▪ report

Hutt Corridor Study Stage 2

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Hutt Corridor Study Stage 2

Prepared for
Wellington Regional Council

By
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Revision History

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A	Stephen Hewett	Draft	2 June 2002
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Action	Name	Signed	Date
Prepared by	Stephen Hewett		
Reviewed by	Andrew Murray		
Approved by	Robert Jamieson		

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1 Introduction

The Regional Land Transport Committee through the Wellington Regional Council have commissioned the Hutt Corridor Plan Study. This corridor links Wairarapa, Hutt Valley, Porirua, Kapiti and Wellington City. This is a multi-modal corridor with highways, major local roads, rail and bus services playing a major role in daily travel patterns.

The purpose, scope, objectives and methodology of the Study are set out in the document "Hutt Corridor Study Stage 1 Report, March 2002", and this document should be read in conjunction with the Stage 1 Report. This document outlines the preliminary strategic that can be confirmed for a Hutt Corridor Plan, as part of the Region's wider transport strategies.

This study was directed by a Technical group made up of officers from Wellington Regional Council, Transfund New Zealand, Transit New Zealand, Hutt City Council, Upper Hutt City Council, Masterton District Council, Porirua City Council and Wellington City Council. The technical group is chaired by Tony Brennand from the Wellington Regional Council.

1.1 Report Structure

The remainder of this report is structured as follows:

Section 2	Describes the indicators and assessment methodology;
Section 3	Describes the assessment of results for Stage 1 options;
Section 4	Describes the evaluation of individual projects;
Section 5	Details Stage 2 transport scenarios; and
Section 6	Assessment of results for Stage 2 options.

2 Indicators and Assessment Methodology

This section list the indicators against which the options in Stage 1 have been assessed and described the methodologies used in the assessments.

2.1 The Planning Balance Sheet Method

The Planning Balance Sheet (PBS) method is being used for all the Wellington Regional Transport Study to evaluate the options at each stage. Each option is scored against a series of indictors, applying weightings and summing the individual scores to obtain an overall score for each option.

Table 2.1 gives the possible range of scores used in the PBS method. Note that scores may differ depending on the criteria or weightings used.

Table 2.1

Planning Balance Sheet Scoring System

Description	Score
Adequately meets indicator	++
Partially meets indicator	+
Neutral with respect to indicator	0
Marginally fails to meet indicator	-
Fails to meet indicator	--

2.2 The Indicators

There are four main indicators used to assess the options. They are:

- Indicator 1: Accessibility and Economic Development
- Indicator 2: Affordability
- Indicator 3: Economic Efficiency
- Indicator 4: Sustainability

Table 2.2 gives the full set of indicators and Appendix A lists the indicators and the individual measures within each.

Table 2.2

Indicators

1. ACCESSIBILITY & ECONOMIC DEVELOPMENT
Motor Vehicle Statistics
Vehicle Travel Times to Airport (minutes):
Public Transport Statistics
Annual economic cost of congestion
2. AFFORDABILITY
5 year cost (Capital plus operating costs)
3. ECONOMIC EFFICIENCY
Benefit Cost Ratio
4. SUSTAINABILITY
Environment CO emissions
Fuel consumption
Safety
V/C Ratio

2.3 Methodology for Accessibility and Sustainability Indicators

This section briefly outlines the generic process used to assess the options with respect to:

- Indicator 1: Accessibility (To provide a transport system that optimises access to and within the region.)
- Indicator 4: Sustainability indicators (To provide a land transport system that:
  - Operates in a manner that recognises the needs of the community;
  - Avoids, remedies or mitigates adverse effects;
  - Uses resources in an efficient way; and
  - supports an optimal demand for energy.

The process involved two general steps:

- the options were assessed by individuals separately using their own specific methods (Authors evaluation only);
- the individuals met for a Delphi Session to discuss their individual scores and to agree the scores for the collective PBS (Yet to undertaken).

Several methods were used by individuals in the first step. These methods included:

- Combining of specific indicators using an objective process with or without weighting them to obtain a PBS numerical value;

- Assess whether scenarios meet or fail to meet the objectives of an indicator relative to the base, using all of the indicators or only those judged to be critical in differentiating between the options.

The scores for these indicators were allocated by splitting the results into 5 bands as given in Table 2.3 for the two main assessment methods.

Table 2.3

Allocating Scores for Indicators 1, and 4

Combining Indicators Objectively	Meet/Fail Assessment	Score
highest value	adequately meets indicator	++
intermediate value	partially meets indicator	+
1 (base)	neutral to indicator	0
intermediate value	marginally fails to meet indicator	-
lowest value	fails to meet indicator	- -

The Delphi Session involved:

- Calculating the average score for each indicator;
- Discussing variations between scores, with the reasoning behind scores explained;
- If a consensus was not reached quickly, undertaking further investigations, such as referring to the technical notes, until an agreed score became clear;
- Revisiting scores in the light of further evidence if necessary.

2.4 Methodology for Economic Efficiency Indicator

This section describes the methodology for determining Indicator 3, Economic Efficiency.

The specific indicator is total system use costs per person-kilometre and this is measured by the *Cost Benefit Ratio*. This is the ratio of the expected present value of the option benefits to the expected present value of the option costs, that is:

$$\text{Cost Benefit Ratio} = \text{NPV (Benefits - Costs + Tolls)} / \text{NPV Cost}$$

2.4.1 Benefits

The indicative benefits of each option have been calculated using the AM 2 hour and Interpeak 7-hour models. The Weekday daily benefits have been calculated as 2 times the AM peak plus 1.7 times the Interpeak periods modelled. The Weekend benefits have been calculated as 4 times the Interpeak benefits. The Annual benefits have been calculated as 240 weekdays and 60 weekend benefits. The 25 year benefits were calculated using a uniform series present worth factor of 9.524, which equates to 25 years from time zero. Time zero is assumed to be 2016, the year modelled. Because we are only using one model year of 2016 there is no growth assumed in the benefits calculation.

The calculation is:

1 weekday	= 2 * (AM peak outputs) + 1.7 * (Interpeak outputs)
1 weekend	= 4* (Interpeak outputs)
1 year	= 240 * 1 weekday + 60 * 1 weekend

2.4.2 Construction Costs

The construction costs of the options have been obtained from various feasibility-study reports, and technical review by Graham Ramsay, Beca. These and are given in Table 2.4 in 2001 dollars. Those costs estimated prior to the year 2001 have been factored to 2001 values to account for changes in the Consumer Price Index (CPI) as published by Statistics New Zealand.

Table 2.4

Construction Costs of Projects in Stage 1 Options

Project and Source	Option	Cost ($million)
■ Advance Traffic Management System (ATMS) ■ Melling Grade Separated Interchange ■ Silverstream Bridge Upgrade to 4 lanes	H1	19.7
■ Hutt Expressway High Occupancy Toll (HOT) Lane ■ Melling Grade Separated Interchange ■ Silverstream Bridge Upgrade to 4 lanes	H2	66.5
■ Hutt Expressway High Occupancy Toll (HOT) Lane	H2_2a	13
■ Hutt Expressway Tidal Flow Lane (Petone – Ngauranga); ■ Full Grade Separation at: – Melling – Belmont – Silverstream – Moonshine Road – Gibbons Street – Totara Park Road ■ Realignment of Petone Curve; ■ Whakatiki Street access to SH2 closed; and ■ Silverstream Bridge Upgrade to 4 lanes.	H3	212.2
■ Hutt Expressway Tidal Flow Lane (Petone – Ngauranga);	H3_2a	28

Project and Source	Option	Cost ($million)
■ Hutt Expressway High Occupancy Vehicle (HOV) Bus only lane (Petone – Ngauranga) ■ New Bus & Ferry Services & Routes between Hutt & Porirua	P1	39.4
■ Increased frequency and speed of rail services; and ■ New bus service between Hutt & Porirua.	P2	6.5
■ Melling Loop Light Rapid Transit (LRT); ■ Stokes Valley LRT; ■ New stations at Timberlea & Cruickshank Road; ■ Hutt Valley Heavy Rail Services; and ■ Wairarapa Services.	P3	32.6
■ Rail speeds increased; ■ Bus services between Hutt & Porirua; ■ Hutt Expressway HOV Bus only lane; ■ Wainuiomata Superbus network; and ■ Eastbourne Ferry Service doubled	P4	60.4
■ Petone – Grenada Link Road; and ■ Esplanade Upgrade.	X1	67.0
■ Melling – Porirua Link Road; and ■ Cross Valley Link: – Whites Line Road to Wakefield Bridge; – 4-lane road from Randwick Road to Dowse SH2 interchange.	X2	125.0
■ Melling – Porirua Link Road; ■ Melling Grade Separation; and ■ Randwick – Melling Link around the Lower Hutt CBD	X3	170.0
■ Belmont – Porirua Link Road; ■ Randwick – Cambridge Terrace – Belmont Link.	X4	155.0

2.4.3 Public Transport Capital Costs

Public transport capital costs are only included if a scenario results in less PT vehicles and this does not translate into a benefit.

The number of new buses and / or new double-carriage trains required in an option was calculated and the corresponding number required in the base subtracted. If the net result was positive, it was multiplied by the estimated cost of a new bus ($250,000) or two train car sets ($5,000,000).

2.4.4 Public Transport Operating Costs

Bus and train operating costs are calculated directly within the models and include those items not included in vehicle costs, such as labour costs.

2.4.5 Present Value Calculation

The net present values (NPV) of the benefits and costs were calculated over 25 years using 10% discount rate. That is:

$$NPV = Data^{yr} / (1 + r)^{yr}$$

The modelling was undertaken in only one future year, 2016, and the outputs for this year were assumed to be constant for 25 years.

2.4.6 Allocation of Scores

The scores for the Efficiency indicator were allocated by splitting the results into 5 bands as given in Table 2.5.

Table 2.5

Allocation of Efficiency Indicator Scores

Result (BCR)	Score
> 5.0	++
2.0 to 4.9	+
1.0 to 1.9	0
0 to 0.9	-
< -1.0	--

2.5 Methodology for Affordability Indicator

Affordability is measures by the plan for a land transport system that recognises funding constraints and the ability to pay. The target is for the 5 year costs not to exceed $250 million within the Wellington Region. It is assumed that $150 million is the target figure for this corridor.

The scores for the Affordability indicator were allocated by splitting the results into 4 or 5 bands as given in Table 2.6.

Table 2.6

Allocation of Affordability Indicator Scores

Total Option Cost ($)	Score
0 to $50M	++
$50M to $100M	+
	0
$100M to $150M	-
> $150M	--

3 Results of Assessment of Stage 1 Options

This section presents and comments on the results of the assessments of the Stage 1 options using the PBS methodology. Table 3.1 gives the results for all options and indicators. The results of the performance indicator tests are detailed in the following Tables in Appendix A:

- Table 5.1 – AM peak results
- Table 5.2 – AM peak results as % difference compared to the Base
- Table 5.3 – AM peak results as actual difference compared to the Base
- Table 5.4 – Interpeak results
- Table 5.5 – Interpeak results as % difference compared to the Base
- Table 5.6 – Interpeak results as actual difference compared to the Base
- Table 5.7 – The Benefit Cost Ratio for each option.

Table 3.1

Planning Balance Sheet Scores for Stage 1 Options

Indicators	Options													
	Base	**H1**	**H2**	**H2-2a**	**H3**	**H3_2a**	**X1**	**X2**	**X3**	**X4**	**P1b**	**P2**	**P3**	**P4**
1. Accessibility														
Motor Vehicle Statistics	**0**	**0**	**+**	**+**	**-**	**-**	**+**	**+**	**0**	**0**	**0**	**+**	**+**	**++**
Public Transport Statistics	**0**	**0**	**0**	**0**	**0**	**0**	**+**	**+**	**0**	**0**	**+**	**+**	**+**	**++**
Vehicle Travel times to Airport	**0**	**-**	**+**	**+**	**++**	**+**	**+**	**0**	**0**	**0**	**0**	**0**	**0**	**+**
2. Affordability														
5 year cost	**++**	**+**	**++**	**++**	**--**	**+**	**+**	**--**	**--**	**--**	**++**	**++**	**++**	**+**
3. Economic Efficiency														
Benefit Cost Ratio (BCR)	**0**	**--**	**-**	**0**	**-**	**0**	**+**	**0**	**-**	**-**	**0**	**++**	**-**	**0**
4. Sustainability														
Environment	**0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**+**	**+**	**+**	**+**
Fuel	**0**	**0**	**-**	**-**	**--**	**--**	**-**	**-**	**-**	**-**	**+**	**+**	**+**	**+**
Safety	**0**	**0**	**-**	**-**	**+**	**-**	**-**	**-**	**-**	**-**	**0**	**0**	**0**	**0**
V/C Ratios	**0**	**0**	**+**	**+**	**++**	**+**	**+**	**-**	**-**	**-**	**0**	**0**	**0**	**0**

4 Evaluation of Individual Projects

4.1 Passenger Transport Services

4.1.1 Wairarapa Service Improvements

The current Wellington Transport Strategic Model has no PT trips between the Wairarapa and Hutt or Wellington Cities. However, from our initial investigation of the 2001 Rimutaka screenline roadside interview survey and the 2002 Rail survey 340 people currently use the rail with some 2000 - 3000 people per day driving over the Rimutaka Range into Upper Hutt, Lower Hutt and Wellington City. There seems to be significant scope to improve patronage of the Wairarapa to Wellington rail services.

This improvement looks appropriate as part of an overall passenger transport strategy, but can only be evaluated fully when the new Wellington Transport Strategic model is available in May 2003.

Recommendation: Include as part of the overall passenger Transport improvement strategy

4.1.2 Eastbourne Ferry Service Improvement

Only 56 passengers were attached to this service by doubling the frequency. The model output does not support this improvement, as 56 passengers would not justify the additional ferry required to double the frequency during peak periods.

Recommendation: This PT improvements does not seem viable and should be dropped

4.1.3 Petone Ferry Service

The model estimates that this service would attach only three passengers. The delays to potential Petone passengers using either existing bus and rail services or cars is not sufficient to attached passengers of this new service.

Recommendation: This PT improvements does not seem viable and should be dropped

4.1.4 Seaview Ferry Service

The model estimates that this service would attach zero passengers. The delays to potential Seaview passengers using either existing bus and rail services or cars is not sufficient to attached passengers of this new service. In addition the catchment for this service is small.

Recommendation: This PT improvements does not seem viable and should be dropped

4.1.5 Superbus Services

The proposed Superbus network proposed included improved services that covered:

- Lower Hutt;
- Stokes Valley;
- Upper Hutt;
- Western Hills; and
- Wainuiomata.

(a) Lower Hutt

The Lower Hutt service only picks up passengers from the corner of Melling Link and High Street and then travels as an express into Wellington CBD. The services provide good penetration into the CBD but only attached 168 passengers and most were directly transferred from the Melling rail service. This service is in direct competition with the Melling rail service.

Recommendation: This PT improvements does not seem viable and should be dropped

(b) Stokes Valley

During the 2-hour morning peak period the proposed Stokes Valley services picks up 400 passengers from Stokes Valley Road and 160 from the corner of Melling Link and High Street and then travels as an express into Wellington CBD. The service provides good penetration into the CBD. This service also provides the same service as the proposed Lower Hutt service.

Recommendation: Include as part of the overall passenger Transport improvement strategy

(c) Upper Hutt

During the 2-hour morning peak period the proposed Upper Hutt services travel down the State Highway and picks up a total of 460 passengers from Akatarawa, Totara Park Road, Gibbons, Whakatiki Street, Moonshine Road and Silverstream Bridge, before expressing to Wellington CBD. The model shows that patronage for this service is a transfer from rail with few drivers and car passengers being attracted to this bus service. The potential benefits of this service should be discussed further with the Technical group.

Recommendation: Include as part of the overall passenger Transport improvement strategy

(d) Western Hills

The Western Hills service attached 337 passengers during the 2-hour morning peak period, but with most passengers directly transfer from the Melling rail service. This service is in direct competition with the Melling rail service. The service would reduce the number of rail passengers that drive their car to the rail station.

Promotion of this service would increase the subsidy as either the Melling or this proposed Western Hill buses would be commercially viable.

Recommendation: This PT improvement does not seem viable with the Melling rail service in place and should be dropped.

(e) Wainuiomata

During the 2-hour morning peak period the proposed Wainuiomata service picks up 760 passengers from Wainuiomata area and then travels as an express into Wellington CBD from the intersection of Wainuiomata Road and Parkway. The service provides good penetration into the CBD. This service does result in some passengers transferring from rail to bus, but does provide a good alternative to using the car from the Wainuiomata area. The current model does not model the benefits buses gain in bypassing delayed car traffic on The Esplanade during the peak morning period.

Recommendation: Include as part of the overall passenger Transport improvement strategy

4.1.6 Haywards Bus Service

The modelled service split between Upper Hutt, Lower Hutt and Porirua is estimated to carry the following passengers during the morning two-hour peak period with a headway of 30 minutes:

- Lower Hutt to Porirua 18 passengers
- Porirua to Lower Hutt 16 passengers
- Upper Hutt to Porirua 30 passengers
- Porirua to Upper Hutt 25 passengers

The current service between Upper Hutt and Porirua with a headway of 60 minutes was surveyed recently. The patronage flows recorded were:

Porirua to Upper Hutt

- AM peak 2 hours – 10 passengers
- Interpeak 7 hours – 4 passengers

Upper Hutt to Porirua

- AM peak 2 hours – 2 passengers
- Interpeak 7 hours – 13 passengers

This service would require a high subsidy, and does not compete efficiently with car travel. The viability and function of this service should be further discussed with the Technical Group.

Recommendation: This PT improvement does not seem viable. As the Upper Hutt to Porirua service is currently in operation with a high subsidy the Technical Group should discuss the strategic long-term viability of this service or the proposed additional service to Lower Hutt.

4.1.7 Increased Rail Speed and Doubled Rail Frequency

Increasing the rail speed by 10% and halving the headway of the current rail services showed that modal shift is sensitive to service frequency. Vehicle volumes on SH2 from Petone to Ngauranga only change by 70 vehicles, but rail passengers through this corridor have increased by 500 over the two hour AM peak period. This option is expected to produce $46 million in road user benefits and have an indicative BCR of 7.1.

The Wellington Regional Council have confirmed that existing track alignment can accommodate a 10% increase in speed safely.

Recommendation: Include as part of the overall passenger Transport improvement strategy

4.1.8 New Timberlea and Cruickshank Stations

During the morning two-hour peak period approximately 280 and 160 passengers were modelled accessing the rail at the proposed Timberlee and Cruickshank stations respectively, which was modelled with a service frequency of 15 minute headway.

These two new stations would be well utilised and provide improved access to the Wellington CBD and Lower Hutt.

Recommendation: Include as part of the overall passenger Transport improvement strategy

4.1.9 Petone to Ngauranga Capacity Improvements

The three capacity improvement projects evaluated in Stage 1:

(1) Tidal Flow;

(2) High Occupancy Toll Lane (HOT); and

(3) Bus Only Lane

have been evaluated separately to determine the individual BCR and the effect on auto traffic and Passenger Transport flows between Petone and Ngauranga. Table 4.1 and 4.2 provides a comparison of the vehicles and passenger transport flows between Petone and Ngauranga.

Table 4.1

AM 2-Hour Peak Southbound Trip Distribution through Petone - Ngauranga Corridor

Mode	Base	Tidal Flow	HOT	Expressway Bus Lane
Private Vehicles	8086	10439	9371	8068
Bus	141	501	360	727
Train	5998	5252	4834	5753

Table 4.2

AM 2-Hour Peak Northbound Trip Distribution through Petone - Ngauranga Corridor

Mode	Base	Tidal Flow	HOT	Expressway Bus Lane
Private Vehicles	6145	6703	6510	6195
Bus	138	145	141	140
Train	298	331	409	302

Table 4.3 compares these three capacity improvements.

Table 4.3

Petone - Ngauranga Corridor Improvement BCR's

Options	BCR AM & PM Flows	BCR AM Peak Flows
Tidal Flow	1.1	
HOT Lane	1.3	0.6
Hutt Expressway Bus Lane	0.2	0.1

Based on the AM flow only the HOT lane optimal annual toll value is estimated at around $520,000.

The Tidal flow project is estimated to attract approximately an extra 1000 vehicles into the Wellington CBD the remaining 1400 vehicle would travel to other area where parking is expected to be available. This will require additional car parking infrastructure. Assuming a rough order of cost of $25,000 per car park to construct and purchase land on the CBD fringe. The Tidal Flow project would require approximately $25,000,000 in car park infrastructure. This reduces the BCR to 1.1

The HOT lane is estimated to attract approximately an extra 650 vehicles into the Wellington CBD mostly due to a transfer from rail. The HOT project would require approximately $16,250,000 in car park infrastructure. This reduces the BCR to 1.3. However, if the toll revenue was included in the economic evaluation the cost was reduced increasing the BCR to 1.5.

The modelling shows that the Expressway Bus lane has little effect on attracting motorist from cars with the increase in bus patronage coming from rail. The main reasons why the model shows little effect in attracting motorists onto buses is that before the generalised cost for bus travel is compared to the generalised cost of auto travel, the model adds the generalised cost of rail travel and bus travel together to calculated the average generalised cost of PT travel. Therefore the benefit of improved bus travel is reduced by the averaging effect of combining rail travel.

We have analysed the generalised cost of travelling by bus and car from the Wainuiomata and Stokes Valley and the proposed super bus network plus Expressway Bus lane have a significant effect in reducing car travel to the Wellington CBD. However, these commuter cars are replaced by peak compression or induced auto trips to other areas. We believe

that the Expressway Bus only lane should generate significantly more benefits than currently been calculated.

Recommendation: Include the High Occupancy Toll and the Expressway Bus Lane as part of the overall passenger Transport improvement strategy.

4.1.10 Melling Rail Extension

Sinclair Knight Merz were commissioned to evaluate the feasibility of a Melling Rail extension, with Booz Allen Hamiton undertaking modelling using the current Wellington Regional model. Based on the Hutt City Council Melling Rail Extension Feasibility & Scheme Assessment Study Stage II Report, February 2001, the project sought to determine the feasibility of extending the Melling branch rail line across the Hutt River and / or linking the Melling branch rail line to the Wairarapa rail line at Waterloo Station using light rail through the streets of lower Hutt business central district.

The study evaluated eight options divided into three groups, with those options in each group having similar features in relation to operation and construction phasing. The groups are:

- Heavy Rail Extension of Melling line to east bank of river (2 options)
- Heavy Rail Extension of Melling line to east bank of river plus Light Rail link through Central Business District to Wairarapa line (3 options)
- Light Rail Link from Melling line direct to Wairarapa line, passing through the central business district (3 options)

The study recommended the option, which completes the loop from the Melling line to the Wairarapa line and provides excellent access to the CBD.

The likely operation on this link would be running light rail vehicles from Wellington Station, to Petone, Melling, through the Hutt Central Business District, Waterloo, then back to Petone and Wellington (or in the reverse direction).

For the Hutt Corridor Stage 1 strategic evaluation the Melling LRT loop was modelled with a two-way operation with a 20-minute headway from Melling to Waterloo Station. The model estimated that during the 2-hour AM peak:

- 49 passengers would use the LRT from Waterloo to Melling.
- 69 passengers would use the LRT from Melling to Lower Hutt CBD, with 22 passengers travelling from Melling to Waterloo.

As part of the Stage 2 evaluation the headway was increased from 20 minutes to 10 minutes. The model estimated that during the 2-hour AM peak:

- 62 passengers would use the LRT from Waterloo to Melling.
- 76 passengers would use the LRT from Melling to Lower Hutt CBD, with 38 passengers travelling from Melling to Waterloo.

The previous evaluation by Booz Allen Hamilton provided a similar result, in terms of the increase in PT trips during the AM peak 2-hour period. However, we do not believe the LRT loop can stack up with the lower projected patronage between the Melling and Wairarapa rail lines.

A summary of the key performance indicators is provided in Table 4.4.

Table 4.4

Summary of Key AM Peak Indicator for Melling LRT Loop (Headway 10 Minutes)

Key Indicator	*Base*	*Option P3*	*Percentage Difference*
Total Motor Vehicle Travel Time (hrs)	29678	29627	-0.2
Travel Time from Upper Hutt to Airport (hrs)	52.1	51.7	-0.8
Total Passenger Travel Time (hrs)	10939	12333	1.0
Estimated Cost		$12M	
BCR		0.8	
Total Number of Vehicle Trips	141026	140950	-0.1
Total number of Passenger Transport Trips	49921	49980	0.5
Cost of Congestion	78825	78448	-0.6

In our opinion the only potentially viable options would be to extend the Melling rail line across the river to improve access into the Hutt CBD.

As an alternative it would be more cost effective to provide a shuttle bus service from Waterloo and Melling Stations.

Recommendation: Based on the current modelling result the Melling Loop LRT does not seem to be viable, and therefore should not be evaluated further as part of the Hutt Corridor strategic transport improvements. However, we proposed to evaluate extending the Melling line across the river.

4.1.11 Stokes Valley LRT

For the Hutt Corridor Stage 1 strategic evaluation the Stokes Valley LRT was modelled with a 20-minute headway from Stokes Valley to Wellington joining the Wairarapa rail line north of Pomare Station. The model estimated that during the 2-hour AM peak:

- 154 passengers would use the LRT from Stokes Valley; and.
- 17 passengers to Stokes Valley.

As part of stage two of the evaluation the headway was increased from 20 minutes to 10 minutes. The model estimated that during the 2-hour AM peak:

- 370 passengers would use the LRT from Stokes Valley; and.
- 24 passengers to Stokes Valley.

A summary of the key performance indicators is provided in Table 4.5.

Table 4.5

Summary of Key AM Peak Indicator for Option Stokes Valley LRT (Headway 10 Minutes)

Key Indicator	*Base*	*Option P3*	*Percentage Difference*
Total Motor Vehicle Travel Time (hrs)	29678	29600	-0.3
Travel Time from Upper Hutt to Airport (hrs)	51.9	51.8	-0.5
Total Passenger Travel Time (hrs)	10939	12289	0.6
Estimated Cost		$6M	
BCR		1.4	
Total Number of Vehicle Trips	141026	140890	-0.2
Total number of Passenger Transport Trips	49921	50052	0.7
Cost of Congestion	78825	78241	-0.9

In our opinion the Stokes Valley bus network has better accessibility and penetration into the Wellington CBD at a lower cost.

Recommendation: Based on the current modelling result the Stokes Valley LRT does not seem to be viable, and therefore should not be evaluated further as part of the Hutt Corridor strategic transport improvements.

4.1.12 Hutt to Porirua Link Options

Bill Barclay has been commissioned to use the Hutt City Traffic model to test the local effects of:

Option X1 which includes the following improvements:

- Petone – Grenada Link Road; and
- Esplanade Upgrade.

Option X2 which includes the following improvements:

- Melling – Porirua Link Road; and
- Cross Valley Link:
  - Whites Line Road to Wakefield Bridge;
  - 4 lane road from Randwick Road to Dowse SH2

These option were coded into the Hutt Traffic Model as follows:

Option TT31 – Option X1

The base was modified to include:

- Grade separation at Koro Cr (no connection);
- Interchange at Dowse Drive;
- Petone-Grenada link road;
- Diamond interchange at Petone;
- 4 lanes on Esplanade and Estuary Bridge.
- Cuba St connection to Esplanade retained with high-capacity intersection. (BCHF Option X1)

Option TT41 – Cross Valley Link Only

- Grade separation at Koro Cr (no connection);
- Interchange at Dowse Drive
- Upgrade of Wakefield St with connection across river to Ludlam / Whites Line intersection;
- Roundabout at Hutt / Wakefield intersection with no modifications to Dowse interchange.

Option TT42 – Option X2 without Cross Valley Link

- Grade separation at Koro Crescent(no connection);
- Interchange at Dowse Drive;
- Melling-Porirua link road;
- New interchange at Melling with SH2 and Melling Bridge -Porirua link traffic grade separated;
- 4 lanes on Melling Bridge.

Option TT43 – Option X2 with Cross Valley Link

- Grade separation at Koro Crescent (no connection);
- Interchange at Dowse Drive;
- Upgrade of Wakefield St with connection across river to Ludlam / Whites Line intersection;
- Roundabout at Hutt / Wakefield intersection with no modifications to Dowse interchange;
- Melling-Porirua link road;
- New interchange at Melling with SH2 and Melling Bridge-Porirua link traffic grade separated;
- 4 lanes on Melling Bridge.

The Hutt Traffic model has been run for the years 2001 and 2016, for morning peak and interpeak periods. Trip matrices representing both fixed base matrix and induced travel conditions (derived from the Wellington Transport Strategic Model) have been applied.

Summary two-way flows on selected links for the morning peak hour for 2016 is shown in Tables 4.6.

Establishment of the Dowse interchange transfers a large amount of traffic from the Petone Ramps to Dowse. Much of this traffic is travelling to or from central parts of Lower Hutt rather than to Seaview, Eastbourne or Wainuiomata, and it will be seen that in the morning peak while flows immediately east of the Petone Ramps drop by over 1,000 vehicles per hour, at the Estuary Bridge the reduction is only around 100. Although flows at either end of the Esplanade are of similar magnitude, it is clear that relatively small proportions are travelling the full length.

Petone to Grenada Link

Addition of a Petone-Grenada link increases flows at Petone, but the majority of traffic from the new link uses SH2 and accesses the valley floor at Dowse Interchange. The Hutt model identifies that the Petone ramp merges would be at capacity in 2016 with this link road. Under induced traffic conditions flow on SH2 between Petone and Dowse (5490 vph) exceeds the capacity of a four lane road. Therefore this option would require 6 lanes between Petone and Dowse interchanges. Six laning through the Korokoro area is extremely difficult due to the Cemetery and Petone rail station. The extra traffic induced by the new link road would over load the proposed Dowse Interchanges as proposed.

Cross Valley Link

The interchange configuration, which Transit has adopted at Dowse Drive establishes an efficient cross-valley route using Hutt Road, Railway Avenue, Ewen Bridge and Woburn Road. This route will compete effectively with any new cross valley route on Wakefield Street if the new route is not connected directly to the interchange, and it will be seen that on the Option TT41 network (Cross Valley Road only) the new bridge only attracts a few hundred vehicles per hour. Its attractiveness is even worse if a new Porirua-Melling link is built, since some traffic previously travelling through Ngauranga will be diverted to Melling, away from the Dowse connection.

The finding that the Cross Valley Link has poor attractiveness for traffic contrasts with the conclusions of earlier studies, which found that it would carry flows equivalent to between 20,000 and 30,000 vehicles per day. Those studies however assumed a direct connection between SH2 and Wakefield Street, and relied on Victoria Street as a link to the Ewen Bridge. Under these conditions the new Cross Valley Link would be very efficient, and more successful in attracting traffic from both Estuary and Ewen Bridges.

Another important issue is whether Hutt Road or Victoria Street is used as the main link to Ewen Bridge. At present, both roads carry similar volumes of traffic, between 15,000 and 20,000 vehicles per day. The nature of the traffic however is quite different; on Hutt Road a

large proportion is travelling between central Lower Hutt and Wellington. Construction of an interchange at Dowse merely changes the point at which these vehicles transfer between SH2 and Hutt Road, and total volumes only increase by a modest amount. Victoria Street on the other hand carries mainly short-distance traffic between Lower Hutt and Petone, and if the interchange is connected there will be a substantial increase in flow, probably beyond the capacity of a two-lane road. The present proposal of connecting to Hutt Road makes effective utilisation of both roads within a two-lane regime, but at the same time reduces the effectiveness of a new bridge at Wakefield Street.

Melling – Porirua Link

A Porirua link terminating at Melling will further intensify pressure at Melling, already a major attraction point. The link will be used by many vehicles presently passing through Ngauranga, or using State Highway 58 and as a result there will be a transfer of traffic from Ewen Bridge to Melling, and to a lesser extent from the Cross Valley Link and Estuary Bridges. This link option removes the pressure on the Dowse Interchange, due to the unattractiveness. However, this is because fewer than expected vehicles are attached to use the Cross Valley Link if not directly connected to State Highway 2.

Summary

In summary the Petone – Grenada link road would overload the

- Petone on-ramps;
- The two lane on State Highway 2 between Petone and Dowse; and
- Hutt Road roundabout Dowse Interchange link approach and Hutt Road north approach.

The Melling interchange would be more complicated with the inclusion of the Melling to Porirua link road. If the Cross Valley link is only constructed between Whites Lines West and Wakefield Street with no connection to the State Highway 2. The Hutt model has predicted few vehicle being attracted to it. The Cross Valley link would need to be connected directly to SH2 at Dowse. This would require the Dowse interchange to be significantly altered.

Table 4.6

2016 morning peak hour two-way flows on selected links (vph)

Network:	Direction	TT10	TT11	TT31	TT31-I	TT41	TT43-F	TT43-I
Estuary Br	Eastbound	1160	1070	520	720	820	760	740
	Westbound	1590	1520	1690	2010	1340	1290	1240
Cross Valley Link Br	Eastbound					480	290	310
	Westbound					740	520	560
Ewen Br	Eastbound	2030	1950	2450	2600	1820	1760	2010
	Westbound	1930	2040	1750	2030	1540	1120	1210
Melling Br	Eastbound	1210	1350	1540	1820	1250	1860	2370
	Westbound	1270	1250	1270	1330	1220	1800	2220
Kennedy-Good Br	Eastbound	1230	1220	1030	1110	1210	860	1000
	Westbound	850	830	800	850	810	780	880
Silverstream Br	Eastbound	480	480	730	750	480	660	680
	Westbound	40	40	30	40	40	1014	20
Petone Interchange (E side)	Eastbound	2520	1710	660	1040	1750	1420	1490
	Westbound	601	220	1900	2880	240	210	270
Dowse Interchange (E side)	Northbound		1350	2530	2800	1370	1650	1760
	Southbound		1560	870	890	1650	1250	1500
SH2 Petone - Dowse	Northbound	1200	1840	4170	5490	1800	1790	1740
	Southbound	2270	2890	3200	3960	2970	2690	2710
SH2 Dowse - Melling	Northbound	1300	1480	1800	2310	1370	1640	1840
	Southbound	2000	1980	2200	2440	1940	2590	2780
SH2 Melling - Kennedy-Good	Northbound	1270	1320	1300	1400	1320	1460	1450
	Southbound	2850	2830	2670	2700	2830	2640	2670
SH2 Kennedy-Good - Manor Park	Northbound	1290	1440	1320	1400	1440	1230	1110
	Southbound	3060	3050	2620	2680	3060	2190	2180
SH2 Manor Park - Silverstream	Northbound	1120	1160	1220	1270	1160	1290	1290
	Southbound	2080	2080	2230	2260	2070	2270	2300

Note: TT31-F is the flows with the fixed base matrix. TT31-I is the flows with the induced matrix derived from the WTS model with the Option X1 included.

5 Stage II Transport Scenarios

Based on the Stage I evaluation of the transport packages and further evaluation of individual projects as discussed in section 3. The following modified options have been developed for the Hutt Corridor. These are outlined below and a full description of the coding assumptions made for each Stage 2 option, by period, for the EMME/2 modelling is shown in Appendix B. It should be noted that the improved Wairarapa rail service has not been modelled as the current model will not reflect the benefits of this improvement. However, the improved Wairarapa service should in our opinion be included in the improved passenger transport strategy.

5.1 Stage 2 Options

5.1.1 Option S1

This option is a combination of the Stage 1 options H1 +H2 + P2 + P3 modified to remove the ferry service improvements, the Lower Hutt and Western Hill services from the superbus network and Melling Loop and Stokes Valley LRT services.

Option S1 includes the following improvements:

- Hutt Expressway High Occupancy Toll (HOT) Lane;
- Melling Grade Separated Interchange;
- Silverstream Bridge Upgrade to 4 lanes;
- Haywards Bus Services;
- Double rail frequency and speed increase of 10%;
- New rail stations at Timberlea and Cruickshank Road and Heavy Rail Services; and
- Superbus network (Upper Hutt, Stokes Valley and Wainuiomata services only).

5.1.2 Option S2

This option is a combination of the Stage 1 options H1 + P4 modified to remove the Eastbourne ferry service improvement and the Lower Hutt and Western Hill services from the superbus network.

Option S2 includes the following improvements:

- Hutt Expressway Bus Lane + existing Bus Lane Services;
- Melling Grade Separated Interchange;
- Silverstream Bridge Upgrade to 4 lanes;
- Haywards Bus Services;
- Double rail frequency and speed increase of 10%;

- New rail stations at Timberlea and Cruickshank Road and Heavy Rail Services; and
- Superbus network (Upper Hutt, Stokes Valley and Wainuiomata services only).

5.1.3 Option S3

This option is an Option S2 but with the removal of the Hutt Expressway Bus lane and superbus network and inclusion of the Hutt Expressway Tidal Flow lane.

Option S3 includes the following improvements:

- Hutt Expressway Tidal Flow lane;
- Melling Grade Separated Interchange;
- Silverstream Bridge Upgrade to 4 lanes;
- Haywards Bus Services;
- Double rail frequency and speed increase of 10%; and
- New rail stations at Timberlea and Cruickshank Road and Heavy Rail Services.

5.1.4 Option S4

Option S4 includes the following improvements:

- Hutt Expressway High Occupancy Toll (HOT) Lane;
- Melling Grade Separated Interchange;
- Silverstream Bridge Upgrade to 4 lanes;
- Haywards Bus Services;
- Double rail frequency and speed increase of 10%;
- New rail stations at Timberlea and Cruickshank Road and Heavy Rail Services;
- Superbus network (Upper Hutt, Stokes Valley and Wainuiomata services only);
- Petone-Grenada Link; and
- Esplanade Upgrade.

5.1.5 Option S5

Option S5 includes the following improvements:

- Hutt Expressway High Occupancy Toll (HOT) Lane;
- Melling Grade Separated Interchange;
- Silverstream Bridge Upgrade to 4 lanes;
- Haywards Bus Services;
- Double rail frequency and speed increase of 10%;

- New rail stations at Timberlea and Cruickshank Road and Heavy Rail Services;
- Superbus network (Upper Hutt, Stokes Valley and Wainuiomata services only);
- Melling – Porirua Link Road: and
- Cross Valley Link:
  - Whites Line West to Wakefield Street;
  - 4 lane road from Randwick Road to Dowse SH2

5.1.6 Option S6

Option S6 includes the following improvements:

- Hutt Expressway High Occupancy Toll (HOT) Lane;
- Melling Grade Separated Interchange;
- Silverstream Bridge Upgrade to 4 lanes;
- Haywards Bus Services;
- Double rail frequency and speed increase of 10%;
- New rail stations at Timberlea and Cruickshank Road and Heavy Rail Services;
- Superbus network (Upper Hutt, Stokes Valley and Wainuiomata services only);
- Petone-Grenada Link; and
- Cross Valley Link:
  - Whites Line West to Wakefield Street;
  - 4 lane road from Randwick Road to Dowse SH2
- Extend Melling Line across river to CBD

5.2 Option S1

This option is based on an optional tolling scenario for the Hutt Expressway High Occupancy Toll (HOT) Lane and significantly improved Rail and Bus service.

We have corrected the negative way in which the current WTS model, models the benefits of Grade Separated Interchanges. However, the regional model is not designed to model the true benefits of grade separating intersection. We therefore have not included the cost of the proposed Melling Interchange as it incorrectly biases the BCR.

A summary of the key performance indicators is provided in Table 4.1. In addition, Table 4.2 provides a comparison of the vehicle and passenger transport flow through the Petone to Ngauranga corridor.

Table 4.1

Summary of Key AM Peak Indicator for Option S1

Key Indicator	Base	Option S1	Percentage Difference
Total Motor Vehicle Travel Time (hrs)	29677	28861	-2.8%
Travel Time from Upper Hutt to Airport (hrs)	52.1	44.3	-14.9%
Total Passenger Travel Time (hrs)	12216	12720	4.1%
Estimated Cost		$54.2M	
BCR		2.2	
Total Number of Vehicle Trips	141127	140510	-0.4%
Total number of Passenger Transport Trips	49720	51039	2.7%
Cost of Congestion	78924	70134	-11.1%

Table 4.1 shows that the travel time between Upper Hutt railway station and the Wellington Airport is 15% faster with the HOT lane and the cost of congestion over the regional network has reduced by 11%.

Assuming that this strategy could be constructed in 2 years in a preliminary BCR of 4.1 has been calculated. If the AM benefits for the HOT were only included the preliminary BCR could be expected to reduce to 3.6. The inclusion of the toll revenue in the economic evaluation would reduce the cost and therefore increase the BCR.

Table 4.2

AM 2-Hour Peak Southbound Trip Distribution through Petone – Ngauranga Corridor

Mode	Base	Option S1	Percentage Difference
State Highway 2 (Vehicles)	8086	7436	13%
HOT Lane (Vehicles)		1700	
Vehicle Passengers	3557	3220	-9%
Bus (Passengers)	141	1440	980%
Train (Passengers)	5998	5529	-9%
Total	17782	20062	13%

Table 4.2 shows that Option S1 increases vehicle flow between Petone and Ngauranga by 13% with train passenger flow reducing by 9%. The increased number of bus services and bus speed between Petone and Ngauranga has encouraged a 980% increase in bus passengers. This option with the tolled lane increases the number of vehicle by 13%, but vehicle passengers decrease by 10%. Vehicle passengers seem to be attached to the improved bus service. With this option the total southbound people flow between Petone and Ngauranga has increased by 11%.

It is estimated that 400 new car parks would need to be constructed within the Wellington CBD at a cost of $10million.

5.3 Option S2

This option is based on the Hutt Expressway Bus Only Lane and significantly improved Rail and Bus service.

A summary of the key performance indicators is provided in Table 4.3. In addition, Table 4.4 provides a comparison of the vehicle and passenger transport flow through the Petone to Ngauranga corridor.

Table 4.3

Summary of Key AM Peak Indicator for Option S2

Key Indicator	*Base*	*Option S2*	*Percentage Difference*
Total Motor Vehicle Travel Time (hrs)	29677	28889	-2.2%
Travel Time from Upper Hutt to Airport (hrs)	52.1	49.1	-5.6%
Total Passenger Travel Time (hrs)	12216	13074	7.0%
Estimated Cost		$47.5M	
BCR		2.1	
Total Number of Vehicle Trips	141127	139870	-0.9%
Total number of Passenger Transport Trips	49720	51836	4.3%
Cost of Congestion	78924	43687	-7.7%

Table 4.3 shows that the travel time between Upper Hutt railway station and the Wellington Airport is 6% faster with the Hutt Expressway Bus Lane and the cost of congestion over the regional network has reduced by 8%.

Assuming that this strategy could be constructed in 2 years a preliminary BCR of 4.2 has been calculated. If the AM benefits for the Bus only lane were only included the preliminary BCR could be expected to reduce to 3.0.

Table 4.4

AM 2-Hour Peak Southbound Trip Distribution through Petone – Ngauranga Corridor

Mode	*Base*	*Option S2*	*Percentage Difference*
State Highway 2 (Vehicles)	8086	7943	-2%
Vehicle Passengers	3557	3463	-3%
Bus (Passengers)	141	1997	1400%
Train (Passengers)	5998	5777	-4%
Total	17782	19180	8%

Table 4.4 shows that Option S2 decreases vehicle flow between Petone and Ngauranga by 2% with train passenger flow reducing by 4%. The increased number of bus services and bus speed between Petone and Ngauranga has encouraged a 1400% increase in bus

passengers. This option increases the total southbound people flow between Petone and Ngauranga by 8%, but carries these people in less vehicles.

Under this scenario the model predicts that only some 300 vehicles destined for the CBD are removed on the AM peak two hour period. A detailed analysis for the generalised cost and model split calculation has lead us to believe that the model is underestimating the number of drivers that would transfer to either a bus or train. However the model is predicting that people would be attached to live in the Hutt area because of the improved accessibility. This would explain the 8% increase in trips between Petone and Ngauranga in the AM peak period.

This option meets the requirements on Objective 1, Theme 1.1 of the RLTS.

5.4 Option S3

This option is based on Hutt Expressway Tidal Flow Lane and significantly improved Rail and Bus services.

A summary of the key performance indicators is provided in Table 4.5. In addition, Table 4.6 provides a comparison of the vehicle and passenger transport flow through the Petone to Ngauranga corridor.

Table 4.5

Summary of Key AM Peak Indicator for Option S3

Key Indicator	*Base*	*Option S3*	*Percentage Difference*
Total Motor Vehicle Travel Time (hrs)	29677	29261	-1.5
Travel Time from Upper Hutt to Airport (hrs)	52.1	42.2	-18.9
Total Passenger Travel Time (hrs)	12216	12247	0.25
Estimated Cost		$71.0M	
BCR		1.9	
Total Number of Vehicle Trips	141127	141311	-0.1
Total number of Passenger Transport Trips	49720	50142	0.9
Cost of Congestion	78924	44983	-8.5

Table 4.5 shows that the travel time between Upper Hutt railway station and the Wellington Airport is 19% faster with the HOT lane and the cost of congestion over the regional network has reduced by 9%. Assuming that this strategy could be constructed in 2 years and including the estimated $25 million to construct additional car parking the preliminary BCR has been calculated as 3.8.

Table 4.6

AM 2-Hour Peak Southbound Trip Distribution through Petone – Ngauranga Corridor

Mode	Base	Option S3	Percentage Difference
State Highway 2 (Vehicles)	8086	10470	30%
Vehicle Passengers	3557	4343	22%
Bus (Passengers)	141	383	270%
Train (Passengers)	5998	5690	-5%
Total	17782	20886	18%

Table 4.6 shows that Option S3 increases vehicle and passenger flow between Petone and Ngauranga by 30% and 22% respectively, with train passenger flow reducing by 5%. The increased number of bus services and bus speed between Petone and Ngauranga has encouraged a 270% increase in bus passengers. This option would increase the people travelling southbound in the morning peak two hour period by 18%.

The performance of the tidal flow lane is lower than the inclusion of the HOT and Bus only lane.

5.5 Option S4

This option is based on an optional tolling scenario for the Hutt Expressway High Occupancy Toll (HOT) Lane, significantly improved Rail and Bus services plus the Petone to Grenada Link to improve the connection between Hutt City and Porirua.

A summary of the key performance indicators is provided in Table 4.7. In addition, Table 4.8 provides a comparison of the vehicle and passenger transport flows through the Petone to Ngauranga corridor.

Table 4.7

Summary of Key AM Peak Indicator for Option S4

Key Indicator	Base	Option S4	Percentage Difference
Total Motor Vehicle Travel Time (hrs)	29677	29053	-2.2
Travel Time from Upper Hutt to Airport (hrs)	52.1	45.8	-12.0
Total Passenger Travel Time (hrs)	12216	12605	3.2
Estimated Cost		$111.5M	
BCR		1.7	
Total Number of Vehicle Trips	141127	141056	-0.1
Total number of Passenger Transport Trips	49720	50755	2.1
Cost of Congestion	78924	70152	-11.1

Table 4.7 shows that the travel time between Upper Hutt railway station and the Wellington Airport is 12% faster with the HOT lane and the cost of congestion over the regional network has reduced by 11%.

Assuming that this strategy could be constructed in 3 years a preliminary BCR of 3.1 has been calculated. If the AM benefits for the bus only lane were only included the preliminary BCR could be expected to reduce to 3.0.

Table 4.8

AM 2-Hour Peak Southbound Trip Distribution through Petone – Ngauranga Corridor

Mode	*Base*	*Option S4*	*Percentage Difference*
State Highway 2 (Vehicles)	8086	7427	0%
HOT Lane (Vehicles)		649	
Vehicle Passengers	3557	3675	3%
Bus (Passengers)	141	543	385%
Train (Passengers)	5998	5467	-9%
Total	17782	18741	5%

Table 4.8 shows that there is no increase in vehicle flow between Petone and Ngauranga, but with 3% increase in vehicle passengers (i.e. Occupancy has increased). Train passenger flow has reduced by 12%. The increased number of bus services and bus speed between Petone and Ngauranga has encouraged a 385% increase in bus passengers. This option would increase the people travelling southbound in the morning two hour period by 18%.

Table 4.9 details the vehicle flow using the Petone to Grenada Link Road.

Table 4.9

AM Peak Two Hour Traffic Flow on the Petone to Grenada Link Road

Direction	*Vehicles*	*Car Passengers*
Eastbound – Porirua to Hutt	3027	801
Westbound – Hutt to Porirua	2812	697

The addition of the Petone to Grenada Link Road seems to attract 1050 southbound vehicles (13%) between Petone and Ngauranga.

The number of vehicles using the Petone to Grenada link has reduced by some 2000 vehicle as part of this strategy from when modelled as a single improvement in Stage 1 as Option X1. This may explain why the BCR has drop with the inclusion of the strategic link road. Benefits only increased by $81million compared to $148million as a single improvement.

5.6 Option S5

This option is an alternative to Option S4 with Stage 1 Option X2 replacing Option X1.

A summary of the key performance indicators is provided in Table 4.10. In addition, Table 4.11 provides a comparison of the vehicle and passenger transport flow through the Petone to Ngauranga corridor.

Table 4.10

Summary of Key AM Peak Indicator for Option S5

Key Indicator	*Base*	*Option S5*	*Percentage Difference*
Total Motor Vehicle Travel Time (hrs)	29677	28854	-2.8
Travel Time from Upper Hutt to Airport (hrs)	52.1	44.9	-13.8
Total Passenger Travel Time (hrs)	12216	12471	2.1
Estimated Cost		$169.7M	
BCR		1.6	
Total Number of Vehicle Trips	141127	141365	0.2
Total number of Passenger Transport Trips	49720	50435	1.4
Cost of Congestion	78924	68252	-13.5

Table 4.10 shows that the travel time between Upper Hutt railway station and the Wellington Airport is 14% faster with the HOT lane and the cost of congestion over the regional network has reduced by 14%.

Table 4.11

AM 2-Hour Peak Southbound Trip Distribution through Petone – Ngauranga Corridor

Mode	*Base*	*Option S5*	*Percentage Difference*
State Highway 2 (Vehicles)	8086	7433	9%
HOT Lane (Vehicles)		1416	
Vehicle Passengers	3557	3959	11%
Bus (Passengers)	141	579	410%
Train (Passengers)	5998	5314	-12%
Total	17782	19796	11%

Table 4.11 shows that there is a 9% increase in vehicle flow between Petone and Ngauranga, with train passenger flow reducing by 12%. The increased number of bus services and bus speed between Petone and Ngauranga has encouraged a 410% increase in bus passengers. This option increases the total southbound people flow between Petone and Ngauranga by 11%.

Table 4.12 details the vehicle flow using the Petone to Grenada Link Road.

Table 4.12

AM Peak Two Hour Traffic Flow on the Melling to Porirua Link Road

Direction	Vehicles	Car Passengers
Eastbound – Porirua to Hutt	3520	963
Westbound – Hutt to Porirua	2702	599

The number of vehicles using the Melling to Porirua link has reduced by some 300 vehicles as part of this strategy from when modelled as a signal improvement in Stage 1 as Option X2.

However, with the inclusion of the Melling to Porirua link plus the Cross Valley link benefits were increased by $164million compared to $155million as a single improvement.

5.7 Option S6

This option is an alternative to Option S4 with the Petone Esplanade upgrade being replaced by the Cross Valley link and the Melling Rail line extended over the river to improve access to the Hutt CBD.

A summary of the key performance indicators is provided in Table 4.13. In addition, Table 4.14 provides a comparison of the vehicle and passenger transport flow through the Petone to Ngauranga corridor.

Table 4.13

Summary of Key AM Peak Indicator for Option S6

Key Indicator	Base	Option S6	Percentage Difference
Total Motor Vehicle Travel Time (hrs)	29677	28837	-3
Travel Time from Upper Hutt to Airport (hrs)	52.1	46.0	-12
Total Passenger Travel Time (hrs)	12216	12684	4
Estimated Cost		$157.8	
BCR		1.6	
Total Number of Vehicle Trips	141127	141001	-0.1
Total number of Passenger Transport Trips	49720	50906	2
Cost of Congestion	78924	68564	-13

Table 4.13 shows that the travel time between Upper Hutt railway station and the Wellington Airport is 12% faster with the HOT lane and the cost of congestion over the regional network has reduced by 13%. Taking account of the AM benefits only gives an indicative Benefits Cost Ratio (BCR) of approximately 2.0 for this option.

Table 4.14

AM 2-Hour Peak Southbound Trip Distribution through Petone – Ngauranga Corridor

Mode	Base	Option S4	Percentage Difference
State Highway 2 (Vehicles)	8086	7427	0%
HOT Lane (Vehicles)		672	
Vehicle Passengers	3557	3678	3%
Bus (Passengers)	141	571	404%
Train (Passengers)	5998	5645	-6%
Total	17782	18979	7%

Table 4.14 shows that there is no change in vehicle flow between Petone and Ngauranga, but vehicle passengers increase by 3%. Train passenger flow reduces by 6%. The increased number of bus services and bus speed between Petone and Ngauranga has encouraged a 404% increase in bus passengers. This option increases the total southbound people flow during the AM Peak period by 11%.

Table 4.15 details the vehicle flow using the Petone to Grenada Link Road.

Table 4.15

AM Peak Two Hour Traffic Flow on the Petone to Grenada Link Road

Direction	Vehicles	Car Passengers
Eastbound – Porirua to Hutt	3058	808
Westbound – Hutt to Porirua	2803	682

The number of vehicles using the Petone to Grenada link has reduced by some 1920 vehicle as part of this strategy from when modelled as a signal improvement in Stage 1 as Option X1 and 100 vehicles more than Option S4. The inclusion of the extension of the Melling rail line across the Hutt River to a new Hutt CBD station and the Cross Valley Link with a direct connection to State Highway 2 has increased the benefits for this project from $202 million to $343million.

It is our option that the extension of the Melling rail line across the Hutt river with good bus linkage could be a worthwhile project and would seem to have greater benefits than the proposed Melling loop LRT.

6 Results of Assessment for Stage 2 Options

This section presents and comments on the results of the assessments of the Stage 2 options using the PBS methodology. Table 6.1 gives the results for all options and indicators.

Table 6.1

Planning Balance Sheet Scores for Stage 2 Options

Indicators	Options						
	Base	S1	S2	S3	S4	S5	S6
1. Accessibility							
Motor Vehicle Statistics	0	+	+	+	++	++	++
Public Transport Statistics	0	+	++	0	+	+	+
Vehicle Travel times to Airport	0	++	+	0	+	+	+
2. Affordability							
5 year cost	0	+	++	+	-	- -	- -
3. Economic Efficiency							
Benefit Cost Ratio (BCR)	0	+	+	0	0	0	+
4. Sustainability							
Environment	0	+	+	+	+	+	+
Fuel	0	0	+	+	0	0	0
Safety	0	+	+	0	0	-	0
V/C Ratios	0	+	+	0	-	+	-

7 Conclusion

The Regional Land Transport Committee through the Wellington Regional Council have commissioned the Hutt Corridor Plan Study. This corridor links Wairarapa, Hutt Valley, Porirua, Kapiti and Wellington City. This is a multi-modal corridor with highways, major local roads, rail and bus services playing a major role in daily travel patterns.

The purpose, scope, objectives and methodology of the Study are set out in the document "Hutt Corridor Study Stage 1 Report, March 2002", and this document should be read in conjunction with the Stage 1 report. This document outlines the preliminary strategy that can be confirmed for a Hutt Corridor Plan, as part of the Region's wider transport strategies.

Six Stage 2 strategies were developed for the Stage 1 options modelled. Further analysis of the Stage 1 component found the following individual improvements should be analysed as part of a transport strategy for the Hutt Corridor. The transport and infrastructure improvements are:

- Wairarapa rail service
- Supers bus network from:
  - Stoke Valley;
  - Upper Hutt; and
  - Wainuiomata to the Wellington CBD
- Increase rail speed and double rail frequency
- New Stations at Timberlea and Cruickshank
- Capacity improvement between Petone and Ngauranga using either:
  - Tidal flow lane;
  - High Occupancy Vehicle Toll lane; or
  - Bus only lane.
- Melling rail extension across the Hutt River with a new Hutt CBD station.
- Hutt to Porirua Link on either the:
  - Petone to Grenada link alignment; or
  - Melling to Porirua Link Road alignment.

Each Stage two strategy was evaluated around the following core transport improvements:

- Melling Grade Separated Interchange;
- Silverstream Bridge Upgrade to 4 lanes;
- Haywards Bus Services;
- Double rail frequency and speed increase of 10%;

- New rail stations at Timberlea and Cruickshank Road and improved Heavy Rail Services; and
- Superbus network (Upper Hutt, Stokes Valley and Wainuiomata services only).

Table 7.1 summaries the capital cost, 25 year user benefits and Benefit Cost Ratios for each Stage 2 option.

Table 7.1

Stage 2 Benefit Cost Ratios

Option	*Capital Cost* *$M*	*25 Year User Benefits* *$M*	*BCR*
S1	54.2	121.8	2.2
S2	47.5	98.8	2.1
S3	71.0	134.0	1.9
S4	121.5	202.6	1.7
S5	179.7	286.0	1.6
S6	157.8	343.3	2.2

Based on the planning balance sheet, Strategy Option S2 with the Expressway bus only lane between Petone and Ngauranga seems to be the best overall option.

However, we believe that the High Occupancy Vehicle Lane Toll lane between Petone and Ngauranga could provide a better long-term solution, but would need more detailed investigation.

The Stage 2 analysis has also identified that the Petone to Grenada link road would require the widening of State Highway 2 between Petone and Dowse Interchanges to six lanes. This would be extremely difficult due to the location of the Cemetery and Petone rail station at Korokoro. The cost of this improvement has not been included, in the capital cost and it would decrease the BCR.

It would seem from the analysis that the Melling to Porirua link would be a better option. However, it has been identified through this analysis that if the Cross Valley link is not directly connected to State Highway 2 then this link does not provide the relief to Petone Esplanade and Ewen Bridge that one would expect. Direct connection to State Highway 2 would require the reconstruction of the proposed Dowse grade separated interchange.

Option S6 included the extension of the Melling rail line across the Hutt River to a new Station on the edge of the Hutt CBD. The analysis shows that this infrastructure improvement complements the core strategy improvements.

▪ Appendix A

Performance indicator test results and indicative BCR for each Stage 1 option

INDICATOR	Table 5.1 - AM Results (Note: Values are for the period 0700 to 0900)													
	Base	H1	H2	H3	P1	P2	P3	P4	X1	X2	X3	X4	X6	X7
ACCESSIBILITY														
Auto														
Total motor vehicle travel time (hrs)	29678	29705	29530	29572	29147	29305	29561	29024	29793	29786	29556	29804	29591	29694
Total motor vehicle travel distance ('000km)	1487	1486	1507	1546	1480	1481	1485	1478	1518	1511	1514	1514	1490	1488
Average vehicle network speed (km/hr)	50.1	50.0	51.0	52.3	50.8	50.5	50.2	50.9	50.9	50.7	51.2	50.8	50.3	50.1
Total auto trips spread from the peak	189	164	11	-286	63	110	151	51	-78	-16	-60	-24	178	177
Total vehicle hours below service level D	8435	8248	8629	8021	8253	8184	8356	8203	8712	8511	8281	8157	8386	8431
Auto Travel times to Airport (mins):														
CBD	9.9	9.9	9.9	10.0	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
Port	12.4	12.4	12.5	12.6	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4
Johnsonville to Airport	25.3	25.3	25.3	25.5	25.0	25.0	25.2	24.8	24.1	24.9	24.7	25.1	25.1	25.3
Porirua to Airport	32.4	32.5	32.3	32.1	31.9	32.0	32.3	31.7	33.5	31.9	31.6	32.5	32.3	32.5
Plimerton to Airport	38.8	38.9	38.6	38.4	38.2	38.3	38.7	38.1	39.9	38.3	38.1	38.9	38.7	38.9
Paraparaumu to Airport	54.2	54.3	54.0	53.8	53.7	53.8	54.1	53.5	55.2	53.8	53.5	54.3	54.1	54.2
West External to Airport	72.8	72.8	72.6	72.3	72.2	72.3	72.7	72.1	73.7	72.3	72.0	72.9	72.7	72.7
Lower Hutt to Airport	38.7	38.7	33.1	29.9	37.1	37.6	38.4	36.8	35.7	38.4	37.5	37.0	38.5	38.7
Upper Hutt to Airport	51.9	54.5	46.3	40.6	50.3	50.7	51.4	49.8	49.0	51.2	50.3	50.4	51.7	51.9
East External to Airport	117.8	115.5	112.3	105.8	116.2	116.6	117.3	115.7	114.9	117.2	116.3	116.4	117.7	117.8
Transit														
Total passenger travel time (hrs)	12125	12124	11901	11521	12582	12425	12406	12787	11958	11891	11952	11978	12124	12115
Total passenger travel distance ('000km)	426	426	412	399	452	449	438	462	417	413	417	417	426	425
Average passenger network speed (km/hr)	38.9	38.9	38.2	38.1	39.1	40.3	39.3	39.5	38.6	38.4	38.5	38.5	38.9	38.9
AFFORDABILITY														
Strategy Revenue ($)														
Toll	0	0	2087	0	0	0	0	0	0	0	0	0	0	0
Fare	75627	75590	74465	72155	82238	79360	76797	82363	74955	74174	74639	74736	75661	75575
Parking	114432	114460	116549	119633	112530	112981	113925	112069	115908	115612	115242	115379	114374	114478
Total	190060	190050	193101	191787	194768	192341	190722	194433	190863	189787	189881	190115	190035	190053
ECONOMIC EVALUATION														
Cross-valley-link-road user benefits	0	-175	3315	5809	4170	2458	1526	5293	9289	6272	5680	4542	51	80
Porirua-Hutt-link-road user benefits	0	-136	120	239	148	185	34	176	2985	5580	5863	5966	357	272
Non-link-road user benefits	0	-1139	3487	7855	5782	5951	2306	7355	2406	1399	2540	1920	375	165
Region-wide user benefits	0	-1450	6921	13902	10100	8594	3866	12824	14680	13251	14083	12428	783	517
SUSTAINABILITY														
Environment														
CO2 Emmissions (Tonnes)	379.1	379.0	382.5	387.6	375.1	376.0	378.1	374.0	385.8	383.9	382.7	384.5	378.9	379.4
CO Emmissions (Tonnes)	15.4	15.4	15.4	15.4	15.2	15.2	15.4	15.1	15.5	15.5	15.4	15.5	15.4	15.4
Fuel														
Fuel Consumption (Litres)	151654	151599	153006	155026	150034	150412	151257	149605	154339	153546	153062	153802	151566	151745
Safety														
Total Accident Cost ($)	45099	44643	45698	43313	44889	44894	45036	44810	46836	47397	47474	47470	45228	45138
General Statistics														
Total Number of motor vehicle trips	141026	140994	141618	142517	140343	140199	140720	140011	141985	142011	141920	141869	141050	141054
Total Number of passenger trips	50306	50289	50659	50977	50020	50026	50195	49916	50608	50602	50562	50564	50321	50318
Total Number of slow trips	47498	47547	47405	47287	47285	47217	47357	47164	47204	47315	47245	47248	47476	47486
Total Number of PT trips	49921	49943	49274	48490	51110	51204	50487	51625	49298	49130	49385	49376	49922	49908
Average motor vehicle trip length (km)	10.5	10.5	10.6	10.9	10.5	10.6	10.6	10.6	10.7	10.6	10.7	10.7	10.6	10.5
Cost of Congestion ($)	78825	78119	74574	72065	74845	76380	78111	74236	75111	76745	73818	75784	78297	78745
V/C Ratios														
Melling Bridge (WB)	0.77	0.76	0.00	0.00	0.76	0.75	0.77	0.76	0.75	0.87	0.00	0.82	0.78	0.77
SH2 South of SH58 (SB)	0.60	0.59	0.62	0.70	0.60	0.59	0.60	0.60	0.57	0.47	0.47	0.54	0.60	0.60
Kenn Good Bridge (WB)	0.85	0.85	0.91	1.04	0.85	0.85	0.86	0.85	0.81	0.95	0.89	0.68	0.85	0.85
Randwick Rd (SB)	0.76	0.76	0.76	0.74	0.76	0.75	0.75	0.76	0.90	0.71	0.38	0.36	0.76	0.76
Petone Esplanade (WB)	0.81	0.81	0.89	0.84	0.79	0.79	0.80	0.79	0.68	0.70	0.79	0.79	0.81	0.81
Hutt Rd South of Wakefield (SB)	0.49	0.49	0.53	0.53	0.51	0.50	0.49	0.51	0.68	0.43	0.42	0.46	0.49	0.49
SH2 Petone - Ngauranga (SB)	1.19	1.19	1.09	1.06	1.17	1.18	1.18	1.17	1.12	1.17	1.16	1.16	1.19	1.19
SH1 Ngauranga - Aotea Quay (SB)	0.81	0.81	0.85	0.90	0.80	0.81	0.81	0.80	0.82	0.83	0.82	0.82	0.81	0.81
SH1 Aotea Quay - Ngauranga (NB)	0.75	0.75	0.77	0.79	0.77	0.77	0.76	0.78	0.76	0.75	0.75	0.75	0.75	0.75

INDICATOR	Table 5.2 - AM Results - % Difference													
	Base	H1	H2	H3	P1b	P2	P3	P4	X1	X2	X3	X4	X6	X7
ACCESSIBILITY														
Auto														
Total motor vehicle travel time (hrs)	29678	0.09%	-0.50%	-0.36%	-1.79%	-1.26%	-0.39%	-2.20%	0.39%	0.36%	-0.41%	0.42%	-0.29%	0.05%
Total motor vehicle travel distance ('000km)	1487	-0.11%	1.32%	3.97%	-0.48%	-0.46%	-0.16%	-0.66%	2.04%	1.58%	1.77%	1.76%	0.16%	0.03%
Average vehicle network speed (km/hr)	50.1	-0.21%	1.83%	4.34%	1.33%	0.80%	0.23%	1.58%	1.64%	1.21%	2.19%	1.33%	0.46%	-0.02%
Total auto trips spread from the peak	189	-12.93%	-93.96%	-251.56%	-66.77%	-41.71%	-20.19%	-72.97%	-141.55%	-108.32%	-131.85%	-112.88%	-5.78%	-6.25%
Total vehicle hours below service level D	8435	-2.23%	2.29%	-4.91%	-2.16%	-2.98%	-0.94%	-2.76%	3.28%	0.89%	-1.83%	-3.30%	-0.58%	-0.06%
Auto Travel times to Airport (mins):														
CBD	10	-0.19%	0.34%	1.10%	-0.16%	-0.12%	-0.02%	-0.06%	0.19%	0.14%	-0.06%	0.23%	-0.06%	-0.09%
Port	12	-0.16%	0.48%	1.78%	-0.32%	-0.16%	-0.08%	-0.16%	0.32%	0.16%	0.00%	0.32%	-0.08%	-0.08%
Johnsonville to Airport	25	0.12%	0.20%	0.79%	-1.11%	-0.95%	-0.16%	-1.62%	-4.48%	-1.50%	-2.26%	-0.55%	-0.44%	0.16%
Porirua to Airport	32	0.19%	-0.56%	-1.17%	-1.73%	-1.48%	-0.28%	-2.19%	3.21%	-1.67%	-2.47%	0.19%	-0.31%	0.15%
Plimerton to Airport	39	0.15%	-0.54%	-1.13%	-1.49%	-1.29%	-0.26%	-1.88%	2.65%	-1.34%	-1.98%	0.28%	-0.28%	0.10%
Paraparaumu to Airport	54	0.11%	-0.39%	-0.85%	-1.05%	-0.90%	-0.18%	-1.33%	1.75%	-0.88%	-1.40%	0.17%	-0.18%	-0.11%
West External to Airport	73	0.08%	-0.29%	-0.63%	-0.80%	-0.67%	-0.14%	-0.99%	1.29%	-0.66%	-1.04%	0.12%	-0.14%	-0.12%
Lower Hutt to Airport	39	0.08%	-14.28%	-22.61%	-4.01%	-2.72%	-0.78%	-4.86%	-7.63%	-0.70%	-2.98%	-4.22%	-0.52%	0.18%
Upper Hutt to Airport	52	5.05%	-10.76%	-21.71%	-3.08%	-2.31%	-0.87%	-3.97%	-5.57%	-1.25%	-3.01%	-2.85%	-0.33%	-0.02%
East External to Airport	118	-1.95%	-4.67%	-10.19%	-1.36%	-1.02%	-0.42%	-1.78%	-2.46%	-0.51%	-1.27%	-1.19%	-0.08%	0.00%
Transit														
Total passenger travel time (hrs)	12125	-0.01%	-1.85%	-4.98%	3.77%	2.47%	2.31%	5.46%	-1.38%	-1.93%	-1.43%	-1.21%	-0.01%	-0.08%
Total passenger travel distance ('000km)	426	-0.02%	-3.19%	-6.39%	6.18%	5.40%	2.84%	8.45%	-1.97%	-3.12%	-2.18%	-2.04%	0.02%	-0.14%
Average passenger network speed (km/hr)	39	-0.01%	-1.80%	-2.15%	0.39%	3.43%	0.91%	1.57%	-0.78%	-1.47%	-0.97%	-1.01%	0.05%	-0.08%
AFFORDABILITY														
Strategy Revenue ($)														
Toll	0													
Fare	75627	-0.05%	-1.54%	-4.59%	8.74%	4.94%	1.55%	8.91%	-0.89%	-1.92%	-1.31%	-1.18%	0.04%	-0.07%
Parking	114432	0.02%	1.85%	4.54%	-1.66%	-1.27%	-0.44%	-2.06%	1.29%	1.03%	0.71%	0.83%	-0.05%	0.04%
Total	190060	-0.01%	1.60%	0.91%	2.48%	1.20%	0.35%	2.30%	0.42%	-0.14%	-0.09%	0.03%	-0.01%	0.00%
ECONOMIC EVALUATION														
Cross-valley-link-road user benefits	0													
Porirua-Hutt-link-road user benefits	0													
Non-link-road user benefits	0													
Region-wide user benefits	0													
SUSTAINABILITY														
Environment														
CO2 Emmissions (Tonnes)	379	-0.04%	0.89%	2.22%	-1.07%	-0.82%	-0.26%	-1.35%	1.77%	1.25%	0.93%	1.42%	-0.06%	0.06%
CO Emmissions (Tonnes)	15	0.08%	-0.39%	-0.14%	-1.75%	-1.21%	-0.38%	-2.14%	0.52%	0.43%	-0.29%	0.51%	-0.28%	0.05%
Fuel														
Fuel Consumption (Litres)	151654	-0.04%	0.89%	2.22%	-1.07%	-0.82%	-0.26%	-1.35%	1.77%	1.25%	0.93%	1.42%	-0.06%	0.06%
Safety														
Total Accident Cost ($)	45099	-1.01%	1.33%	-3.96%	-0.47%	-0.46%	-0.14%	-0.64%	3.85%	5.09%	5.27%	5.26%	0.28%	0.09%
General Statistics														
Total Number of motor vehicle trips	141026	-0.02%	0.42%	1.06%	-0.48%	-0.59%	-0.22%	-0.72%	0.68%	0.70%	0.63%	0.60%	0.02%	0.02%
Total Number of passenger trips	50306	-0.03%	0.70%	1.33%	-0.57%	-0.56%	-0.22%	-0.78%	0.60%	0.59%	0.51%	0.51%	0.03%	0.02%
Total Number of slow trips	47498	0.10%	-0.20%	-0.44%	-0.45%	-0.59%	-0.30%	-0.70%	-0.62%	-0.39%	-0.53%	-0.53%	-0.05%	-0.03%
Total Number of PT trips	49921	0.04%	-1.30%	-2.87%	2.38%	2.57%	1.13%	3.41%	-1.25%	-1.58%	-1.07%	-1.09%	0.00%	-0.03%
Average motor vehicle trip length (km)	10.5	-0.09%	0.90%	2.88%	0.00%	0.12%	0.06%	0.06%	1.35%	0.88%	1.13%	1.16%	0.14%	0.01%
Cost of Congestion ($)	78825	-0.90%	-5.39%	-8.58%	-5.05%	-3.10%	-0.91%	-5.82%	-4.71%	-2.64%	-6.35%	-3.86%	-0.67%	-0.10%
V/C Ratios														
Melling Bridge (WB)	1	-1.13%	-100.00%	-100.00%	-0.62%	-2.05%	-0.43%	-1.45%	-2.85%	13.44%	-100.00%	6.20%	1.03%	0.25%
SH2 South of SH58 (SB)	1	-1.04%	3.65%	16.07%	-0.52%	-1.09%	-0.93%	-0.90%	-5.69%	-21.94%	-21.60%	-10.87%	0.71%	0.28%
Kenn Good Bridge (WB)	1	-0.54%	6.76%	22.01%	-0.96%	-0.32%	0.43%	-0.77%	-4.92%	11.66%	4.47%	-20.09%	-0.32%	-0.17%
Randwick Rd (SB)	1	-0.07%	0.09%	-2.54%	-0.55%	-1.59%	-0.74%	-0.63%	18.68%	-6.15%	-49.65%	-52.94%	0.19%	0.04%
Petone Esplanade (WB)	1	-0.06%	9.91%	3.46%	-2.09%	-1.58%	-0.58%	-2.42%	-15.74%	-13.69%	-2.22%	-2.57%	-0.15%	-0.04%
Hutt Rd South of Wakefield (SB)	0	0.19%	7.74%	7.01%	3.26%	1.59%	0.70%	3.57%	39.17%	-13.23%	-14.28%	-5.55%	-0.24%	-0.01%
SH2 Petone - Ngauranga (SB)	1	0.02%	-7.88%	-10.88%	-1.35%	-0.87%	-0.24%	-1.61%	-5.81%	-1.67%	-2.18%	-2.28%	-0.20%	0.02%
SH1 Ngauranga - Aotea Quay (SB)	1	-0.03%	4.80%	11.01%	-1.24%	-0.84%	-0.20%	-1.33%	1.30%	1.66%	1.44%	1.16%	0.00%	0.00%
SH1 Aotea Quay - Ngauranga (NB)	1	-0.10%	2.87%	5.51%	2.74%	1.81%	0.72%	3.18%	1.05%	-0.58%	-0.90%	-0.33%	0.06%	0.00%

INDICATOR	Table 5.3 - AM Results - Actual Difference													
	Base	**H1**	**H2**	**H3**	**P1**	**P2**	**P3**	**P4**	**X1**	**X2**	**X3**	**X4**	**X6**	**X7**
ACCESSIBILITY														
Auto														
Total motor vehicle travel time (hrs)	29678	27	-148	-106	-531	-373	-117	-654	115	108	-122	126	-87	16
Total motor vehicle travel distance ('000km)	1487	-2	20	59	-7	-7	-2	-10	30	24	26	26	2	1
Average vehicle network speed (km/hr)	50.1	-0.1	0.9	2.2	0.7	0.4	0.1	0.8	0.8	0.6	1.1	0.7	0.2	0.0
Total auto trips spread from the peak	189	-24	-177	-475	-126	-79	-38	-138	-267	-204	-249	-213	-11	-12
Total vehicle hours below service level D	8435	-188	193	-414	-182	-251	-80	-233	277	75	-154	-278	-49	-5
Auto Travel times to Airport (mins):														
CBD	10	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port	12	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Johnsonville to Airport	25	0.0	0.1	0.2	-0.3	-0.2	0.0	-0.4	-1.1	-0.4	-0.6	-0.1	-0.1	0.0
Porirua to Airport	32	0.1	-0.2	-0.4	-0.6	-0.5	-0.1	-0.7	1.0	-0.5	-0.8	0.1	-0.1	0.0
Plimerton to Airport	39	0.1	-0.2	-0.4	-0.6	-0.5	-0.1	-0.7	1.0	-0.5	-0.8	0.1	-0.1	0.0
Paraparaumu to Airport	54	0.1	-0.2	-0.5	-0.6	-0.5	-0.1	-0.7	0.9	-0.5	-0.8	0.1	-0.1	-0.1
West External to Airport	73	0.1	-0.2	-0.5	-0.6	-0.5	-0.1	-0.7	0.9	-0.5	-0.8	0.1	-0.1	-0.1
Lower Hutt to Airport	39	0.0	-5.5	-8.7	-1.6	-1.1	-0.3	-1.9	-3.0	-0.3	-1.2	-1.6	-0.2	0.1
Upper Hutt to Airport	52	2.6	-5.6	-11.3	-1.6	-1.2	-0.4	-2.1	-2.9	-0.6	-1.6	-1.5	-0.2	0.0
East External to Airport	118	-2.3	-5.5	-12.0	-1.6	-1.2	-0.5	-2.1	-2.9	-0.6	-1.5	-1.4	-0.1	0.0
Transit														
Total passenger travel time (hrs)	12125	-2	-224	-604	457	300	280	662	-167	-235	-173	-147	-1	-10
Total passenger travel distance ('000km)	426	0	-14	-27	26	23	12	36	-8	-13	-9	-9	0	-1
Average passenger network speed (km/hr)	38.9	0.0	-0.7	-0.8	0.2	1.3	0.4	0.6	-0.3	-0.6	-0.4	-0.4	0.0	0.0
AFFORDABILITY														
Strategy Revenue ($)														
Toll	0	0	2087	0	0	0	0	0	0	0	0	0	0	0
Fare	75627	-37	-1162	-3473	6610	3733	1170	6736	-673	-1453	-988	-891	34	-52
Parking	114432	27	2117	5200	-1902	-1451	-508	-2363	1476	1180	810	947	-58	45
Total	190060	-10	3041	1727	4708	2281	662	4373	804	-273	-178	55	-25	-7
ECONOMIC EVALUATION														
Cross-valley-link-road user benefits	0	-175	3315	5809	4170	2458	1526	5293	9289	6272	5680	4542	51	80
Porirua-Hutt-link-road user benefits	0	-136	120	239	148	185	34	176	2985	5580	5863	5966	357	272
Non-link-road user benefits	0	-1139	3487	7855	5782	5951	2306	7355	2406	1399	2540	1920	375	165
Region-wide user benefits	0	-1450	6921	13902	10100	8594	3866	12824	14680	13251	14083	12428	783	517
SUSTAINABILITY														
Environment														
CO2 Emmissions (Tonnes)	379	0	3	8	-4	-3	-1	-5	7	5	4	5	0	0
CO Emmissions (Tonnes)	15	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel														
Fuel Consumption (Litres)	151654	-55	1352	3372	-1619	-1242	-397	-2049	2685	1892	1408	2148	-88	91
Safety														
Total Accident Cost ($)	45099	-456	599	-1786	-210	-206	-63	-290	1737	2297	2375	2371	128	39
General Statistics														
Total Number of motor vehicle trips	141026	0 -32	592	1491	-683	-827	-306	-1015	959	985	894	843	24	28
Total Number of passenger trips	50306	0 -17	353	671	-286	-280	-111	-390	302	296	256	258	15	12
Total Number of slow trips	47498	0 49	-93	-211	-213	-281	-141	-334	-294	-183	-253	-250	-22	-12
Total Number of PT trips	49921	0 22	-647	-1431	1189	1283	566	1704	-623	-791	-536	-545	1	-13
Average motor vehicle trip length (km)	10.55	-0.01	0.10	0.30	0.00	0.01	0.01	0.01	0.14	0.09	0.12	0.12	0.02	0.00
Cost of Congestion ($)	78825	-706	-4250	-6760	-3980	-2444	-714	-4589	-3714	-2080	-5006	-3041	-528	-80
V/C Ratios														
Melling Bridge (WB)	0.8	-0.01	-0.77	-0.77	0.00	-0.02	0.00	-0.01	-0.02	0.10	-0.77	0.05	0.01	0.00
SH2 South of SH58 (SB)	0.6	-0.01	0.02	0.10	0.00	-0.01	-0.01	-0.01	-0.03	-0.13	-0.13	-0.07	0.00	0.00
Kenn Good Bridge (WB)	0.9	0.00	0.06	0.19	-0.01	0.00	0.00	-0.01	-0.04	0.10	0.04	-0.17	0.00	0.00
Randwick Rd (SB)	0.8	0.00	0.00	-0.02	0.00	-0.01	-0.01	0.00	0.14	-0.05	-0.38	-0.40	0.00	0.00
Petone Esplanade (WB)	0.8	0.00	0.08	0.03	-0.02	-0.01	0.00	-0.02	-0.13	-0.11	-0.02	-0.02	0.00	0.00
Hutt Rd South of Wakefield (SB)	0.5	0.00	0.04	0.03	0.02	0.01	0.00	0.02	0.19	-0.07	-0.07	-0.03	0.00	0.00
SH2 Petone - Ngauranga (SB)	1.2	0.00	-0.09	-0.13	-0.02	-0.01	0.00	-0.02	-0.07	-0.02	-0.03	-0.03	0.00	0.00
SH1 Ngauranga - Aotea Quay (SB)	0.8	0.00	0.04	0.09	-0.01	-0.01	0.00	-0.01	0.01	0.01	0.01	0.01	0.00	0.00
SH1 Aotea Quay - Ngauranga (NB)	0.8	0.00	0.02	0.04	0.02	0.01	0.01	0.02	0.01	0.00	-0.01	0.00	0.00	0.00

Table 5.4 - IP Results (Note: Values are for the period 0900 to 1600)

INDICATOR	Base	H1	H2	H3	P1	P2	P3	P4	X1	X2	X3	X4	X6	X7
ACCESSIBILITY														
Auto														
Total motor vehicle travel time (hrs)	55305	55475	55828	56066	55402	55340	55358	55385	56034	56019	56093	56152	55296	55271
Total motor vehicle travel distance ('000km)	3664	3655	3687	3721	3671	3668	3668	3671	3733	3724	3728	3725	3670	3658
Average vehicle network speed (km/hr)	66.3	65.9	66.0	66.4	66.3	66.3	66.3	66.3	66.6	66.5	66.5	66.3	66.4	66.2
Total auto trips spread from the peak	194	172	14	-282	71	119	168	55	-65	-8	-69	-6	180	187
Total vehicle hours below service level D	208	212	180	250	216	214	207	211	202	232	87	248	214	205
Auto Travel times to Airport (mins):														
CBD	8.3	8.3	8.3	8.2	8.3	8.3	8.3	8.3	8.3	8.3	8.2	8.3	8.3	8.3
Port	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
Johnsonville to Airport	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.5	15.6	15.5	15.6	15.6	15.6
Porirua to Airport	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3
Plimerton to Airport	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1
Paraparaumu to Airport	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	41.9	42.0	42.0	41.9
West External to Airport	61.6	61.6	61.7	61.7	61.7	61.7	61.7	61.7	61.7	61.7	61.6	61.7	61.6	61.6
Lower Hutt to Airport	18.6	18.5	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6
Upper Hutt to Airport	28.5	32.5	28.5	28.9	28.5	28.6	28.5	28.6	28.5	28.5	28.5	28.5	28.5	28.5
East External to Airport	94.6	94.5	94.6	94.4	94.6	94.6	94.6	94.7	94.6	94.6	94.6	94.6	94.6	94.6
Transit														
Total passenger travel time (hrs)	6408	6291	6264	6332	6379	6407	6596	6613	6283	6270	6327	6409	6410	6407
Total passenger travel distance ('000km)	218	213	212	215	219	221	221	225	212	210	212	217	218	218
Average passenger network speed (km/hr)	36.7	36.3	36.4	36.4	36.9	37.1	36.2	36.6	36.3	36.0	36.1	36.5	36.7	36.6
AFFORDABILITY														
Strategy Revenue ($)														
Toll	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fare	45163	44501	44150	44692	45822	46143	45813	46571	44515	44310	44827	45091	45171	45157
Parking	203023	203213	203736	203722	203160	202794	202935	202751	203437	203402	203158	203163	203056	203053
Total	248186	247714	247885	248414	248983	248937	248747	249323	247952	247712	247985	248253	248226	248210
ECONOMIC EVALUATION														
Cross-valley-link-road user benefits	0	-1329	-704	-1165	-520	-250	313	-369	7899	6896	4573	2625	-59	-22
Porirua-Hutt-link-road user benefits	0	-560	59	23	1692	1695	32	1762	3846	6996	7368	7048	778	371
Non-link-road user benefits	0	-2802	-903	-1727	-469	-342	-222	134	1354	1419	2062	3217	99	-78
Region-wide user benefits	0	-4691	-1547	-2869	703	1103	123	1527	13099	15311	14003	12890	818	271
SUSTAINABILITY														
Environment														
CO2 Emmissions (Tonnes)	826.9	827.1	834.6	838.6	828.5	827.6	827.7	828.3	841.1	838.8	840.1	840.0	827.4	826.0
CO Emmissions (Tonnes)	29.1	29.2	29.4	29.5	29.2	29.2	29.2	29.2	29.5	29.5	29.6	29.6	29.1	29.1
Fuel														
Fuel Consumption (Litres)	330757	330854	333833	335455	331380	331052	331084	331320	336427	335502	336021	336013	330950	330404
Safety														
Total Accident Cost ($)	103421	102064	104342	96834	103681	103596	103567	103680	107540	108433	108613	108667	103604	103204
General Statistics														
Total Number of motor vehicle trips	364670	364564	365096	364920	364073	363800	364533	363761	366042	366105	366012	365837	364737	364692
Total Number of passenger trips	81505	81483	81721	81835	81564	81552	81554	81575	81991	81955	81936	81883	81525	81523
Total Number of slow trips	128779	129050	128283	127759	128417	128455	128633	128304	127220	127436	127300	127479	128705	128742
Total Number of PT trips	38032	37833	37626	37691	38236	38361	38115	38429	37512	37460	37617	37731	38015	38024
Average motor vehicle trip length (km)	10.0	10.0	10.1	10.2	10.1	10.1	10.1	10.1	10.2	10.2	10.2	10.2	10.1	10.0
Cost of Congestion ($)	10185	10253	11454	12274	10784	10587	10405	10704	9242	10791	9402	10659	10378	10092
V/C Ratios														
Melling Bridge (WB)	0.67	0.66	0.00	0.00	0.67	0.67	0.67	0.67	0.69	0.80	0.00	0.78	0.67	0.67
SH2 South of SH58 (SB)	0.28	0.27	0.28	0.29	0.28	0.28	0.28	0.28	0.26	0.25	0.23	0.25	0.28	0.28
Kenn Good Bridge (WB)	0.55	0.55	0.59	0.59	0.55	0.55	0.55	0.55	0.58	0.57	0.58	0.36	0.55	0.55
Randwick Rd (SB)	0.44	0.44	0.44	0.43	0.44	0.44	0.44	0.44	0.43	0.42	0.18	0.17	0.44	0.44
Petone Esplanade (WB)	0.31	0.31	0.33	0.32	0.31	0.30	0.31	0.31	0.27	0.20	0.27	0.28	0.31	0.31
Hutt Rd South of Wakefield (SB)	0.27	0.27	0.31	0.29	0.28	0.28	0.27	0.28	0.38	0.28	0.26	0.28	0.27	0.28
SH2 Petone - Ngauranga (SB)	0.62	0.62	0.44	0.48	0.64	0.63	0.62	0.64	0.56	0.60	0.60	0.60	0.62	0.62
SH1 Ngauranga - Aotea Quay (SB)	0.35	0.35	0.36	0.36	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
SH1 Aotea Quay - Ngauranga (NB)	0.87	0.87	0.88	0.90	0.87	0.87	0.87	0.88	0.87	0.87	0.87	0.87	0.87	0.87

INDICATOR	Table 5.5 - IP Results - % Difference													
	Base	H1	H2	H3	P1	P2	P3	P4	X1	X2	X3	X4	X6	X7
ACCESSIBILITY														
Auto														
Total motor vehicle travel time (hrs)	55305	0.31%	0.95%	1.38%	0.18%	0.06%	0.10%	0.14%	1.32%	1.29%	1.42%	1.53%	-0.02%	-0.06%
Total motor vehicle travel distance ('000km)	3664	-0.24%	0.62%	1.54%	0.19%	0.10%	0.10%	0.17%	1.88%	1.64%	1.74%	1.65%	0.15%	-0.18%
Average vehicle network speed (km/hr)	66.3	-0.55%	-0.32%	0.16%	0.01%	0.04%	0.01%	0.03%	0.55%	0.35%	0.31%	0.12%	0.17%	-0.12%
Total auto trips spread from the peak	194	-11.21%	-92.66%	-245.63%	-63.31%	-38.55%	-13.13%	-71.42%	-133.59%	-104.03%	-135.76%	-103.15%	-7.24%	-3.41%
Total vehicle hours below service level D	208	1.56%	-13.60%	19.98%	3.84%	2.46%	-0.59%	1.05%	-2.85%	11.30%	-58.41%	19.11%	2.58%	-1.47%
Auto Travel times to Airport (mins):														
CBD	8	0.00%	0.08%	-0.11%	-0.08%	0.16%	0.15%	0.15%	0.08%	0.01%	-0.15%	-0.01%	0.04%	0.15%
Port	10	0.00%	0.10%	-0.10%	-0.10%	0.10%	0.10%	0.10%	0.10%	0.00%	-0.10%	0.00%	0.00%	0.10%
Johnsonville to Airport	16	0.00%	0.32%	0.26%	0.13%	0.19%	0.06%	0.19%	-0.45%	0.06%	-0.19%	0.00%	0.00%	0.00%
Porirua to Airport	21	-0.05%	0.19%	0.14%	0.05%	0.09%	0.00%	0.14%	0.19%	0.09%	-0.05%	0.05%	-0.05%	0.00%
Plimerton to Airport	27	-0.04%	0.15%	0.07%	0.04%	0.07%	0.00%	0.11%	0.11%	-0.04%	-0.15%	-0.04%	0.00%	0.00%
Paraparaumu to Airport	42	-0.02%	0.10%	0.07%	0.02%	0.05%	0.00%	0.07%	0.07%	0.02%	-0.05%	0.00%	-0.02%	-0.05%
West External to Airport	62	-0.02%	0.06%	0.05%	0.03%	0.05%	0.02%	0.06%	0.06%	0.02%	-0.02%	0.02%	0.00%	-0.15%
Lower Hutt to Airport	19	-0.05%	0.49%	0.38%	0.16%	0.16%	0.05%	0.27%	0.16%	0.16%	0.49%	0.05%	0.00%	0.00%
Upper Hutt to Airport	29	13.85%	-0.07%	1.26%	0.11%	0.14%	0.04%	0.18%	0.11%	0.00%	-0.18%	0.00%	0.00%	-0.04%
East External to Airport	95	-0.10%	-0.02%	-0.22%	0.02%	0.03%	0.01%	0.04%	0.03%	-0.01%	-0.05%	0.00%	0.00%	-0.02%
Transit														
Total passenger travel time (hrs)	6408	-1.83%	-2.25%	-1.19%	-0.46%	-0.02%	2.92%	3.19%	-1.96%	-2.16%	-1.27%	0.01%	0.03%	-0.02%
Total passenger travel distance ('000km)	218	-2.43%	-3.02%	-1.56%	0.32%	1.24%	1.33%	2.93%	-2.75%	-3.57%	-2.66%	-0.55%	0.05%	-0.05%
Average passenger network speed (km/hr)	37	-0.88%	-0.84%	-0.58%	0.55%	1.08%	-1.24%	-0.04%	-1.04%	-1.69%	-1.67%	-0.49%	0.02%	-0.03%
AFFORDABILITY														
Strategy Revenue ($)														
Toll	0													
Fare	45163	-1.47%	-2.24%	-1.04%	1.46%	2.17%	1.44%	3.12%	-1.44%	-1.89%	-0.75%	-0.16%	0.02%	-0.01%
Parking	203023	0.09%	0.35%	0.34%	0.07%	-0.11%	-0.04%	-0.13%	0.20%	0.19%	0.07%	0.07%	0.02%	0.02%
Total	248186	-0.19%	-0.12%	0.09%	0.32%	0.30%	0.23%	0.46%	-0.09%	-0.19%	-0.08%	0.03%	0.02%	0.01%
ECONOMIC EVALUATION														
Cross-valley-link-road user benefits	0	0												
Porirua-Hutt-link-road user benefits	0	0												
Non-link-road user benefits	0	0												
Region-wide user benefits	0	0												
SUSTAINABILITY														
Environment														
CO2 Emmissions (Tonnes)	827	0.03%	0.93%	1.42%	0.19%	0.09%	0.10%	0.17%	1.71%	1.43%	1.59%	1.59%	0.06%	-0.11%
CO Emmissions (Tonnes)	29	0.30%	0.96%	1.38%	0.20%	0.08%	0.10%	0.17%	1.33%	1.34%	1.46%	1.54%	0.00%	-0.07%
Fuel														
Fuel Consumption (Litres)	330757	0.03%	0.93%	1.42%	0.19%	0.09%	0.10%	0.17%	1.71%	1.43%	1.59%	1.59%	0.06%	-0.11%
Safety														
Total Accident Cost ($)	103421	-1.31%	0.89%	-6.37%	0.25%	0.17%	0.14%	0.25%	3.98%	4.85%	5.02%	5.07%	0.18%	-0.21%
General Statistics														
Total Number of motor vehicle trips	364670	-0.03%	0.12%	0.07%	-0.16%	-0.24%	-0.04%	-0.25%	0.38%	0.39%	0.37%	0.32%	0.02%	0.01%
Total Number of passenger trips	81505	-0.03%	0.27%	0.40%	0.07%	0.06%	0.06%	0.09%	0.60%	0.55%	0.53%	0.46%	0.02%	0.02%
Total Number of slow trips	128779	0.21%	-0.39%	-0.79%	-0.28%	-0.25%	-0.11%	-0.37%	-1.21%	-1.04%	-1.15%	-1.01%	-0.06%	-0.03%
Total Number of PT trips	38032	-0.52%	-1.07%	-0.90%	0.54%	0.87%	0.22%	1.04%	-1.37%	-1.50%	-1.09%	-0.79%	-0.04%	-0.02%
Average motor vehicle trip length (km)	10.0	-0.21%	0.50%	1.47%	0.35%	0.34%	0.14%	0.42%	1.50%	1.24%	1.37%	1.33%	0.13%	-0.18%
Cost of Congestion ($)	10185	0.66%	12.46%	20.51%	5.88%	3.95%	2.16%	5.10%	-9.26%	5.95%	-7.69%	4.66%	1.89%	-0.92%
V/C Ratios														
Melling Bridge (WB)	0.7	-1.29%	-100.00%	-100.00%	0.48%	0.28%	0.30%	0.46%	2.66%	19.85%	-100.00%	16.02%	0.39%	0.08%
SH2 South of SH58 (SB)	0.3	-3.29%	1.96%	5.68%	0.57%	0.49%	0.51%	0.46%	-4.34%	-10.77%	-16.62%	-10.23%	0.53%	-0.10%
Kenn Good Bridge (WB)	0.5	-0.35%	8.11%	8.68%	0.55%	0.57%	0.48%	0.56%	5.99%	5.08%	6.72%	-33.34%	0.38%	0.15%
Randwick Rd (SB)	0.4	-0.26%	-0.92%	-2.54%	-0.56%	-0.55%	-0.10%	-0.76%	-1.75%	-4.33%	-59.26%	-60.98%	-0.06%	-0.02%
Petone Esplanade (WB)	0.3	-0.96%	6.50%	4.46%	-0.92%	-1.69%	-1.28%	-0.83%	-12.20%	-35.24%	-12.51%	-10.51%	-0.68%	-1.18%
Hutt Rd South of Wakefield (SB)	0.3	-1.63%	13.61%	7.80%	3.45%	2.80%	0.38%	3.87%	41.83%	2.84%	-4.61%	2.28%	0.69%	2.52%
SH2 Petone - Ngauranga (SB)	0.6	0.19%	-28.52%	-22.88%	2.60%	1.79%	0.74%	2.81%	-10.28%	-2.92%	-3.86%	-3.00%	0.39%	-0.01%
SH1 Ngauranga - Aotea Quay (SB)	0.3	0.12%	3.27%	5.31%	1.44%	0.99%	0.37%	1.50%	1.56%	0.81%	0.34%	0.59%	0.11%	0.03%
SH1 Aotea Quay - Ngauranga (NB)	0.9	-0.01%	2.14%	3.56%	0.96%	0.78%	0.37%	1.16%	0.92%	0.43%	0.13%	0.38%	0.07%	0.03%

INDICATOR	Table 5.6 - IP Results - Actual Difference													
	Base	H1	H2	H3	P1	P2	P3	P4	X1	X2	X3	X4	X6	X7
ACCESSIBILITY														
Auto														
Total motor vehicle travel time (hrs)	55305	170	523	761	97	35	53	80	729	714	788	847	-9	-34
Total motor vehicle travel distance ('000km)	3664	-9	23	56	7	4	4	6	69	60	64	61	6	-7
Average vehicle network speed (km/hr)	66.3	-0.4	-0.2	0.1	0.0	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.1	-0.1
Total auto trips spread from the peak	194	-22	-179	-475	-123	-75	-25	-138	-259	-201	-263	-200	-14	-7
Total vehicle hours below service level D	208	3	-28	42	8	5	-1	2	-6	24	-122	40	5	-3
Auto Travel times to Airport (mins):														
CBD	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Johnsonville to Airport	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
Porirua to Airport	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plimerton to Airport	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paraparaumu to Airport	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
West External to Airport	61.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Lower Hutt to Airport	18.6	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Upper Hutt to Airport	28.5	4.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
East External to Airport	94.6	-0.1	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transit														
Total passenger travel time (hrs)	6408	-117.417	-144.32324	-76.04736	-29.60595	-1.32763	187.2437	204.3506	-125.3096	-138.4619	-81.53955	0.72705	1.8291	-1.2817
Total passenger travel distance ('000km)	218	-5.3	-6.6	-3.4	0.7	2.7	2.9	6.4	-6	-7.8	-5.8	-1.2	0.1	-0.1
Average passenger network speed (km/hr)	37	-0.32267	-0.307529	-0.2136242	0.2006076	0.3945033	-0.455067	-0.013348	-0.382088	-0.61835	-0.610467	-0.179556	0.006328	-0.0125
AFFORDABILITY														
Strategy Revenue ($)														
Toll	0													
Fare	45163	-662	-1014	-471	659	980	649	1407.82	-649	-854	-337	-73	7	-7
Parking	203023	190	713	699	138	-229	-88	-271.594	414	379	136	140	33	31
Total	248186	-472	-301	228	796	750	561	1136.226	-234	-475	-201	67	40	24
ECONOMIC EVALUATION														
Cross-valley-link-road user benefits	0	0 -1329	-704	-1165	-520	-250	313	-369	7899	6896	4573	2625	-59	-22
Porirua-Hutt-link-road user benefits	0	0 -560	59	23	1692	1695	32	1762	3846	6996	7368	7048	778	371
Non-link-road user benefits	0	0 -2802	-903	-1727	-469	-342	-222	134	1354	1419	2062	3217	99	-78
Region-wide user benefits	0	0 -4691	-1547	-2869	703	1103	123	1527	13099	15311	14003	12890	818	271
SUSTAINABILITY														
Environment														
CO2 Emmissions (Tonnes)	827	0	8	12	2	1	1	1	14	12	13	13	0	-1
CO Emmissions (Tonnes)	29	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel														
Fuel Consumption (Litres)	330757	97	3076	4698	623	294	326	563	5669	4744	5263	5256	193	-354
Safety														
Total Accident Cost ($)	103421	-1357	921	-6587	260	175	146	258	4119	5012	5192	5246	183	-217
General Statistics														
Total Number of motor vehicle trips	364670	-106	426	250	-597	-870	-137	-909	1372	1435	1342	1167	67	22
Total Number of passenger trips	81505	-22	216	330	59	47	49	70	486	450	431	378	20	18
Total Number of slow trips	128779	271	-496	-1020	-362	-324	-146	-475	-1559	-1343	-1479	-1300	-74	-37
Total Number of PT trips	38032	-199	-406	-341	204	329	83	397	-520	-572	-415	-301	-17	-8
Average motor vehicle trip length (km)	10	-0.02	0.05	0.15	0.04	0.03	0.01	0.04	0.15	0.13	0.14	0.13	0.01	-0.02
Cost of Congestion ($)	10185	67.6191	1269.0742	2089.2265	599.0986	402.1406	219.6562	519.1748	-943.4365	606.3203	-783	474	193	-93
V/C Ratios														
Melling Bridge (WB)	1	-0.01	-0.67	-0.67	0.00	0.00	0.00	0.00	0.02	0.13	-0.67	0.11	0.00	0.00
SH2 South of SH58 (SB)	0	-0.01	0.01	0.02	0.00	0.00	0.00	0.00	-0.01	-0.03	-0.05	-0.03	0.00	0.00
Kenn Good Bridge (WB)	1	0.00	0.04	0.05	0.00	0.00	0.00	0.00	0.03	0.03	0.04	-0.18	0.00	0.00
Randwick Rd (SB)	0	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.02	-0.26	-0.27	0.00	0.00
Petone Esplanade (WB)	0	0.00	0.02	0.01	0.00	-0.01	0.00	0.00	-0.04	-0.11	-0.04	-0.03	0.00	0.00
Hutt Rd South of Wakefield (SB)	0	0.00	0.04	0.02	0.01	0.01	0.00	0.01	0.11	0.01	-0.01	0.01	0.00	0.01
SH2 Petone - Ngauranga (SB)	1	0.00	-0.18	-0.14	0.02	0.01	0.00	0.02	-0.06	-0.02	-0.02	-0.02	0.00	0.00
SH1 Ngauranga - Aotea Quay (SB)	0	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
SH1 Aotea Quay - Ngauranga (NB)	1	0.00	0.02	0.03	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00

Table 5.7 Hutt Corridor - Benefit Cost Calculations (over 25 year evaluation period)

	Base	H1	H2	H2 (AM only)	H3	P1	P1 (AM only)	P2	P3	P4	X1	X2	X3	X4	X6	X7
Benefits																
AM Peak 2 hour User Benefits ($)	$0	-$1,450	$6,921	$6,921	$13,902	$10,100	$10,100	$8,594	$3,866	$12,824	$14,680	$13,251	$14,083	$12,428	$783	$517
Interpeak 7 hour User Benefits ($)	$0	-$4,691	-$1,547	$0	-$2,869	$703	$0	$1,103	$123	$1,527	$13,099	$15,311	$14,003	$12,890	$818	$271
Weekday Daily benefits	$0	-$10,874.10	$11,211	$6,921	$22,927	$21,394.59	$10,100.00	$19,063	$7,941	$28,243.90	$51,628	$52,531	$51,971	$46,769	$2,957	$1,495
Weekend benefits	$0	-$18,764.00	-$6,190	$0	-$11,476	$2,810.80	$0.00	$4,412	$492	$6,108	$52,396	$61,244	$56,012	$51,560	$3,271	$1,085
Annual benefits	$0	-$3,735,624	$2,319,365	$1,661,040	$4,813,913	$5,303,350	$2,424,000	$4,839,864	$1,935,319	$7,145,016	$15,534,552	$16,282,008	$15,833,784	$14,318,160	$905,870	$423,818
25 Year benefits (Discounted 10%)	**$0**	**-$35,578,083**	**$22,089,630**	**$15,819,745**	**$45,847,706**	**$50,509,102**	**$23,086,176**	**$46,094,865**	**$18,431,980**	**$68,049,132**	**$147,951,073**	**$155,069,844**	**$150,800,959**	**$136,366,156**	**$8,627,510**	**$4,036,446**
Costs																
Korokoro Dowse Grade Seperation	$37,000,000															
SH1 ATMS		$5,000,000														
Minor Junction Upgrades (Removing Access)		$500,000														
Minor Junction Upgrades (Signals))			$1,500,000	$1,500,000												
Melling Full Separation			$45,000,000	$45,000,000	$45,000,000	$750,000	$750,000						$45,000,000			
Silverstream Bridge Upgrade		$7,000,000	$7,000,000	$7,000,000	$7,000,000											
SH2 HOT Lane			$13,000,000	$13,000,000												
Petone Curves Realignment					$25,000,000											
Belmont full Grade Separation					$14,000,000											
Silverstream Full Grade Separation					$20,000,000											
Moonshine Full Grade Separation					$12,000,000											
Gibbons Full Grade Separation					$20,000,000											
Totara Park Full grade Separation					$25,000,000											
River Road Upgrade					$15,000,000											
Major Junction Upgrades (Signal+extra lanes)					$1,200,000											
SH2 Tidal 5th Lane					$28,000,000											
Hutt Expressway Buslane						$13,000,000	$13,000,000			$13,000,000						
Petone-Grenada											$45,000,000					
Esplanade Upgrade											$22,000,000					
Cross Valley Link												$45,000,000				
Melling-Porirua												$80,000,000	$80,000,000			
Randwick Melling													$45,000,000			
Belmont-Porirua														$80,000,000		
Randwick -Cambridge-KGB														$75,000,000		
Melling Loop LRT Line									$12,000,000	$12,000,000						
SH58															$10,000,000	
Akatarawa Road																$10,000,000
Tolling Facilities																
New Station at Timberlea									$2,000,000	$2,000,000						
New Station at Cruickshank									$2,000,000	$2,000,000						
New Buses						$8,250,000	$8,250,000	$750,000		$6,750,000						
New Bus Services						$61,112	$61,112	$17,838		$54,240						
New Trains								$5,500,000	$5,500,000	$3,000,000						
New Tains Services								$61,877	$126,051	$126,051						
New Ferry						$5,000,000	$5,000,000			$10,000,000						
Superbus						$11,993,573	$11,993,573									
Haywards bus						$150,000	$150,000	$150,000		$150,000						
Ferry Service						$150,000	$150,000			$300,000						
Stokes Valley LRT									$6,000,000	$6,000,000						
Electrification extened to Featherson									$5,000,000	$5,000,000						
Rail Hutt - Porirua																
Capital Costs Undiscounted		**$12,500,000**	**$66,500,000**	**$66,500,000**	**$212,200,000**	**$39,354,685**	**$39,354,685**	**$6,479,715**	**$32,626,051**	**$60,380,291**	**$67,000,000**	**$125,000,000**	**$170,000,000**	**$155,000,000**	**$10,000,000**	**$10,000,000**
BCR	**N/A**	**-2.8**	**0.3**	**0.2**	**0.2**	**1.3**	**0.6**	**7.1**	**0.6**	**1.1**	**2.2**	**1.2**	**0.9**	**0.9**	**0.9**	**0.4**

Table 5.7 Hutt Corridor - Benefit Cost Calculations (over 25 year evaluation period)

	Base	H2	H2_2a	H2_2a	H3	H3_2a	P1a	P1a_2a	P1a_2a	P1b	P1b_2a	P1b_2a	P3	P3_2a	P3_2d	P3_2e
		Stage 1	Stage 2	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 2	Stage 1	Stage 2	Stage 2	Stage 1	Stage 2	Stage 2	Stage 2
Benefits			All	AM Only				All	AM Only		All	AM Only				
AM Peak 2 hour User Benefits ($)	$0	$6,921	$6,687	$6,687	$13,902	$10,350	$9,035	$14,144	$14,144	$10,100	$1,494	$1,494	$3,866	$5,292	$1,736	$2,178
Interpeak 7 hour User Benefits ($)	$0	-$1,547	$518		-$2,869	$609	$433	-$887		$703	-$184		$123	$1,363	$730	$726
Weekday Daily benefits	$0	$11,211	$14,253.92	$6,687	$22,927	$21,734	$18,806	$26,780	$14,144	$21,394.59	$2,674.52	$1,494	$7,941	$12,901	$4,712.15	$5,590.37
Weekend benefits	$0	-$6,190	$2,070		-$11,476	$2,434	$1,733	-$3,549		$2,810.80	-$737.60		$492	$5,452	$2,918	$2,904
Annual benefits	$0	$2,319,365	$3,545,165	$1,604,880	$4,813,913	$5,362,308	$4,617,514	$6,214,150	$3,394,560	$5,303,350	$597,629	$358,560	$1,935,319	$3,423,384	$1,305,996	$1,515,953
25 Year benefits (Discounted 10%)	**$0**	**$22,089,630**	**$33,764,150**	**$15,284,877**	**$45,847,706**	**$51,070,621**	**$43,977,200**	**$59,183,561**	**$32,329,789.44**	**$50,509,102**	**$5,691,817**	**$3,414,925**	**$18,431,980**	**$32,604,309**	**$12,438,305.90**	**$14,437,934**
Costs																
Korokoro Dowse Grade Seperation	$37,000,000															
SH1 ATMS																
Minor Junction Upgrades (Removing Access)																
Minor Junction Upgrades (Signals))		$1,500,000														
Melling Full Separation		$45,000,000			$45,000,000		$750,000			$750,000						
Silverstream Bridge Upgrade		$7,000,000			$7,000,000											
SH2 HOT Lane		$13,000,000	$13,000,000	$13,000,000												
Petone Curves Realignment					$25,000,000											
Belmont Full Grtade Separation					$14,000,000											
Silverstream Full Grade Separation					$20,000,000											
Moonshine Full Grade Separation					$12,000,000											
Gibbons Full Grade Separation					$20,000,000											
Totora Park Full Grade Separation					$25,000,000											
River Road Upgrade					$15,000,000											
Major Junction Upgrades (Signals+Extral Lanes)					$1,200,000											
SH2 Tidal 5th Lane					$28,000,000	$28,000,000										
Hutt Expressway (HOV) Lane							$13,000,000	$13,000,000	$13,000,000							
Hutt Expressway Buslane										$13,000,000	$13,000,000	$13,000,000				
Petone-Grenada																
Esplanade Upgrade																
Cross Valley Link																
Melling-Porirua																
													$12,000,000	$12,000,000	$12,000,000	
Akatarawa Road																
Tolling Facilities																
Parking Infrastucture			$16,250,000	$16,250,000		$25,000,000										
New Station at Timberlea													$2,000,000	$2,000,000		
New Station at Cruickshank													$2,000,000	$2,000,000		
New Buses							$500,000			$6,250,000	$1,500,000	$1,500,000				
New Bus Services							$13,958			$51,234	$7,984	$7,984				
New Trains							$1,500,000			$1,500,000			$5,500,000	$12,500,000	$4,000,000	$4,000,000
New Tains Services							$20,522			$20,522			$146,573	$143,258	$59,904	$51,894
New Ferry							$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000				
Superbus							$11,993,573	$11,993,573	$11,993,573	$11,993,573	$11,993,573	$11,993,573				
Haywards bus							$150,000	$150,000	$150,000	$150,000	$150,000	$150,000				
Ferry Service							$150,000	$150,000	$150,000	$150,000	$150,000	$150,000				
Stokes Valley LRT													$6,000,000	$6,000,000		$6,000,000
Electrification extened to Featherson													$5,000,000	$5,000,000		
Rail Hutt - Porirua																
Capital Costs Undiscounted		$66,500,000	$29,250,000	$29,250,000	$212,200,000	$53,000,000	$33,078,053	$30,293,573	$30,293,573	$38,865,329	$31,801,557	$31,801,557	$32,646,573	$39,643,258	$16,059,904	$10,051,894
BCR	**N/A**	**0.3**	**1.2**	**0.5**	**0.2**	**1.0**	**1.3**	**2.0**	**1.1**	**1.3**	**0.2**	**0.1**	**0.6**	**0.8**	**0.8**	**1.4**

The BCRs have been calculated using undiscounted capital costs

Option H2_2a - High Occupancy Toll (HOT) Lane
Option P1a_ 2a - High Occupancy Vehicle (HOV) Lane (Petone - Ngauranga)
Option P1b_2a - Bus Only Lane (Petone - Ngauranga)
Option P3_2a - P3 with 10 minute headways for Melling Loop LRT and Stoke Valley LRT
Option P3_2d - P3 with 10 minute headways for Melling Loop LRT only
Option P3_2e - P3 with 10 minute headways for Stoke Valley LRT only

▪ Appendix B

EMME/2 Modelling assumptions made for each Stage 2 option

Hutt Corridor Study – Stage 2 Assumptions Made in Options for EMME/2 Modelling

Stage 2 _S1	**AM 50011 IP 50012** **H2 AM IP**	Hutt Expressway HOT Lane	• Extra inbound lane provided and operated as a high-occupancy-tolled (HOT) lane for the full distance from Petone interchange to Ngauranga merge • The toll is set by iterative model runs so that the V/C ratio in the general purpose lanes is >0.9 and the V/C ratio in the HOT lane is in the range 0.6 to 0.7 **(The optimum toll is 8 minutes)** • The existing 2 inbound lanes remain as general-purpose lanes • The existing two general-purpose lanes in the opposite direction (towards Petone) are unaffected • Public Transport is coded via the general-purpose lanes with a travel-time function that is independent of auto travel times (hence this simulates public transport using an uncongested HOT lane without having to pay a toll).	h2_petone_hot.211 h2_hot2_ampt.221 (Mellington interchange) h2_hot_ippt.221
		Medium-level Junction Upgrades	**Junction** / **Physical Action** / **Model Action** Korokoro / Partial grade separation / As per Base Dowse Drive / Full grade separation / As per Base SH58 / Full grade separation / As per Base Melling / Full grade separation / Increase capacity	H2_s2_cap.211
		Silverstream Bridge Upgrade	Capacity increased across Silverstream Bridge (the capacity increase from 1000 to 1530 pcu/lane/hr applies to Fergusson Drive between SH2 and Field Street). See "Note" under H1.	h1_silverstream.211
	P2 AM	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (30 minute headways) - Upper Hutt (30 minute headways)	p2_porirua_hutt_ ampt.221

		Rail Frequency Doubled	Headway is halved on the following lines: melwel Melling-Wellington maswel Masterton-Wellington taiwel Taita-Wellington uhwela Upper Hutt-Wellington uhwelx Upper Hutt-Wellington Express welmas Wellington-Masterton welmel Wellington-Melling weltai Wellington-Taita weltax Wellington-Taita Express weluha Wellington-Upper Hutt weluhx Wellington-Upper Hutt Express	uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same eleven lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 AM	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211
		Hutt Valley Heavy-Rail Services	Timberlea-Wellington Express (15 minute headway) ~~Taita-Wellington All Stops (30 minute headway)~~ Wellington-Timberlea Express (15 minute headway) ~~Wellington-Taita All Stops (30 minute headway)~~ Headway is changed to 10 minutes on line tlwelx Headway remain unchanged on line weltlx Rail speeds increased by 10% on both lines	p3_timber_ampt.221 uses modline funnction modptatt.mac
	P1 AM	Superbus Network	Superbus services, running at 20 minute headways during AM peak only, between Wellington and: Upper Hutt / Stokes Valley / Wainuiomata	S1_superbus.221

	P2 IP	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (60 minute headways) - Upper Hutt (60 minute headways)	p2_porirua_hutt_ippt.221
		Rail Frequency Doubled	Headway is halved on the following lines: maswel Masterton-Wellington uphwel Upper Hutt-Wellington welmas Wellington-Masterton weluph Wellington-Upper Hutt	uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same four lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 IP	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211
		Hutt Valley Heavy-Rail Services	Timberlea-Wellington All Stops (30 minute headway) Wellington-Timberlea All Stops (30 minute headway) Headway is changed to 15 minutes on both lines Rail speeds increased by 10% on both lines	p3_timber_ippt.221 uses modline funnction modptatt.mac
Stage 2 _S2	**AM 50021 IP 50022** **P1b AM IP**	Hutt Expressway Bus Lane	• Extra inbound lane provided and operated as a high-occupancy-vehicle (HOV) lane for the full distance from Petone interchange to Ngauranga merge • There are still 2 general-purpose lanes in each direction • Bus lane may be configured to operate outbound in PM peak • Bus only lane	P1b_petone_hot.211
		Bus Lane Services	All inbound bus services along Hutt Expressway to travel via bus lane	p1_hov_ampt.221

	H2 **AM** **IP**	Medium-level Junction Upgrades	**Junction** Korokoro Dowse Drive SH58 Melling	**Physical Action** Partial grade separation Full grade separation Full grade separation Full grade separation	**Model Action** As per Base As per Base As per Base Increase capacity	H2_s2_cap.211
		Silverstream Bridge Upgrade	Capacity increased across Silverstream Bridge (the capacity increase from 1000 to 1530 pcu/lane/hr applies to Fergusson Drive between SH2 and Field Street). See "Note" under H1.			h1_silverstream.211
	P2 **AM**	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (30 minute headways) - Upper Hutt (30 minute headways)			p2_porirua_hutt_ ampt.221
		Rail Frequency Doubled	Headway is halved on the following lines: melwel Melling-Wellington maswel Masterton-Wellington taiwel Taita-Wellington uhwela Upper Hutt-Wellington uhwelx Upper Hutt-Wellington Express welmas Wellington-Masterton welmel Wellington-Melling weltai Wellington-Taita weltax Wellington-Taita Express weluha Wellington-Upper Hutt weluhx Wellington-Upper Hutt Express			uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same eleven lines as above.			Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 **AM**	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station			p3_timber.211

		Hutt Valley Heavy-Rail Services	Timberlea-Wellington Express (15 minute headway) ~~Taita-Wellington All Stops (30 minute headway)~~ Wellington-Timberlea Express (15 minute headway) ~~Wellington-Taita All Stops (30 minute headway)~~ Headway is changed to 10 minutes on line tlwelx Headway remain unchanged on line weltlx Rail speeds increased by 10% on both lines	p3_timber_ampt.221 uses modline funnction modptatt.mac
	P1 AM	Superbus Network	Superbus services, running at 20 minute headways during AM peak only, between Wellington and: Upper Hutt / Stokes Valley / Wainuiomata	S1_superbus.221
	P2 IP	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (60 minute headways) - Upper Hutt (60 minute headways)	p2_porirua_hutt_ippt.221
		Rail Frequency Doubled	Headway is halved on the following lines: maswel Masterton-Wellington uphwel Upper Hutt-Wellington welmas Wellington-Masterton weluph Wellington-Upper Hutt	uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same four lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 IP	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211

		Hutt Valley Heavy-Rail Services	Timberlea-Wellington All Stops (30 minute headway) Wellington-Timberlea All Stops (30 minute headway) Headway is changed to 15 minutes on both lines Rail speeds increased by 10% on both lines	p3_timber_ippt.221 uses modline funnction modptatt.mac
Stage 2 _S3	**AM 50031 IP 50041** **H3 AM IP**	Hutt Expressway Tidal Flow	• Extra lane provided and operated as a tidal flow lane • 3 lanes inbound from Petone I/C to Ngauranga merge • 2 lanes outbound from Ngauranga diverge to Petone I/C • Assumed that this arrangement continues during interpeak (whether extra lane operates inbound or outbound during interpeak is not critical)	h3_petone_tidal.211
	H2 AM IP	Medium-level Junction Upgrades	**Junction** / **Physical Action** / **Model Action** Korokoro / Partial grade separation / As per Base Dowse Drive / Full grade separation / As per Base SH58 / Full grade separation / As per Base Melling / Full grade separation / Increase capacity	H2_s2_cap.211
		Silverstream Bridge Upgrade	Capacity increased across Silverstream Bridge (the capacity increase from 1000 to 1530 pcu/lane/hr applies to Fergusson Drive between SH2 and Field Street). See "Note" under H1.	h1_silverstream.211
	P2 AM	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (30 minute headways) - Upper Hutt (30 minute headways)	p2_porirua_hutt_ ampt.221

		Rail Frequency Doubled	Headway is halved on the following lines: melwel Melling-Wellington maswel Masterton-Wellington taiwel Taita-Wellington uhwela Upper Hutt-Wellington uhwelx Upper Hutt-Wellington Express welmas Wellington-Masterton welmel Wellington-Melling weltai Wellington-Taita weltax Wellington-Taita Express weluha Wellington-Upper Hutt weluhx Wellington-Upper Hutt Express	uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same eleven lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 AM	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211
		Hutt Valley Heavy-Rail Services	Timberlea-Wellington Express (15 minute headway) ~~Taita-Wellington All Stops (30 minute headway)~~ Wellington-Timberlea Express (15 minute headway) ~~Wellington-Taita All Stops (30 minute headway)~~ Headway is changed to 10 minutes on line tlwelx Headway remain unchanged on line weltlx Rail speeds increased by 10% on both lines	p3_timber_ampt.221 uses modline funnction modptatt.mac
	P2 IP	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (60 minute headways) - Upper Hutt (60 minute headways)	p2_porirua_hutt_ippt.221

		Rail Frequency Doubled	Headway is halved on the following lines: maswel Masterton-Wellington uphwel Upper Hutt-Wellington welmas Wellington-Masterton weluph Wellington-Upper Hutt	uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same four lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 IP	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211
		Hutt Valley Heavy-Rail Services	Timberlea-Wellington All Stops (30 minute headway) Wellington-Timberlea All Stops (30 minute headway) Headway is changed to 15 minutes on both lines Rail speeds increased by 10% on both lines	p3_timber_ippt.221 uses modline funnction modptatt.mac
Stage 2 _S4	**AM 50041 IP 50042 H2**	Hutt Expressway HOT Lane	• Extra inbound lane provided and operated as a high-occupancy-tolled (HOT) lane for the full distance from Petone interchange to Ngauranga merge • The toll is set by iterative model runs so that the V/C ratio in the general purpose lanes is >0.9 and the V/C ratio in the HOT lane is in the range 0.6 to 0.7 **(The optimum toll is 8 minutes)** • The existing 2 inbound lanes remain as general-purpose lanes • The existing two general-purpose lanes in the opposite direction (towards Petone) are unaffected • Public Transport is coded via the general-purpose lanes with a travel-time function that is independent of auto travel times (hence this simulates public transport using an uncongested HOT lane without having to pay a toll).	h2_petone_hot.211 h2_hot2_ampt.221 (Mellington interchange) h2_hot_ippt.221

		Medium-level Junction Upgrades	**Junction**	**Physical Action**	**Model Action**	H2_s2_cap.211
			Korokoro	Partial grade separation	As per Base	
			Dowse Drive	Full grade separation	As per Base	
			SH58	Full grade separation	As per Base	
			Melling	Full grade separation	Increase capacity	
		Silverstream Bridge Upgrade	Capacity increased across Silverstream Bridge (the capacity increase from 1000 to 1530 pcu/lane/hr applies to Fergusson Drive between SH2 and Field Street). See "Note" under H1.			h1_silverstream.211
	P2 AM	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (30 minute headways) - Upper Hutt (30 minute headways)			p2_porirua_hutt_ ampt.221
		Rail Frequency Doubled	Headway is halved on the following lines: melwel Melling-Wellington maswel Masterton-Wellington taiwel Taita-Wellington uhwela Upper Hutt-Wellington uhwelx Upper Hutt-Wellington Express welmas Wellington-Masterton welmel Wellington-Melling weltai Wellington-Taita weltax Wellington-Taita Express weluha Wellington-Upper Hutt weluhx Wellington-Upper Hutt Express			uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same eleven lines as above.			Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 AM	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station			p3_timber.211

		Hutt Valley Heavy-Rail Services	Timberlea-Wellington Express (15 minute headway) ~~Taita-Wellington All Stops (30 minute headway)~~ Wellington-Timberlea Express (15 minute headway) ~~Wellington-Taita All Stops (30 minute headway)~~ Headway is changed to 10 minutes on line tlwelx Headway remain unchanged on line weltlx Rail speeds increased by 10% on both lines	p3_timber_ampt.221 uses modline funnction modptatt.mac
	P1 AM	Superbus Network	Superbus services, running at 20 minute headways during AM peak only, between Wellington and: Upper Hutt / Stokes Valley / Wainuiomata	S1_superbus.221
	P2 IP	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (60 minute headways) - Upper Hutt (60 minute headways)	p2_porirua_hutt_ippt.221
		Rail Frequency Doubled	Headway is halved on the following lines: maswel Masterton-Wellington uphwel Upper Hutt-Wellington welmas Wellington-Masterton weluph Wellington-Upper Hutt	uses modline function
		Rail Speed Increased	Rail speeds increased by 10% on the same four lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
	P3 IP	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211

		Hutt Valley Heavy-Rail Services	Timberlea-Wellington All Stops (30 minute headway) Wellington-Timberlea All Stops (30 minute headway) Headway is changed to 15 minutes on both lines Rail speeds increased by 10% on both lines	p3_timber_ippt.221 uses modline funnction modptatt.mac
	X1 **AM** **IP**	Petone-Grenada Link Road	• 4-lane road from Cornish Street (Petone) to Westchester Drive / Churton Park Interchange (Grenada) • 70 km/h speed limit (steep grade similar to Ngauranga Gorge) • Volume delay function is fd6 (1400 pcu/lane/hr). Not fd3 because of steep grade • All movements full grade separation at Petone • Assumed there are traffic signals at the tops of the on ramps (hence 50 km/h speed environment) • 20% extra distance	x1_petone_ grenada_s4.211
Stage 2 _S5	**AM** **50051** **IP** **50052**	Hutt Expressway HOT Lane	• Extra inbound lane provided and operated as a high-occupancy-tolled (HOT) lane for the full distance from Petone interchange to Ngauranga merge • The toll is set by iterative model runs so that the V/C ratio in the general purpose lanes is >0.9 and the V/C ratio in the HOT lane is in the range 0.6 to 0.7 **(The optimum toll is 8 minutes)** • The existing 2 inbound lanes remain as general-purpose lanes • The existing two general-purpose lanes in the opposite direction (towards Petone) are unaffected • Public Transport is coded via the general-purpose lanes with a travel-time function that is independent of auto travel times (hence this simulates public transport using an uncongested HOT lane without having to pay a toll).	h2_petone_hot.211 h2_hot2_ampt.221 (Mellington interchange) h2_hot_ippt.221

	Medium-level Junction Upgrades	**Junction** / **Physical Action** / **Model Action** Korokoro / Partial grade separation / As per Base Dowse Drive / Full grade separation / As per Base SH58 / Full grade separation / As per Base Melling / Full grade separation / Increase capacity	H2_s2_cap.211
	Silverstream Bridge Upgrade	Capacity increased across Silverstream Bridge (the capacity increase from 1000 to 1530 pcu/lane/hr applies to Fergusson Drive between SH2 and Field Street). See "Note" under H1.	h1_silverstream.211
P2 AM	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (30 minute headways) - Upper Hutt (30 minute headways)	p2_porirua_hutt_ ampt.221
	Rail Frequency Doubled	Headway is halved on the following lines: melwel Melling-Wellington maswel Masterton-Wellington taiwel Taita-Wellington uhwela Upper Hutt-Wellington uhwelx Upper Hutt-Wellington Express welmas Wellington-Masterton welmel Wellington-Melling weltai Wellington-Taita weltax Wellington-Taita Express weluha Wellington-Upper Hutt weluhx Wellington-Upper Hutt Express	uses modline function
	Rail Speed Increased	Rail speeds increased by 10% on the same eleven lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
P3 AM	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211

	Hutt Valley Heavy-Rail Services	Timberlea-Wellington Express (15 minute headway) ~~Taita-Wellington All Stops (30 minute headway)~~ Wellington-Timberlea Express (15 minute headway) ~~Wellington-Taita All Stops (30 minute headway)~~ Headway is changed to 10 minutes on line tlwelx Headway remain unchanged on line weltlx Rail speeds increased by 10% on both lines	p3_timber_ampt.221 uses modline funnction modptatt.mac
P1 AM	Superbus Network	Superbus services, running at 20 minute headways during AM peak only, between Wellington and: Upper Hutt / Stokes Valley / Wainuiomata	S1_superbus.221
P2 IP	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (60 minute headways) - Upper Hutt (60 minute headways)	p2_porirua_hutt_ippt.221
	Rail Frequency Doubled	Headway is halved on the following lines: maswel Masterton-Wellington uphwel Upper Hutt-Wellington welmas Wellington-Masterton weluph Wellington-Upper Hutt	uses modline function
	Rail Speed Increased	Rail speeds increased by 10% on the same four lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
P3 IP	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211

		Hutt Valley Heavy-Rail Services	Timberlea-Wellington All Stops (30 minute headway) Wellington-Timberlea All Stops (30 minute headway) Headway is changed to 15 minutes on both lines Rail speeds increased by 10% on both lines	p3_timber_ippt.221 uses modline funnction modptatt.mac
	X2 AM IP	Melling-Porirua Link Road	4-lane road from Melling Bridge to Transmission Gully route.	x2_melling_tgully.211
		Cross-Valley Link (Korokoro Dowse)	• 4-lane road from Randwick Rd to SH2 Dowse Interchange • New bridge across Hutt River between Whites Line West and Wakefield St	x2_cross_valley.211 x2_dowse_ampt.221 ~~x2_dowse_ippt.221~~
Stage 2 _S6	**AM 50061 IP 50062**	Hutt Expressway HOT Lane	• Extra inbound lane provided and operated as a high-occupancy-tolled (HOT) lane for the full distance from Petone interchange to Ngauranga merge • The toll is set by iterative model runs so that the V/C ratio in the general purpose lanes is >0.9 and the V/C ratio in the HOT lane is in the range 0.6 to 0.7 **(The optimum toll is 8 minutes)** • The existing 2 inbound lanes remain as general-purpose lanes • The existing two general-purpose lanes in the opposite direction (towards Petone) are unaffected • Public Transport is coded via the general-purpose lanes with a travel-time function that is independent of auto travel times (hence this simulates public transport using an uncongested HOT lane without having to pay a toll).	h2_petone_hot.211 h2_hot2_ampt.221 (Mellington interchange) h2_hot_ippt.221

	Medium-level Junction Upgrades	**Junction** / **Physical Action** / **Model Action** Korokoro / Partial grade separation / As per Base Dowse Drive / Full grade separation / As per Base SH58 / Full grade separation / As per Base Melling / Full grade separation / Increase capacity	H2_s2_cap.211
	Silverstream Bridge Upgrade	Capacity increased across Silverstream Bridge (the capacity increase from 1000 to 1530 pcu/lane/hr applies to Fergusson Drive between SH2 and Field Street). See "Note" under H1.	h1_silverstream.211
P2 AM	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (30 minute headways) - Upper Hutt (30 minute headways)	p2_porirua_hutt_ ampt.221
	Rail Frequency Doubled	Headway is halved on the following lines: melwel Melling-Wellington maswel Masterton-Wellington taiwel Taita-Wellington uhwela Upper Hutt-Wellington uhwelx Upper Hutt-Wellington Express welmas Wellington-Masterton welmel Wellington-Melling weltai Wellington-Taita weltax Wellington-Taita Express weluha Wellington-Upper Hutt weluhx Wellington-Upper Hutt Express	uses modline function
	Rail Speed Increased	Rail speeds increased by 10% on the same eleven lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
P3 AM	New Stations at Timberlea and Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211

	Hutt Valley Heavy-Rail Services	Timberlea-Wellington Express (15 minute headway) ~~Taita-Wellington All Stops (30 minute headway)~~ Wellington-Timberlea Express (15 minute headway) ~~Wellington-Taita All Stops (30 minute headway)~~ Headway is changed to 10 minutes on line tlwelx Headway remain unchanged on line weltlx Rail speeds increased by 10% on both lines	p3_timber_ampt.221 uses modline funnction modptatt.mac
P1 AM	Superbus Network	Superbus services, running at 20 minute headways during AM peak only, between Wellington and: Upper Hutt / Stokes Valley / Wainuiomata	S1_superbus.221
P2 IP	Haywards Bus Service	Buses via SH58 (Haywards Hill) between Porirua and: - Lower Hutt (60 minute headways) - Upper Hutt (60 minute headways)	p2_porirua_hutt_ippt.221
	Rail Frequency Doubled	Headway is halved on the following lines: maswel Masterton-Wellington uphwel Upper Hutt-Wellington welmas Wellington-Masterton weluph Wellington-Upper Hutt	uses modline function
	Rail Speed Increased	Rail speeds increased by 10% on the same four lines as above.	Travel time function changed from ttf=11 to 12 (use modptatt.mac)
P3 IP	New Stations at Timberlea And Cruickshank Rd	2 new stations on Hutt Valley Line north of Upper Hutt Station	p3_timber.211

	Hutt Valley Heavy-Rail Services	Timberlea-Wellington All Stops (30 minute headway) Wellington-Timberlea All Stops (30 minute headway) Headway is changed to 15 minutes on both lines Rail speeds increased by 10% on both lines	p3_timber_ippt.221 uses modline funnction modptatt.mac
X1 **AM** **IP**	Petone-Grenada Link Road	• 4-lane road from Cornish Street (Petone) to Westchester Drive / Churton Park Interchange (Grenada) • 70 km/h speed limit (steep grade similar to Ngauranga Gorge) • Volume delay function is fd6 (1400 pcu/lane/hr). Not fd3 because of steep grade • All movements full grade separation at Petone • Assumed there are traffic signals at the tops of the on ramps (hence 50 km/h speed environment) • 20% extra distance	x1_petone_ grenada_s4.211
X2 **AM** **IP**	Cross-Valley Link (Korokoro Dowse)	• 4-lane road from Randwick Rd to SH2 Dowse Interchange • New bridge across Hutt River between Whites Line West and Wakefield St	x2_cross_valley.211 x2_dowse_ampt.221 ~~x2_dowse_ippt.221~~
AM **IP**	Melling Line Relocation	• Relocate the Melling station across the river closer to CBD	S6_mellingline.211

▪ Appendix C

Performance indicator test results for each Stage 2 option

INDICATOR	Table 5.1 - AM Results (Note: Values are for the period 0700 to 0900)						
	Base	S1	S2	S3	S4	S5	S6
ACCESSIBILITY							
Auto							
Total motor vehicle travel time (hrs)	29697	28861	28889	29261	29053	28854	28837
Total motor vehicle travel distance ('000km)	1487	1496	1478	1520	1514	1516	1512
Average vehicle network speed (km/hr)	50.1	51.8	51.2	52.0	52.1	52.5	52.4
Total auto trips spread from the peak	193	-112	11	-262	-279	-315	-320
Total vehicle hours below service level D	8436	7706	8157	7946	7599	7136	7535
Auto Travel times to Airport (mins):							
CBD	9.9	9.9	9.9	10.0	9.9	9.9	9.9
Port	12.4	12.4	12.4	12.6	12.4	12.4	12.4
Johnsonville to Airport	25.2	24.9	24.8	25.1	23.6	24.1	23.5
Porirua to Airport	32.4	31.5	31.5	31.5	31.1	30.6	31.1
Plimerton to Airport	38.8	37.8	37.8	37.8	37.5	36.9	37.4
Paraparaumu to Airport	54.2	53.2	53.3	53.3	52.9	52.4	52.8
West External to Airport	72.7	71.8	71.8	71.8	71.4	70.9	71.3
Lower Hutt to Airport	38.8	31.4	36.4	29.0	32.9	32.4	33.1
Upper Hutt to Airport	52.1	44.3	49.1	42.2	45.8	44.9	46.0
East External to Airport	118.0	110.2	115.0	108.2	111.8	110.8	111.9
Transit							
Total passenger travel time (hrs)	12216	12720	13074	12247	12605	12471	12684
Total passenger travel distance ('000km)	424	453	471	433	450	440	455
Average passenger network speed (km/hr)	38.5	40.1	40.5	40.0	39.9	39.3	40.4
AFFORDABILITY							
Strategy Revenue ($)							
Toll	0	1860	0	0	711	1550	736
Fare	75353	80734	83460	77462	79995	79233	80874
Parking	114579	113981	111589	117287	114106	114648	113756
Total	189932	196575	195048	194750	194812	195431	195366
ECONOMIC EVALUATION							
Cross-valley-link-road user benefits	0	7642 37%	6070 36%	8295 36%	11508 42%	14291 43%	15179 47%
Porirua-Hutt-link-road user benefits	0	361 2%	227 1%	316 1%	2601 10%	5788 17%	2725 9%
Non-link-road user benefits	0	12707 61%	10447 62%	14499 63%	13108 48%	13431 40%	14054 44%
Region-wide user benefits	0	20709	16744	23109	27216	33510	31958
SUSTAINABILITY							
Environment							
CO2 Emmissions (Tonnes)	379.3	376.5	373.0	383.0	379.6	378.9	378.2
CO Emmissions (Tonnes)	15.4	15.0	15.0	15.3	15.1	15.0	15.0
Fuel							
Fuel Consumption (Litres)	151706	150602	149183	153183	151856	151558	151279
Safety							
Total Accident Cost ($)	45118	44307	43687	44983	44858	46298	44890
General Statistics							
Total Number of motor vehicle trips	141127	140510	139870	141311	141056	141365	141001
Total Number of passenger trips	50330	50237	49870	50502	50333	50463	50302
Total Number of slow trips	47568	47069	47119	47066	46923	46883	46888
Total Number of PT trips	49720	51039	51836	50142	50755	50435	50906
Average motor vehicle trip length (km)	10.5	10.6	10.6	10.8	10.7	10.7	10.7
Cost of Congestion ($)	78924	70134	72863	72215	70152	68252	68564
V/C Ratios							
Melling Bridge (WB)	0.78	0.79	0.72	0.86	0.80	0.86	0.68
SH2 South of SH58 (SB)	0.60	0.62	0.60	0.64	0.58	0.48	0.57
Kenn Good Bridge (WB)	0.86	0.92	0.93	0.91	0.93	0.99	0.89
Randwick Rd (SB)	0.76	0.74	0.74	0.75	0.70	0.70	0.67
Petone Esplanade (WB)	0.81	0.82	0.76	0.90	0.92	0.70	0.85
Hutt Rd South of Wakefield (SB)	0.49	0.53	0.47	0.54	0.67	0.52	0.75
SH2 Petone - Ngauranga (SB)	1.19	1.05	1.17	1.03	1.09	1.09	1.09
SH1 Ngauranga - Aotea Quay (SB)	0.81	0.84	0.80	0.89	0.83	0.85	0.83
SH1 Aotea Quay - Ngauranga (NB)	0.75	0.79	0.78	0.81	0.78	0.78	0.79

INDICATOR	Table 5.2 - AM Results - % Difference						
	Base	S1	S2	S3	S4	S5	S6
ACCESSIBILITY							
Auto							
Total motor vehicle travel time (hrs)	29697	-2.82%	-2.72%	-1.47%	-2.17%	-2.84%	-2.90%
Total motor vehicle travel distance ('000km)	1487	0.60%	-0.65%	2.21%	1.77%	1.89%	1.64%
Average vehicle network speed (km/hr)	50.1	3.51%	2.13%	3.73%	4.03%	4.87%	4.67%
Total auto trips spread from the peak	193	-158.28%	-94.34%	-235.70%	-244.99%	-263.57%	-266.01%
Total vehicle hours below service level D	8436	-8.65%	-3.31%	-5.81%	-9.92%	-15.41%	-10.68%
Auto Travel times to Airport (mins):							
CBD	10	0.16%	-0.20%	0.76%	-0.14%	0.15%	0.00%
Port	12	0.23%	-0.31%	1.25%	-0.02%	0.26%	0.07%
Johnsonville to Airport	25	-1.29%	-1.82%	-0.61%	-6.47%	-4.22%	-6.70%
Porirua to Airport	32	-2.88%	-2.81%	-2.73%	-3.89%	-5.66%	-4.17%
Plimerton to Airport	39	-2.54%	-2.43%	-2.47%	-3.37%	-4.85%	-3.61%
Paraparaumu to Airport	54	-1.80%	-1.69%	-1.75%	-2.49%	-3.42%	-2.65%
West External to Airport	73	-1.33%	-1.25%	-1.30%	-1.85%	-2.54%	-1.97%
Lower Hutt to Airport	39	-19.03%	-6.22%	-25.21%	-15.30%	-16.64%	-14.87%
Upper Hutt to Airport	52	-14.86%	-5.64%	-18.91%	-11.96%	-13.75%	-11.73%
East External to Airport	118	-6.60%	-2.54%	-8.37%	-5.30%	-6.10%	-5.22%
Transit							
Total passenger travel time (hrs)	12216	4.13%	7.02%	0.25%	3.18%	2.09%	3.83%
Total passenger travel distance ('000km)	424	6.86%	11.13%	1.98%	6.13%	3.68%	7.33%
Average passenger network speed (km/hr)	38	4.26%	5.40%	4.00%	3.72%	2.15%	5.10%
AFFORDABILITY							
Strategy Revenue ($)							
Toll	0						
Fare	75353	7.14%	10.76%	2.80%	6.16%	5.15%	7.33%
Parking	114579	-0.52%	-2.61%	2.36%	-0.41%	0.06%	-0.72%
Total	189932	3.50%	2.69%	2.54%	2.57%	2.90%	2.86%
ECONOMIC EVALUATION							
Cross-valley-link-road user benefits	0						
Porirua-Hutt-link-road user benefits	0						
Non-link-road user benefits	0						
Region-wide user benefits	0						
SUSTAINABILITY							
Environment							
CO2 Emmissions (Tonnes)	379	-0.73%	-1.66%	0.97%	0.10%	-0.10%	-0.28%
CO Emmissions (Tonnes)	15	-2.67%	-2.63%	-1.23%	-2.02%	-2.65%	-2.71%
Fuel							
Fuel Consumption (Litres)	151706	-0.73%	-1.66%	0.97%	0.10%	-0.10%	-0.28%
Safety							
Total Accident Cost ($)	45118	-1.80%	-3.17%	-0.30%	-0.58%	2.61%	-0.51%
General Statistics							
Total Number of motor vehicle trips	141127	-0.44%	-0.89%	0.13%	-0.05%	0.17%	-0.09%
Total Number of passenger trips	50330	-0.18%	-0.91%	0.34%	0.01%	0.26%	-0.06%
Total Number of slow trips	47568	-1.05%	-0.94%	-1.06%	-1.36%	-1.44%	-1.43%
Total Number of PT trips	49720	2.65%	4.26%	0.85%	2.08%	1.44%	2.39%
Average motor vehicle trip length (km)	10.5	1.04%	0.25%	2.08%	1.83%	1.72%	1.73%
Cost of Congestion ($)	78924	-11.14%	-7.68%	-8.50%	-11.11%	-13.52%	-13.13%
V/C Ratios							
Melling Bridge (WB)	1	1.57%	-7.09%	10.26%	2.98%	11.01%	-11.94%
SH2 South of SH58 (SB)	1	3.42%	-0.56%	7.76%	-3.41%	-19.19%	-4.94%
Kenn Good Bridge (WB)	1	7.28%	8.39%	6.67%	9.19%	15.63%	3.59%
Randwick Rd (SB)	1	-2.59%	-3.14%	-1.91%	-8.28%	-7.59%	-12.50%
Petone Esplanade (WB)	1	1.02%	-6.20%	11.17%	13.08%	-12.92%	4.57%
Hutt Rd South of Wakefield (SB)	0	8.04%	-3.67%	10.88%	36.25%	6.17%	53.34%
SH2 Petone - Ngauranga (SB)	1	-8.03%	-1.77%	-13.67%	-8.15%	-8.08%	-8.14%
SH1 Ngauranga - Aotea Quay (SB)	1	2.88%	-1.67%	9.01%	2.31%	3.80%	2.32%
SH1 Aotea Quay - Ngauranga (NB)	1	5.63%	4.07%	7.25%	4.16%	4.22%	4.88%

INDICATOR	Table 5.3 - AM Results - Actual Difference						
	Base	S1	S2	S3	S4	S5	S6
ACCESSIBILITY							
Auto							
Total motor vehicle travel time (hrs)	29697	-836	-808	-436	-644	-843	-860
Total motor vehicle travel distance ('000km)	1487	9	-10	33	26	28	24
Average vehicle network speed (km/hr)	50.1	1.8	1.1	1.9	2.0	2.4	2.3
Total auto trips spread from the peak	193	-305	-182	-454	-472	-508	-513
Total vehicle hours below service level D	8436	-730	-279	-490	-837	-1300	-901
Auto Travel times to Airport (mins):							
CBD	10	0.0	0.0	0.1	0.0	0.0	0.0
Port	12	0.0	0.0	0.2	0.0	0.0	0.0
Johnsonville to Airport	25	-0.3	-0.5	-0.2	-1.6	-1.1	-1.7
Porirua to Airport	32	-0.9	-0.9	-0.9	-1.3	-1.8	-1.3
Plimerton to Airport	39	-1.0	-0.9	-1.0	-1.3	-1.9	-1.4
Paraparaumu to Airport	54	-1.0	-0.9	-0.9	-1.4	-1.9	-1.4
West External to Airport	73	-1.0	-0.9	-0.9	-1.3	-1.8	-1.4
Lower Hutt to Airport	39	-7.4	-2.4	-9.8	-5.9	-6.5	-5.8
Upper Hutt to Airport	52	-7.7	-2.9	-9.8	-6.2	-7.2	-6.1
East External to Airport	118	-7.8	-3.0	-9.9	-6.3	-7.2	-6.2
Transit							
Total passenger travel time (hrs)	12216	504	858	31	389	255	468
Total passenger travel distance ('000km)	424	29	47	8	26	16	31
Average passenger network speed (km/hr)	38.5	1.6	2.1	1.5	1.4	0.8	2.0
AFFORDABILITY							
Strategy Revenue ($)							
Toll	0	1860	0	0	711	1550	736
Fare	75353	5381	8107	2110	4642	3880	5521
Parking	114579	-598	-2990	2708	-473	69	-823
Total	189932	6643	5116	4818	4881	5499	5434
ECONOMIC EVALUATION							
Cross-valley-link-road user benefits	0	7642	6070	8295	11508	14291	15179
Porirua-Hutt-link-road user benefits	0	361	227	316	2601	5788	2725
Non-link-road user benefits	0	12707	10447	14499	13108	13431	14054
Region-wide user benefits	0	20709	16744	23109	27216	33510	31958
SUSTAINABILITY							
Environment							
CO2 Emmissions (Tonnes)	379	-3	-6	4	0	0	-1
CO Emmissions (Tonnes)	15	0	0	0	0	0	0
Fuel							
Fuel Consumption (Litres)	151706	-1103	-2523	1477	151	-148	-427
Safety							
Total Accident Cost ($)	45118	-811	-1431	-135	-260	1180	-228
General Statistics							
Total Number of motor vehicle trips	141127	0 -617	-1257	184	-71	238	-126
Total Number of passenger trips	50330	0 -93	-460	172	3	133	-28
Total Number of slow trips	47568	0 -499	-449	-502	-645	-685	-680
Total Number of PT trips	49720	0 1319	2116	422	1035	715	1186
Average motor vehicle trip length (km)	10.54	0.11	0.03	0.22	0.19	0.18	0.18
Cost of Congestion ($)	78924	-8790	-6061	-6709	-8772	-10672	-10360
V/C Ratios							
Melling Bridge (WB)	0.8	0.01	-0.06	0.08	0.02	0.09	-0.09
SH2 South of SH58 (SB)	0.6	0.02	0.00	0.05	-0.02	-0.11	-0.03
Kenn Good Bridge (WB)	0.9	0.06	0.07	0.06	0.08	0.13	0.03
Randwick Rd (SB)	0.8	-0.02	-0.02	-0.01	-0.06	-0.06	-0.10
Petone Esplanade (WB)	0.8	0.01	-0.05	0.09	0.11	-0.10	0.04
Hutt Rd South of Wakefield (SB)	0.5	0.04	-0.02	0.05	0.18	0.03	0.26
SH2 Petone - Ngauranga (SB)	1.2	-0.10	-0.02	-0.16	-0.10	-0.10	-0.10
SH1 Ngauranga - Aotea Quay (SB)	0.8	0.02	-0.01	0.07	0.02	0.03	0.02
SH1 Aotea Quay - Ngauranga (NB)	0.8	0.04	0.03	0.05	0.03	0.03	0.04

INDICATOR	Table 5.4 - IP Results (Note: Values are for the period 0900 to 1600)						
	Base	S1	S2	S3	S4	S5	S6
ACCESSIBILITY							
Auto							
Total motor vehicle travel time (hrs)	55362	55746	55377	55921	56197	28854	28837
Total motor vehicle travel distance ('000km)	3668	3688	3674	3699	3722	3732	1512
Average vehicle network speed (km/hr)	66.2	66.2	66.3	66.1	66.2	66.3	52.4
Total auto trips spread from the peak	207	-109	16	-262	-286	-315	-320
Total vehicle hours below service level D	212	287	211	293	226	230	7535
Auto Travel times to Airport (mins):							
CBD	8.3	8.3	8.3	8.3	8.3	8.3	9.9
Port	10.5	10.5	10.5	10.5	10.5	10.5	12.4
Johnsonville to Airport	15.6	15.6	15.6	15.6	15.5	15.6	23.5
Porirua to Airport	21.3	21.3	21.3	21.3	21.3	21.4	31.1
Plimerton to Airport	27.1	27.1	27.1	27.1	27.1	27.1	37.4
Paraparaumu to Airport	42.0	42.0	42.0	42.0	42.0	42.0	52.8
West External to Airport	61.6	61.7	61.7	61.7	61.7	61.7	71.3
Lower Hutt to Airport	18.5	18.5	18.6	18.5	18.5	18.5	33.1
Upper Hutt to Airport	28.5	28.5	28.5	28.5	28.5	28.5	46.0
East External to Airport	94.6	94.6	94.6	94.6	94.6	94.5	111.9
Transit							
Total passenger travel time (hrs)	6531	6810	6827	6838	6792	6783	6813
Total passenger travel distance ('000km)	212	229	229	230	228	225	455
Average passenger network speed (km/hr)	35.0	36.5	36.5	36.5	36.6	36.1	40.4
AFFORDABILITY							
Strategy Revenue ($)							
Toll	0	0	0	0	0	0	736
Fare	44626	47887	48001	48205	47850	47748	80874
Parking	203280	202797	202529	202864	202417	202745	113756
Total	247906	250684	250530	251069	250268	250493	195366
	0	0	0	0	0	0	0
ECONOMIC EVALUATION							
Cross-valley-link-road user benefits	0	252	-97	491	4435	8521	15179
Porirua-Hutt-link-road user benefits	0	2255	1941	2277	4935	9107	2725
Non-link-road user benefits	0	1885	1757	1824	3296	3899	14054
Region-wide user benefits	0	4392	3600	4592	12666	21527	31958
SUSTAINABILITY							
Environment							
CO2 Emmissions (Tonnes)	827.6	833.9	828.3	836.4	841.2	842.8	378.2
CO Emmissions (Tonnes)	29.2	29.4	29.2	29.5	29.6	29.7	15.0
Fuel							
Fuel Consumption (Litres)	331055	333566	331329	334575	336490	337124	151279
Safety							
Total Accident Cost ($)	103523	101673	100851	102021	103079	106177	44890
General Statistics							
Total Number of motor vehicle trips	364827	363648	363401	363600	364255	364806	141001
Total Number of passenger trips	81541	81678	81573	81719	81875	82019	50302
Total Number of slow trips	128865	127875	128217	127572	127053	126613	46888
Total Number of PT trips	37779	38459	38586	38524	38307	38135	50906
Average motor vehicle trip length (km)	10.1	10.1	10.1	10.2	10.2	10.2	10.7
Cost of Congestion ($)	10211	12038	10760	12857	10177	12000	68564
V/C Ratios	0	0	0	0	0	0	0
Melling Bridge (WB)	0.67	0.69	0.68	0.69	0.71	0.80	0.68
SH2 South of SH58 (SB)	0.28	0.28	0.28	0.29	0.27	0.25	0.57
Kenn Good Bridge (WB)	0.55	0.56	0.55	0.56	0.57	0.58	0.89
Randwick Rd (SB)	0.44	0.43	0.44	0.43	0.42	0.42	0.67
Petone Esplanade (WB)	0.31	0.31	0.31	0.32	0.36	0.21	0.85
Hutt Rd South of Wakefield (SB)	0.27	0.29	0.27	0.31	0.38	0.29	0.75
SH2 Petone - Ngauranga (SB)	0.62	0.48	0.64	0.48	0.40	0.41	1.09
SH1 Ngauranga - Aotea Quay (SB)	0.35	0.36	0.35	0.37	0.35	0.36	0.83
SH1 Aotea Quay - Ngauranga (NB)	0.87	0.89	0.88	0.90	0.88	0.89	0.79

INDICATOR	Table 5.5 - IP Results - % Difference						
	Base	S1	S2	S3	S4	S5	S6
ACCESSIBILITY							
Auto							
Total motor vehicle travel time (hrs)	55362	0.69%	0.03%	1.01%	1.51%	-47.88%	-47.91%
Total motor vehicle travel distance ('000km)	3668	0.56%	0.16%	0.85%	1.48%	1.75%	-58.78%
Average vehicle network speed (km/hr)	66.2	-0.13%	0.13%	-0.16%	-0.03%	0.09%	-20.87%
Total auto trips spread from the peak	207	-152.69%	-92.40%	-226.92%	-238.31%	-252.30%	-254.92%
Total vehicle hours below service level D	212	35.19%	-0.56%	37.88%	6.36%	8.34%	3448.61%
Auto Travel times to Airport (mins):							
CBD	8	0.01%	0.12%	0.13%	0.15%	0.11%	19.79%
Port	10	0.01%	0.10%	0.10%	0.11%	0.09%	18.43%
Johnsonville to Airport	16	0.35%	0.23%	0.26%	-0.37%	0.36%	51.26%
Porirua to Airport	21	0.23%	0.16%	0.16%	0.20%	0.26%	45.82%
Plimerton to Airport	27	0.17%	0.13%	0.11%	0.14%	0.11%	38.01%
Paraparaumu to Airport	42	0.11%	0.08%	0.07%	0.07%	0.11%	25.77%
West External to Airport	62	0.07%	0.06%	0.05%	0.06%	0.07%	15.67%
Lower Hutt to Airport	19	-0.11%	0.14%	-0.16%	-0.13%	-0.03%	78.27%
Upper Hutt to Airport	29	-0.12%	0.04%	-0.15%	-0.16%	-0.20%	61.23%
East External to Airport	95	-0.04%	0.01%	-0.05%	-0.05%	-0.06%	18.25%
Transit							
Total passenger travel time (hrs)	6531	4.27%	4.54%	4.70%	4.01%	3.87%	4.32%
Total passenger travel distance ('000km)	212	7.63%	8.01%	8.29%	7.58%	6.12%	114.41%
Average passenger network speed (km/hr)	35	4.33%	4.36%	4.38%	4.58%	3.21%	15.46%
AFFORDABILITY							
Strategy Revenue ($)							
Toll	0						
Fare	44626	7.31%	7.56%	8.02%	7.23%	7.00%	81.23%
Parking	203280	-0.24%	-0.37%	-0.20%	-0.42%	-0.26%	-44.04%
Total	247906	1.12%	1.06%	1.28%	0.95%	1.04%	-21.19%
ECONOMIC EVALUATION							
Cross-valley-link-road user benefits	0	0					
Porirua-Hutt-link-road user benefits	0	0					
Non-link-road user benefits	0	0					
Region-wide user benefits	0	0					
SUSTAINABILITY							
Environment							
CO2 Emmissions (Tonnes)	828	0.76%	0.08%	1.06%	1.64%	1.83%	-54.30%
CO Emmissions (Tonnes)	29	0.73%	0.05%	1.05%	1.56%	1.69%	-48.48%
Fuel							
Fuel Consumption (Litres)	331055	0.76%	0.08%	1.06%	1.64%	1.83%	-54.30%
Safety							
Total Accident Cost ($)	103523	-1.79%	-2.58%	-1.45%	-0.43%	2.56%	-56.64%
General Statistics							
Total Number of motor vehicle trips	364827	-0.32%	-0.39%	-0.34%	-0.16%	-0.01%	-61.35%
Total Number of passenger trips	81541	0.17%	0.04%	0.22%	0.41%	0.59%	-38.31%
Total Number of slow trips	128865	-0.77%	-0.50%	-1.00%	-1.41%	-1.75%	-63.61%
Total Number of PT trips	37779	1.80%	2.14%	1.97%	1.40%	0.94%	34.75%
Average motor vehicle trip length (km)	10.1	0.89%	0.55%	1.19%	1.64%	1.75%	6.65%
Cost of Congestion ($)	10211	17.89%	5.38%	25.91%	-0.33%	17.52%	571.45%
V/C Ratios							
Melling Bridge (WB)	0.7	2.13%	1.18%	2.76%	6.24%	19.88%	1.83%
SH2 South of SH58 (SB)	0.3	2.25%	0.74%	3.07%	-1.17%	-10.73%	105.68%
Kenn Good Bridge (WB)	0.5	1.95%	0.32%	2.11%	3.90%	6.16%	61.45%
Randwick Rd (SB)	0.4	-1.87%	-0.87%	-2.75%	-3.97%	-5.65%	51.12%
Petone Esplanade (WB)	0.3	1.48%	0.22%	3.28%	17.57%	-30.58%	174.14%
Hutt Rd South of Wakefield (SB)	0.3	6.79%	-1.22%	15.12%	42.19%	7.19%	178.54%
SH2 Petone - Ngauranga (SB)	0.6	-23.15%	3.02%	-22.59%	-34.75%	-33.04%	76.32%
SH1 Ngauranga - Aotea Quay (SB)	0.3	3.64%	1.45%	5.56%	2.37%	3.34%	140.59%
SH1 Aotea Quay - Ngauranga (NB)	0.9	2.79%	1.27%	3.90%	1.89%	2.60%	-8.93%

INDICATOR	Table 5.6 - IP Results - Actual Difference						
	Base	S1	S2	S3	S4	S5	S6
ACCESSIBILITY							
Auto							
Total motor vehicle travel time (hrs)	55362	384	15	559	835	-26508	-26525
Total motor vehicle travel distance ('000km)	3668	21	6	31	54	64	-2156
Average vehicle network speed (km/hr)	66.2	-0.1	0.1	-0.1	0.0	0.1	-13.8
Total auto trips spread from the peak	207	-315	-191	-469	-492	-521	-526
Total vehicle hours below service level D	212	75	-1	80	13	18	7323
Auto Travel times to Airport (mins):							
CBD	8.3	0.0	0.0	0.0	0.0	0.0	1.6
Port	10.5	0.0	0.0	0.0	0.0	0.0	1.9
Johnsonville to Airport	15.6	0.1	0.0	0.0	-0.1	0.1	8.0
Porirua to Airport	21.3	0.0	0.0	0.0	0.0	0.1	9.8
Plimerton to Airport	27.1	0.0	0.0	0.0	0.0	0.0	10.3
Paraparaumu to Airport	42.0	0.0	0.0	0.0	0.0	0.0	10.8
West External to Airport	61.6	0.0	0.0	0.0	0.0	0.0	9.7
Lower Hutt to Airport	18.5	0.0	0.0	0.0	0.0	0.0	14.5
Upper Hutt to Airport	28.5	0.0	0.0	0.0	0.0	-0.1	17.5
East External to Airport	94.6	0.0	0.0	0.0	0.0	-0.1	17.3
Transit							
Total passenger travel time (hrs)	6531	278.96435	296.65625	306.98926	261.8833	252.73291	282.38379
Total passenger travel distance ('000km)	212	16.2	17	17.6	16.1	13	242.9
Average passenger network speed (km/hr)	35	1.51681286	1.52554798	1.5343858	1.60208594	1.1242559	5.41107124
AFFORDABILITY							
Strategy Revenue ($)							
Toll	0						
Fare	44626	3261	3375	3579	3225	3122	36248
Parking	203280	-483	-751	-415	-863	-535	-89524
Total	247906	2778	2625	3163	2362	2588	-52540
ECONOMIC EVALUATION							
Cross-valley-link-road user benefits	0 0	252	-97	491	4435	8521	15179
Porirua-Hutt-link-road user benefits	0 0	2255	1941	2277	4935	9107	2725
Non-link-road user benefits	0 0	1885	1757	1824	3296	3899	14054
Region-wide user benefits	0 0	4392	3600	4592	12666	21527	31958
SUSTAINABILITY							
Environment							
CO2 Emmissions (Tonnes)	828	6	1	9	14	15	-449
CO Emmissions (Tonnes)	29	0	0	0	0	0	-14
Fuel							
Fuel Consumption (Litres)	331055	2511	274	3520	5435	6068	-179777
Safety							
Total Accident Cost ($)	103523	-1850	-2672	-1501	-443	2654	-58633
General Statistics							
Total Number of motor vehicle trips	364827	-1179	-1426	-1227	-572	-21	-223826
Total Number of passenger trips	81541	137	32	178	334	478	-31239
Total Number of slow trips	128865	-990	-648	-1293	-1812	-2252	-81977
Total Number of PT trips	37779	680	807	745	528	356	13127
Average motor vehicle trip length (km)	10	0.09	0.06	0.12	0.16	0.18	0.67
Cost of Congestion ($)	10211	1826.8233	549.2647	2645.6651	-34.167	1788.6084	58352.3887
V/C Ratios							
Melling Bridge (WB)	1	0.01	0.01	0.02	0.04	0.13	0.01
SH2 South of SH58 (SB)	0	0.01	0.00	0.01	0.00	-0.03	0.29
Kenn Good Bridge (WB)	1	0.01	0.00	0.01	0.02	0.03	0.34
Randwick Rd (SB)	0	-0.01	0.00	-0.01	-0.02	-0.02	0.23
Petone Esplanade (WB)	0	0.00	0.00	0.01	0.05	-0.09	0.54
Hutt Rd South of Wakefield (SB)	0	0.02	0.00	0.04	0.11	0.02	0.48
SH2 Petone - Ngauranga (SB)	1	-0.14	0.02	-0.14	-0.22	-0.20	0.47
SH1 Ngauranga - Aotea Quay (SB)	0	0.01	0.01	0.02	0.01	0.01	0.49
SH1 Aotea Quay - Ngauranga (NB)	1	0.02	0.01	0.03	0.02	0.02	-0.08

▪ Appendix D

Rough Order of Cost, Indicative Benefits and BCRs for each Stage 2 option

Table 5.7 Hutt Corridor - Benefit Cost Calculations (over 25 year evaluation period)

	Base	S1	S2	S3	S4	S5	S6
Benefits							
AM Peak 2 hour User Benefits ($)	$0	$20,709	$16,744	$23,109	$27,216	$33,510	$31,958
Interpeak 7 hour User Benefits ($)	$0	$4,392	$3,600	$4,592	$12,666	$21,527	$31,958
Weekday Daily benefits	$0	$48,884	$39,608.00	$54,024	$75,964	$103,616	$118,245
Weekend benefits	$0	$17,568	$14,400	$18,368	$50,664	$86,108	$127,832
Annual benefits	$0	$12,786,336	$10,369,920	$14,067,936	$21,271,248	$30,034,296	$36,048,624
25 Year benefits (Discounted 10%)	**$0**	**$121,777,064**	**$98,763,118**	**$133,983,022**	**$202,587,366**	**$286,046,635**	**$343,327,095**
Costs							
Korokoro Dowse Grade Seperation							
SH1 ATMS							
Minor Junction Upgrades (Removing Access)							
Minor Junction Upgrades (Signals))		$1,500,000	$1,500,000		$1,500,000	$1,500,000	$1,500,000
Melling Full Separation							
Silverstream Bridge Upgrade		$7,000,000	$7,000,000	$7,000,000	$7,000,000	$7,000,000	$7,000,000
SH2 HOT Lane		$13,000,000			$13,000,000	$13,000,000	$13,000,000
Petone Curves Realignment							
Belmont Full Grtade Separation							
Silverstream Full Grade Separation							
Moonshine Full Grade Separation							
Gibbons Full Grade Separation							
Totora Park Full Grade Separation							
River Road Upgrade							
Major Junction Upgrades (Signals+Extral Lanes)							
SH2 Tidal 5th Lane				$28,000,000			
Hutt Expressway (HOV) Lane							
Hutt Expressway Buslane			$13,000,000				
Petone-Grenada					$45,000,000		$45,000,000
Esplanade Upgrade					$22,000,000		
Cross Valley Link						$45,000,000	$45,000,000
Melling-Porirua						$80,000,000	
Randwick Melling							
Belmont-Porirua							
Randwick -Cambridge-KGB							
Melling Loop LRT Line							
SH58							
Akatarawa Road							
Tolling Facilities							
Parking Infrastructure		$10,000,000		$25,000,000	$10,000,000	$10,000,000	$10,000,000
Relocation of Melling Line							$13,000,000
New Station at Timberlea		$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
New Station at Cruickshank		$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
New Buses		$2,500,000	$3,250,000	$2,750,000	$2,750,000	$3,000,000	$3,000,000
New Bus Services		$26,588	$45,580	$39,069	$32,172	$27,851	$35,213
New Trains		$4,000,000	$6,500,000	$4,000,000	$4,000,000	$4,000,000	$4,000,000
New Tains Services		$75,729	$75,729	$75,729	$75,729	$75,729	$75,729
New Ferry							
Superbus		$11,993,573	$11,993,573		$11,993,573	$11,993,573	$11,993,573
Haywards bus		$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
Ferry Service							
Stokes Valley LRT							
Electrification extened to Featherson							
Rail Hutt - Porirua							
Capital Costs Undiscounted		**$54,245,890**	**$47,514,882**	**$71,014,797**	**$121,501,474**	**$179,747,153**	**$157,754,515**
BCR	**N/A**	**2.2**	**2.1**	**1.9**	**1.7**	**1.6**	**2.2**

The BCRs have been calculated using undiscounted capital costs