessment criteria included:

- Transport planners – who evaluated the investment objectives, accessibility and likely social impacts
- Traffic engineer – who evaluated multi-modal road safety
- Transport economist – who evaluated the economics and likely BCRs
- Design manager – who evaluated resilience, implementability and affordability
- Environmental planners – who evaluated the likely environmental impacts

The Project Team used the same seven point scoring system to evaluate each programme as used during the long list assessment (see Table 2).

The results of the Stage 1 MCA evaluation are shown below in Table 5.

Table 5 Stage 1 programme evaluations

			Programme				
			Do-minimum	Programme 1 - Wakefield St to Whites Line West	Programme 2 - Old Jackson St Bridge to Railway Avenue	Programme 3 - Udy Street to Randwick Road	Programme 4 - Four Laning The Esplanade
Investment Objectives	Resilience	Two road crossings	0	3	3	3	0
		One rail crossing	0	0	0	0	0
		One active mode crossing	0	3	3	0	3
	Accessibility	Improves Modal Choice	0	3	3	0	3
Total			0	9	9	3	6
MCA		Safety	0	3	3	0	3
		Economy	0	0	-3	0	3
		Social and Environmental	0	0	-3	0	-3
		Implementability	0	3	-3	3	3
Total			0	6	-6	3	6
IAF		Strategic Fit	0	3	0	0	-3
		Effectiveness	0	3	-3	3	3
		BCR	0	3	0	3	0
Total			0	9	-3	6	0
Cost ($m)		High	0	0	-3	-3	0
		Low	0	0	-3	0	0
Total			0	0	-6	-3	0

Table 6 below summaries the Project Team's initial programme scores and rankings. It is noted that the maximum and minimum potential scores for a programme ranged from -39 to +39.

Table 6 Initial programme scores and rankings

Programme	MCA Score	Ranking
Programme 1 – Wakefield Street to Whites Line West Connection – Northern River Crossing	+24	1st
Programme 2 – Four-laning The Esplanade – Unlocking Capacity Through Existing Infrastructure	+12	2nd
Programme 3 – Udy Street to Randwick Crescent Connection – Central River Crossing	+9	3rd
Do-minimum	0	4th
Programme 4 – Old Jackson Street Bridge to Railway Avenue Connection – Southern River Crossing	-6	5th

The initial programme evaluation scores and rankings were presented to attendees at PBC Workshop Two. Although, workshop attendees were generally supportive of the programmes and the MCA evaluation process being undertaken, they did request that the assessment criteria be further refined before completing the MCA evaluation. As a result of this feedback the following amendments were made to the assessment criteria:

- The term redundancy was added to reflect the number of additional crossing points achieved
- Accessibility was changed to modal choice, to better represent options that reduced single vehicle occupancy and achieve secondary health and climate change benefits as a result
- Resilience was re-framed to refer to the improvements that would be obtained by moving vital infrastructure away from vulnerable locations – tsunami, earthquakes and flooding
- Safety was split into two, specifically referencing active modes and vehicles
- Economic impacts were removed as it was considered that these impacts were covered holistically in the BCR criteria
- Social and environmental impacts were split into two assessment criteria. Furthermore, social was replaced with amenity impacts, to better review the impacts to the desirability of an alternative / option on the local population
- The IAF assessment criterion was removed as it was considered short term and would be replaced in 2020 / 21 and the intent of the criteria was already covered in the investment objectives.

Stage 2 programme evaluation process

Based on the feedback from the Workshop Three attendees, the programme evaluation criteria shown in Table 4 was updated and is reflected in Table 7.

Table 7 Stage 2 evaluation assessment criteria

Assessment criteria	Description
Investment Objectives	
Investment Objectives One and Two	This is an assessment against the programmes ability to achieve the investment objectives:

Assessment criteria	Description	
	Aligns with both investment objectives	+3
	Aligns with one investment objective	0
	Does not align with investment objective	-3
Success Factors		
Redundancy	This assessment involved asking, how much does the programme improve redundancy in the network for road, rail and active modes:	
	Adds an additional / improves a river crossing	+3
	Status Quo	0
	Removes an existing river crossing	-3
Resilience (IO1)	This assessment involved asking, how resilient is the new programme when considering the effects of earthquakes, tsunami and flooding:	
	Earthquakes and resulting liquefaction:	
	Network moved away from liquefaction prone area	+3
	Status quo	0
	Network moved closer to liquefaction prone area	-3
	Tsunami:	
	Network moved away from tsunami prone area	+3
	Status quo	0
	Network moved closer to tsunami prone area	-3
	Flooding:	
	Network moved away from flood prone area	+3
	Status quo	0
	Network moved closer to flood prone area	-3
Modal choice (IO2)	This is an assessment as to whether the programme improves access to different modes, beyond the private single occupancy vehicle:	
	Improves more than one type of mode other than the private vehicle	+3
	Improves one type of mode other than private vehicles	0
	Does not improve modal choice	-3

Assessment criteria	Description
Safety – general traffic	This is an assessment for how likely it is that the programme will improve the safety environment for general traffic through the study area: Options that avoid high crash areas – Udy Street, Cuba Street, Jackson Street and the Esplanade +3 Options that avoid one or two of either Udy Street, Cuba Street, Jackson Street and the Esplanade 0 Options that include Udy Street, Cuba Street, Jackson Street and the Esplanade -3
Safety – active modes	This is an assessment for how likely it is that the programme will improve the safety environment for active mode users through the study area: Provides three or more cycle facilities and avoids Hutt Road and The Esplanade +3 Provides one or two cycle facilities and avoids either Hutt Road or The Esplanade 0 Provides no additional cycle facilities and does not avoid Hutt Road or The Esplanade -3
Implementability	This is an assessment for how easy the different alternatives / options within the programme will be to construct: Easily constructed using standard construction methods +3 Can be implemented, with some advanced construction techniques required 0 Extremely difficult to build and will require significant works / cause significant disruption -3
Likely BCR	This is an assessment of the likely BCR for the different programmes: BCR is over 1 +3 BCR is between 0 and 1 0 BCR is less than 1 -3
Impacts	
Amenity	This is an assessment for how likely it is that the programme will impact upon residential areas, increasing severance and reducing amenity value: Percentage of the proposed route is less than 30% through residential areas +3

Assessment criteria	Description	
	Percentage of the proposed route is between 30% and 60% through residential areas	0
	Percentage of proposed route through residential areas is higher than 60%	-3
Environmental impacts	This is an assessment for how likely it is that the programme will impact the immediate environment:	
	Percentage of the proposed route is less than 30% through recreational and landscape protected areas	+3
	Percentage of the proposed route is between 30% and 60% through recreational and landscape protected areas	0
	Percentage of proposed route through recreational and landscape protected areas is higher than 60%	-3

Based on the updated assessment criteria, the Project Team revisited its original programme evaluations. The Project Team members who undertook the revised scoring included:

- Transport planners – who evaluated the investment objectives, redundancy. modal choice and amenity impacts
- Traffic engineer – who evaluated multi-modal road safety
- Transport economist – who evaluated likely BCRs
- Design manager – who evaluated resilience and implementability
- Environmental planners – who evaluated the environmental impacts

The Project Team used the same seven point scoring system to evaluate each programme (see Table 2).

The updated assessment criteria and evaluation scores were then presented for consideration at PSG Workshop Three. The PSG were supportive of the updated criteria and programme scores and rankings.

Table 8 sets out the Stage 2 (final) programme evaluation scores following completion of PSG Workshop Three.

Table 8 Stage 2 (final) programme evaluation scores

		Criteria			Do-minimum	Wakefield St to Whites Line West	Old Jackson St Bridge to Railway Avenue	Udy Street to Randwick Road	Four Laning The Esplanade
		3	0	-3					
Investment Objective Alignment		Aligns with both investment objectives	Aligns with one investment objective	Does not align with either investment objective	0	3	0	3	-3
Redundancy	**Road**	Additional / improved river crossing	Status Quo	Removal of existing crossing	0	3	3	3	0
	Rail	Additional / improved river crossing	Status Quo	Removal of existing crossing	0	3	0	0	0
	Active Modes	Additional / improved river crossing	Status Quo	Removal of existing crossing	0	3	3	3	3
Resilience	**Earthquakes - liquefaction**	Network is moved away from liquefaction prone area	Status Quo	Network closer to liquefaction prone areas	0	3	-3	0	-3
	Tsunami	Network is moved away from tsunami risk area	Status Quo	Network closer to tsunami prone areas	0	3	-3	0	-3
	Flooding	Network is moved away from flood prone area	Status Quo	Network closer to flood prone areas	0	3	-3	-3	-3
Modal Choice		Improves more than one type of mode other than private vehicle (i.e. bus, cycle and rail)	Improves one type of mode other than private vehicle	Does not improve modal choice	0	3	3	3	3
Safety	**General Traffic**	Options that avoid Udy Street, Cuba Street, Jackson Street and The Esplanade	Options that include one or two of either Udy Street, Cuba Street, Jackson Street and The Esplanade	Options that include Udy Street, Cuba Street, Jackson Street and The Esplanade	0	3	3	-3	-3
	Active Modes	Provides 3 or more separate cycle facilities and avoids Hutt Road and the Esplanade	Provides between 1 and 2 cycle facilities and avoid either Hutt Road or The Esplanade	Provides no additional cycle facilities and does not avoid Hutt Road or The Esplanade	0	3	3	0	0
Implementability		The option is easily implemented using standard construction methods	This option can be implemented and is not overly complex. Some advanced techniques may be required but will constitute a small percent of the project	The option is extremely difficult to build and will require significant works such as grade separation	0	0	-3	0	3
BCR		If the BCR is over 1	If the BCR is between 0 and 1	if the BCR is less than 0	0	0	-3	0	3
Amenity		The percentage of the proposed route is less than 30% through residential areas	The percentage of the proposed route is between 30% and 60% through residential areas	The percentage of the proposed route is higher than 60% through residential areas	0	0	3	-3	0
Environment		The percentage of the proposed route is less than 30% through recreational and landscape protected areas	The percentage of the proposed route is between 30% and 60% through recreational and landscape protected areas	The percentage of the proposed route is higher than 60% recreational and landscape protected areas	0	0	-3	0	0
Total					0	30	0	3	-3

Based on the evaluations set out in the above table, the overall programme rankings are shown at Table 9 below. It is noted that the potential scores for the Stage 2 evaluation ranged from -42 to +42.

Table 9 Stage 2 – Scores and Ranking

Programme	MCA Score	Ranking
Wakefield Street to Whites Line West Connection – Northern River Crossing	+30	1st
Udy Street to Randwick Crescent Connection – Central River Crossing	+3	2nd
Old Jackson Street Bridge to Railway Avenue Connection – Southern River Crossing	0	3rd
Do-minimum	0	4th
Four-laning The Esplanade – Unlocking Capacity Through Existing Infrastructure	-3	5th

As set out above in Table 9, Programme 1 (i.e. the Wakefield Street programme) was ranked first. It is also noted that this programme was ranked first following completion of the Stage 1 evaluation process.

MCA Peer Review

Stantec undertook a peer review of the MCA process. This review recommended that the unweighted (i.e. raw) MCA scores (as set out above in Table 8 above) be subjected to a weightings process for sensitivity testing purposes.

The Project Team undertook the weighting analysis by splitting the assessment criteria into three distinct categories:

- Problem statements
- Investment objectives
- Other criteria

These three categories were each weighted out of 100% and the assigned weightings are shown at Table 10 below.

Table 10 Assessment Criteria Weightings

Assessment Criteria	Sub-Assessment Criteria	Percentage
Problem Statements	Redundancy – Road	8.34%
	Redundancy - Rail	8.33%
	Redundancy – Active Modes	8.34%
	Resilience – earthquakes / liquefaction	8.33%
	Resilience – Tsunami	8.33%
	Resilience – Flooding	8.33%

Assessment Criteria	Sub-Assessment Criteria	Percentage
	Modal Choice	25%
	Safety – General Traffic	12.50%
	Safety – Active Modes	12.50%
Investment Objective Alignment		100%
Other Criteria	Implementability	30%
	BCR	30%
	Amenity	20%
	Environment	20%

The assessment and outcomes of using these weightings is shown below at Table 11.

Table 11 Weighted Assessment

		Criteria			Weighting	Do-minimum	Wakefield St to Whites Line West	Old Jackson St Bridge to Railway Avenue	Udy Street to Randwick Road	Four Laning The Esplanade
		3	0	-3						
Investment Objective Alignment		Aligns with both investment objectives	Aligns with one investment objective	Does not align with either investment objective	100%	0.00	3.00	0.00	3.00	-3.00
Redundancy	**Road**	Additional / improved river crossing	Status Quo	Removal of existing crossing	8.34%	0.00	0.25	0.25	0.25	0.00
	Rail	Additional / improved river crossing	Status Quo	Removal of existing crossing	8.33%	0.00	0.25	0.00	0.00	0.00
	Active Modes	Additional / improved river crossing	Status Quo	Removal of existing crossing	8.34%	0.00	0.25	0.25	0.25	0.25
Resilience	**Earthquakes - liquefaction**	Network is moved away from liquefaction prone area	Status Quo	Network closer to liquefaction prone areas	8.33%	0.00	0.25	-0.25	0.00	-0.25
	Tsunami	Network is moved away from tsunami risk area	Status Quo	Network closer to tsunami prone areas	8.33%	0.00	0.25	-0.25	0.00	-0.25
	Flooding	Network is moved away from flood prone area	Status Quo	Network closer to flood prone areas	8.33%	0.00	0.25	-0.25	-0.25	-0.25
Modal Choice		Improves more than one type of mode other than private vehicle (i.e. bus, cycle and rail)	Improves one type of mode other than private vehicle	Does not improve modal choice	25%	0.00	0.75	0.75	0.75	0.75
Safety	**General Traffic**	Options that avoid Udy Street, Cuba Street, Jackson Street and The Esplanade	Options that include one or two of either Udy Street, Cuba Street, Jackson Street and The Esplanade	Options that include Udy Street, Cuba Street, Jackson Street and The Esplanade	12.50%	0.00	0.38	0.38	-0.38	-0.38
	Active Modes	Provides 3 or more separate cycle facilities and avoids Hutt Road and the Esplanade	Provides between 1 and 2 cycle facilities and avoid either Hutt Road or The Esplanade	Provides no additional cycle facilities and does not avoid Hutt Road or The Esplanade	12.50%	0.00	0.38	0.38	0.00	0.00
Implementability		The option is easily implemented using standard construction methods	This option can be implemented and is not overly complex. Some advanced techniques may be required but will constitute a small percent of the project	The option is extremely difficult to build and will require significant works such as grade separation	30%	0.00	0.00	-0.90	0.00	0.90
BCR		If the BCR is over 1	If the BCR is between 0 and 1	if the BCR is less than 0	30%	0.00	0.00	-0.90	0.00	0.90
Amenity		The percentage of the proposed route is less than 30% through residential areas	The percentage of the proposed route is between 30% and 60% through residential areas	The percentage of the proposed route is higher than 60% through residential areas	20%	0.00	0.00	0.60	-0.60	0.00
Environment		The percentage of the proposed route is less than 30% through recreational and landscape protected areas	The percentage of the proposed route is between 30% and 60% through recreational and landscape protected areas	The percentage of the proposed route is higher than 60% recreational and landscape protected areas	20%	0.00	0.00	-0.60	0.00	0.00
Total						0	6	-0.5	3	-1

As set out above, the weightings analysis supported the outcomes of the unweighted MCA scoring analysis - Programme 1 being identified as the emerging preferred programme. In summary, Programme 1 was ranked first for the following key reasons:

- It was the best performing programme from a redundancy and resilience perspective (i.e. Investment Objective 1). That is, a new northern river crossing would be less vulnerable to earthquakes, liquefaction, tsunami and flooding, when compared to the other river crossings that were considered
- It was equal best performing from a multi-modal perspective (Investment Objective 2)
- It was equal best performing from amenity and environmental perspective, due to it impacting less on local amenity and having less impacts on recreational / residential areas
- It was considered the best performing programme from an implementation perspective.

The Project Team also made the following observations regarding the less preferred programmes:

- Programme 3 (i.e. the Udy Street to Randwick Crescent Connection) was ranked second, mostly due to its redundancy and multi modal benefits. However, it performed poorly in terms of resilience benefits and in the other assessment criteria. In particular it was highlighted that it would have adverse amenity effects on Udy Street, including creating severance between the communities on either side of this street
- Programme 2 (i.e. The Old Jackson Street Bridge to Railway Avenue Connection) was ranked third due mostly to its multi modal and redundancy benefits. However, it performed poorly from a BCR perspective due to the high costs associated with constructing a tunnel. In addition, the likely environmental impacts that a central river crossing would have on wetland environments was assessed as being significantly negative
- Programme 4 (i.e. Four-laning the Esplanade) was ranked fifth (i.e. behind the do-minimum programme). It performed particularly poorly from a resilience perspective. It was also observed that it was likely to further increase community severance between Petone and the Petone Foreshore.

Gracefield Rail Line or Randwick Road connection

Following identification of Programme 1 as the emerging preferred programme, attendees at the PSG Workshop Three discussed connectivity options between the Wakefield Street and the Seaview / Gracefield area. The two options considered were:

- A new road running along the Gracefield Rail Line
- An upgrade of Randwick Road.

A preference was identified for the Gracefield Rail Line option as it was considered to have less community severance effects and amenity value impacts when compared with the Randwick Road option. In terms of the latter, HCC officers noted that the Randwick Road option was unlikely to be able to accommodate any significant increases in general traffic (including heavy vehicle traffic) following construction of a new Wakefield Street bridge. HCC officers also noted that the Gracefield Rail Line option was consistent with the alignment identified in the Petone Spatial Plan 2040.

Workshop attendees acknowledged that although they had identified a preference for the Gracefield Rail Line option, both options would need to be further considered as part of any future investigations into Programme 1. It was also identified that KiwiRail had yet to be re-engaged on utilising the rail line alignment for a new road.

New or Upgraded Wakefield Street Bridge

Following the identification of Programme 1 as the emerging preferred programme, and following completion of Workshop Three, the Project Team and HCC officers asked themselves the following two questions:

3. should a new and separate multi-modal bridge be built north of the existing Ava Rail Bridge (but not provide for rail and therefore the Ava Rail Bridge would be retained); or
4. should the Ava Rail Bridge be upgraded or replaced with a new multi-modal bridge (providing for rail, active modes and general traffic).

Transport benefits were identified for both options, however, and to ensure that a preferred bridge was identified for inclusion in the emerging preferred programme, an option comparison, or mini MCA, of the two bridge options was undertaken. More information on the two options and the associated MCA process can be found in the MCA Report.

Bridge Option A utilised an alignment from Wakefield Street to White Lines West and comprised construction of a new bridge to the north of the Ava Rail Bridge (Question 1). Bridge Option B utilised an alignment from Wakefield Street to Randwick Road and comprised either upgrading or replacing the existing Ava Rail Bridge (Question 2).

Table 10 Wakefield Street Bridge Assessment Criteria

Assessment Criteria	Description
Success Factors	
Redundancy	This assessment involved asking, which bridge option improves redundancy for road transport: Adds an additional river crossing +3 Status Quo 0 Removes an existing river crossing -3 This assessment involved asking, which bridge option improves redundancy for rail transport: Adds an additional rail crossing +3 Upgrades existing rail crossing 0 No change -3 This assessment involved asking, which bridge option improves redundancy for active modes: Includes and additional active mode crossing +3 Status quo 0 Removes an existing active mode river crossing -3
Resilience	This assessment involved asking, how resilient is each bridge option when considering the effects of earthquakes, tsunami and flooding:

Assessment Criteria	Description
	Earthquakes resulting in liquefaction: Network moved away from liquefaction prone area +3 Status quo 0 Network moved closer to liquefaction prone area -3 Tsunami: Network moved away from tsunami prone area +3 Status quo 0 Network moved closer to tsunami prone area -3 Flooding: Network moved away from flooding prone area +3 Status quo 0 Network moved closer to flooding prone area -3
Modal choice	This is an assessment as to which bridge option improves access to different modes beyond the private single occupancy vehicle: Improves more than one type of mode other than private vehicle +3 Improves one type of mode other than private vehicles 0 Does not improve modal choice -3
Safety – general traffic	This assessment evaluated each bridge options potential to reduce the number of general traffic deaths and serious injuries (DSIs) within the study area: Highly likely to reduce DSIs +3 Likely to reduce DSIs 0 Not likely to reduce DSIs -3
Safety – Active Modes	This assessment evaluated each bridge options potential to reduce the number of active mode deaths and serious injuries (DSIs) within the study area: Highly likely to reduce DSIs +3 Likely to reduce DSIs 0 Not likely to reduce DSIs -3
Amenity	This is an assessment for how likely it is that the programme will impact upon residential areas, increasing severance and reducing amenity value, specifically relating to how the bridge options connect into the existing road infrastructure

Assessment Criteria	Description	
	Improves amenity	+3
	Maintains current amenity	0
	Reduces amenity	-3
Implementability	This is an assessment for how easy the different alternatives / options within the programme will be to construct:	
	Easily constructed using standard construction methods	+3
	Can be implemented, with some advanced construction techniques required	0
	Extremely difficult to build and will require significant works	-3
Improves existing damaged / inadequate infrastructure	This is an assessment of whether the bridge option improves the existing damaged / inadequate infrastructure	
	Improve existing damaged / inadequate infrastructure	+3
	N/A	0
	Does not improve damaged / inadequate infrastructure	-3
Consentability	This is an assessment of how easy it is likely to be to achieve resource consent for each bridge option:	
	Resource consent easy to achieve	+3
	N/A	0
	Resource consent difficult to achieve	-3

Based on the assessment criteria in the above table, the Project Team undertook an MCA evaluation to help identify a preference between an upgraded bridge or a new bridge.

The Project Team members who undertook the bridge evaluation included:

- Transport planners – evaluated redundancy, modal choice and affordability
- Traffic engineer – evaluated safety
- Design manager – evaluated resilience and implementability
- Environmental planners – evaluated the consentability

The upgraded or new bridge evaluation scores are shown at Table 11 below.

Table 11 New or upgraded Wakefield Street bridge options

	Redundancy			Resilience				Safety						
MCA Assessment	**Road**	**Rail**	**Active Modes**	**Earthquake - Liquefaction**	**Tsunami**	**Flooding**	**Modal Choice**	**General Traffic**	**Active Modes**	**Amenity**	**Implementability**	**Improves Existing Damaged / Inadequate Facilities**	**Consentability**	**Total**
Option A (New Separate Multi Modal Bridge North of the Ava Rail Bridge)	3	3	3	0	-3	-2	3	0	3	-3	-3	-3	0	1
Option B (Upgrade or Replace the Existing Ava Rail Bridge with a new Multi Modal bridge)	3	0	3	0	-3	3	3	0	3	-1	-2	3	0	12

The MCA evaluation resulted in Bridge Option A scoring +1 and Bridge Option B scoring +12 (out of a possible +39). Therefore, Bridge Option B was preferred through the MCA process. Although the Project Team, in consultation with HCC officers, concluded that the latter bridge option should be included in the emerging preferred programme, it was acknowledged by both that future business cases may elect to re-visit this particular conclusion.

In addition, the Project Team recognised that particular aspects of the alignment for Option B would require further option development and assessment in subsequent business cases. This included determining the preferred connections (i.e. form and function) at the following locations:

- SH2/Dowse Interchange
- Hutt Road
- Cuba Street (including to the north and south)
- Randwick Road / Whites Line West
- Parkside Road
- Seaview Road

Identifying the emerging preferred programme

In addition to supporting the need for the anchor resilience project to address the resilience problem, attendees from both workshops, identified a number of options from the other programmes that would also contribute to addressing the multi modal / growth problems / investment objectives. These included:

- Active mode improvements on:
  - The Esplanade
  - Hutt Road
  - A new active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project
- Improvements to the existing Gracefield Interchange to allow full movements for all road based vehicles
- Cuba Street connections (e.g. on / off ramps)
- Bus priority (e.g. bus lanes) on The Esplanade (once the new east-west multi-modal transport corridor is in place).

Furthermore, through discussions at PSG at Workshop Three, it was decided that train station access plans should be specifically included in the emerging preferred programme (as these plans weren't part of the do-minimum programme).

This mixing and matching process (i.e. bottom up approach) resulted in the following options being identified for inclusion in the emerging preferred programme:

- Bus priority improvements at the following intersections:
  - The Esplanade / Hutt Road
  - Hutt Road / Jackson Street
  - Jackson Street / Cuba Street
  - Randwick Road / Waione Street
  - Randwick Road / Whites Line East
- Bus priority (e.g. bus lanes) and amenity improvements on The Esplanade
- Active mode upgrades on The Esplanade and Hutt Road (and through the wider Project Study Area if required) to respond to the increases in walking and cycling that is predicted by the Te Ara Tupua Walking and Cycling Project

- Train station access plans for the Petone, Ava and Woburn Train Stations
- Inclusion of an active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project
- On-road cycle improvements on Ewen Bridge to improve safety and connectivity to the Hutt *River* Trail
- Gracefield Interchange improvements to enable full movements to be made by all on-road based vehicles
- Connections from the new Wakefield Street river crossing alignment to Cuba Street and the Dowse Interchange / Hutt Road.

It is noted that where road improvements were proposed, both the attendees at PBC Workshop Two and PSG Workshop Three recommended that such improvements incorporate active mode facilities and also cater for micro-mobility transport modes. This recommendation would ensure that all works will have at least, secondary benefits of improving health and reducing future climate change impacts in these areas. Workshop attendees also recognised that options identified through the additional MCA and subsequent mixing and matching processes, would need to be staged from an affordability and wider transport system design perspective.

Emerging preferred programme

At the conclusion of the mixing and matching process, the following programme was identified as the preferred programme or package of interventions requiring further assessment:

1. Active mode improvements on:
   - The Esplanade
   - Hutt Road
   - Ewen Bridge
   - A new active mode connection between Woburn and the new Petone to Melling section of the Te Ara Tupua Walking and Cycling Project
2. Bus priority improvements at:
   - The Esplanade Road / Hutt Road
   - Hutt Road / Jackson Street
   - Jackson Street / Cuba Street
   - Randwick Road / Waione Street
   - Randwick Road / Whites Line East
3. Train station access plans to improve active mode and micro-mobility access to the Petone, Ava and Woburn Train Stations
4. Improvements to the existing Gracefield Interchange to allow full movements for all road based vehicles
5. New east-west multi-modal transport corridor on a Wakefield Street to Whites Line / Randwick Road alignment), including:
   - an upgraded or replaced Ava Rail Bridge
   - new or upgraded road connections to Seaview / Gracefield
   - Cuba Street connections (e.g. on / off ramps)
   - Connections to the Dowse Interchange / Hutt Road
   - bus priority (e.g. bus lanes) on The Esplanade (once the new east-west multi-modal transport corridor is in place).

ATTACHMENT A – LONG LIST OF ALTENRATIVES / OPTIONS

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
1	Wakefield Street and Whites Line West bridge	Constructing a new road between Wakefield Street and Whites Line West, across the Hutt River in Petone. It is planned that a 17.5m wide road (Local distributor road / Residential) will tie both roads. The road is to be 2x3.5m lanes+2x2.5m shoulders + 2x1.5m foot paths + 1x 2.5m central easement = 17.5m wide. The total planned length of new road, including concrete bridge, is to be 400 m long The bridge over the river to consist of 6x25.0m concrete beam spans, 5x concrete columns and 2 concrete end abutments with wind walls. The river is 146.0 m wide at the crossing.	3	3	-1	3	-3	-3	0	**2**	**Yes**
2	Whites Line West Upgrade	A 500 m upgrade of Whites Line West to accommodate the new traffic, including new pavement and marking. Potential to create access islands for residential traffic	1	1	2	0	0	0	3	**7**	**Yes**
3	Wakefield Street upgrade	A 1.25 km upgrade of Wakefield Street to accommodate the additional traffic. Reconfigure to 2 x 3.5 m lanes Likely to include a small residential access lane on the north east side, which may extend to industrial access. Shared path (2.5 m) on the north side.	1	1	2	0	0	0	3	**7**	**Yes**
4	kefield Street connection to Dowse Intercha	A 140 m long ramp and associated structure connecting Wakefield Street to Dowse Interchange - 2x3.5 + 2x1.5 = 10.0m wide. Potentially having a new roundabout between Dowse Interchange and the Hutt Road roundabout.	1	0	-3	-3	0	0	-3	**-8**	**No - construction and land purchase issues**
5	Ava Bridge Replacement with Road Rail Bridge	A single 360 m long bridge on the existing bridge alignment with 2 x 3.5 m lanes, 2 railway lines, and a 3 m shared path = replacing the current Ava Rail Bridge. Connects into Wakefield Street in the West with a 250 m long connection.	3	3	-1	3	0	-3	0	**5**	**Yes**
6	Whites Line West connection to the Randwick Road roundabout	Alterations to the Whites Lines and Randwick Road roundabout to enable traffic to travel west from the roundabout.	1	0	3	3	0	3	0	**10**	**Yes**
7	Road connection following Rail corridor to Whites Line roundabout	A 500 m realignment of the rail and inclusion of a 700 m road corridor between the Ava Rail Bridge and Whites Line East and Randwick Road roundabout. This may require a replacement of the Randwick Road rail bridge.	3	1	-3	-2	-2	-3	-3	**-9**	**No - construction difficulties**
8	Road connection following Rail corridor to Pohutukawa Street	An 800 m realignment of the rail and road corridor between the Ava Rail Bridge Pohutukawa Street. This may require a replacement of the Randwick Road and Whites Line East rail bridges. There may also be a realignment of the Seaview rail spur.	3	1	-3	-3	0	-3	-3	**-8**	**No - construction and land purchase issues**
9	Reconfigure Dowse interchange to north facing ramps	Removal of the southbound on ramp and northbound off ramp at the Dowse interchange. Continue leaving connectivity for cyclists travelling on both ramps.	0	-3	3	-3	0	3	-3	**-3**	**No - does not achieve investment objectives**
10	Remove Connection to Dowse interchange from Hutt Road	This would create a half interchange at the end of Udy Street/Riddlers Crescent. This includes a connection over the Hutt Valley rail line, including two bridges.	0	-3	3	-3	0	0	-3	**-6**	**No - does not achieve investment objectives**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
11	South facing interchange at end of Udy Street	This would create a half interchange at the end of Udy Street/Riddlers Crescent. This includes a connection over the Hutt Valley rail line, including two bridges.	0	-3	-3	-3	-3	-3	-3	**-18**	**No - construction difficulties**
12	Roundabout at Udy Street/Hutt Road	A new roundabout on Hutt Road and Udy Street to provide safe passage across Hutt Road/Udy street.	0	1	3	3	0	0	0	**7**	**Yes**
13	Flyover on Udy Street to SH2	A 150 m long two lane two way flyover over Hutt Road on SH2 connecting Udy Street and Riddlers Crescent.	0	1	-3	-3	-3	-3	-3	**-14**	**Yes**
14	Improve Udy Street	Changes to the road layout of Udy Street along it's entire length (1,050 m) to create an arterial route, including Riddlers Crescent.	2	1	3	2	1	0	0	**9**	**Yes**
15	Railway Ave Interchange	A 90 m long overbridge across the railway line as well as a full interchange at the Western end of Railway Avenue similar to the Dowse interchange.	3	1	-3	-1	1	-3	3	**1**	**Yes**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
16	Interchange/roundabout at Wakefield/Cross Valley	This involves the provision of either a signalised interchange or roundabout interchange at the eastern end of Wakefield Street. This could connect into a north-south arterial route also delivered as part of the programme.	1	1	2	-1	0	0	0	**3**	**Yes**
17	Road/Active mode bridge from the South of Memorial Park to Randwick Crescent/Barber Grove	A 370 m long, two way two lane bridge (2 x 3.5 m) bridge with a 2.5 m active mode path on the north or south side of the bridge connecting Barber Grove to the west bank of the Hutt River.	3	3	0	3	-1	-3	3	**8**	**Yes**
18	Road along Rail corridor from Parkside Road to Randwick Road	A new 1,150 m road along the old rail corridor with 2 x 3.0 m lanes. It connects into Randwick Road via York Street. New intersection control is likely to be via a roundabout.	3	1	3	-3	3	0	0	**7**	**Yes**
19	Road along Rail corridor from Parkside Drive to Whites Line Roundabout	A 1,600 m length two lane two way road (2 x 3.0 m), with two bridges, spanning the stream and railway line, connecting into the Whites Line Roundabout.	3	1	1	-3	3	0	0	**5**	**Yes**
20	Allow full movements at Gracefield Road/Wainuiomata Hill Road 'interchange'	This involves the creation of an westbound connection from Gracefield Road to Wainuiomata Hill Road as well as an eastbound connection form the Hill Road to Gracefield Road. The eastbound connection will require either a new tunnelled section, or widening of the existing.	1	3	3	3	3	0	0	**13**	**Yes**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
21	Connect Wainui Road to Woburn Road	This involves the upgrade of approximately 800 m of local roads into arterial roads with a new 120 m bridge spanning the Hutt Valley Railway line. The upgraded route then connects into Woburn road at Ludlam Park.	0	0	-3	-3	0	-3	-3	**-12**	**No - does not achieve investment objectives and there are construction difficulties**
22	Four lane Waione Street Bridge	This involves adding a new structure to the Waione Street bridge to create four lanes of traffic without the removal of the existing bridge.	-3	0	3	-3	-3	-3	0	**-9**	**Yes**
23	Second Waione Street Bridge	This option involves the construction of a second Bridge at the mouth of the Hutt River (north of the existing Waione Street bridge. This could be on either the same alignment at 180 metres long– creating four lanes connecting to The Esplanade or on the old Jackson Street Bridge alignment, at 260 m long with a 120 m connection onto Croft Grove.	-3	0	-1	-3	-3	-3	0	**-13**	**Yes**
24	Second active mode path on Waione Street Bridge	This option involves the construction of a second active mode path at 2.5 m wide on the northern side of the existing Waione Street Bridge above the water pipes.	-3	2	3	3	3	0	3	**11**	**Yes**
25	Remove Waione Street Bridge	This involves the removal of the Waione Street Bridge.	3	-3	3	-3	0	0	0	**0**	**No - due to significant impacts on travel time**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
26	Road under Flood bank from Waione Street to Memorial Park	This option involves the construction of a 500 m long two lane two way buried road (2 x 3.5 m) under an improved stop bank on the western side of the Hutt River. It will connect from the end of Jackson Street to the south end of Memorial Park. An active mode shared path can be provided on the top of the stop bank.	-3	-3	-3	-3	-3	-3	-3	**-21**	**Yes - due to innovative solution**
27	Road under flood bank from Memorial Park to Wakefield Street	This option involves the construction of an 800-metre-long, two lane two way buried road (2 x 3.5 metres) under an improved stop bank along the western bank of the Hutt River. It will connect from the south end of Memorial Park to the end of Wakefield Street in the north. An active mode shared path can be provided on the top of the stop bank.	-3	-3	-3	-3	-3	-3	-3	**-21**	**Yes - due to innovative solution**
28	Road under flood bank from Wakefield Street to Railway Avenue	This option involves the construction of an 800 m long two lane two way buried road (2 x 3.5 m) under an improved stop bank on the western side of the Hutt River. It will connect from the south end of Memorial Park to the end of Wakefield Street in the north. An active mode shared path can be provided on the top of the stop bank.	-3	-3	-3	-3	-3	-3	-3	**-21**	**Yes - due to innovative solution**
29	Create a loop from Waione Street down East Street	This creates a 650 m heavy vehicle priority loop around East Street. With other options it will prevent The Esplanade being the key east to west route for heavy vehicles. While this can work both ways, priority would be in the clockwise direction.	0	0	3	0	0	0	-3	**0**	**No - does not achieve investment objectives**
30	Sever The Esplanade west of Jessie Street	This option would prevent vehicles from traversing the entire length of The Esplanade / Waione Street, forcing east- west traffic onto another route. Exceptions could be made for buses running public transport services.	0	0	3	-3	0	3	0	**3**	**No - this would just move congestion elsewhere on the network**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
31	Sever Cuba Street just prior to The Esplanade	This option severs Cuba Street immediately to the north of The Esplanade. It will result in the removal of the signals on The Esplanade, improving traffic flow.	0	0	3	-3	0	3	0	**3**	**No - this option was not preferred**
32	Pedestrianise Jackson Street (except buses) between Victoria Street and Cuba Street	This option converts 950 metres of Jackson Street into a through route between Victoria Street and Cuba Street. A local example would include Manners Street in Wellington city.	0	2	1	-3	1	3	0	**4**	**No - would have detrimental impacts on the commercial business along Jackson Street**
33	Remove Hutt Road SB connection to SH2	This option removes the ability for southbound traffic on Hutt Road to enter the roundabout to access State Highway 2. It still maintains all other forms of access.	0	-3	3	-3	0	3	-3	**-3**	**No - does not achieve investment objectives**
34	Improved cycling links at Ewen Bridge	This option improves the cycling connections at Ewen Bridge and the associated intersections / roundabouts on either side. The focus is on improving commuter trips but will capture all cyclists travelling on road, to and from Railway Avenue, Victoria Street, Queens Drive and Woburn Road. There is also opportunity to try and connect to the Hutt River Trail on both sides of the river through this option. This option will be primarily achieved through alterations to the road space and road marking.	1	3	3	3	3	3	3	**19**	**Yes**
35	Active Mode connection from Montague Street to Hutt Valley High	A 230-metre-long, 3 m shared path for pedestrians and cyclists across the Hutt River. This option will also include the construction of a 450 m long shared path along the perimeter of the school to Woburn Road.	1	3	-1	3	-1	0	0	**5**	**Yes**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
36	Active mode connection from Buckley Street to St Albans Grove	A 210-metre-long, 3-metre-wide shared mode path connecting from the end of Buckley Street shared path to the end of St Albans Grove.	1	3	-1	3	-1	0	0	**5**	**Yes**
37	Active Mode track upgrade on St Albans Grove	Provision of a 250-metre-long active mode shared path by reallocating existing road space.	1	3	3	3	3	3	3	**19**	**Yes**
38	Active Mode track upgrade on Woburn Rd	Provision of a 1,200 metre long cycle path suitable for older school children as well as commuter cyclists by the reallocation of road space.	1	3	3	3	3	3	3	**19**	**Yes**
39	Active Mode track upgrade on Bellevue Road/Laings Road/Bloomfield Terrace	Provision of a 1,200 metre long cycle path that is suitable for older school children as well as commuter cyclists through a reallocation of road space.	3	3	3	3	3	3	3	**21**	**Yes**
40	Improved Rail frequency	Improved rail frequency to and from Wellington on the Hutt Valley line.	0	3	3	3	3	0	0	**12**	**Yes**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
41	Improved Bus services	Changes to the bus services within the Hutt Valley to make their use a more desirable choice.	0	3	3	3	3	0	0	**12**	**Yes**
42	Add bus priorities on the Esplanade plus amenity improvement options The Esplanade	Installation of bus priorities, chicanes/speed bumps along 2.5 km of The Esplanade. This can also work in conjunction with a bylaw preventing heavy vehicle access.	0	3	3	3	3	3	3	**18**	**Yes**
43	Prevent access to The Esplanade	This option restricts access to The Esplanade in a manner similar to the Cuba Street option. It seeks to ensure traffic flows smoothly on The Esplanade by reducing the need for vehicles to slow and stop for side road access (friction).	0	0	0	-3	3	0	0	**0**	**No - does not achieve investment objectives**
44	Connect Union and Adelaide Street	This option connects Union Street with Adelaide Street with a 550 metre long local road to prevent local trips from having to be made on Jackson Street.	0	0	3	-3	0	0	-3	**-3**	**No - does not achieve investment objectives**
45	Extend a freight road from Parkside Road to Seaview Road	Convert the southern of the old rail network into a freight road (2 x 3.5 m), connecting Parkside Road and Seaview Road. This link is approximately 1,200 metres long.	3	3	3	0	0	0	0	**9**	**Yes**

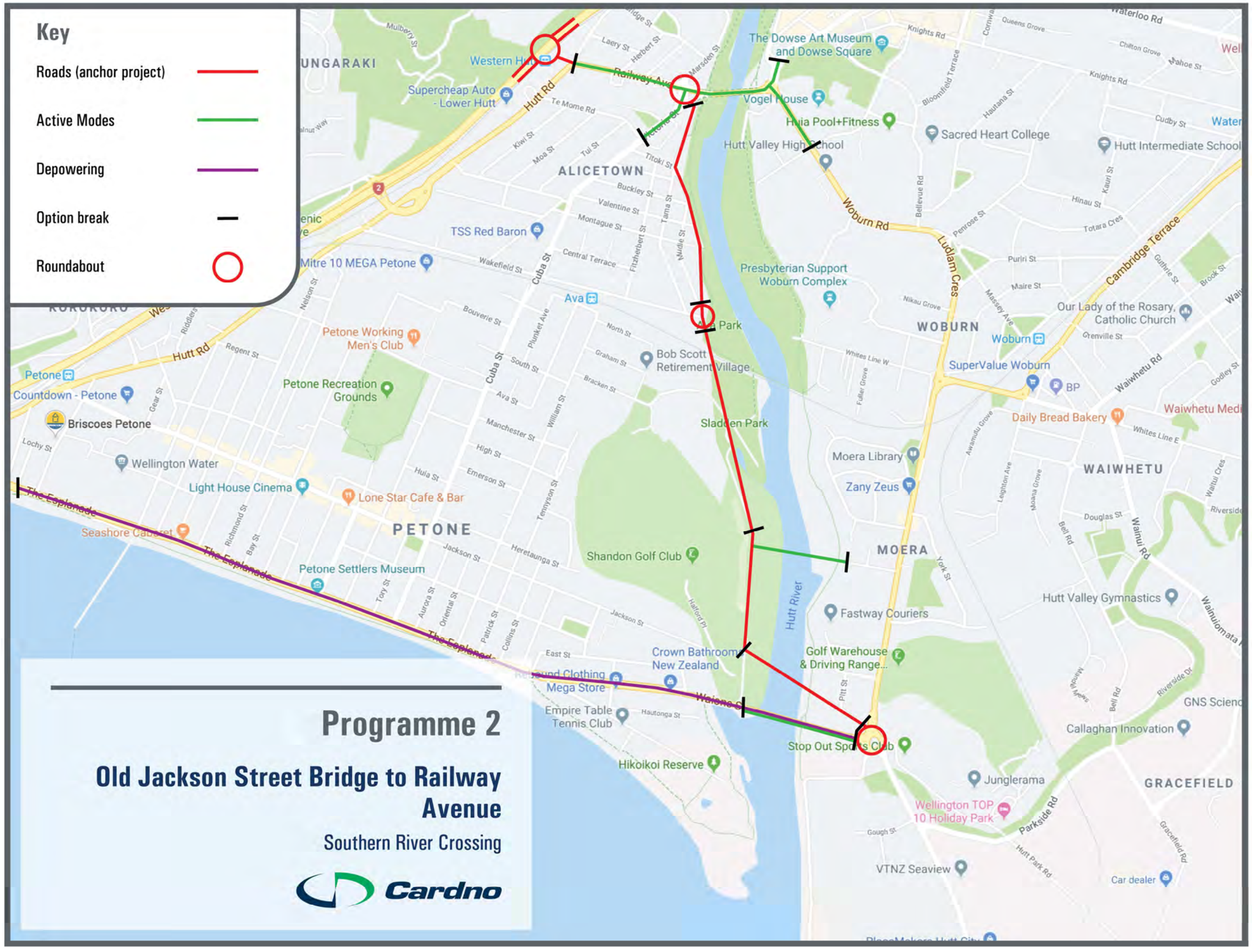
Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Social	Cost Range	BCR Benefit Range	Total Score	Shortlist Inclusion
46	Hutt Rail Trail	A 2.5 km cycleway on the southern side of the Hutt Valley Rail Line connecting Hutt Road in the west to Randwick Road in the east, with connections to Cuba Street in Alicetown.	3	3	1	3	3	0	3	**16**	**Yes**
47	Four Lane The Esplanade	Creation of four lanes along The Esplanade, enabling additional traffic throughput. This will be 3.5 km long in total, extending from Hutt Road to the Randwick Road roundabout.	-3	0	0	-3	-3	-3	0	**-12**	**Yes**
48	Wakefield Street and Hutt Road roundabout	This involves the construction of a roundabout at the intersection of Wakefield Street and Hutt Road to improve connectivity as well as capacity if Wakefield Street is upgraded and traffic volumes through this intersection increase.	1	1	3	0	0	0	0	**5**	**Yes**
49	Extend Udy Street to Hutt River	This involves the property purchase and extension of Udy Street for 1,100 metres as a two way two lane (2 x 3.5 metre lanes) road, to the western banks of the Hutt River. Provision for active modes can be made. The road bends around Wilford School and Memorial Park.	1	1	3	-1	0	0	0	**4**	**Yes**
50	Hutt Road / The Esplanade Roundabout to Hutt Road / Wakefield Street Intersection Active Mode Upgrades	This involves upgrading / widening the existing footpath to create an active mode area for pedestrians and cyclists.	0	3	3	3	3	0	3	**15**	**Yes**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Socia	Cost Range	BCR Benefit Range	Total Score	hortlist Inclusio
51	Hutt Road / The Esplanade Roundabout to Waione Street / Randwick Road Roundabout Active Mode Upgrades	This involves upgrading / widening the existing footpath to create an active mode area for pedestrians and cyclists.	0	3	3	3	3	0	3	**15**	**Yes**
52	Hutt Road / The Esplanade Roundabout	This involves modifying the existing roundabout and adjacent islands to provide a bus only lane.	0	1	3	-1	1	3	0	**7**	**Yes**
53	Cuba Street / Jackson Street Intersection	This involves modifying the existing traffic signals and paint marking to provide a bus priority lane. There is no opportunity to widen the carriageway to add in additional lanes.	0	3	3	3	3	3	3	**18**	**Yes**
54	Waione Street / Randwick Road Roundabout	This involves modifying the paint marking at the existing roundabout to provide a bus only lane.	0	3	3	3	3	3	3	**18**	**Yes**
55	Whites Line East / Randwick Road Roundabout	This involves modifying the paint marking and islands at the existing roundabout to provide a bus only lane.	0	3	3	3	3	3	3	**18**	**Yes**

Option number	Name	Description	Resilience	Accessibility	Feasibility	Public/ Stakeholders	Environmental and Socia	Cost Range	BCR Benefit Range	Total Score	hortlist Inclusio
56	Cuba Street on / off ramps	This involves constructing on / off ramps at the Cuba Street a part of the East / West multi-model corridor. Assuming the bridge over the railway line is to be re-constructed.	3	3	-2	3	0	-3	0	**4**	**Yes**
57	Whites Line East / Randwick Road roundabout	This involves the upgrading of the existing roundabout at the Whites Line East / Randwick Road intersection.	1	1	3	3	0	0	0	**8**	**Yes**
58	Mason Street / Randwick Road roundabout	This involves the construction of a roundabout at the Mason Street / Randwick Road intersection.	1	1	3	1	0	0	0	**6**	**Yes**
59	Parkside Road roundabout	This involves the construction of a roundabout where the railway line crosses Parkside Road.	1	1	3	1	0	0	0	**6**	**Yes**
60	Seaview Road roundabout	This involves the construction of a roundabout where the railway line crosses Seaview Road.	1	1	3	1	0	0	0	**6**	**Yes**

ATTACHMENT B – FOUR IDENTIFIED PROGRAMMES


Key
Roads (anchor project)
Active Modes
Option break
Roundabout
Allow full movements at the Gracefield Interchange
Programme 1
Wakefield Street to Whites Line West
Northern River Crossing
Cardno
IGARAKI
ALICETOWN
WOBURN
MOERA
PETONE
WAIWHETU
GRACEFIELD
SEAVIEW
Western Hutt
Supercheap Auto Alicetown
Hutt Rd
Railway Ave
Te Mome Rd
Victoria St
Kiwi St
Moa St
Tui St
Buckley St
Valentine St
Montague St
Central Terrace
Fitzherbert St
Tama St
Mulvie St
Tss Red Baron Motorcycles
10 MEGA Petone
Ava
Ava Park
Petone Working Men's Club
Bouverie St
Plunket Ave
North St
Graham St
Bracken St
Cuba St
South St
Ava St
William St
Manchester St
High St
Emerson St
Hula St
Lone Star Cafe & Bar
Recreation Grounds
Bob Scott Retirement Village
Sladden Park
The Dowse Art Museum and Dowse Square
Vogel House
Hutt Pool+Fitness
Hutt Valley High School
Sacred Heart College
Hutt Intermediate School
Waterloo
Wellington Free Ambulance
Knights Rd
Queens Grove
Chilton Grove
Mahoe St
Cudby St
Hautana St
Kauri St
Hinau St
Totara Cres
Penrose St
Puriri St
Maire St
Woburn Rd
Ludlam Cres
Presbyterian Support Woburn Complex
Cambridge Terrace
Vincent St
Collingwood St
Guthrie St
Brook St
Waiwhetu Rd
Melone Rd
Riverside Dr
Mission St
Galway St
Grenville St
Our Lady of the Rosary, Catholic Church
Woburn
SuperValue Woburn
BP
Daily Bread Bakery
Waiwhetu Medical Centre
Te Whiti Riser
Te Whiti Park
Godley St
Whites Line E
Hayward Eastern Hills Scenic Reserve
Zany Zeus
Awamutu Grove
Leighton Ave
Moana Grove
Douglas St
Bell Rd
Wainui Rd
Riverside Ct
Hayward Terrace
Tyndall St
Shandon Golf Club
Randwick School & Community...
Fastway Couriers
Golf Warehouse & Driving Range...
Hutt Valley Gymnastics
Wainuiomata Rd
Riverside Dr
Smeaton
Pitt St
York St
Halford Pl
Jackson St
Heretaunga St
Tory St
Aurora St
Oriental St
Patrick St
Collins St
East St
The Esplanade
Crown Bathrooms New Zealand
Empire Table Tennis Club
Waione St
Hikoikoi Reserve
Stop Out Sports Club
GNS Science
Callaghan Innovation
Junglerama
Wellington TOP 10 Holiday Park
Parkside Rd
Hutt Park Rd
Gracefield Rd
VTNZ Seaview
Car dealer
Freewheel
PlaceMakers Hutt City
Kokiri Marae Keriana Olsen Trust
Tunnel Grove
Wainuiomata Lookout


Key
Roads (anchor project)
Active Modes
Depowering
Option break
Roundabout
Programme 2
Old Jackson Street Bridge to Railway Avenue
Southern River Crossing
Cardno
Western Hutt
Supercheap Auto - Lower Hutt
Hutt Rd
Railway Ave
The Dowse Art Museum and Dowse Square
Vogel House
Hutt Pool+Fitness
Sacred Heart College
Hutt Valley High School
Hutt Intermediate School
ALICETOWN
TSS Red Baron
Mitre 10 MEGA Petone
Presbyterian Support Woburn Complex
Woburn Rd
Ludlam Cres
Cambridge Terrace
Ava
Petone Working Men's Club
Bob Scott Retirement Village
Petone Recreation Grounds
Sladden Park
WOBURN
Our Lady of the Rosary, Catholic Church
Woburn
SuperValue Woburn
BP
Daily Bread Bakery
Waiwhetu Rd
Petone
Countdown - Petone
Briscoes Petone
Wellington Water
Light House Cinema
Lone Star Cafe & Bar
PETONE
Seashore Cabaret
The Esplanade
Petone Settlers Museum
Shandon Golf Club
Moera Library
Zany Zeus
WAIWHETU
MOERA
Hutt River
Fastway Couriers
Hutt Valley Gymnastics
Crown Bathrooms New Zealand
Golf Warehouse & Driving Range...
Empire Table Tennis Club
Hikoikoi Reserve
Stop Out Sports Club
Callaghan Innovation
Junglerama
Wellington TOP 10 Holiday Park
VTNZ Seaview
GRACEFIELD
Car dealer

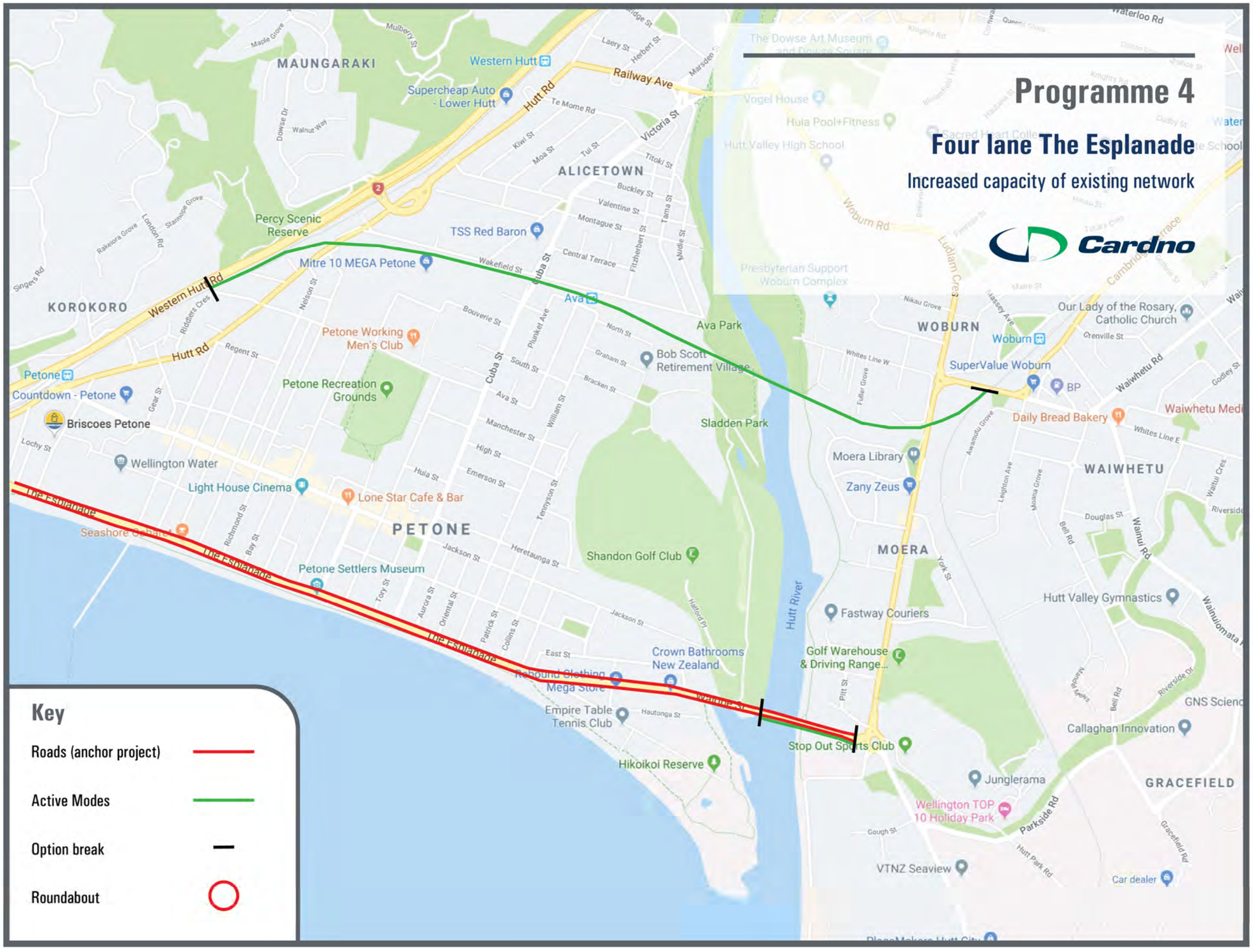

Key
Roads (anchor project)
Active Modes
Option break
Roundabout
Programme 3
Udy Street to Randwick Road
Central River Crossing
Cardno
MAUNGARAKI
KOROKORO
PETONE
ALICETOWN
WOBURN
MOERA
WAIWHETU
GRACEFIELD
Western Hutt
Supercheap Auto - Lower Hutt
The Dowse Art Museum and Dowse Square
Vogel House
Huia Pool+Fitness
Hutt Valley High School
Percy Scenic Reserve
TSS Red Baron
Mitre 10 MEGA Petone
Presbyterian Support Woburn Complex
Ava
Ava Park
Petone Working Men's Club
Bob Scott Retirement Village
Petone Recreation Grounds
Petone
Countdown - Petone
Briscoes Petone
Sladden Park
Wellington Water
Light House Cinema
Lone Star Cafe & Bar
Seashore Cabaret
Petone Settlers Museum
Shandon Golf Club
Moera Library
Zany Zeus
Our Lady of the Rosary, Catholic Church
Woburn
SuperValue Woburn
BP
Daily Bread Bakery
Fastway Couriers
Hutt Valley Gymnastics
Crown Bathrooms New Zealand
Golf Warehouse & Driving Range...
Empire Table Tennis Club
Stop Out Sports Club
Callaghan Innovation
Hikoikoi Reserve
Junglerama
Wellington TOP 10 Holiday Park
VTNZ Seaview
Car dealer
Hutt River
Railway Ave
Hutt Rd
Western Hutt Rd
Victoria St
Woburn Rd
Cuba St
Waione St
The Esplanade
Parkside Rd
Waiwhetu Rd

Programme 4

Four lane The Esplanade

Increased capacity of existing network

Cardno



Appendix Four Cross Valley Transport Connections – Programme Business Case – Economic Assessment Report

Purpose

The purpose of the Appendix is to provide the context and methodology used during the economic assessment that underpins this PBC. The economic analysis has been completed in order to understand what the overall benefits of implementing the emerging preferred programme would be, in terms of the financial cost versus the financial return of the project.

BCR Assumptions

The BCR has been prepared based on the following assumptions:

- Time Zero is 1 July 2019
- Stages 1, 2 and 3 will be constructed in 2022, 2026 and 2030 respectively
- Duration of construction for Stages 1 and 2 is 12 months, and 24 months for Stage 3
- Analysis period is 40 years
- Discount factor is 6%
- Traffic Growth is 1.3% per annum based on traffic growth at the Petone on and off ramps between 2012 and 2018

Travel Time Benefits

The travel time benefits have been estimated based on speed flow curves on the key link roads and intersections within the Project Study Area. The speed flow curves have been used based on transportation models prepared around New Zealand.

The base traffic flows are taken from the HCC traffic count database and adjusted to a 2019 base. Changes in the traffic flow as a result of the emerging preferred programme have then been estimated based on the assessments undertaken in Part B.

Table 1 below shows the estimated redistribution of flows that will transfer from Waione Bridge to the new Wakefield Bridge, and are based on the origin and destination of the trip i.e. it has been assumed that 80% of the flows travelling between Waiwhetū to Petone will transfer from the Waione bridge to the new Wakefield bridge.

Table 1 Redistribution of Flows

From \ to	Petone	Wellington	Upper Hutt
Waiwhetu	80%	90%	-
Wainui	20%	20%	100%
Eastbourne	0%	0%	100%

The overall effects of the redistribution of flows is the transfer of around 11,600 vpd from the Waione Bridge to the new Wakefield bridge.

The analysis has been undertaken on 24-hour flows, however speed flow curves are generally used for hourly flows. Therefore, the 24-hour flows have been converted to hourly flows. Generally, the peak hour flows are around 10% of the underlying 24-hour flows. This varies

depending on the type of road i.e. if the road is an arterial route, a shopping street or a local residential road. Flows have been extracted for some key streets and the average hourly flows by direction have been compared to the two-way daily flow. The factors vary between 20 on Cuba Street and 25 on Jackson Street. The average was 22.94.

Future years have been assessed for 2029 and 2039. These assume that travel patterns will remain with uniform growth in the study area.

Vehicle Operating Cost Benefits

Vehicle operating costs have been based on total distance travelled and the average speed travelled in both the do minimum and emerging preferred programme. The tables in the EEM have been used to convert the distance travelled to monetary values. In accordance with Section 4.4.8 of the EEM, vehicle emission costs are 4% of the vehicle operating costs.

Crash Benefits

The base crash costs have been calculated in accordance with the EEM Method A, where the existing crash history over a five-year period has been analysed.

Crash models are based on crash exposure rates. Generally, the more distance travelled the more crashes, if all other factors were equal. This assumption has been used to estimate the emerging preferred programme crash costs. The total vehicle kilometres travelled in the do minimum programme (from the travel time benefit calculations) has been compared to the total vehicle kilometres travelled in the emerging preferred programme and the base crash cost factored accordingly.

The future year crash costs have been based on the methodology in the EEM.

Cycle and Pedestrian Benefits

The EEM methodology for estimating new cyclists on an improved network has been used. This has been undertaken using the average density of population within different catchments and factored by a commute share parameter and likelihood of new cyclist multiplier. The population density of the Project Study Area has been assumed to be 780 persons per square kilometre, which is the average density of the urban area for Lower Hutt City.

Agglomeration Benefits

Agglomeration benefits are the economic benefits as a result from travel between workers and places of work becoming more efficient.

Care needs to be taken for the agglomeration possibilities as it could be considered that the Project Study Area already has economic clusters occurring in Seaview and Jackson Street. This is partially due to District Plan land zoning.

To estimate agglomeration benefits, results from a transport model have been used. However, alternative methodologies have been undertaken, such as using census journey to work data, rather than model demands. While there is a transport model of Lower Hutt, it is for the present year only, does not have alternatives modes and does not have trip purposes.

Travel time savings for commuting and employee trips only have been used (i.e. not recreational / shopping trips) and have been based on a demand matrix and generalised cost matrix for each mode and analysis year. Base and future year employment is required along with the GDP value of each zone (proportion of wider area based on employment).

Agglomeration benefits for the Let's Get Wellington Moving economic analysis were calculated at around 35% of the traditional benefits (e.g. travel time, vehicle operating cost and crash reduction). Agglomeration benefits for the P2G Link Road economic analysis were calculated at around 100% of the traditional benefits. For the emerging preferred programme, a conservative 10% has been used.

Imperfect Competition Benefits

Imperfect competition benefits are those economic benefits resulting from transport improvements causing output to increase in sectors where there are price cost margins

Conventional transport economics assumes all transport-using sectors operate in perfect competition, where price equals marginal costs. If price cost margins exist, they cause a wedge between gross labour costs and the market value of what is produced. Hence, where there are price cost margins, a transport-induced increase in output will cause a wider economic impact identical to the size of this wedge.

It could be considered that a new multi-modal transport connection contains price-cost margins as transport to and from Seaview have higher delays than other industrial areas.

The EEM states that "*this can typically add up to an additional 5% of wider economic benefits over conventional benefits".*

Imperfect competition benefits for the Let's Get Wellington Moving economic analysis were calculated at between 1 and 5% of the traditional benefits (e.g. travel time, vehicle operating cost and crash reduction). Imperfect competition benefits for the P2G Link Road economic analysis used the EEM approach of using 5% of the traditional benefits. For the emerging preferred programme, the EEM value of 5% is been adopted.

Increased Labour Benefits

Increased labour supply benefits are economic benefits resulting from a reduction in commuting costs and removal of a barrier for new workers accessing areas of employment

Increased labour is due to increased travel opportunities removing barriers for companies to hire more staff and promoting growth. International research also shows that denser employment areas are more productive per person than less dense employment areas.

The benefits are based on the change in commuter costs and then factors by net wage and labour supply elasticity. The EEM states that "*this can typically add up to an additional 10% of wider economic benefits over conventional benefits".*

Increased labour benefits for the Let's Get Wellington Moving economic analysis were calculated at between 4% and 6% of the traditional benefits (e.g. travel time, vehicle operating cost and crash reduction). Increased labour benefits for the P2G Link Road's economic analysis was calculated at around 6% of the traditional benefits. For the emerging preferred programme, a conservative 5% has been used.

Land Value Benefits

The economic analysis undertaken for the Let's Get Wellington Moving project included land value uplift as a benefit based on people being willing to pay more to live in accessible places or attractive environments.

The LGWM team reviewed the land costs of areas within a 10 minute walk of public transport stations. While total benefits have been provided, the increase per property has not. The land increase benefits for the Let's Get Wellington Moving economic analysis was calculated at between 16% and 31% of traditional benefits. The P2G Link Road did not separate this out. For the emerging preferred programme, a conservative 10% has been used.

Resilience Benefits

Section A10.8 of the EEM discusses resilience and Section A13.12 provides an example of calculating benefits associated with reducing the risk of replacing a bridge that could be lost in a natural event. In order to undertake this analysis, the strength of the existing bridge is required (e.g. will a 1:200-year flood or a 1:100-year earthquake destroy the bridge). Also, the additional travel time if the bridge is destroyed needs to be estimated.

Resilience benefits for the P2G Link Road economic analysis was calculated to be 15% of traditional benefits. For the emerging preferred programme, 15% has been used until detailed analysis is undertaken.

Staging

The EEM requires an analysis period of 40 years to be used. The analysis period starts when the first amount of money is spent. For projects with long construction periods, such as Transmission Gully Motorway, the benefits are only realised after construction is completed and may only be for 35 years if the construction is significant. Benefits and costs spent in the future are also discounted to the base year at a rate of 6% to convert all costs to the base year so that all projects in New Zealand are evaluated on the same basis. The discount factor is lower than the rate of inflation, thereby reducing the benefits further for future years.

As the emerging preferred programme is being staged, the costs and benefits of future components are discounted accordingly, however, a full 40 years of benefits will not be realised.

Costs

The costs used in the economic analysis are set out in Table 2 below.

Table 2 Staging Costs Used in Economic Analysis

Stage	Construction Year	2019 Construction Estimate ($)	Discounted Construction Estimate ($)
Stage 1	2021	17,000,000	15,129,939
Stage 2	2025	8,000,000	5,639,684
Stage 3	2029	75,600,000	42,214,645

Benefit Calculations

The transport and economic benefits to be generated by the emerging preferred programme have been calculated using an adaption of the standard the NZTA EEM worksheets. The worksheets can be provided upon request.

The resulting BCR is 3.6 using traditional benefits only. The BCR increases to 5.3 when wider economic benefits are included. A summary of the costs and benefits are provided in Table 3 below.

Table 3 Economic Analysis Summary

Benefit / Cost Type	Benefits / Costs
Travel time savings	221,990,522
Vehicle Operating Costs	4,311,391
Crash cost savings	485,115
Vehicle Emissions Savings	215,570
Pedestrian and Cycle	2,443,969
Sub Total - Traditional Benefits	**229,446,567**
Agglomeration	22,678,703
Imperfect Competition	11,339,351
Increased Labour	11,339,351
Land Value	22,678,703
Resilience	34,018,054
Sub Total - WEBs	**102,054,163**
TOTAL BENFITS	**331,500,730**
Construction Cost	62,984,269
BCR without WEBs	**3.6**
BCR with WEBs	**5.3**

Appendix Five Indicative Results Alignment Assessment

GPS 2018 Priorities	High	Comments
Safety - a safe transport system free of death and serious injury	Addresses safety issues presenting a high crash risk, affecting communities subject to high safety risk, and / or in Safer Journeys area of high concern	**Medium.** Safety concerns persist throughout the project study area, particularly for vulnerable road users: ► Between 2009 and 2018 there have been: 77 cycling crashes 75 pedestrian crashes ► Between 2014 and 2018: 44% of all serious crash involved vulnerable road users The likely reductions in deaths and serious injuries cannot be fully known at this stage. However, it is considered that as a result of implementing the emerging preferred programme, the safety environment throughout the study area will be improved significantly
	Addresses safety issues presenting a high societal consequence risk	
Access to opportunities, enables transport choice and access, and is resilient - Thriving regions	Enables a significant regional economic development opportunity in an approved Regional Economic Development (RED) programme	N/A - not in a RED area
	Addresses significant resilience gap or impediment to access on nationally important social and economic connections	**High.** Particularly for the Estuary (Waione Street) Bridge. The Estuary (Waione Street) Bridge has been identified as a significant resilience risk due to lateral movement (Wellington Resilience PBC 2018). In addition, this PBC has identified additional risks, including flooding, liquefaction, tsunamis and acting as a bottle neck for traffic and active mode users. The Estuary (Waione Street) Bridge provides an extremely important lifeline connection between areas in the east of Lower Hutt and the west, and subsequently further to SH2 and Wellington City. The emerging preferred programme will improve this lifeline connection by adding a second resilient route
	Addresses a gap in an approved RED programme in high priority RED regions	N/A - not in a RED area
	Makes best use of key corridors that prioritise national freight and tourism	**High**. SH2 is part of the “core freight network” and provides access for tourists to Wellington City (e.g. Interislander Ferry) and the Wellington Region. The emerging preferred programme will improve east-west connectivity for freight, through the project study area, via an additional connection to Seaview industrial area. Connectivity for tourists to Wellington will also be improved as a result

Access to opportunities, enables transport choice and access, and is resilient - Liveable cities	Supports high priority elements in agreed integrated land use and multi-modal plans	**High**. Key components of the emerging preferred programme are identified in a number of strategic documents, including the Wellington Regional Transport Plan 2015, Wellington Urban Growth Plan 2014-43, and the Hutt Story Strategic Context.
	Address significant gap in access to new housing in high growth urban areas	**High.** The emerging preferred programme will improve access to key growth areas: ► Petone ► Seaview / Gracefield ► Wainuiomata ► Eastbourne The emerging preferred programme has been specifically designed to accommodate and encourage growth in these areas
	Addresses a significant resilience risk to continued operation of key corridors	**High**. The emerging preferred programme will improve the resilience of the project study area and as a result, the wider Wellington Region's key transport system. It is also noted that a number of lifeline utilities are located within the project study area, or are dependent on the transport system operating for response and recovery purposes. By adding a second resilient route, the emerging preferred programme will improve the resilience of the transport network in terms of its ability to respond and recover in times of emergency
	Makes best use of key corridors that prioritise multi-modal use and freight	**High**. The emerging preferred programme seeks to increase east-west multi-modal travel choice, which in turn will encourage modal shift and freight efficiency
	Provides significant operational efficiencies to reduce the costs of meeting appropriate levels of service without impacting benefits	**High.** The emerging preferred programme seeks to implement transport efficiencies (e.g. freight), and smart transport services (e.g. increasing PT patronage, priority intersections and improved efficiencies).
Environment - Reduce adverse effects on the climate, local environment and public health	Addresses significant reductions in harm to the environment and people, particularly arising from land transport-related air pollution, noise, and impact of construction and ongoing use of transport infrastructure on water quality and biodiversity	Not yet known - environmental effects alignment will be assessed by future business cases or consent applications.
	Addresses long term significant reductions in greenhouse gas emissions from land transport	Not yet known - environmental effects alignment will be assessed by future business cases or consent applications. It is noted that all programmes seek to increase east-west multi-modal travel choice, which in turn will encourage modal shift and greenhouse gas reductions.
Overall Results Alignment Assessment: Overall, the emerging preferred programme is considered to have a **High** alignment with the GPS 2018 priorities.		

Appendix Six Cross Valley Transport Connections Programme Business Case – Cost Assessment Report

Purpose

The purpose of this Appendix is to provide the understanding for how the costs that have been assigned to the emerging preferred programme were calculated. This Appendix explains the construction cost estimation method used to calculate costs, as well as the costs themselves.

Context

In order to understand associated construction costs, a costing exercise was completed for each of the 60 options included in the long list. Essentially, completing this task allowed for the final emerging preferred programme to be costed, and the economic analysis provided above to be completed. The remainder of this Appendix outlines the methodology used during this construction process, as well as the resulting costs associated with each of the 60 options.

Methodology

High level costing was completed for all 60 options. At this stage, the methodology used to complete this task was kept at a high level, due to a number of detailed unknowns in the option development process. Detailed pricing will be completed at the next stage of the business case, when the finer details of each option are known.

As such the high-level methodology includes:

- Costs were based on a combination of; previous experience of similar projects and cross referenced with ACENZ percentages
- Construction costs were based on an estimate of rates / items used for projects with a similar scope
- The costs for design options for similar projects were also scaled to be representative for the options considered in this PBC
- Extras / overs were allowed for to allow for uncertainty to be calculated, due to the lack of knowledge at the PBC phase, and to provide contingency. This contingency includes poor ground conditions, existing services requirements and other unknowns

A spreadsheet was constructed in order to apply consistent costing to all options. If this detailed spreadsheet is required, it can be provided upon request.

Costs

Using this spreadsheet, it was possible to associate a cost to each option indicated in the long list, based on the high level description of the options form and function. Table 1 below outlines the costs associated with each option. It is noted that property acquisition costs are not included within the costs outlined below.

Table 1 Analysis of Option Costs

Option number	Name	Description	Capital cost low	Capital cost high
1	Wakefield Street and Whites Line West bridge	Constructing a new road between Wakefield Street and Whites Line West, across the Hutt River in Petone ► It is planned that a 17.5m wide road (Local distributor road / Residential) will tie both roads ► The road is to be 2x3.5m lanes + 2x2.5m shoulders + 2x1.5m foot paths + 1x2.5m central easement = 17.5m wide ► The total planned length of the new road, including concrete bridge, is to be 400 m long.\The bridge over the river is to consist of 6x25.0m concrete beam spans, 5x concrete columns and 2 concrete end abutments with wind walls ► The river is 146.0 m wide at the crossing	$19,900,000	$29,900,000
2	Whites Line West Upgrade	A 500m upgrade of Whites Line West to accommodate the new traffic, including new pavement and marking. Potential to create access islands for residential traffic.	$3,300,000	$5,000,000
3	Wakefield Street upgrade	A 1.25 km upgrade of Wakefield Street to accommodate the additional traffic. Reconfigure to 2 x 3.5 m lanes Likely to include a small residential access lane on the north east side, which may extend to industrial access. Shared path (2.5 m) on the north side.	$7,700,000	$11,600,000
4	Wakefield Street connection to Dowse Interchange	A 140 m long ramp and associated structure connecting Wakefield Street to Dowse Interchange - 2x3.5 + 2x1.5 = 10.0m wide. Potentially having a new roundabout between Dowse Interchange and the Hutt Road roundabout.	$5,000,000	$7,500,000
5	Ava Bridge Replacement with Road Rail Bridge	A single 360m long bridge on the existing bridge alignment with 2 x 3.5 m lanes, 2 railway lines, and a 3 m shared path = replacing the current Ava Rail Bridge. Connects into Wakefield Street in the West with a 250m long connection.	$26,500,000	$39,750,000
6	Whites Line West connection to the Randwick Road roundabout	Alterations to the Whites Lines and Randwick Road roundabout to enable traffic to travel west from the roundabout.	$600,000	$1,200,000
7	Road connection following Rail corridor to Whites Line roundabout	A 500 m realignment of the rail and inclusion of a 700m road corridor between the Ava Rail Bridge and Whites Line East and Randwick Road roundabout. This may require a replacement of the Randwick Road rail bridge.	$12,400,000	$18,600,000
8	Road connection following Rail corridor to Pohutukawa Street	An 800m realignment of the rail and road corridor between the Ava Rail Bridge Pohutukawa Street. This may require a replacement of the Randwick Road and Whites Line East rail bridges. There may also be a realignment of the Seaview rail spur.	$17,400,000	$26,100,000
9	Reconfigure Dowse interchange to north facing ramps	Removal of the southbound on ramp and northbound off ramp at the Dowse interchange. Continue leaving connectivity for cyclists travelling on both ramps.	$300,000	$900,000
10	Remove Connection to Dowse interchange from Hutt Road	This would create a half interchange at the end of Udy Street / Riddlers Crescent. This includes a connection over the Hutt Valley rail line, including two bridges.	$1,200,000	$1,800,000
11	South facing interchange at end of Udy Street	This would create a half interchange at the end of Udy Street / Riddlers Crescent. This includes a connection over the Hutt Valley rail line, including two bridges.	$41,000,000	$62,000,000
12	Roundabout at Udy Street / Hutt Road	A new roundabout on Hutt Road and Udy Street to provide safe passage across Hutt Road / Udy street.	$2,200,000	$4,400,000
13	Flyover on Udy Street to SH2	A 150 m long two lane two way flyover over Hutt Road on SH2 connecting Udy Street and Riddlers Crescent.	$13,900,000	$20,850,000
14	Improve Udy Street	Changes to the road layout of Udy Street along its entire length (1,050m) to create an arterial route, including Riddlers Crescent.	$6,800,000	$10,200,000
15	Railway Ave Interchange	A 90 m long overbridge across the railway line as well as a full interchange at the Western end of Railway Avenue, similar to the Dowse interchange.	$50,000,000	$75,000,000
16	Interchange / roundabout at Wakefield / Cross Valley	This involves the provision of either a signalised interchange or roundabout interchange at the eastern end of Wakefield Street. This could connect into a north-south arterial route also delivered as part of the programme.	$2,000,000	$3,000,000
17	Road / Active mode bridge from the South of Memorial Park to Randwick Crescent / Barber Grove	A 370m long, two way two lane bridge (2 x 3.5m) bridge with a 2.5m active mode path on the north or south side of the bridge, connecting Barber Grove to the west bank of the Hutt River.	$22,000,000	$33,000,000
18	Road along Rail corridor from Parkside Road to Randwick Road	A new 1,150m road along the old rail corridor with 2 x 3.0 m lanes. It connects into Randwick Road via York Street. New intersection control is likely to be via a roundabout.	$6,200,000	$9,300,000
19	Road along Rail corridor from Parkside Drive to Whites Line Roundabout	A 1,600m length two lane two way road (2 x 3.0m), with two bridges, spanning the stream and railway line, connecting into the Whites Line Roundabout.	$12,700,000	$19,100,000

Option number	Name	Description	Capital cost low	Capital cost high
20	Allow full movements at Gracefield Road / Wainuiomata Hill Road 'interchange'	This involves the creation of an westbound connection from Gracefield Road to Wainuiomata Hill Road as well as an eastbound connection form the Hill Road to Gracefield Road. The eastbound connection will require either a new tunnelled section, or widening of the existing.	$7,800,000	$15,600,000
21	Connect Wainui Road to Woburn Road	This involves the upgrade of approximately 800m of local roads into arterial roads with a new 120m bridge spanning the Hutt Valley Railway line. The upgraded route then connects into Woburn road at Ludlam Park.	$14,200,000	$21,300,000
22	Four lane Waione Street Bridge	This involves adding a new structure to the Waione Street bridge to create four lanes of traffic without the removal of the existing bridge.	$16,400,000	$24,600,000
23	Second Waione Street Bridge	This option involves the construction of a second Bridge at the mouth of the Hutt River (north of the existing Waione Street bridge). This could be on either the same alignment at 180m long– creating four lanes connecting to The Esplanade or on the old Jackson Street Bridge alignment, at 260m long with a 120m connection onto Croft Grove.	$20,000,000	$30,000,000
24	Second active mode path on Waione Street Bridge	This option involves the construction of a second active mode path at 2.5m wide on the northern side of the existing Waione Street Bridge above the water pipes.	$3,000,000	$4,500,000
25	Remove Waione Street Bridge	This involves the removal of the Waione Street Bridge.	$1,000,000	$3,000,000
26	Road under Flood bank from Waione Street to Memorial Park	This option involves the construction of a 500m long two lane two way buried road (2 x 3.5m) under an improved stop bank on the western side of the Hutt River. It will connect from the end of Jackson Street to the south end of Memorial Park. An active mode shared path can be provided on the top of the stop bank.	$100,000,000	$300,000,000
27	Road under flood bank from Memorial Park to Wakefield Street	This option involves the construction of an 800m long, two lane two way buried road (2 x 3.5m) under an improved stop bank along the western bank of the Hutt River. It will connect from the southern end of Memorial Park to the end of Wakefield Street in the north. An active mode shared path can be provided on the top of the stop bank.	$180,000,000	$540,000,000
28	Road under flood bank from Wakefield Street to Railway Avenue	This option involves the construction of an 800 m long two lane two way buried road (2 x 3.5 m) under an improved stop bank on the western side of the Hutt River. It will connect from the south end of Memorial Park to the end of Wakefield Street in the north. An active mode shared path can be provided on the top of the stop bank.	$170,000,000	$510,000,000
29	Create a loop from Waione Street down East Street	This creates a 650m heavy vehicle priority loop around East Street. With other options it will prevent The Esplanade being the key east to west route for heavy vehicles. While this can work both ways, priority would be in the clockwise direction.	$3,000,000	$6,000,000
30	Sever The Esplanade west of Jessie Street	This option would prevent vehicles from traversing the entire length of The Esplanade / Waione Street, forcing east- west traffic onto another route. Exceptions could be made for buses.	$100,000	$500,000
31	Sever Cuba Street just prior to The Esplanade	This option severs Cuba Street immediately to the north of The Esplanade. It will result in the removal of the signals on The Esplanade, improving traffic flow.	$150,000	$750,000
32	Pedestrianise Jackson Street (except buses) between Victoria Street and Cuba Street	This option converts 950 metres of Jackson Street into a through route between Victoria Street and Cuba Street. A local example would include Manners Street in Wellington city.	$250,000	$1,000,000
33	Remove Hutt Road SB connection to SH2	This option removes the ability for southbound traffic on Hutt Road to enter the roundabout to access State Highway 2. It still maintains all other forms of access.	$150,000	$300,000
34	Improved cycling links at Ewen Bridge	This option improves the cycling connections at Ewen Bridge and the associated intersections / roundabouts on either side. The focus is on improving commuter trips but will capture all cyclists travelling on road, to and from Railway Avenue, Victoria Street, Queens Drive and Woburn Road. There is also opportunity to try and connect to the Hutt River Trail on both sides of the river through this option. This option will be primarily achieved through alterations to the road space and road marking.	$350,000	$700,000
35	Active Mode connection from Montague Street to Hutt Valley High	A 230m long, 3m shared path for pedestrians and cyclists across the Hutt River. This option will also include the construction of a 450m long shared path along the perimeter of Hutt Valley High School to Woburn Road.	$4,600,000	$9,200,000
36	Active mode connection from Buckley Street to St Albans Grove	A 210m long, 3m wide shared mode path connecting from the end of the Buckley Street shared path, to the end of St Albans Grove.	$3,600,000	$7,000,000
37	Active Mode track upgrade on St Albans Grove	Provision of a 250m long active mode shared path by reallocating existing road space.	$100,000	$200,000
38	Active Mode track upgrade on Woburn Rd	Provision of a 1,200m long cycle path by the reallocation of road space.	$300,000	$600,000
39	Active Mode track upgrade on Bellevue Road / Laings Road / Bloomfield Terrace	Provision of a 1,200m long cycle path through a reallocation of road space.	$300,000	$600,000
40	Improved Rail frequency	Improved rail frequency to and from Wellington on the Hutt Valley line.	Not costed	Not costed

Option number	Name	Description	Capital cost low	Capital cost high
41	Improved Bus services	Changes to the bus services within the Hutt Valley.	Not costed	Not costed
42	Add bus priorities on the Esplanade plus amenity improvement options The Esplanade	Installation of bus priorities, chicanes / speed bumps along 2.5 km of The Esplanade. This can also work in conjunction with a bylaw preventing heavy vehicle access.	$400,000	$1,000,000
43	Prevent access to The Esplanade	This option restricts access to The Esplanade in a manner similar to the Cuba Street option. It seeks to ensure traffic flows smoothly on The Esplanade by reducing the need for vehicles to slow and stop for side road access (friction).	$1,000,000	$2,000,000
44	Connect Union and Adelaide Street	This option connects Union Street with Adelaide Street with a 550m long local road to prevent local trips from having to be made on Jackson Street.	$2,600,000	$5,200,000
45	Extend a freight road from Parkside Road to Seaview Road	Convert the southern section of the old rail network into a freight road (2 x 3.5m), connecting Parkside Road and Seaview Road. This link is approximately 1,200m long.	$4,400,000	$6,600,000
46	Hutt Rail Trail	A 2.5km cycleway on the southern side of the Hutt Valley Rail Line connecting Hutt Road in the west to Randwick Road in the east, with connections to Cuba Street in Alicetown.	$6,600,000	$9,900,000
47	Four Lane The Esplanade	Creation of four lanes along The Esplanade, enabling additional traffic throughput. This will be 3.5km long in total, extending from Hutt Road to the Randwick Road roundabout.	$13,300,000	$20,000,000
48	Wakefield Street and Hutt Road roundabout	This involves the construction of a roundabout at the intersection of Wakefield Street and Hutt Road to improve connectivity, as well as capacity if Wakefield Street is upgraded and traffic volumes through this intersection increase.	$2,100,000	$3,200,000
49	Extend Udy Street to Hutt River	This involves the extension of Udy Street for 1,100m as a two way two lane road (2 x 3.5m lanes), to the western banks of the Hutt River. Provision for active modes can be made. The will be located adjacent to Wilford School and Memorial Park.	$3,600,000	$5,400,000
50	Hutt Road / The Esplanade Roundabout to Hutt Road / Wakefield Street Intersection Active Mode Upgrades	This involves upgrading / widening the existing footpath to create an active mode area for pedestrians and cyclists	$6,400,000	$9,600,000
51	Hutt Road / The Esplanade Roundabout to Waione Street / Randwick Road Roundabout Active Mode Upgrades	This involves upgrading / widening the existing footpath to create an active mode area for pedestrians and cyclists	$3,000,000	$4,500,000
52	Hutt Road / The Esplanade Roundabout	This involves modifying the existing roundabout and adjacent islands to provide a bus only lane	$600,000	$1,200,000
53	Cuba Street / Jackson Street Intersection	This involves modifying the existing traffic signals and paint marking to provide a bus priority lane. There is no opportunity to widen the carriageway to add in additional lanes.	$100,000	$200,000
54	Waione Street / Randwick Road Roundabout	This involves modifying the paint marking at the existing roundabout to provide a bus only lane	$20,000	$40,000
55	Whites Line East / Randwick Road Roundabout	This involves modifying the paint marking and islands at the existing roundabout to provide a bus only lane	$60,000	$120,000
56	Cuba Street on / off ramps	This involves constructing on / off ramps at the Cuba Street a part of the East / West multi-model corridor. Assuming the bridge over the railway line is to be re-constructed.	$11,000,000	$17,000,000
57	Whites Line East / Randwick Road roundabout	This involves the upgrading of the existing roundabout at the Whites Line East / Randwick Road intersection	$2,100,000	$3,200,000
58	Mason Street / Randwick Road intersection	This involves the construction of a new intersection at the Mason Street / Randwick Road intersection	$2,100,000	$3,200,000
59	Parkside Road Intersection	This involves the construction of new intersection where the railway line crosses Parkside Road.	$2,100,000	$3,200,000
60	Seaview Road Intersection	This involves the construction of a new intersection where the railway line crosses Seaview Road.	$2,100,000	$3,200,000

These costs outlined in Table 1 above were used to understand the total costs for delivering the emerging preferred programme – the total costs were built using the costs associated with the relevant options included within the emerging preferred programme, from the list above.

Based on the costing information held above, Terra Consultants (Terra) were engaged to review the accuracy of the cost estimates provided within this PBC. Due to the conceptual nature of the available option / alternative design information, it was agreed that the methodology used for calculating likely costs was appropriate. Therefore, at this stage in the business case process, a direct review of the costing methodology was unlikely to present the best use of resources, nor would it provide significant value to the business case. Rather, it was agreed that Terra would highlight risks associated with the following aspects of the emerging preferred programme:

- Land purchase
- Consenting
- Construction delays
- Whether or not these points would have an impact on overall costs

Terra's review has been provided below at Table 2. Table 2 shows that there is still a number of unknowns that could impact on the final costs required to implement the emerging preferred programme. As this project progresses through the different stages of the business case model, more details will be confirmed, allowing for the risks outlined in Table 2 to be understood in more detail / eliminated, and the final costs to be calculated more accurately.

Table 2 Terra Group's Risk Review of PBC Cost Analysis

Option number	Name	Description	Capital cost low	Capital cost high	Land Purchase	Associated time delays	Consenting	Associated time delays	Construction	Associated cost delays
2	Whites Line West Upgrade	A 500 m upgrade of Whites Line West to accommodate the new traffic, including new pavement and marking. Potential to create access islands for residential traffic, similar to Blenheim Road in Christchurch	$3,300,000	$5,000,000	No land purchase required as per scope	Nil	Possible delays in consenting process due to changes in scope, design change, and council/local authority's requirements	6 months	Possibility of inaccurate cost estimates, unrealistic tender amount, construction delays, weather, TMP requirements, stakeholder management and conflict between parties	Cost can significantly increase with time and cost overruns once the site is established. Prior investigation to identify works around underground services and potential clashes is important
3	Wakefield Street upgrade	A 1.25 km upgrade of Wakefield Street to accommodate the additional traffic. Reconfigure to 2 x 3.5 m lanes Likely to include a small residential access lane on the north east side, which may extend to industrial access. Shared path (2.5 m) on the north side	$7,700,000	$11,600,000	No land purchase required as per scope	Nil	Possible delays in consenting process due to changes in scope, design change, and council/local authority's requirements	8 months	Possibility of inaccurate cost estimates, unrealistic tender amount, construction delays, weather, TMP requirements, stakeholder management and conflict between parties	Cost to significantly increase with time overruns once the site is established. Prior investigation to identify works around underground services and potential clashes is important
4	Wakefield Street connection to Dowse Interchange	A 140 m long ramp and associated structure connecting Wakefield Street to Dowse Interchange - 2x3.5 + 2x1.5 = 10.0m wide. Potentially having a new roundabout between Dowse Interchange and the Hutt Road roundabout	$5,000,000	$7,500,000	Potential land purchase as per the scope. Legal requirements and public consultation required	12-18 months	Possible delays in consenting process due to changes in scope, design change, and council/local authority's requirements	12 months	Accounting risks associated with geotechnical investigations for the stabilisation of earth fill. Contractor to ensure the stability of the structure. Contractually, risks identified with inaccurate cost estimates, poor grade materials, procurement, unrealistic tender amount, TMP requirements, stakeholder management and conflict between parties.	Cost fluctuations due to poor design, stakeholder management, traffic control, health and safety and working around live services
5	Ava Bridge Replacement with Road Rail Bridge	A single 360 m long bridge on the existing bridge alignment with 2 x 3.5 m lanes, 2 railway lines, and a 3 m shared path = replacing the current Ava Rail Bridge. Connects into Wakefield Street in the West with a 250 m long connection.	$26,500,000	$39,750,000	Land purchase as per the scope. Legal requirements, public consultation and social aspects	12-18 months	Possible delays in consenting process due to changes in scope, design change, and council/local authority's requirements. Environmental aspects to be considered to construct over the river	12 months	Risks associated with bridge construction, liaison with relevant parties for approvals / preliminary investigations to construct over the river. Delays in material procurement and productivity. Planning risk associated with public transport and freight traffic.	Cost can significantly increase in line with resource management, procurement, inefficient details, accidents, high storm events & inconsistent weather and transport charges. Planning for extra bus routes during construction stage may be required

Option number	Name	Description	Capital cost low	Capital cost high	Land Purchase	Associated time delays	Consenting	Associated time delays	Construction	Associated cost delays
6	Whites Line West connection to the Randwick Road roundabout	Alterations to the Whites Lines and Randwick Road roundabout to enable traffic to travel west from the roundabout	$600,000	$1,200,000	No land purchase required as per scope	Nil	Possible delays in consenting process due to changes in scope, design change, and council/local authority's requirements	8-12 months	Possibility of unrealistic tender amount, construction delays, weather, TMP requirements, stakeholder management and conflict between parties.	Cost fluctuations expected due to insufficient details for working around underground services and TMP requirements
18	Road along Rail corridor from Parkside Road to Randwick Road	A new 1,150 m road along the old rail corridor with 2 x 3.0 m lanes. It connects into Randwick Road via York Street. New intersection control is likely to be via a roundabout	$6,200,000	$9,300,000	Land purchase as per the scope around the Parkside Road wetlands. Legal requirements, environmental impacts, public consultation and social aspects	12 - 18 months	Possible delays in consenting for ground improvements and earthworks. Time to allow for process due to changes in scope, design change, and council/local authorities requirements	8-12 months	risks associated with bridge construction, liaison with relevant parties for approvals / preliminary investigations to construct over the river. Delays in material procurement, soil stabilisation and remediation. Traffic control to be monitored.	Cost fluctuations in relation to the earthworks and soil stabilisation. Difference during construction stage to the preliminary investigations and findings. Material procurement and stand down times
20	Allow full movements at Gracefield Road/Wainuiomata Hill Road 'interchange'	This involves the creation of an westbound connection from Gracefield Road to Wainuiomata Hill Road as well as an eastbound connection form the Hill Road to Gracefield Road. The eastbound connection will require either a new tunnelled section, or widening of the existing	$7,800,000	$15,600,000	Potential land purchase as per the scope. Legal requirements and public consultation for tunnelling/widening options	12-18 months	Possible delays in consenting process due to changes in scope, design change, and council/local authority's requirements	12 months	Accounting risks associated with geotechnical investigations for the stabilisation of earth fill and mse walls. Contractor to ensure the stability of the structure. Contractually, risks identified with inaccurate cost estimates, poor grade materials, procurement, unrealistic tender amount, TMP requirements, stakeholder management and conflict between parties.	Cost fluctuations due to poor design/scope change/scope creep, stakeholder management, traffic control and live traffic, health and safety, working around live services and TMP management during construction
34	Improved cycling links at Ewen Bridge	This option improves the cycling connections at Ewen Bridge and the associated intersections / roundabouts on either side. The focus is on improving commuter trips but will capture all cyclists travelling on road, to and from Railway Avenue, Victoria Street, Queens Drive and Woburn Road. There is also opportunity to try and connect to the Hutt River Trail on both sides of the river through this option.	$350,000	$700,000	No land purchase required as per scope	Nil	Allow time for consenting and consultation. Possible changes in scope, design and future planning. Consultation with the council/local authorities	6-12 months	Risks associated with the construction cost estimates and project expectations. Traffic control is the major issue as the works will be carried out with live traffic operating in the adjacent lanes	Risk includes the implementation of water blasting and traffic management with live traffic. Stakeholder management and liaison with the respective authorities for corridor access. Road improvements or alterations to space to be confirmed prior to the construction

Option number	Name	Description	Capital cost low	Capital cost high	Land Purchase	Associated time delays	Consenting	Associated time delays	Construction	Associated cost delays
		This option will be primarily achieved through alterations to the road space and road marking								
42	Add bus priorities on the Esplanade plus amenity improvement options The Esplanade	Installation of bus priorities, chicanes/speed bumps along 2.5 km of The Esplanade. This can also work in conjunction with a bylaw preventing heavy vehicle access	$400,000	$1,000,000	No land purchase required as per scope	Nil	Allow time for consultation in conjunction with the public transport priorities and speed calming measures. Alternate traffic routes to be assessed for possible diversions and congestion	12 - 18 months	Risks associated with the construction of speed calming devices due to live traffic and detours required. Kerb and channel construction risk of material storage and construction traffic	Traffic management costs. Likelihood of damage to surrounding property/land contamination. Potential cost risk to allow for remediation of surroundings.
45	Extend a freight road from Parkside Road to Seaview Road	Convert the southern of the old rail network into a freight road (2 x 3.5 m), connecting Parkside Road and Seaview Road. This link is approximately 1,200 metres long	$4,400,000	$6,600,000	Land purchase as per the scope around the KiwiRail rail corridor. Legal requirements, environmental impacts, public consultation and social aspects	12 - 18 months	Possible delays in consenting for ground improvements and earthworks. Time to allow for process due to changes in scope, design change, and council/local authorities requirements	8-12 months	risks associated with constructing the three intersections to be managed around the risk highlighted in option 18 the Parkside Road intersection. Liaison with relevant parties for approvals / preliminary investigations for construction and management of the TTM. Delays in material procurement, soil stabilisation and remediation. Traffic control to be monitored	Cost fluctuations in relation to the earthworks and soil stabilisation. Difference during construction stage to the preliminary investigations and findings. Material procurement and stand down times
46	Hutt Rail Trail	A 2.5 km cycleway on the southern side of the Hutt Valley Rail Line connecting Hutt Road in the west to Randwick Road in the east, with connections to Cuba Street in Alicetown	$6,600,000	$9,900,000	Large land purchase as per the scope. Legal requirements, consultation with KiwiRail and social aspects	12-18 months	Possible delays in consenting process due to changes in scope, design change, KiwiRail and local authority's requirements. Environmental aspects to be considered to construct at the southern end of the line	12 months	Risks associated with bridge construction, liaison with relevant parties for approvals / preliminary investigations to check existing soil conditions and loading capacities. Delays in material procurement and productivity. Risk involved in maintaining the structural integrity of the existing structures	Cost can significantly increase in line with resource management, procurement, inefficient design and major bridge design complexity, inconsistent weather and transport charges. TTM inefficiency
48	Wakefield Street and Hutt Road roundabout	This involves the construction of a roundabout at the intersection of Wakefield Street and Hutt Road to improve connectivity as well as capacity if Wakefield Street is	$2,100,000	$3,200,000	No land purchase required as per scope	Nil	Risk for separate consents at various times may increase the cost of consenting and approvals. This should be accounted with the	8 months	Possibility of inaccurate cost estimates, unrealistic tender amount, construction delays, weather, TMP requirements, stakeholder management and conflict between parties.	Cost risk associated with the TTM, diversion of traffic, pedestrian safety and stakeholder management. Reinstatement of the surrounding area

Option number	Name	Description	Capital cost low	Capital cost high	Land Purchase	Associated time delays	Consenting	Associated time delays	Construction	Associated cost delays
		upgraded and traffic volumes through this intersection increase					Wakefield Street upgrade as discussed in option 2. Changes in scope and design may further increase the costs substantially			
50	Hutt Road / The Esplanade Roundabout to Hutt Road / Wakefield Street Intersection Active Mode Upgrades	This involves upgrading / widening the existing footpath to create an active mode area for pedestrians and cyclists	$6,400,000	$9,600,000	Potential land purchase required for bridge modifications. Legal requirements, consultation with KiwiRail and social aspects	12-18 months	Possible delays in consenting process due to changes in scope, design change, KiwiRail and local authority's requirements. Consultation and planning for future development to be connected to the proposed shared paths	12 months	Risks associated with bridge modifications, liaison with relevant parties for approvals / preliminary investigations to check existing soil conditions and loading capacities. Delays in material procurement and productivity. Risk involved in maintaining the structural integrity of the existing structures. TMP required on roads during construction	Cost can significantly increase in line with resource management, procurement, inefficient design and major bridge design complexity, inconsistent weather and transport charges. TTM inefficiency due to live road and pedestrian traffic during construction.
51	Hutt Road / The Esplanade Roundabout to Waione Street / Randwick Road Roundabout Active Mode Upgrades	This involves upgrading / widening the existing footpath to create an active mode area for pedestrians and cyclists	$3,000,000	$4,500,000	No land purchase required as per scope	12-18 months	Possible delays in consenting process for the bridge modification and its socio-economic aspects. Scope and design consultation with KiwiRail and local authority's planning for future development to be connected to the proposed shared paths	12 months	Risks associated with bridge modifications and liaison with relevant parties for approvals. Delays in material procurement and productivity of resources. Risk involved in maintaining the structural integrity of the existing bridge structure. TMP required on Seaview Road for the new paint marking. Live traffic and pedestrian safety risk as well as possibility of major congestions and delays	Cost can significantly increase in line with resource management, procurement, inefficient design and major bridge design complexity, inconsistent weather and transport charges. TTM inefficiency due to live road and pedestrian traffic during construction
52	Hutt Road / The Esplanade Roundabout	This involves modifying the existing roundabout and adjacent islands to provide a bus only lane	$600,000	$1,200,000	No land purchase required as per scope. Public land to be acquired for road widening	8-12 months	Consent process to be involved with works on the Esplanade or risk to time and cost overruns. Planning in conjunction with the public transport priorities	12 - 18 months	Risks associated with the construction of bus only lane, excavation along the existing berm area, underground and overhead services, live traffic and pedestrians. Risk of material storage and construction noise	Traffic management costs. Likelihood of damage to surrounding property/land contamination. Potential cost risk to allow for remediation of surroundings.
53	Cuba Street / Jackson Street Intersection	This involves modifying the existing traffic signals and paint marking to provide a bus priority lane There is no opportunity to	$100,000	$200,000	No land purchase required as per scope	6 months	Approval to be involved with the paint marking and signage for public transport priorities.	6 - 12 months	TTM, notification to the relevant stakeholders and public safety	Traffic management costs if any delays occur. Working around bollards and streetlights

Option number	Name	Description	Capital cost low	Capital cost high	Land Purchase	Associated time delays	Consenting	Associated time delays	Construction	Associated cost delays
		widen the carriageway to add in additional lanes					Specifications of the relevant scope			
54	Waione Street / Randwick Road Roundabout	This involves modifying the paint marking at the existing roundabout to provide a bus only lane	$20,000	$40,000	No land purchase required as per scope	6 months	Approval to be involved with the paint marking and signage for public transport priorities. Specifications of the relevant scope	6 - 12 months	TTM, notification to the relevant stakeholders and public safety	Traffic management costs if any delays occur. Working around bollards and streetlights
55	Whites Line East / Randwick Road Roundabout	This involves modifying the paint marking and islands at the existing roundabout to provide a bus only lane	$60,000	$120,000	No land purchase required as per scope	6 months	Approval to be involved with the paint marking and signage for public transport priorities. Specifications of the relevant scope	6 - 12 months	TTM, notification to the relevant stakeholders and public safety	Traffic management costs if any delays occur. Working around bollards and streetlights
56	Cuba Street on / off ramps	This involves constructing on / off ramps at the Cuba Street a part of the East / West multi-model corridor. Assuming the bridge over the railway line is to be re-constructed	$11,000,000	$17,000,000	Potential land purchase as per the scope. Legal requirements, public consultation and funding	12-18 months	Possible delays in consenting process due to changes in scope and complexities with the design, consultants to engage to rectify the queries with the council / local authority's requirements	12 months	Accounting risks associated with geotechnical investigations for the stabilisation of earth fill. Contractor to ensure the stability of the structure. Risks identified with inaccurate cost estimates, low graded materials, procurement, unrealistic expectations, estimated project costs, variations, TTM, stakeholder engagement and management and conflict between parties	Cost fluctuations due to design complexities causing stand down periods, stakeholder management, inefficient resources, lack of relevant technology and machinery, project scheduling and staging, large variations, traffic control, health and safety and working around live services
57	Whites Line East / Randwick Road roundabout	This involves the upgrading of the existing roundabout at the Whites Line East / Randwick Road intersection	$2,100,000	$3,200,000	Potential land acquisition for upgrading the existing road intersection / road corridor	12 months	Time for the consent and approval from local authorities. Specifications of the relevant scope and regulatory aspects	6 - 12 months	TTM, notification to the relevant stakeholders, public safety, working around overhead and live services. Construction. Noise and heavy operating machinery	Traffic management costs if any delays occur. Working around bollards and streetlights. Prior investigations for the surrounding services and infrastructure to avoid stand down periods
58	Mason Street / Randwick Road roundabout	This involves the construction of a roundabout at the Mason Street / Randwick Road intersection	$2,100,000	$3,200,000	Potential land acquisition for upgrading the existing road intersection / road corridor	12 months	Time for the consent and approval from local authorities. Specifications of the relevant scope and regulatory aspects	6 - 12 months	TTM, notification to the relevant stakeholders, public safety, working around overhead and live services. construction. noise and heavy operating machinery	Traffic management costs if any delays occur. Working around bollards and streetlights. Prior investigations for the surrounding services and infrastructure to avoid stand down periods

Option number	Name	Description	Capital cost low	Capital cost high	Land Purchase	Associated time delays	Consenting	Associated time delays	Construction	Associated cost delays
59	Parkside Road roundabout	This involves the construction of a roundabout where the railway line crosses Parkside Road	$2,100,000	$3,200,000	Potential land acquisition for upgrading the existing road intersection / road corridor	12 months	Time for the consent and approval from local authorities. Specifications of the relevant scope and regulatory aspects	6 - 12 months	TTM, notification to the relevant stakeholders, public safety, working around overhead and live services. construction. noise and heavy operating machinery	Traffic management costs if any delays occur. Working around bollards and streetlights. Prior investigations for the surrounding services and infrastructure to avoid stand down periods
60	Seaview Road roundabout	This involves the construction of a roundabout where the railway line crosses Seaview Road	$2,100,000	$3,200,000	Potential land acquisition for upgrading the existing road intersection / road corridor	12 months	Time for the consent and approval from local authorities. Specifications of the relevant scope and regulatory aspects	6 - 12 months	TTM, notification to the relevant stakeholders, public safety, working around overhead and live services. construction. noise and heavy operating machinery	Traffic management costs if any delays occur. Working around bollards and streetlights. Prior investigations for the surrounding services and infrastructure to avoid stand down periods