Western Corridor transportation study

# Planning balance sheet assessment

18 April 2005


TRANSIT NEW ZEALAND ARARAU AOTEAROA

greater WELLINGTON REGIONAL COUNCIL

# Planning Balance Sheet Assessment

Prepared for

## Greater Wellington Regional Council

## and Transit New Zealand

Prepared by

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## Executive Summary

One of the evaluation tools required to be applied in the assessment of options for the Western Corridor Transportation Study is a Planning Balance Sheet (PBS). A PBS establishes a framework of objectives and sub attributes and then scores and weights each item for each option. A PBS shows the trade offs between cost, performance and impact and can also be used for sensitivity testing.

The PBS is being used alongside other tools such as risk assessment and consultation feedback in the study process. These tools will aid rather than drive the decision making process associated with the review of the Corridor Plan for the Western Corridor.

The PBS is structured under objectives established for the review of the Wellington Regional Transport Strategy. These are:

- assist economic and regional development
- assist safety and personal security
- improve access, mobility and network reliability
- protect and promote public health
- ensure environmental sustainability
- consider economic efficiency and affordability.

The PBS details sub attributes under each of these objectives, indicators for each attribute and a scoring system out of 10. The scoring system allows for benefits as well as disbenefits to be recognised and in most cases the study base case represents the midpoint of 5.

Weightings for each objective have been established by the Regional Land Transport Committee and alternative weightings have been applied which represent the view of Land Transport New Zealand, the Transport Action Group and Transport 2000+ as follows.

| Planning Balance Sheet Weightings | RLTS Workshop | Land Transport NZ | Transport Action Group | Transport 2000+ |
|---|---|---|---|---|
| Assist economic and regional development | 19% | 20% | 25% | 20% |
| Assist safety and personal security | 14% | 20% | 13% | 20% |
| Improve access, mobility and network reliability | 16% | 20% | 15% | 20% |
| Protect and promote public health | 11% | 20% | 10% | 20% |
| Ensure environmental sustainability | 16% | 20% | 15% | 20% |
| Consider economic efficiency and affordability | 24% | Consider separately | 22% | - |

Transport 2000+ has recommended further attributes in the PBS relating to a number of additional sustainability issues. The effects of these will be tested through sensitivity analysis in the next stage of the study.

Twenty nine project elements have been assessed using the PBS technique. These are identified in the table below.

A considerable amount of the data for the PBS is derived from the Wellington Strategic Transport Model. This includes:

- Average all-mode generalised cost per person kilometre
- Average generalised cost per hcv kilometre
- Accident cost
- Average multi-modal cost for key movements
- Road congestion indicators
- Availability of a good public transport alternatives
- $CO_2$ emissions
- Travel time benefits
- Vehicle operating cost benefits

Expert assessments have been undertaken for attributes that can not be assessed by the model. These have been undertaken by appropriately qualified experts in the following areas:

- Air quality
- Noise
- Landscape
- Ecology
- Built Heritage
- Archaeology
- Severance, community disruption and active travel.

In addition a broad public health assessment has been undertaken on each element to verify and confirm the relevant scores above. Iwi values have been scored on the basis of previous reports and project consultation with iwi to date.

The assessments identify the nature and extent of both positive and negative effects of each element, any risks or opportunities associated with the assessment and potential areas of mitigation of those effects.

A funding assessment has been undertaken as the basis of affordability that concludes that a suitable target budget for the western corridor for the purposes of this assessment is $1.2 billion over 20 years.

The PBS results for each element with the alternative weighting systems are shown in the following table:

| | Description | RLTC | LTNZ and T2000+ | TAG |
|---|---|---|---|---|
| **RAIL IMPROVEMENTS** | | | | |
| RT1 | Double track Pukerua Bay tunnel section. | 4.2 | 5.1 | 4.3 |
| RT2 | Double track MacKays to Raumati | 5.3 | 5.0 | 5.3 |
| RT3 | Double track Raumati to Paraparaumu | 4.3 | 5.1 | 4.4 |
| RE1 | Waikanae electrification extension | 5.1 | 5.1 | 5.1 |
| RS1 | New rail station and bus interchange at Lindale | 5.7 | 5.1 | 5.7 |
| RS2 | New rail station at Raumati | 5.0 | 5.0 | 5.0 |
| RS9 | Park and ride capacity improvements | 5.8 | 5.2 | 5.7 |
| **HIGHWAY IMPROVEMENTS** | | | | |
| HT1 | Transmission Gully - full length 4 lane | 4.9 | 5.9 | 5.0 |
| HT4 | Transmission Gully - full length 2 lane | 5.3 | 5.9 | 5.3 |
| HT7 | Transmission Gully - full length 4 lane, with removal of Mana temporary improvements | 5.0 | 5.9 | 5.0 |
| HC1 | Coastal motorway | 4.9 | 5.1 | 5.0 |
| HC2 | Coastal expressway, no Mana bypass | 5.3 | 5.3 | 5.4 |
| HC4 | Coastal expressway, with Mana bypass | 5.2 | 5.4 | 5.2 |
| HC5 | Northern and central intersection and bottleneck upgrades consisting of Whitford Brown intersection, Mana bypas, Pukerua Bay bypass, Paekakariki intersection, Paraparaumu bypass, Otaihanga Road, Waikanae improvements. | 5.0 | 4.9 | 5.0 |
| HC6 | Northern motorway | 5.0 | 5.3 | 5.0 |
| HC7 | Northern expressway | 5.4 | 5.5 | 5.4 |
| HC8 | Ngauranga to Linden motorway upgrade | 4.8 | 4.9 | 4.8 |
| HC9 | Ngauranga to Linden motorway upgrade, with reduced geometry | 4.1 | 4.9 | 4.2 |
| HP1 | Johnsonville to Pukerua Bay parallel local road | 4.6 | 5.1 | 4.7 |
| HP2 | Fishermans Table to Poplar Avenue parallel local road | 3.9 | 5.0 | 4.0 |
| HP3 | Western Link Road | 4.6 | 5.1 | 4.7 |
| HE3 | Grays Road upgrade | 5.1 | 4.7 | 5.1 |
| HE5 | Grays Road realignment | 4.8 | 5.1 | 4.8 |
| HE6 | Petone to Granada link | 5.8 | 5.1 | 5.8 |

Orange <4.5, White 4.5 to 5.5, Green >5.5

Initial strategy scenarios have been developed and tested as a first round of analysis. The scenarios are based on the following themes:

1. **Public Transport and Travel Demand Management**
2. **Roading**
3. **Improved Reliability**
4. **Congestion Relief**
5. **Project Efficiency**

Specific elements have been identified under each of the scenarios above and have been assessed and evaluated through the PBS. The results are as follows:

| Planning Balance Sheet Assessment | Scenarios | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Economic & regional development | 5.2 | 6.6 | 6.6 | 6.0 | 5.9 |
| Safety & personal security | 5.8 | 7.1 | 7.3 | 4.3 | 4.6 |
| Access, mobility & network reliability | 5.4 | 7.5 | 7.7 | 6.6 | 5.8 |
| Public health | 5.0 | 6.2 | 5.3 | 4.5 | 4.9 |
| Environmental sustainability | 4.5 | 4.9 | 4.2 | 4.2 | 4.5 |
| Economic efficiency & affordability | 5.6 | 2.8 | 3.8 | 5.2 | 5.8 |
| PBS score – RLTC | 5.3 | 5.6 | 5.7 | 5.2 | 5.4 |
| PBS score – LTNZ | 5.2 | 6.5 | 6.2 | 5.1 | 5.2 |
| PBS Score – TAG | 5.3 | 5.7 | 5.7 | 5.3 | 5.4 |

These scores will be subject to sensitivity testing and further refinement of scenarios into a range of package options once stage 2 consultation is complete.

## 1. Introduction

A number of strategic evaluation tools have been developed to assess and evaluate the advantages and disadvantages of strategies for transport infrastructure and management of the Western Corridor.

One tool that Greater Wellington and Transit New Zealand have specifically requested be developed and used is a Planning Balance Sheet (PBS). This has been used alongside other inputs such as risk assessment and consultation feedback.

This report documents the development and application of the PBS. It has been applied to the project methodology at two stages, firstly the evaluation of specified project elements and secondly to scenarios formed from combinations of the project elements.

The report is structured as follows:
**Sections 2, 3 and 4** set out the development of the Planning Balance Sheet and relating scoring and weighting systems.
**Section 5** provides a brief description of the project elements.
**Section 6** outlines the nature of inputs from the Wellington Strategic Transport Model. A more detailed report on modelling is provided separately.
**Sections 7 to 16** summarise the expert assessments and scoring for indigenous habitats, regional ecosystems and landscape values, air quality, noise, active travel, archaeology and heritage, community severance, community disruption and iwi values. As part of this section 12 reports on an overview assessment of public health issues.
**Section 17** details how economic efficiency and affordability has been assessed and includes an assessment of funding streams.
**Section 18** reports on the overall results of the PBS evaluation of elements.
**Sections 19, 20 and 21** finally identify possible strategy scenarios of elements and records the scoring approaches and results.

## 2. Development of the Planning Balance Sheet

The Planning Balance Sheet technique provides a scoring and weighting framework for the evaluation of options against stated criteria or objectives. It is a tool to assist in the understanding of the performance of an option and to make explicit the trade offs between different criteria or objectives.

The PBS is not in itself a decision making tool, it is a tool for analysts and decision makers to assist with that process along with a range of other tools.

The Regional Land Transport Committee of Greater Wellington agreed the broad objectives for the review of the Wellington Regional Land Transport Strategy prior to commencement of this study. These have therefore been adopted as the starting point for the PBS. These objectives are based on the matters that the recent Land Transport Management Act 2003 has identified must be given particular regard in preparing transport strategies and programmes. These are:

- Assist economic and regional development

- Assist safety and personal security
- Improve access, mobility and network reliability
- Protect and promote public health
- Ensure environmental sustainability

The RLTC then added one additional objective as follows:

- Consider economic efficiency and affordability.

Under this framework a number of specific subattribute objectives were identified by the project team and agreed with the Technical Steering Group as follows:

***Economic and Regional Development***

- Minimise average multi-modal user costs
- Minimise road freight user costs
- Maximise regional GDP

***Safety and Personal Security***

- Maximise safety
- Maximise personal security

***Access, Mobility and Network Reliability***

- Improve accessibility to and integration of all modes of transport
- Improve reliability of travel time for road and rail
- Improve resilience of the road and rail network
- Improve the extent of choice for mode options

***Public Health***

- Promote positive effects on air quality
- Minimise adverse effects of noise
- Promote facilities for active travel (cycling and walking)
- Minimise the extent of community severance and related effects
- Minimise the extent of community displacement and construction disruption

***Environmental Sustainability***

- Incorporate understanding of iwi values
- Minimise greenhouse gas emissions
- Minimise effects on indigenous habitats
- Minimise environmental effects on significant ecosystems
- Maximise landscape, visual and recreational opportunities
- Minimise adverse effects on archaeology and heritage

***Economic Efficiency and Affordability***

- Consider affordability of elements and packages
- Provide economic efficiency of elements and packages

## 3. PBS Indicators

Specific indicators have been identified for each of the above subattributes. These were agreed by the Technical Steering Group and are shown in the full PBS table set out below. In addition scoring systems were devised at an early stage for each sub-objective to ensure that a consistent approach was taken to scoring across the PBS. The scoring system is designed to be able to recognise both benefits and disbenefits.

The mid point for scoring in most cases is the "base case". This has been defined as the existing transportation infrastructure and associated environment plus the committed projects of:

- Lindale Grade Separation,
- MacKays Crossing,
- 4 laning north of Plimmerton to the Weigh Station,
- Mana Plimmerton clearways with HOV lanes, and
- The Inner City Bypass.

No rail infrastructure improvements are in the base case.

A number of the PBS indicators are capable of analysis through the Wellington Strategic Transport Model (WTSM) owned and operated by Greater Wellington. The WTSM models three different years, 2001, 2016 and 2026. The base year for the modelling is 2016. This is because there is little projected population growth between 2016 and 2026 in the base case and the 2016 year would be close to the time that any major projects would be able to come on stream.

The population and land use projections in the base case have adopted medium growth demographic projections. These projections will be updated when new projections are available from work being undertaken as part of the Wellington Regional Strategy. This will also allow sensitivity testing against alternative growth projections.

A number of indicators are not assessed by the model and these range from numerical measures through to expert assessment against specified criteria. Project team specialist experts have been used to undertake assessment and evaluation of specific items in the PBS as required and these are documented later in this report.

**Planning Balance Sheet**

| Objectives and Sub Attributes | | | | |
|---|---|---|---|---|
| **1. ECONOMIC AND REGIONAL DEVELOPMENT** | **INDICATOR** | **Score 0** | **Score 5** | **Score 10** |
| Average multi-modal user cost | Average cost per person km | +10% | Base | -10% |
| Average road freight user cost | Average cost per truck km | +10% | Base | -10% |
| Changes to GDP | Return on investment | 0% | 10% | 20% |
| **2. SAFETY AND PERSONAL SECURITY.** | **INDICATOR** | **Score 0** | **Score 5** | **Score 10** |
| Actual Safety Rate | Social cost / PEM | +30% | Base | -30% |
| Personal Security, defined as the threat of criminal activity to self or property. | Usage of element and access to help as measured by % increase in PT trips | -10% | Base number of trips | +10% |
| **3. ACCESS, MOBILITY AND NETWORK RELIABILITY** | **INDICATOR** | **Score 0** | **Score 5** | **Score 10** |
| Multi-modal Accessibility and integration | Travel time between 13 key locations (at least three include transfers eg Paraparaumu Beach to Courtenay Place) | +10% | Base | -10% |
| Reliability of travel time for road and rail | Weighted sum of congestion points on the road with peak volume to capacity ratio 0.8-0.9, 0.9-1.0, 1.0-1.1, etc along with a similar measure on the rail network | +60% | Base | -60% |
| Network Resilience for road and rail | Total lane or track distance of road or rail. 20% bonus score where parallel alternative route provided | N/A | Current level (2004) | 2 tracks, 2 roads 1 of which is 4 lane |
| Mode Option Choice | Ratio of car journey time to best alternative journey time. | -30% | Base | +30% |

| 4. PUBLIC HEALTH | INDICATOR | Score 0 | Score 5 | Score 10 |
|---|---|---|---|---|
| Air quality | 1. Compliance with national air quality standard for PM10 of 50 ug/m3 24 hour average.<br>2. %change from base at community locations within 60 metres of the source. | +40% | Base | -40% |
| Noise | Number of houses where living environment exceeds 65 dBA (Leq 24 hr). | +50% | Base | -50% |
| Active Travel | Pedestrian and cycle safety, grades and accessibility to facilities. | Loss of existing shared path | No change. | High standard dedicated ped and cycle facilities. |
| Community Severance and related effects. | Total population separated from it's principal community facilities by a highway of 10,000 a.a.d.t or more. | +90% | Base | -90% |
| Community displacement and construction disruption effects. | Number of dwellings directly adjacent to project X 0.1 + number of dwellings displaced. | 200 dwelling equivalents | 0 dwelling equivalents | Not applicable |
| Crashes | Social cost: PEM multi modal values. | +30% | Base | -30% |
| **5. ENVIRONMENTAL SUSTAINABILITY** | **INDICATOR** | **Score 0** | **Score 5** | **Score 10** |
| Iwi Values | Preliminary assessment based on existing reports and consultation with iwi. | | | |
| Greenhouse gases | Gross Change in CO2 emissions | +30% | Base | -30% |
| Indigenous habitats | Permanent change to terrestrial or marine habitats that are representative of the ecological district. | Permanent change to more than 100 ha of indigenous habitat. | Base | Long term protection to more than 100 ha of indigenous habitat. |
| Significant Ecosystems | The presence and sensitivity of regionally or nationally important ecosystems, which are potentially affected. | Major adverse effects on >1 nationally or | Base case effects | Major contribution to the long term sustainable |

| | | | | |
|---|---|---|---|---|
| | | regionally important ecosystems | | management of nationally important ecosystems or restoration of potentially nationally important ecosystems |
| Landscape and Visual including recreational values | Expert assessment based on :<br>1. The presence and value of significant outstanding natural landscapes.<br>2. Permanent change to landscape character.<br>3. The capacity for the landscape to absorb change associated with new transport infrastructure. (VAC = Visual Absorption Capability) | Major permanent change to a high value landscape that has low VAC and limited mitigation potential. | Base Case Effects | Major landscape restoration to a significant outstanding natural landscape. |
| Archaeology and Heritage | The number and significance of archaeological and heritage sites damaged or destroyed plus expert commentary including mitigation potential. | Damage or destruction to concentrations of archaeological and heritage sites of very high value and little mitigation potential. | Base case effects | Long term protection of concentrations of archaeological and heritage sites of very high value. |
| **6. ECONOMIC EFFICIENCY AND AFFORDABILITY** | **INDICATOR** | **Score 0** | **Score 5** | **Score 10** |
| Element Efficiency | Regional Benefits/Construction Cost | 0 | 0.25 | 0.5 |
| Package Efficiency | Regional Benefits/Construction Cost | 0 | 0.25 | 0.5 |
| Element Affordability | Cost($) / corridor length (km) | $44M/km | $22M/km | 0 |
| Package Affordability | Total package cost – (defined as Implemented Infrastructure and Services) | $2.4B | $1.2B | $0 |

## 4. Weighting of Objectives and Sensitivity Testing

An important part of the PBS is that it allows for weighting of different elements and sub attributes. This allows judgements to be made on the relative importance of one objective against another.

Greater Wellington has undertaken a workshop exercise with the RLTC to develop weights for the Wellington Regional Land Transport Strategy. These have been adopted as the lead weightings for the study as it is an important contributing study to the WRLTS.

The weighting derived from the workshop are as follows:

- Assist economic and regional development. 19%
- Assist safety and personal security 14%
- Improve access, mobility and network reliability 16%
- Protect and promote public health 11%
- Ensure environmental sustainability 16%
- Consider economic efficiency and affordability. 24%

In order to develop alternative weightings to test the sensitivity, the draft PBS was supplied separately to two groups that could be considered to represent views further to the left and the right of the RLTC. The Transport Action Group, that represents business interests, and Brent Efford of Transport 2000+, who represents public transport users, cyclists and pedestrians, were both asked to review the PBS and to propose weightings that represented the relative importance that they attributed to each objective. Land Transport New Zealand was also consulted on weightings and considered that the objectives of the Land Transport Management Act should be equally weighted and the question of efficiency and affordability considered separately.

The following table summarises the views on weightings.

| Planning Balance Sheet Weightings | RLTS Workshop | Land Transport NZ | Transport Action Group | Transport 2000+ |
|---|---|---|---|---|
| Assist economic and regional development | 19% | 20% | 25% | 20% |
| Assist safety and personal security | 14% | 20% | 13% | 20% |
| Improve access, mobility and network reliability | 16% | 20% | 15% | 20% |
| Protect and promote public health | 11% | 20% | 10% | 20% |
| Ensure environmental sustainability | 16% | 20% | 15% | 20% |
| Consider economic efficiency and affordability | 24% | Consider separately | 22% | - |

Transport 2000+ also consider that the PBS should include extra (refer table below) items that would take greater account of depleting oil reserves, climate change, aging population, population forecasts and effects of pollution.

| | INDICATOR | Score 0 | Score 5 | Score 10 |
|---|---|---|---|---|
| **ECONOMIC AND REGIONAL DEVELOPMENT** | | | | |
| **Insulation from oil price increases** | Promotes a pattern of development which is energy-efficient | Will be adversely affected by significant oil price increases[1] | Oil price effect essentially neutral[2] | Substitutes renewable energy or no energy use for oil use[3] |
| **ENVIRONMENTAL SUSTAINABILITY** | | | | |
| **Climate change 1** | GHG emissions | Will increase GHG emissions | Will maintain current level of GHG emissions | Replaces a current GHG emitter with zero emissions |
| **Climate change 2** | Resistance to adverse weather | At high risk of disruption from weather or sea level rise[4] | New project with essentially no risks of slips, flooding etc | Project substantially improves the weather-proofing of the corridor[5] |
| **Aging population 1** | Easily useable alternatives to motoring | Facilitates motoring only | Provides an alternative to motoring but not convenient for the physically impaired | Alternative to motoring, easily accessed by all levels of physical ability. |
| **Aging population 2** | Access to social, recreational, medical (SRM) nodes | Does not improve non-car access to SRM nodes | Improves non-car access to SRM nodes with mode changing | Provides 'front door, single seat' PT access to SRM nodes |
| **Population peak 1** | Appropriate sizing of investment | Justified only if regional population exceeds 1M | Justified only if population = 750 k | Justified by current population, can accommodate 750 k without extra investment |
| **Population peak 2** | Match between traffic and population growth | Will facilitate/ cause extra traffic growth | Will ensure traffic growth no higher than population growth | Will reduce traffic volumes in absolute terms |
| **Preventing pollution** | Zero harmful emissions from transport sources into the local environment by 2050 | Will increase emissions | Will maintain current levels of emissions | Will reduce emissions to contribute to a 'zero by 2050' trend line |

These additional lines will be tested by running the model to test different oil price and population distribution scenarios. This is discussed further later in the report.

[1] Project will maintain or increase use of oil-based energy – e.g. road projects without TDM
[2] Project will reduce oil use by approximately the amount of price increases – e.g. diesel rail freight replacing road freight, or diesel bus use replacing private car
[3] Project will eliminate oil use, e.g. by substituting electric traction for diesel, or by substituting active modes, or by eliminating trips.
[4] E.g. from slips, flooding, coastal erosion, wave action
[5] E.g. raising low-lying roads, widening cuts, coastal protection

## 5. Brief Description of Project Elements

The project elements developed and assessed within the study were identified in the Confirmed Elements report dated 18 February 2005. The following is a brief summary of the elements assessed using the Planning Balance Sheet

| Element No. | Description |
|---|---|
| | **RAIL IMPROVEMENTS** |
| RT1a | Double track Pukerua Bay Tunnel Section. Involves additional track between Pukerua Bay and Paekakariki using a combination of cut and tunnel. |
| RT1b | Double track Pukerua Bay Tunnel Section. Involves additional track between Pukerua Bay and Paekakariki using a separate alignment alongside the existing highway. |
| RT2 | Double track MacKays to Raumati. Double track the existing single track section between MacKays Crossing and Raumati. |
| RT3 | Double track Raumati to Paraparaumu. Double track the existing single track section between Raumati and Paraparaumu. |
| RE1 | Extension of commuter network. Electrification of Waikanae section (starting north of existing Paraparaumu station). |
| RS1 | New rail station at Lindale. |
| RS2 | New rail station at Raumati, located between Poplar Avenue and Leinster Road. |
| | **HIGHWAY IMPROVEMENTS** |
| HT1 | Transmission Gully 4 lane for the full length. |
| HT4 | Transmission Gully 2 lane for the full length. |
| HT7 | Transmission Gully 4 lane for the full length. Includes the removal of temporary improvements at Mana. |
| HC1a | Coastal Upgrade + 2 lanes (Motorway). Over Transmission Gully length with coastal section on reclamation. |
| HC1b | Coastal Upgrade + 2 lanes (Motorway). Over Transmission Gully length with coastal section on viaduct. |
| HC2 | Coastal upgrade +2 lanes through Mana. Over Transmission Gully length. Uses existing alignment through Mana. |
| HC4 | Coastal Upgrade - expressway concept. Over Transmission Gully length. Involves Mana Bypass through Ngatitoa Domain. |
| HC5 | Intersection and Bottleneck Upgrades. Involves small scale physical works at the following locations; Whitford Brown Avenue, Mana, Paekakariki, Pukerua Bay, Paraparaumu, Otaihanga Road, Waikanae. These individual elements have also been scored individually. |
| HC6 | Northern SH1 Upgrade + 2 lanes (Motorway). From MacKays Crossing to Peka Peka. |
| HC7 | Northern SH1 Upgrade + 2 lanes (Expressway) From MacKays Crossing to Peka Peka. |

| Element No. | Description |
|---|---|
| HC8 | Southern SH1 Upgrade + 2 lanes (Motorway). From Ngauranga Gorge to south of Linden. |
| HP1 | Parallel local road to SH1 from Johnsonville to Pukerua Bay. Involves new local road from Mungavin to Aotea Block and north from Airlie Road to Pukerua Bay. |
| HP2 | Parallel local road to SH1 from Fishermans Table to Poplar Avenue. |
| HP3 | Western Link Road. Runs from Poplar Avenue to Peka Peka. Is a parallel local road to SH1. |
| HE3 | Grays Road, improvements to existing road corridor at various locations. |
| HE5a | New route Pauatahanui to SH1 at Airlie Road. |
| HE5b | New route Pauatahanui to SH1 at Plimmerton Interchange. |
| HE6a | New link Grenada to Petone via Korokoro Stream Valley. |
| HE6b | New link Grenada to Petone via Horokiwi Road. |
| | **TRAVEL DEMAND MANAGEMENT** |
| TDM1 | Package of travel demand management measures to achieve 5% reduction in journey to work (JTW) trips. |
| TDM2 | Package of travel demand management measures to achieve 10% reduction in journey to work trips. |
| TDM3 | Package of travel demand management measures to achieve 3% reduction in journey to work trips. |

## 6. Modelling of Elements

The Wellington Transport Strategy Model (WTSM) is the multi-modal model of the Wellington Region. The current version was developed by consultants Sinclair Knight Merz and Beca between 2001 and 2003 and delivered to Greater Wellington Regional Council (GWRC) in late 2003. Since then it has been a source of transport data and the main tool for forecasting the impacts of alterations to transport networks, public transport services and land use plans. It has been used in this capacity in all strategic and policy studies initiated by GWRC over the last 18 months including the CBD Corridor Study, the re-evaluation of Transmission Gully Motorway, the Wellington Rail Review and the Wellington Transport Project. It is one of only two comprehensive transport models in New Zealand, the other being the Auckland Regional Transport model (ART).

The model shows that the Base Case car trips across the whole study area are forecast to increase by 18% (1.1% a year) between 2001 and 2016, and public transport trips by 14% (0.9% a year). Across the WCTS study area, the AM peak public transport mode share stays constant at around 15%. The southern boundary of the study area (Ngauranga Gorge), the public transport mode share

is 31% in 2001 rising to 35% by 2016. This is because under the base case highway speeds fall, while rail speeds are maintained.

By 2016, significant peak congestion is forecast on SH1 throughout most of the study area, caused by increasing population, employment and car ownership. Average speed in the AM peak falls from 57 km/h to 52 km/h. Increases in rail use lead to overcrowding, with passengers having to stand in the peak. A very striking change between 2001 and 2016 is the Heavy Commercial Vehicles (HCVs) on the road: there is a 59% increase in truck kilometres (3.1% a year).

The model provides data on a number of the key indicators in the Planning Balance Sheet. This includes the following:

(1) Economic and Regional Development
- Average all-mode generalised cost per person kilometre
- Average generalised cost per HCV kilometre

(2) Safety and Personal Security
- Accident cost
- Perceived safety

(3) Access, Mobility and Network Reliability
- Average multi-modal cost for key movements
- Road congestion indicator
- Availability of a good public transport alternative

(4) Public Health
- Accident cost

(5) Environmental Sustainability
- $CO_2$ emissions

(6) Economic Efficiency and Affordability
- Travel time benefits
- Vehicle operating cost benefits
- Safety benefits

The indicators are for annual effects, calculated from AM peak, PM peak and Interpeak model results and locally derived conversion (annualisation) factors.

Monetised benefits are calculated using Project Evaluation Manual values. The indicators are converted to a score that lies in the range 0 to 10. A score of 5 is deemed neutral compared to the 2016 Base. By definition, the 2016 Base scores 5 for all indicators. If an element or package results in a better outcome than the Base (e.g. a reduction in accidents), it scores higher than 5; if it results in a worse outcome it scores lower than 5. The changes that give scores of 0 and 10 were calibrated to be appropriate for the study and to be consistent with all other indicators in the PBS.

A further refinement Petone Grenada link which includes an additional link to the Tawa Interchange will also be modelled and assessed as part of the next stage of the study.

## 7. Expert Assessment of Elements

A number of items within the PBS were not able to be analysed through the WTSM. These were subject to expert assessment by specialists within the project team in accordance with the PBS methodology.

The assessment undertaken and specialists responsible for each were as follows:

- **Air quality:** Gavin Fisher, Director of Endpoint Ltd and former head of NIWA air quality group
- **Noise:** Malcolm Hunt of Malcolm Hunt and Associates
- **Active travel, community severance and disruption:** Alison Jäppinen of Maunsell Ltd
- **Public Health:** Rob Quigley of Rob Quigley and Associates
- **Indigenous habitats and regionally significant ecosystems**: Steven Fuller, Senior Ecologist Boffa Miskell Ltd
- **Landscape, visual and recreation:** Frank Boffa, Director Boffa Miskwell Ltd
- **Built Heritage:** Ian Bowman Conservation Architect
- **Archaeology:** Mary O'Keefe of Heritage Solutions Ltd

The scope of the assessment of each element included consideration of:

- Existing environmental values in the vicinity of the element
- Assessment of positive effects on the environment
- Assessment of negative effects on the environment
- Comparison with the base case
- Risks and opportunities
- Potential aspects of mitigation of effects

The assessment and scoring for each of these areas are summarised in the following sections.

## 8. Indigenous habitats, regionally significant ecosystems and landscape

Assessment and scoring was undertaken in accordance with the PBS indicators. As part of this the area of habitat affected by elements was measured. However the scoring also took into account other factors in the assessment particularly the potential for opportunities for mitigation. The following summarises the assessments in terms of positive and negative effects on the environment, risks, opportunities and areas of potential mitigation.

**RT1a: Double tracking Pukerua Bay Tunnel Section: Cut and Tunnel**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Significant adverse landscape and visual effects from the cuts at the northern end of the coastal escarpment and the removal of any of the protected Pohutakawa and Cabbage trees along the eastern side of SH1.
- Cuts along the coastal scarp will result in the removal of 2-3 hectares of regenerating coastal shrubland and scrub within an identified ecological sites. The areas affected are of mixed value but are contiguous with areas being actively revegetated by a volunteer group.

*Risks and opportunities:*

- That cuts will be more severe than currently expected.
- That excavation will increase erosion leading to need for additional stabilisation of slopes and rock fall protection.

*Potential mitigation:*

- Rehabilitation of the slopes within the rail corridor for ecological mitigation and erosion control.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 3 |

**RT1b: Double tracking Pukerua Bay Tunnel Section: Tracks Separated on Existing Formation**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Major adverse landscape and visual effects on the coastal escarpment and adverse effects on the natural character of the coastal environment. Visual effects will be most pronounced for motorists travelling beside the high retained platform and from Pukerua Bay Beach.

*Risks and opportunities:*

- Risk of increased adverse effects if development is greater than anticipated.

*Potential aspects of mitigation of effects:*

- Limited potential.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 3 |

**RT2: Double Tracking MacKays Crossing to Raumati**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- There will be major adverse visual effects from cuts in the coastal escarpment which will be highly visible from SH1, the railway corridor and land to the west of the railway. Also adverse visual effects from associated structures, retaining walls and debris protection
- The cut faces and rock benches will not readily support revegetation with native trees. Will be highly susceptible to weeds (gorse, broom, blackberry). Three stands of regionally significant coastal forest will be affected by the proposed work. The extent of this impact will depend on the final height of cuts
- A number of culverts will need to be lengthened during installation of the new track with possible effects on fish passage.

Cumulative landscape and visual effects from other potential works in the same area RT2, RT3, RS2, RS9.

*Risks and opportunities:*

- Cuts will be more extensive than anticipated or destabilise slope.
- Canopy dieback due to effects of wind and drought resulting in greater extent of forest loss.
- Difficulty in revegetating, rehabilitating and restabilising the coastal escarpment.
- Potential to link coastal forest fragments through retirement and revegetation of a continuous length.

*Potential aspects of mitigation of effects:*

- Minimise disturbance to escarpment.
- Advanced ecological mitigation including setting aside an equivalent area of coastal forest.
- Fish passage at culverts.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 3 | Ecosystems | 5 | Landscape | 3 |

**RT3: Double Tracking Raumati to Paraparaumu**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- There will be major adverse visual effects from cuts in the coastal escarpment which will be highly visible from SH1, the railway corridor and residential and commercial land to the west of the railway. Also adverse visual effects from associated structures, retaining walls and debris protection

- The cut faces and rock benches will not readily support revegetation with native trees. Will be highly susceptible to weeds. There will be minimal effect on native vegetation which is dominated in this area by weed species or is sufficiently distant from the corridor.

Cumulative landscape and visual effects from other potential works in the same area RT2, RT3, RS2, RS9.

*Risks and opportunities:*

- Cuts could be more extensive than anticipated.
- Difficulty in rehabilitation of disturbed areas of coastal escarpment.
- Potential to use the development as a means of enhancing the existing landscape beyond the confines of the corridor there by enhancing the gateway to Paraparaumu.

*Potential aspects of mitigation of effects:*

- Most acceptable mitigation would be avoidance or reduction of disturbance to escarpment.
- Mitigation measures to extend beyond cuts through revegetation of the existing modified landscape.
- Recommend single pole over portal
- Lower retaining walls may be more appropriate visually in Paraparaumu outskirts than high terraced cuts.
- Extend corridor upslope to provide greater opportunity for enhancement of landscape values.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 4 |

**RE1: Waikanae Extension**

*Assessment of positive effects on the environment:*

- Enhanced public access/recreational links.

*Assessment of negative effects on the environment:*

- Minor visual and ecological effects.

*Risks and opportunities:*

- Potential to adversely effect ecological sites if the works extend beyond the existing corridor.

*Potential aspects of mitigation of effects:*

- Single overhead pole option preferred.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 5 |

**RS1: New Lindale Station**

*Assessment of positive effects on the environment:*

- Enhanced public access to and from Lindale.

*Assessment of negative effects on the environment:*

- None.

*Risks and opportunities:*

- Potential to enhance recreation/tourism linkages including walkway and cycleway.

*Potential aspects of mitigation of effects:*

- Ensure adequate provisions of buffer areas.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 5 |

**RS2: New Raumati Station**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- The overhead bridge will likely be visually prominent.
- Lighting will be installed in an area currently unlit.
- There appears to be sufficient width for the proposal to avoid the coastal escarpment.
- Potential for cumulative adverse effects on the landscape from the development of other elements (e.g. RT2 and RT3).

*Risks and opportunities:*

- Potential for ecological and more extensive landscape and visual effects if the element is not contained within the existing railway corridor (i.e. cutting into escarpment).
- Potential for innovative design for buildings and the overhead bridge.
- Potential to facilitate recreational access to the escarpment. An overbridge could extend over the entire width of the railway linking with QEII Regional Park.

*Potential aspects of mitigation of effects:*

- Investigate recreational access opportunities.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 4 |

**RS9: Park and Ride Upgrades**

*Assessment of positive effects on the environment:*

- Public access and recreational activities.

*Assessment of negative effects on the environment:*

- No adverse ecological or landscape effects.

*Risks and opportunities:*

- Opportunity for recreational and tourism links through enhanced public access to the coastal escarpment, QEII Regional Park, Whitireia and the coast line.
- Opportunity for innovative landscape design and mitigation.

*Potential aspects of mitigation of effects:*

- Adequate buffer areas to effectively mitigate for landscape and amenity effects.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 5 |

**HT1: Transmission Gully Motorway – 4 Lane**

*Assessment of positive effects on the environment:*

- Improved visual access to Battle Hill Farm Forest and Park and Belmont Regional Park.
- Provides a new gateway to and from Wellington.
- Scenic route with panoramic views of Pauatahanui Inlet and Kapiti Coast.
- Use of viaducts and bridges substantially reduces extent of earthworks and so reduces visual and ecological impacts.

*Assessment of negative effects on the environment:*

- Severs western section of Belmont Regional Park in the Cannons Creek area.
- Highly visible from within parts of Porirua basin, Belmont regional Park and Battle Hill Farm Forest Park.
- Visible to existing rural residential properties at Pauatahanui environs and QEII Regional Park.
- Visual effects of structures and significant earthworks in a rural landscape.
- Ecologically the road footprint will be permanently affect up to 35ha of native vegetation and a further 10 ha of stream habitat. Up to 7km of Duck Creek, Ration Stream, Horokiri Stream and Te Puka Stream will be effected by culverting, permanent diversion, or modification during construction. Theses streams or their tributaries will be crossed at over 75 points with potential effects on fish passage and loss of stream habitat through culverting
- There will be some effect upon Pauatahanui Inlet and its wildlife reserves through sediment movement during construction. The extent of this effect will depend upon the types of sediment control measures employed, the quality of site management, and the weather during construction.

*Risks and opportunities:*

- Excavation, cut and fill and vegetation removal could be more extensive than shown.
- Construction impacts on streams more extensive and of longer duration than predicted.

- Unexpected events such as unseasonal storms or discharge of contaminants, causing extensive downstream damage to Pauahanui Inlet
- However, the greenfield environment allows excellent landscape design opportunities and greater scope for mitigation. This includes opportunities to design elegant structures that compliment landscapes. There are also opportunities to create and enhance a scenic gateway to and from Wellington, integrate road and structures with landscape and ecological views, and improve access and visibility of local Reserves and Regional Parks.

*Potential aspects of mitigation of effects:*

- Improve and enhance access to Regional Parks.
- Integrate roads and structures with existing landscaping.
- Ensure nature and scale of earthworks is compatible with natural landform and landscape patterns.
- Mitigation planting to extend beyond disturbed areas as appropriate, to provide high level of landscape innovation.
- Portions of significant streams (Duck and Horokiri) to be permanently retired from farming, protected and rehabilitated.
- Extraordinary measures (beyond best practice) to ensure management of runoff and sediment movement and protect Pauatahanui Inlet.
- Road design to include innovative management and treatment of stormwater to protect Pauatahanui from contaminated road runoff.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 2 | Ecosystems | 3 | Landscape | 8 |

**HT4: Transmission Gully Motorway – 2 Lane**

*Assessment of positive effects on the environment:*

- As per HT1, except the reduced alignment width will mean a reduction in the height of cuts, reduced width of stream crossings and culverting, and greater opportunity to avoid habitats. It will also mean reduced areas of exposed earthworks and less risk of movement of sediment into Pauatahanui Inlet.
- Use of viaducts and bridges substantially reduces extent of earthworks and so reduces visual and ecological impacts.

*Assessment of negative effects on the environment:*

- As per HT1 except the visual effects of structures and significant earthworks in the rural landscape will be less than HT1 due to the reduced width
- Ecologically the road footprint will permanently affect up to 25ha of native vegetation and a further 5 ha of stream habitat. Up to 7km of Duck Creek, Ration Stream, Horokiri Stream and Te Puka Stream will be affected by culverting, permanent diversion, or modification during construction.

*Risks and opportunities:*

- The risk of discharge damage to Pauatahanui Inlet is much reduced over elements HT1 and HT7 as the width of the alignment is substantially reduced meaning smaller cuts, less exposed and erodable surfaces and less fill areas required
- The reduced width of alignment means that a larger proportion of the designation will be undeveloped providing wider opportunities for mitigation within the corridor such as more extensive land and stream retirement and revegetation.
- The reduced road width also provides opportunity for movement of the alignment within the existing corridor to avoid some areas of significant vegetation.
- The opportunities are similar to HT1.

*Potential aspects of mitigation of effects:*

- As per HT1 with mitigation planting to extend beyond disturbed areas as appropriate, to provide high level of landscape innovation.
- Portions of significant streams (Duck and Horokiri) to be permanently retired from farming, protected and rehabilitated.
- Extraordinary measures (beyond best practice) to ensure management of runoff and sediment movement and protect Pauatahanui Inlet.
- Road design to include innovative management and treatment of stormwater to protect Pauatahanui from contaminated road runoff.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 3 | Ecosystems | 4 | Landscape | 8 |

**HT7: Transmission Gully Motorway – 4 Lane with removal of Mana improvements**

*Assessment of positive effects on the environment:*

- Same as HT1.

*Assessment of negative effects on the environment:*

- Same as HT1.

*Risks and opportunities:*

- Same as HT1.

*Potential aspects of mitigation of effects:*

- Same as HT1.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 2 | Ecosystems | 3 | Landscape | 8 |

**HC1a: Coastal Motorway Linden to MacKays via Mana Bypass Coast on Fill**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Significant adverse visual, ecological and landscape effects from massive sea walls. Total alteration of the coastlines natural structure. In order of 20 ha of rocky seabed would be lost along a three km stretch of this coastline. Removal of prominent Pohutukawa and Cabbage trees along eastern side of SH1 at Paekakariki. Up to 7 ha or terrestrial bush and wetlands vegetation will be lost.
- Potential impacts upon Taupo Stream and Wainui Stream including fish passage issues.
- Significant landscape and visual impact of raised SH1 over railway alignment from Ngati Toa dunes to Plimmerton Goat point.
- Moderate adverse effects on dunelands at northern end of Ngati Toa Domain and that section of coastline. Significant landscape and visual impact of interchange at Papakowhai.

*Risks and opportunities:*

- Opportunities to improve the Mana Esplanade environment, gateways to Plimmerton and Paekakariki.
- Risk of more extensive visual effects if earthworks extend beyond that shown and potentially adverse effects on the Pauatahanui Inlet ecosystem.

*Potential aspects of mitigation of effects:*

- No realistic way to mitigate for the loss of coastal and marine habitat or visual impacts of this option along the centennial Highway section. Avoid large cuts at Paekakariki.
- Adequate provision of landscape and ecological buffer areas along the corridor to provide scope for mitigation of visual, noise, ecological issue. Particularly with residential /urban areas.
- Viaduct design can to some degree mitigate for landscape and visual effects
- Sediment management in Taupo Stream and fish passage in Taupo and Wairaka Streams.

Other aspects include:

- Avoid bush remnants where possible.
- Bridge wetland fragments instead of fill and culvert as currently proposed.
- Redesign the proposal to enhance and restore the Ngati Toa Domain landscape
- Redesign the proposal to enhance and restore the Plimmerton Reserve landscape; and
- Provide additional areas for active recreation to supplement the adverse effects on the Ngati Toa Domain and the Plimmerton Reserve.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 2 | Ecosystems | 5 | Landscape | 0 |

**HC1b: Coastal Motorway Linden to MacKays via Mana Bypass Coast on Viaduct**

*Assessment of positive effects on the environment:*

- The coastal marine area from Paekakariki to Pukerua Bay will be significantly less affected compared to HC1a.

*Assessment of negative effects on the environment:*

- Significant adverse effects on natural character of raised road and viaduct.
- Some coastal habitats lost beneath the viaduct foundations although this will be significantly less than for HC1(a).
- Major earthworks and stabilization (e.g. cut, fills and retaining walls) at ends.

Remainder of route:

- Removal of prominent Pohutukawa and Cabbage trees along eastern side of SH1 at Paekakariki.
- Up to 7.0 ha or terrestrial bush and wetlands vegetation will be lost.
- Potential impacts upon Taupo Stream and Wainui Stream including fish passage issues (including giant kokopu).
- Significant landscape and visual impact of raised SH1 over railway alignment from Ngati Toa dunes to Plimmerton (Goat Point).
- Moderate adverse effects on dunelands at northern end of Ngati Toa Domain and that section of coastline.
- Significant disruption on 2 active recreational reserves (Ngati Toa Domain and Plimmerton Reserve), reduction of size and existing use, visual amenity and recreation access.
- Significant landscape and visual impact of interchange at Papakowhai.

*Risks and opportunities:*

- Opportunities to improve Mana Esplanade environment; improve the 'gateways' into Plimmerton and Paekakariki; enhance coastal and recreational access values using existing road; and to design the viaduct to be an elegant structure that compliments the character of the coastal environment and visual values.
- Also opportunity exists to rehabilitate sections of the coastal foreshore by removal of parts of the existing seawall and State Highway.
- Risks of more extensive visual effects if earthworks extend beyond that shown and potentially adverse effects on the Pauatahanui Inlet ecosystem.

*Potential aspects of mitigation of effects:*

- Viaduct design can to some degree mitigate for landscape and visual effects. Avoid large cuts at Paekakariki.
- Adequate provision of landscape and ecological buffer areas along the corridor to provide scope for mitigation of visual, noise, ecological issues. Particularly within residential / urban areas.
- Extra care when designing bridge over Pauatahanui Inlet channel.

- Sediment management in Taupo Stream and fish passage in Taupo and Wairaka Streams.
- Replacement / reinstatement of up to 7.0 ha of bush and stream habitat.
- Bridge wetland fragments instead of fill and culvert as currently proposed.
- Redesign the proposal to enhance and restore the Ngati Toa Domain and Plimmerton Reserve landscapes.
- Provide additional areas for active recreation to supplement the adverse effects on the Ngati Toa Domain and the Plimmerton Reserve.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 3 | Ecosystems | 5 | Landscape | 5 |

**HC2: Coastal Upgrade Linden to MacKays via Mana Centre**

*Assessment of positive effects on the environment:*

- The coastal marine area from Paekakariki to Pukerua Bay will be unaffected compared to (HC1a and b).
- Ngati Toa Domain will be unaffected by this option.
- A raised road alignment from Plimmerton, Goat Point to Ngati Toa would not be required removing a significant visual and landscape effect seen in the other coastal options (HC1a, HC1b and HC4).

*Assessment of negative effects on the environment:*

Effects of Centennial Highway double deck over existing highway:

- Significant adverse effects on visual amenity from raised structures.
- Significant adverse effects on natural character.
- Major earthworks and stabilization (e.g. cut, fills and retaining walls);
- Minor ecological effects on regenerating coastal shrubland between SH1 and NIMT.

Remainder of route:

- Removal of prominent Pohutukawa and Cabbage trees along eastern side of SH1 at Paekakariki.
- Up to 7.0 ha or terrestrial bush and wetlands vegetation will be lost.
- Potential impacts upon Taupo Stream and Wainui Stream including fish passage issues (Giant kokopu).
- Significant disruption of Plimmerton Domain, reduction of size and existing use, visual amenity and recreation access.
- Significant landscape and visual impact of interchange at Papakowhai.

*Risks and opportunities:*

- As per HC1.

*Potential aspects of mitigation of effects:*

- As per HC1.

| | | | | | |
|---|---|---|---|---|---|
| **Indigenous habitat** | **4** | **Ecosystems** | **5** | **Landscape** | **3** |

**HC4: Coastal Expressway Linden to MacKays via Mana Bypass**

*Assessment of positive effects on the environment:*

- The coastal marine area from Paekakariki to Pukerua Bay will be unaffected compared to (HC1a and HC1b). All other affects will be identical.

*Assessment of negative effects on the environment:*
Effects of Centennial Highway double deck over existing highway:

- Significant adverse effects on natural character.
- Significant adverse effects on visual amenity from raised structures along significant coastline.
- Significant adverse effects on visual amenity and landscape from the cuts at Paekakariki and Pukerua Bay ends.
- Minor ecological effects on regenerating coastal shrubland between SH1 and NIMT.

Remainder of route:

- Removal of prominent Pohutukawa and Cabbage trees along eastern side of SH1 at Paekakariki.
- Up to 7.0 ha or terrestrial bush and wetlands vegetation will be lost.
- Potential impacts upon Taupo Stream and Wainui Stream including fish passage issues (Giant kokopu).
- Significant landscape and visual impact of raised SH1 over railway alignment from Ngati Toa dunes to Plimmerton (Goat Point).
- Moderate adverse effects on dunelands at northern end of Ngati Toa Domain and that section of coastline.
- Significant disruption on 2 active recreational reserves (Ngati Toa Domain and Plimmerton Reserve), reduction of size and existing use, visual amenity and recreation access.
- Significant landscape and visual impact of interchange at Papakowhai.

*Risks and opportunities:*
Opportunity to:

- Improve Mana Esplanade environment;
- Improve ‘gateway’ into Plimmerton and Paekakariki;
- Design the double deck coastal road to be an elegant structure that compliments the character of the coastal environment and visual values.

Risks of more extensive visual effects if earthworks extend beyond that shown, or if the alignment requires parts to extend into the coastal marine area.

*Potential aspects of mitigation of effects:*

- Avoid large cuts at Paekakariki.
- Adequate provision of landscape and ecological buffer areas along the corridor to provide scope for mitigation of visual, noise, ecological issues. Particularly within residential / urban areas.
- Viaduct design can to some degree mitigate for landscape and visual effects.

- Extra care when designing bridge over Pauatahanui Inlet channel.
- Sediment management in Taupo Stream and fish passage in Taupo and Wairaka Streams.
- No net loss of indigenous habitat – replacement / reinstatement of up to 7.0 ha of bush and stream habitat.
- Avoid bush remnants where possible.
- Bridge wetland fragments instead of fill and culvert as currently proposed.
- Redesign the proposal to enhance and restore the Ngati Toa Domain and Plimmerton Domain landscapes.
- Provide additional areas for active recreation to supplement the adverse effects on the Ngati Toa Domain and the Plimmerton Reserve.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 2 |

**HC5: Northern and Central Intersection and Bottleneck Upgrades**

*Assessment of positive effects on the environment:*

- Whitford Brown — None.
- Mana Bypass — Improved access to Plimmerton.
- Pukerua Bay Bypass — Scenic views from highway.
- Paekakariki Interchange — None.
- Paraparaumu Bypass — None.
- Otaihanga Intersection — None.
- Waikanae Bypass — None.

*Assessment of negative effects on the environment:*

- Whitford Brown — Less than minor adverse effects.
- Mana Bypass — Significant landscape and visual impacts from Ngati Toa dunes to Goat Point, and interchange at Papakowhai, disruption to two recreation reserves.
- Pukerua Bay Bypass — Adverse visual effects from earthworks and effects on coastal escarpment, up to 3 hectares of habitat lost, potential impacts on Taupo Stream.
- Paekakariki Interchange — Adverse effects of earthworks, loss of regenerating coastal vegetation.
- Paraparaumu Bypass — Adverse effects of earthworks on residential and commercial land use.
- Otaihanga Intersection — Major cuts will have major visual effects, up to 3 ha of coastal forest lost, impacts on Muaupoko Stream.
- Waikanae Bypass — Moderate landscape and visual effects.

*Risks and opportunities:*

- Whitford Brown — None.
- Mana Bypass — Opportunities to improve Mana Esplanade environment. Some risk to Pauatahanui Inlet ecosystem.

- Pukerua Bay Bypass — Opportunity to improve gateway but risk of more extensive effects if earthworks exceed that shown.
- Paekakariki Interchange — Opportunity to improve gateway but risk of more extensive effects if earthworks exceed that shown.
- Paraparaumu Bypass — None.
- Otaihanga Intersection — Risk of more extensive effects if earthworks exceed that shown.
- Waikanae Bypass — None.

*Potential aspects of mitigation of effects:*

- Whitford Brown — None.
- Mana Bypass — Redesign to enhance and restore reserves, provide landscape and ecological buffer areas, and rehabilitate dune margins.
- Pukerua Bay Bypass — Special attention to treatment at northern end, bridge wetlands fragments, replace habitat, provide buffers.
- Paekakariki Interchange — Special treatment of township gateway.
- Paraparaumu Bypass — Require bridging of stream.
- Otaihanga Intersection — Avoid forest remnant, replace habitat lost, bridge stream.
- Waikanae Bypass — None.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 3 |

**HC6: Northern Motorway**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Road corridor will be considerably widened, largely as a result of the parallel access road. This will create an island of severed land between the motorway and parallel roads. This land will be difficult to utilize.
- Will impact on six significant natural areas. This will result in the loss of around 5 ha of native habitat.
- Will cross four regionally important streams and rivers with potential effects upon fish passage.
- Potential downstream effects of construction on Waikanae Estuary.

*Risks and opportunities:*

- Opportunity to re-focus Paraparaumu town centre and to use severed land between SH1 and parallel access way for mitigation / revegetation.
- Risk that adverse effects are greater than illustrated, particularly excessive cuts with associated vegetation loss and visual effects. Also risk of adverse sedimentation effects on the Waikanae Estuary.

*Potential aspects of mitigation of effects:*

- Adequate provision of landscape and ecological buffer areas along the corridor to provide scope for mitigation of visual, noise, ecological issues. Particularly within residential / urban areas.
- Sediment management in Waikanae River and tributaries.
- Ensure fish passage for all stream crossings.
- No net loss of indigenous habitat – replacement / reinstatement of up to 5.0 ha of bush and stream habitat.
- Avoid bush remnants where possible.
- Review alignment proposal to avoid massive cuts at Otaihanga.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 3 | Ecosystems | 5 | Landscape | 1 |

**HC7: Northern Expressway**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- This alignment compared to HC6 will slightly reduce the amount of native habitat lost and severance of land as this alignment more closely follows the existing SH1 and the parallel access roads are reduced. However, many of the worst effects of the route relate to the interchanges and bypasses, which will be identical.

*Risks and opportunities:*

- As per HC6.

*Potential aspects of mitigation of effects:*

- As per HC6.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 3 | Ecosystems | 5 | Landscape | 2 |

**HC8: Ngauranga to Linden Motorway Upgrade**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Significant new cuts and fill along length of the road, particularly a major new cut immediately north of the Newlands interchange.
- Removal of existing screen and buffers especially residential areas.
- Adverse visual effects on the gateway to Wellington.
- Significant adverse effect on east Johnsonville area.
- Extremely limited room and opportunities to provide buffer areas between residential / commercial areas and motorway as compared to some of the Greenfield options considered.
- Loss of up to 2 ha of regenerating coastal forest in Ngauranga Gorge.
- Fill into Waitohi Stream (Ngauranga Gorge) and loss of stream habitat.

*Risks and opportunities:*

- Significant risk of increased cuts, impacts on properties, and disruption to communities.
- Opportunity for enhancement of existing buffer areas and for innovative non-vegetative landscaping/visual relief in some sections of the motorway (i.e. sculptures).

*Potential aspects of mitigation of effects:*

- Limited opportunity for mitigation because of narrow corridor (topography and proximity of residential boundaries).
- Avoid fill into Waitohi Stream.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 2 |

**HC9: Ngauranga to Linden Motorway Upgrade (min geometry)**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- As per HC8.

*Risks, opportunities and potential mitigation:*

- As per HC8.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 4 |

**HP1: Local Roads – south of Paekakariki**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Minor adverse landscape and visual effects.
- No adverse ecological effects.

*Risks and opportunities:*

- Opportunity to integrate proposed new road with Aotea development, and to rehabilitate/enhance coastal scarp landscape.

*Potential aspects of mitigation of effects:*

- None.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 5 |

**HP2: Local Roads – Paekakariki to Poplar Ave**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Adverse effects on landscape and visual qualities of the QEII Regional Park.
- Adverse impacts on existing recreation facilities at the MacKays Crossing Park gateway and recreational area.
- Potential loss of freshwater habitat, culverting and fish passage issues.

*Risks and opportunities:*

- The strip of severed land between the parallel route and SH1 could be enhanced and integrated with motorway development to provide a visual and ecological buffer and there is an opportunity to make QEII Regional Park more accessible.

*Potential aspects of mitigation of effects:*

- Development would need to be beyond best practice to fully compensate/reinstate values associated with the QEII Regional Park environment.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 5 |

**HP3: Western Link Road**

*Assessment of positive effects on the environment:*

- Enhancement of recreational access.
- Wide corridor allows for establishment of good ecological and landscape buffer areas.

*Assessment of negative effects on the environment:*

- Some wetlands will be severed and up to 7 ha of wetland habitat lost beneath the footprint. Minor adverse effects on the ecology and visual amenity of the Waikanae River Corridor due to establishment of new road/bridge, particularly given 'outstanding landscape' status of the corridor.

*Risks and opportunities:*

- The environmental risks will be contained within new road corridor, given the designation has already been provided for.

*Potential aspects of mitigation of effects:*

- Provide adequate provision of buffer zone for landscape and ecological mitigation purposes, particularly with residential/urban areas.
- Reduce of compensate for loss of up to 7 ha of wetland within or adjacent to the corridor.
- Ensure fish passage.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 4 | Ecosystems | 5 | Landscape | 8 |

**HE3: Grays Road Upgrade**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Major landscape and visual affects associated with earthworks.
- Major ecological effects associated with earthworks near Pauatahanui Inlet and Pauatahanui Township, as well as from the loss of indigenous forest remnants.
- Ecologically the road footprint will permanently affect up to 4 ha of native vegetation, stream habitat and saltmarsh.
- There is the potential for impacts upon Pauatahanui Inlet and its wildlife reserves through sediment movement or contamination during construction. There is no room between the road and the estuary to implement normal sediment management practices.

*Risks and opportunities:*

- Risk of potential significant adverse effects of sediment discharge into estuary and a risk of the extent of earthworks will impact on more habitats than assumed.
- An opportunity exists to relocate the road further inland and remove existing causeway at eastern end of estuary to reconnect Horokiri salt marsh to the estuary.

*Potential aspects of mitigation of effects:*

- There is virtually no opportunity to buffer this route from Pauatahanui Inlet. The only option for mitigation is to relocate the route further inland.
- Bridge all stream crossings instead of culvert.
- No net loss of indigenous habitat – replacement / reinstatement of up to 4.0 ha of bush and stream habitat.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 3 | Ecosystems | 3 | Landscape | 4 |

**HE5a: New Route Pauatahanui to Airlie Road**

*Assessment of positive effects on the environment:*

- Greenfield development at some distance from Pauatahanui Inlet provides greater opportunities to integrate the road with environment and manage construction effects.
- Will take pressure off Pauatahanui Inlet where SH58 currently runs.
- This alignment appears to avoid all SNAs.

*Assessment of negative effects on the environment:*

- Potential for downstream effects from earthworks on Pauatahanui inlet, Taupo swamp and a number of stream habitats.

*Risks and opportunities:*

- Risk of construction effects on the Pauatahanui Inlet and its tributaries. But opportunities to enhance/reinstated natural character/ecosystems at the northeast arm of Horokiri Saltmarsh (Pauatahanui estuary reserve) by removing existing causeway and to redevelop existing SH58 alignment for restoration of natural edge and community use.

*Potential aspects of mitigation of effects:*

- Ensure alignment avoids forest remnants during detailed design.
- Special attention to sediment management to protect Pauatahanui Inlet.
- Bridge all stream crossings instead of culvert.
- Remove existing causeway at Pauatahanui estuary reserve.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 6 |

**HE5b: New Route Pauatahanui to Plimmerton**

*Assessment of positive effects on the environment:*

- As for HE5a.

*Assessment of negative effects on the environment:*

- As for HE5a.

Risks and opportunities:

- As for HE5a.

*Potential aspects of mitigation of effects:*

- As for HE5a.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 5 | Ecosystems | 5 | Landscape | 6 |

**HE6a: Petone to Grenada via Horokiwi Road**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Adverse effects on landscape and disturbances to vegetation from earthworks.
- Highly visible from within parts of Petone, Horokiwi and Belmont Regional Park. Affects existing rural residential properties at Horokiwi.
- Sidles across the coastal scarp for 600 - 800 meters, the most visible portion of the route in one of the areas of greatest visual sensitivity.
- Potentially severs current and future recreational access to southern end of Belmont Regional Park.

- The road footprint will permanently affect up to 25 ha of regenerating native vegetation and stream habitat. Up to 350 meters of streambed, primarily tributaries and headwaters of Korokoro Stream will be affected by culverting. Korokoro Stream is likely to be affected during construction by sediment and erosion movement into the streambed as a result of vegetation removal and earthworks.
- There will be some effect on Wellington Harbour through sediment movement during construction. The extent of this effect will depend upon the types of sediment control measures employed, the quality of site management, and the weather during construction.

*Risks and opportunities:*

- Risk that earthworks will be more extensive than shown and that construction impacts on Korokoro stream are more extensive and of longer duration than predicted. Also that unexpected events such as unseasonal storms or discharge of contaminants, resulting in excessive movement of sediment into Wellington Harbour.
- However, opportunities exist to design elegant structures that compliment landscapes; to integrate road and structures with landscape and ecological values; to improve access to Belmont Regional park and provide attractive highway views from high points.

*Potential aspects of mitigation of effects:*

- Use viaducts to avoid adverse effects from earthworks on streams.
- Rehabilitation and revegetation of forests along alignment as mitigation for loss.
- Provision of access points to Belmont Regional Park

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 3 | Ecosystems | 4 | Landscape | 5 |

**HE6b: Petone to Grenada via Korokoro Valley**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- Potentially severs current and future recreational access to the southern end of Belmont Regional Park.
- Ecologically the road footprint will permanently affect up to 20ha of regenerating native vegetation and a further 3ha of stream habitat. Up to 350 meters of streambed, primarily tributaries and headwaters of Korokoro Stream will be affected by culverting. Korokoro Stream is likely to be affected during construction by sediment and erosion movement into the stream bed as a result of vegetation removal and earthworks.
- There will be some effect upon Wellington Harbour through sediment movement during construction. The extent of this effect will depend upon the types of sediment control measures employed, the quality of site management, and the weather during construction.

*Risks and opportunities:*

- As per HE6a.

*Potential aspects of mitigation of effects:*

- As per HE6a.

| | | | | | |
|---|---|---|---|---|---|
| Indigenous habitat | 2 | Ecosystems | 4 | Landscape | 4 |

## 9. Air Quality

The main factor involved in air quality assessment along the corridor is identifying and assessing the air pollution changes at 'hot spots'. Hot spots are due to either:

(a) A location of very high emissions, such as a busy intersection,
(b) A location where dispersion is constrained, such as a narrow valley, and
(c) Where there might be a sensitive receiving environment, such as school or hospital.

In general for localities where traffic volumes are reduced there is an air quality benefit, and in localities where traffic volumes are increased there is a negative effect. Whether these effects have any significance depends largely on whether people live or work in the affected locality.

The existing 'air quality' hot spots are:-

- Linden Interchange - people mildly affected by vehicle emissions
- Porirua Bus Rail Interchange - people mildly affected by vehicle emissions
- Paremata Roundabout - people moderately affected by vehicle emissions
- Mana Esplanade - people strongly affected by vehicle emissions
- Plimmerton - people mildly affected by vehicle emissions
- Pukerua Bay - people moderately affected by vehicle emissions
- Paekakariki - people mildly affected by vehicle emissions
- Paraparaumu - people mildly affected by vehicle emissions

There are regional and global air pollution effects, but these depend largely on the overall traffic volumes and fleet composition of the entire network upgrade, and are assessed on this basis.

**Rail Infrastructure Elements**

RT1a/b: Double tracking Pukerua Bay Tunnel Section.
RT2: Double Tracking MacKays Crossing to Raumati.
RT3: Double Tracking Raumati to Paraparaumu.
RE1: Waikanae Extension.
RS1: New Lindale Station.
RS2: New Raumati Station.

These have been assessed together because they have very similar air quality implications.

*Assessment of positive effects on the environment:*

- Elements that provide commuters greater opportunity to use the rail network will have air quality benefits. The traffic flow projections show a modest reduction through parts of the route. The positive effects are considered slightly beneficial.

*Assessment of negative effects on the environment:*

- Main negative effect is an increase in dust which may be of concern to some local neighbours. However, any negative effects of rail improvement options are likely to be very minor in nature, and highly localised to small areas.

*Risks and opportunities:*

- Significantly increased rail activity close to existing residents and businesses may lead to objections. From an air quality perspective the rail improvement options offer two significant opportunities. (1) They take traffic, and pollution emissions, away from the bulk of the road route. This is not just a qualitative improvement, but will reduce health effects in these communities due to vehicle emissions. (2) They give a better incentive for people to adopt travel options that generally reduce pollution emissions.

*Potential aspects of mitigation of effects:*

- Not required.

**Score: 5.**

**RS9: Park and Ride Upgrades**

*Assessment of positive effects on the environment:*

- Reducing traffic volumes reduces emissions and has a clear air quality benefit.

*Assessment of negative effects on the environment:*

- Increasing rail activity creates some extra rail dust near to the roadways. Rail corridor expansion may take these dust sources closer to residential locations. Park and ride facilities may increase some local traffic, but the volumes will not be enough to create problems.

*Risks and opportunities:*

- As per rail options above.

*Potential aspects of mitigation of effects:*

- None required.

**Score: 5.5**

**HT1: Transmission Gully Motorway – 4 Lane**

*Assessment of positive effects on the environment:*

- The HT1 development removes a very substantial amount of traffic from the entire coastal route. The daily volumes come from well above the informal indicator limit for air quality effects of 10,000 vehicles per day, to well below it. Given that there are several thousand people in these communities currently potentially affected, this is a significant positive effect.
- A particularly strong positive effect occurs along the Mana Esplanade, and it is expected that reductions in $PM_{10}$, $NO_2$ and CO in this area will show quantified health benefits in the local community.

*Assessment of negative effects on the environment:*

- The HT1 option is mostly routed through unoccupied greenfields land. In this sense it has very few negatives from the air quality point of view. The exception is in the few instance where the HT1 route goes within about 150 m of existing residential areas at Linden and Pauatahanui.

*Risks and opportunities:*

- The major risk for the air quality evaluation is if the traffic flow projections are wrong. Discrepancies of 10-20% will not alter the assessment, but if credible evidence were to show that vehicle numbers have been underestimated by a factor of two of more (or reductions on the coastal route underestimated), then this will have serious implications for the air quality assessment conclusions. This applies to all elements.
- HT1 offers two significant opportunities. Firstly it takes traffic, and pollution emissions, away from a number of sensitive residential areas. This is not just a qualitative improvement, but will significantly reduce health effects in these communities due to vehicle emissions. Secondly, it makes traffic flow more smoothly, thus improving fuel efficiency and reducing emissions per vehicle kilometre travelled. This has not been fully quantified, but it is a benefit worth having, and applies to both local pollution ($PM_{10}$, $NO_2$, CO, VOC), as well as global pollution ($CO_2$).

*Potential aspects of mitigation of effects:*

- Mitigation only needs to be considered at the Linden, Pauatahanui, and MacKays Crossing. Of these, only Pauatahanui will need to be assessed further, with more detailed modelling.
- Mitigation options include (a) a minor route change, (b) a slightly larger buffer distance to any sensitive receivers, (c) re-locating sensitive receivers, or (d) some form of barrier (as is used for noise). It is not likely that any of these, if required, will present significant barriers, but they may entail some extra costs.

**Score: 7.5**

**HT4: Transmission Gully Motorway – 2 Lane**

Similar to HT1 except that the score is slightly lower than for the 4-lane option, as the traffic displacement from the coastal route is not as great.

**Score: 7.2**

**HT7: Transmission Gully Motorway – 4 Lane with removal of Mana improvements**

Similar to HT1 except that with the 2-lane option through Mana, the benefits may be slightly less than the 4-lane option for the simple reason that the remaining traffic may experience more congestion, and/or be travelling more slowly.

**Score: 7.3**

**HC1a/b: Coastal Motorway Linden to MacKays via Mana Bypass Coast**

*Assessment of positive effects on the environment:*

- From Pukerua Bay north the HC1 option improves the traffic flow along the coastal route, and as such has a slight air quality benefit due to less congestion in this area. However despite this the positive aspects for this section are very minor. South of this a mildly positive effect occurs along the Mana Esplanade, simply due to having more freely flowing traffic. However the air quality effects in this area are likely to be of increasing concern unless traffic volumes are decreased.

*Assessment of negative effects on the environment:*

- The northern part of this element requires some additional feeder roads that may increase traffic and emissions slightly in these areas but these effects will be minor.
- Although there are no significant negative aspects over the base case, the HC1 option does allow a significant growth in traffic volumes through one of the clear 'hot-spots in the region at Mana Esplanade. At this point the current peak private vehicle volumes are 21,000 per hour and are predicted to increase to 24,000 under this option. Overall any effects are likely to be minor in nature.

*Risks, opportunities:*

- As per other highway elements.

*Potential aspects of mitigation of effects:*

- Mitigation options include (a) a minor route change, (b) a slightly larger buffer distance to any sensitive receivers, (c) re-locating sensitive receivers, or (d) some form of barrier (as is used for noise). It is not likely that any of these will be viable along the route's hot-spots.

**Score: 4.8**

**HC2: Coastal Upgrade Linden to MacKays via Mana Centre**

*Assessment of positive effects on the environment:*

- A mildly positive general effect occurs simply due to having more freely flowing traffic.
- In addition, along the whole route, the lower speeds in the expressway will lead to slightly lower emissions and possible improvements. Vehicles generally have their lowest emissions/per kilometre when travelling at 70-80 km/hr.

*Assessment of negative effects on the environment:*

- HC2 does allow a significant growth in traffic volumes through the main clear hot-spot in the region. Along Mana Esplanade the current peak private vehicle volumes are 21,000 per hour. These are predicted to increase to 35,000 under HC2. At Mana, where air quality problems likely already exist, there will be a great deal of pressure to reduce these. Overall, the effects of HC2 are likely to be significantly negative from an air quality perspective.

*Risks, opportunities and mitigation:*

- As for other highway elements.

**Score: 4.3**

**HC4: Coastal Expressway Linden to MacKays via Mana Bypass**

*Assessment of positive effects on the environment:*

- A mildly positive effect occurs along the Mana Esplanade, simply due to having more freely flowing traffic. However the air quality effects in this area are likely to be of increasing concern unless traffic volumes are decreased. Along the whole route, the lower speeds in the expressway will lead to slightly lower emissions and possible improvements.

*Assessment of negative effects on the environment:*

- There are no significant negative aspects over the base case, but HC4 does allow a significant growth in traffic volumes through many of the clear 'hot-spots' in the region. In particular along Mana Esplanade the current peak private vehicle volumes are 21,000 per hour. These are predicted to increase to 24,000 under HC4. Overall, any effects of HC4 (positive or negative) are likely to be minor in nature.

*Risks, opportunities and mitigation:*

- As for other highway elements.

**Score: 4.6**

**HC5: Northern and Central Intersection and Bottleneck Upgrades**

*Assessment of positive effects on the environment:*

- A mildly positive effect occurs along the Mana Esplanade, simply due to having more freely flowing traffic. However, this is almost entirely counterbalanced by having the Ngati Toa bypass. The effects are displaced from residential/commercial along the Esplanade, to residential along the new route, although there are fewer affected locations. However the air quality effects in this area are likely to be of increasing concern unless total traffic volumes are decreased.
- Along the whole route, the improved traffic flows will lead to slightly lower emissions.

*Assessment of negative effects on the environment:*

- There are no significant negative aspects over the base case, but the HC5 does allow a significant growth in traffic volumes through many of the clear 'hot-spots in the region, for instance through Mana the current peak private vehicle volumes are 21,000 per hour. These are predicted to increase to 26-30,000 under various HC5 options.
- Any effects of HC5 (positive or negative) are likely to be minor in nature, with the exception of options that affect Mana – which will be significant (positive for the Esplanade, negative for the Ngati Toa route).

*Risks, opportunities and mitigation:*

- As for other highway elements.

**Score: 5.2**

**HC6: Northern Motorway**

*Assessment of positive effects on the environment:*

- The HC6 option does not change the amount of traffic flowing through the region, but does:
  (a) displace this from commercial and residential areas, and
  (b) reduces congestion in these areas. Both of these have local air quality benefits. The positive effects on local air quality along the coastal route resulting from the HC6 option are considered mildly beneficial.

*Assessment of negative effects on the environment:*

- Any negative effects of HC6 are likely to be very minor in nature, and highly localised to tiny portions of the route.

*Risks, opportunities and mitigation:*

- As for other highway elements.

**Score: 5.2**

**HC7: Northern Expressway**

*Assessment of positive effects on the environment:*

- The HC7 option does not change the amount of traffic flowing through the region, but does
  (a) displace this from commercial and residential areas, and
  (b) reduces congestion in these areas. Both of these have local air quality benefits. The proximity of the state highway to the Paraparaumu shopping and residential precincts creates a mild level of local air pollution. With the HC7 option this is reduced. The positive effects on local air quality along the coastal route resulting from the HC7 option are considered mildly beneficial.

*Assessment of negative effects on the environment:*

- Any negative effects of HC7 are likely to be very minor in nature, and highly localised to tiny portions of the route.

*Risks, opportunities and mitigation:*

- Mitigation may be required to avoid the upgrade getting too close to existing residences.

**Score: 5.2**

**HC8: Ngauranga to Linden Motorway Upgrade**

*Assessment of positive effects on the environment:*

- The HC8 option does not significantly change the amount of traffic flowing through the region, but can achieve more optimal traffic flow, leading to modest local air quality benefits. The positive effects on local air quality along the route resulting from the HC8 option could be considered mildly beneficial.

*Assessment of negative effects on the environment:*

- Any expansion of the roadway width can take traffic flows closer to residential and business locations. This can have a mild negative effects, but only if the motorway runs within 20m or so of a sensitive location. There are at least two existing schools adjacent to the route. However, any negative effects of HC8 are likely to be very minor in nature, and highly localised to tiny portions of the route.

*Risks, opportunities and mitigation:*

- As for other highway elements.

**Score: 5**

**HC9: Ngauranga to Linden Motorway Upgrade (min geometry)**

As per HC8.

**Score: 5**

**HP1: Local Roads – south of Paekakariki**

*Assessment of positive effects on the environment:*

- A positive effect occurs along the Mana Esplanade, simply due to having reduced traffic. However this is almost entirely counterbalanced by having the Ngati Toa bypass. The effects are displaced from residential/commercial along the Esplanade, to residential along the new route – although there are fewer affected locations. However the air quality effects in this region are likely to be of increasing concern unless total traffic volumes are decreased.

*Assessment of negative effects on the environment:*

- There are no significant negative aspects over the base case, but HP1 does allow a significant growth in traffic volumes through many of the clear 'hot-spots in the region. The effects of HP1 are likely to be minor in nature, with the exception of options that affect Mana – which will be significant (positive for the Esplanade, negative for the Ngati Toa route).

*Risks and opportunities:*

- As for other highway elements.

*Potential aspects of mitigation of effects:*

- As for other highway elements.

**Score: 4.8**

**HP2: Local Roads – Paekakariki to Poplar Ave**

*Assessment of positive effects on the environment:*

- None.

*Assessment of negative effects on the environment:*

- None.

*Risks, opportunities and potential mitigation:*

- None.

**Score: 5**

**HP3: Western Link Road**

*Assessment of positive effects on the environment:*

- A mildly positive effect occurs through Paraparaumu due to improved traffic flow.

*Assessment of negative effects on the environment:*

- A mildly negative effect occurs due to the road being brought closer to a few residential and business areas.

*Risks, opportunities and potential mitigation:*

- As for other highway elements.

**Score: 5.1**

**HE3: Grays Road Upgrade**

*Assessment of positive effects on the environment:*

- A mildly positive general effect occurs due to improved traffic flow.

*Assessment of negative effects on the environment:*

- A mildly negative effects occurs due to the road being brought closer to a few residential and business areas. The positive effects are only slightly beneficial, and likely to be counterbalanced by the negative effects of route changes bringing the roadway closer to existing residents and businesses.

*Risks, opportunities and potential mitigation:*

- As for other highway elements.

**Score: 4**

**HE5a: New Route Pauatahanui to Airlie Road**

*Assessment of positive effects on the environment:*

- This element reduces flows through Mana resulting in positive effects on local air quality at this location.

*Assessment of negative effects on the environment:*

- The effects of HE5 are likely to be slightly positive from an air quality perspective.

*Risks, opportunities and potential mitigation:*

- As for other highway elements.

**Score: 5.5**

**HE5b: New Route Pauatahanui to Plimmerton**

As for HE5a.

**Score: 5.5**

**HE6a: Petone to Grenada via Horokiwi Road**

*Assessment of positive effects on the environment:*

- There are reduced traffic volumes along the Johnsonville and Ngauranga sections of SH1, but none of these are considered hot spots. There are also reduced flows through Whitby and Haywards, leading to some modest air quality benefits. There are modest increases in traffic at the Petone end, but these are unlikely to result is

significant air quality effects. The positive effects on local air quality along SH1 resulting from the HE6 option are slightly beneficial.

*Assessment of negative effects on the environment:*

- There are no particularly sensitive values associated with this option.

*Risks, opportunities and potential mitigation:*

- As for other highway elements noting that the element offers a moderate opportunity as it slightly reduces traffic flow on SH1 south of Grenada.

**Score: 5.1**

**HE6b: Petone to Grenada via Korokoro Valley**

As per HE6a.

**Score: 5.1**

**TDM1: 5% reduction in JTW trips**

*Assessment of positive effects on the environment:*

- The positive effects on local air quality along the coastal route resulting from the TDM1 are moderately beneficial.

*Assessment of negative effects on the environment:*

- There are almost no negative effects, apart from perhaps some very minor issues associated with rail upgrades. However these will be far outweighed by the traffic reduction benefits. Any negative effects will be insignificant.

*Risks and opportunities:*

- The TDM1 option offers two significant opportunities. (1) It reduces takes traffic, and pollution emissions, by a significant amount. This is not just a qualitative improvement, but will significantly reduce health effects in these communities due to vehicle emissions. (2) It makes traffic flow more smoothly, thus improving fuel efficiency and reducing emissions per vehicle kilometre travelled. This has not been fully quantified, but it is a benefit worth having, and applies to both local pollution ($PM_{10}$, $NO_2$, CO, VOC), as well as global pollution ($CO_2$).

*Potential aspects of mitigation of effects:*

- The only mitigation required may be around certain local infrastructure changes. These will be minor, if required at all.

**Score: 7**

**TDM2: 10% reduction in JTW trips**

*Assessment of positive effects on the environment:*

- The positive effects on local air quality along the coastal route resulting from the TDM2 option could be considered significantly beneficial.

*Assessment of negative effects on the environment:*

- Any negative effects will be insignificant.

*Risks, opportunities and mitigation:*

- As per TDM1.

**Score: 8**

**TDM3: 3% reduction in JTW trips**

*Assessment of positive effects on the environment:*

- The positive effects on local air quality along the coastal route resulting from the TDM3 option could be considered beneficial.

*Assessment of negative effects on the environment:*

- Any negative effects will be insignificant.

*Risks, opportunities and potential mitigation:*

- As for TDM1.

**Score: 6**

## 10. Noise

The PBS indicator for traffic noise is the number of houses exposed to 65 dBA (Leq24hr). The assessment methodology is based on traffic volume predictions, assumed speeds and road surface character. The predictions include assumptions about the proximity of residential sites to existing and proposed routes and includes an allowance for "business as usual" growth of residential sites in areas affected by traffic noise. No specific region wide noise mitigation measures are assumed, though it is recognised that region wide and site specific actions will be taken to reduce exposure where high levels of traffic noise occur.

**RT1a: Double tracking Pukerua Bay Tunnel Section: Cut and Tunnel**
Noise impact assessed as minor/nil. **Score: 5**

**RT1b: Double tracking Pukerua Bay Tunnel Section: Tracks Separated on Existing Formation**
Noise impact assessed as minor/nil. **Score: 5**

**RT2: Double Tracking MacKays Crossing to Raumati**
Noise impact assessed as minor/nil. **Score: 5**

**RT3: Double Tracking Raumati to Paraparaumu**
Noise impact assessed as minor/nil. **Score: 5**

**RE1: Waikanae Extension**
Noise impact assessed as minor/nil. **Score: 5**

**RS1: New Lindale Station**
Noise impact assessed as minor/nil. **Score: 5**

**RS2: New Raumati Station**
Noise impact assessed as minor/nil. **Score: 5**

**RS9: Park and Ride Upgrades**
Noise impact assessed as minor/nil. **Score: 5**

**HT1: Transmission Gully Motorway – 4 Lane**

*Assessment of positive effects on the environment:*

- This element will result in positive benefits along the existing highway corridor by diverting traffic to the new route. However the assessment shows that significant noise effects will remain along parts of the existing network.

*Assessment of negative effects on the environment:*

- The route crosses open land largely away from settled residential areas. However they will be some effects on recreation areas.

*Risks and opportunities:*

- A significant risk is that there is growth in noise sensitive activities along the new corridor in the future. There is therefore an opportunity to manage the reverse sensitivity risk to minimise potential adverse noise effects in the future.

*Potential aspects of mitigation of effects:*

- Studies to date indicate this s not a major requirement for this element.

**Score: 9.2**

**HT4: Transmission Gully Motorway – 2 Lane**

Assessment is similar to HT1 but noise effects are marginally less because corridor is narrower.

**Score: 9.0**

**HT7: Transmission Gully Motorway – 4 Lane with removal of Mana improvements**

Similar to HT1 in noise terms. The Mana clearway removal may take traffic noise further from existing houses but this will have less than 1 dBA effect on existing houses.

**Score: 9.4**

**HC1a and HC1b: Coastal Motorway Linden to MacKays via Mana Bypass**

*Assessment of positive effects on the environment:*

- There are few benefits apart from increasing residential separation distances at Mana and Paekakariki.

*Assessment of negative effects on the environment:*

- Noise effects will be slightly higher than the Base Case with continued growth in traffic volumes and speeds resulting in progressively worsening effects. Some minor noise effects on recreation may result from the Mana Bypass.

*Risks and opportunities:*

- There is a risk that this element will continue to generate adverse noise effects into areas currently adversely affected and also affect new future developments.

*Potential aspects of mitigation of effects:*

- It is likely that measures will be required over time as thresholds of acceptability are crossed and the need arises for reductions in noise exposure at key affected residential sites. Such commitments are included in the Draft Transit New Zealand Environmental Plan.

**Score: 4.4**

**HC2: Coastal Upgrade Linden to MacKays via Mana Centre**

The difference from HC1 is that this route is designed as an expressway. This involves a reduced set back but lower average speeds. These factors cancel each other out to have similar noise effects to HC1.

**Score: 3.4**

**HC4: Coastal Expressway Linden to MacKays via Mana Bypass**

*Assessment of positive effects on the environment:*

- Noise effects are similar to the Base Case with few positive benefits apart from increasing separation distances at Paekakariki.

*Assessment of negative effects on the environment:*

- This element does not address overall noise impacts which are predicted to worsen along the existing route.

*Risks, opportunities and potential mitigation:*

- Similar to other coastal upgrade options.

**Score: 5.4**

**HC5: Northern and Central Intersection and Bottleneck Upgrades**

The combined effects of the HC5 elements is assessed as a slight negative noise impact.

**Score: 4.8**

Individual elements were assessed as:

| | | |
|---|---|---|
| • Whitford Brown: | Nil Impact | Score 5 |
| • Mana Bypass | Negative impact | Score 4.6 |
| • Pukerua Bay Bypass | Minor / Nil | Score 4.9 |
| • Paekakariki | Negative | Score 4.8 |
| • Paraparaumu Bypass | Negative | Score 4.7 |
| • Otaihanga | Minor/nil | Score 5 |
| • Waikanae Bypass | Minor/nil | Score 5 |

**HC6: Northern Motorway**
Potential noise impact is assessed as minor / nil. **Score: 4.8**

**HC7: Northern Expressway**
Potential noise impact is assessed as minor / nil. **Score: 5**

**HC8: Ngauranga to Linden Motorway Upgrade**
Potential noise impact is assessed as negative. **Score: 4.4**

**HC9: Ngauranga to Linden Motorway Upgrade (min geometry)**
Potential noise impact is assessed as negative. **Score: 4.6**

**HP1: Local Roads – south of Paekakariki**
Potential noise impact is assessed as negative. **Score: 4.4**

**HP2: Local Roads – Paekakariki to Poplar Ave**
Potential noise impact is assessed as minor / nil. **Score: 5**

**HP3: Western Link Road**
Potential noise impact is assessed as negative. **Score: 4.6**

**HE3: Grays Road Upgrade**
Potential noise impact is assessed as negative. **Score: 4.8**

**HE5a: New Route Pauatahanui to Airlie Road**
Potential noise impact is assessed as minor nil. **Score: 5**

**HE5b: New Route Pauatahanui to Plimmerton**
Potential noise impact is assessed as minor/nil. **Score: 5**

**HE6a: Petone to Grenada via Horokiwi Road**
Potential noise impact is assessed as minor/nil. **Score: 5**

**HE6b: Petone to Grenada via Korokoro Valley**
Potential noise impact is assessed as minor nil. **Score: 5**

**TDM1: 5% reduction in JTW trips**
Potential noise impact is assessed as minor nil. **Score: 5**

**TDM2: 10% reduction in JTW trips**
Potential noise impact is assessed as minor nil. **Score: 5**

**TDM3: 3% reduction in JTW trips**
Potential noise impact is assessed as minor nil. **Score: 5**

## 11. Active Travel

This item recognises the importance of taking into account in the evaluation of options their ability to provide for facilities for cycling and pedestrians. This focuses on facilities that provide for transportation along the western corridor and therefore provide a mode choice for necessary trips such as trips to work or to community facilities. It does not include facilities designed primarily for recreational walking or cycling activity.

Consideration was given to whether there should be specified active travel project elements independent of the rail, road and travel demand management elements. After analysis of the existing corridor facilities it was concluded that at this stage of analysis it was appropriate to focus on the extent to which the other elements would provide for cycling and walking facilities.

Aspects taken into account in the scoring methodology included:

- The length of facility provided.
- The standard of facility differentiating between:
  - on highway use,
  - local road use,
  - dedicated expressway facilities, and
  - dedicated facilities on local roads.
- Any reduction in standard of existing facilities such as transferring from a cycle path to on road.
- Any loss of existing facilities.

It is assumed that an expressway design would provide both dedicated active travel facilities while a motorway standard would not. Similarly it is assumed that new local roads would provide only for on road cycling.

The resulting scores were as follows:

| | | |
|---|---|---|
| **RT1a/b:** | **Double tracking Pukerua Bay Tunnel Section** | **Score: 5** |
| **RT2:** | **Double Tracking MacKays Crossing to Raumati** | **Score: 5** |
| **RT3:** | **Double Tracking Raumati to Paraparaumu** | **Score: 5** |

| | | |
|---|---|---|
| **RE1:** | **Waikanae Extension** | **Score: 5** |
| **RS1:** | **New Lindale Station** | **Score: 5** |
| **RS2:** | **New Raumati Station** | **Score: 5** |
| **RS9:** | **Park and Ride Upgrades** | **Score: 5** |
| **HT1:** | **Transmission Gully Motorway – 4 Lane** | **Score: 5** |
| **HT4:** | **Transmission Gully Motorway – 2 Lane.** | **Score: 7.6** |
| **HT7:** | **Transmission Gully Motorway – 4 Lane Mana Removal** | **Score: 5** |
| **HC1a/b:** | **Coastal Motorway Linden to MacKays via Mana Bypass Coast** | **Score: 2.8** |
| **HC2:** | **Coastal Upgrade Linden to MacKays via Mana Centre** | **Score: 7.4** |
| **HC4:** | **Coastal Expressway Linden to MacKays via Mana Bypass** | **Score: 7.9** |
| **HC5:** | **Northern and Central Intersection and Bottleneck Upgrades** | **Score: 6.2** |
| **HC6:** | **Northern Motorway** | **Score: 5** |
| **HC7:** | **Northern Expressway** | **Score: 8.5** |
| **HC8:** | **Ngauranga to Linden Motorway Upgrade** | **Score: 4.5** |
| **HC9:** | **Ngauranga to Linden Motorway Upgrade (min geometry)** | **Score: 4.5** |
| **HP1:** | **Local Roads – south of Paekakariki** | **Score: 5.6** |
| **HP2:** | **Local Roads – Paekakariki to Poplar Ave** | **Score: 6** |
| **HP3:** | **Western Link Road** | **Score: 9.5** |
| **HE3:** | **Grays road Upgrade** | **Score: 5** |
| **HE5a:** | **New Route Pauatahanui to Airlie Road** | **Score: 6** |
| **HE5b:** | **New Route Pauatahanui to Plimmerton** | **Score: 5.8** |
| **HE6a:** | **Petone to Grenada via Horokiwi Road** | **Score: 5.7** |
| **HE6b:** | **Petone to Grenada via Korokoro Valley** | **Score: 5.7** |
| **TDM1:** | **5% reduction in JTW trips** | **Score: 5** |
| **TDM2:** | **10% reduction in JTW trips** | **Score: 5** |
| **TDM3:** | **3% reduction in JTW trips** | **Score: 5** |

## 12. Public Health

In addition to the individual public health aspects of noise, air quality and community severance and displacement an overview public health assessment has been undertaken to ensure that the overall public health PBS scores reflects all relevant issues.

Public health aims to promote and protect the health of both the total population and vulnerable populations, with a particular focus on ensuring inequalities in health are not further widened. Experts report that inequalities in health in New Zealand are worsening, with people and communities with more resources achieving health gains, whereas other people and communities achieving none, little or even backward movements in health. Structural issues, such as transport infrastructure and services, are known to affect the health of individuals and populations.

The overview health assessments consider the effects for the Wellington region population, the general population of specific affected communities and also populations along each route who are vulnerable, to assess the extent to which health inequalities may be affected. As a population, vulnerable communities have a lower resilience when exposed to health risks and so the health status of a higher proportion of people within that vulnerable community is affected than would normally be expected, and affected more severely. Within these vulnerable communities there is a further layer of inequalities in health status and issues of resilience, with particular families and individuals at greater risk again. Finally, these groups have little or no resources to mitigate or escape their altered environment, for example by not having access to a car, or access to finances to live elsewhere.

Individual health risks are difficult to quantify and are typically small, but public health effects when magnified by populations become significant.

The population along the Western Corridor spans the socioeconomic spectrum, where vulnerable households are interspersed amongst less vulnerable, and whole communities near the route are both vulnerable and less vulnerable. Communities near and beside the route include Linden, Ranui Heights, Porirua, Porirua East, Paremata, Mana, Cambourne, Plimmerton and Paekakariki. Some of these communities, and a number of residents within more affluent communities have lower than national averages for income, employment, education, access to private transport and other resources.

The assessments also consider the interests of the overall Wellington region, particularly those people commuting by private transport, and the general population living and working along the corridor.

The overview addresses matters already considered in individual PBS items as well as additional issues as follows:

**Pollution related health impacts** including cancers, leukaemia, increased deaths and hospital admissions from cardiovascular diseases and respiratory diseases. Asthma symptoms and bronchodilator use will increase.

**Noise related health impacts** are unlikely to lead to hearing loss but may contribute to high blood pressure, minor psychiatric illness, loss of sleep, increased communication difficulties, and a possible interference with concentration.

**Road traffic accidents** account for over 300 deaths per year, with even more people injured causing both short and long-term incapacity/injury. Pedestrian and cyclist deaths and injuries are significant in New Zealand, with such accidents being more likely for these groups than for drivers. Vulnerable communities experience greater cyclist and pedestrian injury and death rates than less vulnerable communities, particularly for children. Perceived danger from traffic restricts children's independent mobility, with subsequent increases in traffic to transport children, and decreases in fitness and psychological well-being of children who no longer cycle or walk at will.

**Physical activity.** Inactive lifestyles are a causal factor for obesity and overweight, and New Zealand is in the middle of an obesity epidemic. Physical activity reduces the risk of heart disease, stroke, cancer, diabetes, high blood pressure, depression, osteoporosis, obesity and improves well-being. Those without private transport have no other options other than to use local opportunities, and these should always be maintained where possible. Good public transport increases opportunities for physical activity by users (getting to and from public transport hubs), and reduces the number of private vehicles on local roads (increases desirability and perceived safety for all walkers and cyclists). This is particularly true for short local trips. Reduced free-will movement of children due to increased traffic flows and lower perceived safety of the environment impacts on children's mental health and physical health.

**Community Severance.** Community severance occurs when people are separated from social networks/support, community facilities and services by a physical barrier, such as a busy road. For example there is a reduction in the number of social contacts between people as traffic volumes rise in the local area. People without social support have higher death rates, but there is not direct evidence between transport projects and social support. Community severance also results in reduced play areas for children and reduced access to local education, work, shops and healthcare for those without cars.

**Access and mobility.** Access to education, work, shops, healthcare and social networks often requires transport. Those without a car (highly represented in vulnerable communities) have reduced access to those facilities designed that assume car use. Within car-owning households – the elderly, children and women are less likely to have access to the car. People with disabilities are particularly affected by access issues. Health impacts of these are definite. Ensuring safe, accessible and reliable public transport, walking and cycling options goes some way to mitigating a lack of private vehicle transport.

**Housing.** Transport projects make certain areas more desirable, with the possibility of increased house prices and rents. Those who do not own their own home may need to leave the area to find affordable accommodation, increasing social isolation and exclusion from community. Those who do own their own home may see significant gains in wealth through rising house prices. Green field development around new transport corridors and hubs has the potential to increase urban sprawl.

Housing (due to situation next to high traffic areas for example) may become even less desirable, affecting minor psychiatric illness and wellbeing. The direct causal pathways from housing to health impacts are speculative in this case. Displacement of housing is a significant predictor of wellbeing, where security and length of tenancy are related to multiple health outcomes, including minor psychiatric illness, stress and an ability to socially invest/engage with a community. All household members are affected, including children and the elderly. Flow on effects include disrupted friendships, employment and education.

**Employment.** Transport projects present opportunities for training and employment while construction is ongoing. Any increase in employment or job

opportunities has major impacts on income, purpose, social support and participation in society for the individual and family, with subsequent improvements in death rates from cancer, coronary heart disease and stroke, depression, anxiety, self harm and suicide. Such jobs can be targeted at local unemployed. However, it is typical that the wealth generated (particularly GDP) from such expansion is not shared equally.

It is possible that the jobs created may be low-wage, insecure, not available to local unemployed people and also that the higher quality jobs will go to people from outside the local area (further increasing travel for these non-local workers, affecting their families and the communities they travel through). Such a situation would negate one of the potential positive aspects of HC1 variant (increased local employment), though this applies to only certain communities in this case. Employment may be negatively affected by a loss of vehicle traffic through communities, thereby affecting the number of people using shops located on or near these routes. Conversely, greater access to an area may support an employment and service hub that would not otherwise have existed. This has the potential to create a large number of jobs, many of which should be available to local people.

**Education.** Children's performance at school is directly affected by background noise levels of the surrounding environment. This in turn cascades to poorer achievement and reduced lifetime opportunities. Educational attainment is strongly associated with health outcomes such as life expectancy and death rates from cancer, coronary heart disease and stroke.

**Crime.** As the number of people increase in an area the perception of safety can improve if the environment is conductive to this, using crime prevention urban design principles.

**Loss of open space.** Green spaces are used by communities for recreation, farming and horticulture, and/or no particular use. They provide places of employment, contact with the land, peace and quiet, natural beauty and contribute to natural biodiversity. Such factors contribute substantially to both mental and physical health, and loss of open space can be particularly damaging to communities who have little other open space nearby, or who are undergoing rapid development where open spaces are rapidly reducing. Mitigation by preserving alternative open spaces in compensation for the lost space is an option.

A summary of the conclusions of the overview public health assessment for each project elements is set out below.

**RT1a: Double tracking Pukerua Bay Tunnel Section: Cut and Tunnel**
**RT1b: Double tracking Pukerua Bay Tunnel Section: Tracks Separated on Existing Formation**
**RT2: Double Tracking MacKays Crossing to Raumati**
**RT3: Double Tracking Raumati to Paraparaumu**

In comparison to the base case rail infrastructure elements will have a small positive impact on the general population living near to, and travelling between

Paraparaumu and Paekakariki by rail. Since the length of the double tracking is limited, and is within a sparsely populated area, the overall negative health impacts are negligible. The positive health impacts that accrue to the general population from increased use of public transport, improved access to educational opportunities, greater social networks and improved access to employment opportunities are small and difficult to estimate due to the assumed small increases in public transport use. Gains that are made however will not occur at the expense of vulnerable communities, who are generally strong users of public transport.

The positive health impacts will increase as rail patronage increases.

**RS1: New Lindale Station**

In comparison to the base case RS1 will have large positive health impact on the general population living near to, and using the new rail station at Lindale. The gains are largely dependent on an improved frequency of train services, as would be expected from the electrification extension of the network to Waikanae and the double tracking. These should ideally be seen as a package of measures. Clearly, the stations themselves without frequent services provide little additional benefit.

The negative health impacts such as loss of open space and potential increase in availability of fast foods could be easily mitigated by the developer. The positive health impacts that accrue to the general population as a whole from increased use of public transport, improved access to educational opportunities, greater social networks and improved employment opportunities are significant. These gains are commendable because they do not occur at the expense of vulnerable communities, and therefore have the potential to narrow inequalities in death rates between the haves and have-nots. Many of the positive health impacts, while not requiring significant resources, will require careful planning and design to maximise these opportunities.

**RS2: New Raumati Station**

In comparison to the base case RS2 will at best have modest positive health impacts on the general population living near to, and using the new rail station at Raumati. The gains would normally be due to an improved frequency of train services and subsequent modal shift to public transport from private transport, but the modelling data does not support this.

The negative health impacts such as loss of open space and potential increase in availability of fast foods could be easily mitigated by the developer. The modest positive health impacts that may accrue for the general population from increased use of public transport, greater social networks and improved employment opportunities lack supporting modelling data and so should be considered potential gains rather than definite. For low socioeconomic people, women, children and the elderly (lower access to private vehicles), the potential health impacts are less speculative as they will enjoy increased accessibility of local rail services.

**RS9: Park and Ride Upgrades**

In comparison to the base case RS9 will have large positive health impact on the general population living near to, and using the two new and upgraded rail stations of Lindale and Raumati. The gains are largely dependent on an improved frequency of train services, as would be expected from the electrification extension of the network to Waikanae. Clearly, the stations themselves without frequent services provide little additional benefit.

The people most likely to experience considerable negative health impacts are the small number of people neighbouring the new and upgraded station at Raumati. Mitigation to lessen negative health impacts for these neighbouring residents should be investigated. The positive health impacts that accrue to the general population as a whole from increased use of public transport, improved access to educational opportunities, greater social networks and improved employment opportunities are significant. These gains are commendable because they do not occur at the expense of vulnerable communities, and therefore have the potential to narrow inequalities in death rates between the haves and have-nots. Many of the positive health impacts, while not requiring significant resources, will require careful planning and design to maximise these opportunities. However the significant health benefits from increased physical activity could be offset by the potential increased accessibility of fast foods at or near the new stations.

**HT1: Transmission Gully Motorway – 4 Lane**

HT1 will have both positive and negative health impacts on several population groups. The most vulnerable group, those at the southern end of HT1, will experience considerable negative health impacts. The positive health impacts that accrue to the region as a whole from increased employment and connectivity (via cars and goods transport) will be critical to determine overall impact on the vulnerable group. Mitigation to lessen negative health impacts and enhance positive health impacts for this vulnerable population should be investigated. For Pukerua Bay community there are a number of significant public health gains available.

While such gains are commendable, it is important that they do not occur at the expense of vulnerable communities, and so further widen inequalities in death rates between the haves and have-nots. Similarly, Wellington region residents will experience both positive and negative public impacts, positive from the growth in business opportunities, but offset by the induced traffic and lower public transport usage. As usual for such developments, the positive impacts have the potential to be accrued by those more fortunate and the negatives added to those most vulnerable, further widening the inequalities in health. Enhancement of the project to ensure the positives are distributed to those of the highest need is required.

**HT4: Transmission Gully Motorway – 2 Lane**

As for HT1.

**HT7: Transmission Gully Motorway – 4 Lane with removal of Mana improvements**

HT1 will have both positive and negative health impacts on several population groups. The most vulnerable group, those at the southern end of HT1, will experience considerable negative health impacts. The positive health impacts that accrue to the region as a whole from increased employment and connectivity (via cars and goods transport) will be critical to determine overall impact on the vulnerable communities, and so further widen inequalities in death rates between the haves and have-nots.

The acknowledgement of Mana residents wishes to remove the temporary upgrades is one example of the positive public health impact in this element. Similarly, Wellington region residents will experience both positive and negative public impacts, positive from the growth in business opportunities, but offset by the induced traffic and lower public transport usage. As usual for such developments, the positive impacts have the potential to be accrued by those more fortunate and the negatives added to those most vulnerable, further widening the inequalities in health. Enhancement of the project to ensure the positives are distributed to those of the highest need is required

**HC1a/b: Coastal Motorway Linden to MacKays via Mana Bypass**

HC1 will have both positive and negative health impacts on several population groups. Coastal vulnerable groups will experience considerable negative health impacts from the construction and the large increases in induced traffic on the route and feeder streets, reduced public transport, increased traffic near schools, reduced active transport and increased community severance. The positive health impacts that accrue to the Wellington region as a whole from increased employment and connectivity (via faster car and goods transport) will be critical to determine overall impact on the vulnerable group, however they are unlikely to offset the significant number and size of negative impacts. Mitigation to lessen negative health impacts and enhance positive health impacts for these vulnerable populations should be investigated.

Mana residents will experience significant negative health impacts from the Ngati Toa Route. While certain individuals may accrue limited positive impacts (from the altered traffic route), these gains are offset by significant losses to others, and general losses to the community from the loss of many community assets and the net increase in traffic.

For the majority of the Pukerua Bay community there are a number of significant public health gains available due to the bypass removing significant volumes of traffic from bisecting the township, however these could be gained without building the entire HC1 route by just building the bypass. Mitigation to off-set the negative health impacts on the North Eastern residents of Pukerua Bay is required as a smaller portion of the community will remain severed, but more severely so. Those residents who lose their homes (and possibly businesses) will incur severe negative health impacts.

Wellington region residents will experience both positive and negative public health impacts, positive from the growth in business opportunities, but off-set by the induced traffic and flow-on effects into Wellington City, lower public

transport usage and urban sprawl. As is usual for such developments, the positive impacts have the potential to be accrued by those more fortunate, and the negatives added to those most vulnerable, further widening inequalities in health. Enhancement of the project to ensure the positives are distributed to those of highest need is required.

**HC2: Coastal Upgrade Linden to MacKays via Mana Centre**

As for HC1 except that Mana residents will experience continued and worsening negative health impacts from the two additional lanes of traffic, yet this will be offset slightly by the increased employment opportunities for local residents.

**HC4: Coastal Expressway Linden to MacKays via Mana Bypass**

As for HC1.

**HC5: Northern and Central Intersection and Bottleneck Upgrades**

HC5 overall will have both positive and negative health impacts on several population groups, but on balance the health impacts are largely negative. Coastal vulnerable groups and severely affected residents will experience considerable negative health impacts from the construction and the assumed large increases in induced traffic on the route and feeder streets, reduced public transport, increased traffic near schools, reduced active transport and increased community severance. The positive health impacts that accrue to the Wellington region as a whole from increased employment and connectivity (via faster car and goods transport) will be critical to determine overall impact on the vulnerable group, however they are unlikely to offset the significant number and size of negative impacts. Mitigation to lessen negative health impacts and enhance positive health impacts for these vulnerable populations should be investigated.

Severely affected residents in Mana, Paraparaumu, Waikanae and certain Pukerua Bay residents will experience significant negative health impacts from new alignments. While certain individuals may accrue limited positive impacts (from the altered traffic route), these gains are offset by significant losses to others, and general losses to the community from the loss of many community assets and the net increase in traffic.

For the majority of the Pukerua Bay community there are a number of significant public health gains available due to the bypass removing significant volumes of traffic from bisecting the township, however these could be gained without building the entire HC5 overall route by just building the bypass. Mitigation to off-set the negative health impacts on the North Eastern residents of Pukerua Bay is required as a smaller portion of the community will remain severed, but more severely so.

Wellington region residents will experience both positive and negative public health impacts, positive from the growth in business opportunities, but off-set by the induced traffic and flow-on effects into Wellington City, lower public transport usage, significant localised business closures in several towns and urban sprawl. As is usual for such developments, the positive impacts have the potential to be accrued by those more fortunate, and the negatives added to

those most vulnerable, further widening inequalities in health. Enhancement of the project to ensure the positives are distributed to those of highest need is required.

**HC6: Northern Motorway**

HC6 will have both positive and negative health impacts on several population groups, though on balance the health impacts are predominantly negative. Coastal vulnerable groups will experience considerable negative health impacts from construction, and less significant negative health impacts from the small increases in induced traffic on the route and feeder streets, reduced public transport, reduced active transport and increased community severance. Residents who will lose homes and have their businesses made unviable by the realignment and new roads will experience severe negative health impacts. Mitigation to lessen negative health impacts for these vulnerable populations should be investigated.

The positive health impacts that sometimes accrue to a region as a whole, and the coastal communities themselves, from greater connectivity (via faster car and goods transport) are unlikely to eventuate given the limited impact this proposal has on traffic vehicle movements. Given the likelihood of traffic bottlenecks being worsened on other parts of the route (unless other improvements are also made) the employment and connectivity benefits are likely to be transient at best. Positive health impacts from employment may be achieved though hiring and training local people to work on the construction of HC6, but these will be significantly outweighed by the prospect of business closures in Waikanae, and particularly Paraparaumu.

Wellington region residents will experience predominantly negative public health impacts due to the small amount of induced traffic and flow-on effects into Wellington City, lower public transport usage and urban sprawl.

**HC7: Northern Expressway**

As per HC6.

**HC8: Ngauranga to Linden Motorway Upgrade**

HC8 will have both positive and negative health impacts on several population groups. Vulnerable groups (particularly those at either end of the HC8 route) will experience considerable negative health impacts from the construction, but less significant negative health impacts from the modest increases in induced traffic on an already busy route (those residents and employees close enough to be affected by noise, air and visual pollution). The impact on feeder streets, reduced public transport, reduced active transport and increased community severance are more significant negative issues.

Mitigation to lessen negative health impacts against these should be investigated. The positive health impacts that sometimes accrue to a region as a whole and the communities nearby, from greater connectivity (via faster car and goods transport) are likely to be small given the modest increase in traffic vehicle movements. Given the likelihood of traffic bottlenecks being worsened on other parts of the route (unless other improvements are also made) the employment and connectivity benefits are likely to be transient at best. Positive

impacts on employment may be achieved though hiring and training local people to work on the construction of HC8.

Wellington region residents will experience predominantly negative public health impacts due to the small amount of induced traffic and flow-on effects into Wellington City, lower public transport usage and increased likelihood of urban sprawl.

**HC9: Ngauranga to Linden Motorway Upgrade (min geometry)**
As for HC8.

**HP1: Local Roads – south of Paekakariki**
In comparison to the base case HP1 will have both positive and negative health impacts on several population groups, but on balance the health impacts are largely negative. Vulnerable community residents (particularly Okowai, Mana, Papakowhai, Plimmerton, Karehana Bay and Pukerua Bay) and significantly affected residents in the same communities will experience considerable negative health impacts from the construction. The projected increases in induced traffic on the route feeder streets, increased traffic near schools and through densely populated communities, reduced active transport and increased community severance loss of green space will also lead to negative health impacts.

The positive health impacts that sometimes accrue to the Wellington region as a whole from increased employment and connectivity (via faster car and goods transport) will be critical to determine overall impact on the vulnerable group, however they are unlikely to offset the significant number and size of negative impacts. Mitigation to lessen negative health impacts and enhance positive health impacts for these vulnerable populations should be investigated.

Residents in Mana will experience significant negative public health from new alignments. While certain individuals may accrue limited positive impacts (from the altered traffic route), these gains are off set by significant losses to others, and general losses to the community from the loss of any community assets and the net increase in traffic

Wellington region residents will experience both positive and negative public impacts, positive from the growth in regional business opportunities and the steady public transport usage, but offset by the induced traffic flow-on effects into Wellington City, loss of community assets in Mana and urban sprawl. As is usual for such developments, the positive impacts have the potential to be accrued by those more fortunate, and the negatives added to those most vulnerable, further widening inequalities in health. Enhancement of the project to ensure the positives are distributed to those of highest need is required.

**HP2: Local Roads – Paekakariki to Poplar Ave**
In comparison to the base case HP2 will have both positive and negative health impacts on several population groups, but on balance the health impacts are largely negative. Vulnerable community residents (particularly Paekakariki, Raumati and Paraparaumu) and residents in the same communities will experience modest negative health impacts from construction. The likely

increases in traffic leaving and entering residential communities at either end of the route, reduced active transport, increased community severance and loss of green space will also lead to negative health impacts.

The likelihood of seeing positive health impacts that sometimes accrue to a region as a whole, and the communities themselves from greater connectivity (via faster car and goods transport) is low given the limited impact this proposal has on regional traffic vehicle movements. An improved public transport service between towns is possible (if services are provided), which may improve access and mobility for vulnerable groups. Short term positive health impacts on employment may be achieved though hiring and training local people to work on the construction of HP2

Wellington region residents will experience largely negative health impacts from the lost green space within the regional park

**HP3: Western Link Road**

In comparison to the base case HP3 will have both positive and negative health impacts on several population groups, but on balance the health impacts are largely negative. Vulnerable community residents (particularly Raumati South, Raumati Beach, Paraparaumu, Paraparaumu Beach, Otaihanga and Waikanae Beach) and significantly affected residents in the same communities will experience considerable negative health impacts from construction. The projected increases in induced traffic on the route and feeder streets, increased traffic near schools and through populated communities, reduced active transport, increased community severance, loss of green space will also lead to negative health impacts. Designation of safe walkways and cycle ways along HP3 and on feeder streets would mitigate many of the negative impacts on community severance, active transport and access to open spaces. The positive health impacts that may accrue to the Wellington region as a whole from increased employment and connectivity (via faster car and goods transport) are unlikely. Mitigation to lessen negative health impacts and enhance positive health impacts for these vulnerable populations should be investigated.

Residents in all communities along HP3 will experience significant negative health impacts from new alignments. While certain individuals may accrue limited positive impacts (from the altered traffic route), these gains are offset by significant losses to others, and general losses to the community from the net increase in traffic. As is usual for such developments, the positive impacts have the potential to be accrued by those more fortunate, and the negatives added to those most vulnerable, further widening inequalities in health. Enhancement of the project to ensure the positives are distributed to those of highest need is required.

Wellington region residents will experience little public health impacts from the development as SH1 traffic levels show little alteration from the base case.

**HE3: Grays Road Upgrade**

In comparison to the base case HE3 will have both positive and negative health impacts on several population groups, and on balance these appear neutral. Vulnerable community residents (particularly Cambourne and Pauatahanui)

and residents in the same communities will experience modest negative health impacts from construction, but the transference of traffic from residents on the current route to largely unpopulated land will incur positive health impacts. However these positive health impacts will be slightly offset by the increase in traffic leaving and entering residential communities throughout the region, with the subsequent reduced active transport, public transport use, increased community severance. Loss of green space will also lead to negative health impacts.

The likelihood of seeing positive health impacts that sometimes accrue to a region as a whole, and the communities themselves from greater connectivity (via faster car and goods transport) is low given the limited impact this proposal has on regional traffic vehicle movements. Short term positive health impacts on employment may be achieved though hiring and training local people to work on the construction of HE3.

**HE5a: New Route Pauatahanui to Airlie Road**
In comparison to the base case HE5 will have modest public health impacts on the Wellington Region population due to the modest size of the project, it's low impact on traffic flows, the short term nature of any employment and the distance of any development from local populations. A small number of affected local residents and businesses, who are directly affected by the new route will incur severe negative health impacts through the loss of housing and business, and mitigation for these people is required.

**HE5b: New Route Pauatahanui to Plimmerton**
As HE5a.

**HE6a: Petone to Grenada via Horokiwi Road**
HE6 will have both positive and negative health impacts on population groups. Local community residents at either end of the route may experience health impacts from construction, from reduced access and pleasure from Belmont Regional Park, and a small number of residents will be severely affected by increased noise and pollution as the route passes near by Linconshire Road. However the local communities may also experience positive health impacts from the improved public transport, greater connectivity, and a projected decrease in local traffic flows. These also have the potential to increase active transport and decrease community severance for the majority of local residents. Short term positive health impacts on employment may be achieved though hiring and training local people to work on the construction of HE6.

Wellington region residents on the other hand will experience largely negative public health impacts from the lost green space within the regional park, increased traffic flows and decreased mode share of public health.

**HE6b: Petone to Grenada via Korokoro Valley**
HE6 variant will have both positive and negative health impacts on population groups.

Local community residents at either end of the route may experience health impacts from construction, from reduced access and pleasure from Belmont

Regional Park, and a small number of residents will be severely affected by increased noise and pollution as the route passes near by Linconshire Road. However the local communities may also experience positive health impacts from the improved public transport, greater connectivity, and a projected decrease in local traffic flows. These also have the potential to increase active transport and decrease community severance for the majority of local residents. Short term positive health impacts on employment may be achieved though hiring and training local people to work on the construction of HE6 variant.

Wellington region residents on the other hand will experience largely negative public health impacts from the lost green space within the regional park, increased traffic flows and decreased mode share of public health.

**TDM1: 5% reduction in JTW trips**
TDM1 will have positive health impacts on the Wellington region population. The gains are dependent on other measures also being undertaken such as further promotion of cycling and walking, improved rail, and safe public transport systems, as would be expected from an integrated solution and so TDM1 should ideally be seen as a package of measures.

The negative health impacts are few and can be mitigated by careful planning and integration with other developments. The positive health impacts that accrue to the general population as a whole from increased use of public transport, greater social networks, community cohesion, reduced pollution, safer streets and improved employment opportunities are significant. These gains are commendable because they do not occur at the expense of vulnerable communities, and therefore have the potential to narrow inequalities in death rates between the haves and have-nots. Many of the positive health impacts will require careful planning and design to maximise these opportunities.

**TDM2: 10% reduction in JTW trips**
As TDM1.

**TDM3: 3% reduction in JTW trips**
TDM3 will have a very small positive health impact on the Wellington region population. The gains are dependent on other measures also being undertaken such as further promotion of cycling and walking, improved rail, and safe public transport systems, as would be expected from an integrated solution and so TDM3 should ideally be seen as a package of measures.

The negative health impacts are few and can be mitigated by careful planning and integration with other developments. The positive health impacts that accrue to the general population as a whole from increased use of public transport, greater social networks, community cohesion, reduced pollution, safer streets and improved employment opportunities are small due to the small size of the predicted affects of TDM1 on traffic volumes and lack of impact on mode share. To retain these small positive health impacts, careful planning and design will be required to maximise these opportunities.

## 13. Archaeology and Built Heritage

The areas of archaeological effects and heritage effects have been assessed separately by Mary O'Keefe and Ian Bowman but the two experts have jointly scored the two areas together for input to the Planning Balance Sheet. While in most cases there is a common relationship between areas of archaeological and built heritage interest the potential effects of some elements are less able to be defined for archaeology because the nature and extent of the values are less able to be defined.

The basis of the assessments are the local authority and NZHPT registers of heritage buildings, the NZAA site index, and recent archaeological fieldwork. Both registers are incomplete and are updated with additional information on existing places or new places worth registration or listing. The NZAA index is an inventory, and sites listed in it may not be extant. It also may not include all sites actually present on the ground.

Further historical and architectural conservation research into each of the heritage structures may identify heritage values, which may be affected by the proposed element.

Destruction of any archaeological sites will require an authority to modify, damage or destroy archaeological sites under S.10 of the Historic Places Act, following a detailed archaeological assessment.

Opportunities for mitigation of adverse effects include:

- Screening of existing sites whose wider landscape setting is affected by an element.
- Design refinement to avoid direct impacts on existing resources.
- Relocation of affected structures to an appropriate location maintaining existing relationships orientation and setting.
- Destruction of many archaeological sites can be partially mitigated by appropriate management of the sites including monitoring of all earthworks, recording and sampling of exposed archaeological sites.

The assessments found few positive benefits in terms of archaeological and heritage values and therefore the summaries below focus on the scale and nature of adverse effects.

**RT1a: Double tracking Pukerua Bay Tunnel Section: Cut and Tunnel**
The destruction of archaeological sites at the base of the sea cut cliff between Paekakariki and Pukerua Bay would have a permanent adverse effect.

**Score: 2**

**RT1b: Double tracking Pukerua Bay Tunnel Section: Tracks Separated on Existing Formation**
As per RT1a.

**Score: 4**

**RT2: Double Tracking MacKays Crossing to Raumati**
As per RT1a.

**Score: 3**

**RT3: Double Tracking Raumati to Paraparaumu**
As per RT1a.

**Score: 3**

**RE1: Waikanae Extension**
This proposal will not impact on any heritage sites.

**Score: 5**

**RS1: New Lindale Station**
This proposal will not impact on any heritage sites.

**Score: 5**

**RS2: New Raumati Station**
This proposal will not impact on any heritage sites.

**Score: 5**

**RS9: Park and Ride Upgrades**
This proposal will not impact on any heritage sites.

**Score: 5**

**HT1: Transmission Gully Motorway – 4 Lane**
HT1 may facilitate the destruction of archaeological sites in the sand dunes north of SH 1 at Paekakariki. However, such sites are unlikely to be of high archaeological significance. Adverse effects can be mitigated by appropriate archaeological management, including monitoring of all earthworks, recording and sampling of exposed archaeological sites.

**Score: 5**

**HT4: Transmission Gully Motorway – 2 Lane**
As per HT1.

**Score: 5**

**HT7: Transmission Gully Motorway – 4 Lane with removal of Mana improvements**
As per RT1a.

**Score: 5**

**HC1a: Coastal Motorway Linden to MacKays via Mana Bypass Coast on Fill**

The proposed roadway largely destroys a significant NZHPT and KCDC registered heritage area at Paekakariki Railway Station as well as a number of the individually registered and listed buildings within the area. A number of the buildings are registered category I, which indicates that they are of national significance. According to the Rail Heritage Trust, the group is "one of the country's finest collections of associated station structures". Destruction of the grouping would have a major permanent adverse impact on national railway heritage, as would the loss of the buildings directly affected.

The destruction of the 1906 Restaurant, Main Road Paekakariki, would have a moderate permanent adverse affect.

The proximity of the proposed roadway would have a less than minor permanent adverse effect on Kerehoma Farm Homestead, Pukerua Bay, Archaeological site R26/229, brickworks, Urupa, located west of Onepu Road, Pukerua Bay.

Known and potential sites at the base of the sea cut cliff between Paekakariki and Pukerua Bay, in the strip between the railway line and the existing SH1 and the archaeological site R26/284, WW2 roadblock, and WW2 pillbox site would have a permanent adverse effect.

At Mana the element affects values in Ngati Toa Domain. The domain is a very significant archaeological site for the Wellington Region. The presence of middens with moa bones and early period artefacts has been documented. The first early "moa hunter" occupation was followed by a later prehistoric occupation. Paremata Pa was occupied on the same site in the 1840's, and was for a time contemporaneous with European occupation, including Thom's whaling station and the Paremata military camp.

Each of these phases of occupation are archaeologically significant. The Paramata site remains the most significant and about the best known moa hunter site in Wellington. Paremata Pa was a small permanently occupied settlement which was occupied for about ten years. It provides an important archaeological example and archaeological assemblage of Maori occupation during the early contact period.

The later military camp known as Paremata Barracks is nationally significant as a ruin of New Zealand's earliest stone and second earliest completed Colonial Military Fortification. It was uniquely designed for its location and intended use using locally excavated and manufactured materials.

The proposed off ramp which enters into the centre of the Ngati Toa Domain near to Paremata Barracks, would create a major permanent adverse effect and would add to the previous damage done to the structure and setting over time. Extensive earthworks, construction of the yacht club buildings, ramps and roadways have done extensive damage to the archaeological values of the site which has destroyed significant fabric of the wider Barracks setting, which

included a palisade, structures, gardens and previous whaling and earlier Moa hunter sites.

The earthworks required for road construction will permanently destroy very significant archaeological features and this will have a very major adverse effect.

**Score: 1**

**HC1b: Coastal Motorway Linden to MacKays via Mana Bypass Coast on Viaduct**
As for HC1a.

**Score: 1**

**HC2: Coastal Upgrade Linden to MacKays via Mana Centre**
Similar to HC1 except there should be less risk to archaeological sites along the foot of the scarp between Pukerua Bay and Paekakariki. However additional effects include less than minor permanent adverse effects on:

- Mungavin Homestead, Mungavin Avenue, Porirua PCC heritage register number JB 41 and
- The Wall Estate Chapel Buildings, Paremata Crescent,
- Also the Paekakariki Hill Road overbridge would have a moderate permanent adverse effect on the Paekakariki Village.

**Score: 1**

**HC4: Coastal Expressway Linden to MacKays via Mana Bypass**
The same as for HC2 but with the additional adverse effects on Ngati Toa Domain described in HC1.

**Score: 1**

**HC5: Northern and Central Intersection and Bottleneck Upgrades**
There are major adverse effects from modification or destruction of the heritage and archaeological sites.

These are summarised as:

| | |
|---|---|
| • Whitford Brown | No adverse effects. |
| • Mana Bypass | Major adverse effects at Paremata Barracks and archaeological sites at Ngati toa Domain (refer HC1). |
| • Pukerua Bay Bypass | Permanent adverse effects on two archaeological sites, less than minor effects on 3 archaeological sites and one heritage site (refer HC1). |
| • Paekakariki Interchange | Major adverse effects on railway station historic area and buildings, 1906 restaurant and archaeological sites at base of scarp. |
| • Paraparaumu Bypass | Moderate risk of unknown archaeological sites affected. |

- Otaihanga Intersection — Moderate risk of unknown archaeological sites affected.
- Waikanae Bypass — Moderate risk of unknown archaeological sites affected.

**Score: 2**

**HC6: Northern Motorway**
The proposed off ramp will have a less than minor negative adverse effect on the Memorial Gates, Memorial Park, Tutanekai Street, Paraparaumu, KCDC heritage register number B50, as the immediate landscape setting of the gates will be changed to having an off ramp and motorway nearby.

There is also a low risk of damage to unknown archaeological sites.

**Score: 4**

**HC7: Northern Expressway**
As per HC6.

**Score: 4**

**HC8: Ngauranga to Linden Motorway Upgrade**
The proposed motorway will have a less than minor negative adverse effect on Greer House, Willowbank Road, Tawa, Nott House, Middleton Road, and House, Westchester Road, as the immediate landscape setting of the houses will be slightly modified to having an enlarged motorway nearby.

There is also a low risk of damage to unknown archaeological sites.

**Score: 4.5**

**HC9: Ngauranga to Linden Motorway Upgrade (min geometry)**
Same as HC8.

**Score: 4.5**

**HP1: Local Roads – south of Paekakariki**
This element includes a local road on the Ngati Toa Domain Bypass route. The proposed off ramp which enters into the centre of the Ngati Toa Domain will create a major permanent adverse effect to the Paremata Barracks albeit the scale of effect may be less than other elements. The earthworks required for road construction will also permanently destroy very significant archaeological features, and thus will have a very major adverse effect on Maori occupation at Ngati Toa domain and unrecorded sites between Pukerua Bay and Paremata.

**Score: 2**

**HP2: Local Roads – Paekakariki to Poplar Ave**

There are 39 recorded archaeological sites within Queen Elizabeth Park. While some are not in the vicinity of the alignment there is a high probability of further unrecorded sites affected. The proposed alignment will have a major adverse impact on recorded and unrecorded sites.

The proposed alignment will have a major adverse effect if the alignment passes through the urupa (Urupa and Norfolk Pine, KCDC heritage register number W3) and will impact directly on recorded and unrecorded sites. If the alignment passes near the urupa it will have a less than minor adverse effect.

**Score: 1**

**HP3: Western Link Road**

The proposed road will have a less than minor negative adverse effect on the following heritage items because the immediate landscape setting will be altered:

- Old Church Building 1896, KCDC heritage register number B41,
- Maketu's Grave, Kauri Road, Waikanae, KCDC register number 87.
- Takamore cemetery, KCDC plan W1, HPT register*, NZAA R26/272.

In addition the road will cut through the Takamore wahi tapu area and will destroy any archaeological sites in its alignment.

**Score: 1**

**HE3: Grays Road Upgrade**

There are no known heritage or archaeological sites within or near the alignment. However, the possibility of unrecorded archaeological sites remains.

**Score: 5**

**HE5a: New Route Pauatahanui to Airlie Road**

There are no known heritage or archaeological sites within or near the alignment. However, the possibility of unrecorded archaeological sites remains.

**Score: 5**

**HE5b: New Route Pauatahanui to Plimmerton**

As per HE5a.

**Score: 5**

**HE6a: Petone to Grenada via Horokiwi Road**

The element passes close to one heritage item, a house on Westchester Road, (WCC District Plan Heritage Register plan 26, plan symbol number 373) and the most extreme adverse effects on the sites would be destruction or major modification due to road construction.

**Score: 4**

**HE6b: Petone to Grenada via Korokoro Valley**
This element is likely to affect a heritage and archaeological site at the former Wellington Woollen Manufacturing Company Mill in Cornish Street Petone. Remains include the mill wall and a weir upstream of the mill to provide a water supply.

**Score: 3**

**TDM1: 5% reduction in JTW trips**
This proposal will not impact on any heritage or archaeological sites.

**Score: 5**

**TDM2: 10% reduction in JTW trips**
This proposal will not impact on any heritage or archaeological sites.

**Score: 5**

**TDM3: 3% reduction in JTW trips**
This proposal will not impact on any heritage or archaeological sites.

**Score: 5**

## 14. Community Severance

Severance and connectivity describe the effects that roads and traffic have on social interaction within and between urban settlements.

Social interaction is fundamental to community well being and transport infrastructure plays a significant role in connecting communities and facilitating social interaction. Providing a direct access route for vehicles, pedestrians, and cyclists, between residential settlements improves connectivity. For settlements which are predominantly residential and which rely on other centres for basic social and commercial services, safe and efficient access to service centres is particularly important for their social well-being and for their health and safety.

Although roads provide important connections in a community, they can also be divisive. The principal components of severance are physical severance and psychological severance.

Physical severance relates to the direct barrier effect that roads can have on local trip patterns within and between communities. A barrier effect occurs when physical changes to a route result in extended travel times. For example, trip times for vehicles can be extended as a result of introducing a median barrier restricting right turn movement. Roundabouts facilitate traffic flows and provide for local vehicle access, but are difficult for pedestrians and cyclists to cross safely and comfortably at grade. Conversely traffic signals are more manageable for pedestrians and cyclists, but are likely to mean slightly

longer delays for vehicle traffic. In terms of social impact, for example, the introduction of roundabouts will create a physical severance effect for pedestrians and cyclists.

This can also affect rural activities and severance of farm properties affecting operational farming activities.

A behavioural aspect of physical severance occurs when individuals modify their preferred trip patterns as a result of roading developments. Individual trip modifications can include changing the time of travel, mode of travel, frequency of trips, travel path, and in extreme cases trip suppression.

Psychological severance refers to the "feeling" of being cut off. At a community wide level, this perception can arise from barrier effects. At the level of local residential streets, this perception is related to traffic volumes and is indicated by a change in the frequency and extent of social interaction on local streets. Where highway improvements increase traffic volume on existing local streets a general feeling of being "cut off" may develop. This results from both the increased traffic volumes and from the flow on actual and perceived effects, which tend to impede or reduce the level of social interaction. These actual and perceived effects may include feelings of danger such that children are no longer allowed to cross the road unaccompanied, traffic noise that makes conversation difficult, smell of exhaust fumes, delays in crossing the road and restricted use of local facilities.

The PBS methodology identifies an indicator of severance as the total population separated from its principal community facilities by a highway of 10,000 aadt or more.

The other factors that have also been taken into account are:

- Changes in traffic volumes on existing roads.
- The extent to which any new route bisects local residential streets and/or recreation areas.

**RT1a: Double tracking Pukerua Bay Tunnel Section: Cut and Tunnel**
**RT1b: Double tracking Pukerua Bay Tunnel Section: Tracks Separated on Existing Formation**
**RT2: Double Tracking MacKays Crossing to Raumati**
**RT3: Double Tracking Raumati to Paraparaumu**
**RE1: Waikanae Extension**

**All Score: 5**

The rail infrastructure projects involve dual tracking in some areas south of Paraparaumu. This is not expected to increase any existing rail severance effects. The diversion onto rail from road associated with increased frequency of services enabled by these projects is not likely to be sufficient to have any material effects on existing severance effects along the corridor.

**RS1: New Lindale Station**
Access across the railway associated with the new station will tend to facilitate accessibility as this area develops rather than reduce any existing adverse severance effects.

**Score: 5**

**RS2: New Raumati Station**
This element will provide for access across the highway and rail and has the potential to reduce barrier effects of road and rail in terms of recreational opportunities along the escarpment.

**Score: 5.5**

**RS9: Park and Ride Upgrades**
Enhancement of park and ride facilities is not expected to have any adverse severance effects indeed if associated with improved access across the railway it may improve severance effects.

**Score: 5.5**

**HT1: Transmission Gully Motorway – 4 Lane**

At the southern end of the route the existing severance effect of the State Highway and railway is reduced by the Kenpuru Link. Similarly the transfer of traffic from the Porirua East and Whitby local roading network will reduce existing severance effects along high flow distributor roads.

At Pauatahanui the route will sever existing rural properties but does not cut across existing routes. Severance of rural properties along the route has largely been addressed through direct negotiation. At the northern end of the route similarly there are not expected to be any adverse severance effects.

Reduced flows along the existing state highway corridor with existing severance effects at Pukerua Bay, Mana and Paekakariki.

**Score: 6**

**HT4: Transmission Gully Motorway – 2 Lane**
As per HT1.

**Score: 6**

**HT7: Transmission Gully Motorway – 4 Lane with removal of Mana improvements**
The removal of the Mana improvements involve the removal of the old bridge and reversion back to a 2 lane road. Flows along this section of highway are significantly reduced such that the removal of the improvements is unlikely to make any significant further reduction in severance effects.

**Score: 6**

**HC1a: Coastal Motorway Linden to MacKays via Mana Bypass Coast on Fill**

There are existing severance effects on the communities from Linden to the north of Porirua, however these communities generally have good access to local facilities such as schools without crossing the State Highway. There will be a concern about additional severance through Mana with the addition of a further transport route however access to Ngati Toa domain will be retained. The elevated structure at the north end of the Mana Bypass will be imposing and may result in some psychological severance.

At Pukerua Bay the overall community will benefit from much reduced flows on the exiting route significantly reducing severance and improving connectivity within this community. However, the route and interchange at the northern end of Pukerua Bay will introduce some new significant severance effects for a small part of the community.

Severance effects at Paekakariki are largely associated with accessibility into and out of the township. Improved access onto, off and across the highway through a grade separated interchange will reduce severance effects.

**Score: 5.5**

**HC1b: Coastal Motorway Linden to MacKays via Mana Bypass Coast on Viaduct**

Same as HC1a.

**Score: 5.5**

**HC2: Coastal Upgrade Linden to MacKays via Mana Centre**

This element avoids the Mana Bypass but requires four lanes through Mana on the existing alignment. This is likely to see the removal or at least reduction of some of the new traffic lights and will increase already serious severance effects at Mana.

Other effects will be similar to HC1.

**Score: 4**

**HC4: Coastal Expressway Linden to MacKays via Mana Bypass**

Severance effects collectively will be similar to HC1a except that as an expressway the design will provide facilities for cycle and pedestrian use and severance effects will therefore be less severe.

**Score: 6**

**HC5: Northern and Central Intersection and Bottleneck Upgrades**

This includes intersection improvements along the existing alignment and bypasses of Mana and Pukerua Bay. All these components are expected to reduce existing severance effects although comfortable provision for pedestrians and cycles is sometimes difficult to achive in such schemes.

**Score: 6**

**HC6: Northern Motorway**
The highway and rail form an existing barrier along this part of the corridor around which communities and services have developed. Key cross linkages occur at Paraparaumu and Waikanae. The wider route is expected to be perceived as a more significant barrier although access across the intersections will be easier than at present.

**Score: 3**

**HC7: Northern Expressway**
Similar to HC6 except that severance effects should be less severe because of the ability to accommodate cycles and pedestrians along the route.

**Score: 3.5**

**HC8: Ngauranga to Linden Motorway Upgrade**
Severance from Ngauranga Gorge all the way to the suburb of Linden is already significant. The addition of two lanes to the southern route of SH1 is unlikely to have an increased adverse effect.

**Score: 5**

**HC9: Ngauranga to Linden Motorway Upgrade (min geometry)**
As for HC8.

**Score: 5**

**HP1: Local Roads – south of Paekakariki**
Although there are already parallel local roads from Johnsonville up to Porirua which would be used, north of Porirua to Pukerua Bay, the upgrading and building of new side roads at Aotea Block and Airlie Road to Pukerua Bay will increase connectivity between these communities on low speed low volume roads. Some severance effects may occur to rural proerties south of Pukerua Bay.

**Score: 6**

**HP2: Local Roads – Paekakariki to Poplar Ave**
The road which will be built running parallel with SH1 from Tilley Rd to Poplar Avenue does not go through any existing communities and will increase connectivity between Raumati and Paekakariki. As a result it will reduce any severance effects of the existing highway.

**Score: 6**

**HP3: Western Link Road**
The road which will be built running parallel with SH1 from Poplar Rd up to Peka Peka Rd. It establishes a new corridor and river crossing. Intersections are provided to ensure access from the existing network and the corridor is

wide enough to provide for landscaping and walkways and cycleways. While there is a risk that a project of this nature could increase severance the design of the facility should avoid such effects and provide improved connectivity within and between the Kapiti communities.

**Score: 6**

**HE3: Grays Road Upgrade**
This could affect some rural properties within some areas improved accessibility to the Pauatahanui Inlet and in some areas this may be adversely affected.

**Score: 5**

**HE5a: New Route Pauatahanui to Airlie Road**
This new road is planned to go through an area where there is very little development, and therefore severance will be limited to rural farming properties and should be capable of mitigation.

**Score: 5**

**HE5b: New Route Pauatahanui to Plimmerton**
This route provides some traffic relief to the part of Camborne traversed by Grays Road although severance effects on this link are not currently severe. This may increase as flows grow over time and residential activities north of Grays Road increase.

**Score: 5.5**

**HE6a: Petone to Grenada via Horokiwi Road**
This is a new link from the end of Westchester Drive East which will cross Horokiwi Rd and then link to SH2 at Petone. The new road will have a minor effect of the residents of Horokiwi Rd. However it will increase connectivity between Petone, Newlands and Grenada Tawa.

**Score: 5.5**

**HE6b: Petone to Grenada via Korokoro Valley**
This will be similar to HE6a.

**Score: 5.5**

**TDM1: 5% reduction in JTW trips**
This will not be a sufficient reduction to reduce existing severance effects.

**Score: 5**

**TDM2: 10% reduction in JTW trips**
This may just be noticeable to communities affected by severance.

**Score: 5.2**

**TDM3: 2% reduction in JTW trips**
This will not be a sufficient reduction to reduce existing severance effects.

**Score: 5**

## 15. Community Disruption

Transport infrastructure projects can be highly disruptive to communities, individuals and businesses. Delays to travellers during construction has been taken into account in the modelling of the costs and benefits of each element. This assessment considers the level of disturbance through the displacement of activities and the extent of those in close proximity to elements who can be expected suffer some loss of amenity during construction.

The agreed PBS indicator is *"the number of dwellings directly adjacent to the project multiplied by a factor of 0.1 plus the number of dwellings/businesses displaced."*

This means that disturbance during construction is given one tenth of the weight of those displaced. The indicator relies on dwellings acknowledging that the size of household units will vary but that information on this is difficult to obtain.

The resulting scores are as follows:

| | | |
|---|---|---|
| **RT1a/b:** | **Double tracking Pukerua Bay Tunnel Section** | **Score: 5** |
| **RT2:** | **Double Tracking MacKays Crossing to Raumati** | **Score: 5** |
| **RT3:** | **Double Tracking Raumati to Paraparaumu** | **Score: 5** |
| **RE1:** | **Waikanae Extension** | **Score: 5** |
| **RS1:** | **New Lindale Station** | **Score: 5** |
| **RS2:** | **New Raumati Station** | **Score: 5** |
| **RS9:** | **Park and Ride Upgrades** | **Score: 4.6** |
| **HT1:** | **Transmission Gully Motorway – 4 Lane** | **Score: 4.7** |
| **HT4:** | **Transmission Gully Motorway – 2 Lane** | **Score: 4.7** |
| **HT7:** | **Transmission Gully Motorway – 4 Lane Mana Removal** | **Score: 4.7** |
| **HC1a/b:** | **Coastal Motorway Linden to MacKays via Mana Bypass Coast** | **Score: 1.5** |
| **HC2:** | **Coastal Upgrade Linden to MacKays via Mana Centre** | **Score: 2.7** |
| **HC4:** | **Coastal Expressway Linden to MacKays via Mana Bypass** | **Score: 2.4** |
| **HC5:** | **Northern and Central Intersection and Bottleneck Upgrades** | **Score: 2.2** |
| **HC6:** | **Northern Motorway** | **Score: 1.6** |
| **HC7:** | **Northern Expressway** | **Score: 2.1** |
| **HC8:** | **Ngauranga to Linden Motorway Upgrade** | **Score: 2.2** |
| **HC9:** | **Ngauranga to Linden Motorway Upgrade (min geometry)** | **Score: 2.1** |
| **HP1:** | **Local Roads – south of Paekakariki** | **Score: 4.9** |

| | | |
|---|---|---|
| **HP2:** | **Local Roads – Paekakariki to Poplar Ave** | **Score: 4.8** |
| **HP3:** | **Western Link Road** | **Score: 3** |
| **HE3:** | **Grays road Upgrade** | **Score: 4.7** |
| **HE5a:** | **New Route Pauatahanui to Airlie Road** | **Score: 4.8** |
| **HE5b:** | **New Route Pauatahanui to Plimmerton** | **Score: 4.8** |
| **HE6a:** | **Petone to Grenada via Horokiwi Road** | **Score: 4.8** |
| **HE6b:** | **Petone to Grenada via Korokoro Valley** | **Score: 4.8** |
| **TDM1:** | **5% reduction in JYW trips** | **Score: 5** |
| **TDM2:** | **10% reduction in JTW trips** | **Score: 5** |
| **TDM3:** | **3% reduction in JTW trips** | **Score: 5** |

## 16. Effects on Iwi Values

The effects of each element on iwi values have not been subject to expert assessment. The process to determining preliminary scores in this area has included the following:

- Review of previous reports and cultural impact assessments relevant to the elements.
- Early consultation with appropriate iwi to determine concerns, issues and agree consultation processes.
- Collective briefing, discussion and feedback from the Ara Taahi Committee of Greater Wellington.
- Briefing, discussion and feedback from individual consultation meeting with Ngati Toa, Wellington Tenths Trust and Te Runanaga O Ati Awa ki Whakarongotai.

The scores at this stage have not been agreed with relevant iwi. These will continue to be refined in conjunction with ongoing consultation processes.

## 17. Economic Efficiency and Affordability

The sixth objective is to have regard to economic efficiency and affordability. This objective does not derive directly from the Land Transport Management Act. It has been added by the Regional Land Transport Committee for the overall review of the regional Land Transport Strategy to ensure that corridor plans have regard to funding constraints and value for money in terms of transport costs and benefits.

Efficiency is judged on the basis of the benefit costs ratio derived in accordance with the former Transfund Project Evaluation Manual methodology. This is then converted to a score of 0 to 10 match with B/C ratios of 0 to 4.

The transport benefits derived from the model for each element are as follows:

| Element No. | Description | 2016 Annual Benefits |
|---|---|---|
| | **RAIL IMPROVEMENTS** | |
| RT1 | Double track Pukerua Bay Tunnel Section. Double track the existing single track section between Pukerua Bay and Paekakariki (note requires RT2) – 10 minute frequency | $4.9M |
| RT2 | Double track MacKays to Raumati. Double track the existing single track section between MacKays Crossing and Raumati – 15 minute frequency | $2.9M |
| RT3 | Double track Raumati to Paraparaumu. Double track the existing single track section between Raumati and Paraparaumu (note requires RT1 and RT2) – 10 minute frequency | $4.9M |
| RE1 | Extension of commuter network. Electrification of Waikanae section (starting north of existing Paraparaumu station) | $1.1M |
| RS1 | New rail station at Lindale | $1.7M |
| RS2 | New rail station at Raumati, located between Poplar Avenue and Leinster Road | Nil |
| RS3 | New rail station at Aotea | Nil |
| RS4 | New rail station at Glenside | Nil |
| RS5 | New rail station at Newlands | Nil |
| RS6 | New rail station at MacKays | Nil |
| RS7 | Removal of station at Muri/Pukerua Bay | $0.3M |
| RS8 | Removal of station at Redwood/Takapu | $0.4M |
| RS9 | Park and ride capacity improvements (all stations) | $2.2M |
| RS10 | A bus rail interchange at Lindale | $2.4M |
| RS11 | A bus rail interchange at Porirua | $1.1M |
| RS13 | Park and ride capacity improvements at Paraparaumu | $1.2M |
| | **HIGHWAY IMPROVEMENTS** | |
| HT1 | Transmission Gully 4 lane for the full length | $13M |
| HT2 | Transmission Gully 4 lane for the southern section only (Linden to SH58) | $2.4M |
| HT3 | Transmission Gully 4 lane for the south section, 2 lane for the north section | $12.9M |
| HT4 | Transmission Gully 2 lane for the full length | $13M |

| Element No. | Description | 2016 Annual Benefits |
|---|---|---|
| HT5 | Transmission Gully 2 lane reversible flow | $7.2M |
| HT6 | Transmission Gully 4 lane for the northern section (SH58 to Mackays Crossing) | $8.9M |
| HT7 | Transmission Gully 4 lane for the full length. With removal of temporary Mana improvements. | $13.4M |
| HC1 | Coastal Upgrade + 2 lanes (Motorway). Over Transmission Gully length | $11.9M |
| HC2 | Coastal upgrade no work through Mana. Over Transmission Gully length | $8.9M |
| HC4 | Coastal Upgrade - expressway concept. Over Transmission Gully length | $11.9M |
| HC5 | Intersection and Bottleneck Upgrades. Involves small scale physical works at the following locations; Whitford Brown Avenue, Mana, Pukerua Bay, Paekakariki, Paraparaumu, Otaihanga Road, Waikanae. Benefits are $2.5M, $3M, $1.8M, Nil, $1.3M,$0.5M, $1.9M respectively | $11M Note 2 |
| HC6 | Northern SH1 Upgrade + 2 lanes (Motorway). From MacKays Crossing to Peka Peka | $9.9M |
| HC7 | Northern SH1 Upgrade + 2 lanes (Expressway). From MacKays Crossing to Peka Peka | $9.9M |
| HC8 | Southern SH1 Upgrade + 2 lanes (Motorway). From Ngauranga Gorge to south of Linden | $4.1M |
| HP1 | Parallel local road to SH1 from Johnsonville to Pukerua Bay | $2.4M |
| HP2 | Parallel local road to SH1 from Fishermans Table to Poplar Avenue | Nil |
| HP3 | Western Link Road. Runs from Poplar Avenue to Peka Peka as a parallel local road with at grade intersections | $1.6M Note 3 |
| HE1 | Paekakariki Hill Road | $2.5M |
| HE2 | Akatarawa Road | $7.8M |
| HE3 | Grays Road | $1.3M |
| HE4 | SH58 | $2.3M |
| HE5 | New route Pauatahanui to Taupo Swamp | $1.3M |
| HE6 | Petone-Newlands and Tawa Link | $12.9M |
| HE8 | Belmont-Porirua Link | $8.6M |

In regard to the benefits shown above it is important to note that :

1. WTSM does not fully account for difficulty of a two lane road over the steep grades as would be the case with a 2 lane Transmission Gully route (HT4).
2. WTSM does not account for merge capacity constraints and presumes optimistically that the single lane capacity can be achieved.
3. Western Link Rd as an expressway would have $9.4M annual benefits.

The judgement of affordability is currently a difficult issue. There are number of potential funding sources for projects over the next 20 years. In order to provide a framework in which to take this into account in the Planning Balance Sheet a review has been undertaken of all relevant sources.

**Transit New Zealand State Highway Construction**

The following table shows current and forecast State Highway construction expenditure in the Wellington Region.

| Year | Allocation ($ million) | Source |
|---|---|---|
| 2003/04 | $38.7 | Central Region NLTP June 2004 |
| 2004/05 | $33.3 | Central Region NLTP June 2004 |
| 2005/06 | $36.6 | Transit's 10-year SH Plan 2004/05 – 2013/14 |

The Central Region NLTP notes that the figure for 2004/05 is likely to increase as additional projects are added during the year, so the allocations could be considered as a lower bound.

Transit's 10-year State Highway plan includes forecast amounts for each year after 2005/06 but these gradually reduce to $8.3 million in 2013/14. It is considered more likely that other projects will be identified and added to future years over time so that the annual allocation will continue at approximately the current levels. Discussion with Transit New Zealand supports this view.

On the basis of these allocations it is estimated that State Highway construction funding is likely to average approximately $35 million per annum over the next ten years. Based on the possibility of adding additional projects an upper bound annual allocation of $40 million is considered realistic. There is no reason to expect that the amounts would be any greater or smaller in the subsequent ten-year period so the funding profile assumes a continuation of the same annual amounts as the first ten years.

**Regionally Distributed Funds**

In December 2003 the Government announced additional funds for land transport over a ten-year period. These included an increase in fuel excise duty to be distributed regionally on the basis of population (with Auckland receiving 35% of the total collected for ten years from April 2005).

It has been estimated that this mechanism will provide $220 million of funding for Wellington Region over the ten years from April 2005. GWRC understands that there are no specific constraints on the rate at which this

amount can be drawn down over the ten years notwithstanding that the fuel excise duty to fund it will accrue at a fairly uniform rate over the ten years.

**Additional Crown Contribution**

The December 2003 Government announcement of additional funds for land transport included an additional special Crown contribution over ten years for transport funding for Auckland beginning in 2004/05, comprising $50 million per annum in 2004/05 and 2005/06 and up to $100 million for the following eight years. It was considered that the regionally distributed funding on its own would be insufficient for Auckland region to be able to deliver on the NZ Transport Strategy objectives.

The allocation under this category is based on an assessment of specific needs in the Auckland region and that, unlike the regionally distributed funding allocation, Auckland's additional funding is associated with a specific programme of projects. At present it appears that Auckland will receive approximately $750 million over ten years for this specific programme.

The Wellington Region has also undertaken discussions with Government about a similar additional funding arrangement to assist Wellington Region in delivering on NZ Transport Strategy objectives. A first stage announcement on this was made in February 2005 regarding rail unit upgrade detailed further below. A further announcement is expected in the next few months once government has received the preliminary findings of the Western Corridor Transportation Study.

For the purposes of this assessment it is assumed that Wellington Region may achieve a funding allocation of approximately $300 – 600 million over ten years from this source. It has also been assumed that further funding of similar magnitude could be available in the second ten-year period. In the low case estimate the lower bound is reduced to $200 million in the second ten-year period to acknowledge the high degree of uncertainty about this assumption.

**Special Government funding for rail**

In recent years Government provided additional funding contributions for specific passenger rail projects. In Auckland this included approximately $80 million to buy back the metropolitan track network. In the Wellington Region special funding has been provided to cover the local share for refurbishment of the English electric rolling stock and to purchase rolling stock for the Wairarapa line. GWRC considers that the Government is likely to be receptive to approaches for further special-purpose rail funding contributions.

GWRC has estimated that this funding category could average $20 – 30 million per annum (with a mid-point of $25 million pa), and that this funding would be additional to both the new electric rolling stock for the Wellington region, which is the subject of a separate business case, and the additional Crown Contribution category, some of which is also associated with rail.

It is considered that there may be some potential for double counting of likely Government contributions under the above funding categories and that the

lower bound estimate should be adjusted down to $15 million pa in the first ten years and $10 million pa in the second ten years on account of this.

**Toll revenue**

A study for GWRC has estimated that the maximum toll revenue that is likely to be generated by a Transmission Gully highway is approximately $14 million pa in 2016 rising to $17 million pa in 2026. Toll revenue could be less than this if tolls are set lower to attract more traffic from existing State Highway 1 to Transmission Gully. Transmission Gully toll revenue is estimated at $15 million pa in the upper bound scenario and $5 million in the midpoint and lower bound scenarios. There is no revenue in the first ten-year period.

**Other funding categories**

Other funding sources available to Wellington Region but not considered in the analysis of potential funding for the Western Corridor include:

- State highway maintenance
- Local road maintenance
- Local road construction/improvements
- Promotion of walking and cycling
- Public passenger transport financial subsidies (Transfund and local contributions)
- Road congestion pricing, HOT lanes or other local initiatives

These are not included in the estimate of funding because they are largely for on-going programmes of work that are unlikely to be replaced/reduced significantly by any recommendations out of the Western Corridor Transportation Study, or the amounts of funds involved are relatively insignificant eg local road construction and promotion of walking and cycling. Road congestion pricing or HOT lanes are a potential future source of additional revenue but are insufficiently far advanced to consider as a source of revenue at this stage.

**Funding amounts**

Discussion thus far has been about funding allocations for the whole Wellington Region. The proportion of overall region-wide funding that might be available for implementing the Western Corridor Strategy is assumed for the mid point and lower bound estimates as 50% of all Wellington Region expenditure. In the upper bound case it is assumed that the Western Corridor would account for two thirds of expenditure. Both of these proportions are greater than the length of the Western Corridor as a proportion of the total length of the main corridors in the Wellington region. However they are considered appropriate due to the high proportion of the region's growth that is occurring on the Kapiti Coast and the fact that the Western corridor is the main transport route linking Wellington with cities further north.

The resulting estimated potential funding amounts are shown in the table below. Estimates are presented for each funding category for two consecutive ten-year periods commencing 2005/06. The mid-point estimate is regarded as the most likely outcome. However, lower and upper bound totals are provided to reflect the uncertainty in many of the estimates.

**Summary of potential funding sources for projects in Western Corridor ($million)**

| Funding category | Comment | 10 year period | Potential funding total Wngtn Region | | | Potential funding total Western Corridor | | |
|---|---|---|---|---|---|---|---|---|
| | | | lower | mid point | upper | lower | mid point | upper |
| Transit NZ State highway construction | Mid-point estimate $35M/year ongoing. High case $40M/yr | 2005/06-14/15 | 350 | 350 | 400 | 175 | 175 | 267 |
| | | 2015/16-24/25 | 350 | 350 | 400 | 175 | 175 | 267 |
| Regionally Distributed Funds | Fixed allocation of $220M distributed over 10 years commencing April 2005 | 2005/06-14/15 | 220 | 220 | 220 | 110 | 110 | 147 |
| | | 2015/16-24/25 | 0 | 0 | 0 | 0 | 0 | 0 |
| Additional Crown contribution | Govt announcement due in Dec 04 Assume similar funding avail 2015-25 | 2005/06-14/15 | 300 | 450 | 600 | 150 | 225 | 400 |
| | | 2015/16-24/25 | 200 | 450 | 600 | 100 | 225 | 400 |
| Special Crown funding for rail | Low case estimate reduced to reflect possible double counting | 2005/06-14/15 | 150 | 250 | 300 | 75 | 125 | 200 |
| | | 2015/16-24/25 | 100 | 250 | 300 | 50 | 125 | 200 |
| Toll revenue Transmission Gully | Dependent on Transmission Gully being built | 2005/06-14/15 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2015/16-24/25 | 50 | 50 | 150 | 50 | 50 | 150 |
| **Ten year totals** | | 2005/06-14/15 | 1020 | 1270 | 1520 | 510 | 635 | 1013 |
| | | 2015/16-24/25 | 700 | 1100 | 1450 | 375 | 575 | 1017 |
| 20-year total | | | 1720 | 2370 | 2970 | 885 | 1210 | 2030 |
| Average annual amount | | | 86 | 119 | 149 | 44 | 61 | 102 |

As a result of this analysis $1.2 billion total cost was adopted as the mid point for scoring affordability in the PBS. The lower limit of $0 billion was selected for a score of 10 as it reflects the level of current annual expenditure and $2.4 billion for a score of 0.

The resulting scores are shown on the overall spreadsheet below.

## 18. Overall Results of PBS Element Evaluation

The PBS has been assembled in a single spreadsheet which is shown as attached. The sheet shows where significant trade offs are made between different factors

Review of the PBS scores reveals that:

- While changes to GDP are still to be taken into account in the PBS, the scores for Economic and Regional Development sit within a narrow band of results. The major roading investment project along the coastal route show the best performance but Transmission Gully is not far behind these scores. This will need to be updated once the GDP Input-Output model results are available.
- The overall results for Personal Safety and security also sit within a reasonably narrow band. However it is notable that the upgrades of the existing highway from MacKays to Peka Peka score best on actual safety. While the park and ride improvements and double tracking projects provide the best performance in terms of personal security.
- Under the Public Health objective the rail projects are largely neutral. The Transmission Gully elements show the greatest benefits because of both air quality benefits noise benefits and low levels of community disruption.
- The scores for environmental sustainability range from 2.7 for HC1a to 5.0 for the travel demand management elements and some rail projects. There is a significant margin between Transmission Gully (4.7) and alternative coastal upgrades such as HC4 (3.4).

**PLANNING BALANCE SHEET**

| | | Double Tracking - North-South Junction cut and tunnel inc RT2/RT3 RT1a | Double Tracking - North-South Junction, tracks seperated on existing inc RT2/RT3 RT1b | Double Tracking - MacKays Crossing-Raumati RT2 | Double Tracking - Raumati-Paraparaumu RT3 | waikanae extension RE1 | new rail station: lindale only RS1 | new rail station: raumati only RS2 | park and ride upgrade RS9 | tgm 4 lanes HT1 | tgm 2 lanes HT4 | tgm 4 lanes with removal of mana temporary improvements HT7 | costal upgrade: linden - mackays via mana bypass, coast on fill HC1a | costal upgrade: linden - mackays via mana bypass, coast on viaduct HC1b | costal upgrade: linden - mackays via mana centre HC2 | costal upgrade: linden - mackays via mana bypass HC4 | Intersection and Bottleneck upgrades - P1 to P7 combined HC5 | costal upgrade: mackays - peka peka HC6 | costal upgrade: mackays - peka peka HC7 | costal upgrade: ngauranga - linden HC8 | costal upgrade: ngauranga - linden (min geometry 500m) HC9 | local roads: south of paekakariki HP1 | local roads: paekakariki - poplar ave HP2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1. Economic and Regional Development** | | | | | | | | | | | | | | | | | | | | | | | |
| 1a | average multi-modal user cost | 5.3 | 5.3 | 5.2 | 5.3 | 5.3 | 5.3 | 5.1 | 5.2 | 6.4 | 6.4 | 6.5 | 6.6 | 6.6 | 6.6 | 6.6 | 5.8 | 6.0 | 6.0 | 5.7 | 5.7 | 5.4 | 5.0 |
| 1b | average road freight user cost | 5.3 | 5.3 | 5.3 | 5.3 | 5.0 | 5.3 | 5.0 | 5.0 | 5.7 | 5.4 | 5.4 | 6.1 | 6.1 | 5.9 | 6.1 | 5.7 | 6.2 | 6.2 | 5.5 | 5.5 | 5.5 | 5.3 |
| 1d | changes to GDP | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| | **SUBTOTAL** | **5.2** | **5.2** | **5.2** | **5.2** | **5.1** | **5.2** | **5.0** | **5.1** | **5.7** | **5.6** | **5.6** | **5.9** | **5.9** | **5.8** | **5.9** | **5.5** | **5.7** | **5.7** | **5.4** | **5.4** | **5.3** | **5.1** |
| **2. Safety and Personal Security** | | | | | | | | | | | | | | | | | | | | | | | |
| 2a | actual safety rate | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.3 | 6.2 | 4.6 | 7.1 | 7.1 | 4.9 | 4.9 | 4.9 | 5.2 |
| 2b | personal security | 6.6 | 6.6 | 5.9 | 6.6 | 5.3 | 5.6 | 4.9 | 7.2 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| | **SUBTOTAL** | **5.6** | **5.6** | **5.3** | **5.6** | **5.1** | **5.2** | **5.0** | **5.7** | **5.8** | **5.8** | **5.8** | **5.8** | **5.8** | **5.9** | **5.8** | **4.7** | **6.4** | **6.4** | **5.0** | **5.0** | **4.9** | **5.2** |
| **3. Access, Mobility and Network Reliability** | | | | | | | | | | | | | | | | | | | | | | | |
| 3a | multi-modal accessibility and integration | 5.4 | 5.4 | 5.5 | 5.4 | 5.2 | 5.1 | 5.0 | 5.2 | 7.2 | 7.2 | 7.2 | 8.0 | 8.0 | 8.2 | 8.0 | 5.1 | 5.2 | 5.2 | 5.2 | 5.2 | 5.9 | 5.0 |
| 3b | reliability of travel time for road | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 7.1 | 5.6 | 7.1 | 6.0 | 6.0 | 6.0 | 6.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.2 | 4.9 |
| 3c | network resilience for road and rail | 5.2 | 5.2 | 5.2 | 5.1 | 5.3 | 5.0 | 5.0 | 5.0 | 9.2 | 7.1 | 9.2 | 8.0 | 8.0 | 7.8 | 8.0 | 6.9 | 7.1 | 7.1 | 6.2 | 5.7 | 5.5 | 5.9 |
| 3d | mode option choice | 6.4 | 6.4 | 6.4 | 6.4 | 5.9 | 6.0 | 5.0 | 5.9 | 4.4 | 4.4 | 4.4 | 4.6 | 4.6 | 4.5 | 4.6 | 6.3 | 6.2 | 6.2 | 6.2 | 6.2 | 5.0 | 5.0 |
| | **SUBTOTAL** | **5.5** | **5.5** | **5.5** | **5.5** | **5.3** | **5.3** | **5.0** | **5.3** | **7.0** | **6.1** | **7.0** | **6.7** | **6.7** | **6.6** | **6.7** | **5.8** | **5.9** | **5.9** | **5.6** | **5.5** | **5.4** | **5.2** |
| **4. Public Health** | | | | | | | | | | | | | | | | | | | | | | | |
| 4a | air quality | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.5 | 7.5 | 7.2 | 7.3 | 4.8 | 4.8 | 4.3 | 4.6 | 5.2 | 5.2 | 5.2 | 5.0 | 5.0 | 4.8 | 5.0 |
| 4b | noise | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 9.2 | 9.0 | 9.4 | 4.4 | 4.4 | 3.4 | 5.4 | 4.8 | 4.8 | 5.0 | 4.4 | 4.6 | 4.4 | 5.0 |
| 4c | active travel | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 7.6 | 5.0 | 2.8 | 2.8 | 7.4 | 7.9 | 6.2 | 5.0 | 8.5 | 4.5 | 4.5 | 5.6 | 6.0 |
| 4d | community severance and related effects | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.5 | 5.5 | 5.0 | 6.0 | 6.0 | 6.0 | 5.5 | 5.5 | 4.0 | 6.0 | 6.0 | 4.0 | 3.5 | 5.0 | 5.0 | 6.0 | 6.0 |
| 4e | community displacement, construction disruption | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 4.6 | 4.7 | 4.7 | 4.7 | 1.5 | 1.5 | 2.7 | 2.4 | 2.2 | 1.6 | 2.1 | 2.2 | 2.1 | 4.9 | 4.8 |
| 4f | crashes | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 | 6.3 | 6.2 | 4.6 | 7.1 | 7.1 | 4.9 | 4.9 | 4.9 | 5.2 |
| | **SUBTOTAL** | **5.0** | **5.0** | **5.0** | **5.0** | **5.0** | **5.1** | **5.1** | **5.0** | **6.4** | **6.8** | **6.4** | **4.2** | **4.2** | **4.7** | **5.4** | **4.8** | **4.6** | **5.2** | **4.3** | **4.4** | **5.1** | **5.3** |
| **5. Environmental Sustainability** | | | | | | | | | | | | | | | | | | | | | | | |
| 5a | iwi values | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 4.5 | 4.5 | 4.5 | 3.0 | 3.2 | 3.4 | 3.0 | 3.6 | 5.0 | 5.0 | 5.0 | 5.0 | 4.5 | 4.0 |
| 5b | greenhouse gases | 5.1 | 5.1 | 5.1 | 5.1 | 5.0 | 5.0 | 5.0 | 5.1 | 6.3 | 6.8 | 6.3 | 5.5 | 5.5 | 5.7 | 5.5 | 5.7 | 6.4 | 6.4 | 4.6 | 4.6 | 5.8 | 5.0 |
| 5c | indigenous habitats | 4.0 | 4.0 | 3.0 | 4.0 | 5.0 | 5.0 | 5.0 | 5.0 | 2.0 | 3.0 | 2.0 | 2.0 | 3.0 | 4.0 | 4.0 | 4.0 | 3.0 | 3.0 | 4.0 | 4.0 | 5.0 | 5.0 |
| 5d | significant ecosystems | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 3.0 | 4.0 | 3.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| 5e | landscape and visual including recreational values | 3.0 | 3.0 | 3.0 | 4.0 | 5.0 | 5.0 | 4.0 | 5.0 | 8.0 | 8.0 | 8.0 | 0.0 | 5.0 | 3.0 | 2.0 | 3.0 | 1.0 | 2.0 | 2.0 | 4.0 | 5.0 | 5.0 |
| 5f | archaeology and heritage | 2.0 | 4.0 | 3.0 | 3.0 | 5.0 | 5.0 | 5.0 | 5.0 | 4.5 | 4.5 | 4.5 | 1.0 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 | 4.0 | 4.5 | 4.5 | 2.0 | 1.0 |
| | **SUBTOTAL** | **4.0** | **4.3** | **4.0** | **4.3** | **5.0** | **5.0** | **4.8** | **5.0** | **4.7** | **5.1** | **4.7** | **2.7** | **3.8** | **3.7** | **3.4** | **3.9** | **4.1** | **4.2** | **4.2** | **4.5** | **4.5** | **4.2** |
| **6. Economic Efficiency and Affordability** | | | | | | | | | | | | | | | | | | | | | | | |
| 6a | affordability | 0.0 | 0.0 | 7.6 | 0.9 | 5.0 | 10.0 | 10.0 | 10.0 | 1.1 | 3.8 | 1.5 | 4.6 | 4.6 | 6.0 | 4.6 | 6.2 | 3.6 | 4.8 | 4.8 | 0.0 | 4.3 | 0.9 |
| 6b | efficiency | 3.0 | 3.0 | 5.0 | 2.9 | 5.0 | 5.0 | 0.0 | 5.0 | 2.6 | 3.7 | 2.8 | 3.9 | 3.9 | 4.3 | 3.9 | 3.6 | 3.9 | 4.9 | 3.5 | 2.4 | 2.3 | 0.0 |
| | **SUBTOTAL** | **1.5** | **1.5** | **6.3** | **1.9** | **5.0** | **7.5** | **5.0** | **7.5** | **1.8** | **3.8** | **2.2** | **4.3** | **4.2** | **5.1** | **4.3** | **4.9** | **3.8** | **4.9** | **4.2** | **1.2** | **3.3** | **0.4** |
| 1 | Economic and Regional Development | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 |
| 2 | Safety and Personal Security | 0.8 | 0.8 | 0.7 | 0.8 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.7 | 0.9 | 0.9 | 0.7 | 0.7 | 0.7 | 0.7 |
| 3 | Access, Mobility and Network Reliability | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 1.1 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.8 |
| 4 | Public Health | 0.6 | 0.6 | 0.6 | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 | 0.6 | 0.6 |
| 5 | Environmental Sustainability | 0.6 | 0.7 | 0.6 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.4 | 0.6 | 0.6 | 0.5 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| 6 | Economic Efficiency and Affordability | 0.4 | 0.4 | 1.5 | 0.5 | 1.2 | 1.8 | 1.2 | 1.8 | 0.4 | 0.9 | 0.5 | 1.0 | 1.0 | 1.2 | 1.0 | 1.2 | 0.9 | 1.2 | 1.0 | 0.3 | 0.8 | 0.1 |
| | **GRAND TOTAL (RLTC)** | **4.2** | **4.3** | **5.3** | **4.3** | **5.1** | **5.7** | **5.0** | **5.8** | **4.9** | **5.3** | **5.0** | **4.9** | **5.1** | **5.3** | **5.2** | **5.0** | **5.0** | **5.4** | **4.8** | **4.1** | **4.6** | **3.9** |
| 1 | Economic and Regional Development | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 |
| 2 | Safety and Personal Security | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 0.9 | 1.3 | 1.3 | 1.0 | 1.0 | 1.0 | 1.0 |
| 3 | Access, Mobility and Network Reliability | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.1 | 1.4 | 1.2 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.0 |
| 4 | Public Health | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.3 | 1.4 | 1.3 | 0.8 | 0.8 | 0.9 | 1.1 | 1.0 | 0.9 | 1.0 | 0.9 | 0.9 | 1.0 | 1.1 |
| 5 | Environmental Sustainability | 0.8 | 0.9 | 0.8 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 1.0 | 0.9 | 0.5 | 0.8 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.8 |
| 6 | Economic Efficiency and Affordability | 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 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | **GRAND TOTAL (LTNZ, T2000+)** | **5.1** | **5.1** | **5.0** | **5.1** | **5.1** | **5.1** | **5.0** | **5.2** | **5.9** | **5.9** | **5.9** | **5.1** | **5.3** | **5.3** | **5.4** | **4.9** | **5.3** | **5.5** | **4.9** | **4.9** | **5.1** | **5.0** |
| 1 | Economic and Regional Development | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 1.4 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| 2 | Safety and Personal Security | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.6 | 0.8 | 0.8 | 0.6 | 0.6 | 0.6 | 0.7 |
| 3 | Access, Mobility and Network Reliability | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 1.0 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.8 |
| 4 | Public Health | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.7 | 0.6 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.5 |
| 5 | Environmental Sustainability | 0.6 | 0.7 | 0.6 | 0.7 | 0.8 | 0.8 | 0.7 | 0.8 | 0.7 | 0.8 | 0.7 | 0.4 | 0.6 | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 0.6 |
| 6 | Economic Efficiency and Affordability | 0.3 | 0.3 | 1.4 | 0.4 | 1.1 | 1.7 | 1.1 | 1.7 | 0.4 | 0.8 | 0.5 | 0.9 | 0.9 | 1.1 | 0.9 | 1.1 | 0.8 | 1.1 | 0.9 | 0.3 | 0.7 | 0.1 |
| | **GRAND TOTAL (TAG)** | **4.3** | **4.3** | **5.3** | **4.4** | **5.1** | **5.7** | **5.0** | **5.7** | **5.0** | **5.3** | **5.0** | **5.0** | **5.1** | **5.4** | **5.2** | **5.0** | **5.0** | **5.4** | **4.8** | **4.2** | **4.7** | **4.0** |

**PLANNING BALANCE SHEET**

| | | western link road | local roads: grays rd only | New Route Pauatahanui to SH1 - Pauatahanui to Airlie Rd | New Route Pauatahanui to SH1 - Pauatahanui to Plimmerton Interchange | Petone to Grenada Link - Petone-Horokiwi Rd-Westchester Ave | Petone to Grenada Link - Petone-Korokoro Stream-Westchester Ave | removal of 5% of hbw trips | removal of 10% of hbw trips | removal of 2% of hbw trips |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **HP3** | **HE3** | **HE5a** | **HE5b** | **HE6a** | **HE6b** | **TDM1** | **TDM2** | **TDM3** |
| **1. Economic and Regional Development** | | | | | | | | | | |
| 1a | average multi-modal user cost | 5.1 | 5.4 | 5.4 | 5.4 | 5.6 | 5.6 | 5.1 | 5.1 | 5.1 |
| 1b | average road freight user cost | 5.0 | 5.1 | 5.1 | 5.1 | 5.1 | 5.1 | 5.0 | 5.0 | 5.0 |
| 1d | changes to GDP | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| | **SUBTOTAL** | **5.0** | **5.2** | **5.2** | **5.2** | **5.2** | **5.2** | **5.0** | **5.1** | **5.0** |
| **2. Safety and Personal Security** | | | | | | | | | | |
| 2a | actual safety rate | 4.8 | 4.9 | 4.9 | 4.9 | 5.0 | 5.0 | 5.0 | 5.1 | 5.0 |
| 2b | personal security | 5.0 | 5.0 | 5 | 5 | 5.0 | 5.0 | 4.8 | 4.8 | 4.9 |
| | **SUBTOTAL** | **4.9** | **4.9** | **4.9** | **4.9** | **5.0** | **5.0** | **5.0** | **5.0** | **5.0** |
| **3. Access, Mobility and Network Reliability** | | | | | | | | | | |
| 3a | multi-modal accessibility and integration | 5.3 | 5.3 | 5.3 | 5.3 | 5.4 | 5.4 | 5.2 | 5.1 | 5.1 |
| 3b | reliability of travel time for road | 5.2 | 4.8 | 4.8 | 4.8 | 5.3 | 5.3 | 5.0 | 5.0 | 5.0 |
| 3c | network resilience for road and rail | 6.8 | 5.0 | 5.9 | 5.7 | 7.5 | 7.5 | 5.0 | 5.0 | 5.0 |
| 3d | mode option choice | 5.0 | 5.3 | 5.3 | 5.3 | 5.0 | 5.0 | 5.3 | 5.3 | 5.5 |
| | **SUBTOTAL** | **5.6** | **5.1** | **5.3** | **5.3** | **5.8** | **5.8** | **5.1** | **5.1** | **5.1** |
| **4. Public Health** | | | | | | | | | | |
| 4a | air quality | 5.1 | 4.0 | 5.5 | 5.5 | 5.1 | 5.1 | 7.0 | 8.0 | 6.0 |
| 4b | noise | 4.6 | 4.8 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| 4c | active travel | 9.5 | 5.0 | 6.0 | 5.8 | 5.7 | 5.7 | 5.0 | 5.0 | 5.0 |
| 4d | community severance and related effects | 6.0 | 5.0 | 5.0 | 5.5 | 5.5 | 5.0 | 5.0 | 5.2 | 5.0 |
| 4e | community displacement, construction disruption | 4.6 | 3.0 | 4.7 | 4.8 | 4.8 | 4.8 | 5.0 | 5.0 | 5.0 |
| 4f | crashes | 4.8 | 4.9 | 4.9 | 4.9 | 5.0 | 5.0 | 5.0 | 5.1 | 5.0 |
| | **SUBTOTAL** | **5.8** | **4.4** | **5.2** | **5.2** | **5.2** | **5.1** | **5.3** | **5.5** | **5.2** |
| **5. Environmental Sustainability** | | | | | | | | | | |
| 5a | iwi values | 3.0 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 5.0 | 5.0 | 5.0 |
| 5b | greenhouse gases | 5.1 | 4.8 | 4.8 | 4.8 | 4.0 | 4.0 | 5.1 | 5.2 | 5.0 |
| 5c | indigenous habitats | 4.0 | 3.0 | 5.0 | 5.0 | 3.0 | 2.0 | 5.0 | 5.0 | 5.0 |
| 5d | significant ecosystems | 5.0 | 3.0 | 5.0 | 5.0 | 4.0 | 4.0 | 5.0 | 5.0 | 5.0 |
| 5e | landscape and visual including recreational values | 8.0 | 4.0 | 6.0 | 6.0 | 5.0 | 4.0 | 5.0 | 5.0 | 5.0 |
| 5f | archaeology and heritage | 1.0 | 5.0 | 5.0 | 5.0 | 4.0 | 3.0 | 5.0 | 5.0 | 5.0 |
| | **SUBTOTAL** | **4.4** | **4.0** | **5.0** | **5.0** | **4.1** | **3.6** | **5.0** | **5.0** | **5.0** |
| **6. Economic Efficiency and Affordability** | | | | | | | | | | |
| 6a | affordability | 3.9 | 7.8 | 5.7 | 5.7 | 6.5 | 6.7 | 5.0 | 5.0 | 5.0 |
| 6b | efficiency | 2.4 | 4.6 | 1.9 | 2.1 | 10.0 | 10.0 | 5.0 | 5.0 | 5.0 |
| | **SUBTOTAL** | **3.2** | **6.2** | **3.8** | **3.9** | **8.3** | **8.4** | **5.0** | **5.0** | **5.0** |
| 1 | Economic and Regional Development | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 2 | Safety and Personal Security | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| 3 | Access, Mobility and Network Reliability | 0.9 | 0.8 | 0.9 | 0.8 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 |
| 4 | Public Health | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 5 | Environmental Sustainability | 0.7 | 0.6 | 0.8 | 0.8 | 0.7 | 0.6 | 0.8 | 0.8 | 0.8 |
| 6 | Economic Efficiency and Affordability | 0.8 | 1.5 | 0.9 | 0.9 | 2.0 | 2.0 | 1.2 | 1.2 | 1.2 |
| | **GRAND TOTAL (RLTC)** | **4.6** | **5.1** | **4.8** | **4.8** | **5.8** | **5.8** | **5.1** | **5.10** | **5.04** |
| 1 | Economic and Regional Development | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 2 | Safety and Personal Security | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 3 | Access, Mobility and Network Reliability | 1.1 | 1.0 | 1.1 | 1.1 | 1.2 | 1.2 | 1.0 | 1.0 | 1.0 |
| 4 | Public Health | 1.2 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.0 |
| 5 | Environmental Sustainability | 0.9 | 0.8 | 1.0 | 1.0 | 0.8 | 0.7 | 1.0 | 1.0 | 1.0 |
| 6 | Economic Efficiency and Affordability | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | **GRAND TOTAL (LTNZ, T2000+)** | **5.1** | **4.7** | **5.1** | **5.1** | **5.1** | **4.9** | **5.1** | **5.2** | **5.1** |
| 1 | Economic and Regional Development | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| 2 | Safety and Personal Security | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.6 |
| 3 | Access, Mobility and Network Reliability | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 |
| 4 | Public Health | 0.6 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 |
| 5 | Environmental Sustainability | 0.7 | 0.6 | 0.8 | 0.8 | 0.6 | 0.5 | 0.8 | 0.8 | 0.8 |
| 6 | Economic Efficiency and Affordability | 0.7 | 1.4 | 0.8 | 0.9 | 1.8 | 1.8 | 1.1 | 1.1 | 1.1 |
| | **GRAND TOTAL (TAG)** | **4.7** | **5.1** | **4.8** | **4.9** | **5.8** | **5.7** | **5.1** | **5.1** | **5.0** |

- The Economic efficiency and affordability scores sit in a wider range from 1.2 to 8.4. The top performing project in this regard is Petone to Grenada followed by the new rail station projects.

The four weighting systems detailed in Section 4 of the report have been applied and the results are summarised in the table below. It should be noted that both the LTNZ and Transport 2000+ weightings exclude Economic Efficiency and Affordability on the basis that this should be considered separately.

| | Description | RLTC | LTNZ and T2000+ | TAG |
|---|---|---|---|---|
| **RAIL IMPROVEMENTS** | | | | |
| RT1 | Double track Pukerua Bay tunnel section. | 4.2 | 5.1 | 4.3 |
| RT2 | Double track MacKays to Raumati | 5.3 | 5.0 | 5.3 |
| RT3 | Double track Raumati to Paraparaumu | 4.3 | 5.1 | 4.4 |
| RE1 | Waikanae electrification extension | 5.1 | 5.1 | 5.1 |
| RS1 | New rail station and bus interchange at Lindale | 5.7 | 5.1 | 5.7 |
| RS2 | New rail station at Raumati | 5.0 | 5.0 | 5.0 |
| RS9 | Park and ride capacity improvements | 5.8 | 5.2 | 5.7 |
| **HIGHWAY IMPROVEMENTS** | | | | |
| HT1 | Transmission Gully - full length 4 lane | 4.9 | 5.9 | 5.0 |
| HT4 | Transmission Gully - full length 2 lane | 5.3 | 5.9 | 5.3 |
| HT7 | Transmission Gully - full length 4 lane, with removal of Mana temporary improvements | 5.0 | 5.9 | 5.0 |
| HC1 | Coastal motorway | 4.9 | 5.1 | 5.0 |
| HC2 | Coastal expressway, no Mana bypass | 5.3 | 5.3 | 5.4 |
| HC4 | Coastal expressway, with Mana bypass | 5.2 | 5.4 | 5.2 |
| HC5 | Northern and central intersection and bottleneck upgrades consisting of Whitford Brown intersection, Mana bypas, Pukerua Bay bypass, Paekakariki intersection, Paraparaumu bypass, Otaihanga Road, Waikanae improvements. | 5.0 | 4.9 | 5.0 |
| HC6 | Northern motorway | 5.0 | 5.3 | 5.0 |
| HC7 | Northern expressway | 5.4 | 5.5 | 5.4 |
| HC8 | Ngauranga to Linden motorway upgrade | 4.8 | 4.9 | 4.8 |
| HC9 | Ngauranga to Linden motorway upgrade, with reduced geometry | 4.1 | 4.9 | 4.2 |
| HP1 | Johnsonville to Pukerua Bay parallel local road | 4.6 | 5.1 | 4.7 |
| HP2 | Fishermans Table to Poplar Avenue parallel local road | 3.9 | 5.0 | 4.0 |

| | Description | RLTC | LTNZ and T2000+ | TAG |
|---|---|---|---|---|
| HP3 | Western Link Road | 4.6 | 5.1 | 4.7 |
| HE3 | Grays Road upgrade | 5.1 | 4.7 | 5.1 |
| HE5 | Grays Road realignment | 4.8 | 5.1 | 4.8 |
| HE6 | Petone to Granada link | 5.8 | 5.1 | 5.8 |

Orange <4.5, White 4.5 to 5.5, Green >5.5

The PBS will be subject to further analysis through sensitivity testing both on scores and weighting. This will include matters raised by Transport 2000+ which will be addressed by additional modelling to test:

- The effects of significant oil price rises, and
- Changes in population characteristics and distribution.

Additional modelling is also being undertaken to further test delays and disruption to transport during element construction.

## 19. Strategy Scenarios

Initial scenarios have been developed for a first round of analysis of combination of elements. The methodology for identifying these scenarios involved:

- Identification of a wide range of scenario themes with the Technical Steering Group.
- Rationalisation of themes into interrelated groups.
- Identification of theme group compatible elements based on technical performance of elements.
- Refinement of the scenarios to represent a suitable range of alternatives for first round analysis.

The PBS has been used to analyse the scenarios based on the assessments undertaken for each element.

The five scenarios are defined as follows:

**1. Public Transport and Travel Demand Management Scenario**

This scenario endeavours to assess what can be achieved in the corridor by way of rail investment and travel demand management. It puts in place rail improvements that would enable a 10 minute frequency of trains from Paraparaumu south and extends the electrification north but only as far as a new transport interchange hub at Lindale. To compliment this a new element has been added that has not been assessed in the PBS elements and that is a significant upgrade of the Porirua Bus Rail Interchange.

The elements that make up this scenario are:

- **RT1a/b** **Double Tracking Pukerua Bay Tunnel Section**
- **RT2** **Double Tracking MacKays Crossing to Raumati**
- **RS1** **Kapiti Bus Rail Interchange**

- **RS11 Porirua Bus Rail Interchange**
- **RS9 Additional Park and Ride**
- **Non-price Travel Demand Management**
- **Priced Travel Demand Management**
- **Additional Rail Units**

It is likely that this scenario will require aggressive implementation of travel demand management including comprehensive road pricing or at least congestion charging.

**2. Roading Scenario**

At the other end of the strategic continuum from a focus on public transport is a focus on road investment. This scenario provides for a high standard of highway along the length of the corridor from Ngauranga to Peka Peka at either expressway or motorway standard. This scenario includes Transmission Gully. In addition it includes the east west link between Grenada Petone and the Western Link Road.

The elements that make up this scenario are:

- **HE6 Petone to Grenada**
- **HC8 Ngauranga to Linden Motorway Upgrade**
- **HT1 Transmission Gully Motorway – 4 Lane**
- **HC7 Northern Expressway**
- **HP3 Western Link Road**

**3. Improved Reliability Scenario**

This scenario seeks to provide a high level of reliability throughout the corridor by improvement to both road and rail infrastructure but adopts a coastal expressway option as an alternative to Transmission Gully. Its focus on reliability will enable a ten minute rail service as well as expressway standard highway along the corridor. In addition the additional links from Petone Grenada and Western Link Road are provided for.

The elements that make up this scenario are:

- **RS1 Kapati Bus Rail Interchange**
- **RS11 Porirua Bus Rail Interchange**
- **RT1a/b Double Tracking Pukerua Bay Tunnel Section**
- **RT2 Double Tracking MacKays Crossing to Raumati**
- **HE6 Petone to Grenada Link**
- **HC4 Coastal Expressway with Mana Bypass**
- **HC7 Northern Expressway**
- **HE3 Grays Road Upgrade**
- **HP3 Western Link Road**
- **Aotea Block Connection**
- **Additional Rail Units**
- **Non-price Traffic Demand Management**

**4. Congestion Relief Scenario**

This scenario targets the existing congestion point hot spots along the corridor. This places emphasis on the southern part of the corridor with investment south of Tawa including the Petone Grenada link. In addition bottlenecks along the corridor are addressed.

The elements that make up this scenario are:

- **HE6** **Petone to Grenada Link**
- **HC5** **Northern and Central Intersection and Bottleneck Upgrades, including**
  - Whitford Brown Intersection
  - Mana Bypass
  - Pukerua Bay Bypass
  - Paekakariki Intersection
  - Paraparaumu Bypass
  - Otaihanga Intersection
  - Waikanae improvements
- **Ngauranga to Tawa Motorway Upgrade**
- **Additional Rail Units**

**5. Project Efficiency Scenario**

This element places greater weight on the economic efficiency of individual projects as judged by the calculation of their cost benefit ratio. Elements have therefore been selected on their economic efficiency performance from the PBS. This approach reflects the way in which projects have previously been prioritised prior to the Land Transport Management Act.

The elements that make up this scenario are:

- **RS1** **Kapati Bus Rail Interchange**
- **RS11** **Porirua Bus Rail Interchange**
- **RT2** **Double Tracking MacKays Crossing to Raumati**
- **HE6** **Petone to Grenada Link**
- **HC5** **Northern and Central Intersection and Bottleneck Upgrades, including**
  - Whitford Brown Intersection
  - Mana Bypass
  - Pukerua Bay Bypass
  - Paekakariki Intersection
  - Paraparaumu Bypass
  - Otaihanga Intersection
  - Waikanae improvements
- **HE3** **Grays Road Upgrade**
- **Additional Rail Units**
- **Non-price Traffic Demand Management**

These scenarios are a first iteration of possible strategic outcomes from the study and will form the basis of the Stage 2 public consultation. A process of optimisation and refinement will then be undertaken taking into account further

analysis, public consultation feedback, political input and cross fertilisation with the Wellington Regional Study.

## 20. Scoring of Scenarios

Each of the above 5 scenarios has been analysed and scored in the Planning Balance Sheet. The indicators analysed through the Wellington Strategic Transport Model have been sourced from further model runs of the overall corridor study area.

The establishment of scores for the areas of expert assessment has drawn on the element assessment to derive an overall scenario score. Some assessments are more suited to a calculation to achieve this overall score whilst others require a more qualitative approach.

The approach in each of the expert assessment areas and resulting scores are summarised below:

**Noise**

Scoring of elements for noise is based on the percentage change in the net number of houses affected by transport noise levels above 65 dBA. Scenarios have been based on a cumulative basis taking into account the scale of both positive and negative effects associated with each element and discounting those that have a neutral effects.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Noise** | 5 | 8.2 | 4.2 | 4.4 | 4.6 |

**Landscape, Ecology and Habitat**

These areas required a more qualitative approach with input from the expert assessors taking into account the scale and intensity of positive and negative effects and having regard to particular hot spot areas of adverse effects.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Landscape** | 4 | 5.5 | 4 | 3.5 | 4.5 |
| **Ecology** | 5 | 4.3 | 4.6 | 4.9 | 4.5 |
| **Habitat** | 4 | 3.4 | 3.5 | 3.8 | 4 |

**Active Travel**

This is based on the cumulative facilities provided across a scenario associated with expected facilities for cyclists and pedestrians.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Active** | 5.2 | 7.2 | 8.2 | 5.4 | 5.5 |

**Community Severance**

This has been scored on a balance of positive and negative severance effects across a scenario.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Severance** | 5.0 | 4.2 | 3.8 | 5.5 | 5.5 |

**Community Disruption**

A cumulative quantified approach is taken with community disruption with the worst score of 0 equating to 500 dwelling equivalents for a complete scenario.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Disruption** | 5.0 | 1.8 | 1.8 | 2.3 | 3.4 |

**Iwi Values**

This has been scored by factoring the scores of elements by the scale of each element as represented by the construction cost.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Iwi** | 5.0 | 4.7 | 4.1 | 4.1 | 3.9 |

**Network Resilience**

This item is also scored on a cumulative effect basis.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Resilience** | 5.3 | 8.4 | 8.4 | 6.9 | 7.1 |

**Archaeology and Heritage**

This has required judgement of the severity of effects associated with elements, an averaging process was employed which was weighted towards hot spots with adverse effects of a major level.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Arch / Her.** | 4.0 | 3.5 | 2 | 3.1 | 3.9 |

**Air Quality**

Air quality has also been assessed on a cumulative basis having regard to the existing hot spots along the corridor.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Air Quality** | 5.0 | 7.4 | 5.3 | 5.3 | 6.3 |

**Efficiency and Affordability**

Efficiency has been scored on the same basis as the elements with the cumulative costs and benefits of each element providing a total B/C ratio for each scenario. Similarly the affordability scoring is based on the assessment recorded in section 17 above with a total scenario cost of $1.2 billion equating to a score of 5, $2.4 billion a score of 0 and $0 a score of 10.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Efficiency** | 2.8 | 4.2 | 4.8 | 4.9 | 5.5 |
| **Affordability** | 8.3 | 1.5 | 2.7 | 5.5 | 6.0 |

## 21. Results of Scenarios PBS Evaluation

The results of the Planning Balance Sheet evaluation for the initial scenarios is summarised in the following table.

| Planning Balance Sheet Assessment | Scenarios | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Economic & regional development | 5.2 | 6.6 | 6.6 | 6.0 | 5.9 |
| Safety & personal security | 5.8 | 7.1 | 7.3 | 4.3 | 4.6 |
| Access, mobility & network reliability | 5.4 | 7.5 | 7.7 | 6.6 | 5.8 |
| Public health | 5.0 | 6.2 | 5.3 | 4.5 | 4.9 |
| Environmental sustainability | 4.5 | 4.9 | 4.2 | 4.2 | 4.5 |
| Economic efficiency & affordability | 5.6 | 2.8 | 3.8 | 5.2 | 5.8 |
| PBS score – RLTC | 5.3 | 5.6 | 5.7 | 5.2 | 5.4 |
| PBS score – LTNZ | 5.2 | 6.5 | 6.2 | 5.1 | 5.2 |
| PBS Score – TAG | 5.3 | 5.7 | 5.7 | 5.3 | 5.4 |

These scores will be subject to further sensitivity testing and further refinement of scenarios into alternative packages once stage 2 consultation is complete.

The results are to be used as one tool in the process of evaluation alongside other information including risk assessment and consideration of overall performance criteria.