Transmission Gully Project: Assessment of Traffic & Transportation Effects

TRANSMISSION GULLY PROJECT: TECHNICAL REPORT #4

ASSESSMENT OF TRAFFIC & TRANSPORTATION EFFECTS

- Final
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Contents

Abbreviations

Abbreviation	Expansion
AADT	Annual Average Daily Traffic
AEE	Assessment of Effects on the Environment
CAS	Crash Analysis System
CBD	Central Business District
COPTTM	Code of Practice for Temporary Traffic Management
CTMP	Construction Traffic Management Plan
EED	Engineering Exception Decisions
EEM	Economic Evaluation Manual
EIR	Environmental Impact Report
EPA	Environmental Protection Authority
GATS	Greater Wellington Area Transportation Strategic Review
GPS	Government Policy Statement
GRPA	Government Roading Powers Act (1989)
GWRC	Greater Wellington Regional Council
HCC	Hutt City Council
HCM	Highway Capacity Manual
HCV	Heavy Commercial Vehicles
IP	Inter Peak
KCDC	Kapiti Coast District Council
LOS	Level of Service
LTMA	Land Transport Management Act
MERA	Monitoring and Evaluation Research Associates Ltd
NLTP	National Land Transport Programme
NoR	Notice of Requirement
NZTA	NZ Transport Agency
NZTS	New Zealand Transport Strategy
PCC	Porirua City Council

Abbreviation	Expansion
PCE	Parliamentary Commissioner for the Environment
PPFM	NZTA Planning, Programming and Funding Manual
PTMA	Public Transport Management Act (2008)
PTS	Porirua Transportation Strategy
RATAG	Regulatory Authorities Technical Advisory Group
RCA	Road Controlling Authority
RLTP	Regional Land Transport Programme
RLTS	Regional Land Transport Strategy
RMA	Resource Management Act (1991)
RoNS	Roads of National Significance
RPS	(Wellington) Regional Policy Statement
SAR	Scheme Assessment Report
SATURN	Simulation and Assignment of Traffic to Urban Road Networks
SH	State Highway
SIDRA	Signalised and Un-signalised Intersection Design and Research Aid
SKM	Sinclair Knight Merz
SSTMPs	Site Specific Traffic Management Plans
STS	Sustainable Transport Strategy
TDM	Travel Demand Management
TG	the Transmission Gully Project
TKTPL	Tim Kelly Transportation Planning Ltd
TTM	Temporary Traffic Management
TTMP	Temporary Traffic Management Plan
UHCC	Upper Hutt City Council
WCC	Wellington City Council
WCP	Western Corridor Plan
WNC	Wellington Northern Corridor
WTSM	Wellington Transport Strategy Model

Executive Summary & Conclusions

Scope of the Assessment

The primary purpose of this assessment is to forecast changes in travel patterns and traffic volumes arising from the Transmission Gully Project and to use these changes to identify the effects of the project upon the operation and performance of the local and regional transportation network. These changes have also formed a key input to parallel components of the wider evaluation of effects, such as noise.

The NZ Transport Agency (NZTA) has no current plans to apply user tolls to the Transmission Gully Project, and on this basis, the assessment has assumed that no tolls will apply. As an effects-based assessment, no evaluation has been undertaken of the economic performance of the project at this stage.

The scope of this assessment was defined in consultation with the NZTA.

The Transmission Gully Project

The Transmission Gully Project will provide a new route for State Highway 1 (SH1) between Linden (Tawa) and MacKays Crossing (north of Paekakariki), a distance of approximately 27kms. It is not currently proposed to apply tolls to vehicles using the route.

The route will provide a minimum of four traffic lanes and a continuous median barrier. Additional crawler lanes will be provided on the steeper sections of the route, where the maximum gradient will be 8%. Through traffic will be unimpeded, with all intersections constructed to a grade-separated standard.

Access to and from the route will be limited. Aside from the tie-ins with SH1 to the north and south, access will be provided to State Highway 58 (SH58) (east of Pauatahanui village), the Porirua link roads and the Kenepuru link road.

The Porirua link roads will connect the main alignment (by means of a single, grade-separated intersection) to Waitangirua (at Warspite Avenue) and Whitby (at James Cook Drive / Navigation Drive). These link roads will be local roads, for which the responsibility for securing the designation, construction, operation and maintenance lies with Porirua City Council (PCC).

The Kenepuru link road will connect the main alignment to western Porirua at Kenepuru Drive. This will be a State highway connection, providing one traffic lane in each direction.

Project Background & Policy Consistency

Between 2004 and 2006, the Western Corridor Study considered the merits of a number of strategies to upgrade the transportation network in the SH1 corridor. This concluded that strategies focussed upon either solely upgrading public transportation or roading would not adequately

address the problems in this area. This recognised that these modes of transportation are complementary to one another, rather than in direct competition. Instead, a strategy which proposed balanced improvements across both public transportation and roading was recommended, as the optimal means of ensuring the ability of the overall network to meet future demands in an efficient manner.

This position was encapsulated in the 2006 report of the sub-committee hearing submissions relating to the proposed Western Corridor Plan[1]:

'the Western Corridor faces a series of serious reliability, resilience and congestion problems that are impacting negatively on the Region, and on the main arterial transport link between Auckland, the Capital, and the South Island. All modelling and the experience of affected communities suggest that those problems are likely to increase over the next 20 years even under conservative forecasts of population and economic growth. Commuters in the Region already show strong usage of public transport. Although further modal shift from private motor vehicles to public passenger transport is desirable, this, in itself, will not replace the need for substantial upgrade of the roading infrastructure in the Western Corridor'.

Furthermore, submissions made to the sub-committee overwhelmingly supported the progression of the Transmission Gully Project as the appropriate roading upgrade, in preference to any substantive improvements to the existing SH1 route (the Coastal Route).

Accordingly, the Transmission Gully Project formed a central component of the Western Corridor Plan (WCP) in 2006, which has been subsequently integrated into the Regional Land Transport Strategy (RLTS).

In May 2009, the anticipated contribution to regional and national economic development resulting from the wider upgrade of SH1 between Wellington Airport and Levin was recognised by its inclusion as one of seven Roads of National Significance (RoNS) in a Government Policy Statement (GPS). The Transmission Gully Project is an integral element of this wider upgrade project.

For many years, the Transmission Gully Project has been anticipated in the planning of the local road network within Porirua, and is strongly supported by PCC on the basis of the benefits which it is expected to bring to the district.

As such, the project is strongly aligned with the transportation policies and objectives at the national, regional and district levels.

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[1] *Proposed Western Corridor Plan: Hearing Sub-committee's Report. Greater Wellington Regional Council / Transit New Zealand, March 2006.*

Assessment Methodology

The performance of the transportation network both with and without the Transmission Gully Project has been assessed for typical weekday periods in the year 2026.

This assessment has been informed with outputs from the regional transportation model and a traffic model. These models have been subject to rigorous processes of calibration, validation and peer review to ensure that the resulting forecasts are reliable.

Although the analysis is considered to be based upon the best information available, it is nonetheless subject to a degree of inevitable uncertainty arising from such aspects as the progression of other projects, rates of demographic and economic growth, the treatment applied to the existing coastal route and the timing of the proposed link roads to eastern Porirua. This uncertainty has been addressed by the use of sensitivity testing, which confirms that the underlying benefits of the Transmission Gully Project remain robust in the light of other changes which may occur.

Problem Definition & Benefits of the Transmission Gully Project

The problems experienced in the existing SH1 corridor are self-evident to regular travellers in this area. The use of models has assisted in quantifying these problems, the degree to which these will intensify in the future and the extent of benefits which will be provided by the Transmission Gully Project.

- Congestion
  - The corridor is currently subject to regular congestion during weekday peak periods. More severe congestion is experienced during holiday periods, or when incidents occur (such as crashes, slips, etc).
  - This results in increased travel times and a greater variability of travel times, making journey planning difficult for individuals and businesses (such as freight operators).
  - A consequence of these conditions is that people change their travel behaviour to avoid expected congestion by travelling at other times, to alternative destinations, at lower frequencies or by other modes. Together, these changes result in inconvenience for travellers in the corridor and some suppression of traffic demand along the existing SH1 route.
  - By the provision of a new four-lane route, the Transmission Gully Project will reduce travel times and allow journeys to be planned with a greater level of certainty around travel times. Whilst the risks of any temporary closures will be significantly reduced, the consequences in terms of potential delays will also be reduced. As a result, travellers will benefit through being able to travel at times and in a manner

which is most convenient for them, with efficiency benefits for both individuals and businesses.

- Accessibility
  - Access between the Hutt Valley and SH1 to the north is currently poor, requiring the use of indirect routes by means of SH1 and SH2 via the Ngauranga Gorge, Grays Road or SH58 around the Pauatahanui inlet.
  - The Transmission Gully Project will provide a route between SH58 at Haywards and SH1 (north) which is significantly shorter and faster, resulting in an improved level of accessibility between these areas.
  - Similarly, poor road conditions for north-south travel along SH1 and resulting peak period congestion restricts accessibility between Kapiti / Horowhenua and areas to the south.
  - The Transmission Gully Project will allow reduced and more certain travel times at all time periods, removing deterrents to travel in the corridor and improving accessibility and regional cohesiveness.

- Use of Inappropriate Routes
  - Routes such as the Paekakariki Hill Road, Grays Road and SH58 along the Pauatahanui inlet suffer from poor geometry but are used by significant volumes of traffic between the Porirua / Kapiti areas and the Hutt Valley.
  - The Transmission Gully Project will provide a high standard route for these traffic movements, resulting in significant benefits to the existing routes.

- Safety
  - Although some improvements have been achieved in recent years along the existing SH1 route, the ability to achieve further reductions in the frequency and severity of crashes is constrained by the geometry of the route. Similarly, high traffic volumes using the inappropriate routes (above) results in a poor crash record.
  - The Transmission Gully Project will be constructed to appropriate design standards, with limited access, continuous overtaking opportunities and grade-separated intersections. As a result, the frequency of crashes will be significantly reduced. Furthermore, the diversion of traffic away from roads with poor geometric standards will provide benefits in terms of a reduction in the overall number of crashes.

- Severance
  - A number of existing communities in the corridor suffer severance and problems of accessibility arising from the barrier represented by high volumes of through traffic. In Paremata, Mana, Plimmerton and

Paekakariki, community facilities are separated from residential areas by SH1. Crossing the route involves detours, delays and safety concerns. Pauatahanui village also experiences inappropriate volumes of through traffic with resulting severance and safety concerns, particularly for the movement of children to and from the primary school.

- With the removal of large volumes of extraneous traffic by the Transmission Gully Project, all of these communities will benefit from improved levels of connectivity, accessibility and safety.

- Vulnerable Road Users
  - Whilst the SH1 corridor has seen some improvements in pedestrian and cycle facilities in recent years, these road users can feel intimidated by the high volumes of traffic which affects the perceived safety and enjoyment of travel by these modes of transport.
  - The much lower volumes of traffic along the existing SH1 route will create opportunities for the implementation of measures to encourage walking and cycling, more consistent with the local function of the route.

- Route Security
  - The existing SH1 route is vulnerable to long-term closure after a major natural event such as an earthquake or tsunami.
  - Although the Transmission Gully Project will itself be at some risk of closure, the availability of a secondary route will offer benefits in terms of a lower risk and duration of Wellington being isolated following such an event.

This assessment acknowledges that the Transmission Gully Project will result in some transfer of trip movements from the parallel suburban rail network. The identification of such an effect necessarily arises as a consequence of a project-focussed assessment required for the Assessment of Effects on the Environment (AEE). In this respect, the project should be regarded as one component of a wider package of measures promoted by the Regional Land Transport Strategy (RLTS). The overall effect of this package is to improve the uptake of rail whilst at the same time ensuring that additional road capacity is available to ensure a high level of service.

The project will result in some localised increases in traffic volumes, most significantly on Kenepuru Drive and SH58 to the east of Pauatahanui. Assessments have been undertaken to ensure that these routes are able to accommodate these increases, and where appropriate, measures to provide mitigation have been identified.

Construction

During the construction of the Transmission Gully Project, some impacts will arise associated with the need for construction traffic to utilise local roads for access.

The specific routes and locations affected have been identified. In all cases, potential effects will be tightly controlled through the application of a Construction Traffic Management Plan (CTMP), supported by a number of Site Specific Traffic Management Plans (SSTMP). These plans include a range of measures which together will ensure that construction activity will have minimal impacts upon the safety and efficiency of the road network, and the amenity of residents in the areas affected.

Conclusion

The Transmission Gully Project is a vital component of the improvements to the transportation network in the corridor.

The project will generate strong benefits to its users (longer distance and local travellers, businesses) in terms of reduced and more certain travel times and improved safety. Non-users will also benefit through traffic reductions on local roads, reduced community severance and improved accessibility.

At a regional and national level, benefits will arise as a result of facilitating economic activity and the provision of improved accessibility to and from Wellington in the event of a natural disaster.

It is for all of these reasons that the project is strongly aligned with the intent and direction of transportation policies at the district, regional and national levels.

The conclusions of this assessment are not new, and reinforce those of a number of previous evaluations of the project undertaken over several years. They also confirm the sentiments of the local communities in the corridor, expressed during consultation exercises held for the project.

For these reasons, the proposed designation should be confirmed to enable this critical upgrade of the strategic transportation network to proceed at the earliest possible opportunity.

1. Introduction

The Transmission Gully Project (the Project) consists of three components:

- The Transmission Gully Main Alignment (the Main Alignment) involves the construction and operation of a State highway formed to expressway standard from Linden to MacKays Crossing. The NZ Transport Agency (NZTA) is responsible for the Main Alignment.
- The Kenepuru Link Road involves the construction and operation of a road connecting the Main Alignment to existing western Porirua road network. The NZTA is responsible for the Kenepuru Link Road.
- The Porirua Link Roads involves the construction and operation of two local roads connecting the Main Alignment to the existing eastern Porirua road network. Porirua City Council (PCC) is responsible for the Porirua Link Roads.

1.1. Transmission Gully Main Alignment

The Main Alignment will provide an inland State highway between Wellington (Linden) and the Kapiti Coast (MacKays Crossing). Once completed, the Main Alignment will become part of State Highway 1 (SH1). The existing section of SH1 between Linden and MacKays Crossing will likely become a local road.

The Main Alignment is part of the Wellington Northern Corridor (Wellington to Levin) road of national significance (RoNS). The Wellington Northern Corridor is one of the seven RoNS that were announced as part of the Government Policy Statement on Land Transport Funding (GPS) in May 2009. The focus of the RoNS is on improved route security, freight movement and tourism routes.

The Main Alignment will be approximately 27 kilometres in length and will involve land in four districts: Wellington City, Porirua City, Upper Hutt City, and Kapiti Coast District.

The key design features of the Main Alignment are:

- Four lanes (two lanes in each direction with continuous median barrier separation);
- Rigid access control;
- Grade separated interchanges;
- Minimum horizontal and vertical design speeds of 100 km/h and 110km/hr respectively; and
- Maximum gradient of 8%;
- Crawler lanes in some steep gradient sections to account for the significant speed differences between heavy and light vehicles.

1.2. Kenepuru Link Road

The Kenepuru Link Road will connect the Main Alignment to western Porirua. The Kenepuru Link Road will provide access from Kenepuru Drive to the Kenepuru Interchange. This road will be a State highway designed to following standards:

- Two lanes (one in each direction);
- Design speeds of 50 km/h;
- Maximum gradient of 10%; and
- Limited side access

1.3. Porirua Link Roads

The Porirua Link Roads will connect the Main Alignment to the eastern Porirua suburbs of Whitby (Whitby Link Road) and Waitangirua (Waitangirua Link Road). The Porirua Link Roads will be local roads designed to the following standards:

- Two lanes (one in each direction);
- Design speeds of 50 km/h;
- Maximum gradient of 10%; and
- Some side access will be permitted.

1.4. Background

The existing SH1 between Linden and MacKays Crossing to the north of Wellington suffers from an inadequate level of capacity provision, resulting in peak period delays and poor travel time reliability. In addition, safety problems, severance and poor accessibility to/from the route are experienced.

A need to improve this section of SH1 has been recognised for many years. The concept of an inland, alternative route to bypass the existing SH1 coastal route and communities north of Wellington was first raised in the early 1940s and has been under consideration by various parties ever since.

The key events in the development of the Transmission Gully Project are:

- In the early 1940s, the possibility of an alternative inland route for SH1 north of Wellington was first discussed.
- In 1981, the National Roads Board embarked on an assessment of the Western Corridor (undertaken by the Ministry of Works and Development and the Ministry of Transport) looking at options for an inland route (now known as Transmission Gully) in comparison to an upgrade of the coastal route.
- In 1986, the findings of the National Roads Board's Western Corridor Report were released, with the report rejecting an inland route and supporting major improvements along the existing coastal route.

- In 1987, the Greater Wellington Area Land Use and Transportation Strategic Review (GATS) were jointly funded by the National Roads Board, Wellington Regional Council and the Urban Transport Council. The Western Corridor section was separated out for early consideration. The GATS considered a large number of options including routes through Porirua East/Whitby, Takapu Valley, Belmont deviation through Belmont Regional Park to SH2, as well as upgrades to the SH1 coastal route.
- In 1989, an Environmental Impact Report (EIR) compared the impacts of options proposed in GATS including public transport and roading upgrades. The EIR considered both coastal and inland options. The EIR concluded that in addition to public transport upgrades, roading improvements were required to address the growing congestion on SH1. The EIR found the inland route would be more environmentally and socially acceptable. The favoured route was an inland alignment from MacKays Crossing to Takapu, continuing through the Takapu Valley with an interchange on SH1 at Tawa.
- In 1990, the Parliamentary Commissioner for the Environment (PCE) conducted an audit of the EIR. The PCE agreed in principle with the findings of the EIR with some reservations and recommendations. The audit found that Takapu Valley was not necessarily the best alignment at the southern end and that further investigation of the links to the Hutt Valley and Porirua was required. The PCE's principal recommendations were to finalise and designate the inland route and to consult with the public to reduce uncertainty for both the coastal and inland route communities.
- In 1991, the Wellington Regional Council conducted further investigations into possible alignments at the southern end. A number of alignments were examined and the conclusion was for a connection to SH1 at Linden as well as connection to western Porirua at Kenepuru. Justification for this was provided by clear benefits to the management of Porirua traffic and relief provided to routes around the Pauatahanui Inlet. This would also reduce environmental and social impacts associated with the Takapu Valley option.
- In 1996, a preliminary design was produced for the Linden to MacKays Crossing alignment and the NoRs were lodged.
- In 1997, the hearing took place for the NoRs for the Linden to MacKays Crossing alignment.
- In 2003, all the appeals on the notices were finally resolved and the designations for the Linden to MacKays Crossing alignment were included in the relevant district plans.
- In 2004, an existing local road designation was altered to provide local road access to the Linden to MacKays Crossing alignment from eastern Porirua.
- In 2004, the Western Corridor Transportation Study (jointly commissioned by Greater Wellington Regional Council (GWRC) and Transit NZ) commenced to provide the basis for an integrated transportation strategy to manage travel demands in the Western Corridor. The resulting Western Corridor Plan (WCP) included consideration of major public transport and roading options and travel demand management (TDM) initiatives. Consultation on the WCP indicated that affected communities did not support the coastal route and expressed a strong preference for the Transmission Gully Project.

- In 2006, the WCP was endorsed by the Transit NZ Board and adopted by the GWRC and included the Transmission Gully Project in the Regional Land Transport Strategy (2007 to 2016) (RLTS) for construction within 10 years, as part of a balanced multi-modal approach to addressing transport needs within the Western Corridor.
- In 2008, a draft Scheme Assessment Report (SAR)[2] was prepared which involved the assessment of numerous options for a Transmission Gully alignment both within and beyond the confines of the existing designation. Together with a detailed consultation process, a preferred alignment for Transmission Gully was produced.
- In 2009, detailed environmental and engineering investigation work commenced for the Transmission Gully Project.
- In May 2009 the GPS was released which included the RoNS programme. The WNC was confirmed as one of the RoNS.
- In December 2009, the NZTA Board announced that the Transmission Gully Project was the preferred route to improve access through the southern end of the Western Corridor. The NZTA press release stated:

  "our task was to choose the route which would deliver the best result for the region and New Zealand [as part of the Roads of National Significance], while also bearing in mind the potential impact on the environment and surrounding communities. In the end it was clear that TG was the better choice. It is less expensive, it will provide a safer four-lane route, it's better for local communities and better for the environment, and it will reduce travel times between Kapiti and Wellington".

- In 2010, detailed environmental and engineering investigation work was progressed and the preferred alignment was optimised to accommodate road design, ecological, water quality and other considerations. In March 2010, the NZTA signalled its intention to lodge the statutory RMA documentation with the Environmental Protection Authority (EPA) using the new "national consenting process".

1.4.1. Development of the Current Design

The assessments for the SAR were undertaken between 2006 and 2008. The key objective for this phase was to identify the optimal route alignment which could then be further refined and used as the basis for assessment and consent applications.

The SAR is referred to as Phase I and the investigations and assessments (the current phase) are referred to as Phase II. Phase III refers to the consenting of the Project.

Whilst the Transmission Gully Project has been the subject of numerous investigations over many years, it is only since 2006 that detailed on-site, in-depth investigations into the impact of the proposed alignment from an engineering and environmental perspective have been undertaken.

The key aspects that were considered during the SAR phase were:

- Geotechnical constraints;
- Physical environmental impacts;
- Social impacts;
- Cost;
- Timeliness;
- Network flexibility; and
- Route performance and safety.

The associated findings from these investigations indicated that the proposed route would provide substantial benefits over the existing designated alignment and the alternative coastal route upgrade.

At a high level, the key benefits identified in the SAR include:

Improving Route Security

While both the existing coastal route and the Transmission Gully Project route traverse fault lines, the proposed design for the Transmission Gully Project offers greatly improved route security for the existing SH1 and the regional road network over the existing coastal route.

Where the route is vulnerable to damage from major seismic events, engineered earth embankments or reinforced soil embankments have been used rather than bridge structures, which will provide greater resilience and allow easier and faster reinstatement.

Improving Highway Safety and Function

The alignment will be constructed for open road speed limits (100km/h) and a median barrier will be provided along the entire route. Crawler / climb lanes and arrester beds (run-off areas for out-of-control vehicles) on the steepest sections, along with grade-separated interchanges to remove conflicts associated with vehicle turning movements, provide additional safety improvements over the coastal route.

Managing Environmental Impacts

Generally, the proposed the Transmission Gully Project route provides greater opportunities to manage environmental impacts when compared to the previously designated alignment or the coastal route. The mitigation measures required by conditions on the existing designation (such as the planting of approximately 150,000 native trees and shrubs) will still be able to be utilised for the proposed alignment.

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[2] References in 5

Improving Connections to Local Roads

An eastern Porirua interchange known as the James Cook Interchange will connect to both James Cook Drive in Whitby and Warspite Avenue in Waitangirua via the Whitby and Waitangirua link roads respectively. This will provide for an improved level of connectivity and accessibility for the eastern Porirua area.

The Kenepuru Link Road will also connect the Main Alignment to western Porirua.

1.5. Purpose of Report

In 2009, Sinclair Knight Merz (SKM) in association with Tim Kelly Transportation Planning Ltd (TKTPL) was commissioned to undertake an assessment of the effects of the preferred the Transmission Gully Project upon the operation of the transportation network.

This report presents the findings of the traffic and transportation assessments conducted as part of the environmental assessment of the Transmission Gully Project. The effects of the project upon the operation and performance of the local and regional transportation networks is also described.

This report is part of a suite of documents in support of the NoRs and resource consent applications for the Project.

1.6. Scope of the Assessment

1.6.1. Scope Definition

The scope for the transportation assessments of the Transmission Gully Project was developed and agreed in consultation with the NZTA and detailed in a Scoping Report[3].

The principal aspects of the agreed scope are defined below.

Regular project team meetings have been held between all the parties undertaking assessments to ensure that there has been appropriate co-ordination and feedback throughout the project development and assessment.

1.6.2. Core Assessment Scenarios

The assessments have been based around two principal scenarios, a 'Basecase' scenario without the Transmission Gully Project in place, and a 'with the Transmission Gully Project' scenario. The

[3] "Final Scoping Report", SKM, June 2010.

assessments focus upon the evaluation of conditions in 2026[4], a few years after the expected completion of construction.

These two scenarios are described in more detail below.

A number of sensitivity tests have been undertaken to assess the extent to which the assessments of the Transmission Gully Project may be sensitive to changes in some of the key assumptions which form the basis of these scenarios. These tests are described in detail in Section 5.

1.6.2.1. "Basecase" Scenario

The Basecase represents a realistic future scenario for 2026, but without the Transmission Gully Project in place. This has been developed to provide a baseline against which the effects of the Transmission Gully Project can then be assessed.

This recognises that a number of other transportation projects are likely to be progressed and development will continue to occur in the period to 2026, irrespective of the Transmission Gully Project. Therefore, expected external changes to both land use and transport networks have been included in the modelling undertaken to produce a realistic Basecase scenario.

This is a standard approach used for assessing the effects of a project from a transport planning perspective. It is important to note that this is not an assessment of the economic benefits of the Transmission Gully Project, for which the definition of the 'baseline' or 'Do-Minimum' might differ slightly.

The Basecase includes the land use changes forecast by the GWRC which are also applied in the assessment of other transportation projects across the region.

Transport projects which have not yet been constructed (and have not been consented), but are expected to be completed in 2026 regardless of whether the Transmission Gully Project goes ahead are included in the Basecase. The projects included in the Basecase modelling are detailed in Appendix D. Principal among these are:

- Other RoNS projects;
- Petone (SH2) - Grenada (SH1) Link Road;
- SH58 Upgrades; and
- Anticipated Public Transport improvements (i.e. new rolling stock, twin tracking and electrification to Waikanae, integrated ticketing etc).

[4] The assessments detailed in this report have been based primarily upon results for 2026. This is because this provides a representative picture of the performance of the transportation network including TG a few years after its expected opening to traffic. Also, a higher level of confidence can be placed upon these forecasts than those for the later assessment years. Some assessments have also been undertaken for the years 2031 and 2041, primarily to provide input into other workstreams where longer term forecasts are required.

The projects included in the Basecase were considered in detail during the Scoping Stage and agreed with the NZTA.

Other RoNS projects have been included because the Transmission Gully Project is only one component of prioritised infrastructural improvements to the SH1 corridor between Wellington Airport and Levin. The Government has made a commitment to the construction of these projects though the GPS. The current programme for the RoNS upgrade work is detailed in Table 4.1.

Table 4.1: Wellington Northern Corridor RoNS Upgrade Work Programme

Phase	Project
1	Ngauranga – Aotea Quay Basin Reserve Peka Peka – Otaki Expressway MacKays Crossing – Peka Peka Expressway
2	the Transmission Gully Project: Linden – MacKays Crossing
3	Mount Victoria Tunnel Duplication Ruahine Street Widening Otaki – Levin Terrace Tunnel Duplication

It is the Government's expectation that all RoNS projects will be substantially complete by 2020. Hence, all of the projects above have been included in the Basecase scenario for 2026.

Despite this, it is acknowledged that some of the other RoNS projects may not be progressed as currently programmed. For this reason, the sensitivity of the effects of the Transmission Gully Project to the progression of the other RoNS projects has been the subject of assessment, as described in Section 5.

The Petone to Grenada project has also been assumed to be operational prior to the opening of the Transmission Gully Project, with its inclusion in the Basecase scenario. Although not part of the RoNS package, the NZTA considers that the resolution of capacity issues through Ngauranga Gorge (SH1) is necessary prior to 2021. Again, uncertainty around the progression of this project and the consequences for the assessment of the Transmission Gully Project has been the subject of sensitivity testing, described in Section 5.

SH58 improvements have been included because these are proposed as part of NZTA's SH58 strategy to address existing issues on this route.

It is considered that the Basecase represents a reliable and credible 'picture' of the future transportation network in 2026 without the Transmission Gully Project. As such, it forms an appropriate baseline against which to assess the performance of the Transmission Gully Project.

1.6.2.2. "With the Transmission Gully Project" Scenario

The 'with the Transmission Gully Project' scenario is the same as the Basecase, except that it also includes the proposed Transmission Gully Project and some changes to the existing SH1 or 'coastal route'.

The existing coastal route is likely to revert to a local road (under the control of PCC) once the Transmission Gully Project is opened to traffic. Irrespective of the ownership of the route, there will be changes to its form and function. This is reinforced by one of the Transmission Gully Project objectives which is *"To assist in the integration of the land transport system by enabling the existing SH1to be developed into a safe and multi-functional alternative to the proposed new strategic link."*

Consistent with this objective, an indicative package of measures to be applied to the coastal route was developed in consultation with the NZTA and PCC. Whilst the detail of the final measures to be implemented may differ slightly, the package is nonetheless regarded as a realistic basis for assessment purposes. From south to north, the package of measures which it is assumed could be applied to the coastal route is described below.

Linden – Paremata Roundabout

- Whitford-Brown traffic signals to be optimised in terms of overall delay minimisation (i.e. broad split of signal green times according to balance of traffic movements). This is expected to increase the available green times (and hence reduce delays) for turning movements.

Paremata Roundabout – Plimmerton Roundabout

- No changes to the Paremata roundabout – egress from railway station parking area should be significantly improved with reductions in through traffic volumes;
- For all existing traffic signals (Mana View Road, Acheron Road, Steyne Avenue, Grays Road) green times will be allocated according to traffic demands on each approach. This is expected to increase green times (and hence reduce delays) for turning movements, and reduce waiting times for pedestrian movements;
- Additional traffic signals at Marina View intersection; and
- Kerbside traffic lanes between Acheron Road and the Paremata Bridge to be permanently reserved for use by turning vehicles and parking, reducing through traffic to a single lane in each direction.

Plimmerton Roundabout – Pukerua Bay (South)

- 80 km/hr speed limit; and
- Retain two lanes in each direction.

Pukerua Bay

- Introduce signal control at side road intersections, to incorporate pedestrian phases and facilitate crossing of road. Signal green times to be set to match balance of traffic movements, expected to reduce delays to side road movements and pedestrians.

Pukerua Bay North – MacKays Crossing (Transmission Gully tie-in)

- Traffic signals at Paekakariki Hill Road / Beach Road intersection in Paekakariki – green times to be set to match balance of traffic movements; and
- 70 km/hr zone to commence further south at Fisherman's Table and continue further north to the tie-in with the Transmission Gully Project

It should be noted that these are not committed designs for the route but a number of most likely outcomes used to reflect the effects of the expected changes to the route for assessment purposes. These measures are only assumed to be implemented with the Transmission Gully Project in place.

1.6.3. Effects Based Assessment

The scenarios described above have been assessed across a range of criteria which measure the performance of the transportation network. Where appropriate, transportation and traffic models have been used to provide quantitative forecasts to assist in this process. The criteria assessed are:

- Changes in trip patterns (distribution, length, trip induction, mode transfer);
- Traffic impacts analysis (traffic volumes, travel times, overall network performance, interchange performance);
- Heavy vehicles (volumes by road sections, travel times);
- Route security and trip reliability;
- Public transport (patronage, trip patterns, volumes);
- Walking and cycling (opportunities, impacts); and
- Safety (changes in frequency, severity and location of crashes).

These effects have been assessed by identifying conditions for the Basecase (without the Transmission Gully Project) and then assessing the changes which would occur with the Transmission Gully Project in place.

Some of this information has been used to inform analyses of other effects undertaken by parallel workstreams, such as noise, air and water quality. Throughout the project assessments, a high level of interaction has been maintained between the workstreams to exchange the necessary information.

These assessments necessarily relate only to those effects associated with the Transmission Gully Project, and not the effects associated with the wider and balanced package of measures of which it forms a part.

In this respect, it is stressed that the Transmission Gully Project forms an integral component of a package of improvements across all modes of transportation, as defined by the WCP and the RLTS. It is also central to the package of improvements identified for the SH1 corridor between Wellington Airport and north of Levin as defined by the RoNS.

1.6.4. Consistency with Transportation Policy

A review has been undertaken of relevant transportation policy at the national, regional and local levels. In each case, the key issues have been identified and the consistency of the Transmission Gully Project with the policy positions described. This is presented at Section 8 and Appendix F.

1.7. Structure of Report

The remainder of this report is structured as follows:

- Section 2 describes the Assessment Framework used;
- Section 3 outlines the Basecase conditions, both existing and in future years;
- Section 4 describes the evaluation of the Transmission Gully Project against the Basecase scenario and assessment of effects;
- Section 5 describes sensitivity testing;
- Section 6 addresses the integration of the transportation assessments with land-use forecasts for the region;
- Section 7 outlines temporary traffic impact and management measures; and
- Section 8 provides a review of the transportation policy context within which the Transmission Gully Project has been developed and assessed.

2. Assessment Framework

2.1. Overall Modelling Approach

Where appropriate, the assessment of effects has been informed by the use of transportation models. The overall modelling approach has been based upon the following hierarchy of models:

- Regional multi-modal modelling using the Wellington Transport Strategy Model (WTSM);
- Regional traffic modelling using the latest Transmissions Gully Project SATURN[5] model; and
- Detailed operational modelling of intersections using SIDRA[6].

The models have been used to assess the performance of the transportation network in the years 2006, 2026, 2031 and 2041.

The assessments detailed in this report have been based primarily upon results for 2026. With this being a few years after the programmed opening of the Transmission Gully Project to traffic, this provides a good basis for the assessment of the project upon the performance of the transportation network.

The year 2006 is the base year for the WTSM and the SATURN model, being the latest year for which demographic information is available from the census. This provides a basis for comparing the change in conditions between those which exist at present, and those which are forecast for the year 2026, both with and without the Transmission Gully Project in place.

Assessments for the years 2031 and 2041 have been run primarily to provide input into other workstreams where longer term forecasts are required.

2.2. Wellington Transport Strategy Model

WTSM is owned and operated by the GWRC. Originally developed to a 2001 census base, this model has more recently been updated to a 2006 census base. The process of model development has been subject to industry-standard validation and peer review processes to ensure its reliability for application to the assessment of projects such as the Transmission Gully Project. The validation and peer review of the updated WTSM is documented in the following reports:

- "WTSM Update Validation Report", SKM, February 2008; and
- "WTSM 2006 Update Peer Review", Arup Ltd, June 2008.

The WTSM Peer Review report can be found at Appendix G.

[5] SATURN (Simulation and Assignment of Traffic to Urban Road Networks) is a suite of flexible network analysis programmes developed at the Institute for Transport Studies, University of Leeds in the United Kingdom.

[6] SIDRA (Signalised and Un-signalised Intersection Design and Research Aid) INTERSECTION is an advanced micro-analytical traffic evaluation tool that simulates traffic conditions at intersections.

WTSM has been used to assess the general impact of the Transmission Gully Project upon travel demands. It is a strategic multi-modal model that forecasts travel demands, patterns and mode shares for the entire region. WTSM is structured as a traditional four-stage model, encompassing the generation, distribution, mode split and assignment of trips. A separate sub-model is used to generate forecasts of heavy commercial vehicle movements.

The Basecase (without the Transmission Gully Project) and 'with the Transmission Gully Project' networks have been modelled in WTSM, generating travel demands by both private vehicle and public transport. The resulting traffic demands have then been fed to the SATURN model for a more detailed evaluation of route choice, traffic volumes by road section and intersection delays.

Apart from the description of the transport networks, WTSM uses a range of inputs including land use data by zone, fuel price, parking costs, car ownership levels, public transport fares, and values of time. For the purposes of the Transmission Gully Project assessments, the inputs used are consistent with those adopted for the assessment of other transportation projects across the region, including modelling undertaken for the development of the RLTS.

2.3. SATURN Modelling

The SATURN model which has formed the basis of the Transmission Gully Project assessments is a refinement of that which was originally developed for the assessments reported in the draft SAR.

2.3.1. SATURN Model Development

In 2007, SKM developed SATURN models to assess the proposed Transmission Gully Project as part of the draft SAR assessments. In 2008, these models were updated to reflect expected network changes as part of the Ngauranga Triangle Study and for application to the Melling Interchange Scheme Assessment. A peer review of the most recent version of the SATURN model undertaken by Flow Transportation Specialists concluded that this was a suitable tool for the assessment of the effects of the Transmission Gully Project.

A full description of the development of these SATURN models, their calibration, validation and peer review is documented in the following reports:

a) "Transmission Gully (TG), SATURN 2006 Base Model Validation Report", Revision C, SKM report, 20th July 2007;
b) "Ngauranga Triangle SATURN Model, 2006 Base Model Revalidation", Revision B, SKM report, 16th October 2008;
c) "Hutt Bridges SATURN Model: 2006 BASE MODEL REVALIDATION", Final, SKM report, September 2009;
d) "Hutt Bridges SATURN Model: Review of Base Traffic Model", Flow Transportation Specialists Ltd Report, September 2009;
e) "Transmission Gully Draft Review of Transport Assessment", Flow Transportation Specialists Ltd Report, August 2010;

f) "Transmission Gully, Review of Traffic Model", Flow Transportation Specialists Ltd, October 2010; and

g) Letter from Flow Transportation Specialists Ltd, 25 November 2010.

Items e), f) and g) from the list above are included in Appendix G.

The geographic extent of the SATURN model is consistent with WTSM. The traffic demands generated by WTSM have been converted to the more detailed SATURN zone structure using factors based upon land-use data, reviewed and adjusted where necessary to account for localised future developments, and for areas where new development is expected to occur (for example, Aotea Block and Silverwood).

The SATURN model takes account of general residential development in the vicinity of the Porirua link roads. The effects of any individual residential access points to these roads have not been simulated as the detail of the frequency of such accesses has yet to be defined.

Detailed traffic demands by road section generated by the SATURN model have been used as inputs to assessments of the operational performance of intersections using SIDRA.

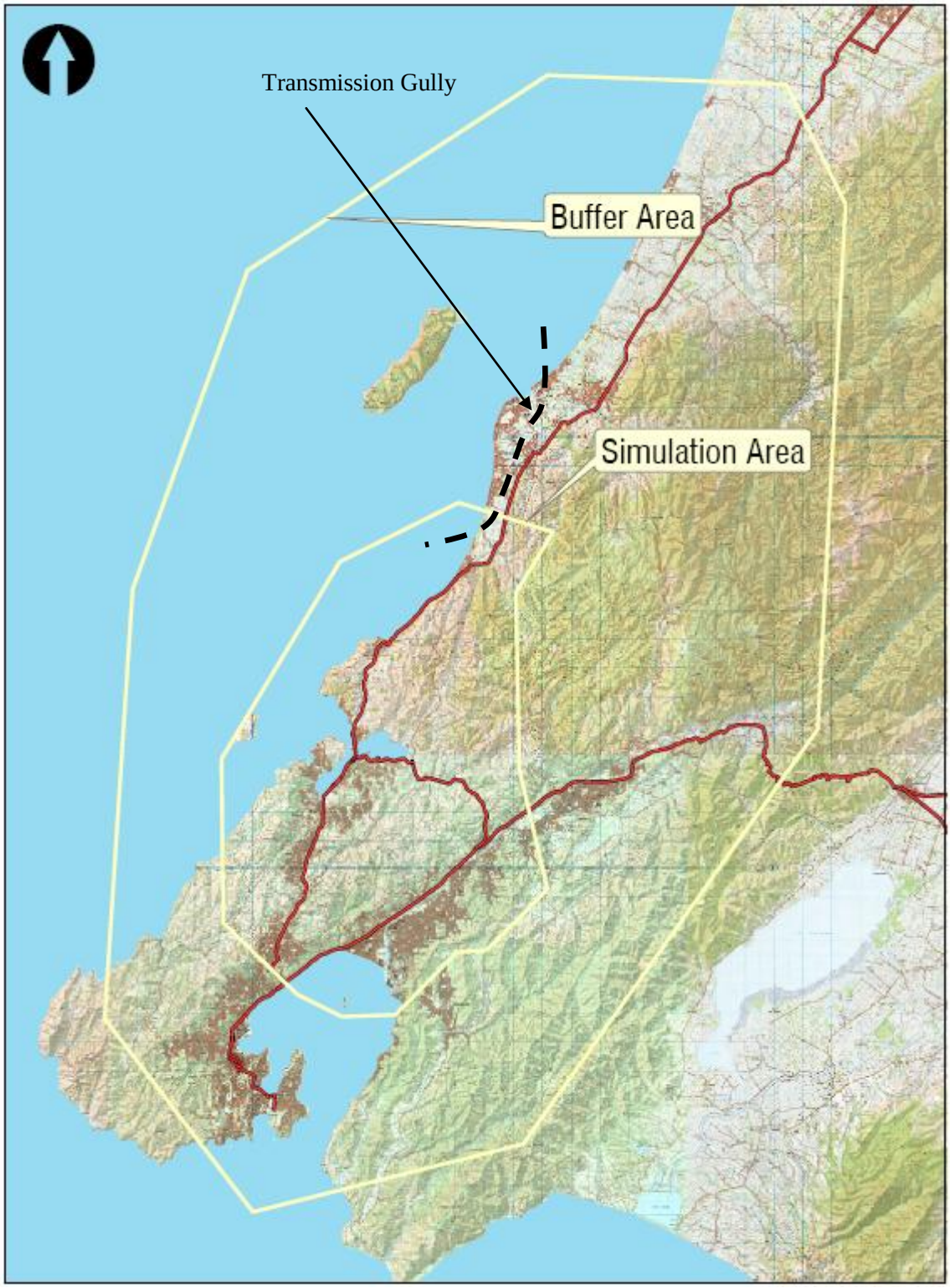
2.3.2. SATURN Modelling Specifications

2.3.2.1. Model Area

The level of detail within the SATURN model reflects proximity to the Transmission Gully Project and the likelihood of traffic reassignment:

- 'Buffer' coding for more distant areas, in which link capacities and speeds are reflected but with no detailed coding of intersections; and
- 'Simulation' coding in the areas where traffic reassignment is likely, in which the principal intersections are fully simulated (turn capacities, signal timings and priorities) in order to quantify the delays which may influence driver route choice.

- **Figure 4.1: Model Buffer and Simulation Area Coverage**



The geographic coverage area of the model is shown in Figure 4.1. The extent of the modelled area is consistent with WTSM, with buffer coding providing the same level of detail as WTSM with regards to intersections and link speed-flow relationships. The more detailed SATURN simulation

network coverage where zones have been disaggregated and intersection detail included has the following boundary points:

- SH1, between Ngauranga Gorge and the Aotea Quay on/off ramps;
- Hutt Road, south of the Ngauranga Gorge;
- Burma Road, south of the Fraser Avenue intersection;
- Titahi Bay Road, south of Te Pene Avenue;
- SH1, north of MacKays Crossing;
- SH2, south of Silverstream Bridge;
- Eastern Hutt Road, between Stokes Valley and Taita;
- Wainuiomata Hill Road, east of Gracefield; and
- Seaview Road, south of Port Road.

As a result, the simulation network encompasses the area in which any changes in vehicle routeing as a result of the Transmission Gully Project can be expected to occur. The validity of this approach has been confirmed by the independent model Peer Reviewer.

2.3.2.2. Time Periods

The time periods assessed are appropriate for capturing most of the effects of the Transmission Gully Project and are consistent with the earlier versions of the model:

- Weekday AM peak: 7am – 8am;
- Weekday Inter peak (IP): average for the period 11am – 1pm; and
- Weekday PM peak: 5pm – 6pm.

Whilst the weekday morning and evening peak periods typically extend beyond the one-hour periods above, the periods used nonetheless provide a representative assessment of the periods during which peak traffic demands apply.

Where appropriate, preloading has been used to allow for the effects of vehicles on the road network at the commencement of each modelled period, to ensure that congestion levels are accurately simulated. The extent of preloading used has been based upon observed traffic volumes in the vicinity of the Transmission Gully Project.

Although significant congestion can be experienced during weekend and holiday periods, the high variability of traffic volumes and hence, levels of delay experienced, means that reliable models cannot be developed to assess conditions in these periods. This is a common issue for assessments of this type, and means that the full benefits of the project are not captured by this approach. As a result, the assessment is regarded as conservative.

2.3.2.3. User Classes

Different criteria apply to the routing of light and commercial vehicles. For this reason, user classes are applied in SATURN to differentiate between vehicle types. The user classes used are consistent with those in WTSM:

- Light vehicles (cars, utes, etc); and
- Medium/Heavy Commercial Vehicles (HCV).

The travel demands for each user class have been assigned to the network in SATURN to identify traffic demands on each road section by vehicle type.

2.4. SIDRA Intersection Modelling

Key intersections and proposed interchanges have been modelled in SIDRA to assess in more detail the effects of the Transmission Gully Project upon the operational performance of individual intersections (due mainly to changes in volumes and patterns of traffic demand as identified by the SATURN model). Operational performance is principally assessed in terms of the Level of Service (LOS). This is a widely recognised performance measure, with values ranging from A (good LOS, free flow conditions) to F (poor LOS, highly congested conditions) as detailed in Table 4.2.

- **Table 4.2: Level of Service Descriptions**

Level of Service	Average Delay per Vehicle (seconds)	Traffic Signals and Roundabouts
A	<10	Good operation
B	10 to 20	Good with acceptable delays and spare capacity
C	20 to 35	Satisfactory
D	35 to 55	Operating near capacity
E	55 to 80	At capacity: at signals, incidents will cause excessive delays. For roundabouts, other forms of control should be considered
F	>80	Traffic volumes typically exceed capacity
Source: SIDRA Intersection user guide (July 2007)		

For each intersection, SIDRA models were constructed for each of the three modelled weekday periods (AM, IP, PM), for the year 2026. Traffic demands (for light and heavy vehicles separately) were derived from the SATURN model.

The following intersections were assessed using SIDRA:

- Proposed Transmission Gully / SH58 interchange (large roundabout);
- Proposed Transmission Gully / Link Roads interchange (double roundabout in ‘dumb-bell’ configuration);
- Proposed Transmission Gully / Kenepuru Link Road interchange (large roundabout);
- Proposed Waitangirua Link Road / Warspite Avenue intersection (roundabout and traffic signal configurations assessed);

- Proposed Kenepuru Link / Kenepuru Drive intersection (roundabout and traffic signal configurations assessed);
- Existing Kenepuru Drive / Titahi Bay Road intersection (roundabout); and
- Existing SH1/ Whitford Brown Avenue (traffic signals).

Existing intersections within the wider simulation area have been assessed only where the effect of the Transmission Gully Project is likely to result in a significant increase in traffic demands (more than 10% and 50 vehicles/hour and if the existing traffic demand was more than 80% of the available capacity, indicating that small changes in traffic volumes may have more significant impacts on intersection performance, on at least one leg).

In many cases, the effect of the Transmission Gully Project will be to reduce traffic demands and hence delays experienced at intersections. For these cases, SIDRA assessments have not been undertaken.

The individual intersection SIDRA models were initially established using industry-accepted default parameters. For existing intersections, the models were then adjusted to ensure that the levels of modelled delay and queue lengths broadly reflected the observed performance of the intersections as experienced by members of the evaluation team.

New intersections proposed as part of the Transmission Gully Project were evaluated using default parameters.

2.5. Model Outputs

In summary, each of the modelling tools above has been used to produce the following information for input into the assessment framework:

Tool	Outputs for other Models	Outputs for Assessment Framework
WTSM	Traffic demands (to Transmission Gully SATURN)	Public transport patronage Mode shares HCV trips
Transmission Gully SATURN	Intersection turning demands (to SIDRA)	Hourly volumes using the Transmission Gully Project and associated links Travel times on key routes
SIDRA		Performance of key intersections

3. Basecase Conditions

3.1. Basecase Definition

As described in Section 2.1, assessments have been undertaken for 2006 and a number of forecast years.

The Basecase represents the existing transportation network (in 2006, the base-year of the assessments), and the transportation network as it is expected to be in each of the forecast years (primarily 2026), but without the Transmission Gully Project.

The descriptions of the transportation networks used for the Basecase 2006 assessments include only those projects which were completed at this time, as it would not be appropriate to include projects which were not operational[7].

For the Basecase 2026 assessments, the transportation network has been assumed to include a number of other roading and public transportation projects which it is expected will be operational by this time.

The projects included in the 2006 and 2026 Basecase models are summarised at Appendix D.

3.2. Basecase Transportation Network

3.2.1. Basecase Road Network

SH1 is the primary strategic route within the Wellington region, providing essential connectivity, not only for the communities along it, but also for longer distance movements between Wellington and areas to the north.

Between Linden and the Mungavin interchange at Porirua, SH1 has motorway status with a 100 km/hr speed limit, two lanes in each direction, a solid or wide-grassed median, limited access and hard shoulders. The Mungavin interchange is a grade-separated roundabout with full slip roads, whilst the northern Porirua intersection (Ramp Bridges) has north-facing slip roads only. The Whitford-Brown intersection is at-grade and controlled by traffic signals (the northbound through movement is not subject to signal control).

Between the Paremata roundabout and north of Plimmerton, SH1 is urban in nature with a 50 km/hr speed limit, two lanes in each direction without any physical median barrier, frequent intersections and private accesses. The section between the Marina View and Acheron Road

[7] The exception being the construction of the railway overbridge at MacKays Crossing which was under construction in 2006 but operational by the time the models were calibrated and validated. This was included in the base SATURN models as constructed and the model calibrated assuming it was operational.

intersections currently operates with the nearside lanes reserved for use by high occupancy vehicles (T2 lanes, for vehicles having two or more people) at peak periods[8].

North of Plimmerton, the 'rural section' of SH1 provides an expressway standard road with a 100 km/hr speed limit, four lanes and a wire rope median barrier. Within this section, a single at-grade intersection provides access to Airlie Road and the northern part of Plimmerton.

At Pukerua Bay, the road standard drops to one lane in each direction, with a 50 km/hr limit and frequent intersections and accesses. North of Pukerua Bay, the 'coastal section' of SH1, although rural in nature has a 80 km/hr speed restriction, with one lane in each direction separated for part of its length by a wire-rope barrier. At Paekakariki, the speed limit drops to 70 km/hr and an at-grade intersection at Beach Road provides access to the township and the Paekakariki Hill Road.

North of Paekakariki, the speed limit increases to 80 km/hr and then 100 km/hr with one lane in each direction. At MacKays Crossing, four lanes are provided with a median barrier as far as the Poplar Avenue intersection on the southern edge of Raumati.

Significantly, there are no overtaking opportunities for a distance of over 10 kms between south of Pukerua Bay and MacKays Crossing.

SH2 connects communities in the Hutt Valley with Wellington City, the Wairarapa and beyond to Hawke's Bay. The two State Highways intersect at the base of the Ngauranga Gorge, from which point the combined routes continue to central Wellington as SH1 and beyond to the airport by means of the inner city bypass.

The two main corridors above are connected by SH58, which runs for a distance of approximately 15 kms from SH1 at Paremata to SH2 at Haywards. To the west of Pauatahanui, SH58 follows the edge of the Pauatahanui inlet, with a number of tight bends. This section is subject to occasional closure as a result of slips or flooding. The section of SH58 at Paremata is urban in nature and subject to a 50 km/hr speed restriction.

The State Highway network is supported by a network of local roads. Those of most significance in the vicinity of the Transmission Gully Project include:

- Kenepuru Drive / Main Road Tawa: this is a broadly parallel route to SH1 which links the residential and commercial areas of southern Porirua and Tawa;
- Mungavin Avenue / Warspite Avenue: links SH1 at Porirua with Eastern Porirua, Cannons Creek and Waitangirua;
- Titahi Bay Road: links SH1 with the Porirua CBD, Elsdon and Titahi Bay;

[8] A review of the operation of Mana Esplanade required as a condition of the designation for the improvements in this area recommended the removal of the T2 lanes. These are now proposed to be removed (expected to occur in early-mid 2011) and replaced with 'Clearway' controls to apply at peak periods.

- Whitford Brown Avenue: links SH1 north of Porirua with Papakowhai, Aotea Block, Ascot Park and Whitby;
- Grays Road: links SH1 at Plimmerton with Pauatahanui and SH58 along the northern side of the Pauatahanui inlet. The tight geometry of this road at its western end restricts access for some heavy vehicles, and the road is subject to occasional closure as a result of flooding;
- Paekakariki Hill Road: a steep, narrow, and winding rural road which runs from SH1 at Paekakariki to SH58 at Pauatahanui. This road cannot safely accommodate heavy vehicles or vehicles with long trailers over its full length, and is prone to closure during significant rainfall events;
- Akatarawa Road: although providing a more direct route between SH1 at Waikanae and SH2 at Upper Hutt, this road is of a low standard with a poor alignment and several single lane sections. As such, it is not suitable for any significant volumes of traffic, cannot accommodate heavy vehicles and is subject to closure during significant rainfall events;
- James Cook Drive: an arterial route in Whitby connecting SH58 to, Discovery Drive and Navigation Drive;
- Discovery Drive: an arterial route in Whitby that connects to James Cook Drive and Spinnaker Drive; and
- Navigation Drive: an arterial route in Whitby that connects to James Cook Drive and Joseph Banks Drive.

As detailed in Section 1.6.2.1 and summarised by the table at Appendix D, there are a number of committed and planned improvements to the regional roading network which are of significance to the assessment of the Transmission Gully Project and are programmed to proceed regardless of the project. Principal amongst these are:

- Other RoNS projects (as described at Table 1.1);
- Petone (SH2) - Grenada (SH1) Link Road; and
- SH58 Upgrades.

3.2.2. Basecase Rail Network

The North Island Main Trunk (NIMT) railway runs between central Wellington and the Kapiti Coast, and beyond this to the central North Island and Auckland.

Suburban passenger services operate between Wellington and Waikanae, with a high frequency service during weekday peak periods and frequent trains at other times. Scheduled running times are 60 minutes between Waikanae and Wellington, and 30 minutes between Plimmerton and Wellington.

Figures supplied by GWRC indicate that the number of passenger trips in the entire corridor is 4-5 million per annum. Peak period services are subject to frequent overcrowding.

The Capital Connection operates once a day between Palmerston North and Wellington, providing connectivity to the Horowhenua and northern Kapiti Coast areas. In addition to these commuter services, the Overlander is a mainly tourist-orientated service operating once a day in each direction between Wellington and Auckland.

The NIMT also carries a significant volume of freight, with several trains daily in each direction.

The railway network is currently the subject of a significant upgrade project, the main elements of which are:

- Delivery of new 'Matangi' rolling stock from late 2010, comprising 48 2-car electric units, each providing 149 seats, to progressively replace the 'English Electric' units;
- Extension of electrification and double tracked lines to extend commuter services to Waikanae;
- Installation of power supply equipment and railway signalling;
- Addition of another line into Wellington railway station to reduce delays;
- Enlargement of the Johnsonville line tunnels; and
- Improvement of a number of platform and station facilities.

Other network-wide improvements included are the implementation of a real-time information system and integrated ticketing.

3.2.3. Basecase Bus Network

Bus services are currently precluded from operating in the corridor where these would compete with the subsidised rail service. The extensive network of local bus services across the corridor area is primarily orientated towards providing connectivity between residential areas and the rail network. This network is operated by Mana Coach Services.

3.2.4. Basecase Walking & Cycling

Walking and cycling are important modes of transportation for shorter distance trips within the corridor. These modes are being actively promoted by all of the local authorities, with the development of more integrated networks. A longer distance cycle route runs parallel to SH1 between Porirua and Kapiti (the Ara Harakeke Pathway), part of which comprises a narrow shared-use path adjacent to Centennial Highway, upgraded as part of the median barrier improvement project completed in 2007.

3.2.5. Basecase Travel Demand Management

Travel Demand Management (TDM) is being promoted by GWRC across the region, with a number of initiatives within the corridor area to constrain the growth in travel demand and encourage the use of alternative modes of travel to the private car. Included in these forecasts are the assumed effects of a travel planning initiative which reduces commuting travel by car to the Wellington CBD by 5%, most of which (90%) is transferred to public transport. GWRC has

advised that this approach is consistent with the transportation assessments completed for the RLTS.

3.3. Basecase Patterns of Land-Use

Land-use assumptions have been based upon land use forecasts for the years 2026 and 2031 prepared by Monitoring and Evaluation Research Associates Ltd (MERA). These were produced as part of the WTSM 2006 update process (with minor modifications made by GWRC), and are currently applied by GWRC for all regional modelling. Subsequent to these forecasts, GWRC developed a forecast for 2041, based upon the MERA forecasts.

A review was undertaken to determine if any of the original land-use assumptions implicit in the WTSM may be out of date, as a result of subsequent changes in the status of specific developments or plan changes since the establishment of the transportation model. This review is summarised in Section 6.

The differences identified were considered to be of a sufficiently minor nature to suggest that changes were not justified to the core land use forecasts. It was found that the land use changes signalled in the latest planning documents were broadly consistent with the land use assumptions provided in WTSM. Therefore, they were unlikely to have any material effect on the transport assessment being undertaken.

The same land use assumptions have been used for all scenarios, irrespective of whether the Transmission Gully Project is assumed to be constructed. The potential effect of the Transmission Gully Project upon land use patterns has been separately addressed as part of the planning assessments for the project. The issue of land use effects associated with the Transmission Gully Project is discussed within the Land Use and Transport Integration report which is summarised at Section 6 and included in full at Appendix E.

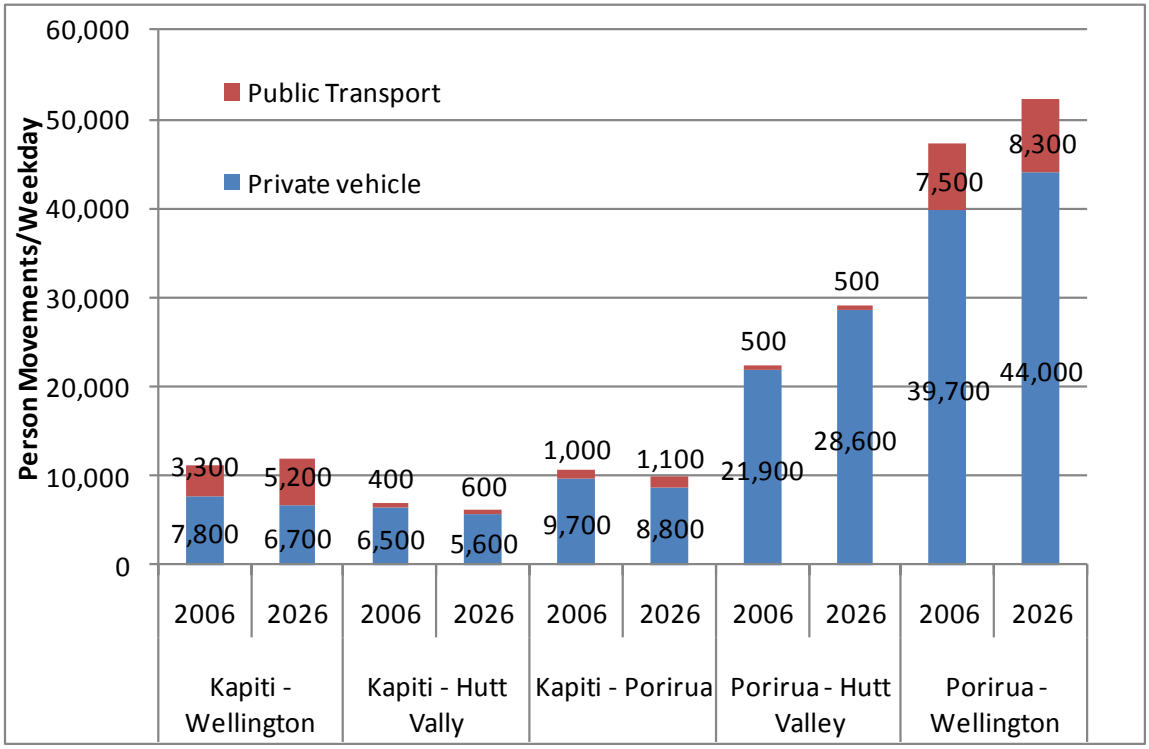
3.4. Basecase Patterns of Travel

3.4.1. Total Travel Demand & Mode of Travel (excluding freight)

The primary travel movements utilising the SH1 corridor are those between Kapiti and Wellington, Kapiti and the Hutt Valley and between Porirua and the Hutt Valley. Other movements in the area include those between Kapiti and Porirua and between Porirua and Wellington.

Figure 4.2 summarises the total travel demand (in person-trips) between these areas for a typical weekday in 2006 and 2026 Basecase, and separately identifies the split of this travel which takes place by means of private vehicles and public transport (principally rail).

- **Figure 4.2: Total Travel Demand in Person Trips Between Areas for a Typical Weekday 2006 and 2026 Basecase**



The total number of person-trips between Kapiti and Wellington in 2006 is 11,000, of which 29% take place on public transport. Without the Transmission Gully Project, this is expected to grow to 12,000 person-trips by 2026, of which 44% would take place on public transport. Whilst the number of private vehicle trips declines by 14%, public transport demand increases by 61%.

Movements between Kapiti and the Hutt Valley are not well serviced by public transport, with rail users having to change trains in Wellington and no direct bus services available. As a result, the proportion of this travel made by public transport is low. Without the Transmission Gully Project, the forecasts indicate some contraction (12%) in the volume of movement between Kapiti and the Hutt Valley between 2006 and 2026, though with an increased (but still small) share of this travel made by public transport.

Although the volume of movements between Kapiti and Porirua is similar to that between Kapiti and Wellington, the uptake of public transport is significantly lower. This is most likely due to the dispersed nature of employment within these areas, making travel by public transport less convenient to the use of the car. Without the Transmission Gully Project, the forecasts indicate a small contraction (8%) in the volume of movement between Kapiti and Porirua between 2006 and 2026, though with an increased (but still small) share of this travel made by public transport.

Movements between Porirua and the Hutt Valley are expected to grow by 30% between 2006 and the 2026 Basecase. As for the Kapiti – Hutt Valley movements, the poor convenience of public transportation results in only 2% of these movements being made by public transport. The private

vehicle movements are split between routes, with most using the SH1 / Ngauranga / SH2 route (via the Petone – Grenada link road when available) to the south and the remainder the SH58 / SH2 route to the north. The choice of route is governed by the costs of travel on each route (time and distance) and the specific locations of the trip origins and destinations.

Movements between Porirua and Wellington are dominant in terms of volume, and are expected to grow by 11% between 2006 and the 2026 Basecase. Public transport is expected to grow at the same rate as private vehicle use, 16% between 2006 and 2026.

These changes occur for a variety of reasons:

- Increasing congestion experienced on the road network results in some suppression of vehicle trips;
- Improvements to the rail infrastructure without the Transmission Gully Project will encourage more people to use this as a mode of transport;
- Changes in patterns of land-use (in particular the relative rates of growth within the region) result in increases or reductions in demand for some specific movements; and
- An assumed escalation of fuel prices, consistent with other regional forecasts, results in some reduction in demand for longer distance road-based trips in preference to shorter-distance movements.

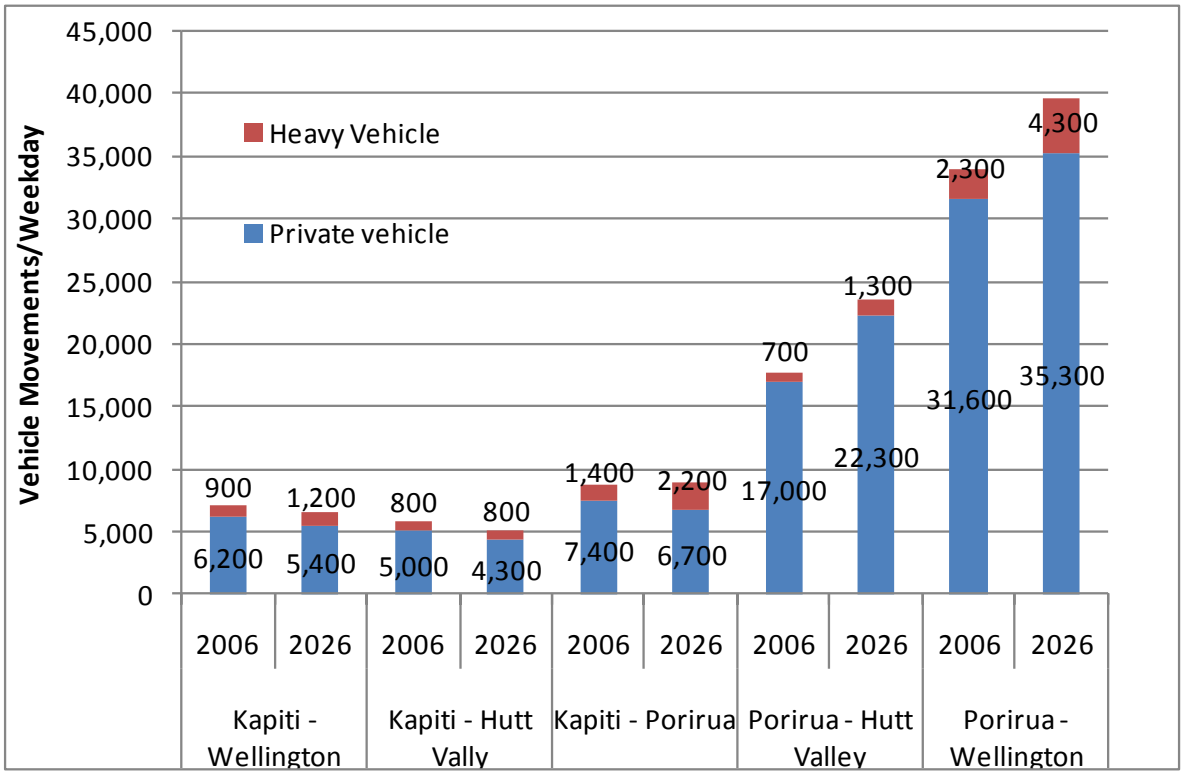
It is important to note that patterns of travel demand and the supply of infrastructure are inter-related, for both the roading and public transport networks. This is reflected in the forecasts from the transportation models, which indicate a suppressed demand for road travel without the Transmission Gully Project in place. Whilst some trips have a realistic choice available between the use of road and rail, others are more captive to one mode and hence less likely to change in response to infrastructural improvements.

In summary, upgrades to the rail network without a concurrent improvement to the roading infrastructure would represent an imbalanced solution to the transportation problems in the corridor. This would result in deteriorating conditions on the road network and a suppression of trips as people are forced to make changes in their patterns, times and modes of travel.

3.4.2. Basecase Freight Movement

A significant volume of freight in the corridor is moved by road, with the remainder by rail. Figure 4.3 summarises the number of heavy vehicle movements between each of the main areas, relative to the number of private vehicles. The figures for Kapiti include those longer distance heavy vehicle movements with an origin and/or destination further to the north.

- **Figure 4.3: Number of Vehicle Movements, 2006 and 2026 Basecase Weekday**



The forecast rates of growth for heavy vehicle movements, with or without the Transmission Gully Project, are above those for general road traffic demand and reflect an expectation that growth in the national and regional economy will lead to increases in the demand for road-based freight movement. For the movements summarised above, growth over the period 2006 to 2026 is expected to be 78 – 83%.

Figure 4.5 summarises the existing (2006) weekday heavy vehicle volumes on the principal road sections in the network. The SH1 corridor is a vital conduit for heavy vehicle movements, with 7 – 11% of total daily traffic volumes being heavy vehicles. Similarly, 6 – 12% of traffic volumes on SH58 are heavy vehicles.

Changes in levels of economic activity will lead to rates growth in the numbers of heavy vehicles using the road network which will be greater than those for general traffic. Figure 4.6 summarises forecast weekday heavy vehicle volumes on the principal road sections in the Basecase network in the year 2026, and Figure 4.7 summarises the overall rate of growth from 2006 to the 2026 Basecase.

Over the period 2006 - 2026, heavy vehicle numbers are expected to grow by 87% - 118% on SH1, and by 31-46% on SH58.

3.5. Basecase Road Network Conditions

3.5.1. Basecase Network Wide Conditions

Figure 4.4 shows the change in key performance statistics for the entire modelled road network (in the SATURN model) over the period from 2006 to the 2041 Basecase. The change in total vehicle trips, total distance travelled, total time spent travelling and average speed are shown relative to conditions in the 2006 base year.

- **Figure 4.4: Daily Network Statistics 2006 to 2041 Basecase**[9]

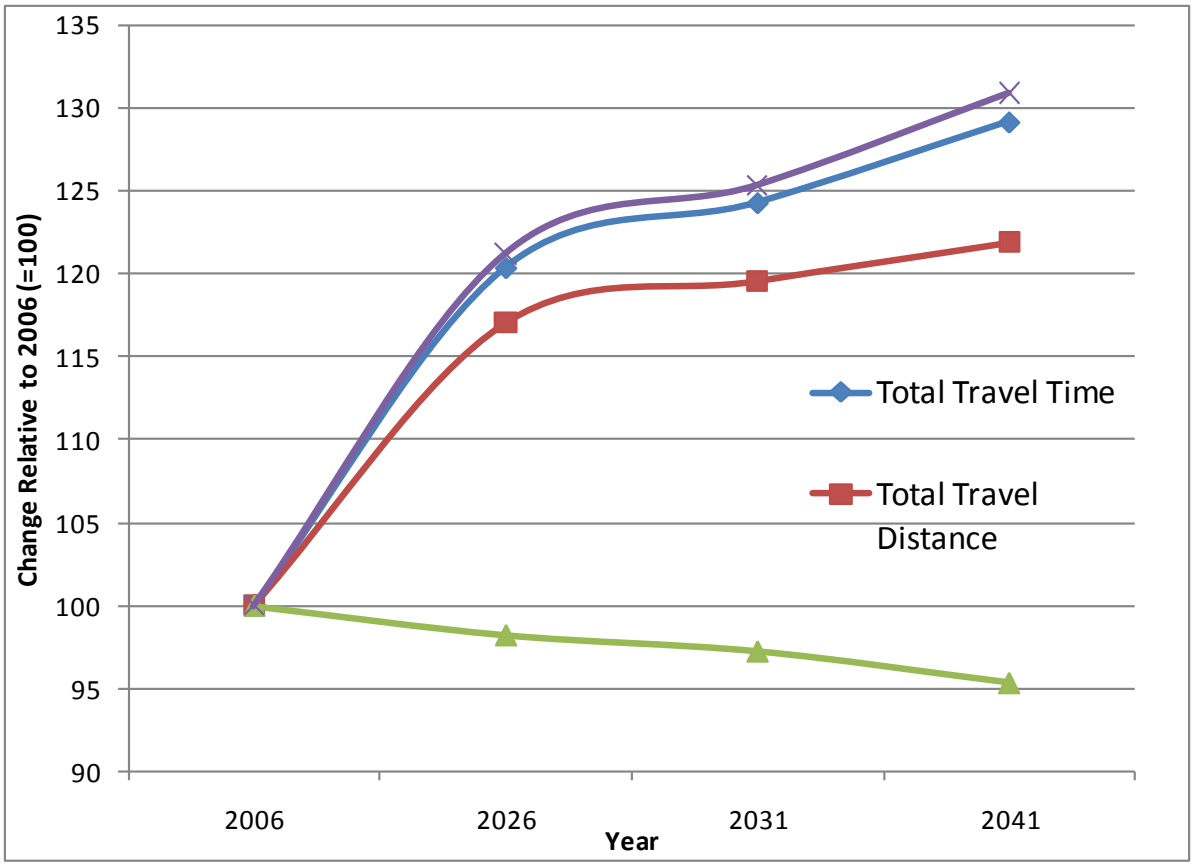


Figure 4.4 shows that the number of vehicle trips is expected to increase by more than 30% between 2006 and 2041. At the same time, the increase in total time spent travelling is forecast to increase at a slightly lower rate. This is despite increasing congestion in the corridor, and occurs because of a forecast reduction in the average length of trip (attributable to assumed increases in fuel prices). With the growth in travel time greater than that for travel distance, average speeds are forecast to reduce by 5% in the period to 2041.

It is stressed that results relate to averages for the entire simulation network. Conditions in the

[9] Note that the scale on the x-axis is does not reflect the actual time between years i.e. there is a greater time between 2006 and 2026 than 2026 to 2031

more immediate SH1 corridor will deteriorate more rapidly, as a result of an insufficiency of roading capacity. This will manifest itself in increasing travel times and more rapidly declining travel speeds.

3.5.2. Basecase Traffic Volumes

Figure 4.5 summarises the 2006 modelled weekday traffic volumes on the principal road sections in the network. Annual Average Daily Traffic (AADT) totals for all-traffic and heavy vehicles only are shown, together with all-traffic volumes for each modelled time period.

Traffic volumes along SH1 vary, generally increasing towards the south. Daily volumes are 22,300 – 23,500 vehicles/day north of Plimmerton, increasing to 32,600 vehicles/day along Mana Esplanade, 40,500 vehicles/day south of the Paremata roundabout, and 52,000 vehicles/day between the Whitford-Brown intersection and the Porirua ramp bridges. Beyond this point, there is some reduction in volumes, with 43,900 vehicles/day between the Mungavin interchange and south towards the Tawa interchange.

The route carries a significant number of heavy vehicles, varying between 7% and 11% of total volumes or 2,000 – 3,700 heavy vehicles/day.

Peak-hour traffic volumes on SH1 exhibit strong tidality, indicative of its importance as a commuter route to and from Wellington. In the AM peak period, southbound volumes are 67-79% of two-way volumes, with the corresponding figure for the northbound volume in the PM peak period being 59 – 68%.

Traffic volumes using SH58 vary from 18,100 vehicles/day east of the Paremata roundabout to 14,600 vehicles/day to the east of Pauatahanui.

The important connectivity provided by Kenepuru Drive is evident in the daily volumes of 14,800 vehicles/day using this route between Porirua and Tawa, and to access a range of commercial activities and the Porirua Hospital. Whitford-Brown Avenue provides access to SH1 for an extensive residential area including Papakowhai, Ascot Park, Aotea and beyond and carries volumes of 11,300 vehicles/day. Grays Road provides a convenient route around the northern edge of the Pauatahanui Inlet, especially for movements between Kapiti and the Hutt Valley. The daily volume on this route is 5,850 vehicles/day.

There are a number of other local roads in the vicinity of the proposed Transmission Gully Main Alignment or the associated link roads that could be potentially affected by the project. In Whitby, James Cook Drive, Navigation Drive and Discovery Drive distribute local traffic with traffic volumes of approximately 3,000 vehicles/day. Similarly, Warspite Avenue carries approximately 6,000 vehicles/day.

SB	NB
16200	15300
1170	1450
2520	660
750	820
910	1910

SB	NB
7470	7370
120	220
360	320
460	470
520	480

SB	NB
22900	21000
1680	1840
3070	970
1130	1120
1390	2560

SB	NB
7470	7370
120	220
360	320
460	470
520	480

SB	NB
11100	11200
870	1160
1090	530
600	640
770	1090

SB	NB
11400	11300
1130	1420
1140	610
600	630
830	1130

SB	NB
12100	11400
950	1210
1260	540
650	640
760	1150

EB	WB
2810	3240
260	330
170	280
160	160
220	340

SB	NB
17200	15400
1030	1240
1740	550
940	900
1050	1560

EB	WB
9110	8980
650	430
470	1230
500	440
1000	510

EB	WB
7000	7560
820	880
920	690
310	350
640	920

EB	WB
5640	5650
370	340
160	800
300	280
830	280

SB	NB
26700	25300
1540	2130
3350	920
1370	1400
1510	3080

SB	NB
21100	19400
1240	1720
2580	730
1090	1090
1240	2210

EB	WB
7000	7560
820	880
920	690
310	350
640	920

SB	NB
22900	21000
1680	1840
3070	970
1130	1120
1390	2560

Porirua
Ranui heights
Linden
Paekakariki
Pukerua Bay
Plimmerton
Camborne
Titahi Bay
Paremata
Whitby
Pau tahanui
Elsdon
Cannons Creek
Porirua
Ranui heights
Linden
Tawa
See Insert

Legend

1 hour for AM / PM / IP, and 24hrs for AADT

SB/EB;NB/WB
237862
850
800
300
750

South Bound / North Bound
AADT
AADT, HCV
AM
IP
PM

Approx. Reporting Locations

Residential Areas

Coastline

Roads

Main

Other

Minor

Railways

Kilometers

0 0.5 1 2 3 4

Transmission Gully Phase II Investigations

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TITLE

Traffic Flow Data - 2006 Figure 4.5

SCALE @ A4	SKM PROJECT No	DRAWING No	AMDT
1:92,123	ZB01023		

SB	NB
18600	18900
2570	3060
2650	820
920	1030
950	2240

SB	NB
7850	7620
180	310
320	320
480	490
600	480

SB	NB
29400	28700
3590	3960
3430	1460
1540	1560
1730	3180

SB	NB
7850	7620
180	310
320	320
480	490
600	480

SB	NB
11300	11600
1820	2170
1130	550
610	670
720	1110

SB	NB
11700	12000
2150	2690
1280	630
620	670
780	1230

SB	NB
12200	11900
1960	2270
1280	570
660	670
720	1210

EB	WB
2470	3010
450	460
140	220
150	140
170	430

SB	NB
18200	16900
2170	2540
1720	680
1010	1010
1100	1510

EB	WB
6170	6360
1120	1150
1000	490
260	280
490	950

EB	WB
8820	7940
930	630
430	1150
460	400
1110	370

EB	WB
8340	8270
960	860
220	990
460	440
1110	430

SB	NB
30100	30500
3240	4290
3530	1090
1590	1700
1640	3620

SB	NB
21900	21800
2500	3330
2540	910
1170	1230
1200	2340

EB	WB
6170	6360
1120	1150
1000	490
260	280
490	950

SB	NB
29400	28700
3590	3960
3430	1460
1540	1560
1730	3180

Porirua
Ranui heights
Linden
Pukerua Bay
Paekakariki
Plimmerton
Camborne
Titahi Bay
Paremata
Whitby
Pau tahanui
Elsdon
See Insert
Cannons Creek
Porirua
Ranui heights
Linden
Tawa

Legend

1 hour for AM / PM / IP, and 24hrs for AADT

SB/EB;NB/WB	South Bound / North Bound
237862	AADT
850	AADT, HCV
800	AM
300	IP
750	PM

Approx. Reporting Locations

Residential Areas

Coastline

Roads

Main

Other

Minor

Railways

Kilometers

0 0.5 1 2 3 4

Transmission Gully Phase II Investigations			
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Traffic Flow Data - 2026 Basecase
Figure 4.6

SCALE @ A4	SKM PROJECT No	DRAWING No	AMDT
1:92,123	ZB01023		

SB	NB
15%	23%
118%	110%
5%	25%
22%	25%
5%	18%

SB	NB
5%	3%
56%	43%
-10%	3%
5%	4%
16%	0%

SB	NB
28%	37%
114%	115%
12%	50%
36%	40%
24%	24%

SB	NB
5%	3%
56%	43%
-10%	3%
5%	4%
16%	0%

SB	NB
1%	3%
109%	87%
4%	2%
2%	4%
-6%	2%

SB	NB
3%	6%
91%	89%
12%	4%
2%	6%
-6%	9%

SB	NB
1%	5%
107%	88%
2%	5%
2%	4%
-5%	5%

EB	WB
-12%	-7%
73%	41%
-18%	-21%
-8%	-15%
-25%	27%

SB	NB
5%	10%
110%	105%
-1%	24%
8%	12%
4%	-4%

EB	WB
-12%	-16%
37%	31%
8%	-29%
-17%	-20%
-24%	3%

EB	WB
-3%	-12%
44%	46%
-9%	-7%
-7%	-10%
11%	-29%

EB	WB
48%	46%
160%	152%
36%	23%
55%	55%
34%	56%

SB	NB
13%	20%
111%	102%
6%	19%
17%	21%
8%	17%

SB	NB
4%	12%
102%	94%
-2%	24%
8%	13%
-3%	6%

EB	WB
-12%	-16%
37%	31%
8%	-29%
-17%	-20%
-24%	3%

SB	NB
28%	37%
114%	115%
12%	50%
36%	40%
24%	24%

Porirua
Linden
Ranui heights
Paekakariki
Pukerua Bay
Plimmerton
Camborne
Titahi Bay
Paremata
Whitby
Pauatahanui
Elsdon
See Insert
Cannons Creek
Porirua
Ranui heights
Linden
Tawa

Legend

1 hour for AM / PM / IP, and 24hrs for AADT

SB/EB;NB/WB	South Bound / North Bound
237862	AADT (% Volume change for period)
850	AADT, HCV (% Volume change for period)
800	AM (% Volume change for period)
300	IP (% Volume change for period)
750	PM (% Volume change for period)

Approx. Reporting Locations

Residential Areas

Coastline

Roads

Main

Other

Minor

Railways

Kilometers

0 0.5 1 2 3 4

Transmission Gully Phase II Investigations

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Traffic Flow Changes - Basecase 2026 Compared to 2006 Figure 4.7

SCALE @ A4	SKM PROJECT No	DRAWING No	AMDT
1:92,123	ZB01023		

Changes in demographic patterns and levels of economic activity will lead to growth in levels of traffic demand in the future. Figure 4.6 summarises forecast weekday traffic volumes on the principal road sections in the Basecase network in the year 2026, and Figure 4.7 summarises the overall rate of growth from 2006 to the 2026 Basecase.

Rates of forecast traffic growth in the corridor reflect road network conditions without the Transmission Gully Project, the improvements being made to the rail network and the other factors such as the outlook for fuel price growth. As the reliability of the road network deteriorates, vehicle movements are increasingly replaced by rail travel or road travel to alternative destinations.

Growth in daily traffic volumes along SH1 over the period 2006 – 2026 varies between 3% at a point south of Paekakariki and 32% between the Mungavin interchange and the Tawa interchange. On SH58, forecast growth is negative, between -7% and -14% over the same period. This is principally because most of the growth is in the movement between Porirua and the Hutt Valley, which predominately uses a route via SH1 to Ngauranga Gorge and SH2 rather than via SH58 (and because the Petone – Grenada link road is assumed to be available for these movements in the future). As indicated by Figure 4.3, the movement between Kapiti and the Hutt Valley is forecast to reduce by 2026.

Growth rates for daily traffic volumes mask significant variance by time period. On SH1, the growth in traffic volumes in the inter-peak period is higher than that forecast to occur in the peak periods, due to the effects of congestion and trip suppression / retiming at the busier periods.

3.6. Basecase Travel Times

3.6.1. Observed Travel Times

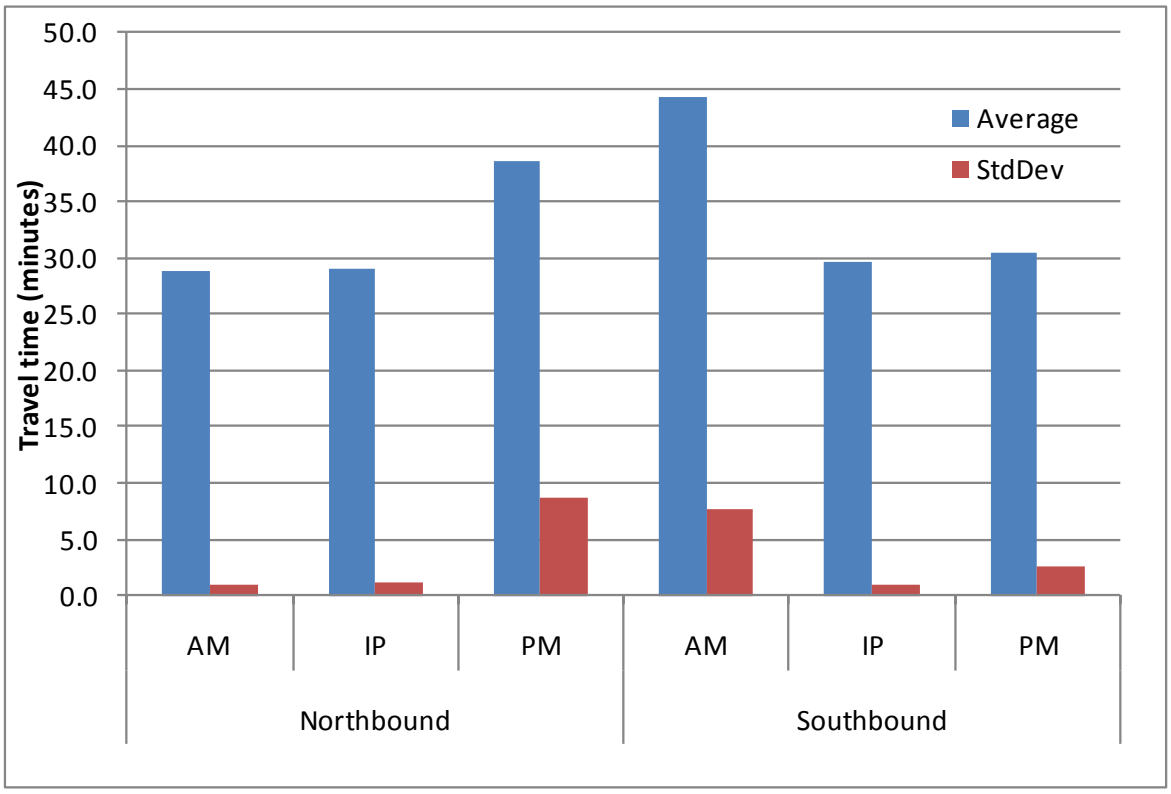
Travel time information in the SH1 corridor has been routinely collected by the NZTA in the period since 2004. Whilst information for individual years can be subject to the effects of specific conditions on the survey days (such as weather, roadworks and incidents), averages and trends over this period provide a useful indication of relative travel times by time period and direction, and the variance in these times.

Figure 4.8 summarises travel time observations for SH1 between the base of the Ngauranga Gorge and MacKays Crossing. The average observed travel times indicate that in the peak periods and directions of travel (northbound in the PM peak and southbound in the AM peak) travel times are significantly higher (31 – 50%) than in uncongested periods and directions.

Figure 4.8 also shows that the variability of travel times (indicated by the standard deviation) is much greater for the peak periods and directions of travel. For the northbound movement in the PM peak and southbound movement in the AM peak, the standard deviation of the observed travel times is 23% and 17% of the average values respectively. This compares to 3 – 9% for other time periods and directions of travel.

This indicates that at higher levels of traffic demand not only do travel times increase significantly in the SH1 corridor, but also the variability of travel times increases due to congestion. Under such conditions, the consequences of any incidents or disruptions to traffic flow are magnified, with greatly increased travel times.

- **Figure 4.8: Average Observed Travel Times on SH1 (2004 to 2010) between Ngauranga Gorge and MacKays Crossing and Standard Deviation[10]**



3.6.2. Basecase Forecast Travel Times

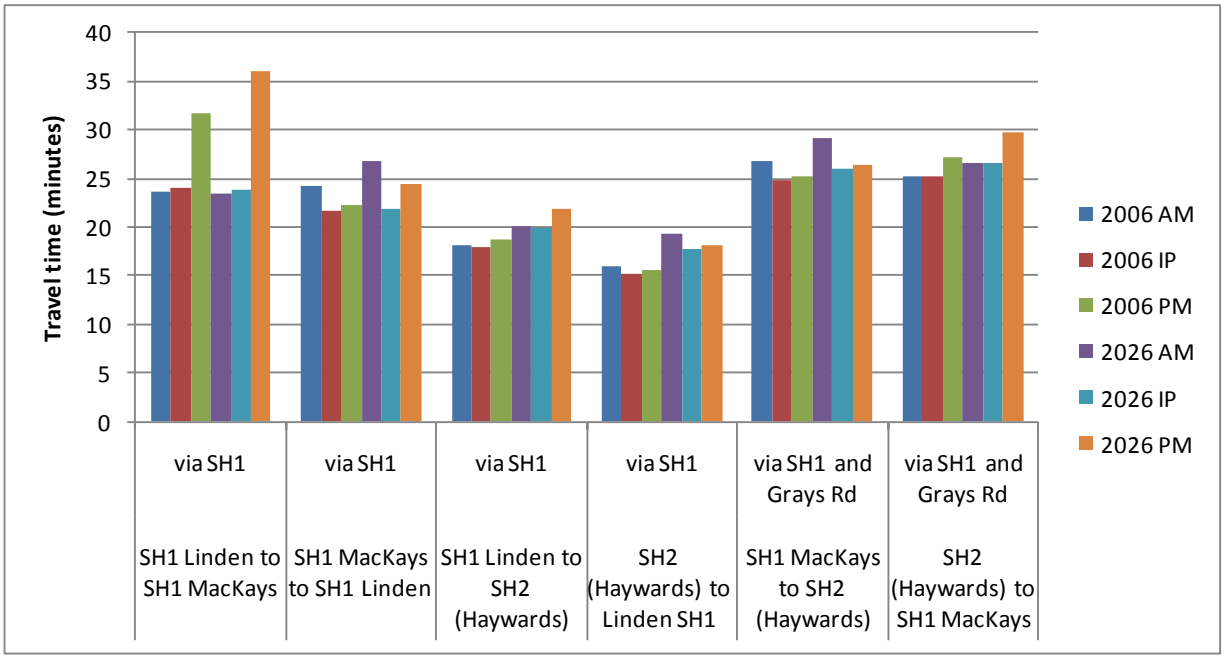
Forecast travel times for future years without the Transmission Gully Project have been generated by the SATURN model for a number of key routes through the study area between:

- SH1 Linden and SH1 MacKays Crossing;
- SH1 Linden and SH2 (Haywards); and
- SH1 MacKays Crossing and SH2 (Haywards).

Figure 4.9 shows the modelled travel times on these key routes for the Basecase (without the Transmission Gully Project) for 2006 and 2026, with travel on SH1, and SH58 where applicable.

[10] The March 2008 PM Northbound data has been excluded as this is not considered to be reliable. Travel times are taken between Ngauranga Gorge and MacKays Crossing, not Linden and MacKays Crossing as in the modelling, as they are the timing points used for the NZTA travel time surveys

- **Figure 4.9: Average Travel Times on Key Routes for 2006 and 2026 Basecase (minutes)**



Along SH1, the effect of congestion arising from higher traffic volumes in peak periods is evident. In 2006, the northbound journey from Linden to MacKays Crossing takes 33% longer in the PM peak period when compared to the AM peak. With the route running close to capacity, small increases in traffic demand will have a disproportionate effect upon delays, shown by forecast increases of 14% and 11% in the PM peak northbound and AM peak southbound travel times respectively in the period to 2026.

Increasing delays experienced by vehicles from SH58 at the Paremata roundabout and increases in travel time along SH58 due to the proposed speed reductions and inclusion of roundabouts (refer Appendix D), will increase travel times for movements between SH58 (east) and SH1 (south). Similarly, delays will increase for vehicle movements exiting Grays Road at its intersection with SH1 due to heavier through movements on SH1 which will result in more of the traffic signal green time being allocated to SH1 movements.

The travel times shown in Figure 4.9 are average values from the model for typical weekday periods. These do not show the much higher travel times which can occur at holiday periods or as a result of incidents.

3.6.2.1. SH1 Travel Times

Forecast travel times by distance on SH1 between Linden and MacKays Crossing are shown by figures at Appendix B. The figures compare Basecase (without the Transmission Gully Project) results by year for each modelled time period and direction of travel.

These forecasts indicate that delays for northbound movements will develop at the Paremata roundabout in the Inter-Peak and PM peak periods. For southbound movements, the largest delays will develop at the Paremata roundabout and Whitford Brown Avenue intersection[11].

3.6.2.2. SH58 Travel Times

Forecast travel times by distance on SH58 between SH1 at Paremata and SH2 at Haywards are shown by figures at Appendix B. The figures compare Basecase (without the Transmission Gully Project) results by year for each modelled time period and direction of travel.

Increases in travel time will occur primarily in the period prior to 2026, due to the construction of a number of roundabouts to facilitate side road movements and a reduction in the speed limit to 70 km/hr between the Moonshine Road intersection and Pauatahanui as detailed in the August 2010 SH58 Strategy Study by MWH for NZTA.

3.6.3. Basecase Network Reliability

The variability of travel times experienced is an important consideration for the existing users of SH1. When travellers plan their trip, they need to allow not only for the expected travel time but also its variability, particularly if their arrival time at their destination is critical (for example, if travelling to the airport).

The variability of travel times is greatly increased not only by congestion, but also incidents (crashes and natural events such as slips). With high traffic volumes, especially at peak periods, any such incident on SH1 can rapidly result in high levels of delay for users.

In the period September 2004 to March 2008, 51 instances of full or partial closure were recorded on the section of SH1 between Mungavin and MacKays Crossing[12]. Of these, 27 were as a result of crashes. SH58 between SH1 and the proposed Transmission Gully interchange has experienced 23 closures in the same time period, with 10 being as a result of crashes. A combined total of six closures from natural events have been recorded for both stretches of highway. It should be noted that a wire-rope barrier was introduced on the coastal section of SH1 between Pukerua Bay and Paekakariki in 2007, which has resulted in some reduction in the number of full closures due to crashes.

Figure 4.8 shows the variability in the observed travel times on SH1 between Ngauranga Gorge and MacKays Crossing. For the AM peak period, whilst the average southbound travel time is 44 minutes, the variability (standard deviation) about this value is 8 minutes. For the PM peak, the average northbound travel time is 39 minutes with a variation of about 9 minutes. This is based

[11] NZTA is currently studying options for reducing delays at the Whitford-Brown intersection. Currently, there are no committed improvements at this location.

[12] Data provided by NZTA's Network Maintenance Contractor from its incident response database

upon the variation in travel times arising from typical weekday conditions, and hence does not show the much higher levels of travel time variability which occur around holiday weekends and when specific incidents occur.

Without the Transmission Gully Project, rising traffic demands will increase the frequency, duration and severity of congestion in the corridor. Figure 4.9 shows modelled travel times for the years 2006 and 2026, indicating that under normal traffic flow conditions, travel times may be increased by as much as 14% on SH1 over this period. This will be accompanied by increases in the variability of travel times, and magnified as a result of incidents when they occur.

In addition, sections of the SH1 route are susceptible to the effects of natural disasters, including earthquake- induced landslides, liquefaction and fault rupture as well as tsunamis. Even extreme rain events may induce landslides sufficient to temporarily close the route.

3.6.4. Basecase Intersection Performance

Without the Transmission Gully Project, rising traffic demands over the period 2006 to 2026 will place a number of the existing intersections in the SH1 corridor under increasing strain. This is likely to be manifested in increased delays, queue lengths and some deterioration in safety performance.

Intersections which have existing capacity or delay problems or are likely to develop such problems by the 2026 Basecase include:

- SH1 / Mungavin Roundabout;
- SH1 / Whitford Brown Avenue;
- SH1 / SH58 Paremata Roundabout;
- SH58 / Paekakariki Hill Road;
- SH58 / James Cook Drive;
- SH58 / Joseph Banks Drive;
- Kenepuru Drive/ Titahi Bay Road; and
- Omapere Street / Warspite Avenue.

As noted in Section 2.3, existing intersections have only been simulated using SIDRA where these are currently operating close to capacity limits and it is likely that the Transmission Gully Project will result in an increase in traffic demands sufficient to cause some deterioration in operating performance on at least one approach.

Of these intersections only Kenepuru Drive / Titahi Bay Road and SH1 / Whitford Brown Avenue met the criteria for modelling, as the other intersections will either experience a significant reduction in traffic demands as a result of the Transmission Gully Project, or have sufficient spare capacity to accommodate an increase in traffic demands. Despite not meeting these criteria, the

Kenepuru Drive / Raiha Street intersection was also modelled as this will experience a change in the balance of traffic movements as a result of the Transmission Gully Project.

The SIDRA assessments indicate that in the Basecase, the LOS in the PM peak period at the Kenepuru Drive / Titahi Bay Road roundabout will decline from D in 2006 to F by 2026. Similarly, the LOS will deteriorate in all time periods at the Whitford-Brown intersection on SH1. At the Kenepuru Drive / Raiha Street intersection there will be no appreciable change in the LOS on Kenepuru Drive but the LOS on Raiha Street deteriorates in each time period, especially the PM peak where it will deteriorate from D in 2006 to E in the 2026 Basecase.

There are a number of other intersections on the existing SH1 coastal route which are likely to develop operational and safety problems without the Transmission Gully Project by 2026. These have not been modelled in SIDRA as the flows through them will decrease significantly when the Transmission Gully Project is operational, providing an opportunity for safety, accessibility and operational improvements. These intersections, which will be positively affected by the Transmission Gully Project include:

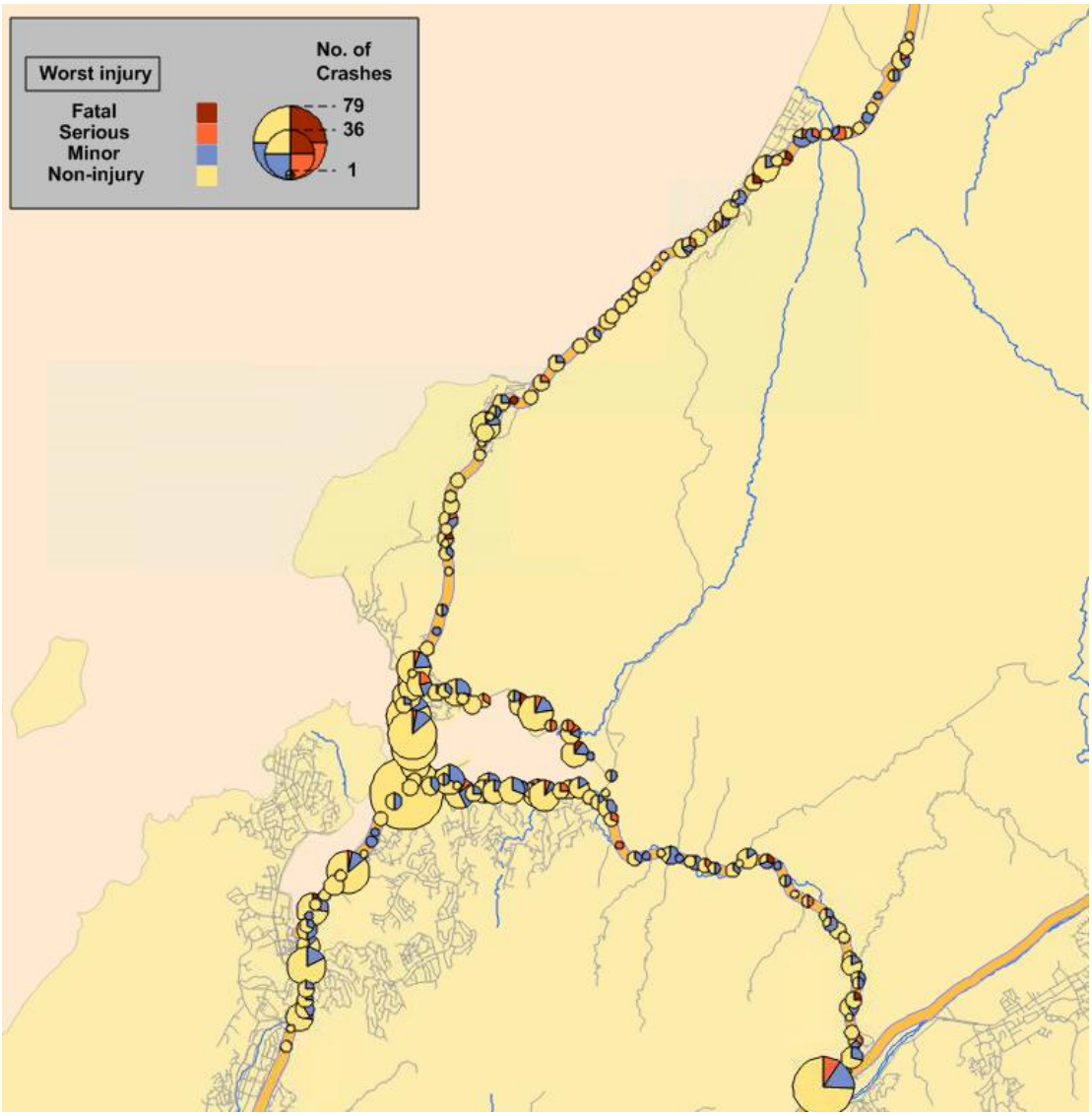
- SH1 / Teihana Road (Pukerua Bay);
- SH1 / Wairaka Road (Pukerua Bay);
- SH1 / Pukerua Beach Road (Pukerua Bay);
- SH1 / Steyne Avenue (Plimmerton);
- SH1 / Grays Road;
- SH1 / Pope Street;
- SH1 / Acheron Road;
- SH1 / Mana View Road;
- SH1 / Pascoe Avenue; and
- SH58 / Seaview Road.

3.6.5. Basecase Crash Performance

3.6.5.1. General

The recent crash history for the SH1 corridor has been extracted from the Crash Analysis System (CAS) database maintained by the NZTA, for the 5-year period 2005-2009 inclusive. The area covered is shown in Figure 4.10 and includes SH1, SH58 and Grays Road, Figure 4.10 also shows the number and severity of crashes along each route. SH1 crashes were extracted from Linden to just north of MacKays Crossing, on SH58 they were extracted from SH1 to SH2 and on Grays Road they were extracted from SH1 along Paekakariki road to SH58.

- **Figure 4.10: Crashes by Severity, 2005-2009**



These crashes are further broken down in Table 4.3. Between 2005 and 2009 there have been 974 recorded crashes on SH1, SH58 and Grays Road. Of these, 24% involved injuries with 10 fatal incidents. Over this period, there has been no discernible downward trend in the total number of incidents.

- **Table 4.3: State Highway and Grays Road Crash History 2005-2009**

Year	Fatal	Serious	Minor	Non Injury	Total
2005	2	11	37	126	176
2006	3	11	39	156	209
2007	2	2	40	145	189
2008	1	9	24	146	180
2009	2	10	41	167	220
Total	10	43	181	740	974
Source: CAS Database (Number of Recorded Incidents)					

Table 4.4, Table 4.5 and Table 4.6 show the crash history on SH1, SH58 and Grays Road respectively for the period 2005 - 2009. Where crashes have occurred at the intersections of these roads, they have been included in the totals for each of the relevant road sections. For this reason, the combined totals of Tables 3-2 to 3-4 exceed those shown by Table 3.1

- **Table 4.4: SH1 Crash History 2005-2009**

Year	Fatal	Serious	Minor	Non Injury	Total
2005	2	4	17	81	104
2006	2	7	22	93	124
2007	1	1	22	92	116
2008	1	3	14	96	114
2009	0	2	15	100	117
Total	6	17	90	462	575
Source: CAS Database (Number of Recorded Incidents)					

On SH1, 20% of the crashes involved injuries. Whilst the number of crashes involving a fatality has reduced from 2 in 2005 and 2006 to 0 in 2009, there is no overall downward trend in the number of total incidents.

- **Table 4.5: SH58 Crash History 2005-2009**

Year	Fatal	Serious	Minor	Non Injury	Total
2005	0	6	15	47	68
2006	1	1	15	56	73
2007	0	1	18	53	72
2008	0	4	11	43	58
2009	1	6	20	59	86
Total	2	18	79	258	357
Source: CAS Database (Number of Recorded Incidents)					

On SH58, 28% of the crashes involved injuries, significantly higher than the other roads. Again, no clear downward trend in the overall number of incidents is apparent.

- **Table 4.6: Grays Road Crash History 2005-2009**

Year	Fatal	Serious	Minor	Non Injury	Total
2005	0	1	6	5	12
2006	0	3	2	18	23
2007	1	0	2	14	17
2008	0	2	1	15	18
2009	1	2	8	18	29
Total	2	8	19	70	99
Source: CAS Database (Number of Recorded Incidents)					

On Grays Road, 29% of the crashes involved injuries. 2009 saw a significant increase in the total number of incidents on this route (PCC has subsequently introduced lower speed limits and other temporary measures on this route to address the high crash rate).

3.6.5.2. State Highway Crashes by Road Section

- **Table 4.7: SH1 Sections Crash History 2005-2009**

SH1 Section	Fatal	Serious	Minor	Non Injury	Total
Linden to Paremata Roundabout	1	1	32	129	163
Paremata Roundabout to Plimmerton Roundabout	1	4	26	195	226
Plimmerton Roundabout to Pukerua Bay	1	1	7	29	38
Pukerua Bay	1	1	4	26	32
Pukerua Bay to MacKays Crossing	2	10	21	83	116
Total	6	17	90	462	575
Source: CAS Database (Number of Recorded Incidents)					

Table 4.7 shows the number of crashes on the sections of SH1 between 2005 and 2009. Along the section of SH1 between Linden and MacKays Crossing, there has been an average of 23 reported injury crashes per year over the period 2005-2009. The Paremata to Plimmerton Section has the lowest percentage of injury crashes (14%), due mainly to the lower urban speed environment. South of Paremata, SH1 has a solid median, resulting in a lower percentage of injury crashes (21%), particularly head-on, than other high speed sections.

There is a high proportion of injury crashes from Pukerua Bay to MacKays Crossing (28%) where no median barrier exists. A wire rope barrier was installed along the coastal section between Pukerua Bay and Paekakariki in 2007. For the two years before this, 2005 and 2006, there were a total of 17 injury crashes, with one fatal crash. In the two years after, 2008 and 2009, there were only 10 injury crashes, of which none involved fatalities. Whilst these changes in crash statistics indicate a reduction in the number and severity of injury crashes (particularly head-on) due to the installation of the median safety barrier, a longer crash history is required to confirm this trend.

- **Table 4.8: SH58 Sections Crash History 2005-2009**

SH58 Section	Fatal	Serious	Minor	Non Injury	Total
Paremata Roundabout to Pauatahanui	0	8	42	149	199
Pauatahanui to Haywards	2	10	37	109	158
Total	2	18	79	258	357
Source: CAS Database (Number of Recorded Incidents)					

Table 4.8 shows the number of crashes on the sections of SH58 between 2005 and 2009. Overall, SH58 has a higher percentage of injury crashes than SH1. The section of SH58 between the Paremata roundabout and Pauatahanui has a greater number of crashes, but of lower severity, due

to poor road alignment and part of the route lying within a 50 km/hr zone. East of Pauatahanui, fewer crashes but of greater severity occur, due to the higher speeds achievable on this section.

3.6.5.3. Local Road Crashes

Table 4.9 shows the number of crashes on sections of the local road network. A lower proportion of crashes involve injuries on many of the roads due to the lower speed environment when compared to the State highways. An exception to this is the Paekakariki Hill Road, where the poor road geometry contributes to a high proportion of injury crashes.

- **Table 4.9: Local Road Crash History 2005-2009**

Local Road Section	Fatal	Serious	Minor	Non Injury	Total
Main Road - Raiha Street to Linden Avenue	0	0	4	24	28
Raiha Street - Kenepuru Drive to Prosser Street	0	0	9	26	35
Kenepuru Drive - Titahi Bay Road to Kenepuru Link Road	0	1	7	97	105
Kenepuru Drive - Kenepuru Link Road to Raiha Street	0	1	6	27	34
Titahi Bay Road - Mungavin Interchange to Hagley Street	0	0	7	140	147
Whitford Brown Avenue - SH1 to Warspite Avenue	1	10	9	49	69
Warspite Avenue - Omapere Street to Waitangirua Link Road	0	0	7	23	30
Warspite Avenue - Waitangirua Link Road to Waihora Crescent	0	0	6	31	37
James Cook Drive - Navigation Drive to SH58	0	0	2	7	9
Discovery Drive-James Cook Drive to Spinnakar Drive	0	1	4	9	14
Navigation Drive - James Cook Drive to Joseph Banks Drive	0	1	0	2	3
Paekakariki Hill Road - SH1 to Grays Road	2	12	34	73	121
Source: CAS Database (Number of Recorded Incidents)					

3.6.5.4. Key Intersection Crashes

Table 4.10 shows the number of crashes at key intersections on SH1 between 2005 and 2009.

The poor crash performance at some of these intersections is attributable to sub-standard conditions, aggravated by high volumes of traffic, for example:

- Paekakariki Hill Road / Beach Road / SH1: significant delays for the side road movements encourage drivers to take small gaps in the through traffic movements on SH1. This is compounded by conflict between the side road movements, limited visibility from the Paekakariki Hill Road approach and the close proximity of a rail crossing on Beach Road;

- Pukerua Bay: all of the side road intersections within Pukerua Bay suffer from high delays to minor road movements and restrictions upon available sight distances;
- Airlie Road: this priority intersection is located within a section of SH1 having 4-lanes and subject to high speeds; and
- Paremata Roundabout: movements exiting the Paremata railway station parking area are subject to high delays in the PM peak period with the result that drivers are tempted to risk taking small gaps in the northbound traffic stream.

- **Table 4.10: Key Intersection Crashes on SH1, 2005-2009**

Side Road	Fatal	Serious	Minor	Total Injury	Non Inj	Total
Paekakariki Hill Road / Beach Rd	0	0	2	2	7	9
Ames Street	0	0	1	1	1	2
Pa/Toenga Road	0	1	7	8	55	63
Pukerua Beach Road	0	0	1	1	3	4
Wairaka Road	0	0	1	1	1	2
Teihana Road	0	1	2	3	9	12
Gray Street	0	0	0	0	3	3
Airlie Road	1	1	2	4	5	9
Plimmerton Roundabout	0	1	3	4	13	17
Grays Road	0	0	1	1	8	9
Steyne Avenue	0	0	2	2	6	8
Pope Street	0	0	2	2	6	8
Acheron Road	0	1	3	4	16	20
Mana View Road	0	1	1	2	20	22
Pascoe Avenue	0	1	2	3	9	12
Marina View Road	0	0	0	0	7	7
Paremata Roundabout	0	0	9	9	64	73
Whitford Brown Avenue	0	1	3	4	20	24
Mungavin interchange	0	1	8	9	58	67
Source: CAS Database (Number of Recorded Incidents)						

3.6.5.5. Basecase Forecast Crashes

The expected number of crashes in the future on SH1 (without the Transmission Gully Project) was estimated by reference to the observed crash rates and forecast traffic volumes for the 2026 Basecase.

SH1 was divided into five sections within which the road characteristics are similar:

- Linden (South) to the Paremata Roundabout (motorway/expressway);
- The Paremata Roundabout to Plimmerton (urban);
- Plimmerton to Pukerua Bay (rural-rolling);

- Pukerua Bay (urban); and
- Pukerua Bay to MacKays Crossing (North) (rural-rolling).

Midblock crash analysis was carried out using the average traffic flow over these sections for the 2026 Basecase.

Table 4.11 shows the expected number of midblock injury crashes in 2026 on the five sections of SH1. There are expected to be a total of 31 injury crashes with over half occurring north of Plimmerton. As these numbers exclude intersection crashes, they are not directly comparable to figures quoted in previous tables. .

It is expected that the frequency of crashes on SH1 will rise as traffic flows (and associated crash exposure) increases over time (including the presence of a higher percentage of heavy vehicles).

- **Table 4.11: Crash Analysis Summary, 2005 to 2009 Recorded Injury Crashes and Expected Midblock Injury Crashes in 2026 Basecase[13]**

		2026 Expected Midblock
SH1	Linden (South) to Paremata Roundabout	11
	Paremata Roundabout to Plimmerton	3
	Plimmerton to Pukerua Bay	5
	Pukerua Bay	3
	Pukerua Bay to MacKays Crossing (North)	10
Total	SH1	31
Source: SATURN Model and EEM1 Procedures		

3.7. Basecase Public Transport Network Conditions

Recent years have not seen any significant changes to the number of passengers using the Paraparaumu line (remaining between 4.0 and 4.5m trips per annum[14]). This is due partly to a range of technical problems resulting in poor reliability of the service and some overcrowding at peak periods.

Current work to improve the reliability of the infrastructure and the introduction of the new 'Matangi' rolling stock and other improvements are expected to improve reliability, and the longer term outlook to 2026 is for a growth in patronage, as shown by Figure 4.2. Part of this forecast growth is attributable to poor conditions on the road network (without the Transmission Gully

[13] These values should only be used as an indication of growth as only mid block crashes have been analysed. This is not intended to be a comprehensive analysis but to provide an indication of the safety benefits associated with increased travel on higher quality sections of network in the future with TG in place.

[14] Email from GWRC operations staff to Tim Kelly on the 28th of May 2010

Project), which causes a higher proportion of travellers (those for whom a choice of mode is available) to use the rail network.

The bus network remains subject to the performance of the road network, with no specific proposals for bus lanes or specialised infrastructure. The reliability of some bus services will be impaired by worsening congestion without the Transmission Gully Project. For example, services from Paremata railway station will experience increasing difficulty and delays exiting the station area to the Paremata roundabout.

3.8. Summary of Basecase Transportation Issues in the Corridor

3.8.1. Travel Patterns

Some of the travel demands in the corridor, for example between Kapiti and Wellington, are serviced by both the road and public transport networks. However, there are also a significant number of travel movements which are not conveniently serviced by public transport, for example Kapiti – Hutt Valley and Porirua – Hutt Valley. As a result, the road and public transport networks serve the needs of different, but overlapping, groups of travellers.

3.8.2. Travel Times

Road congestion in the SH1 corridor results in lengthy travel times during weekday peak periods. Travel between the Hutt Valley and SH1 (north) requires the use of routes which are indirect (SH58 and Grays Road around the Pauatahanui Inlet) or inappropriate for large volumes of traffic (Grays Road, Paekakariki Hill Road).

During weekend and holiday periods severe congestion can occur as a result of increased road traffic demands. In the event of an incident, such as a crash or natural event, the extent of disruption is often magnified.

3.8.3. Travel Time Reliability

Traffic congestion not only increases total travel times but also the variability or uncertainty of travel times in the corridor. The planning of journeys becomes increasingly difficult, resulting in additional and unnecessary costs being borne by travellers and businesses.

3.8.4. Travel Safety

A number of improvements have been made in recent years to address specific crash problems in the corridor. The construction of median wire rope barriers along the coastal section of SH1, reduced speed limits, intersection improvements and other measures have resulted in some reduction in crash rates.

However the scope for further significant safety work to reduce the current crash rate is limited. To achieve substantive further reductions in crash numbers, road realignments and widening would be

required, involving significant land and financial requirements. Without the Transmission Gully Project, rising traffic demands are likely to aggravate existing crash problems in the corridor.

3.8.5. Route Security

The northern access to Wellington is vulnerable to closure after a significant earthquake, tsunami or storm event. As both SH1 and SH2 are vulnerable, these routes and the adjacent railways could be closed for several weeks (if not months) while repair and reinstatement work takes place. Such closures would be extremely disruptive and would result in lost productivity for the region and the nation.

3.8.6. Community Severance

In addition to the noise, pollution and vibration associated with high traffic volumes, communities in the existing SH1 corridor experience significant levels of severance. Roads (linear infrastructure) with high volumes of traffic make it difficult for people to cross or to get access to adjacent communities or facilities, and for local traffic to access SH1.

Much of the Pukerua Bay community is severed from the railway stations by SH1. At Paremata, the railway station lies on the opposite side of SH1 to the community. At Mana, the local shopping centre, railway station and reserve are separated from most of the residential development by SH1, with only at-grade crossing facilities available. At Paekakariki and Plimmerton, local traffic experiences delay accessing or crossing SH1. Despite the provision of traffic signals in Plimmerton / Mana, conditions will deteriorate as the volumes of through traffic grow in the future and crossing (and access to) SH1 becomes more difficult. (These issues are addressed in the Social Impact Assessment (Technical Report No. 17)).

4. The Transmission Gully Project and Effects

The Transmission Gully Project is described in some detail in Section 1. Furthermore, drawings GM01 – GM21 included in the Notice of Requirement (NoR) documentation show the proposed scheme.

4.1. Differences between the Existing and Proposed Designation Schemes

When compared to the existing alignment and designation for the Transmission Gully Project, the alignment which is now proposed reduces the effect of the project on the environment and its susceptibility to natural disasters.

The most significant aspect of the change, with regard to transportation effects, is the connection of the Whitby and Waitangirua link roads to the Main Alignment at a single interchange, which includes some changes to the alignment (and hence length) of these link roads.

4.2. Assessment Methodology

The Transmission Gully Project will have a significant and immediate primary effect upon the routing of traffic movements within the SH1 corridor. Less obvious secondary impacts will arise on the local network as a result of changes in network connectivity and changes in congestion levels. Effects will also be felt in terms of changes in the balance of trips between road and public transportation, and some trip induction is likely to occur as the relief of congestion results in the release of currently suppressed demands for road travel.

The hierarchy of modelling tools described in Section 2 has been used to assist in the identification of the operation and performance of the transportation network with the Transmission Gully Project in place. A comparison with the Basecase conditions (described in Section 3) allows the incremental effects of the Transmission Gully Project upon network performance to be quantified.

A series of tests has been undertaken to understand the sensitivity of the assessment undertaken to key input assumptions. These are described in Section 5.

4.3. Effects Upon Total Travel Demand and Mode of Travel

4.3.1. Trip Induction

By reducing the costs of travel by road, the Transmission Gully Project can be expected to result in a number of behavioural responses by travellers, which together will result in some increase in the demand for road travel in this corridor. The resulting 'induced' trips can arise for a number of reasons including:

- **Mode transfer:** some people who use the public transport network (principally rail) find the improved convenience and reliability of the road network such that they prefer to travel by private vehicle instead;

- **Change in trip origin or destination (redistribution):** some people visit destinations in the SH1 corridor in preference to other locations because of the improved accessibility. This might be in the form of a short-term response with trips made for shopping or business, or a longer-term response in the form of moving house or a business; and
- **Change in time of travel:** people who previously travelled earlier or later than desired in order to avoid expected congestion (and variability in travel times), especially at peak periods, retime their journeys to travel closer to their desired time of travel.

The forecast volumes of major travel movements in the corridor for 2026 (summarised by Figure 4.11) indicate that there will be some generally small increases both in the total volume of travel in the corridor and also the proportion of this travel which is undertaken by road as a result of the Transmission Gully Project.

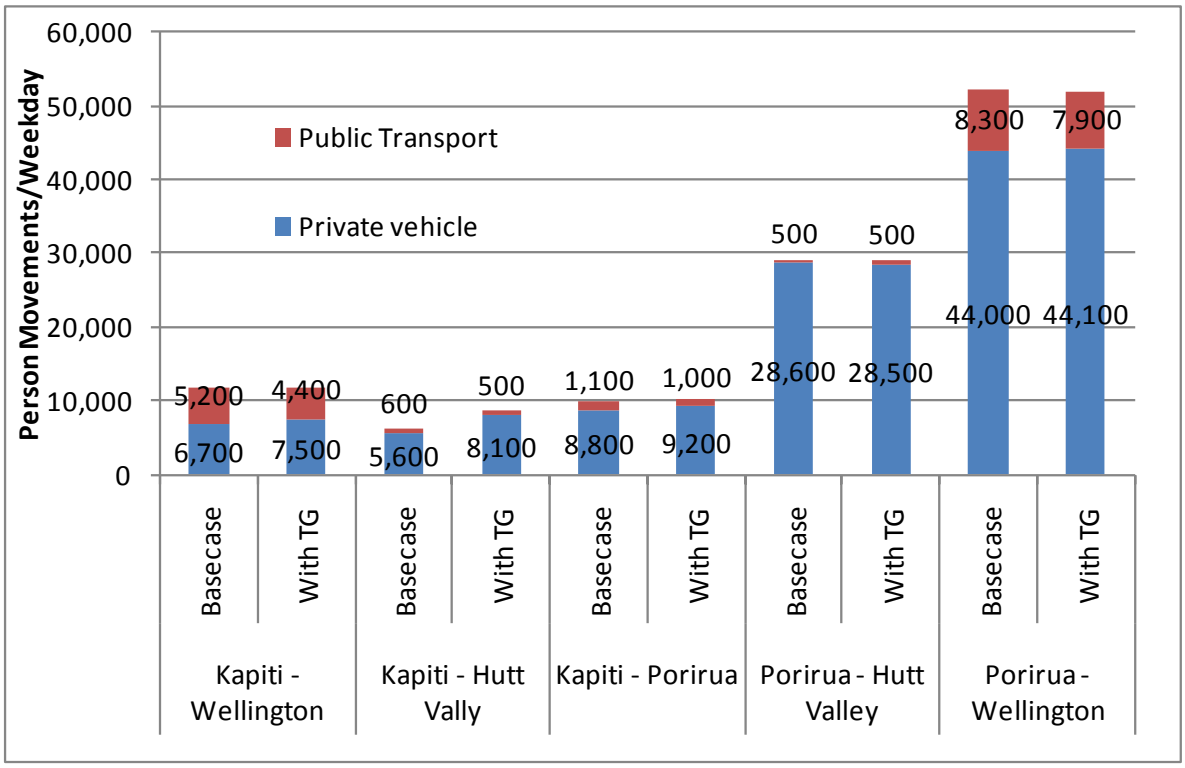
For movements between Kapiti and Wellington, whilst the total volume of travel will remain virtually constant, the proportion of travel made by road will increase from 56% to 63%, with a corresponding decline in the share made by public transport from 44% to 37%.

The redistributional effect of the Transmission Gully Project is apparent in the significant increase in the volume of travel between Kapiti and the Hutt Valley, by 41% from 6,100 to 8,600 trips/day as accessibility is improved between these areas. At the same time, there will be a small reduction in the number of trips made by public transport.

For movements between Kapiti and Porirua, whilst the total volume of travel will increase slightly (4%), the proportion of travel made by road will increase marginally from 89% to 90%, with a corresponding marginal decline in the share made by public transport from 11% to 10%.

The Transmission Gully Project is forecast to have little effect upon the volume of movement between Porirua and the Hutt Valley, because most of this movement takes place by means of the SH1 / SH2 corridors and Ngauranga Gorge (and using the Petone – Grenada link when completed). This corridor will see little change in conditions, other than an improvement in accessibility for some movements in Porirua as a result of the Kenepuru Link.

- **Figure 4.11: Forecast Total Travel Demand in Person Trips Between Areas for a Typical Weekday 2026, Basecase and With the Transmission Gully Project**



For movements between Porirua and Wellington, whilst the total volume of travel will remain virtually constant, the proportion of travel made by road will increase slightly, with a corresponding decline in the share made by public transport.

It is important to note that the effects above occur because the improved accessibility provided by the Transmission Gully Project will allow people to travel to the destinations they wish, at the times and using the mode of transport which are most convenient to them. All of these responses have an associated benefit to the travellers concerned and in aggregate to the region as a whole.

As indicated in Section 1.6.3, these results necessarily relate only to those effects associated with the Transmission Gully Project, and not the effects associated with the wider and balanced package of measures of which it forms a part.

4.4. Effects Upon the Road Network

4.4.1. Overall Network Performance

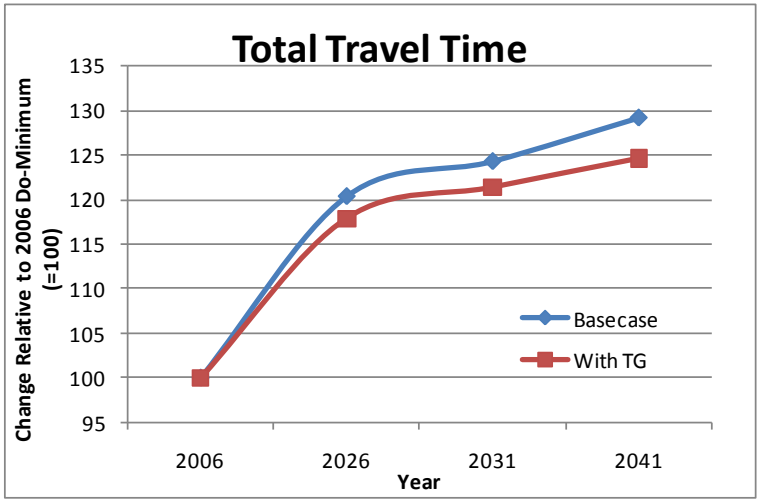
The Transmission Gully Project will have an impact upon overall road network conditions. Table 4.12: Travel Time Variability, Standard Deviation (minutes) summarises the forecast changes in the overall performance of the regional network (total vehicle distances travelled, total travel time, average speeds and total vehicle trips from SATURN) as a result of the project.

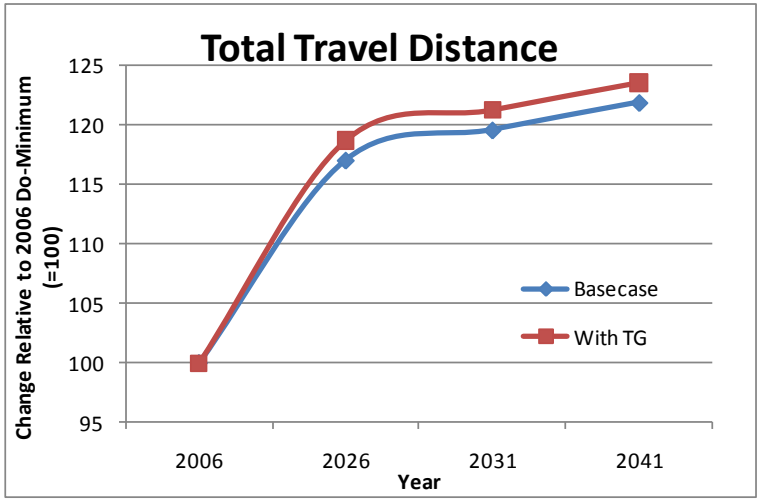
Whilst the change in the overall number of vehicle trips in the region is negligible (0.1%), the Transmission Gully Project will have the effect of reducing total travel times across the network by 2 – 4%. At the same time, there will be a small (1%) increase in total travel distances. The combined effect of these changes is a 3 – 5% improvement in average vehicle speeds.

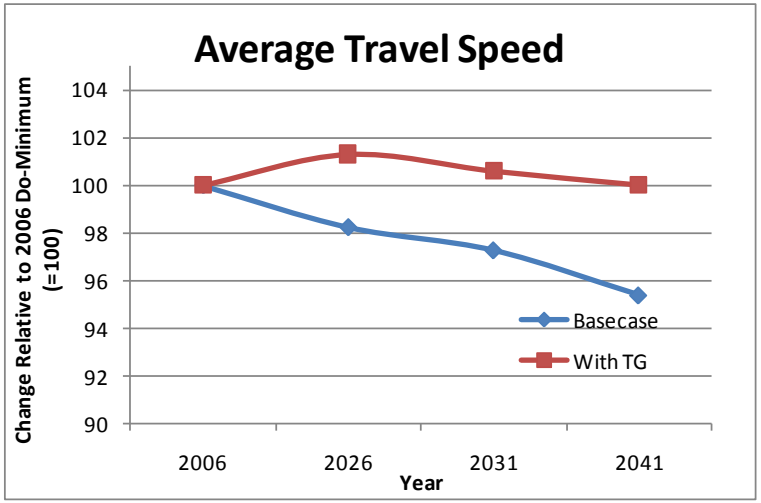
Between the end points at Linden and MacKays Crossing, the Transmission Gully Project will be marginally (0.65km) longer than the route via the existing SH1.

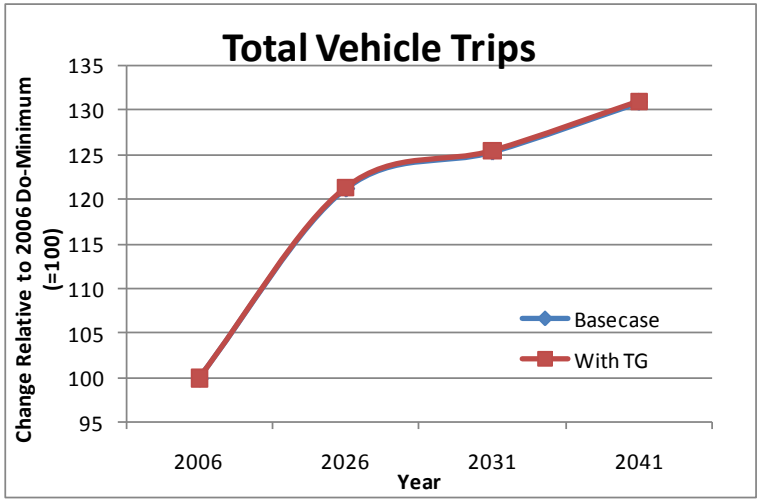
It should be noted that the effects of the Transmission Gully Project described above are averages across the wider regional network. In the more immediate SH1 corridor, the effects will be more significant.

- **Figure 4.12: Network Statistics, 2026, Basecase and With the Transmission Gully Project** [15]









[15] In the Total Vehicle Trips chart, the Basecase series is very close to the Transmission Gully scenario and although plotted is obscured by the Transmission Gully line.

4.4.2. Traffic Volumes

The opening of the Transmission Gully Project to traffic will result in significant changes in the volumes and patterns of travel on the existing road network.

Most significantly, the Transmission Gully Project will result in a large diversion of traffic away from the existing SH1 route between Linden and MacKays Crossing. In addition, there will be a range of more subtle changes in traffic volumes on other sections of the road network as drivers utilise routes which are less congested with the inclusion of the Transmission Gully Project.

Also, as described in Section 4.3.1, the Transmission Gully Project will result in some induction of 'new' trips as a result of the improved accessibility it provides. A variety of traveller responses will lead to a release of trip movements previously suppressed by the poorer quality of the road network, as the Transmission Gully Project will enable people to travel in ways and at times which are more convenient for them.

Figure 4.13 summarises the forecast traffic volumes on the network in the year 2026 with the Transmission Gully Project in place. The effect of the project in terms of changes in traffic volumes in 2026 relative to the 2026 Basecase (without the Transmission Gully Project) is summarised by Figure 4.14. The effects on key sections of the network are described in more detail below.

SB	NB
11700	11800
1600	1800
1750	520
560	620
620	1540

SB	NB
7380	7670
190	290
250	440
450	470
630	480

SB	NB
22500	21700
2610	2850
2680	1080
1150	1160
1400	2550

Porirua

SB	NB
11400	11700
470	680
690	430
710	740
640	850

Ranui heights

EB	WB
6460	6490
450	340
180	630
400	380
590	240

Linden

SB	NB
9700	8620
1030	1160
1090	480
500	490
670	790

SB	NB
1480	1610
470	700
230	90
60	100
100	120

Paekakariki

SB	NB
13000	13200
2150	2710
1560	700
660	700
840	1520

SB	NB
11300	11000
1370	1510
1490	530
570	570
670	1410

Pukerua Bay

SB	NB
3140	2790
700	890
400	140
170	150
140	310

Legend

1 hour for AM / PM / IP, and 24hrs for AADT

SB/EB;NB/WB
237862
850
800
300
750

South Bound / North Bound
AADT
AADT, HCV
AM
IP
PM

Approx. Reporting Locations

Residential Areas

Coastline

Roads

Main

Other

Minor

Railways

Plimmerton

EB	WB
1430	1380
220	240
120	130
80	70
120	100

SB	NB
10700	9770
1170	1380
940	360
610	570
650	990

Camborne

EB	WB
4560	4170
740	780
590	290
210	210
400	520

EB	WB
6600	6050
620	400
270	850
370	290
730	360

Titahi Bay

Paremata

Pau[illegible]tahanui

EB	WB
8620	7870
870	740
330	880
450	420
1190	440

SB	NB
21500	22600
2150	2970
2450	790
1160	1240
1160	2810

Whitby

EB	WB
7180	7540
1230	1230
1090	620
310	340
550	1070

SB	NB
13500	13400
1390	1970
1510	480
720	760
750	1480

Elsdon

SB	NB
10600	9430
1240	1420
1350	570
510	490
760	1100

See Insert

Cannons Creek

SB	NB
1460	1970
150	250
300	100
60	110
70	220

Porirua

Ranui heights

Linden

EB	WB
1900	1410
390	350
200	120
90	70
180	160

SB	NB
10000	8920
1020	1270
1480	430
470	470
620	1100

Tawa

SB	NB
32200	30300
3640	4010
3770	1560
1650	1650
2080	3340

Kilometers

0 0.5 1 2 3 4

Transmission Gully Phase II Investigations			
DRAWN JBG	DATE 22/12/10	PROJECT MANAGER A. Bell	PROJECT DIRECTOR T. Innes
DESIGNED	REVIEW		

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TITLE

Traffic Flow Data - 2026 With TG
Figure 4.13

SCALE @ A4	SKM PROJECT No	DRAWING No	AMDT
1:92,123	ZB01023		

SB	NB
-37%	-38%
-38%	-41%
-34%	-37%
-39%	-40%
-35%	-31%

SB	NB
-6%	1%
3%	-7%
-22%	36%
-6%	-3%
5%	0%

SB	NB
-24%	-24%
-27%	-28%
-22%	-26%
-25%	-26%
-19%	-20%

SB	NB
46%	54%
154%	119%
113%	32%
46%	52%
7%	78%

SB	NB
-87%	-86%
-74%	-68%
-79%	-84%
-89%	-86%
-86%	-89%

SB	NB
10%	10%
0%	1%
23%	11%
7%	5%
8%	24%

SB	NB
-74%	-77%
-64%	-61%
-69%	-76%
-75%	-77%
-80%	-75%

EB	WB
-42%	-54%
-51%	-48%
-13%	-43%
-49%	-46%
-27%	-76%

SB	NB
-41%	-42%
-46%	-46%
-45%	-47%
-40%	-43%
-41%	-34%

EB	WB
-26%	-34%
-34%	-32%
-41%	-40%
-19%	-27%
-18%	-46%

EB	WB
-25%	-24%
-34%	-37%
-38%	-26%
-20%	-26%
-34%	-1%

EB	WB
3%	-5%
-9%	-13%
49%	-11%
-2%	-4%
7%	2%

SB	NB
-28%	-26%
-34%	-31%
-31%	-28%
-28%	-27%
-29%	-22%

SB	NB
-39%	-39%
-44%	-41%
-41%	-48%
-38%	-38%
-38%	-37%

EB	WB
16%	19%
9%	8%
9%	26%
21%	20%
14%	12%

SB	NB
9%	6%
1%	1%
10%	7%
7%	6%
20%	5%

Porirua
Ranui heights
Linden
Paekakariki
Pukerua Bay
Plimmerton
Camborne
Titahi Bay
Paremata
Whitby
Pau tahanui
Elsdon
Cannons Creek
Porirua
Ranui heights
Linden
Tawa

See Insert

Legend

1 hour for AM / PM / IP, and 24hrs for AADT

SB/EB;NB/WB	South Bound / North Bound
237862	AADT (% Volume change for period)
850	AADT, HCV (% Volume change for period)
800	AM (% Volume change for period)
300	IP (% Volume change for period)
750	PM (% Volume change for period)

Approx. Reporting Locations

Residential Areas

Coastline

Roads

Main

Other

Minor

Railways

Kilometers

0 0.5 1 2 3 4

Transmission Gully Phase II Investigations

DRAWN	DATE	PROJECT MANAGER	PROJECT DIRECTOR
JBG	22/12/10	A. Bell	T. Innes
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TITLE

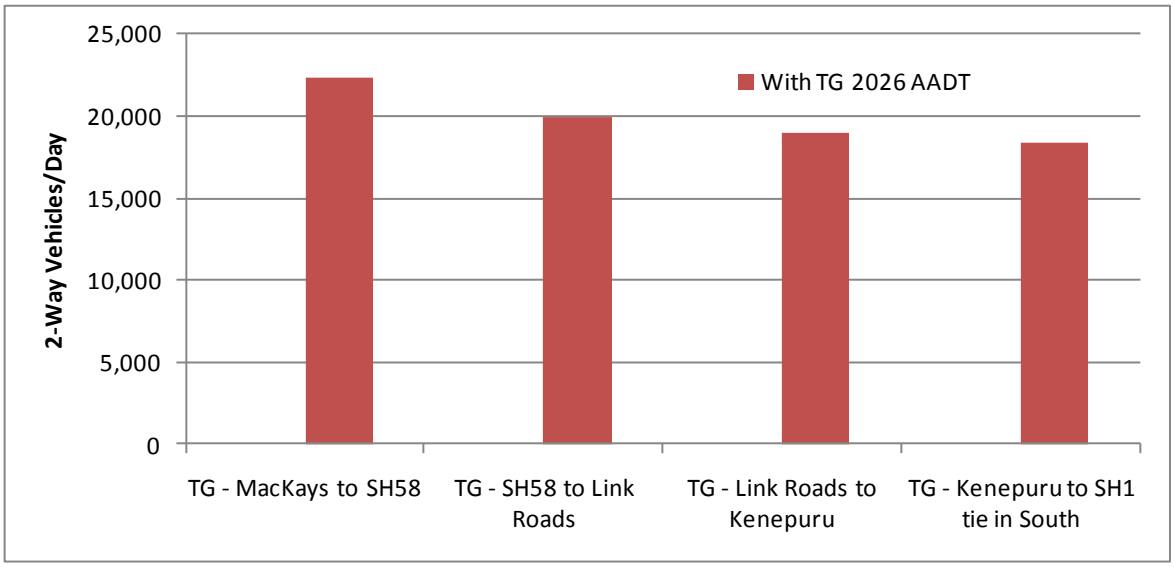
Traffic Flow Changes - 2026 With TG Compared to Basecase Figure 4.14

SCALE @ A4	SKM PROJECT No	DRAWING No	AMDT
1:92,123	ZB01023		

4.4.2.1. Transmission Gully Main Alignment

The forecast daily flows for 2026 on all sections of the Transmission Gully Main Alignment are shown by Figure 4.15. The Transmission Gully Main Alignment will carry 18-20,000 vehicles/day on the section between the SH58 intersection and Linden, and 22,300 vehicles/day between the SH58 intersection and MacKays Crossing.

- **Figure 4.15: 2026 Forecast AADT Traffic Flows on The Transmission Gully Main Alignment**



4.4.2.2. Kenepuru Link Road & Associated Roads

The Kenepuru link is forecast to carry 12,900 vehicles/day in 2026, providing access to the Transmission Gully Project / SH1 from the Porirua CBD, Kenepuru and the northern part of Tawa for traffic travelling to Wellington, the Hutt Valley and Kapiti. A small proportion of this traffic will comprise movements between Kenepuru and Whitby, for which a route via the Transmission Gully Main Alignment and the Whitby Link road will be more convenient.

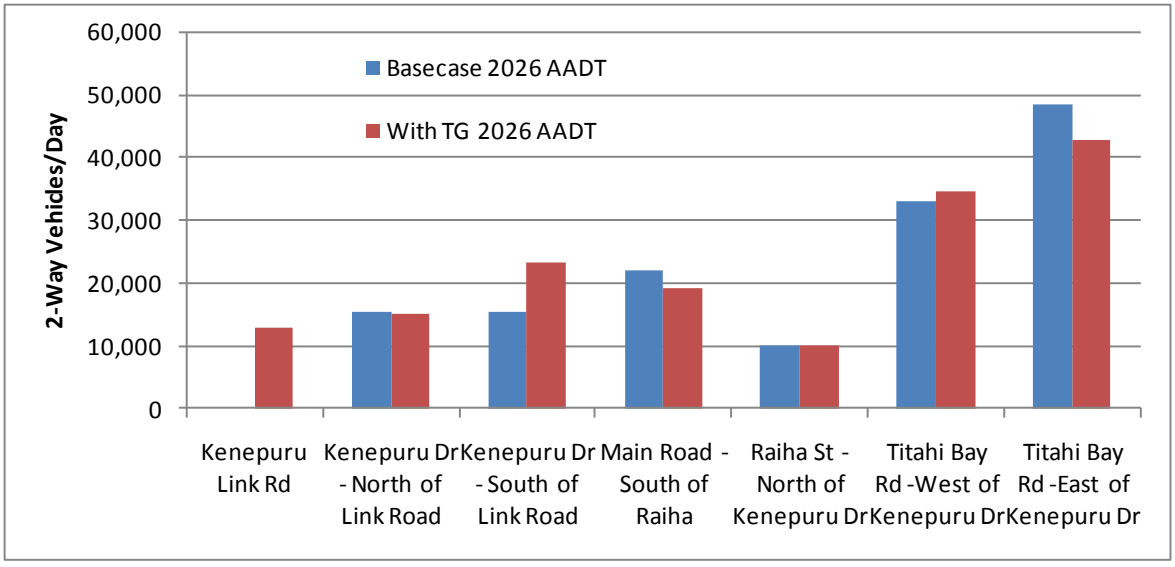
The AADT flows on the Kenepuru Link Road, Kenepuru Road, Main Road, Raiha Street and Titahi Bay Road are shown by Figure 4.16.

The addition of the link road results in the rerouting of vehicles. Trips that previously travelled the length of Kenepuru Drive now use the link road to access the State highway network. Although there are some additional trips on the local roads, many of the link road trips were already travelling on Kenepuru Drive. Therefore the increases on the local roads are smaller than the traffic volume on the link road as the trips are not new trips but just trips that have rerouted locally. This occurs for all the link roads.

There will be a small reduction in flow on Kenepuru Drive to the north of the proposed Kenepuru Link due to vehicles to and from Tawa (to the south of the Kenepuru Link Road) using the link road rather than Kenepuru Drive and the Mungavin interchange.

The convenience of the Kenepuru Link as a means of travelling between the Kenepuru / north Tawa areas and SH1 / the Transmission Gully Project will be reflected in a significant (50%) increase in traffic volumes on that section of Kenepuru Drive between Kenepuru Link Road and Raiha Street intersections. South of the Raiha Street intersection (along Main Road towards Tawa), a small reduction in traffic volumes will occur as a result of the Transmission Gully Project.

- **Figure 4.16: Forecast 2026 AADT Traffic Flows on the Kenepuru Link Road and Associated Roads for Basecase and With the Transmission Gully Project**



Although the assessments indicate that this increase in traffic volumes on Kenepuru Drive can be accommodated without any major operational problems, there will be some deterioration in conditions, especially for right turn movements to and from the accesses in this area. In this respect, the NZTA has committed to work with PCC to assess the detailed conditions in this area and identify a mutually acceptable package of traffic management measures.

The effect of the Transmission Gully Project and the Kenepuru Link Road will be to reduce traffic flows on Titahi Bay Road to the east of the Kenepuru Drive intersection by approximately 12%. Whilst a small increase in traffic volumes to the west of the intersection will also occur, there will be a significant improvement to conditions at this location. Mungavin Avenue to the east of the SH1 interchange is also likely to experience a small reduction in traffic demands.

4.4.2.3. Whitby Link Road & Associated Roads

The Whitby Link Road is forecast to carry 3,400 vehicles/day in 2026.

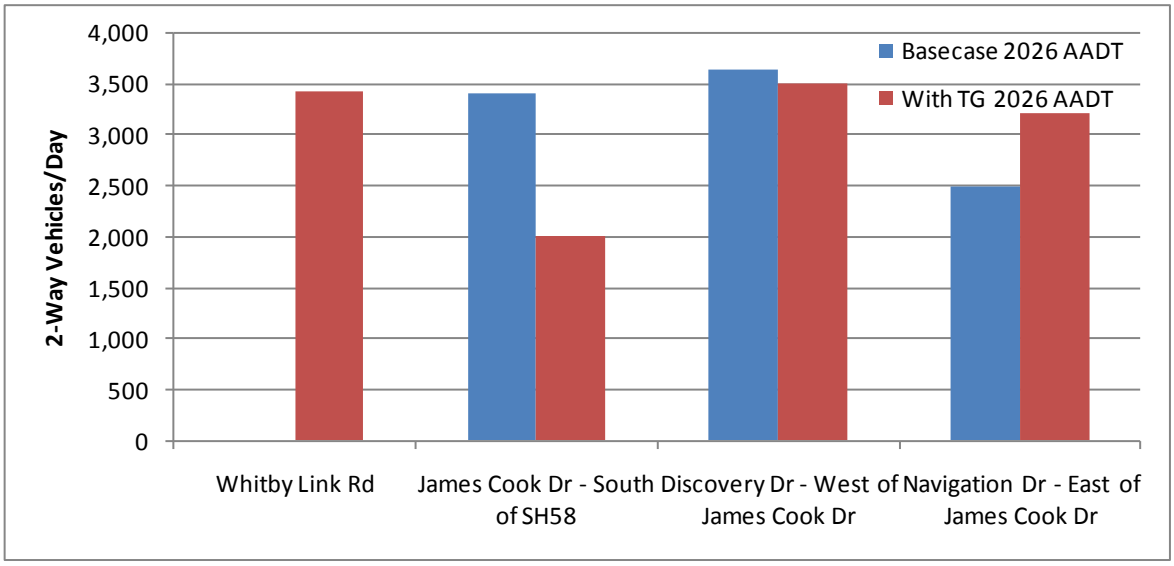
The operation of the Whitby Link Road will result in some redistribution of traffic movements within the suburb. In general, those existing roads which will act as feeder routes to and from the link road will experience some increase in traffic volumes. Other roads will see a reduction in traffic volumes as traffic utilises more convenient routes.

Figure 4.17 shows forecast traffic volumes for 2026 on the Whitby Link Road, James Cook Drive (SH58 – Discovery Drive), Discovery Drive (west of James Cook Drive) and Navigation Drive (east of James Cook Drive).

James Cook Drive (SH58 – Discovery Drive) will experience a reduction in traffic as some movements divert to the use of the link road and the Transmission Gully Project. Some of the traffic accessing the link road will use Navigation Drive (to the east of the James Cook Drive intersection), which will experience an increase in traffic volumes as a result. In this case, the existing traffic volumes are low and the wide cross-section means that this road will be able to easily accommodate the increased traffic demands without any deterioration in amenity. Discovery Drive will see a small increase in volumes, the net result of a number of gains and losses of specific movements.

Where increases in traffic volumes occur, these will be able to be easily accommodated by the existing road network in this area.

- **Figure 4.17: Forecast 2026 AADT Traffic Flows on the Whitby Link Road and Associated Roads for Basecase and With the Transmission Gully Project**



4.4.2.4. Waitangirua Link Road & Associated Roads

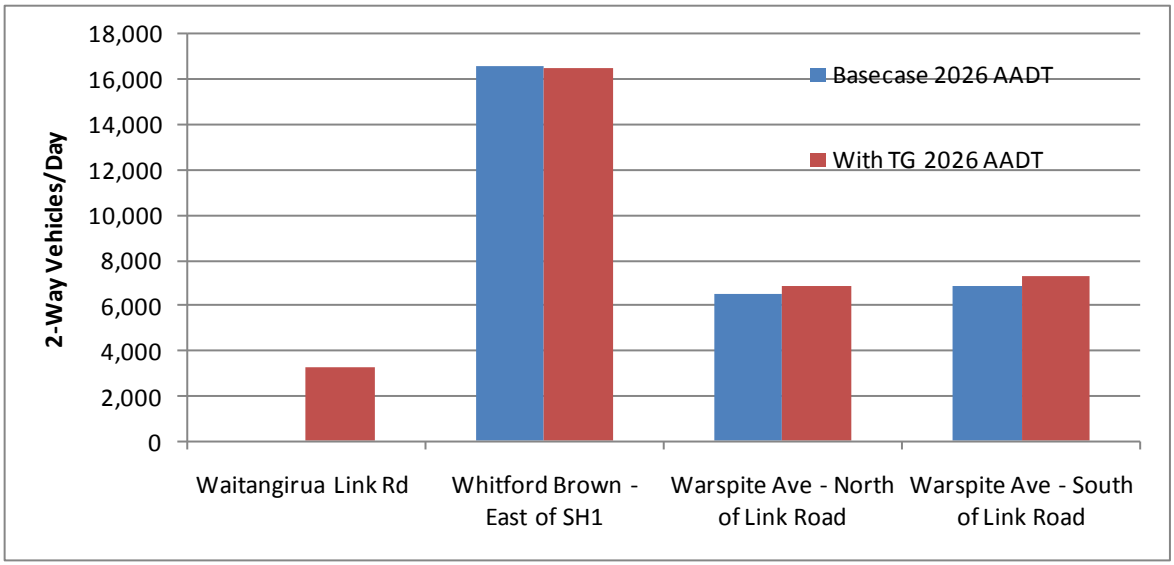
The Waitangirua Link Road is forecast to carry 3,300 vehicles/day in 2026.

Figure 4.18 shows the forecast traffic volumes on the Waitangirua Link Road, Whitford Brown Avenue and two sections of Warspite Avenue.

In general, there will be little impact upon these roads, with traffic to/from the link road replacing existing movements on Warspite Avenue.

The forecast usage of the Waitangirua Link Road is lower than that forecast in the draft SAR. This is principally because adjustments to the alignment have increased the length of the link road, and the speed environment proposed is now 50 km/hr rather than the 70 km/hr originally assumed. In addition, a more accurate representation of the proposed Petone – Grenada project in the latest assessments has changed the routes which drivers are assumed to take (between the SH2/SH1 and SH2/SH58 routes) with some impact upon the expected use of this link road.

- **Figure 4.18: Forecast 2026 AADT Traffic Flows on the Waitangirua Link Road and Associated Roads for Basecase and With the Transmission Gully Project**



4.4.2.5. SH1 Traffic

Figure 4.19 shows forecast traffic volumes on sections of SH1.

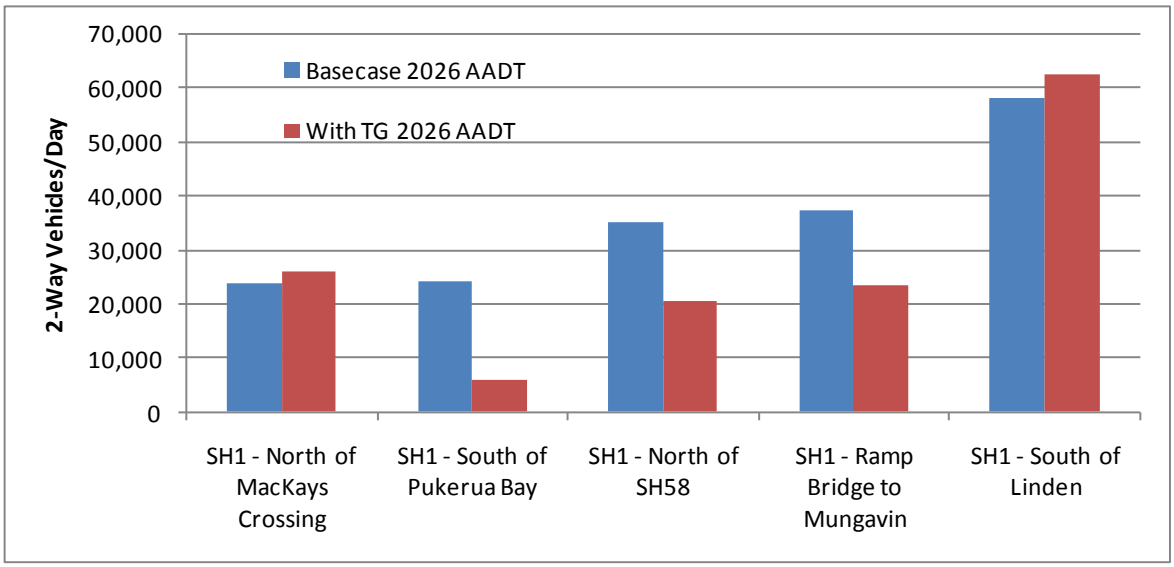
The section of the existing SH1 between Linden and MacKays Crossing will generally experience reductions in daily traffic volumes of 14,000-20,000 vehicles/day in 2026. South of Paekakariki, the residual volume on the existing SH1 will be 3,100 vehicles/day comprising only traffic with a local origin or destination. Residual volumes will be higher on sections further to the south, being 5,900 vehicles/day to the south of Pukerua Bay, 20,500 vehicles/day on Mana Esplanade and 44,200 vehicles/day south of the Mungavin interchange. The Transmission Gully Project will provide an alternative route predominantly to through traffic on SH1, and this through traffic is a

lower proportion of total traffic on SH1 further south, with the remainder of traffic having a local origin or destination.

SH1 is expected to experience some increase in traffic volumes beyond the limits of the Transmission Gully Project. To the north of MacKays Crossing and south of Linden, daily traffic volumes in 2026 are expected to increase by 11% and 8% respectively. This occurs as a result of trip induction, described in Section 4.3.1.

To the north of MacKays Crossing, this increase will be accommodated without any significant impact upon the operation of SH1, especially with the planned expressway to the north of this point. To the south of Linden, these increases are expected to result in some slight deterioration in peak-period travel times on SH1 between Linden (the southern extent of the Transmission Gully Project) and the Takapu Road (south Tawa) intersection. To the south of the Takapu Road intersection, traffic volumes on SH1 will be reduced by the operation of the proposed Petone – Grenada link road.

- **Figure 4.19: Forecast 2026 AADT Traffic Flows on SH1 for Basecase and With the Transmission Gully Project**



4.4.2.6. SH58 Traffic & Associated Roads

Figure 4.20 shows forecast traffic volumes on SH58 at three locations, on Grays Road and on the Paekakariki Hill Road.

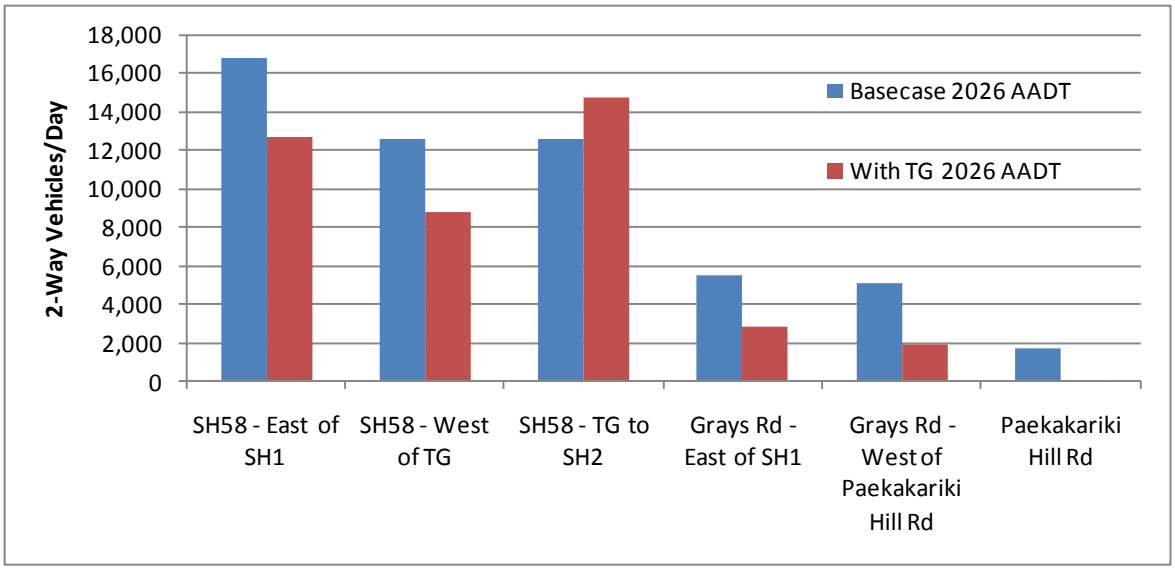
SH58 between Paremata and the Transmission Gully interchange will experience a reduction in traffic volumes of between 24% and 34%. This is predominantly due to the effective bypass that the Transmission Gully Project will provide between SH58 (east of the Transmission Gully

interchange) and SH1 (south), and the more convenient route provided (by means of the proposed link roads) for localised movements.

To the east of the Transmission Gully interchange, daily traffic volumes using SH58 will increase by 18%. This is due to the improved accessibility and hence increased volume of travel between the Kapiti and Hutt Valley areas. A number of improvements to this route are planned, which will allow these increases to be accommodated without adverse effects upon the capacity or safety of the route. These include grade separation of the SH2/SH58 intersection and the installation of a number of roundabouts to improve the accessibility and safety at side road intersections, these improvements are from the SH58 Strategy Study by MWH in August 2010.

By the provision of a fast and convenient route between SH1 at MacKays Crossing and SH58 (east) with the Transmission Gully Project, the existing routes carrying traffic between these points will experience a significant reduction in traffic volumes. These include Grays Road (where volumes will be almost halved) and the Paekakariki Hill Road, which will revert to use primarily by local traffic only.

- **Figure 4.20: Forecast 2026 AADT Traffic Flows on SH58 and Associated Roads for Basecase and With the Transmission Gully Project**

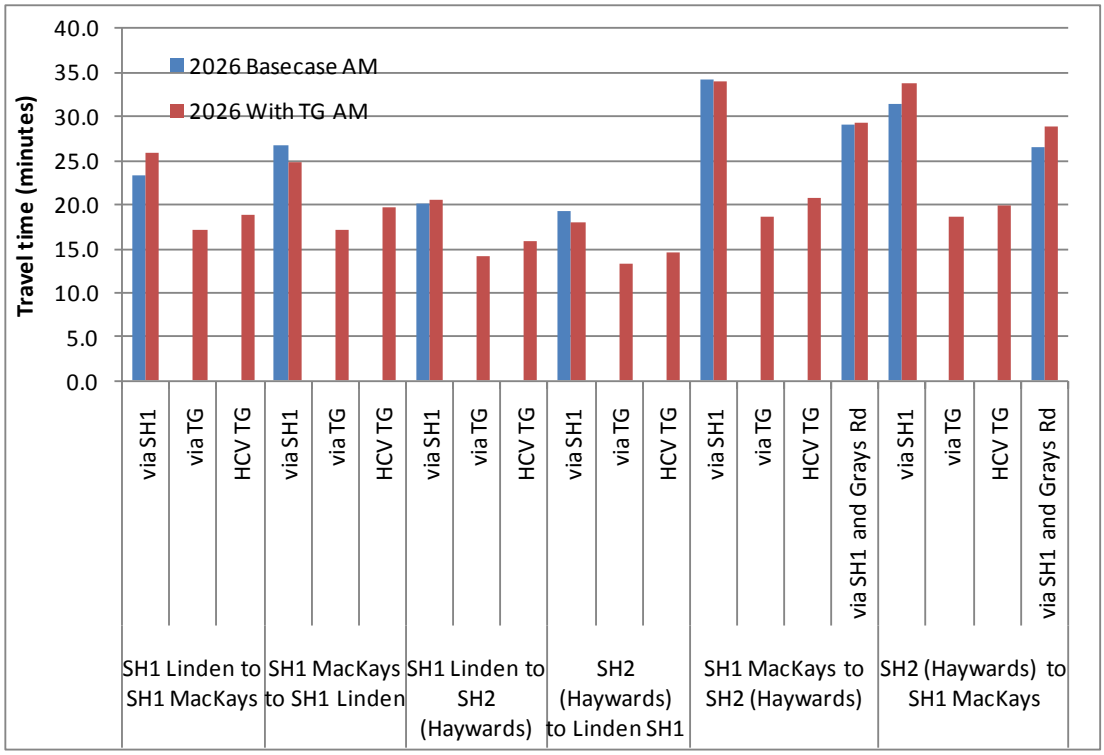


4.4.3. Effects Upon Travel Times

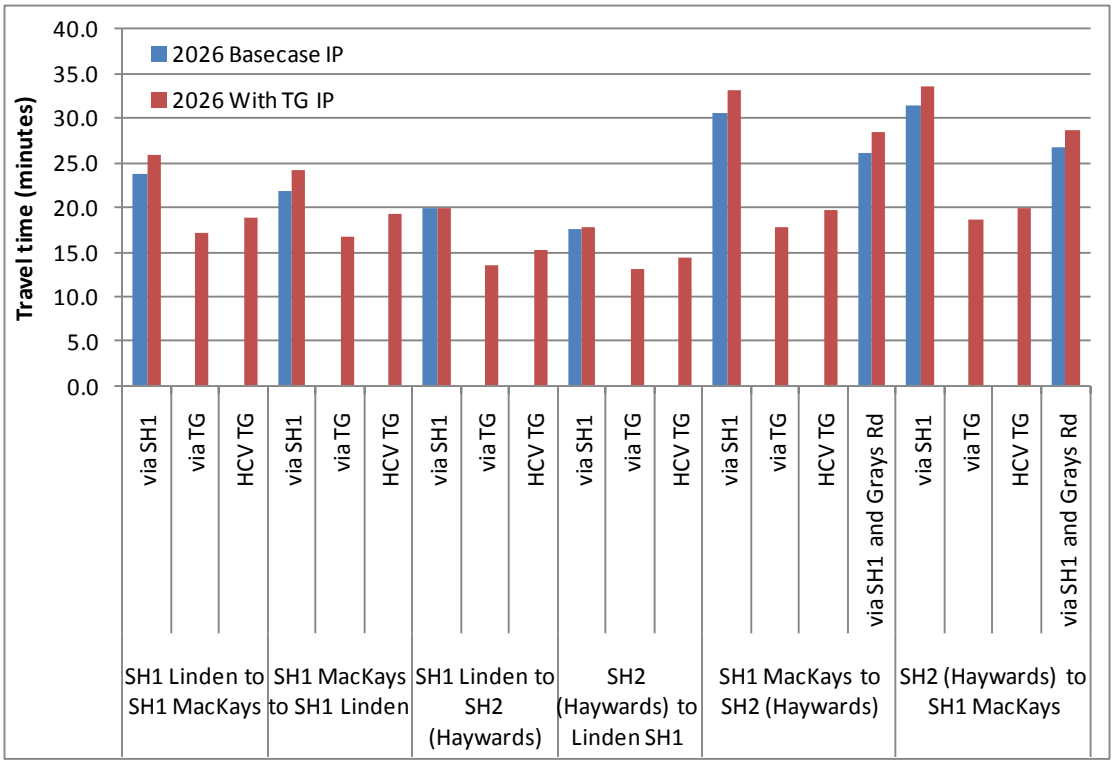
Between Linden and MacKays Crossing, the Transmission Gully Project route will be marginally longer (0.67 kms) than the existing SH1 route. However, the route will be significantly faster, depending upon the time of day that travel takes place and the levels of traffic. A vehicle travelling at the speed limit between the two end points will take 15.9 minutes along the Transmission Gully Project route, a saving of 6.7 minutes (or nearly 30%) on the time via the existing route (22.6 minutes).

The benefits of the Transmission Gully Project will be more apparent during peak period traffic conditions when congestion affects the existing SH1 route, resulting in additional delay. Figure 4.21 to Figure 4.23 summarise the forecast total travel times between Linden and MacKays Crossing in 2026 along both routes for the Basecase and With the Transmission Gully Project scenarios.

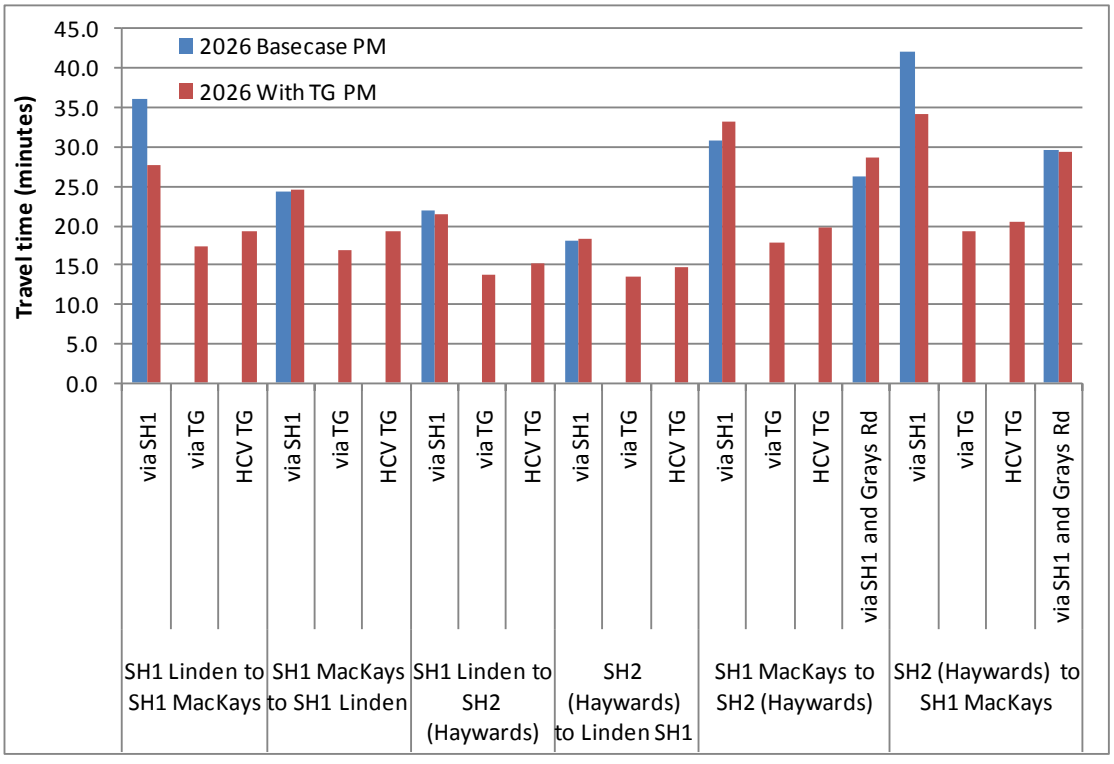
- **Figure 4.21: Key Route Travel Time Comparison 2026 AM, Basecase and With the Transmission Gully Project (minutes)**



- **Figure 4.22: Key Route Travel Time Comparison 2026 IP, Basecase and With the Transmission Gully Project (minutes)**



- **Figure 4.23: Key Route Travel Time Comparison 2026 PM Basecase and With the Transmission Gully Project (minutes)**



With the Transmission Gully Project in place, residual-traffic using the existing SH1 route will benefit from lower travel times as a result of reduced congestion, but this will be offset by the package of proposed measures to be applied to the coastal route, section 1.6.2.2, which will have the general effect of reducing travel speeds.

The net result of these effects will be determined by the time of day and direction of travel. For example, northbound movements in the AM peak period will experience some increase in travel times (because these are not currently subject to significant congestion). Conversely, southbound movements in the AM peak will benefit from reduced travel times because the effects of reducing congestion in this direction will outweigh those of the measures to be applied to the route.

It should be noted that once the Transmission Gully Project is operational, the focus of the changes to the existing SH1 coastal route will be upon securing improvements in accessibility and amenity for the adjacent communities, rather than reductions in travel time.

A comparison of the 2026 Basecase travel times on the coastal route with those via the Transmission Gully Project indicates that there will be travel time reductions in all time periods and for all journeys, some of which will be significant in scale. For example, movements between SH2 at Haywards and SH1 at MacKays Crossing will take 30 minutes in the PM peak in the 2026 Basecase, because these movements travel through Pauatahanui Village and along the edge of the Pauatahanui Inlet via Grays Road. The Transmission Gully Project will provide a much more direct and faster route, with travel times of only 19 minutes, a reduction of 11 minutes (or 37%).

4.4.3.1. Link Road Travel Times

The proposed Kenepuru, Waitangirua and Whitby Link Roads will provide improvements in accessibility to the areas they serve, allowing traffic to access the strategic road network more quickly and hence provide relief to parts of the local road network.

Figure 4.24 and Figure 4.25 provide a summary of the reductions in travel times and distances for a number of key movements which will utilise the link roads.

As expected, many of the movements with an origin or destination in the Whitby, Waitangirua or Kenepuru areas will experience significant travel time reductions. In some cases, travel time reductions are suppressed by some increase in travel distances and localised increases in traffic volumes (for example, on SH58 to the east of the proposed Transmission Gully interchange).

- **Figure 4.24: 2026 Forecast Travel Time AM Basecase and With the Transmission Gully Project (minutes)**

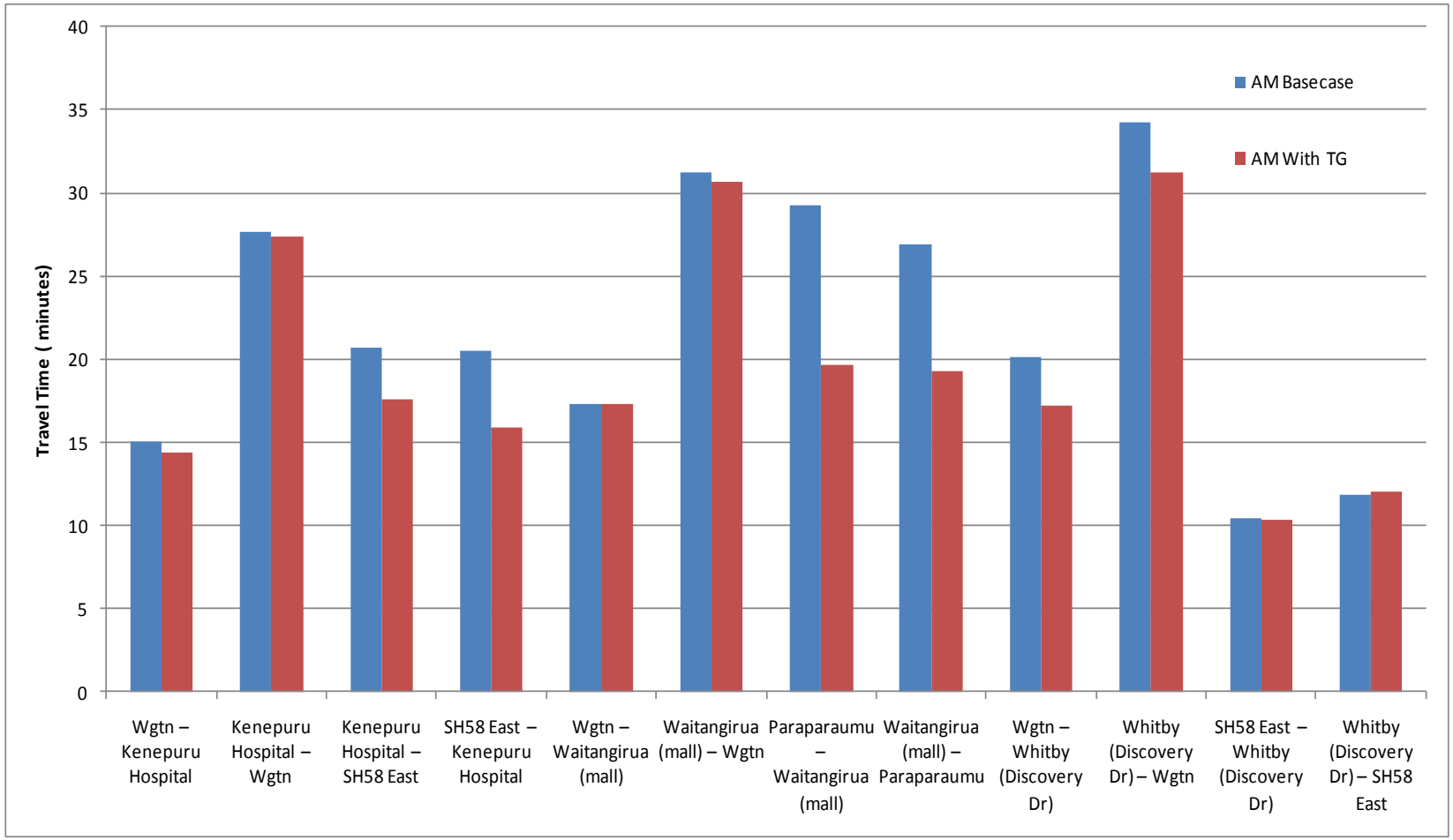
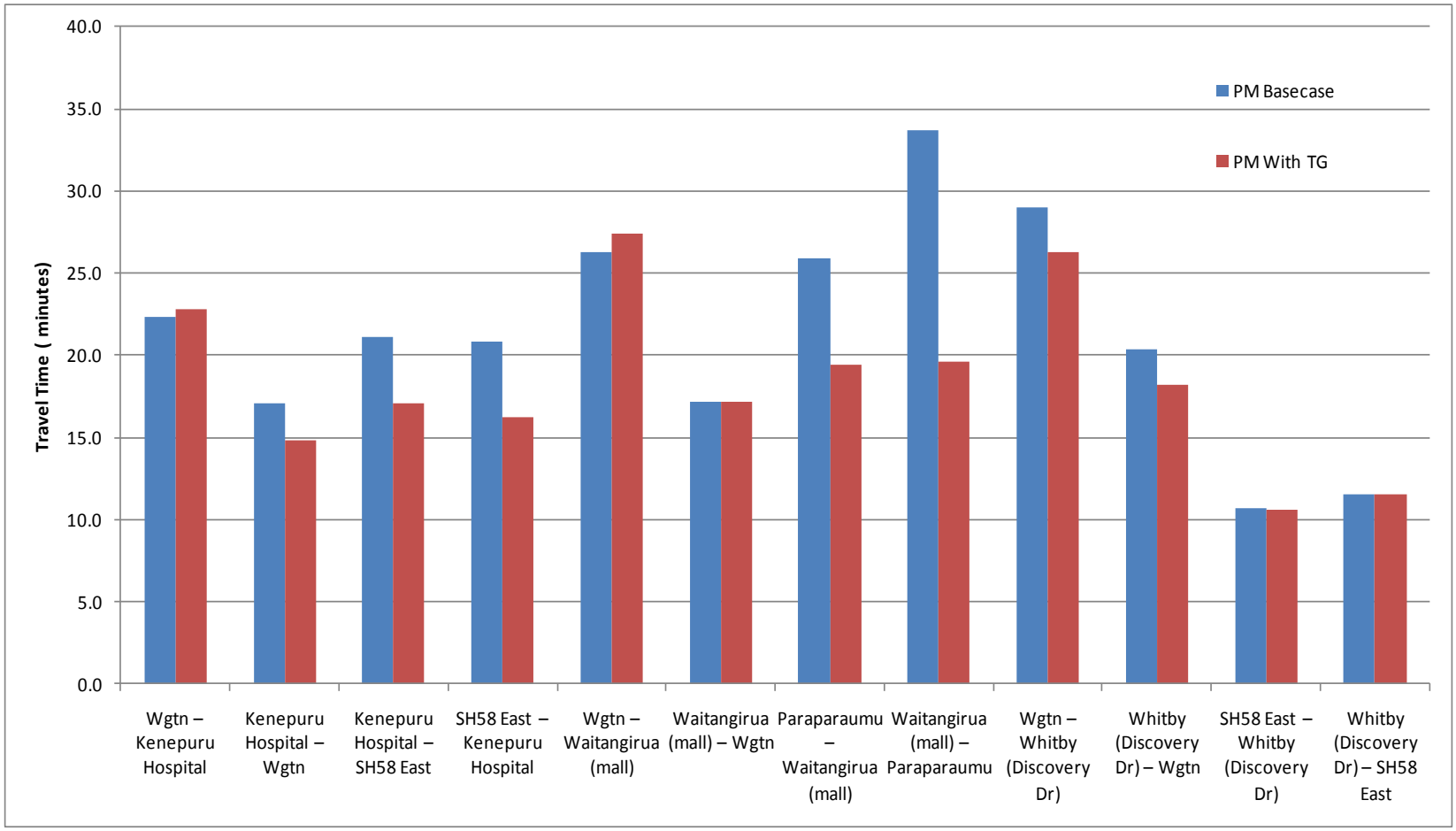


Figure 4.25: 2026 Forecast Travel Time PM Basecase and With the Transmission Gully Project (minutes)



4.4.3.2. Effects on Travel Time Variability

As described in Section 3.6, the variability or uncertainty of travel times in the SH1 corridor is a significant issue. Table 4.12 shows the travel time variability, between Linden and MacKays Crossing, both as observed for travel along the existing SH1 (Basecase, without the Transmission Gully Project) and forecast for travel along the Transmission Gully Project (With the Transmission Gully Project). Travel time variability is shown in the peak direction of travel, i.e. southbound in the AM peak and northbound in the PM peak.

As a result of significant reductions in regular congestion and the effects of random incidents, the Transmission Gully Project will virtually eliminate travel time variability for travel between Linden and MacKays Crossing, with a very low residual level of variability in 2026. This is an important benefit of the project, enabling individuals and businesses to plan their travel with a much greater degree of certainty.

- **Table 4.12: Travel Time Variability, Standard Deviation (minutes)**

	Basecase, on SH1 (2004-2009 observed[16])	With TG, on TG (2026 estimated)
Linden to MacKays Crossing (PM)	9.0	0.1
MacKays Crossing to Linden (AM)	5.0	0.1
Source: NZTA Observed, SATURN Model and Economic Evaluation Manual (EEM) Volume1 Procedures		

4.4.4. Effects Upon Freight Volumes

In combination with the package of measures to be applied to the existing coastal route (described in Section 1.6.2.2) the Transmission Gully Project will result in the removal of a large number of heavy vehicles from the existing SH1route and in particular, the communities of Paekakariki, Pukerua Bay, Plimmerton, Mana and Paremata.

The Road Transport Association (RTA) has indicated that truck drivers have a preference for avoiding urban areas because of the interruptions to travel resulting from frequent intersections[17]. This, together with a significant freight time saving of 7 minutes along the Transmission Gully Project in the peak direction in 2026, when compared to the same trip on the coastal route in the 2026 Basecase, is expected to result in virtually all through HCV movements between Linden and MacKays Crossing using the Transmission Gully Project route. This is despite the greater degree

[16] NZTA travel time data 2004 to 2009 from the Mungavin Interchange to MacKays Railway Crossing. The March 2008 PM Northbound data has been excluded as the data is not considered to be reliable.

[17] TG Road Transport Association Meeting notes, Opus International Consultants, October 2007

of ascent and descent necessary along the Transmission Gully Project route and the marginally longer distance involved. This is reinforced by support expressed for the Transmission Gully Project by the freight industry, as reported in a number of press releases and newspaper articles.[18][19]

As shown by Figure 4.13 and Figure 4.14, the Transmission Gully Project will result in large reductions in the number of the HCVs using the existing SH1 coastal route. These reductions will result in significant amenity improvements for the communities along the existing SH1route in terms of noise / vibration, air quality and severance.

As indicated in Section 3, the current difficulty of access for heavy vehicles between SH1 and SH58 (east of the Transmission Gully Project), due to the poor alignment of SH58 and Grays Road, results in many such vehicles using a longer route by means of the Ngauranga Gorge between the SH1 and SH2 corridors. By the provision of a more convenient route between SH1 and SH58, the Transmission Gully Project will remove many heavy vehicles from the routes on both sides of the Pauatahanui Inlet, and provide more direct accessibility to and from the Hutt Valley.

4.5. Effects Upon Route Security

By the introduction of a parallel alternative route to SH1, the effects of incidents (crashes and natural events such as slips and earthquakes) will be significantly reduced by the Transmission Gully Project. These effects are described in some detail in the report "Transmission Gully & State Highway 1 Coastal Route, Route Security in Earthquake Events", Opus International Consultants, June 2009. This report confirms the significant route security benefits associated with the construction of the Transmission Gully Project. These include:

- The Transmission Gully Project route bypasses sections of earthquake vulnerability on existing SH1;
- The Transmission Gully Project route is also less prone to frequent operational incidents such as slips and traffic accidents; and
- Having two routes provides a measure of redundancy and a greater level of security and availability of access in and out of the greater Wellington area.

[18] "Wellington Northern Corridor decision welcomed", Press release, Road Transport Forum, December 2009. This indicates that truck operators welcomed the decision to adopt TG over upgrading of the coastal route.

[19] "Expect crawling on the highway", Opinion piece by Richard Long, The Dominion Post, January 2010. This reports that Tony Friedlander (the then Chief Executive Officer of the RTF) is generally supportive of the TG project proposal.

4.6. Effects Upon Intersection Performance

4.6.1. Existing Intersections

Consistent with significant reductions in traffic demands on many existing roads, the Transmission Gully Project will lead to an improvement in the performance of a number of key intersections throughout the corridor. As described in Section 2.4, detailed assessments using SIDRA have in general not been undertaken where traffic reductions and hence benefits, are expected. The criteria used in Section 2.4 applies to each movement at the intersection. This means that an intersection may be modelled if one or more movements have a significant increase in traffic, despite an overall reduction in traffic demands.

Traffic reductions on Titahi Bay Road (east) and Kenepuru Drive (north of the link road) will provide some improvements in the LOS at the Titahi Bay Road / Kenepuru Drive intersection. The LOS on each leg and overall at the intersection is shown by Table 4.13.

These results indicate a significant improvement in conditions on some approaches, especially in the Inter-Peak period. This will translate into reductions in delay and queues on these approaches to this intersection.

- **Table 4.13: LOS for Titahi Bay Road / Kenepuru Drive for Basecase and With the Transmission Gully Project - 2026**

	AM		IP		PM	
Approach	**Basecase**	**With TG**	**Basecase**	**With TG**	**Basecase**	**With TG**
Kenepuru Drive South	LOS B	LOS B	LOS E	LOS B	LOS D	LOS B
Titahi Bay Road East	LOS A	LOS A	LOS A	LOS A	LOS A	LOS A
Kenepuru Drive North	LOS B	LOS A	LOS B	LOS B	LOS B	LOS B
Titahi Bay Road West	LOS A	LOS A	LOS E	LOS B	LOS F	LOS F
Overall	LOS A	LOS A	LOS C	LOS B	LOS F	LOS E
Source: SIDRA Model						

LOS on each leg of the SH1 / Whitford-Brown Avenue intersection is shown by Table 4.14. Whilst the SH1 northbound off- ramp will experience some increase in traffic demand as a result of the operation of the Transmission Gully Project, this will be offset by a large reduction in traffic volumes through the intersection. As a result, the effect of the Transmission Gully Project will be to improve the overall efficiency of operation of this intersection.

By reducing queues on the northbound off-ramp, the improvements at this location will generate a significant safety benefit by reducing potential conflicts between northbound through traffic movements and those wishing to exit to Whitford-Brown Avenue.

- **Table 4.14: LOS for SH1 / Whitford Brown Avenue for Basecase and With the Transmission Gully Project - 2026**

	AM		IP		PM	
Approach	**Basecase**	**With TG**	**Basecase**	**With TG**	**Basecase**	**With TG**
Whitford Brown Avenue	LOS B	LOS A	LOS A	LOS A	LOS B	LOS B
SH1 SB	LOS C	LOS B	LOS B	LOS B	LOS D	LOS C
SH1 NB off ramp	LOS F	LOS D	LOS D	LOS C	LOS D	LOS C
Overall	LOS C	LOS B	LOS C	LOS B	LOS D	LOS C
Source: SIDRA Model						

Although the intersection of Kenepuru Drive and Raiha Street did not meet the criteria for modelling in SIDRA, an assessment was undertaken in order to check the potential for impacts at this location as a result of the Transmission Gully Project, and the results are shown in Table 4.15.

The traffic volumes on Kenepuru Drive between the Kenepuru link road and Raiha Street intersections are expected to increase significantly (~50%) as a result of the Transmission Gully Project. Despite this, the impacts upon the operation of this intersection will be minor, because the effect of the Transmission Gully Project will be primarily to redistribute turning movements rather than increase overall traffic volumes using the intersection.

- **Table 4.15: LOS for Kenepuru Drive / Raiha Street for Basecase and With the Transmission Gully Project - 2026**

	AM		IP		PM	
Approach	**Basecase**	**With TG**	**Basecase**	**With TG**	**Basecase**	**With TG**
Kenepuru Drive East	LOS A	LOS A	LOS A	LOS A	LOS A	LOS A
Raiha Street	LOS C	LOS C	LOS D	LOS C	LOS F	LOS E
Kenepuru Drive South	LOS A	LOS A	LOS A	LOS A	LOS A	LOS A
Source: SIDRA Model						

It is stressed that because SIDRA assessments have only been undertaken for those intersections where some increases in delay could occur as a result of the Transmission Gully Project, the significant delay reductions at many other intersections have not been reported.

Reductions in volumes of through traffic will generate significant benefits to traffic turning to or from side roads along the existing SH1 route. For example, traffic wishing to exit from the Paremata railway station car-park will experience a large reduction in delays, as will traffic exiting side roads in Mana, Plimmerton, Pukerua Bay and Paekakariki.

4.6.2. New Intersections

Table 4.16 summarises the assessed performance of the new Transmission Gully Project interchanges and associated intersections for the year 2026.

For the Kenepuru Drive / Kenepuru Link intersection, both roundabout and traffic signal configurations were assessed. In consultation with both the NZTA and PCC, a roundabout was adopted as the preferred solution at this location as this would offer the most efficient means of accommodating the expected traffic demands. Also, pedestrian and cycle movements along Kenepuru Drive are able to be accommodated safely by means of an underpass beneath the Kenepuru link road approach.

For the Waitangirua Link / Warspite Avenue intersection, traffic signals were adopted as the preferred form of control, despite not providing the optimal solution in terms of traffic delays. This was because the needs of pedestrians and cyclists can be more safely accommodated at this location by traffic signals rather than a roundabout.

In both of these cases, the proposed solution would not preclude the adoption of an alternative intersection configuration at some point in the future if this was considered appropriate.

All of the other new intersections will provide a high LOS with minimal levels of delay to vehicle movements.

- **Table 4.16: LOS for New Intersections, 2026 (with the Transmission Gully Project)**

2026	With TG		
	AM	IP	PM
Kenepuru Link / Kenepuru Drive (signal)	C	C	C
Kenepuru Link / Kenepuru Drive (roundabout)	A	A	B
Waitangirua Link / Warspite Avenue (signal)	D	C	D
Waitangirua Link / Warspite Avenue (roundabout)	A	A	A
SH58 / Transmission Gully (grade-separated roundabout)	A	A	A
Transmission Gully / Kenepuru (slip roads)	A	A	A
Transmission Gully / Link Roads (north roundabout)	A	A	A
Transmission Gully / Link Roads (south roundabout)	B	B	B
Source: SIDRA Models			

4.7. Effects Upon Crash Performance

In addition to the five sections of SH1 analysed for the Basecase, the Transmission Gully Project was split into three sections for the purposes of forecasting crash numbers:

- Linden (South) to link road Interchange;
- link road Interchange to SH58 Interchange; and
- SH58 Interchange to MacKays Crossing (North).

Once the expected number of mid-block crashes on sections of SH1 and the Transmission Gully Project were calculated, for both the Basecase and With the Transmission Gully Project scenarios, a comparison was made for individual sections of SH1 and for the route as a whole, as detailed in Table 4.17.

- **Table 4.17: Crash Analysis Summary, Expected Injury Crashes in 2026, Do Min and With the Transmission Gully Project [20]**

		2026		
		Basecase Injury Crashes per year	With TG Injury Crashes per year	% change from Basecase
SH1	Linden (South) to Paremata Roundabout	11	7	-36%
	Paremata Roundabout to Plimmerton	3	2	-33%
	Plimmerton to Pukerua Bay	5	1	-80%
	Pukerua Bay	3	1	-67%
	Pukerua Bay to MacKays Crossing (North)	10	1	-90%
Transmission Gully	Linden (South) to James Cook Interchange	-	2	-
	James Cook Interchange to SH58 Interchange	-	2	-
	SH58 Interchange to MacKays Crossing (North)	-	2	-
Total	SH1route	31	12	-61%
	Transmission Gully Main Alignment	-	6	-
	Total	**31**	**18**	**-42%**
Source: SATURN Model and EEM Volume1 Procedures				

Table 4.17 shows the expected number of mid-block crashes along SH1 and the Transmission Gully Project route for both the Basecase (without the Transmission Gully Project) and With the Transmission Gully Project scenarios. Overall, a net reduction in the number of crashes of 42% is

[20] These values are indicative only, being based only upon midblock crashes.

forecast. This occurs as traffic changes route from the existing SH1, with poor geometry, limited passing opportunities and frequent intersections, to the Transmission Gully Project, which will be constructed to appropriate design standards, with grade-separated intersections and passing opportunities throughout.

As described in Section 4.4.2, traffic volumes and congestion levels on a number of local roads will be affected by the Transmission Gully Project. This will result in a change to the crash distribution, as traffic reductions and increases lead to broadly corresponding changes in the expected number of crashes.

Table 4.18 summarises the recorded number of crashes, injury and non-injury, together with forecast traffic volumes for the Basecase and With the Transmission Gully Project scenarios for each of the more significant local roads. In most cases, roads will experience reductions in volumes of traffic and hence crash numbers.

The section of Kenepuru Drive between the link road and Raiha Street intersections will experience a substantial increase in traffic, for the reasons described in Section 4.4.2.2. As this section of road already carries significant volumes of traffic, there will be a need to identify a package of appropriate traffic management measures to ensure safety is maintained in this area. As described in Section 4.4.2.2, the NZTA and PCC have agreed to work collaboratively to address resulting issues in this area.

Navigation Drive will experience a 28% increase in traffic volumes. While this could be viewed as a relatively large percentage increase, the total number of vehicles using this road remains well within the practical capacity of a road of this nature. The wide cross-section means that this road will be able to easily accommodate the increased traffic demands without any deterioration in safety.

Table 4.18: Local Road Crashes and Traffic Volume Changes

Local Road Section	Number of crashes (2005-2009)	Traffic Volumes (vehicles/day)		
		Basecase (2026)	With TG (2026)	% change[21] (2026)
Grays Road - SH1 to SH58 (includes small section of Paekakariki Hill Road)	99	5,100	1,900	-62%
Main Road - Raiha Street to Linden Avenue	28	22,000	19,100	-13%
Raiha Street - Kenepuru Drive to Prosser Street	35	10,500	10,500	0%
Kenepuru Drive - Titahi Bay Road to Kenepuru Link Road	105	15,500	15,100	-3%
Kenepuru Drive - Kenepuru Link Road to Raiha Street	34	15,500	23,100	49%
Titahi Bay Road - Mungavin Interchange to Hagley Street	147	48,300	42,600	-12%
Whitford-Brown Avenue - SH1 to Warspite Avenue	69	16,600	16,500	-1%
Warspite Avenue - Omapere Street to Waitangirua Link Road	30	6,600	6,900	5%
Warspite Avenue - Waitangirua Link Road to Waihora Crescent	37	6,800	7,300	7%
James Cook Drive - Navigation Drive to SH58[22]	9	3,400	2,000	-41%
Discovery Drive-James Cook Drive to Spinnaker Drive	14	3,600	3,500	-3%
Navigation Drive - James Cook Drive to Joseph Banks Drive[23]	3	2,500	3,200	28%
Paekakariki Road - SH1 to Grays Road	121	1,700	100	> -70%
Source: CAS Database and SATURN Model				

As described in Section 3.6.5, a significant number of crashes currently occur at intersections along the SH1 route. The removal of large volumes of through traffic from these intersections will result in a substantial reduction in the number of crashes at these locations. Table 4.19 summarises the recorded number of crashes, injury and non-injury, together with forecast traffic volumes for the Basecase and With the Transmission Gully Project scenarios for each of the key intersections along the existing SH1route.

[21] The percentage change is the change in volumes on the road and gives an indication only of the likely change in the number of crashes. As it is clear that significant reductions will arise as a result of the TG project, more detailed assessments were not warranted.

[22] There were no reported crashes in 2007 on James Cook Drive. Traffic volumes are south of SH58.

[23] Navigation Drive is a new section of road and hence there were no recorded crashes prior to 2008.

■ **Table 4.19: SH1 Intersection Crashes and Traffic Volume Reductions**

SH1 Intersections	Number of observed crashes (2005-2009)	SH1 Traffic Volumes (vehicles/day)		
		Basecase (2026)	With TG (2026)	% change[24] (2026)
Paekakariki / Beach Road	9	26,500	5,700	-79%
Ames Street	2	23,000	4,600	-80%
Pa/Toenga Road	63	23,600	5,200	-78%
Pukerua Beach Road	4	24,600	6,300	-75%
Wairaka Road	2	24,100	5,800	-76%
Teihana Road	12	24,400	6,100	-75%
Gray Street	3	25,200	7,000	-72%
Airlie Road	9	24,100	5,900	-75%
Plimmerton Roundabout	17	25,400	7,300	-71%
Grays Road	9	27,200	9,100	-66%
Steyne Avenue	8	29,500	14,600	-50%
Pope Street	8	28,700	13,900	-51%
Acheron Road	20	30,400	15,700	-48%
Mana View Road	22	32,900	18,400	-44%
Pascoe Avenue	12	35,700	21,200	-41%
Marina View Road	7	35,000	20,500	-41%
Paremata Roundabout	73	48,200	31,200	-35%
Whitford Brown Avenue	24	41,900	33,200	-21%
Mungavin interchange	67	86,500	69,400	-20%
Source: CAS Database and SATURN Model				

4.8. Remote Impacts of the Transmission Gully Project

Whilst the primary effects of the Transmission Gully Project will be felt in the more immediate SH1 and SH58 corridors, some changes in traffic volumes will occur in areas more distant from the project.

Table 4.20 shows traffic volume changes as a result of the Transmission Gully Project on a number of key road sections elsewhere in the region. These results indicate that the effects of the Transmission Gully Project will be less significant upon other parts of the road network, and likely to be within the normal day to day variability in traffic volumes.

[24] The percentage change is the change in volumes on the road and is indicative only of the likely change in the number of crashes.

- **Table 4.20: Traffic Flows on Key Roads in the Wider Network, 2026**

Road Section	2026 Volumes (Vehicles/Day)		Change	
	Basecase	With TG	Absolute	%
SH1 Ngauranga Gorge	82,000	82,100	100	0.1%
SH1 Ngauranga – Aotea	107,700	107,700	0	0.0%
SH1 Terrace Tunnel	66,000	66,000	0	0.0%
SH1 Raumati	33,600	35,100	1,500	4.5%
SH2 Ngauranga – Petone	84,200	84,000	-200	-0.2%
SH2 South of Haywards	41,400	41,200	-200	-0.5%
SH2 North of Haywards	40,300	40,700	400	1.0%
Petone – Grenada Link	29,700	28,900	-800	-2.7%
Source: SATURN Model				

The effects are greatest on SH1 immediately to the north of the Transmission Gully Project at Raumati because of the combined effects of mode transfer and trip induction. The small reduction in traffic volumes using the Petone – Grenada link arises as a result of the improved travel times between Porirua and SH58 / SH2 due to the Transmission Gully Project.

4.9. Effects Upon Public Transportation

4.9.1. Rail Network

The process of seeking a designation for the Transmission Gully Project necessarily requires an assessment of the effects of the project alone. One of these effects is a transfer of some trips from public transportation, principally the parallel rail network.

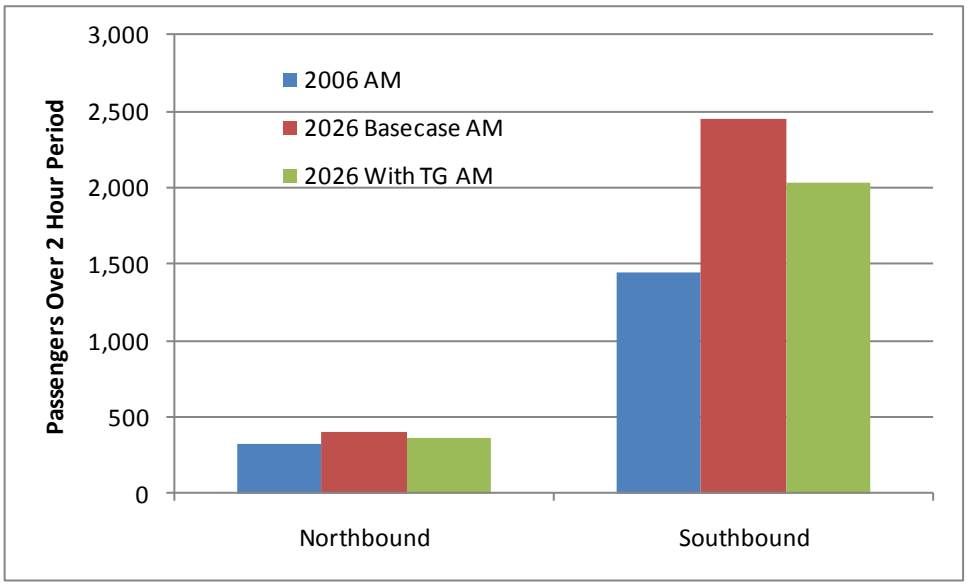
Figure 4.26, Figure 4.27 and Figure 4.28 show the number of passenger movements on the Paraparaumu line at a point south of Pukerua Bay, for 2006, the 2026 Basecase and 2026 With the Transmission Gully Project scenarios in each peak. The figures are disaggregated by time period and direction.

This indicates a significant growth in rail patronage (of up to 69% in the peak periods and directions) between 2006 and the 2026 Basecase, driven largely by the combined effects of investment in the rail network and increasing congestion on State Highway 1 and other routes.

The opening of the Transmission Gully Project after the rail upgrades have been completed will then lead to some reductions in patronage on the rail network (of up to 17% relative to the 2026 Basecase, and for the peak periods and directions of travel). However, the combined effect of the improvements to the rail and road infrastructure remains a significant net gain in rail patronage between 2006 and the 2026 'with the Transmission Gully Project' scenario, even when allowance is made for 'background' growth in this period.

This is consistent with the findings and recommendations of the Western Corridor Strategy. The WCS identified that upgrades to either the roading network or the rail network alone would not adequately address the issues in the corridor, and a combined package was required which improved rail patronage whilst also significantly improving the capacity of the road network.

- **Figure 4.26: Passenger Movements South of Pukerua Bay in the AM Peak**



- **Figure 4.27: Passenger Movements South of Pukerua Bay in the Inter Peak**

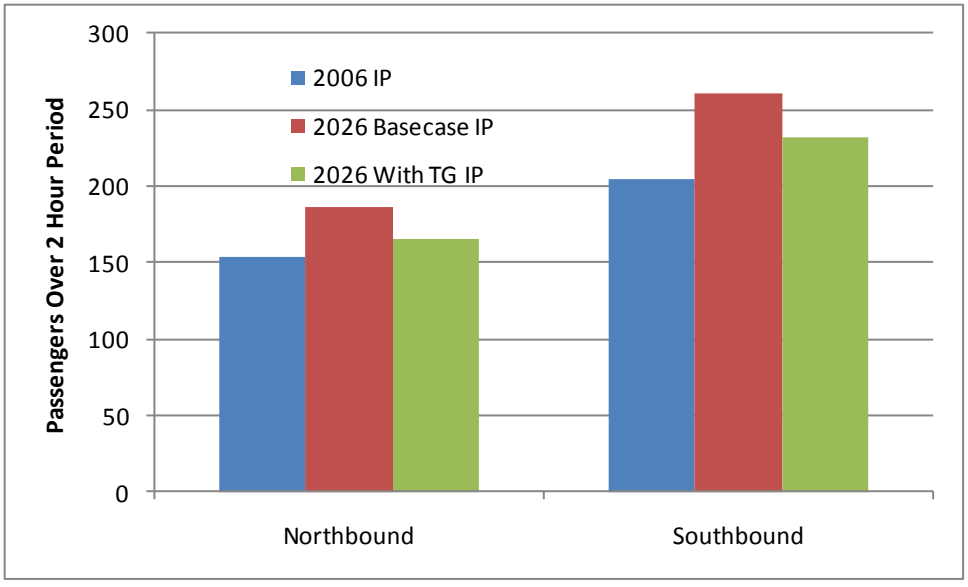
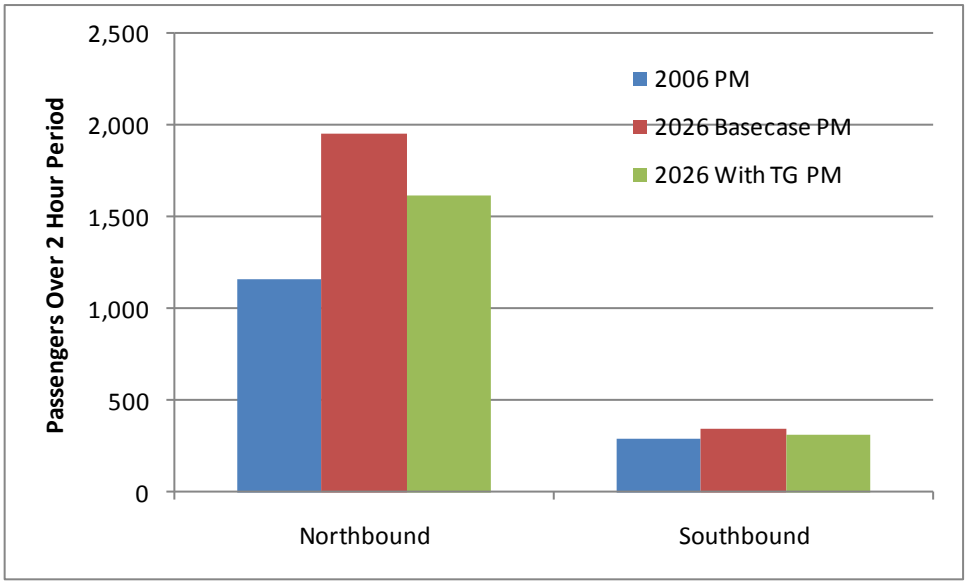


Figure 4.28: Passenger Movements South of Pukerua Bay in the PM Peak



The complementary nature of the relationship between rail and road upgrades in this corridor was recognised in the 2005 consultation document for the Western Corridor Study, which observed that[25]:

"Passenger transport infrastructure and Travel Demand Management strategies should be introduced before building new highway infrastructure. Making improvements to rail before the road infrastructure would encourage people to switch to rail and provide increased capacity for the shift from private to public transport that could be expected during any future roading improvements.

An improved rail service would also retain a greater proportion of the shift to public transport following roading improvements, which would help achieve less traffic on the highway for longer."

4.9.2. Bus Network

The effects of the Transmission Gully Project upon bus patronage will be small and will relate mainly to the use of buses for connection to the rail network.

Some bus routes will benefit from the congestion relief attributable to the Transmission Gully Project, allowing for more reliable operation against published timetables. For example, bus services which connect with trains at the Paremata railway station will not be subject to high delays exiting to the Paremata roundabout. In the 2026 PM peak the delay is expected to decrease from

[25] Proposed Western Corridor Plan: Consultation Document. *GWRC / Transit NZ, October 2005.*

approximately 5 minutes in the Basecase to less than 30 seconds with the Transmission Gully Project.

4.9.3. Walking / Cycling

It is not expected that the Transmission Gully Project will have any noticeable effect on the number of trips made by the active modes of transport (walking, cycling).

However, the removal of large volumes of traffic from the existing SH1 route and some local roads will create significant opportunities for improved cycling and walking facilities. Use of the existing cycleway adjacent to SH1 between Pukerua Bay and Paekakariki will become a less intimidating and more pleasant experience, which is likely to result in increased usage.

Similarly, severance will be significantly reduced in communities such as Pukerua Bay, allowing the railway station to be more readily accessed from residential areas to the west of the existing SH1. At Mana, the retail area on the western side of SH1 will be more easily accessible by pedestrians and cyclists from residential areas to the east.

Proposals for the form of the Kenepuru Link Road / Kenepuru Drive and Waitangirua Link Road / Warspite Avenue intersections have taken account of the needs of pedestrians and cyclists. In this respect, the provisional intersection designs have been developed in close liaison with both PCC officers.

The Transmission Gully Main Alignment will cross a number of established walking and cycling routes. At these locations, access is generally being maintained or enhanced through the provision of underpasses, as described in the Urban Design and Landscape Framework (Technical Report #23). Such crossing facilities will be conveniently located close to the ‘desire lines’ for walking and cycling movements, ensuring that the Transmission Gully Main Alignment does not become a line of severance.

4.10. Overall Assessment of Effects

Table 4.21 summarises the effects of the Transmission Gully Project upon the operation of the transportation network (for which more detail is provided in the preceding sections of this report.

Table 4.21: Assessment of Effects of the Transmission Gully Project

Effect	Description
Reduced Travel Times	Significant reductions in travel times, both of users of the Transmission Gully Project and users of the local road network
Reduced Travel Time Variability	Significant reductions in the variability of travel times in the corridor, allowing individuals and businesses to plan travel with a greater degree of certainty.
Reduced Intersection Delays	Reductions in delays at a number of intersections along the existing SH1 route, allowing movements to and from side roads to be made more easily and improving accessibility
Reduced Travel Distances	Although the Transmission Gully Project will be slightly longer than the existing SH1 route, travel distances for movements between the Hutt Valley and SH1 (north) will be significantly reduced
Improved Safety	The use by traffic of a continuous four-lane route with a solid median barrier and grade-separated intersections will offer significant safety benefits. Road sections and intersections along the existing SH1 route will experience large reductions in crash numbers as a result of the removal of through traffic.
Reduced Community Severance	Communities along the existing SH1 route and elsewhere (for example, Pauatahanui) will benefit from the removal of large volumes of extraneous traffic, especially commercial vehicles. This will enable these communities to benefit from improved connectivity between residential areas and facilities.
Improved network security	The region will benefit from a reduced probability and duration of isolation following a major natural event such as an earthquake, tsunami or landslip.
Improved conditions for walking and cycling	The removal of traffic from the existing SH1 route will encourage the uptake of walking and cycling alongside and across this route.
Public Transport	Whilst the Transmission Gully Project on its own will lead to some reductions in rail patronage, the project should be viewed as one component of a balanced package of measures for the corridor, which seek to improve conditions across all modes of transportation. Reductions in traffic volumes will allow the reliability of local bus services to be improved.

5. Sensitivity Testing

5.1. Tests Performed

The core analysis of the Transmission Gully Project necessarily makes a number of implicit assumptions regarding the future form of the transportation network. Tests have been undertaken to assess the sensitivity of the analysis to variance in these key assumptions. The purpose of these tests is to confirm the validity of the core assessment of the Transmission Gully Project with changes to these assumptions. These sensitivity tests have been reviewed and accepted by an independent peer reviewer, the review can be found in Appendix G.

The tests performed relate to the proposed Transmission Gully Project, but with the following changes:

- **Old Designation:** assumes instead the original Transmission Gully Project proposal (the existing designation), with separate intersections providing access to link roads serving the Waitangirua and Whitby areas;
- **No Coastal Package:** assumes that no package of measures is applied to the existing SH1 coastal route (the Transmission Gully Project is as proposed);
- **No Link Roads:** assumes the Waitangirua and Whitby Link Roads are not constructed (the rest of the Transmission Gully Project as proposed);
- **No RoNS:** assumes the other RoNS projects in the SH1 corridor do not occur (the Transmission Gully Project as proposed);
- **No Petone – Grenada link road** (the Transmission Gully Project as proposed and all other roading projects assumed to be operational);
- **Fuel Prices:** assesses the effects of lower and higher fuel prices than those assumed in the core scenarios; and
- **No Roading Upgrades:** assumes a 'worst-case' in which none of the roading projects planned for the region (including the other RoNS projects and the Petone – Grenada link road) are assumed to be operation by 2026.

The results of these tests are described in the sections which follow. Whilst all of the travel time and traffic volume changes have been reviewed in detail as part of this assessment, for reporting purposes only the more significant changes have been identified.

5.1.1. Effect of the Changes to the Designation and Link Roads

The original Transmission Gully Project designation envisaged separate interchanges on the Transmission Gully Main Alignment for the Waitangirua and Whitby Link Roads, and that both of these link roads would have operating speeds of 70km/hr. For the current proposal, these link roads connect to the Transmission Gully Main Alignment at a single interchange and are proposed

to have operating speeds / posted speed limits of 50km/hr. The purpose of this sensitivity test was to identify if any significant changes in the routing of vehicles would be likely as a result of the latest link road alignments, connectivity and operating speeds compared to the original designation.

Changes to the designation of the Transmission Gully Main Alignment are slight and have little or no effect upon traffic routing. Whilst changes to the configuration of the Whitby and Waitangirua Link Roads are more significant, the resulting changes are localised. The effect of moving the Waitangirua Link Road connection to the north (i.e. to the new James Cook interchange) is to make the use of this link road less attractive to traffic to/from the south (SH1, Wellington) and more attractive to traffic to/from the north (principally SH58 east). The Whitby Link Road is in a very similar location to that previously proposed and so the effects of this change are insignificant.

In addition to these effects, the current designation results in the link roads being slightly longer which, together with lower assumed operating speeds, (50 km/hr instead of 70 km/hr) makes their use marginally less attractive.

With the Whitby Link Road largely unchanged, the changes in traffic volumes as a result of the speed and length changes are minor (less than 50vph in each peak period).

With the more significant changes to travel times on the Waitangirua Link Road, the impact on traffic volumes as a result of the changes is more significant. Reductions of up to 300 vehicles/hour are expected to occur in the westbound direction in the PM peak, predominantly due to traffic which was using the Waitangirua Link Road to travel between SH58 and the Titahi Bay area switching to using the Kenepuru Link Road.

The effects of implementing the originally designated project in preference to that now proposed (and assessed by the 'With the Transmission Gully Project' scenario) would be to change travel times and hence the routes used for some trip movements. This would have the effect of increasing or decreasing traffic volumes on a number of roads within the area in which the link roads are located.

The more significant changes would be (for the 2026 assessment year):

- Higher daily traffic volumes on the Transmission Gully Main Alignment (between Linden and the Porirua link road interchange) of 1,500 – 2,500 vehicles/day (8 – 13%). This is due to the slightly shorter and faster Waitangirua Link Road encouraging some vehicle trips to use a route between western and eastern Porirua via the Kenepuru Link Road and Main Alignment in preference to Whitford-Brown Avenue and Warspite Avenue;
- Higher traffic volumes using the Kenepuru Link Road (900 vehicles/day / 7%); and

- Slightly higher traffic volumes using the Whitby Link Road (500 vehicles/day / 15%) and Discovery Drive (400 vehicles/day / 11%), due to minor localised rerouting around the interchange area.

These changes would have little impact upon the performance of existing intersections, where changes in forecast delays would be less than 5 seconds per vehicle.

The forecast change in traffic volumes using the link roads is the net result of traffic increases and decreases arising from the effects described above.

These changes are minor within the overall context of the link volumes and those forecast to use the Transmission Gully Main Alignment and there is little overall effect on the reported analysis. These increases are well within the carrying capacity of the currently proposed Transmission Gully Main Alignment and link roads, and also the existing Discovery Drive. The overall conclusions of the assessment regarding the effects of the Transmission Gully Project remain unchanged.

It is possible that sections of the link roads will be posted with a 70 km/hr limit where adjacent development is limited, or in the shorter term prior to development taking place. Further testing identified that this would attract some additional traffic to these routes. On this basis, the core 'with the Transmission Gully Project' assessment, by assuming the application of 50 km/hr speed limits, may be regarded as adopting a pessimistic position with regard to the potential benefits of the link road components of the wider project.

Conclusion: whilst changes to the detail of the proposed Porirua Link Roads would have some effect upon the routing of local traffic, the wider effects of the Transmission Gully Project would remain unaffected.

5.1.2. Effect of the Coastal Route Package

It is anticipated that when the Transmission Gully Project is operational, the existing SH1 route will be modified to provide for improved local accessibility and amenity. As described in Section 1.6.2.2, a package of measures for the coastal route has been developed which represents the types of changes that are expected to be applied along this route.

Because these measures are still subject to further refinement with the relevant territorial authorities, some changes in the detail are possible which could have minor effect on the volumes of traffic using the existing SH1.

As a conservative case, this sensitivity test has assumed that no changes would be made to the coastal route when the Transmission Gully Project is operational.

Key flow or travel time increases identified (>5%) for the sensitivity test compared to the 'With the Transmission Gully Project' scenario include:

- Higher residual traffic volumes on the existing SH1 between the Paremata Roundabout and the northern tie-in at MacKays Crossing (2,700 vehicles/day / 13% north of the Paremata roundabout and 2,900 vehicles/day / 48% south of Pukerua Bay).

These changes would have little impact upon the performance of existing intersections, where changes in forecast delays would be less than 5 seconds per vehicle.

These increases in the volumes of residual traffic on SH1would occur in response to the balance of the travel times between the Transmission Gully Project and the existing SH1 route. Without the application of any measures to the coastal route, travel times on this route would be slightly lower, with a small reduction in the travel time benefits offered by the Transmission Gully Project. As a result, a greater proportion of drivers would remain on the existing coastal route. Whilst all through traffic from Linden to MacKays Crossing would still use the Transmission Gully Project, some trips with a local origin or destination towards the ends of the Transmission Gully Project would revert back to the use of the existing SH1 and local roads in preference to the Transmission Gully Project. The reductions on the Transmission Gully Main Alignment are expected to be between 7% and 10% north of the Kenepuru Link Road.

Conclusion: even without the application of measures to the existing coastal route, the assessed effects of the Transmission Gully Project would remain largely unchanged. The project would continue to offer a high level of benefits (in terms of traffic removal) to the communities along the existing SH1 route (and Pauatahanui village). This result emphasises the importance of the coastal route package for 'locking-in' the benefits of the Transmission Gully Project.

5.1.3. Effect of the Whitby & Waitangirua Link Roads

PCC has responsibility for the funding and construction of the Porirua (Whitby and Waitangirua) link roads. Whilst PCC considers the link roads will attract a high level of funding support from the NZTA, some uncertainty nonetheless exists around the provision of these roads.

For this reason, it is considered appropriate to assess how the evaluation of the Transmission Gully Project would be affected if the link roads were not constructed (this does not apply to the Kenepuru Link Road, which is the responsibility of the NZTA and is part of the main project).

This test assesses the effect of NOT providing either the Whitby or the Waitangirua Link Roads, as currently proposed.

Key flow or travel time increases identified (>5%) for the sensitivity test compared to the 'With the Transmission Gully Project' scenario include:

- Increases in daily volumes on SH1 north of the Mungavin interchange (1,300 vehicles/day / 5%);
- Increases in daily volumes on James Cook Drive south of SH58 (500 vehicles/day / 25%);
- Increases in daily volumes on Discovery Drive (370 vehicles/day / 11%);
- Increases in daily volumes on SH58 west of the Transmission Gully Project (3,700 vehicles/day / 42%); and
- Increases in daily volumes on SH58 east of SH1 (1,000 vehicles/day / 8%).

These increases are the result of reductions on some local roads and the Transmission Gully Main Alignment, these include:

- Decreases in daily volumes on Navigation Drive east of James Cook Drive (-410 vehicles/day / -6%);
- Decreases in daily volumes on Warspite Ave south of the proposed Waitangirua Link Road connection (-480 vehicles/day / -15%); and
- Decreases in daily volumes on the Transmission Gully Main Alignment south of SH58 (between 1,100 and 2,300 vehicles/day / 6% and 11%).

These changes would have little impact upon the performance of existing intersections, where changes in forecast delays would be less than 5 seconds per vehicle.

Without these link roads, the residual traffic volumes on the existing SH1 would be higher, with lower volumes using the Transmission Gully Main Alignment. Without the link roads in place, traffic wishing to access Porirua East would continue to use SH58 and James Cook / Discovery Drive or Mungavin Avenue as at present. As a consequence, traffic volumes on these roads would be higher than for the 'with the Transmission Gully Project' scenario.

The effect of not constructing the link roads would be to reduce the level of benefits provided by the Transmission Gully Project to SH58, James Cook Drive and Discovery Drive and the accessibility provided to Whitby and eastern Porirua.

Nonetheless, without the link roads, the core benefits of the Transmission Gully Project would remain strong, with significant reductions in traffic volumes on the existing SH1 route and other roads.

This result emphasises the importance of the link roads as components of the wider Transmission Gully Project, allowing the benefits to the local road network to be maximised.

Conclusion: although the Porirua Link Roads are not essential to the achievement of the wider benefits of the Transmission Gully Project, they would play an important role in the provision of

accessibility to eastern Porirua and in the reduction of residual traffic volumes on other parts of the road network.

5.1.4. Effect of the Other RoNS Projects

The Transmission Gully Project is one component of the WNC RoNS. While there is clear commitment from the Government and NZTA to construct the whole of the RoNS, a risk nonetheless exists that other projects could be deferred or even cancelled for unforeseen political or financial reasons.

This risk has been addressed by an assessment of the Transmission Gully Project without the other RoNS projects in place. It is stressed that this is considered to be a 'worst case' assessment as the likelihood of this scenario materialising is considered to be low.

This test identifies that there are no locations where traffic volumes would increase significantly without the other RoNS projects. The main effect is a small reduction in total traffic in the corridor, as a result of trip suppression and a reduced transfer from rail. All of this decrease would be experienced along the Transmission Gully Main Alignment, with no change to the residual volumes forecast to use the existing SH1 coastal route.

Conclusion: even as a stand-alone project without other planned improvements along the SH1 corridor between Wellington Airport and Levin, the effects of the Transmission Gully Project would be little changed from those reported in the core assessment. The construction of the other components of the RoNS package will however provide for a more consistent standard of road provision between these points, with some enhancement of the benefits offered by the Transmission Gully Project.

5.1.5. Effect of Petone – Grenada Link Road upon the Transmission Gully Project Assessment

The proposed Petone – Grenada link road will provide a more direct connection between SH1 at Grenada and SH2 at Petone, providing traffic relief to Ngauranga Gorge and the Ngauranga – Petone section of SH2.

The Petone – Grenada link road can be expected to result in some redistribution of travel in its own right, which could affect the level of benefits generated by the Transmission Gully Project.

The purpose of this test was to determine confirm the validity of the core assessment of the Transmission Gully Project if the Petone – Grenada project were not to proceed.

The complexity of this relationship between the two projects warranted a more detailed assessment in which the proposed Petone – Grenada link road was removed from both the 'Basecase' and 'With the Transmission Gully Project' scenarios.

Furthermore, allowance has been made for the potential redistributional effects of the Petone – Grenada link road by running these scenarios in the WTSM model, in order to ensure that realistic patterns of traffic demands were derived.

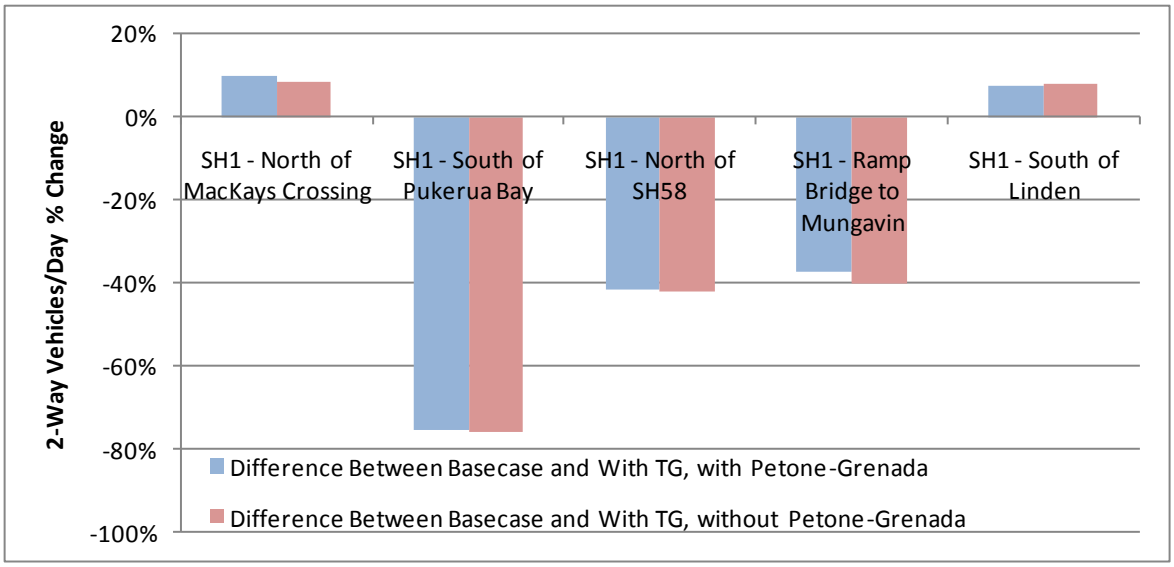
Figure 4.29 to Figure 4.33 show the effects of the Transmission Gully Project (in terms of percentage changes in traffic volumes on key road sections in 2026) for both the core analysis (i.e. with the Petone – Grenada link road assumed to be constructed) and for a sensitivity test in which the Petone – Grenada link road was not constructed. Specifically, the figures show how the absence of the Petone – Grenada link road would affect the traffic changes provided by the Transmission Gully Project for:

- Figure 4.29: sections of the existing SH1 route;
- Figure 4.30: sections of SH58, Grays Road and the Paekakariki Hill Road;
- Figure 4.31: roads in the vicinity of the Kenepuru Link Road;
- Figure 4.32: roads in the vicinity of the Whitby Link Road; and
- Figure 4.33: roads in the vicinity of the Waitangirua Link Road.

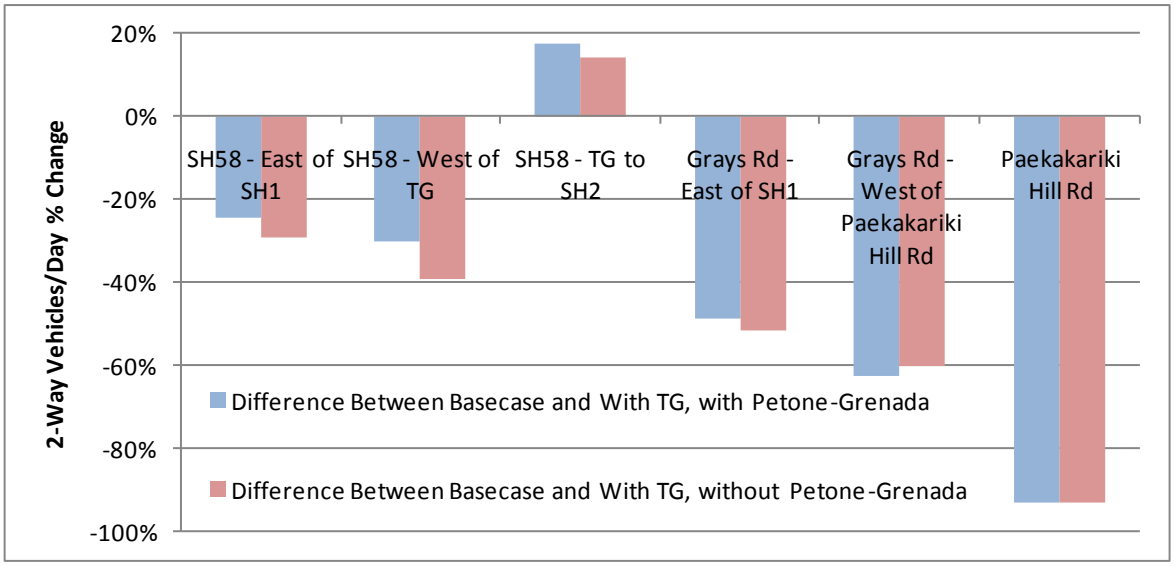
Changes on individual road sections are the net result of a number of factors, including the redistributional effects of the Petone - Grenada link road, and some changes in traffic routing. In general, the absence of the Petone – Grenada link road would result in some increased traffic volumes using the SH2 / SH58 corridors, in preference to SH1. With higher volumes using SH58, the Transmission Gully Project would result in a larger reduction in traffic volumes using SH58 to the west of the Transmission Gully interchange, and a smaller increase to the east of the Transmission Gully interchange.

Overall, the changes in traffic volumes attributable to the Transmission Gully Project (and hence the benefits generated by the project) would not be significantly affected if the proposed Petone - Grenada project were not to be constructed.

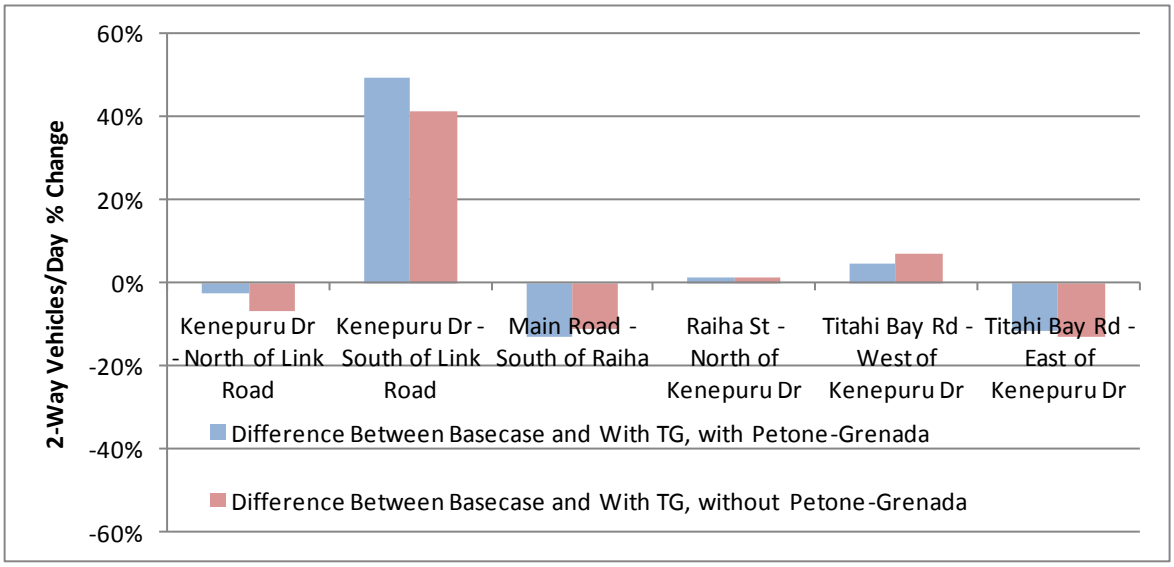
- **Figure 4.29: 2026 Percentage Changes in AADT Traffic Flows Attributable to the Transmission Gully Project on SH1, with and without the Petone – Grenada link road**



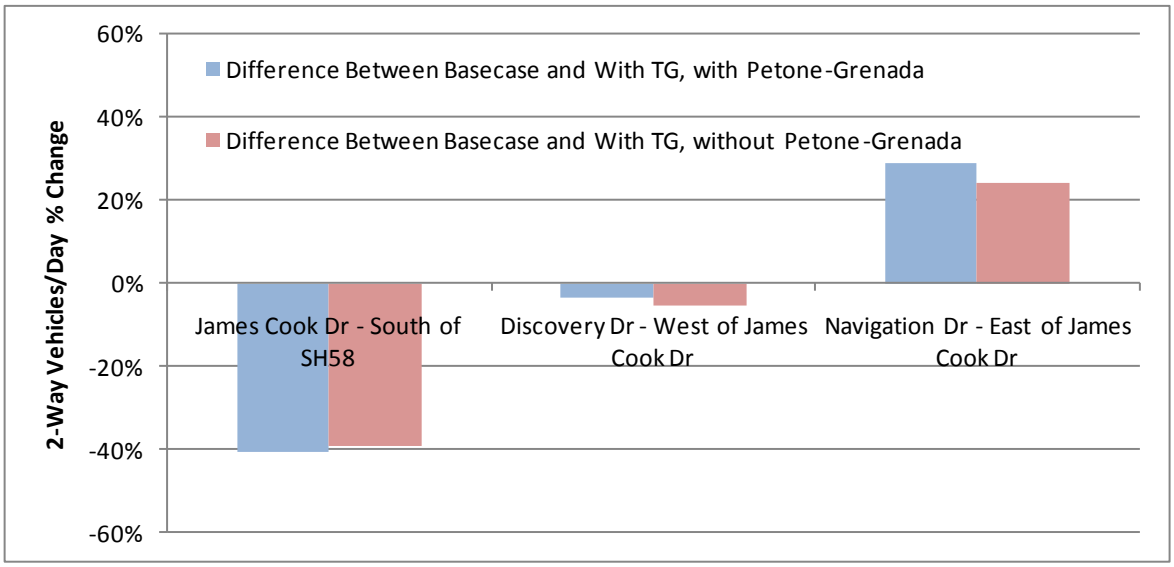
- **Figure 4.30: 2026 Percentage Changes in AADT Traffic Flows Attributable to the Transmission Gully Project on SH58 and Associated Roads, with and without the Petone – Grenada link road**



- **Figure 4.31: 2026 Percentage Changes in AADT Traffic Flows Attributable to the Transmission Gully Project on the Kenepuru Link Road and Associated Roads, with and without the Petone – Grenada Link Road**



- **Figure 4.32: 2026 Percentage Changes in AADT Traffic Flows Attributable to the Transmission Gully Project on roads in the vicinity of the Whitby Link Road, with and without the Petone – Grenada Link Road**



- **Figure 4.33: 2026 Percentage Changes in AADT Traffic Flows Attributable to the Transmission Gully Project on roads in the vicinity of the Waitangirua Link Road, with and without the Petone – Grenada Link Road**

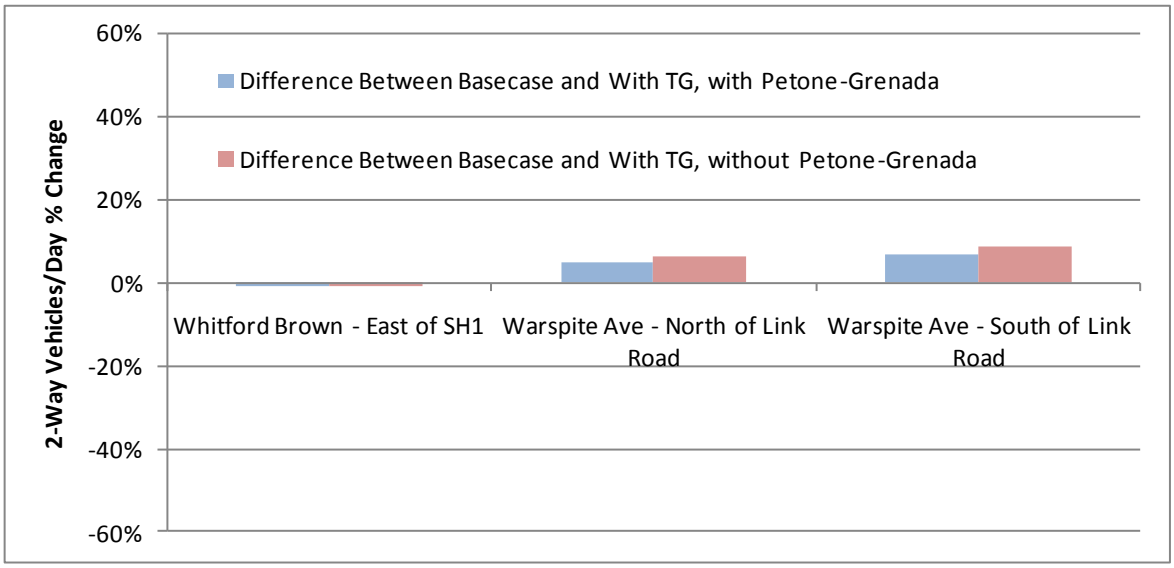


Table 4.22 summarises the forecast traffic volumes expected to use the Transmission Gully Main Alignment and the link roads in 2026 for the core assessment (including the Petone – Grenada link road) and without the Petone - Grenada link road.

- **Table 4.22: 2026 Traffic Volumes Forecast to Use the Transmission Gully Main Alignment and Link Roads, With and Without Petone – Grenada Link Road**

Road Section	AADT, TG with Petone - Grenada	AADT, TG without Petone - Grenada	Difference	Percentage Change
Transmission Gully – MacKays Crossing (north) to SH58	22,300	22,100	-200	-1%
Transmission Gully - SH58 to Porirua Link Roads	20,000	21,900	1,900	10%
Transmission Gully – Porirua Link Roads to Kenepuru	19,000	19,500	500	3%
Transmission Gully - Kenepuru to Linden (south)	18,300	16,900	-1,400	-8%
Whitby Link Road	3,400	3,000	-400	-12%
Waitangirua Link Road	3,300	4,300	1,000	30%
Kenepuru Link Road	13,000	13,600	600	5%
Source: SATURN Model				

This identifies that the forecast traffic volumes using sections of the Transmission Gully Main Alignment and the Kenepuru link road would change by less than 10% if the Petone – Grenada link road were not to be constructed. Changes in the use of the Whitby and Waitangirua link roads

would be more significant and reflect the change in balance of some traffic movements between the SH2/SH58 and SH1 corridors.

Conclusion: whilst there is some interdependency between the Petone – Grenada and Transmission Gully Projects, the assessed effects of the Transmission Gully Project would not be affected to any significant degree by the Petone-Grenada scheme.

5.1.6. Effect of Fuel Costs upon the Transmission Gully Project Assessment

The WTSM, developed by GWRC was used as the basis of the assessment of the transportation impacts of the Transmission Gully Project. This determines the number of trips (travel demand) and distributes travel demands and calculates a split of travel between the available modes, from which traffic demands are forecast.

Traffic demands from the WTSM model were assigned by the Transmission Gully SATURN model in order to identify the changes in traffic volumes on specific road sections as a result of t the Transmission Gully Project.

In the WTSM model, a number of assumptions are made regarding future fuel costs, vehicle efficiency, values of time and PT fares. All of these inputs are subject to some uncertainty, especially the cost of fuel. Changes in the values of these variables impact on the volumes and patterns of forecast travel demand within the models and on the assessed effects of the Transmission Gully Project.

Tests have been undertaken to assess the sensitivity of the core results for the Transmission Gully Project to variations in the assumptions around fuel prices. Tests have been run with fuel costs assumed to be lower and higher than the default value which formed the basis of the core assessment. Each test comprises a re-assessment of the Basecase (without the Transmission Gully Project) and With the Transmission Gully Project [26] scenarios.

The purpose of this section is to outline the underlying assumptions in the default fuel cost scenario, describe the additional sensitivity tests, compare the differences, draw conclusions and confirm the validity of the core assessment with respect to fuel costs.

5.1.6.1. Assumptions in the Model and Tests Undertaken

In the WTSM model fuel costs are combined with vehicle efficiency to calculate costs of vehicle operation, which are applied as a cost per kilometre travelled by each vehicle. As such, the cost of fuel as represented in the model cannot be compared directly with the retail price of fuel.

[26] As described in Section 1.6

Additionally, it should be noted that the values used in the model are longer term projections which do not take into account short term fluctuations in the retail price of fuel.

The default cost assumptions used in the core modelling are consistent with those developed by GWRC in the 2006 WTSM update and used for the assessment of all transportation projects for the RLTS / RLTP in the Wellington region. The default assumption is that the real vehicle operating costs will increase at 1% per year, which takes account of both the change in fuel prices and improvements in the fuel efficiency of the NZ vehicle fleet.

With all other costs in the model (such as public transport fares, values of time, etc) remaining constant, the relative cost of fuel is effectively assumed to increase. As a result, the costs associated with vehicle operation are assumed to increase faster than other costs within the model.

The fuel cost assumptions applies in WTSM only, and is used to determine the volume and distribution of vehicle movements which are then fed to the SATURN traffic model. All of the cost variables (distance and time) in the SATURN model remain constant and are not changed between the different scenarios. The SATURN model is used to assign the resulting traffic demands to the road network in order to establish forecasts of traffic volumes by road section.

Two tests were undertaken, each of which included a 'Basecase (without the Transmission Gully Project)' and 'With the Transmission Gully Project' scenario.

The first test is a lower fuel cost test in which the vehicle operating costs are not assumed to increase relative to other costs within the model (values of time, public transport fares, etc). In 2026, this results in vehicle operating costs which are approximately 20% lower than the default assumption in the default analysis 2026 Basecase.

The second test is a higher fuel cost test where the vehicle operating costs are assumed to increase 20% faster than the increase in the core analysis. In 2026, this results in vehicle operating costs which are less than 5% higher than the default assumption in the default analysis 2026 Basecase.

WTSM was run with these two alternative input assumptions and the resulting traffic demands were then transferred to the SATURN model to identify changes in forecast traffic volumes in 2026. This process was carried out in the 'Basecase' and 'With the Transmission Gully Project' scenarios for both of the tests.

5.1.6.2. Effect of Fuel Cost Tests

The results of the two fuel cost tests compared to the core analysis are presented below: mode shares and travel between key areas from WTSM and traffic volumes on key road sections from the Transmission Gully Project SATURN model.

Figure 4.34 shows the number of person trips in the whole model (the Wellington region) by private vehicle and public transportation for 2006 and the low, default and high fuel cost tests, for both the 'Basecase' and 'With the Transmission Gully Project' scenarios, in 2026.

This indicates that there is virtually no change in the total public and private vehicle trips between fuel cost scenarios and the 'Basecase' and the 'With the Transmission Gully Project' tests. The only differences arise from small changes in the number of 'active mode' trips (walking and cycling) which increase in number as fuel costs increase, with a corresponding small reduction in the number of vehicle and public transportation trips.

There is also no discernable change in the regional PT/private vehicle mode splits between scenarios.

- **Figure 4.34: Effect of Fuel Cost on Total Person Trips by Public Transport and Private Vehicle (from WTSM)**

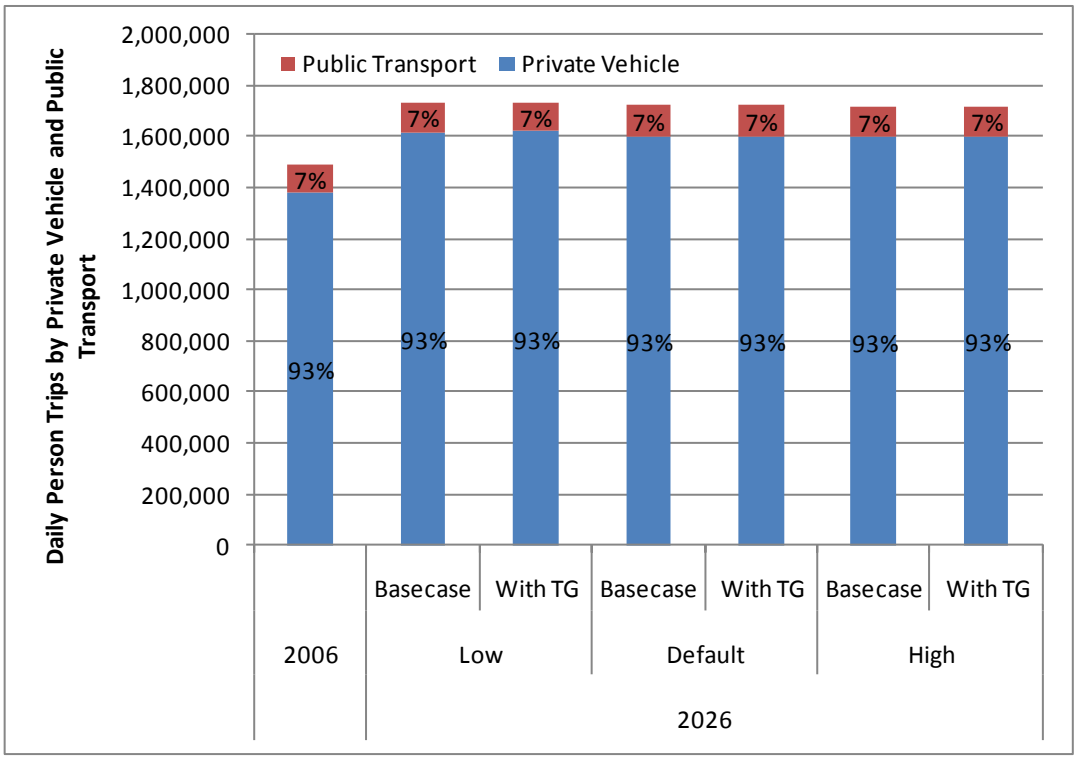


Figure 4.35 shows the number of private vehicle and PT trips between the main origins / destinations in the modelled area, for each of the scenarios and tests, in 2026. In general, the effect of higher assumed fuel costs is to reduce the total number of trips, and increase the proportion of these which are made by public transportation. However, these effects are small in relation to the total number of trips made for the movements shown.

Figure 4.35: 2026 Effect of Fuel Cost on Person Trips by Public Transport and Private Vehicle between key areas (from WTSM)

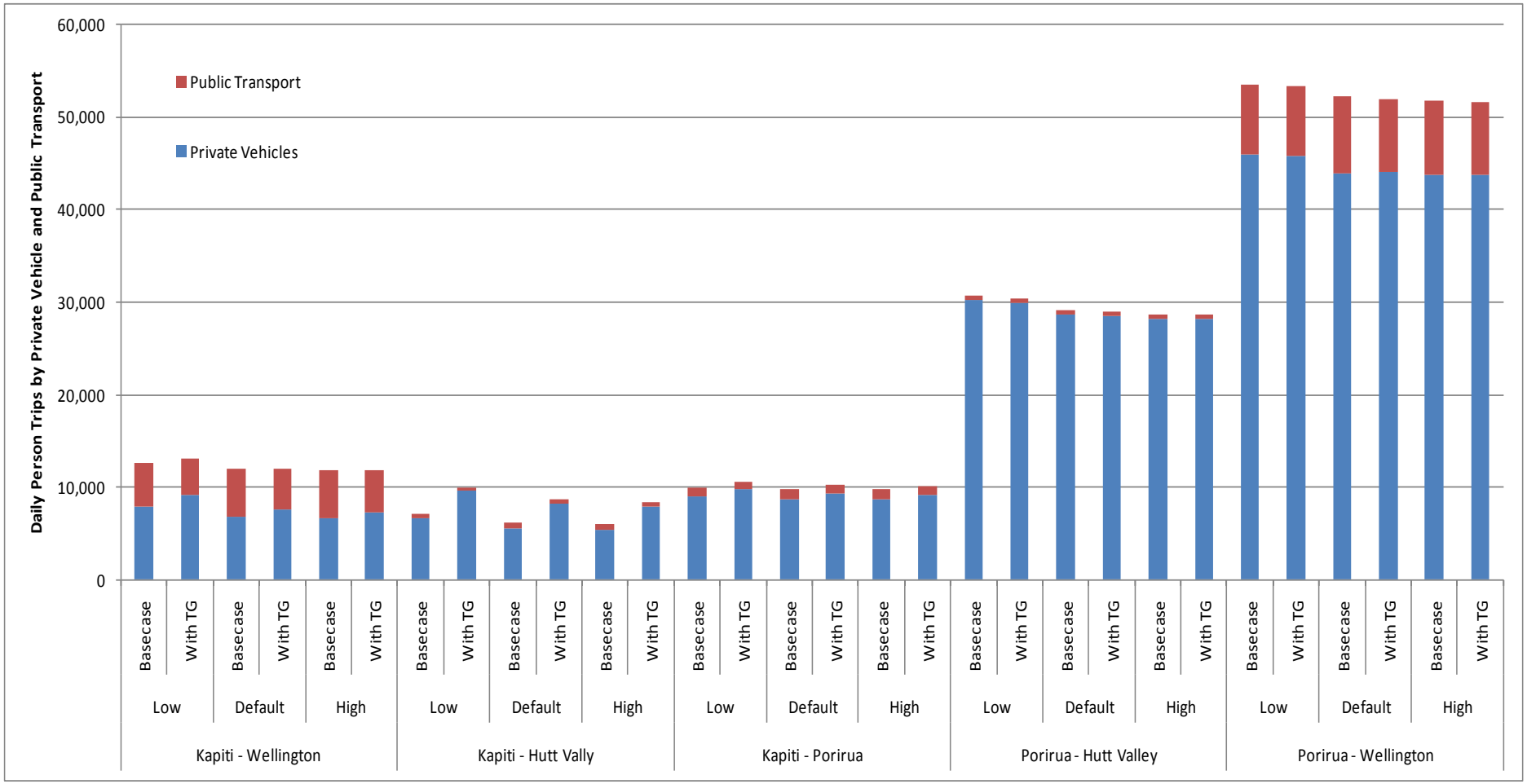


Figure 4.36: Effect of Fuel Cost on 2026 Trip Length Distribution (from SATURN)

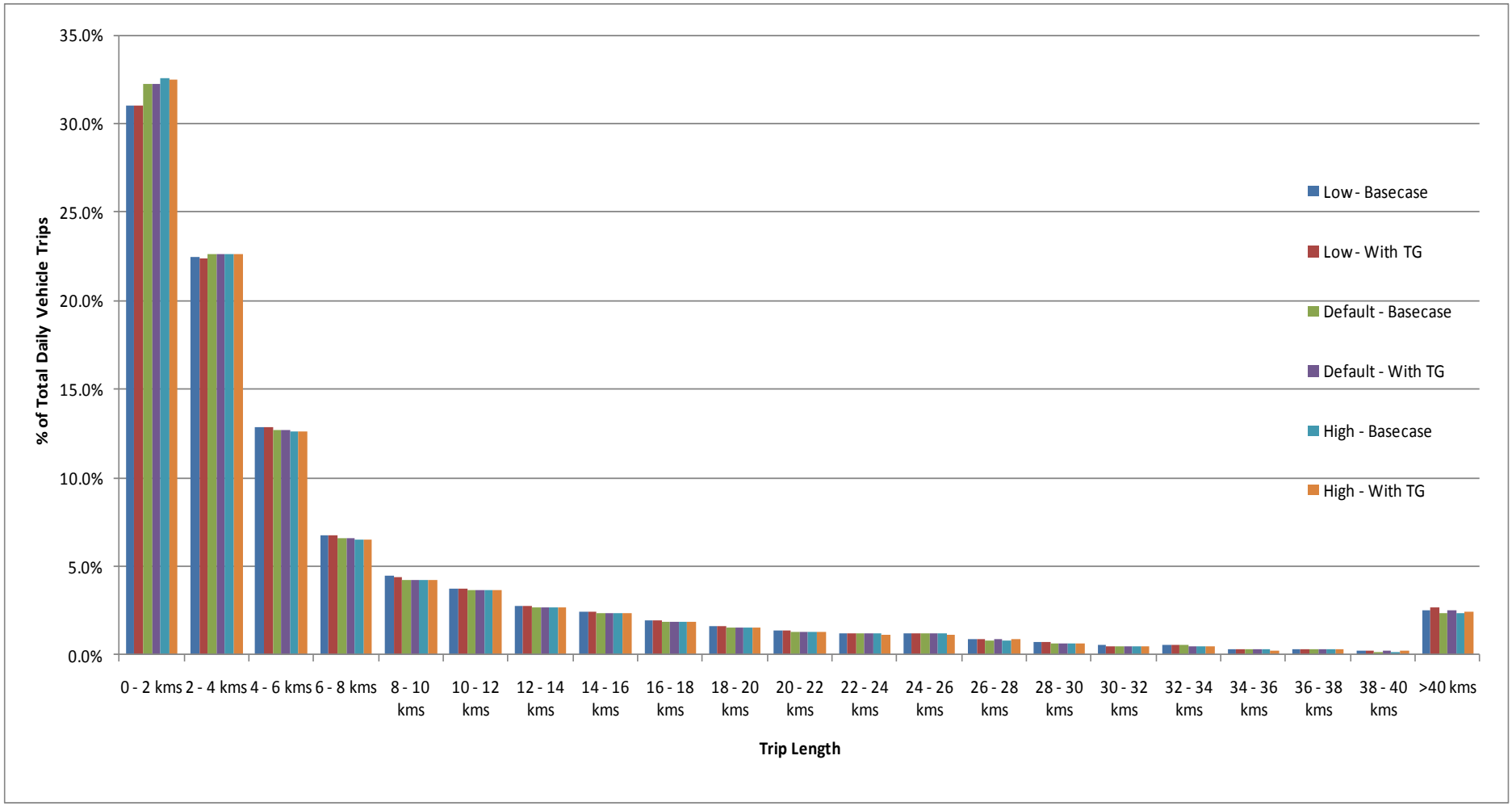


Figure 4.36 shows the private vehicle trip length distribution for each of the scenarios and tests in 2026. The effect of higher fuel prices is to marginally shift the distribution in favour of shorter distance trips, though the effect is slight.

The effect of variance in assumed fuel prices upon the split of travel is illustrated by Figure 4.37. This shows the composition of north-south travel between light vehicles, heavy vehicles and public transport across a screen-line to the south of Pukerua Bay which includes SH1, the Transmission Gully Main Alignment, the Paekakariki Hill Road and the railway line. The position of the screen line was chosen as the cost of fuel is more likely to affect long distance trips and screen line covers many of the long distance trips affected by the Transmission Gully Project.

This indicates that the effect of higher fuel prices is to reduce the total number of person trips in the corridor and increase the proportion of trips which are made by public transportation. The number of HCV movements is not affected, as these trips cannot change mode of travel and are generally fixed in terms of their origin and destination.

The effect of the Transmission Gully Project is broadly unaffected by the fuel price test. In all cases, the effect of the Transmission Gully Project is to increase the total travel in the corridor, releasing suppressed trips, and reduce the proportion of travel which is made by public transportation.

Figure 4.38 shows the effect of fuel prices upon the distribution of vehicle trips between the available routes across the screen-line to the south of Pukerua Bay. This indicates that whilst fuel price has some impact upon the volume of vehicular activity in the overall corridor, the distribution of the traffic between the available routes is unaffected.

5.1.6.3. Validity of Assumptions

As noted above, direct comparisons between retail fuel prices and the assumptions regarding fuel price in the model are not possible.

Despite this, and in the light of recent volatility in fuel prices, checks have been undertaken to confirm the validity of the default assumptions in the model. These checks suggest that the observed trend in fuel prices 2006 – 2011 would exceed the ‘high’ cost scenario only if the latest increases in fuel prices (as at March 2011) are taken into account and the observed rate of fuel price growth over this period is assumed to continue for the longer term.

In reality, it is unlikely that this rate of increase will be sustained for the longer term (some reduction is possible), and a more cautious approach indicates that a rate of growth between the ‘low’ and ‘high’ cost scenarios is more likely. For this reason, the default assumptions adopted by the model and the range of values which form the basis of the sensitivity tests are considered to be appropriate.

- **Figure 4.37: Effect of Fuel Cost on 2026 2-Way Daily Person Trips by Private Vehicle, Public Transport and HCVs Across Screen Line (from WTSM)**

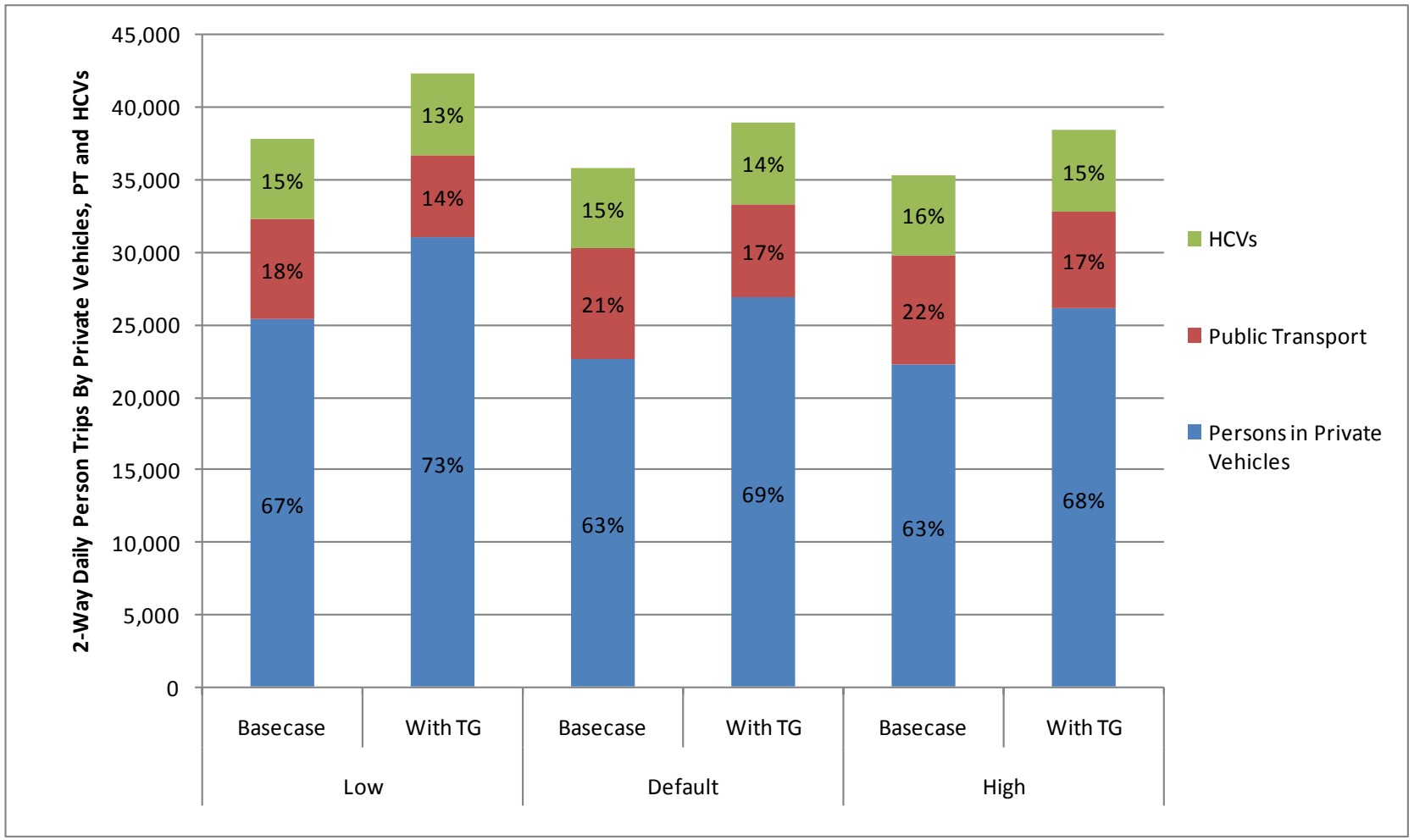
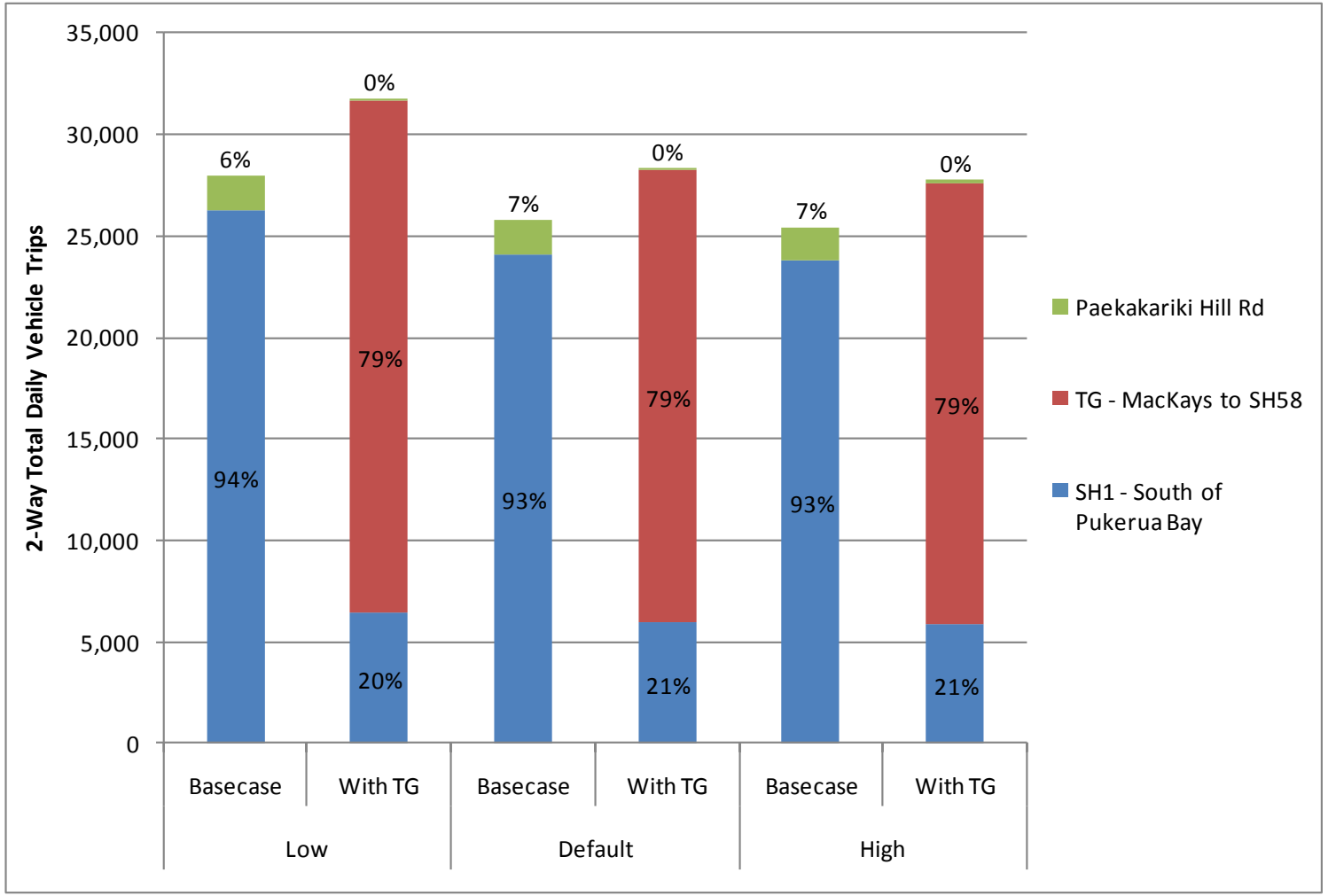


Figure 4.38: Effect of Fuel Cost on 2026 2-Way Total Vehicle Trips Across Screen Line (from SATURN)



The movement of future fuel prices is a key variable in transportation modelling. Together with assumptions relating to the future fuel-efficiency of the vehicle fleet, this affects the costs of vehicle operation and hence the costs of vehicle travel relative to public transportation.

The default approach adopted in the modelling assessments for the Transmission Gully Project is consistent with that applied by GWRC for the assessments of projects for the RLTP and RLTS across the region.

Sensitivity tests indicate that higher fuel prices would slightly reduce overall volumes of travel, and slightly increase the proportion of travel which is made by public transportation.

However, these effects are not large, and may be over-stated as the costs associated with the use of public transportation are assumed to remain static. In reality, higher general fuel costs are likely to result in some increases in public transport fares.

Conclusion: the effects of the Transmission Gully Project remain largely unchanged with variance in the assumed fuel costs. Although the volumes of road based travel may decline at higher levels of fuel cost, the Transmission Gully Project will continue to divert significant volumes of traffic away from the existing SH1 route and the communities along it.

5.1.7. Effect of No Other Roading Projects

5.1.7.1. Description

A remote possibility exists that no other roading projects will be completed within the Wellington region prior to the opening of the Transmission Gully Project.

To assess how such a scenario might impact upon the forecast patterns of travel and traffic volumes, tests with and without the Transmission Gully Project have been run for the year 2026 which assume that the following projects are NOT completed:

- The other RoNS projects;
- The Petone – Grenada link road;
- Melling Interchange;
- Kennedy-Good Bridge grade separation;
- SH2 / SH58 intersection grade-separation;
- Travel Demand Management measures;
- SH58 upgrade (Transmission Gully – SH2); and
- Changes to the existing SH1 Coastal Route.

In practice, whilst such a test may be regarded as hypothetical (because some of all of these projects are likely to be progressed), it nonetheless represents a ‘worst-case’ for the assessment of the Transmission Gully Project.

5.1.7.2. Methodology

The assumed scenario differs significantly from that which has formed the core of the Transmission Gully Project assessments, and can be expected to affect not only traffic volumes, but the distribution of travel and mode.

For this reason, these scenarios were assessed initially with the WTSM model, with the resulting traffic demands then passed to the SATURN traffic model to identify forecast traffic volumes by road section.

All assessments were undertaken for the year 2026.

5.1.7.3. Results

Table 4.23 shows the forecast total volume of daily travel between the Kapiti district and the south in 2026, both for the default analysis and for the test without the completion of any other roading projects (but both including the Transmission Gully Project).

This indicates that the effects of removing all of the other roading projects is slight. Approximately 440 fewer trips would take place by road (suppressed as a result of congestion elsewhere) with virtually all of these transferring to public transport (rail). However, this represents less than 2% of the total trips in the corridor.

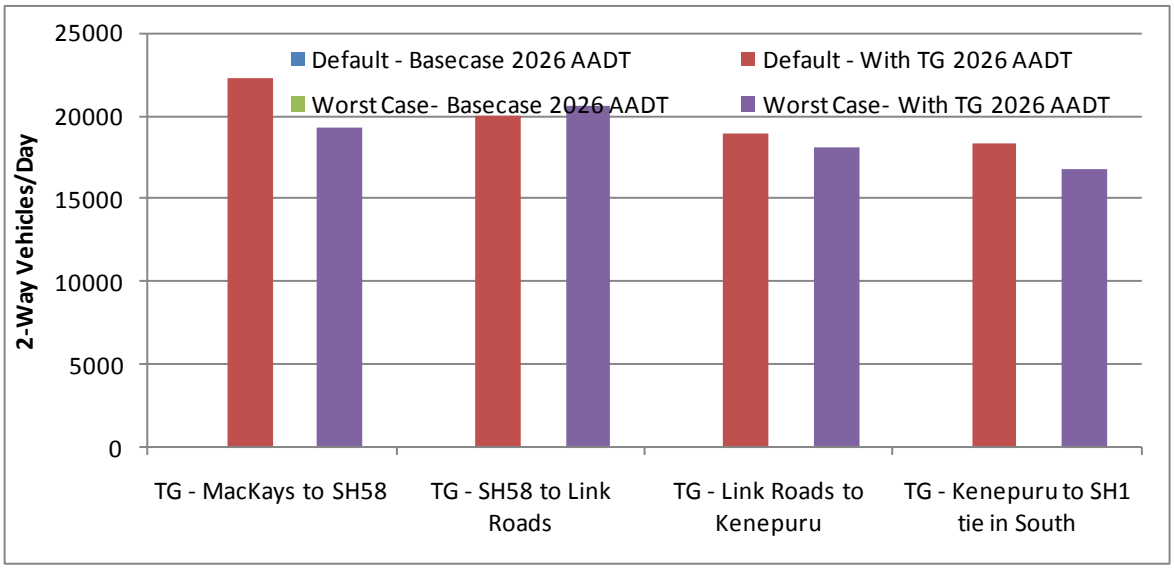
- **Table 4.23: Person Trips Between Kapiti and the South (Trips / Day, with the Transmission Gully Project, 2026)**

	Person Trips by Private Vehicle	Person Trips by Public Transport	Total Person Trips	% Public Transport
Default Assessment	24,930	5,840	30,770	19.0%
No Other Roading Projects Assessment	24,490	6,260	30,750	20.4%
Change	-440	+420	-20	
Source: SATURN Model				

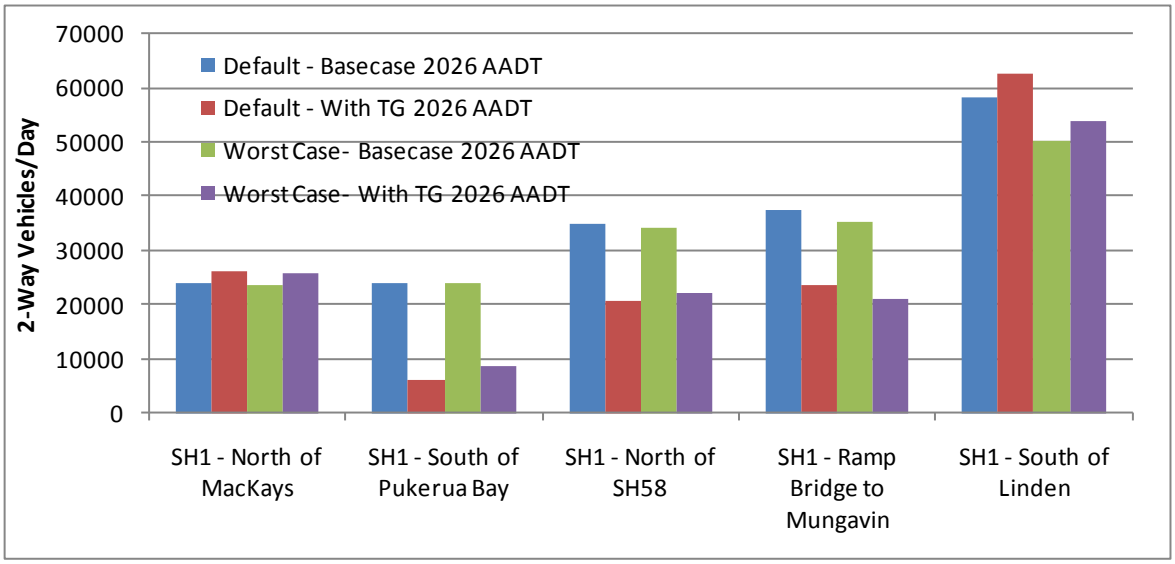
Figure 4.39 to Figure 4.44 show the effect of the test scenario upon forecast traffic volumes for road sections in the study area, both with and without the Transmission Gully Project in 2026:

- Figure 4.39 – Transmission Gully Main Alignment;
- Figure 4.40 – existing SH1 route;
- Figure 4.41 –SH58;
- Figure 4.42 - Kenepuru Link Road and other roads in the vicinity;
- Figure 4.43 - Whitby Link Road and other roads in the vicinity; and
- Figure 4.44 - Waitangirua Link Road and other roads in the vicinity.

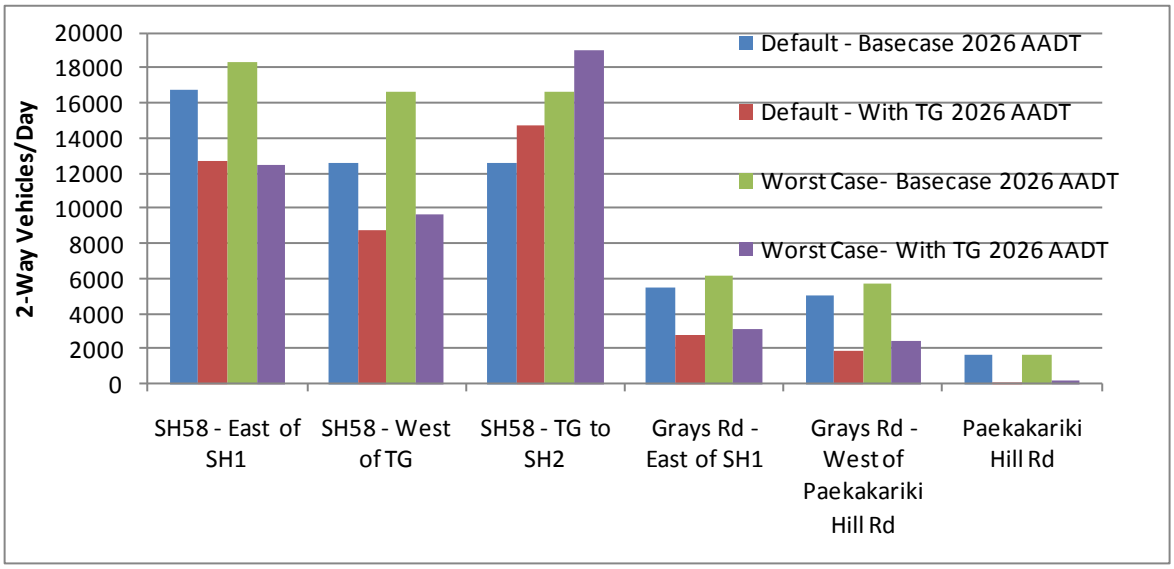
- **Figure 4.39: 2-Way 2026 Forecast AADT Traffic Flows on the Transmission Gully Project, in the Default Analysis and Worst Case Sensitivity Test**



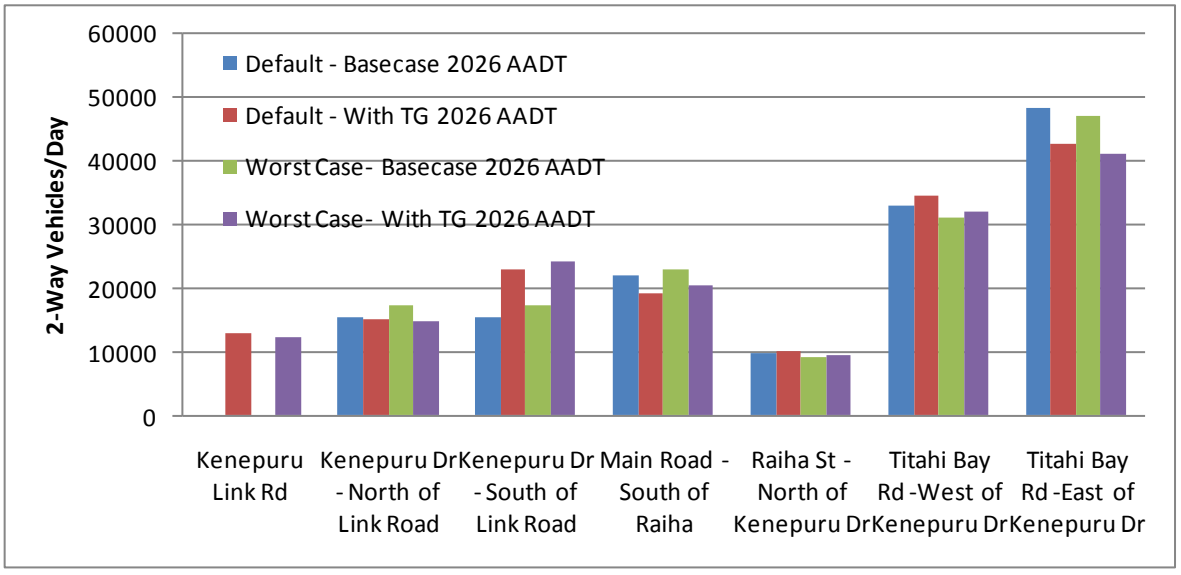
- **Figure 4.40: 2-Way 2026 Forecast AADT Traffic Flows on SH1 for the Basecase and with the Transmission Gully Project, in the Default Analysis and Worst Case Sensitivity Test**



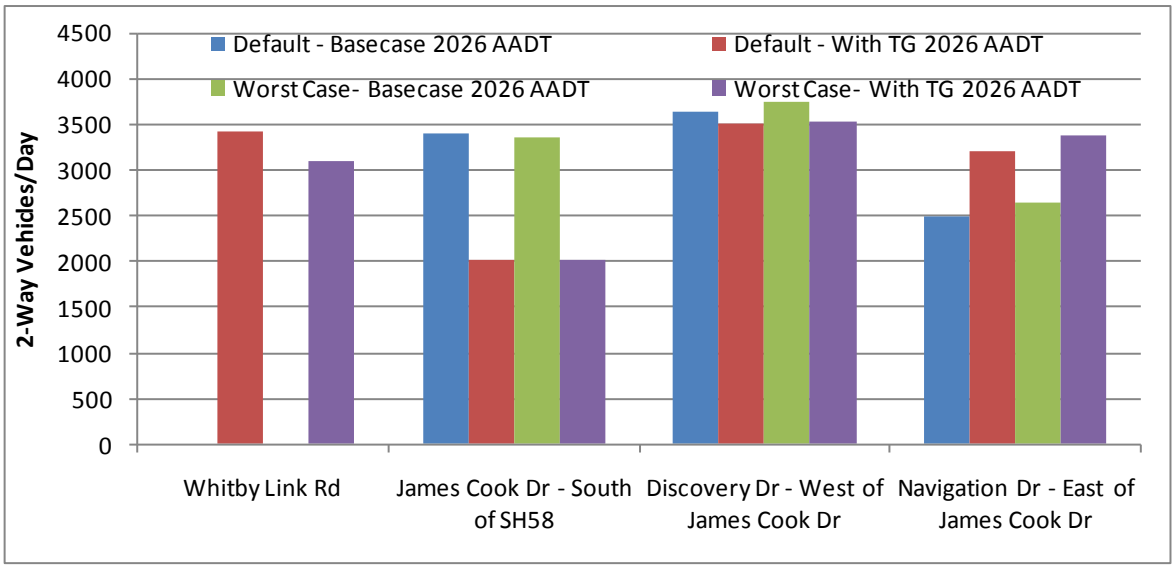
- **Figure 4.41: 2-Way 2026 Forecast AADT Traffic Flows on SH58 and Associated Roads for the Basecase and with the Transmission Gully Project, in the Default Analysis and Worst Case Sensitivity Test**



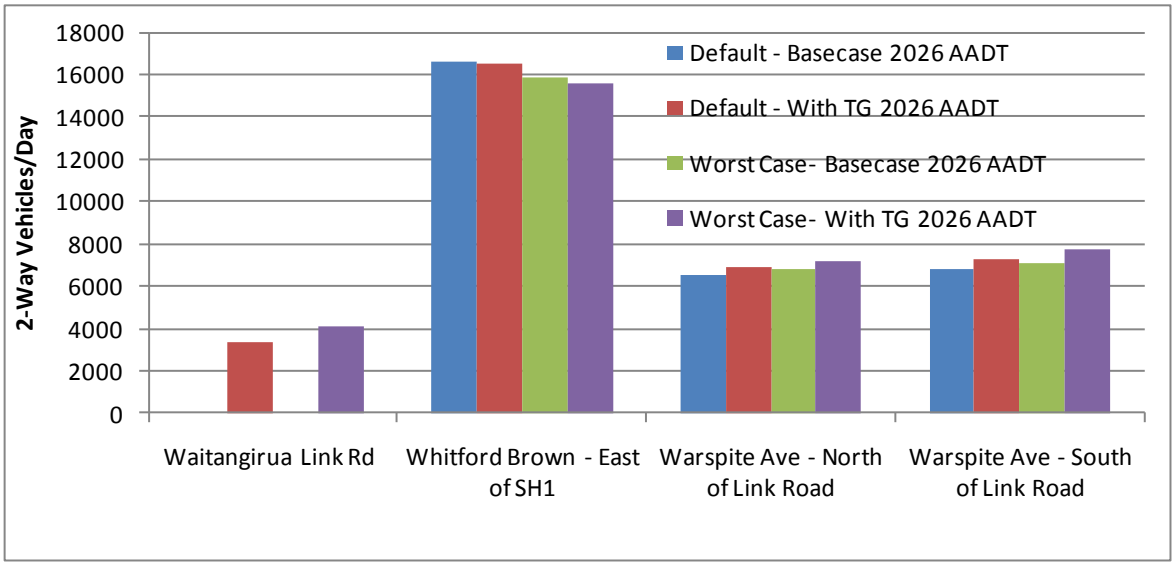
- **Figure 4.42: 2-Way 2026 Forecast AADT Traffic Flows on the Kenepuru Link Road and Associated Roads for the Basecase and with the Transmission Gully Project, in the Default Analysis and Worst Case Sensitivity Test**



- **Figure 4.43: 2-Way 2026 Forecast AADT Traffic Flows on the Whitby Link Road and Associated Roads for the Basecase and with the Transmission Gully Project, in the Default Analysis and Worst Case Sensitivity Test**



- **Figure 4.44: 2-Way 2026 Forecast AADT Traffic Flows on Waitangirua Link Road and Associated Roads for the Basecase and with the Transmission Gully Project, in the Default Analysis and Worst Case Sensitivity Test**



In general, the effects of the test upon traffic volumes are slight, both with and without the Transmission Gully Project in place. As expected, the effects are marginally greater than those reported above for the removal of other RoNS projects or the Petone – Grenada link road alone.

More specifically, the following effects are evident:

- Some increase in traffic volumes using SH2/SH58/Transmission Gully in preference to SH1/ Transmission Gully, due principally to the absence of the Petone – Grenada link road;

- Higher volumes using SH58 to the east of Transmission Gully and lower volumes using SH1 to the south of Linden (for the reason above);
- A marginal increase in residual traffic volumes using some sections of the existing SH1, due to the absence of measures to 'downgrade' this route upon the completion of the Transmission Gully Project; and
- Traffic volumes using the Transmission Gully Main Alignment would change by between -13% (MacKays Crossing – SH58) and +3% (south of SH58).

5.1.7.4. Conclusion

Even under an extremely pessimistic scenario in which no other roading projects are assumed to be completed by 2026, the Transmission Gully Project would still provide a significant level of traffic relief and benefits to the existing SH1 route and other roads in this area. As such, there would be no significant change to the assessed effects of the Transmission Gully Project.

The construction of the other components of the RoNS package, the Petone - Grenada link road and other roading projects in the region will however provide for a more consistent standard of road provision in the wider corridor, with some enhancement of the benefits offered by the Transmission Gully Project.

5.2. Sensitivity Test Conclusions

The conclusions from the sensitivity testing are that:

- The adoption of the currently proposed designation and local link road configuration results in changes in the distribution of local traffic but has very little effect on the wider network compared to the original designation;
- A package of measures to be applied to the existing coastal route would be an important means of 'locking in' the benefits of the Transmission Gully Project by minimising the residual traffic volumes on existing roads and maximising amenity to affected communities, but is not critical to the overall success of the Transmission Gully Project;
- Local link roads serving the Whitby and Waitangirua areas would provide important accessibility and reduce traffic demands on the local road network, but again are not critical to the overall benefits generated by the Transmission Gully Project;
- The effect of the other RoNS projects in the SH1 corridor is slight, resulting in a small degree of further trip induction and transfer from rail;
- In the event that the Petone-Grenada link road was not to be constructed, the benefits provided by the Transmission Gully Project would remain largely unchanged. The Petone – Grenada project would complement, rather than compete with, the Transmission Gully Project;
- In the event that the Fuel costs were to be above or below those assumed in the core assessment, the benefits provided by the Transmission Gully Project would remain largely unchanged. the Transmission Gully Project would continue to divert large volumes of traffic away from the existing SH1 route; and

- Even for a highly pessimistic scenario in which no other roading projects in the wider region were assumed to be completed by 2026, the assessed effects of the Transmission Gully Project would be largely unchanged.

Overall, changes to the detail of the Transmission Gully Project, or to assumptions around the progression of other projects in the SH1 corridor would not have any significant impact upon the assessed benefits of the Transmission Gully Project and this assessment of effects.

6. Land Use & Transportation Integration

Transportation demand and patterns of land-use are inextricably linked. Whilst patterns of land-use are the primary driver of transportation demand, it is also true that the resulting conditions on the transportation network influence patterns of land-use.

These issues have been addressed in parallel to the transportation assessments of the Transmission Gully Project, and are described in detail in a Land Use Assessments report, presented at Appendix E.

In summary, this report describes:

- A review of the land-use forecasts which form the basis of the transportation assumptions of the Transmission Gully Project;
- A review of the assessed likely land-use responses to the Transmission Gully Project; and
- The overall effects of the Transmission Gully Project arising from land-use changes.

In doing so, this report critiques rather than repeats other analyses.

This assessment concludes that:

- Although forecasting of future demographic and economic activity is inevitably subject to uncertainty, the forecasts which form the basis of the transportation assessments of the project are soundly based;
- The opening of the Transmission Gully Project will give rise to significant changes in accessibility, which can be expected to affect the longer term locational decisions of businesses and households, with consequent impacts upon land-use and volumes of transportation demand;
- This additional transportation demand can be accommodated by the strategic road network because of the same infrastructural improvements (the Transmission Gully Project) which will give rise to the improvements in accessibility;
- Whilst some pressures may be created on the local road network, these will only emerge gradually over a period of many years, allowing time for localised improvements to the roading network to be planned and implemented;
- In some areas developmental pressures arising from the Transmission Gully Project will be accommodated where the zoning of District Plans is permissive to such development (and hence the effects have already been anticipated);
- Elsewhere, a consent or plan change necessary to enable development will only be secured after a thorough assessment of the potential effects, offering protection against development which is inappropriate or which could give rise to adverse effects; and
- On balance, the Transmission Gully Project is highly likely to generate positive land-use outcomes, facilitating economic and population growth locally and across the region, and

consistent with the rationale for the inclusion of the project as part of the Roads of National Significance.

7. Temporary Traffic Impact Assessment

A high level Construction Traffic Management Plan (CTMP) has been prepared with the other management plans alongside the AEE. The CTMP outlines the procedures and objectives required to produce Site Specific Traffic Management Plans (SSTMPs). It details the standards that must be adhered to, identifies the objectives in developing SSTMPs and the issues that must be considered, and how the effects of traffic control and construction traffic on local roads will be mitigated. It outlines the systems and procedures for producing SSTMPs including identification and planning, development, the approval process, document control, and implementation. The team structure, roles and responsibilities are also included.

The CTMP details the following objectives for the delivery of Temporary Traffic Management (TTM) during the construction of the Transmission Gully Project:

1) Provide TTM complying fully with the Code of Practice for Temporary Traffic Management (COPTTM) wherever practicable. Non compliance or departures from the standard will be addressed through Engineering Exception Decisions (EEDs) signed off by the implementation team and the relevant RCA;
2) Focus on leading industry standards with regard to TTM and safety;
3) Minimise disruption on the State highways and local roads wherever practicable;
4) Limit where possible the number of construction vehicle trips on local roads and obtain access from arterial roads and State highways;
5) Maintain existing flows and travel times on State highways and local roads adjacent to the work site where practicable;
6) Minimise the impact of works on vulnerable road users such as pedestrians and cyclists;
7) Minimise the effects of construction traffic on local roads used for access;
8) Minimise the impact of construction parking;
9) Develop SSTMPs having consideration for all key stakeholders i.e. residents, GWRC, WCC, PCC and KCDC;
10) Identify all issues and have a planned SSTMP approved and submitted to the applicable council (RCA) and NZTA's network management consultant at least five days before implementation is required;
11) Provide effective communication to affected parties; and
12) Implement TTM that provides stakeholders with exceptional service in terms of functionality and clarity of direction of travel through roadwork sites.

These objectives will be achieved through implementation of the CTMP to ensure the effects of construction are no more than minor. It should be noted that construction dust and noise will be managed throughout the construction process. While some reference is made to these issues in this

document, their management is dealt with in the Construction Noise Management Plan and the Construction Dust Management Plan.

Although an indicative methodology for construction of the Transmission Gully Project has been defined during the investigations phase, the final methodology will not be known until a contractor is appointed. Therefore, an assessment of the likely impacts associated with the construction of the Transmission Gully Project including number of heavy vehicles and likely construction traffic routes, is detailed below. This is based on an assessment of the potential construction staging and access points produced by MacDonald International which has undertaken the construction assessments for the project.

It is important to note that the proposed TTM measures are based on an indicative methodology for constructing the Transmission Gully Project and assessing its impacts. The final methodology will be determined by the contractor appointed to undertake the works. However, while it is likely that the construction methodology will change, the CTMP will ensure that the scale of effects on local residents and road users will be similar.

Table 4.24 describes the types of activities that could be expected to be implemented over the course of the construction of the Transmission Gully Project as well as their expected timeframes, impacts and some proposed mitigation measures which would be put in place in accordance with the CTMP.

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SKM

Table 4.24: Indicative Activities and Potential Mitigation

TTM Activities on Project						
Activity					**Impact**	**Mitigation (in addition to standard TTM in accordance with COPTTM)**
RCA	**Activity**	**Road**	**Duration (approx)**	**Frequency (approx)**		
NZTA	Shoulder Closures on SH1	SH1	Up to 7 years	Ongoing	Potential delays due to rubbernecking	Screens placed as appropriate
NZTA	Lane Closures on SH1	SH1	1 night	nightly	Capacity reduction leading to delays	Undertake during low flow periods and undertake calculations to determine appropriate working windows
NZTA	Closure of SH1	SH1	1 night	Very infrequent	Significant delays to regional and interregional travel	Signed diversions. Duration to be limited. Significant communication exercise to manage demand during closure
NZTA	Shoulder Closures on SH58	SH58	7 years	Ongoing	Potential delays due to rubbernecking	Screens placed as appropriate
NZTA	Lane Closures on SH58	SH58	1 night	nightly	Capacity reduction leading to delays	Undertake during low flow periods and undertake calculations to determine appropriate working windows
NZTA	Closure of SH58	SH58	1 night	Very infrequent	Significant delays to regional and interregional travel	Signed diversions. Duration to be limited. Significant communication exercise to manage demand during closure
PCC	Site Access Via Paekakariki Hill Road	Paekakariki Hill Road	Up to 3 years	Ongoing	Construction traffic on local residential roads leads to potential amenity and safety concerns especially through Pauatahanui Village	Construct alternative access along main alignment from SH58 Use minibuses for access where possible Minor safety improvements to Paekakariki Hill Road such as improved delineation, temporary speed restrictions through Pauatahanui Village, curve easing, inter-visibility improvements etc. Also, heavy vehicle access restrictions at the intersection of SH1 and Paekakariki Hill Road due to safety deficiencies (visibility and geometric alignment) at the intersection. Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
PCC	Site Access Via Flightys Road	Flightys Road	Up to 12 months	Ongoing	Construction traffic on local residential roads leads to potential amenity and safety concerns	Construct alternative access along main alignment from SH58 Use minibuses for access where possible Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
PCC	Site Access Joseph Banks Drive / Navigation Drive / Pacific View	Joseph Banks Drive / Navigation Drive / Pacific View	Up to 12 months	Ongoing	Construction traffic on local residential roads leads to potential amenity and safety concerns	Construct alternative access along main alignment from SH58 Use minibuses for access where possible Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
PCC	Site Access via Ranui Heights	Awatea Street and Apple Terrace Route	Up to 12 months	Ongoing	Construction traffic on local residential roads leads to potential amenity and safety concerns	Construct alternative access from SH1 Use minibuses for access where possible Avoid heavy vehicle access during school drop-off / pick –up times Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
WCC	Site Access via Collins Ave, Linden	Collins Ave and Rangatira Road Route	Up to 3 years	Ongoing	Construction traffic on local residential roads leads to potential amenity and safety concerns	Construct alternative access from SH1 Use minibuses for access where possible Avoid heavy vehicle access during school drop-off / pick –up times Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans

TTM Activities on Project						
Activity					**Impact**	**Mitigation (in addition to standard TTM in accordance with COPTTM)**
RCA	**Activity**	**Road**	**Duration (approx)**	**Frequency (approx)**		
WCC	Site Access via Rangatira Rd, Linden	Rangatira Road Route	Up to 12 months	Ongoing	Construction traffic on local residential roads leads to potential amenity and safety concerns	Construct alternative access from SH1 Use minibuses for access where possible Avoid heavy vehicle access during school drop-off / pick –up times Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
PCC	Site Access via Bradey Road	Bradey Road	Up to 12 months	Ongoing	Construction traffic on local roads leads to potential amenity and safety concerns	Construct alternative access from SH58 via the new Pauatahanui Stream bridge and the main alignment Use minibuses for access where possible Stop/go control at the single lane bridge on Bradey Road (during periods of high heavy vehicle demand) to avoid opposing vehicle conflict. Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
PCC	Site Access via Endeavour Drive / Pacific View	Endeavour Drive / Pacific View	Up to 3 years	Ongoing	Construction traffic on local roads leads to potential amenity and safety concerns	Construct alternative access along main alignment from SH58 Use minibuses for access where possible Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
WCC	Site Access Via Takapu Road	Takapu Road	Up to 3 years	Ongoing	Construction traffic on local residential roads leads to potential amenity and safety concerns	Construct alternative access along main alignment from SH1 Use minibuses for access where possible Minor safety improvements to Takapu Road such as improved delineation, temporary speed restrictions, curve easing, inter-visibility improvements etc. Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
PCC	Kenepuru Link Connection and Site Access	Kenepuru Drive	Up to 3 years	Ongoing	Potential delays due to rubbernecking Impacts on pedestrians and cyclists Impact on property access Construction traffic on local residential roads leads to potential amenity and safety concerns	Screens placed as appropriate Accesses to be maintained at all times Pedestrian and cyclist access to be maintained at all times or alternative routes provided Construct alternative access along main alignment from SH58 Use minibuses for access where possible Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans
PCC	Waitangirua Link Connection and Site Access	Warspite Ave	Up to 12 months	Ongoing	Potential delays due to rubbernecking Impacts on pedestrians and cyclists Impact on property access Construction traffic on local residential roads leads to potential amenity and safety concerns	Screens placed as appropriate Accesses to be maintained at all times Pedestrian and cyclist access to be maintained at all times or alternative routes provided Construct alternative access along main alignment from SH58 Use minibuses for access where possible Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans

TTM Activities on Project						
Activity					**Impact**	**Mitigation (in addition to standard TTM in accordance with COPTTM)**
RCA	**Activity**	**Road**	**Duration (approx)**	**Frequency (approx)**		
PCC	Whitby Link Connection and Site Access	James Cook Drive / Navigation Drive	Up to 12 months	Ongoing	Potential delays due to rubbernecking Impacts on pedestrians and cyclists Impact on property access Construction traffic on local residential roads leads to potential amenity and safety concerns	Screens placed as appropriate Accesses to be maintained at all times Pedestrian and cyclist access to be maintained at all times or alternative routes provided Construct alternative access along main alignment from SH58 Use minibuses for access where possible Development of a maintenance intervention strategy with RCA Noise and dust management through appropriate management plans

The activities in the above table have been broken down into the following two broad categories and the effects at each location are described in some detail in the following sections:

- Construction Activities and Mitigation; and
- Construction Access Traffic and Mitigation.

7.1. Construction Activities and Mitigation

The key locations where construction activities are likely to affect operating conditions on existing road networks have been identified as:

- Linden Interchange;
- Kenepuru Drive and surrounding roads;
- Waitangirua Link (Warspite Avenue);
- Whitby Link (James Cook Drive);
- SH58 / Transmission Gully Interchange; and
- MacKays Crossing.

7.1.1. Linden Interchange / SH1 Tie-In

At Linden, the majority of works will be undertaken off-line. However, the tie-in between the Transmission Gully Main Alignment and the existing SH1 will need to be carefully managed and programmed through the use of temporary road construction and contra-flow to minimise delays to road users. The effects of the works will be reduced by providing TTM (including temporary lanes adjacent to existing lanes) to ensure that the existing number of SH1lanes (i.e. two northbound and two southbound) are maintained during peak periods (with lane and shoulder narrowing as necessary). Speed restrictions will be put in place to allow for the narrower lanes and may lead to some reduction in capacity. However, it is considered that the TTM plans will be developed to minimise impacts or mitigate the effects of the TTM.

Some works will require operations in or over existing traffic lanes, such as the installation of bridge beams. To facilitate this, closures of lanes or potentially directions of travel (i.e. complete closure of the north or southbound lanes) may be required. These closures will generally be scheduled to occur at night or during other periods of low demand. Where appropriate, signed diversion routes over local roads will be put in place to direct traffic through the affected areas. Given the traffic volumes on this section of SH1 during non-peak periods, construction works and associated TTM are unlikely to greatly affect traffic conditions.

However, in addition to the above, extensive communication campaigns will be undertaken in advance of significant components of work so that motorists can make informed decisions about the timing and mode of their travel while the work is being undertaken.

Given the traffic volumes on this section of SH1 in non-peak periods, it is considered that this can be undertaken with effects which are no more than minor.

7.1.2. Kenepuru Drive

At the connection to Kenepuru Drive, vehicle, pedestrian and cycle access will need to be maintained at all times along with property access. This may involve lane narrowing and construction of temporary footways and traffic lanes and property accesses as required. Speed restrictions will be put in place to improve safety for road users using the narrower lanes which may lead to some reduction in capacity. However, TTM plans will be developed to minimise impacts or mitigate the effects of the traffic management.

Some works will require operations in or over traffic lanes. These would be facilitated similarly to works on the Linden Interchange and given the traffic volumes on this section of Kenepuru Drive in non-peak periods; it is considered that this could be undertaken with effects that are no more than minor.

7.1.3. Waitangirua Link

The connection to Warspite Avenue would be managed in a similar way to that described for the Kenepuru Link above. Due to the residential nature of this area, it is unlikely that noisy night works would be able to be conducted. Therefore, construction works which close the road will need to be carefully planned to ensure that alternating flow (stop / go) operations can be implemented without causing significant delays or alternative routes are available and have sufficient capacity to cater for diverted traffic. Given the traffic volumes on this section of Warspite Avenue in non-peak periods, it is considered that this could be undertaken with effects that are no more than minor.

7.1.4. Whitby Link

The connection to James Cook Drive / Navigation Drive would be managed in a similar way to that described for the Waitangirua Link above. Given the traffic volumes on this section of the network in non-peak periods, it is considered that this could be undertaken with effects that are no more than minor.

7.1.5. SH58 / Transmission Gully Interchange

At the SH58 / Transmission Gully interchange, the majority of works will be undertaken offline with traffic lanes moved in stages to allow for construction. Site access points will be installed providing access to the works and the site office as appropriate. Construction of bridge structures will be staged with traffic diverted over or around. The effects of the works will be reduced by providing TTM to ensure that the existing number of SH58 traffic lanes will be maintained during peak periods with lane and shoulder narrowing. The TTM would be facilitated in the same way as described above for Linden Interchange and tie-in. Given the traffic volumes on this section of SH58 in non-peak periods, it is considered that this could be undertaken with effects that are no more than minor.

7.1.6. MacKays Crossing

At MacKays Crossing the majority of works will be undertaken offline while TTM will need to allow for tie-in to the existing State highway. The TTM would be facilitated in the same way as described above for Linden Interchange and tie-in.

Given that overnight volumes (esp. trucks) in this location can be reasonably high, and that no diversionary route is available, careful consideration will need to be given to the continuity of traffic movements in both directions of travel.

It is important to note that MacKays Crossing is not intended to be used as a key temporary access point for construction traffic. However, if this was to change, this could be managed with appropriate TTM.

7.2. Construction Traffic Access and Mitigation

It is envisaged that that there will be major site offices and compounds at the following locations:

- 548 Paekakariki Hill Road (south of Battle Hill Farm Forest Park);
- SH58 Interchange; and
- Kenepuru Interchange.

However, depending on the contractor's methodology, there may be a need for satellite offices at other locations for example; Takapu Road, James Cook Interchange, Wainui Saddle and MacKays Crossing.

A specific SSTMP will be produced for each site office and access point detailing vehicular access, access routes, mitigation of effects on local roads used for access, parking arrangements and protocols and procedures to be used by all staff accessing the site offices.

Construction traffic accessing the site has the potential to have adverse effects. Indicative construction vehicle numbers (based on a possible construction methodology) and access points are shown in Figure 4.45 along with the proposed site offices. The volumes have been developed by MacDonald International who has undertaken the construction assessments for the project and these volumes are considered to be a conservative maximum. The exact method of construction and the need to use each access will be determined by the successful contractor, but all potential access points have been included in this assessment to ensure that construction effects can be managed irrespective of methodology. For each access, the volumes presented represent a likely use if that access was to be utilised. In reality, not all accesses will be utilised to the extent indicated.

The indicative construction traffic volumes in Figure 4.45 include two numbers. The first is indicative light vehicle (car) numbers if minibuses are used to ferry workers to the site. The next is the light vehicle numbers if private vehicles were used. Through the 'Principal's Requirements'

for the project, contractors will be encouraged to use minibuses to ferry workers to the site in order to reduce overall vehicle numbers, therefore the light vehicle numbers (without minibuses) is assumed to be the worst case of the two scenarios. The following sections describe the main construction access points and identify potential traffic management measures to minimise impacts.

The physical condition of all public roads being used to afford access to the Transmission Gully Project site will be monitored throughout the construction process and any repairs required to maintain their serviceability will be managed through the relevant RCA and their maintenance contractor/s.

As mentioned above, it is proposed to use minibuses to ferry workers to the site in order to reduce the number of light vehicle movements required. However, parking facilities will still be provided at the site offices to accommodate management staff, visitors and deliveries. In terms of parking requirements for general staff, parking restrictions will be placed on workers to ensure that parking on local roads does not proliferate and affect residents and businesses.

Traffic flows reported are 2009 estimates from Porirua City Council[27]. Some of the roads have very low levels of traffic, resulting in relatively large percentage increases in traffic flows when the indicative construction traffic is added. Despite the relatively large percentage increases, the total vehicle volumes on these roads are still relatively low and the roads have sufficient capacity to easily accommodate the additional traffic. Many of the affected roads are local roads with very low existing HCV traffic volumes. While the construction traffic will increase the number of HCVs using these roads they will still be well within the capacity of the road. As mentioned above, any affects will be mitigated through the use of the CTMP.

7.2.1. Paekakariki Hill Road

Paekakariki Hill Road will provide light and heavy vehicle access to the proposed site office at No. 548, which is strategically located along the Transmission Gully route to afford access to the northern sections of the project towards the Wainui Saddle, while also providing convenient access to SH58 as a key arterial. Access along Paekakariki Hill Road will be critical for the first two to three years of the project while the Main Alignment is constructed through to SH58, at which point this section of the Transmission Gully Main Alignment will become the main access route to the site office from SH58 and to the northern sections beyond.

An estimated 165 light vehicle (if minibuses were not used) and 160 heavy vehicle movements (one way) could be expected to use Paekakariki Hill Road between the site office and SH58 on a ‘peak day’ when all deliveries will be arriving on site at the peak of construction. Typically, the number of vehicles expected to use this route during a ‘normal’ construction day would be 130 light vehicles (without minibus use) and 95 heavy vehicle movements (one way).

[27] Traffic estimates were receved in an email from Richard Mowll on the 20th of July 2011.

In terms of assessing the impacts on Paekakariki Hill Road, the greatest effect will occur during the AM and PM peak periods when traffic volumes on the adjacent road network and potentially construction traffic (i.e. staff arriving or departing the work site and deliveries being made in preparation for the working day ahead) are at their highest.

Daily traffic on Paekakariki Hill road is in the order of 2,000 vehicles and peak hour volumes are in the order of 250 vehicles per hour. In addition to this, if a conservative assumption is made that 20% of construction traffic occurs during the peak hour, this equates to 35 light vehicle and 30 heavy vehicle movements (one-way). This represents a combined total of 415 vehicle movements during the peak hours or roughly seven vehicles every minute. This is considered to be conservative as most light vehicles will arrive and depart at the start and end of shifts which are unlikely to coincide with the AM or PM peak hours.

While the construction traffic component represents an increase of approximately 25% in overall traffic volume during the peak hour, comparatively speaking, the volumes are still low and well within the capacity of the road corridor even when considering the narrow and geometrically constrained nature of Paekakariki Hill Road. As a result, the effects are likely to be no more than minor and can be effectively managed through the implementation of appropriate TTM (and other measures for managing dust, noise etc) to ensure that road safety is not compromised in any way. However, it is important to note that this represents a worst case scenario and light vehicle movements could be significantly reduced through the use of minivans to ferry staff to site.

As there will be a marked increase in heavy vehicle numbers during the peak period, through consultation with PCC, consideration will be given to implementing road safety improvements along Paekakariki Hill Road to enhance the movement of heavy vehicles. These might include:

- Curve easing/localised widening to facilitate the transport of long loads such as bridge beams;
- Implementation of a larger vegetation maintenance envelope to improve forward visibility/inter-visibility through tight curves;
- Improved signage and road marking;
- Construction of a right turn bay into the construction site;
- Temporary speed restrictions through Pauatahanui Village during working hours; and
- Development of a maintenance intervention strategy with PCC to ensure that maintenance defects and safety issues are responded to in a timely manner.

In addition to the above, due to the current deficiencies in terms of alignment and visibility on the northern section of Paekakariki Hill Road (beyond Battle Hill Farm Forest Park) and at its intersection with SH1, heavy vehicles will be restricted from using this intersection to access the project. Therefore, drivers will be required to access Paekakariki Hill Road from the southern end of the project via Grays Road and SH58.

Despite the narrow and geometrically constrained nature of Paekakariki Hill Road, the indicative numbers of vehicles envisaged would not be out of character for a road of this type. The combined effects of light and heavy vehicles using this access are considered to be no more than minor.

7.2.2. Flightys Road

An upper end estimate of 85 light vehicle and 35 heavy vehicle movements could be expected on a peak day at the height of construction. Typically, the number of vehicles expected to use this access over a day would be 40 light vehicles (if minibuses were not used) and 5 heavy vehicle movements. If minibuses were used, a maximum of 8 trips would be required and would have little effect on the road. A peak demand of 35 HCVs over an 8-hour day would be less than 5 HCVs every hour, while a typical demand of 5 HCVs over an 8-hour day would be less than 1 HCV every 1.5 hours.

Existing volumes on Flightys Road are in the vicinity of 420 vehicles per day.The indicative numbers of vehicles envisaged could be easily accommodated by a road of this type and the existing intersection with SH58. Should any issues with the operation of the intersection be identified, a right turn bay could be installed as part of the TTM. The combined effects of light and heavy vehicles using this access are considered able to be accommodated with the existing traffic without significant effects.

7.2.3. SH58/Bradey Road

This route will provide access for the central construction teams operating to the south of SH58 towards the James Cook Interchange. Bradey Road, and in particular the Bradey Road bridge, provides a key link to the southern side of the Pauatahanui Stream, which eliminates the need to construct a temporary stream crossing in what has been identified as an ecologically significant body of water. Access via Bradey Road will allow work crews to construct the main alignment from SH58 through to James Cook Interchange. Bradey Road will also allow work construction crews to construct the southern abutment of the Pauatahanui Stream Bridge (Bridge No.14) while another crew works on the northern abutment. It is likely that the Bradey Road Bridge may require temporary strengthening. Once completed, Bridge 14 will provide the main access south from SH58.

The Bradey Road Bridge is a single lane bridge and is located close to the SH58 intersection. However, priority is given to movements away from SH58 to avoid queuing back to SH58. There is adequate stacking distance on the north side of the bridge to allow a heavy vehicle to wait on Bradey Road if the bridge is in use by an opposing vehicle. This issue will need to be carefully managed during construction to ensure there are no safety issues at the SH58 intersection. The bridge is the only single lane “pinch point” on this access; the remaining road has room for HCVs to pass in opposite directions.

A high estimate of 140 light vehicle (if minibuses were not used) and 100 heavy vehicle movements could be expected on a peak day when all deliveries were arriving on site at the peak of

construction. Typically, the number of vehicles expected to use this access over a day would be 130 light vehicles (without the use of minibuses) and 65 heavy vehicles. With light vehicles generally arriving and departing at the start and end of shifts (outside traditional traffic peak periods), it is considered that this number of movements could be easily accommodated by the existing network. If (as anticipated) minibuses are used, this number of movements would have little effect. A peak demand of 100 heavy vehicles accessing the site over an 8-hour day would equate to approximately one vehicle every 5 minutes. Typically there would be only around half of this per day. The Bradey Road / SH58 intersection has a right turn bay and good visibility, so access for heavy vehicles is considered to be good.

Existing volumes on Bradey Road are in the vicinity of 120 vehicles per day. Access to Bradey Road would be managed as part of the SH58 work site SSTMP and the indicative numbers of vehicles envisaged could be accommodated by a road of this type. The combined effects of light and heavy vehicles using this access are considered able to be accommodated with the existing traffic without significant effects.

7.2.4. SH58 / Joseph Banks Drive / Navigation Drive / Pacific View

This access will provide access to the main alignment to enable earthworks to occur in the area. A high estimate of 100 light vehicle (if minibuses were not used) and 30 heavy vehicle movements would be expected to use the access on a peak day at the height of construction. Typically, the number of vehicles expected to use this access over a day would be 65 light vehicle (without the use of minibuses) and 30 heavy vehicle movements. The majority of the construction heavy vehicle traffic is likely to be carrying water to site; therefore this number could reduce significantly if water was able to be provided on site. A small number of heavy vehicles are expected to use this access in the site establishment phase with 5 heavy vehicle movements a day expected at this time. Because of the residential nature of these roads, it is recommended that minibuses be used where possible which would reduce the number of light vehicle trips per day to less than five. A peak demand of 30 heavy vehicles accessing the site over an 8-hour day would equate to less than four vehicles every hour. Although the roads are residential in character, this is considered that any potential effects can be mitigated with appropriate traffic management.

Existing volumes on these roads are between 50, on Pacific View, and 3,800, on Joseph Banks Drive, vehicles per day, well within the capacity off all three roads. The indicative numbers of vehicles envisaged could be accommodated by the network in this area. The combined effects of light and heavy vehicles using this access are considered able to be accommodated with the existing traffic without any significant effects.

7.2.5. James Cook Drive – Whitby Link

This access will provide access to the Whitby link road tie-in. An upper end estimate of 80 light vehicles (if minibuses were not used) and less than 5 heavy vehicle movements could be expected on a peak day when all deliveries were arriving on site at the peak of construction. Typically, the number of vehicles expected to use this access over a day would be 65 light vehicle (without the

use of minibuses) and less than 5 heavy vehicle movements. As the site is currently used for construction of a residential subdivision, and expected to be as it develops into the future, it is considered that this number of movements could be easily accommodated by the existing network.

Existing volumes on James Cook Drive are in the vicinity of 4,300 vehicles per day. The indicative numbers of vehicles envisaged could be accommodated by the network in this area. The combined effects of light and heavy vehicles using this access are considered able to be accommodated with the existing traffic without any significant effects.

7.2.6. Warspite Avenue – Waitangirua Link

This access will provide access to the Waitangirua Link Road tie-in. A high estimate of 80 light vehicle (if minibuses were not used) and less than 5 heavy vehicle movements could be expected on a peak day when all deliveries were arriving on site at the peak of construction. Typically, the number of vehicles expected to use this access over a day would be 65 light vehicles (without the use of minibuses) and less than 5 heavy vehicle movements.

Existing volumes on Warspite Avenue vary between 14,700, in Cannons Creek, and 7,300, in Waitangirua, vehicles per day these are all well below the capacity of the road. The indicative numbers of vehicles envisaged could be accommodated by the network in this area. The combined effects of light and heavy vehicles using this access are considered able to be accommodated with the existing traffic without any significant effects.

7.2.7. Ranui Heights

This access will provide access for the construction of the southern sections of the Transmission Gully Main Alignment and the Kenepuru Interchange, via Awatea Street and Apple Terrace. An upper end estimate of 200 light vehicle and 40 heavy vehicle movements could be expected on a peak day when all deliveries were arriving on site at the peak of construction. Typically, the number of vehicles expected to use this access over a day would be 190 light vehicles (if minibuses were not used) and 30 heavy vehicle movements.

With these roads being residential in nature, it is recommended that minibuses are used extensively to provide access to this location. With a maximum of 20 minibus trips required, this number of movements would have little effect. A peak demand of 40 heavy vehicles accessing the site over an 8 hour day would equate to around four vehicles every hour. Typically there would be only 30 heavy vehicles per day.

Existing volumes on these roads are between 100, on Apple terrace, and 3,00, on Awatea Street, vehicles per day, well within the capacity off all three roads. If vehicle numbers are managed through the use of minibuses, the combined effects of light and heavy vehicles using this access are considered able to be accommodated with the existing traffic without any significant effects. Furthermore, this would only occur for up to 12 months while an alternate access is sought from State Highway 1.

7.2.8. Collins Avenue / Rangatira Road

This road will provide access to the SH1 tie-in, Collins Avenue Bridge construction and a satellite office. An upper end estimate of 50 light vehicle and 45 heavy vehicle movements could be expected on a peak day when all deliveries were arriving on site at the peak of construction. Typically, the number of vehicles expected to use this access over a day would be 30 light vehicles (if minibuses were not used) and less than 5 heavy vehicle movements. With the residential nature of the roads, it is recommended that minibuses be used to provide access to this location. A maximum of 19 minibus trips would be required and would have little effect on the road. A peak demand of 50 HCVs over an 8-hour day would around 6 HCVs every hour while typically this would be less and 5 per day.

If vehicle numbers are managed through the use of minibuses, the combined effects of light and heavy vehicles using this access are considered to be no more than minor. Furthermore, this would only occur for up to 12 months while an alternate access is sought from State Highway 1

7.2.9. Takapu Road

This road will provide access to the Cannons Creek Bridge and section. An upper end estimate 90 light vehicle (if minibuses were not used) and 55 heavy vehicle movements could be expected to use Takapu Road between the site access and SH1 on a 'peak day' when all deliveries will be arriving on site at the peak of construction. Typically, the number of vehicles expected to use this route during a 'normal' construction day would be 75 light vehicles (without minibus use) and 40 heavy vehicle movements. A peak demand of 55 HCVs over an 8-hour day would be less than seven HCVs every hour.

The indicative numbers of vehicles envisaged would not be out of character for a road of this type, which is regularly used by Transpower to access the Takapu Road sub-station and GWRC to access the Wellington bulk water main within the Belmont Regional Park. Overall, the combined effects of light and heavy vehicles using this access are considered to be no more than minor.

However, as there will be a marked increase in heavy vehicle numbers during construction, consideration will be given to implementing road safety improvements along Takapu Road to enhance the movement of heavy vehicles, in consultation with WCC. These might include:

- Curve easing/localised widening to facilitate the transport of long loads such as bridge beams;
- Implementation of a larger vegetation maintenance envelope to improve forward visibility/inter-visibility through tight curves;
- Improved signage and road marking;
- Temporary speed restrictions as necessary working hours; and
- Development of a maintenance intervention strategy with WCC to ensure that maintenance defects and safety issues are responded to in a timely manner.

7.2.10.Kenepuru Drive

This access will provide access to the northern section of the link road bridge. A high estimate of 35 light vehicle and 20 heavy vehicle movements could be expected on a peak day when all deliveries were arriving on site at the peak of construction. Typically, the number of vehicles expected to use this access over a day would be 30 light vehicles (if minibuses were not used) and 5 heavy vehicle movement.

Given that Kenepuru Drive is already very busy, it is recommended that minibuses are used extensively to provide access to this location. With a maximum of 22 minibus trips required, this number of movements would have little effect. A peak demand of 20 heavy vehicles accessing the site over an 8-hour day would equate to approximately 2 1/2 vehicles every hour. Typically there would be only 5 heavy vehicles per day.

Existing volumes on Kenepuru Drive vary between 27,100, at Raiha Street, and 13,500, at taitahi Bay Road, vehicles per day these are all well within the capacity of the road . Access to the Kenepuru Link Road construction area would be managed as part of the Kenepuru site SSTMP and the indicative numbers of vehicles envisaged would not be out of character for a road of this type. The combined effects of light and heavy vehicles using this access are considered to be no more than minor.

1756000 1762000 1768000

5456000

5448000

5440000

Cannons Creek
Awatea Street
Porirua
Ranui heights
Apple Terrace
SH 1 Access
Kenepuru
Linden
Paekakariki
Pukerua Bay
Plimmerton
Camborne
Titahi Bay
Paremata
Pauatahanui
Whitby
SH 58
Bradey Road
Elsdon
Cannons Creek
Porirua
Ranui heights
Kenepuru
Linden
Tawa
See insert above
Paekakariki Hill Road
548 Paekakariki Hill Road (south of Battle Hill Farm Park)

Ranui Heights (12 Months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	40	20	200
Typical day	30	18	190
Site Establishment	<5	<5	20

Kenepuru Drive (36 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	20	<5	35
Typical day	5	<5	30
Site Establishment	0	0	0

Collins Ave (36 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	45	19	50
Typical day	<5	11	30
Site Establishment	0	0	0

Rangatira Rd (36 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	10	<5	30
Typical day	5	<5	25
Site Establishment	5	<5	20

Takapu Rd (36 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	55	8	90
Typical day	40	6	75
Site Establishment	5	<5	20

Paekakariki Hill Road (36 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	160	18	165
Typical day	95	14	130
Site Establishment	5	<5	20

Flightys Rd (12 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	35	8	85
Typical day	5	<5	40
Site Establishment	5	<5	20

SH58/Joseph Banks Dr/Navigation Dr/Pacific Dr (12 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	30	9	100
Typical day	30	<5	65
Site Establishment	5	<5	20

Bradey Road (12 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	100	13	140
Typical day	65	11	130
Site Establishment	5	<5	20

Warspite Ave - Waitangirua link (12 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	<5	9	80
Typical day	<5	7	65
Site Establishment			

James Cook Dr/Whitby Link Rd (12 months)	Heavy Trips	Light Trips with minibus replacing cars	Light Cars (without minibus)
Peak Day	<5	9	80
Typical day	<5	7	65
Site Establishment			

Legend

- Site Offices
- Railways

Roads

- Main
- Other
- Minor
- Residential Areas
- Coastline

Kilometers
0 0.5 1 2 3 4

Transmission Gully Phase II Investigations

DRAWN	DATE	PROJECT MANAGER	PROJECT DIRECTOR
JBG	23/3/2011	A. Bell	T. Innes
DESIGNED	REVIEW		

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Level 3, 86 Customhouse Quay
PO Box 10-283, Wellington, NEW ZEALAND
Tel +64 4 473 4265; Fax +64 4 473 3369

TITLE

Construction Traffic Flow Data – Volume locations

SCALE @ A3	SKM PROJECT No	DRAWING No	AMDT
1:66,637	ZB01023		

8. Review of Transportation Policy

There are several statutory and non-statutory documents of relevance to the Transmission Gully Project. The consistency of the Transmission Gully Project with national, regional and local transportation policy is documented in Appendix F, Table 4.26, Table 4.27 and Table 4.28.

This review confirms that the Transmission Gully Project is strongly aligned with the direction of transportation policy:

- At the national level, by forming a central element of the SH1 RoNS, the project is consistent with Government policy to promote economic development as encapsulated in the GPS;
- At the regional level, the need for the project has been identified by the RLTS as a principal component of a balanced package of transportation improvements in the western corridor; and
- At the district level, the principal effects of the project will be felt in Porirua, where the transportation strategy and district planning has strongly supported and anticipated the construction of the Transmission Gully Project for many years.

Appendix A References

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"Western Corridor Plan", Greater Wellington Regional Council, April 2006.

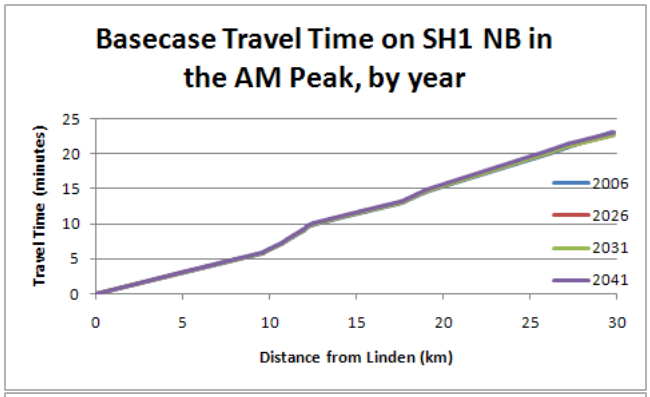
"WTSM 2006 Update Peer Review", Arup Ltd, June 2008.

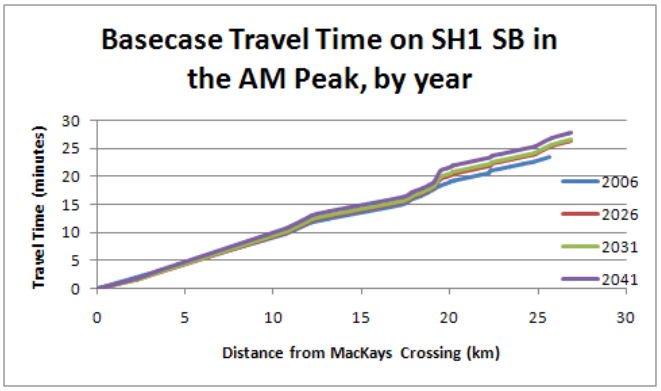
"WTSM Update Validation Report", SKM, February 2008.

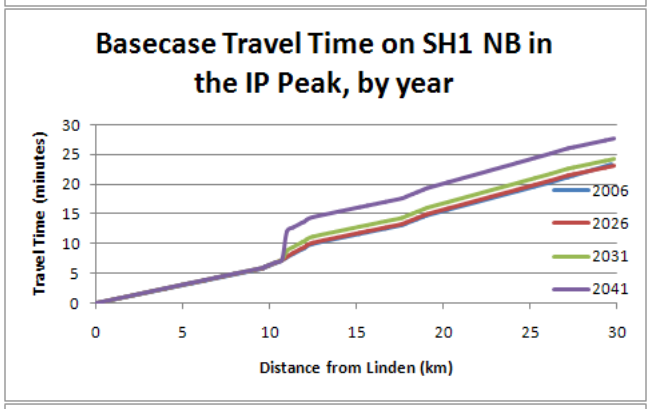
Appendix B Travel Time Graphs Basecase Only

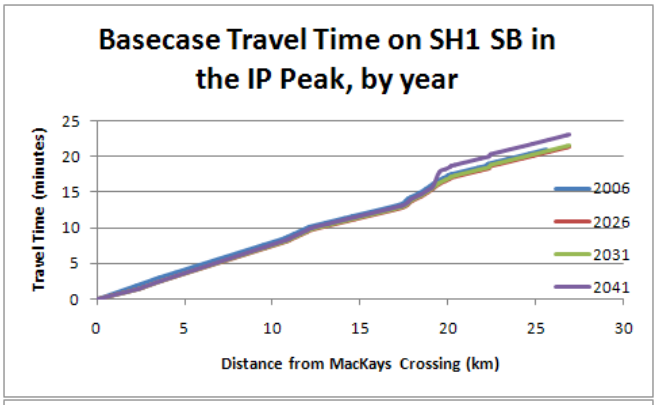
Graphs of travel times for Basecase, 2026, 2031 and 2041.

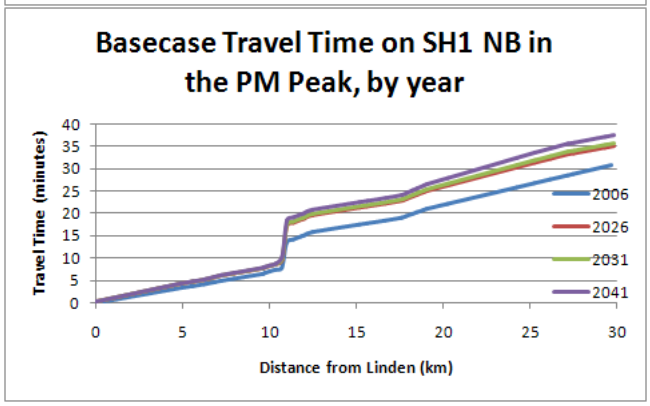
B.1 SH1 Corridor Basecase Travel Time Graphs

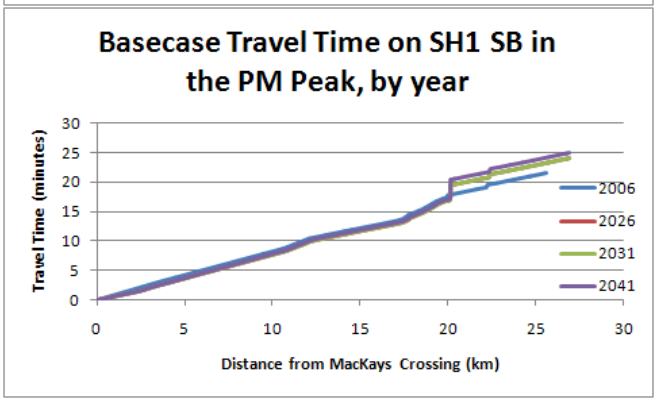




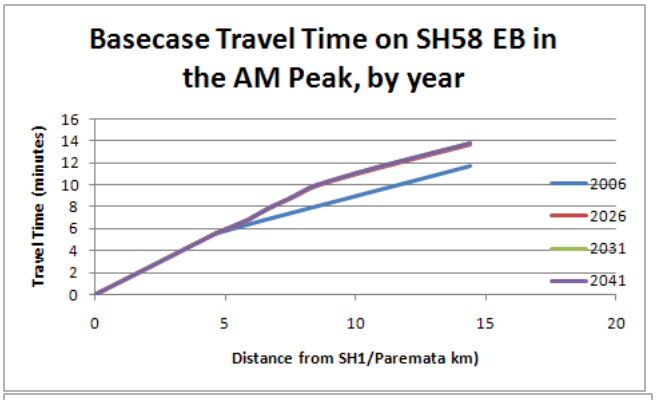


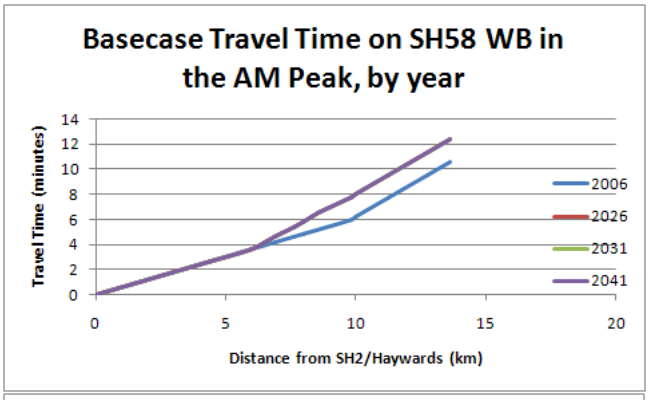


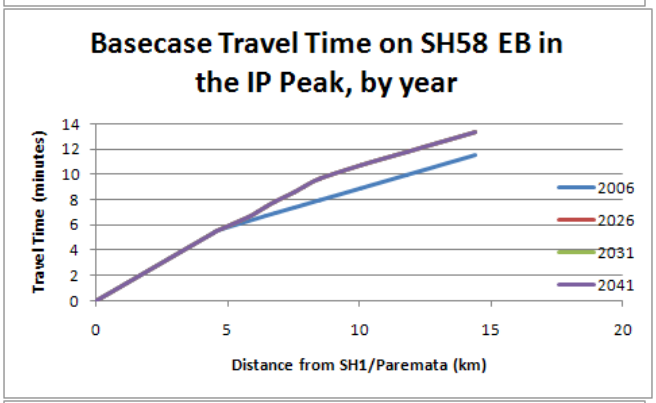


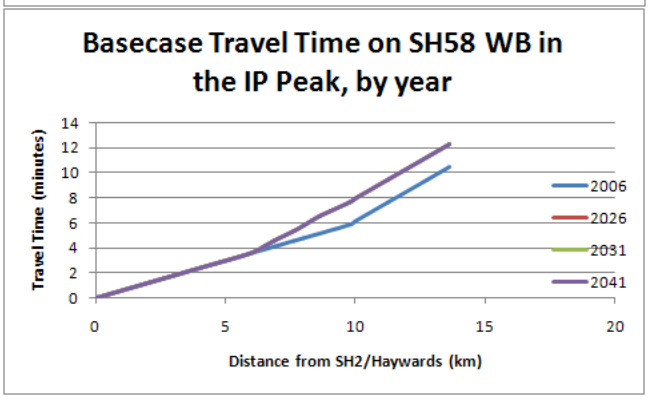


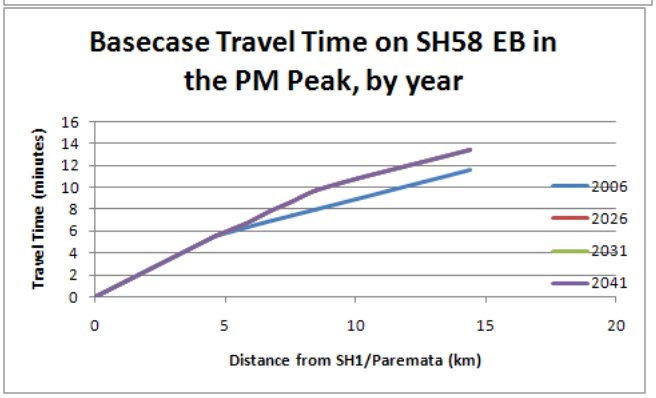
B.2 SH58 Basecase Travel Time Graphs

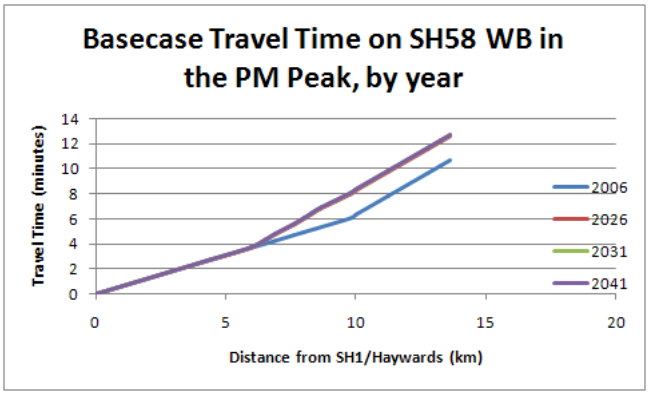








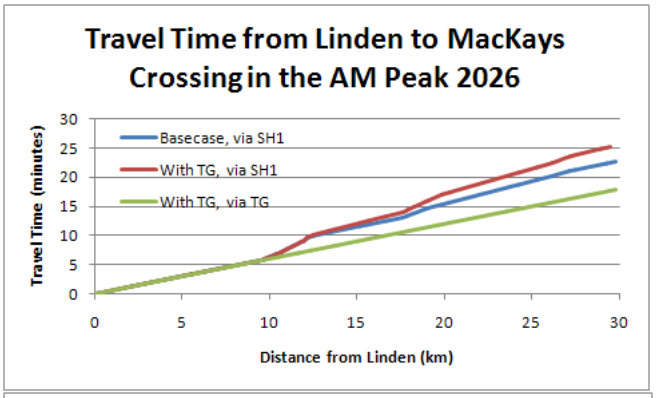


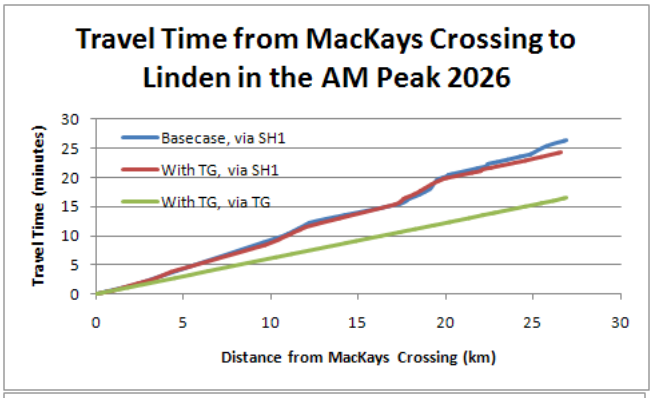


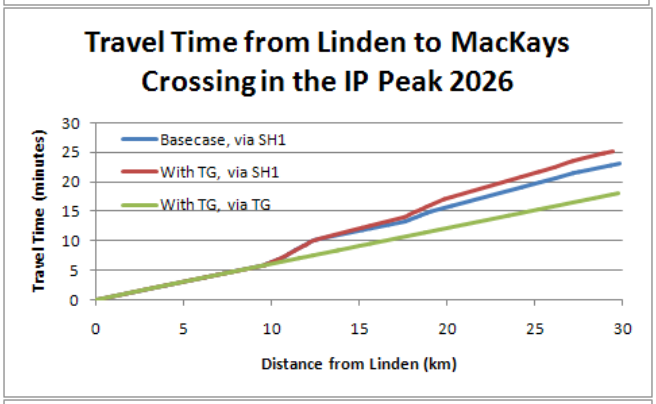
Appendix C Travel Time Graphs, Basecase and With the Transmission Gully Project

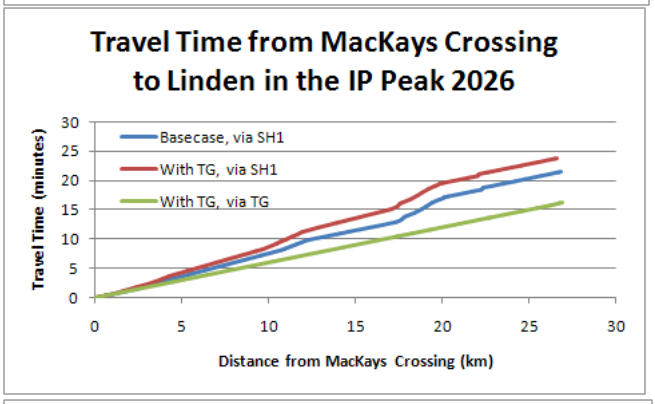
Graphs of travel times for Basecase and with the Transmission Gully Project, 2026

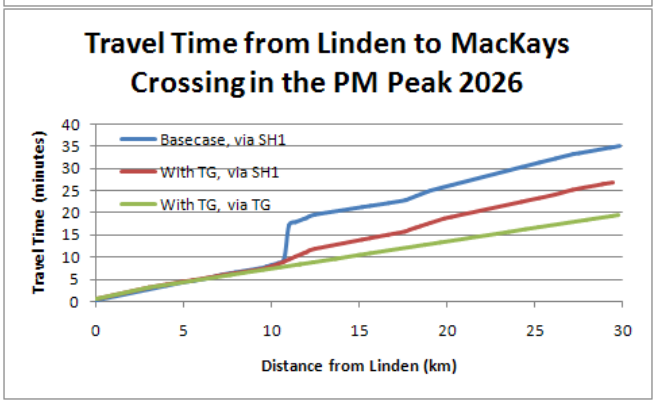
C.1 SH1 and Transmission Gully Main Alignment Corridor Basecase and With the Transmission Gully Project Travel Time Graphs

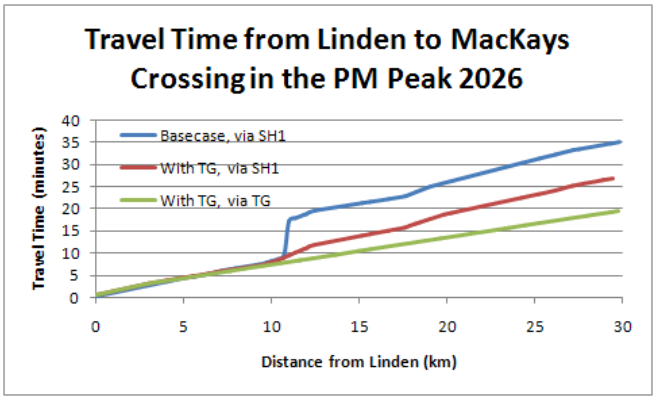




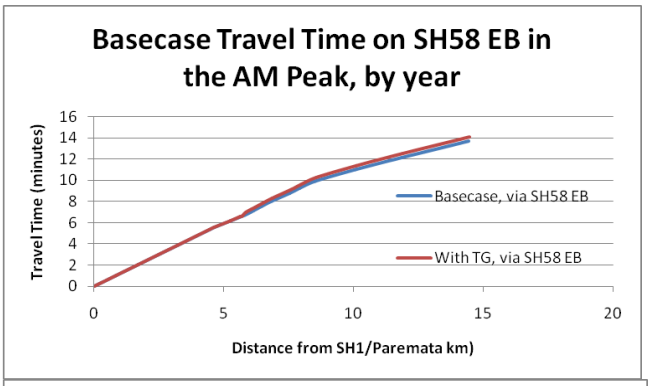


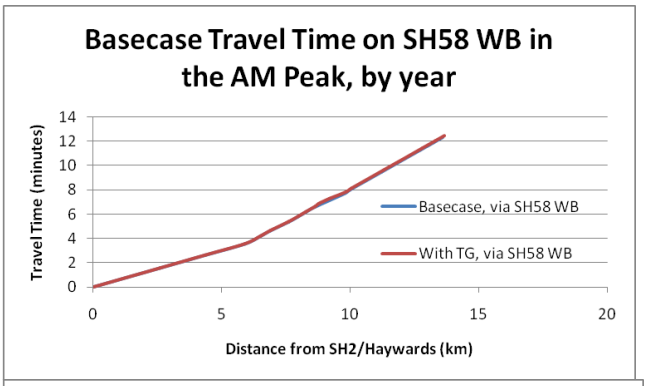


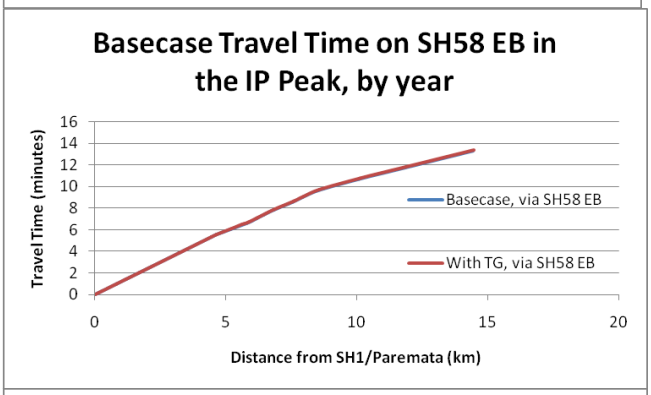


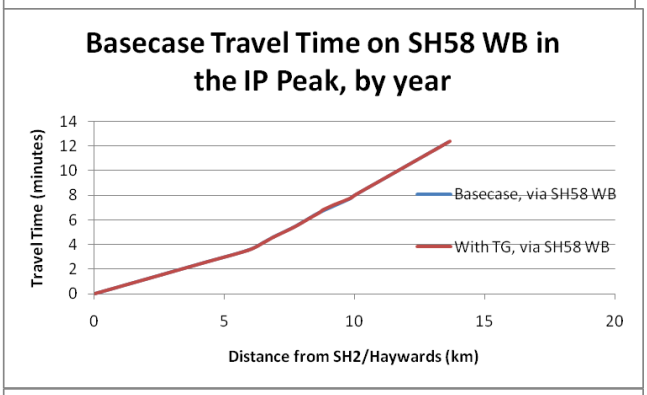


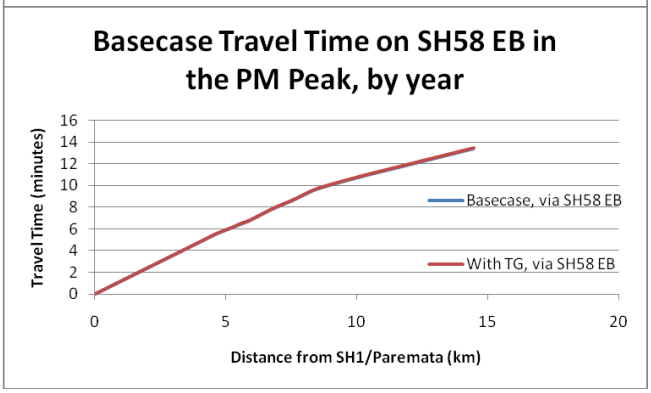
C.2 SH58 Basecase and With the Transmission Gully Project Travel Time Graphs

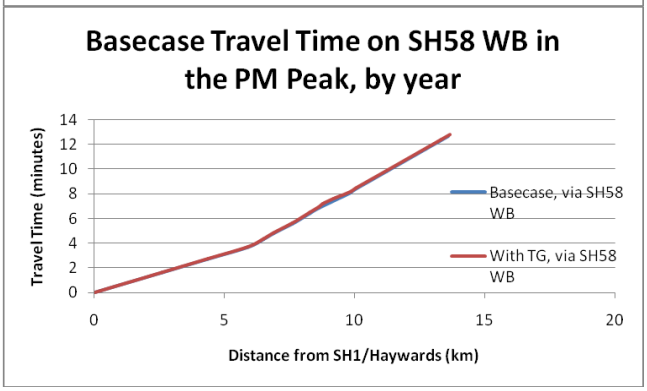












Appendix D Committed and Planned Improvements Included in Transportation Models

✗ Indicates that the project has not been included in the modelling, ✔ indicates the project has been included in the modelling.

- **Table 4.25: Committed and Planned Improvements Included in Transportation Models**[28]

Projects	2006	2016	2026	2031	2041	Description	WTSM	SATURN
Roading								
RoNS								
Airport to Mt Victoria Tunnel	✗	✗	✔	✔	✔	▪ 4-lane 70km/hr Airport to Calibar Road Roundabout	Included	Not included
						▪ 4-lane 70km/h Wellington Road and Ruahine Street on current SH1 alignment		
						▪ Signalisation of Goa Street and closure of Taurima Street intersection		
						▪ Signalisation of Constable Street intersection		
						▪ Mt Victoria Tunnel duplication (50km/h)		
Basin Reserve	✗	✔	✔	✔	✔	▪ Grade separation of SH1 to the north of the existing Basin Reserve	Included	Not included
						▪ Local roads around basin to be modified to provide bus priority		
						▪ One-way pair operation of ICB to remain		
Terrace Tunnel Duplication	✗	✗	✔	✔	✔	▪ 2-lanes in each direction 80km/hr connecting into the ICB at Willis Street / Vivian Street intersection	Included	Included
Aotea to Ngauranga Gorge	✗	✔	✔	✔	✔	▪ 4-lanes 80km/h in the peak direction. i.e. 4-lanes in the southbound direction AM peak and 3-lanes northbound.	Included	Included

[28] Table only includes projects implemented in SATURN and/or WTSM models, refer to network filenote, "Confirm Planning Baseline and Options to be Modelled and Evaluated" by SKM January 2010 for full list of projects included. Some measures have been included in WTSM but not SATURN as they are distant from the simulation area and thus will have very little effect on the modelled result.

Projects	2006	2016	2026	2031	2041	Description	WTSM	SATURN
						▪ Off-peak 100km/h and 3-lanes ▪ 1 lane on the parallel Hutt Road turned into joint bus/HOV lane		
MacKays Crossing to Peka Peka	✗	✗	✔	✔	✔	4-lane 100km/h expressway with restricted access	Included	Included
Peka Peka to Otaki	✗	✗	✔	✔	✔	4-lane 100km/h expressway parallel to existing SH1 and bypassing Otaki to the East	Included	not included
Otaki North to North of Levin	✗	✗	✔	✔	✔	4-lane 100km/h expressway bypassing Otaki to the East.	Included as far as model extent	not included
General								
MacKays Crossing Overbridge	✔	✔	✔	✔	✔	Grade separation of SH1 and the rail crossing and local roads at MacKays crossing. Construction now complete.	Included	Included
Inner City bypass	✗	✔	✔	✔	✔	New road layout including new signals between the Terrace Tunnel and the Basin Reserve. Construction now complete.	Included	Included
Dowse to Petone Interchange	✗	✔	✔	✔	✔	Grade separation project. Now Complete	Included	Included
Melling Interchange	✗	✗	✔	✔	✔	Grade separation of SH2 and Melling bridge. Beca option M3	Included	Included
Kennedy Good Bridge Grade Separation	✗	✗	✔	✔	✔	Grade separation of SH2 & Kennedy Good bridge. Same as MWH option (with local supporting road)	Included	Included

Projects	2006	2016	2026	2031	2041	Description	WTSM	SATURN
Rimutaka Corner Easing (Muldoon's)	✗	✔	✔	✔	✔	Geometric improvements on SH2 Rimutaka Hill Road	Included	Not included
SH2/58 Grade Separation	✗	✔	✔	✔	✔	Grade separation of SH2 and SH58.	Included	Included
Rugby St/Adelaide Road Intersection	✗	✔	✔	✔	✔	Rugby St / Adelaide Road Intersection signalisation and amendments to lane markings. Construction completed.	Included	Not included
Otaki Roundabout	✗	✔	✔	✔	✔	Now Complete	Included	Not included
TDM Impacts	✗	✔	✔	✔	✔	Impacts of TDM strategy - the RLTS assumes 5% reduction in trips to the CBD.	Included	Considered through matrices.
Lindale Grade Separation	✔	✔	✔	✔	✔	Already constructed.	Included	Not included
Mana-Plimmerton Upgrade	✔	✔	✔	✔	✔	Already constructed.	Included	Included
Petone – Grenada Link	✗	✗	✔	✔	✔	New route connecting SH1 at Grenada with SH2 at Petone.	Included	Included
SH58 upgrade TGM to SH2	✗	✗	✔	✔	✔	Roundabouts at 7 locations & 70 km/h treatment: ▪ Roundabout at Bradey Road ▪ Roundabout at Sawmill ▪ Roundabout at Belmont Road ▪ Roundabout at Murphys Road / Flightys Road ▪ Roundabout at Mulhern Rd ▪ Roundabout at Judgeford Golf Club entrance ▪ Roundabout at Moonshine Road ▪ 70 km/h speed limit from Pauatahanui to Moonshine Road	Included	included

Projects	2006	2016	2026	2031	2041	Description	WTSM	SATURN
						Existing alignment with 100 km/h speed limit from Moonshine Road to SH2		
Public Transport								
Integrated Ticketing	✗	✔	✔	✔	✔	Reduced boarding time as a result of improved ticketing	Included	Indirect effects on traffic demands
Real Time Information System	✗	✔	✔	✔	✔	New automated passenger information signs	Included	Indirect effects on traffic demands
Rail Electrification and Double-Tracking to Raumati	✗	✔	✔	✔	✔	Reflected in faster speeds and higher frequency services	Included	Indirect effects on traffic demands
New Rail Rolling Stock	✗	✔	✔	✔	✔	New rail rolling stock with better quality and faster speeds	Included	Indirect effects on traffic demands
Rail Services	✗	✔	✔	✔	✔	4 trains per hour in peaks and 2 trains per hour in off-peak for all but Wairarapa Service	Included	Indirect effects on traffic demands
Rail Station Maintenance and Upgrade	✗	✔	✔	✔	✔	Includes closure of Kaiwharawhara and opening of Lindale	Included	Indirect effects on traffic demands
Park & ride Carparks	✗	✔	✔	✔	✔		Included	Indirect effects on traffic demands
Kaiwharawhara Rail Capacity Improvements	✗	✔	✔	✔	✔	Additional capacity at the Kaiwharawhara 'throat'. Improved reliability.	Included	Indirect effects on traffic demands
New Buslanes	✗	✔	✔	✔	✔		Included	Indirect effects on traffic demands

✗ Indicates that the project has not been included in the modelling, ✔ indicates the project has been included in the modelling.

Appendix E Transmission Gully Project Land Use Assessments

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Transmission Gully Project: Land Use Assessments

prepared by: **Tim Kelly Transportation Planning Ltd**

for: **NZ Transport Agency**

June 2011

Reference: tg landuse assessment v4 jun11

Contents

Abbreviations

Abbreviation	Expansion
BERL	Business and Economic Research Limited
EIR	Environment Impact Report
GATS	Greater Wellington Area Transportation Study
GPS	Government Policy Statement
GRPA	Government Roading Powers Act 1989
GWRC	Greater Wellington Regional Council
KCDC	Kapiti Coast District Council
MERA	Monitoring and Evaluation Research Associates
NGMF	Northern Growth Management Framework
NoR	Notice of Requirement (for designation)
NZTA	NZ Transport Agency
PCC	Porirua City Council
PDF	Porirua Development Framework
RoNS	Roads of National Significance
SAR	Scheme Assessment Report
SATURN	Simulation and Assignment of Traffic to Urban Road Networks
SH1 / 2 / 58	State Highway 1 / 2 / 58
SIDRA	Signalised and Unsignalised Intersection Design and Research Aid
SKM	Sinclair Knight Merz
SNZ	Statistics NZ
TG	Transmission Gully
TKTPL	Tim Kelly Transportation Planning Ltd
WCC	Wellington City Council
WNC	Wellington Northern Corridor
WTSM	Wellington Transport Strategy Model

Executive Summary & Conclusions

The proposed 27 kms Transmission Gully upgrade to State Highway 1 is a central element of a balanced package of transportation improvements in this corridor. The Transmission Gully project is also a core component of the Roads of National Significance improvements planned for State Highway 1 between Wellington Airport and north of Levin.

This report describes:

- a review of the land-use forecasts which form the basis of the transportation assumptions of the Transmission Gully project;
- a review of the likely land-use responses to the Transmission Gully project; and
- the overall effects of the Transmission Gully project arising from such land-use responses.

This report concludes that:

- although forecasting of future demographic and economic activity is inevitably subject to uncertainty, the forecasts which form the basis of the transportation assessments of the project are soundly based;
- the opening of the Transmission Gully project will give rise to changes in absolute and relative accessibility, which can be expected to affect the longer term locational decisions of businesses and households, with consequent impacts upon land-use and volumes of transportation demand;
- this additional transportation demand can be accommodated by the strategic road network because of the same infrastructural improvements (Transmission Gully) which will give rise to the improvements in accessibility;
- whilst some pressures may be created on the local road network, these will only emerge gradually over a period of many years, allowing time for localised improvements to the roading network to be planned and implemented;
- in some areas developmental pressures arising from the Transmission Gully project will be accommodated where the zoning of District Plans has planned for such development (and hence the effects have already been anticipated);
- elsewhere, a consent or plan change necessary to enable development will only be secured after a thorough assessment of the potential effects, offering protection against development which is inappropriate or which could give rise to adverse effects; and
- on balance, the Transmission Gully project is highly likely to generate minor positive land-use outcomes, facilitating economic and population growth locally and across the region, and is consistent with the rationale for the inclusion of the project as part of the Roads of National Significance.

1 Introduction

1.1 Background

The existing State Highway 1 (SH1) between Linden and MacKays Crossing to the north of Wellington suffers from an inadequate level of capacity provision, resulting in peak period delays and poor travel time reliability. In addition, safety problems, severance and poor accessibility to/from the route are experienced.

A need to improve this section of SH1 has been recognised for many years. The importance of the Wellington Northern Corridor (WNC) to the connectivity of Wellington with areas to the north was recognised by its inclusion in a list of Roads of National Significance (RoNS) identified in the Government Policy Statement on Land Transport Funding (GPS) to be prioritised for improvement work. The Transmission Gully Project (the 'Project') forms a key component of the WNC.

The Government has confirmed the 27 km long Project as the preferred alignment for the upgrading of SH1 between Linden and MacKays Crossing, in the Wellington Northern Corridor Project Summary Statement December 2009, and commissioned engineering and environmental assessments with the aim of preparing Notices of Requirement (NoR) and regional resource consents for construction of the Project along the preferred alignment.

1.2 Purpose and Scope of the Assessment

The purpose of this assessment was to undertake an appraisal of the potential impacts of the Project upon patterns of land-use.

The scope of the assessment was to:

- review the validity of the land-use assumptions which form the basis of the transportation assessments of the Project;
- review the likelihood of land-use responses to the Project; and
- determine the extent to which land-use responses associated with the Project may give rise to beneficial or adverse effects.

1.3 Structure of Report

This report is part of a suite of reports that have been prepared in support of the applications for NoRs and resource consents for the Project.

The set of application documents comprises:

- Volume I - Assessment of Effects on the Environment;
- Volume II - Resource Management Act 1991 forms;
- Volume III - Technical reports; and
- Volume IV - Plan set.

This report forms part of Volume III.

Section 2 of this report provides a brief description of the Project. **Section 3** summarises the key findings of the transportation assessments of the Project, and the expected traveller responses to the project of relevance to considerations of land-use. The land-use assumptions which form the basis of the transportation assessments are reviewed in **Section 4**, followed by a review of the likely land-use responses to the Project and their associated effects in **Section 5**.

2 The Transmission Gully Project Environment

The Transmission Gully Project (the Project) is described in full in Technical Report #4.

Table 2.1 provides a breakdown of the route of the Main Alignment by section and local authority area. The route lies predominately (21.4 kms) within Porirua City, with 4.7 kms within Kapiti District and short sections within Upper Hutt City and Wellington City.

The land through which the Main Alignment passes is primarily rural in nature, with a mixture of farming, lifestyle properties and forestry. The route only passes close to residential or commercial activities at the northern and southern tie-ins with SH1, and at the proposed SH58 intersection.

Section Number	Section Name	Length by Territorial Authority (m)					Overview of Land-Uses
		KCDC	PCC	UHCC	WCC	Total	
1	MacKays Crossing	3,500				3,500	*Some commercial activity adjacent to SH1, rural farming, transmission lines, bush and grazing on higher land*
2	Wainui Saddle	1,175	1,200	625		3,000	*Predominately bush and grazing*
3	Horokiri Stream		3,000			3,000	*Predominately rural farming*
4	Battle Hill		3,000			3,000	*Predominately rural farming. Battle Hill is a farm forest park maintained by Greater Wellington*
5	Golf Course		3,000			3,000	*Rural farming, lifestyle properties and golf course*
6	State Highway 58		3,000			3,000	*Lifestyle properties, some commercial activity, electricity sub-station*
7	James Cook		3,000			3,000	*Rural, forestry, borders southern edge of Whitby*
8	Cannons Creek		3,400			3,400	*Rural, forestry, borders southern edge of Cannons Creek*
9	Linden		1,830		970	2,800	*Rural, forestry, SH1 tie-in adjacent to Linden and Tawa residential land-use*
	Total	**4,675**	**21,430**	**625**	**970**	**27,700**	

Table 2.1: Summary of Transmission Gully Main Alignment Route Sections and Existing Land-Uses

3 Transportation Assessments

3.1 Description

Transportation demand and patterns of land-use are inextricably linked. Whilst patterns of land-use are the primary driver of transportation demand, it is also true that the resulting conditions on the transportation network influence patterns of land-use.

The effects of the Project upon patterns of transportation demand have been the subject of separate and thorough investigations as described in the Traffic and Transportation Effects report. Because of the close inter-relationship between land-use and transportation, a close working relationship has been maintained in the completion of these assessments.

It is not intended to duplicate the assessments reported by the transportation workstream. Instead, this section summarises the key aspects of the methodology applied and conclusions reached of relevance to a consideration of land-use, and how this might be affected by the Project.

3.2 Transportation Assessment Methodology

Assessments have been undertaken for two principal scenarios:

- Basecase: this represents the transportation network as it is expected to be in the future, with the exception of the Project. This includes the other Roads of National Significance (RoNS) projects in the State Highway 1 corridor, but excludes the Project and any changes to the existing State Highway 1 coastal route; and
- Transmission Gully: project as proposed by the draft SAR (with no tolls applied to users), with a package of measures applied to 'downgrade' the existing coastal route, and implementation of the other RoNS projects in the State Highway 1 corridor.

The transportation assessments have used a hierarchy of models to assess the likely effects of the Project.

At the highest level, the Wellington Transport Strategy Model (WTSM) has been used to quantify the likely impacts of the Project upon the distribution of travel by mode, destination and route. This model, owned by Greater Wellington, has as its basis travel patterns established from a range of surveys, most significantly household interview surveys undertaken throughout the Wellington region. Future-year forecasts of travel demands are synthesised from a number of demographic and economic variables, consistent with forecasts prepared by Statistics NZ (SNZ). These forecasts in turn are consistent with anticipated land-use developments at the territorial authority level.

The WTSM is used to generate patterns of traffic demand which are then fed into a more detailed traffic assignment model using SATURN (Simulation and Assignment of Traffic to Urban Road Networks) software. This model identifies the traffic demands on each section of the road network by simulating how drivers are likely to respond when the Project is opened to traffic.

Finally, the detailed operation of intersections has been assessed using SIDRA (Signalised and Unsignalised Intersection Design and Research Aid).

3.3 Expected Traveller Responses to the Transmission Gully Project

Significant new infrastructure such as the Project will give rise to a variety of responses by travellers, some of which will have implications for future patterns of land-use.

These responses are summarised by **Table 3.1**, together with a comment on the extent to which each has been accounted for by the transportation assessments. The two most significant effects, reassignment and mode transfer, are fully accounted for by the modelling approach. Changes to the timing and frequency of trips are relatively minor effects, for which no reliable empirically-based adjustment is available.

Trip redistribution covers a variety of responses. In the shorter-medium term, the changes in costs of travel (represented in terms of both distance and time) results in some people changing the destination of their trip. For example, easier travel between Kapiti and the Hutt Valley might result in some Hutt Valley residents choosing to travel to the beaches in Kapiti more frequently, in preference to other destinations or activities. Whilst the pattern of land-use and total number of trips remains unchanged, the distribution of trips changes. Account is taken of this effect by the WTSM.

In the medium-longer term, some people and businesses may decide to relocate to take advantage of improved accessibility. For example, a freight distribution business may decide to locate to Kapiti or Porirua in preference to Wellington, because of the improved connectivity and lower costs associated with travel from here to the rest of the region. This results in a change in the number of dwellings, employment and commercial activity by area, having some effect upon the pattern of land-use. The resulting changes in trip patterns cannot be easily quantified as part of the modelling approach. Because such responses are generally confined to the longer term, their effect is of lesser importance to the overall evaluation of the project. This response is considered in more detail in **Section 5** of this report.

Response	Characteristics	Assessed by Transportation Model
Reassignment – change of route by road users	Short-term	Fully
Mode Transfer – change of mode (from public transportation to road)	Short/Medium term	Fully
Redistribution – travellers change their trip origin and/or destination	Short/Medium/Long term	Fully
Redistribution – relocation of activities	Medium/Long Term	No
Retiming – travellers change their time of travel	Short/Medium term	No
Frequency of travel –travellers change the number of trips made in a given period	Short/Medium term	No

Table 3.1: Traveller Responses to Transmission Gully

3.4 Relevant Conclusions of the Transportation Assessments

A full assessment of the effects of the Project upon the transportation network is described in Technical Report No. 4. The principal effects are:

- large reductions in traffic volumes along the existing State Highway 1 between Linden and MacKays Crossing due to significant travel time savings and much improved travel time reliability offered by the Project and the diversion of all through traffic movements to the new route;
- significant traffic reductions on some other roads, such as Grays Road, the Paekakariki Hill Road and State Highway 58 adjacent to the Pauatahanui Inlet;
- reduced travel times both along the State Highway 1 corridor, and between this corridor and State Highway 2 at Haywards;
- some redistribution of travel, with an increase in travel demands between Kapiti and the Hutt Valley resulting from the reduction in costs of travel;
- some transfer of trips from the parallel rail corridor to road, resulting in an increase in total vehicle volumes (trip induction) beyond the extent of the Project (but acknowledging that this occurs within the wider context of a balanced transportation strategy which is also seeing significant investment in the rail infrastructure); and
- accommodation of rising volumes of road-freight by the Project and removal of truck movements from inappropriate routes and existing communities.

The primary implications of these effects for considerations of accessibility and growth are improvements in :

- general accessibility for trips along the State Highway 1 corridor, and between the State Highway 1 corridor and State Highway 2 at Haywards, arising from reduced costs of travel;

- local accessibility within and across the SH1 corridor arising from reduced traffic volumes on many local roads and significantly easier access to/from the existing State Highway 1 route;
- local accessibility to Whitby and Eastern Porirua, with trips to and from these areas able to readily access the strategic road network with a reduced use of local roads; and
- local accessibility to the Kenepuru Hospital, Kenepuru commercial area and northern Tawa.

4 Review of Land Use Assumptions

4.1 General Approach

As described in **Section 3**, the application of the WTSM model is central to the assessments of the Project. This model is in turn based upon a range of assumptions regarding the pattern of growth and future land-uses across the region.

Forecasts of future growth are inevitably subject to some uncertainty, being influenced by a number of economic and demographic variables at the regional and national levels. Even the best forecasts at a point in time are subject to change as development pressures vary in response to a variety of factors.

This section describes a review of committed developments within each local authority area against the original assumptions which formed the basis of the WTSM forecasts. From this, conclusions are drawn regarding the validity of the assessments made of the Project using this model.

The original demographic and economic forecasts which formed the basis of projected transportation demands in WTSM were prepared by Monitoring and Evaluation Research Associates Ltd (MERA). MERA was commissioned to undertake a thorough review of the original forecasts in the context of current information regarding committed developments within each territorial authority area. This sections presents a summary and interpretation of the MERA review and conclusions.

At the outset, this process acknowledged that some changes in patterns of development since the original forecasts would be inevitable. However, the purpose of this review was only to identify changes where these were of sufficient significance to potentially affect forecasts of future transportation demand and hence the assessment of the Project.

The review process also sought to differentiate between committed development (which can be reasonably expected to occur and hence should be included) and 'aspirational' growth, for which no firm commitment exists. For example, a local authority may have a general expectation that an area might be developed for residential purposes, but such development is not included in the District Plan and no firm commitment exists. Such a case would be categorised as 'aspirational' and dismissed from the assessment. However, if a plan change facilitating residential development has become operative, this was considered to be committed development.

In reality, some potential development cannot be easily categorised and judgement has been required. For example a plan change may be likely to receive approval, but has not yet become operative. In these cases, liaison with the local authorities concerned was used to assist in establishing the status of any specific potential development.

This exercise has only been undertaken for Kapiti Coast District, Porirua City and Wellington City, as these are the local authority areas in which variance in development pressure has potential to significantly affect the Project. Whilst effects may arise in the

Hutt Valley or Horowhenua, these were not considered to be of sufficient significance to warrant assessment.

4.2 Porirua City

Porirua Development Framework (PDF)

Description: The PDF identifies potential areas for future intensification, and is based on a premise that 5,000 additional dwellings are needed prior to 2021 with a combination of infill and urban expansion. A framework for development is also provided for the period to 2050. Targeted measures include:

- Residential intensification / infill at:
  - Cannons Creek / Waitangirua;
  - Whitby;
  - Titahi Bay;
  - Mana – Plimmerton;
  - Paremata;
  - Takapuwahia / Elsdon; and
  - Kenepuru Hospital land
- Industrial / Commercial development at Pauatahanui / Judgeford
- Rural Residential development:
  - Camborne – Pukerua Bay; and
  - Pauatahanui / Judgeford.

Status: Adopted by PCC, but a non-statutory document which is intended to advise a review of the District Plan and structure planning exercises, a process which will be subject to consultation with the community.

WTSM Allowance: The developments identified would be required to be confirmed by the District Plan review process and hence remain uncertain. For this reason, it would be inappropriate to make specific allowance for these over and above the forecasts in the WTSM since this could significantly overstate transportation demands in some areas. Nonetheless, demographic forecasts for Porirua make some allowance for general growth for which specific locations have not been identified, and hence some account has been made for developments of the type anticipated.

Relevance: Development on the scale envisaged by the PDF would increase transportation demands significantly throughout the Porirua area. However, planning for such development partly anticipates the Project and the improvements in accessibility which this will provide.

For example, significant residential development in the Camborne – Pukerua Bay corridor would be more appropriately serviced by the existing SH1 route once large volumes of through traffic have been removed by the opening of the Project.

Porirua City Centre Revitalisation

Description: PCC intends to restructure the central city to improve its urban form and functionality. This includes measures to promote apartment developments and inner-city living for a range of household types. Estimates have been made of an additional 500 residents in the city centre and 500 in the Kenepuru hospital grounds.

Status: Adopted by PCC, but achievement of the plan requires a funding commitment which is not yet confirmed, and a future plan change.

WTSM Allowance: Residential intensification in the Porirua city centre area may be regarded as aspirational only at this stage and hence no specific allowance has been made or is appropriate in the WTSM.

Relevance: The revitalisation of the city centre area is not reliant upon the Project. However, the Project will result in some reductions in traffic congestion currently experienced in the Mungavin interchange and Titahi Bay Road / Kenepuru Drive intersection areas, which is likely to increase the accessibility and attractiveness of the central city area.

Duck Creek & Silverwood Development

Description: Duck Creek and Silverwood are developing residential areas in Whitby, with a capacity of 260-300 and 300-350 households respectively.

Status: Silverwood is currently under development with completion anticipated in 2015, at the rate of approximately 50 dwellings per annum. Duck Creek commercial development is currently the subject of a Comprehensive Development Plan and is likely to commence in the near future.

WTSM Allowance: Whilst allowance has been made in WTSM for these developments, the rate of development may be slightly greater than assumed in the model, resulting in some slight under-statement of the associated traffic volumes for the assessment of the Project.

Relevance: Both areas of development will be accessible to the Project by means of the proposed link roads.

Plan Change 6: Judgeford Hills

Description: Plan change to facilitate rural lifestyle development of 43 lots accessed by means of Bradey Road.

Status: Plan change is operative.

WTSM Allowance: No specific allowance made in WTSM, but potential development is small in scale and would not have a significant impact upon levels of transportation demand.

Relevance: Will be accessible to the Project by means of the proposed SH58 intersection.

Plan Change 13: Broken Hill

Description: Private plan change which rezones 5.1 hectares of land zoned 'rural' to 'industrial'.

Status: Plan change was the subject of a hearing in August 2010. The plan change has now been confirmed (no appeals have been lodged).

WTSM Allowance: At the time the WTSM forecasts were assembled, the application for this plan change had not been lodged and hence no specific allowance was appropriate.

Relevance: Likely to result in some increased use of the Kenepuru link road to / from SH1.

4.3 Kapiti Coast District

Plan Change 73: Paraparaumu Airport

Description: A private plan change which sought to rezone 126 hectares and facilitate development totalling 339,400m^2 at the Paraparaumu airport. Expected land-uses comprised a mix of commercial and retail activities, including development of the airport itself to enable commercial flights.

Status: After an appeal to the Environment Court, the plan change was confirmed and is now operative.

WTSM Allowance: Some development in this area was anticipated in the WTSM forecasts, although the detail of the development was not confirmed at the time these were assembled.

Relevance: Likely to result in some increased use of SH1 to the south of Kapiti, including the Project. The greater accessibility between Kapiti and areas to the south provided by the Project has been partly anticipated in the development proposal.

Plan Change 72a: Wharemauku Precinct

Description: A public plan change which proposes an extension of the Commercial / Retail zone in central Paraparaumu. New rules and standard for development within this area are proposed which focus on the design of buildings and car-parking areas.

Status: Commissioners recommended approval of the plan change. The Council decided to adopt the recommendation in May 2011, but the

appeals periods for the Plan Change does not close until the end of June 2011.

WTSM Allowance: No specific allowance, because the plan change had not been confirmed. However, some growth in the Paraparaumu CBD area has been assumed.

Relevance: Likely to result in some increased use of SH1 to the south of Kapiti, including the Project.

Plan Change 78: Large Format Retail

Description: A public plan change which aims to encourage new Large Format Retail developments to locate within close proximity of the main shopping areas.

Status: Subject to appeal.

WTSM Allowance: No specific allowance, because the plan change has yet to be confirmed. Principally affects the distribution of retail activity within Kapiti rather than the overall quantum of growth.

Relevance: Unlikely to significantly affect the Project.

Plan Change 79: Waikanae North Urban Edge

Description: A private plan change which proposed to manage the expansion of residential development north of Waikanae. Proposed 'low-impact' development and an 'eco-hamlet'. Expected to accommodate 2,400 people in 700-800 households within an area of 340 hectares.

Status: Now operative, though timing and details are uncertain due to NZTA Expressway proposal.

WTSM Allowance: Residential growth in this area has been anticipated for some time and allowance has been made in WTSM for this development.

Relevance: Likely to result in some increased use of SH1 and the Project.

Plan Change 80: Ngarara Farms

Description: A private plan change which proposed to rezone 280ha of land north of Waikanae from 'rural' to 'residential' to facilitate mixed use activities including a range of dwelling types, commercial, recreational and educational activities.

Status: Now operative, though timing and detail uncertain due to NZTA Expressway proposal.

WTSM Allowance: Residential growth in this area has been anticipated for some time and allowance has been made in WTSM for this development.

Relevance: Likely to result in some increased use of SH1 and the Project.

Plan Change 81: Otaki South Development Area

Description: A private plan change which seeks to rezone 19 Ha of land adjacent to the Otaki river and west of SH1 from 'rural' to 'industrial/service'.

Status: Adopted by KCDC but not yet operative.

WTSM Allowance: No specific allowance as plan change has yet to be confirmed.

Relevance: Remote location from the Project is likely to result in minimal impacts.

Plan Change 83: Meadows Precinct

Description: A private plan change which seeks to rezone 6 Ha of land in Paraparaumu from 'residential' to 'commercial/retail', on the corner of Mazengarb Road, Realm Drive and Sovereign Way.

Status: Now operative.

WTSM Allowance: No specific allowance as plan change had not been confirmed at time of model development.

Relevance: Relatively small area would not lead to any significant impact upon the Project.

4.4 Wellington City

Northern Growth Management Framework (NGMF) (2003)

Description: A development framework for the area to both sides of SH1 north of the Ngauranga Gorge and south of Porirua. The NGMF is predicated on a population growth of 9,000 in this area over a 20 year period, compared to the underlying zoning which allows for an additional 4,000 people.

Key development areas identified include:

- Lincolnshire Farm;
- Johnsonville;
- Takapu Road;
- Grenada North; and
- Churton Park.

Status: Whilst operative under the Local Government Act, this only provides a framework to direct growth.

WTSM Allowance: Although the NGMF does not have statutory status under the RMA, it formalises growth pressures in this area which have existed for some time. WTSM has made allowance for a realistic rate of growth in this area but the outturn in terms of the detailed location and timing of development may differ slightly.

Relevance: Growth in this area will have some effect upon travel volumes in the SH1 corridor. The precise location of the growth within the NGMF area is unlikely to have any significant impact upon the overall assessment of the Project.

Urban Development Strategy – Growth Spine (2006)

Description: A strategy which seeks to focus future population and employment growth along a growth spine between Johnsonville and Adelaide Road, supported by a high quality public transport network.

Status: Although a strategy, the principles are being enacted through plan changes 72 (residential review) and 73 (suburban centre review), for which decisions have recently been notified.

WTSM Allowance: WTSM allows for a higher rate of growth in the areas affected, possibly more than that assumed in the strategy.

Relevance: Unlikely that this will significantly affect assessments of the Project since it relates mainly to the distribution rather than overall quantum of growth.

Lincolnshire Farms Development

Description: Development of the hill-top area to the east of Grenada and adjacent to a potential link road to Petone. Includes a business park and 800 – 900 dwellings (approximately 2,500 people), expected to occur from 2020.

Status: Committed development.

WTSM Allowance: Allowed for in WTSM, although the assumed timeframe may require adjustment to reflect the latest status of the development.

Relevance: A significant area of development which will have some effect upon transportation demands in the Project area.

Proposed Plan Change 72 (Residential Review)

Description: A full review of the residential chapters of the District Plan, which provides for two new medium density residential areas surrounding the Johnsonville and Kilbirnie town centres.

Status: Decision notified.

WTSM Allowance: WTSM already allows for significant growth in the relevant areas and hence effects are already taken into account.

Relevance: Unlikely to significantly affect the Project assessments.

Proposed Plan Change 73 (Suburban Centre Review)

Description: A full review of the Suburban Centre chapters of the District Plan, which provides for a splitting of the Suburban Centre zone into

Centres and Business Areas to recognise their differing roles and better manage the activities that locate in these areas.

Status: Decision notified.

WTSM Allowance: Not particularly relevant to the WTSM, though to the extent that this is consistent with the growth spine strategy allowance has been made for the resulting patterns of development.

Relevance: Unlikely that this will significantly affect the Project assessments.

Johnsonville Mall Redevelopment & Town Centre Plan

Description: A proposed redevelopment of the Johnsonville Mall, within the context of a wider redevelopment of the town centre area (an expected increase of 24,000 – 30,000m^2 of retail floor-space).

Status: Relevant consents have been granted.

WTSM Allowance: Some allowance has been made in the WTSM but likely that these understate the effect of the full development as proposed.

Relevance: Significant retail development has the potential to affect the competiveness of Johnsonville as a retail destination and hence the distribution of shopping-related trips. However, such effects which are reliant upon commercial performance are difficult to estimate reliably. A small effect upon the assessment of the Project is likely.

4.5 Conclusion

The projections of population and employment which form the basis of the WTSM forecasts of transportation demand take account of the major developments within the region of relevance to the assessment of the Project.

In some cases, this allowance is explicit, where development has been signalled for some time and good information was available regarding the characteristics and expected timing of development.

In other cases, allowance has been made for more generic growth where details of specific development were not available but a reasonable expectation of growth occurring did exist.

By its nature, growth is subject to some uncertainty. This uncertainty relates mainly to the timing and detailed location of development within a local authority area.

In the context of a strategic roading project which will primarily serve longer distance travel between local authority areas, the precise location of growth within those areas is of lesser significance than the overall quantum of growth, which is relatively well-defined.

Similarly, growth which occurs a few years earlier or later than originally envisaged may largely cancel out in terms of the additional transportation demand across a wider area. At worst, growth which occurs earlier or later affects only the point in time at which the assessed benefits of the Project occur, and not whether they will occur at all.

Importantly, the WTSM has not taken account of aspirational growth where no firm commitment exists. To do so for each local authority area would summate to a level of growth across the region far above that achievable, with a consequent inflation of transportation demands.

For these reasons, it is reasonable to conclude that the assessments of the Project have been based upon forecasts of future demographic and economic growth which are soundly based.

5 Land Use Response to Transmission Gully & Associated Effects

5.1 Likely Land Use Responses to Transmission Gully

As described in **Section 3**, a significant project such as Transmission Gully will have impacts upon the timing, distribution and quantum of travel which go beyond a simple reassignment of vehicle movements from the existing SH1 route.

Since the mid-1990's, it has been recognised that the supply of and demand for road capacity are inter-related. This is because a major roading improvement reduces the costs of travel and the resulting improvements in accessibility and development pressures lead to increases in demand, generically termed 'induced' traffic. In extreme cases, such as the M25 motorway in the United Kingdom, the increases in traffic experienced were well above forecast levels and led to congestion.

The Project will result in a significant reduction in the costs of travel in the SH1 corridor, principally through travel time savings, reduced travel time variability and lower costs of vehicle operation.

This will result in an improvement in the accessibility of destinations served by this section of SH1. Such a change in accessibility, relative to other locations, can be expected to lead to an increase in demand for travel as a result of a range of behavioural responses by travellers.

Some changes may occur immediately. As suggested in **Section 3**, the availability of the route may encourage more people from the Hutt Valley to travel to the coastal attractions of the Kapiti Coast, who were previously discouraged from doing so by a perceived likelihood of delays.

Other changes will occur gradually over time. For example, a household might make a locational decisions to live in Kapiti rather than in Wellington, or a freight business might decide that the establishment of a distribution hub at Paraparaumu airport is now worthwhile.

Collectively, thousands of such individual decisions will lead to an increased level of economic and development activity in those areas experiencing an improvement in accessibility.

Whilst a significant part of this economic and development activity will be relocated from elsewhere in the Wellington region, the general improvement in accessibility within the region can also be expected to attract some activity from elsewhere in the country, or even overseas. For example, a manufacturer for whom transportation costs are significant, may be encouraged to locate in the Porirua basin as a result of improvements in the accessibility of the area to markets by road.

As indicated in **Section 3**, the modelling approach used takes some account of trip induction. Whilst the scale of land-use responses and hence increases in transportation demand cannot be ascertained with any accuracy, it is considered that they could be accommodated by the transportation network, for two reasons:

- the same infrastructural improvement (the Project) which gave rise to the improvements in accessibility will ensure that the strategic road network has sufficient capacity to accommodate any likely increases in demand beyond that assumed in the core transportation analysis; and
- these effects will only emerge over a period of many years, giving time for additional capacity (if needed) to be planned and provided on the local road network.

5.2 Potential Adverse Effects

Table 5.1 summarises the potential adverse effects associated with the land-use pressures arising from the Project and the likelihood of these being realised.

Potential Effect	Likelihood	Comment
Localised increases in transportation demand overload strategic transportation network	None	The changes in transportation demand occur as a result of improved accessibility arising from the Project. By definition, this will ensure that sufficient capacity is available to absorb longer distance travel movements. Were severe congestion to occur, this would increase the costs of travel, with a negative effect upon accessibility and a dampening of population and employment growth pressures.
Localised increases in transportation demand overload local transportation network	Low	Changes in transportation demand will occur gradually over an extended period of time, allowing adjustments and improvements to be made to local networks. Where development has not been anticipated in zoning, a plan change may be required, necessitating a review of the ability of the transportation network to accommodate the increased demand.
Development pressures arising from the Project lead to further reliance upon road travel	Medium	The analysis has indicated some increase in road-based travel as a result of development facilitated by the Project. However, this occurs within the context of combined road and public transport upgrades as part of a wider and balanced transportation strategy.
The Project will reduce development opportunities in other parts of the region	Low	Accessibility is only one aspect of locational decisions made by households and businesses.
The Project will result in development pressures which could have adverse environmental, ecological or other effects	Low	Development can only occur as of right where permitted by the relevant District Plan controls, which will already have anticipated and planned for that type of development. Development elsewhere would require a plan change or consent, necessitating a full review of potential impacts.

Table 5.1: Potential Adverse Land-Use Effects

5.3 Potential Beneficial Effects

Table 5.2 summarises the potential beneficial effects associated with the land-use pressures arising from the Project and the likelihood of these being realised.

Potential Effect	Likelihood	Comment
The greatest growth in transportation demand will occur in those areas best able to accommodate it (the corollary being that development pressures will ease in other areas where congestion is already experienced)	High	The assessments have demonstrated that the infrastructural upgrade represented by the Project will result in growth in transportation demands in the area which it will serve.
The Project will result in a more efficient distribution of land-use	High	The Project will improve the efficiency of businesses by enabling them to locate where their costs of travel are minimised.
The Project will result in net economic gains for the region	High	The analysis indicates that development facilitated by the Project will result in some in-migration of population and employment to the Wellington region. Such gains are one of the rationale for the RoNS upgrade of the SH1 corridor.
The Project will result in net economic gains for the country.	Medium	The analysis indicates that development facilitated by the Project is likely to result in some in-migration of population and employment to New Zealand. The economic benefits for the region are likely to be beneficial for the country as a whole and would not occur as a result of a domestic transfer of economic activity. Such gains are one of the rationale for the RoNS upgrade of the SH1 corridor.
Development associated with the Project will result in some increased uptake of walking and cycling	Medium	The analysis indicate that the co-location of population and employment growth would be likely to allow some greater localised uptake of walking and cycling.

Table 5.2: Potential Beneficial Land-Use Effects

5.4 Conclusion

The potential adverse effects associated with the land-use changes arising from the Project in general have a negligible or low likelihood of occurrence. This is largely because of the controls upon potential effects provided by District Plans. Where development is a permitted activity, its effects will already have been largely anticipated in the establishment of the current pattern of zoning and associated controls. Where development does not have permitted status, then either a resource consent or a plan change will be required to facilitate development. Any application for consent or a plan

change would need to demonstrate that the proposed development could occur without giving rise to adverse effects which are more than minor, and would involve community engagement through the consultation and possible submissions process.

In contrast, the potential beneficial effects associated with land-use change arising from the Project have a medium to high likelihood of occurrence. These go beyond a simple relocation of businesses and households within the region to take advantage of improved accessibility to net benefits for the region and the country as a whole. Such benefits are not unexpected and form part of the rationale for the RoNS infrastructure upgrade programme in the SH1 corridor.

Whilst some uncertainty is inevitable in forecasting future land-uses and how these will respond to the Project, on balance the Project is expected to generate a range of minor but positive effects.

Appendix F Transportation Policy Review Detail

F.1 National Transportation Policy

- **Table 4.26: Review of National Transportation Policy**

Land Transport Management Act (2003) (LTMA)	The LTMA (s94) sets the objective of the NZTA as being to undertake its functions in a way that contributes to an affordable, integrated, safe, responsive and sustainable land transport system. The LTMA also requires that in meeting this objective, the NZTA must exhibit a sense of social and environmental responsibility, which includes … giving early and full consideration to land transport options and alternatives. **Relevance to Transmission Gully** The Transmission Gully Project will significantly improve the integration, safety, responsiveness and sustainability of this part of the land transport system. Although the current assessments consider only the effects of alternative roading scenarios, this should be viewed in this wider context of the project forming an integral component of a balanced package of transportation improvements across all modes of transportation in this corridor. This package was identified through the Western Corridor Plan assessments and is identified in the RLTS.
New Zealand Transport Strategy (2008) (NZTS)	The NZTS objectives represent long term aims for the New Zealand (NZ) transport sector and are consistent with the aim of the LTMA as outlined above. The NZTS objectives are: ▪ Assisting economic development ▪ Safety and personal security ▪ Access and mobility ▪ Protecting and promoting public health ▪ Ensuring environmental sustainability. **Relevance to** Transmission Gully The NZTA objectives are reflected in the RLTS (described below). The Transmission Gully Project was adopted as an integral and necessary component of the RLTS only after detailed assessments through the Western Corridor process which confirmed that the project was consistent with these objectives.

Government Policy Statement (2009) (GPS)	The GPS specifies the short term policy direction for the NZ transport sector. It signals a change in emphasis towards those projects which are seen to be consistent with economic growth & development. This includes: ▪ Investing in the State Highway network, as a key to the efficient movement of freight and people ▪ Generating better value for money from the Government's investment across all land transport activity classes ▪ Enhancing the economic efficiency of individual projects. The NZTA is required to give effect to the following factors, through the National Land Transport Programme (NLTP) over the next three years: ▪ The Government's priority to increase national economic growth and productivity, which includes the national roading priorities set out in the list of RoNS ▪ Considering networks from a national perspective ▪ Achieving value for money ▪ Encouraging integrated planning ▪ Making best use of existing networks and infrastructure ▪ Implementing and fostering a coordinated approach ▪ Considering the impact of volatile fuel prices. The GPS indicates that the focus of short term Government transport policy aligns with the NZTS objective of assisting economic development. Transmission Gully in included on the RoNS list in the GPS, as part of the WNC. This means it has been identified as an essential route and development is a priority.

F.2 Regional Transportation Policy

- **Table 4.27: Review of Regional Transportation Policy**

The Regional Land Transport Strategy (2007) (RLTS)	The RLTS is a statutory document constituted under the Land Transport Act and referred to in the LTMA. The vision of the Wellington RLTS is: 'to deliver, through significant achievements in each period, an integrated land transport system that supports the region's people and prosperity in a way that is economically, environmentally and socially sustainable'. Detailed aspirations are provided in this document but are not included in this overview. The RLTS objectives are: ▪ Assist economic and regional development ▪ Assist safety and personal security ▪ Improve access, mobility and reliability ▪ Protect and promote public health ▪ Ensure environmental sustainability ▪ Ensure that the RTP is affordable to the regional community. It should be noted that the first five of the six RLTS objectives are identical to those of the NZTS, and the principles outlined in the LTMA. Project programming in the RLTS anticipates the completion of upgrades to the rail network prior to the construction and opening of Transmission Gully – section 8.8, p 32. **Relevance to Transmission Gully** The RLTS proposes the development of Transmission Gully as the long term solution to address access and reliability for SH1 between Kapiti and Wellington, as part of a balanced package of transportation upgrades across all modes of transportation – section 8.1, p 29.
Regional Land Transport Programme (2009) (RLTP)	The 10-Year Strategic Roading Programme contained in the RLTP 2009/10 – 2011/12 (2009) identifies funding for Transmission Gully as well as a number of related projects including; ▪ The upgrading of SH58, in conjunction with Transmission Gully. **Relevance to Transmission Gully** The RTP identifies Transmission Gully as a project which will proceed and expresses the importance of preparatory works for Transmission Gully so that the project can be completed quickly (within 5 years) of the project being approved.

Western Corridor Plan (2006) (WCP)	The WCP was developed under the LTMA and has statutory effect being part of the RLTS. The WCP is based on a multi-modal approach to addressing issues through a multiple objective framework. The objectives used for the study were the RLTS objectives and a more detailed understanding of travel needs and possible solutions was sought to support the RLTS. A Planning Balance Sheet was used as the evaluation tool with different sets of weightings applied to understand the effect of different stakeholder perspectives on the evaluation of proposals. **Relevance to Transmission Gully** The WCP confirmed the construction of Transmission Gully as a key component of a package of transportation improvements for the corridor.
Wellington Regional Policy Statement and Proposed Regional Policy Statement (RPS)	The RPS is a statutory document prepared under the RMA. The RPS provides high-level guidance for the study in terms of how transportation proposals are expected to function and their impacts are to be managed. The objectives from the Operative RPS relevant to the Transmission Gully scheme are: **Objective 1** "Urban areas, the built environment and transportation systems are developed so that they, and their associated activities, use resources efficiently and demand for the use of finite resources is moderated." **Objective 2** The adverse environmental effects that result from the use of urban areas, transportation systems and infrastructure are avoided, remedied or mitigated and, in particular, any effects that result from the concentration and scale of activities in urban areas are recognised and provided for." However, the current Wellington RPS is under review. A proposed RPS was notified on the 21 March 2009, with submissions closing on 8 June 2009. Decisions on submissions were approved by the Greater Wellington Regional Council on 18 May 2010 and publicly notified on 22 May 2010. The objectives and policies of the Proposed RPS relevant to this study are: **Objective 9** "The region's energy needs are met in ways that: (a) Improve energy efficiency and conservation (b) Diversify the type and scale of renewable energy development (c) maximise the use of renewable energy resources (d) Reduce dependency on fossil fuels

	(e) Reduce greenhouse gas emissions from transportation." **Objective 10** "The social, economic, cultural and environmental, benefits of regionally significant infrastructure are recognised and protected." **Objective 21** "A compact, well designed and sustainable regional form that has an integrated, safe and responsive transport network and: (a) A viable and vibrant regional central business district in Wellington city (b) An increased range and diversity of activities in and around the regionally significant centres to maintain vibrancy and vitality (c) Sufficient industrial-based employment locations or capacity to meet the region's needs (d) Development and/or management of the Regional Focus Areas identified in the Wellington Regional Strategy (e) Urban development in existing urban areas, or when beyond urban areas, development that reinforces the region's existing urban form (f) Strategically planned rural development (g) A range of housing (including affordable housing) (h) Integrated public open spaces (i) INTEGRATED land use and transportation (j) Improved east-west transport linkages (k) Efficient use of existing infrastructure (including transport network infrastructure) (l) Essential Social services to meet the region's needs." **Policy 29** "Maintaining and enhancing the viability and vibrancy of regionally significant centres – district plans" District Plans shall include policies, rules and/or methods that encourage a range of land use activities that maintain and enhance the viability and vibrancy of the regional significance: (a) Upper Hutt city centre (b) Lower Hutt city centre (c) Porirua city centre

	(d) Paraparaumu town centre (e) Masterton town centre (f) Petone (g) Kilbirnie (h) Johnsonville. **Relevance to Transmission Gully** The Transmission Gully Project is not inconsistent with any of the policies or objectives of the RPS, as confirmed by its inclusion in the RLTS.
Regional Freight Plan (2007)	The Regional Freight Plan is a subsidiary document that supports the RLTS. The following freight policies are included in the plan: ▪ Support rail freight initiatives where benefits exceed those of road freight ▪ Provide an appropriate transport network for freight and commercial needs These policies are aimed to provide the following outcomes identified in the Freight Plan: ▪ Improved level of service for freight ▪ Improved freight linkages ▪ Improved rail and road freight efficiency. **Relevance to Transmission Gully** The Transmission Gully Project will improve the efficiency of road-based freight movement in the SH1 corridor, reducing much of the uncertainty around travel times which results in additional costs to freight operators.

Regional Cycling Plan (2008)	The Regional Cycling Plan is a subsidiary document supporting the RLTS. The Regional Cycling Plan (formerly known as the Regional Cycling Strategy) outlines a shared vision, for the region's key agencies involved in cycling, and sets objectives, desired outcomes, and monitoring for the promotion and development of cycling. The vision of the Regional Cycling Plan is: "The evolution of a cycling culture where cycling is a recognised and valued transport mode that is safe, accessible and pleasant throughout the region." Objectives include: ▪ Create an advocacy ethic that facilitates coordination among lead agencies ▪ Enhance cycling safety throughout the region through education initiatives and improved infrastructure ▪ Increase accessibility, integration, and safety for cycling ▪ Improve awareness of all forms of cycling – commuting, recreation and tourism. The outcomes sought include: ▪ Improved level of service for cycling ▪ Increased mode share for cycling ▪ Improved perception of cycling safety, convenience and ease ▪ Increased safety for cyclists. **Relevance to Transmission Gully** The route along SH1 is identified as a strategic route in the Wellington Cycling Network, and thus is important to the Transmission Gully Scheme. There is no specific mention of Transmission Gully in the Plan; however Wellington cycle routes along SH1 are in the vicinity of the project and the construction of Transmission Gully could permit improvement on the existing SH1 route.

Regional Walking Plan (2008)	The Regional Walking Plan is a subsidiary document supporting the RLTS. The aspiration for walking and cycling as set out in the RLTS vision is: "People will generally walk or cycle for short and medium length trips. Pedestrian and cycling networks will be convenient, safe and pleasant to use." In addition to the above RLTS targets, this implementation plan seeks to achieve the following in accordance with the national GPS and NZTS which signals: "An increase in total walking trip numbers in the region across all trip purposes." **Relevance to Transmission Gully** The above applies generically to all of the Transmission Gully Project. However, disconnected areas adjacent to the existing SH1 are particularly relevant in this policy context, as Transmission Gully would reduce severance in communities along the existing SH1 route, promoting walking as a mode of transport.

Regional Travel Demand Management Plan (2009)	The Regional Travel Demand Management Plan is a subsidiary plan supporting the RLTS. However, the LTMA requires the RLTS to include travel demand management as a measure. GWRC's Regional Travel Demand Management Plan's vision is: "for an integrated land transport system that supports the region's people and prosperity in a way that is economically, environmentally and socially sustainable." Objectives listed are: ▪ Optimise use of the existing road network ▪ Encourage sustainable and efficient travel choices ▪ Promote land use that supports sustainable travel options ▪ Advocate for measures to improve transport and sustainability ▪ Collect and share information to support sustainable transport options Outcomes sought include: ▪ Improved transport efficiency ▪ Improved land use and transport integration ▪ Improved integration between transport modes ▪ Increased peak period public transport mode share ▪ Increased mode share for pedestrians and cyclists ▪ Reduced private car mode share ▪ Increased private vehicle occupancy ▪ Reduced greenhouse gas emissions ▪ Reduced fuel consumption ▪ Reduced severe road congestion ▪ Maintained vehicle travel times between communities and regional destinations ▪ Sustainable economic development supported. **Relevance to Transmission Gully** The Transmission Gully Project is not inconsistent with measures to constrain the growth in transportation demand, as both form key components of the wider and balanced RLTS.

Regional Passenger Transport Plan 2007-2016 (2007)	The Public Transport Management Act 2008 (PTMA) (2007) is designed to give regional councils new tools to develop public transport systems to meet the needs of their communities. The PTMA repeals the Transport Services Licensing Act 1989 (TSLA), and sets the objective of helping regional councils and the NZTA obtain the best value for money in achieving an affordable, integrated, safe, responsive, and sustainable public transport system. In the Wellington context, there is significant interaction between State highway use and passenger rail use at peak travel times. The Regional Passenger Transport Plan sets out Greater Wellington's intentions for the regional passenger transport system over the next ten years. This document is consistent with, and gives effect to, the RLTS. It focuses on delivery of the strategic outcomes identified in the Strategy for passenger transport. The vision identified for passenger transport is; "a sustainable passenger transport system that, through significant achievements in each period, is integrated, accessible and increasingly the mode of choice for a greater number of journeys." In terms of aim, "the vision gives the region something to aim for in the development of its passenger transport network and also delivers on the broader vision of the RLTS to deliver an integrated land transport system that supports, through significant achievements in each period, the region's people and prosperity in a way that is economically, environmentally and socially sustainable." The document also identifies the following values and drivers: "The main drivers for passenger transport in the region include the need to: ▪ Ensure access and mobility ▪ Reduce congestion ▪ Support environmental sustainability These drivers are influenced by the following values or principles that are important in achieving the ideal passenger transport system for the region: ▪ Equity ▪ Accessibility ▪ Reliability ▪ Quality ▪ Simplicity ▪ Affordability." **Relevance to Transmission Gully** The Transmission Gully Project is not inconsistent with measures to promote public transportation, as both form key components of the wider and balanced RLTS.

F.3 Local Transportation Policy

- **Table 4.28: Review of Local Transportation Policy**

District Plans & Strategic Plans	The District and Strategic plans of the councils outlined below are of particular relevance as they set out matters relating to land use development and integration with transport infrastructure. They also outline other environmental management minimum standards and expectations as to how the environment should be managed. For example, they identify what activities are discretionary or non-complying activities. This is important to identify potential adverse effects and determine what assessments are required for any statutory approvals required under the RMA. This also helps to determine whether the NZTA is meeting its objective under the LTMA which includes exhibiting social and environmental responsibility. ▪ Greater Wellington Regional Council (GWRC) ▪ Wellington City Council (WCC) ▪ Hutt City Council (HCC) ▪ Upper Hutt City Council (UHCC) ▪ Porirua City Council (PCC) ▪ Kapiti Coast Council (KCC) **Relevance to Transmission Gully** The Transmission Gully Project would not be inconsistent with any of the objectives or policies of these district plans. These issues are being addressed in detail by others through the planning workstream.
Wellington City Transport and Urban Development Strategy (2006)	The Wellington City Transport and Urban Development Strategy is a non-statutory document that seeks to achieve the following outcomes: ▪ Concentrate future population and employment growth along the Growth Spine, supported by a dedicated, high quality and high frequency public transport corridor, a high quality State highway route with dependable travel times, bus priority along connecting arterial routes and convenient and safe walking and cycling routes ▪ Limit commuter parking in the Central Area ▪ Improve access to the waterfront ▪ Comprehensive travel demand management programme. Long-term outcomes identified in the strategy are summarised below: **More liveable** — Wellington will be a great place to be, offering a variety of places to live, work and play within a high quality public environment.

	More sustainable	Wellington's urban form will support an efficient and sustainable use of our rural and natural resources and promote prosperity and social well-being over the long term.
	Better connected	Wellington will be easy to get around, pedestrian-friendly and offer quality transport choices on a highly interconnected public transport and street system.
	More prosperous	Wellington's urban form, and flexible approach to land use planning in the central city, centres and industrial areas, will contribute to economic growth and prosperity.
	More compact	Wellington will have a contained urban form, with intensification in appropriate areas and mixed land-use, structured around a vibrant central city, key suburban centres and major transport corridors.
	Safer	Wellington will be a safe place to be, with well-designed buildings, spaces and connections between them.
	Stronger sense of place	Wellington will be a memorable, beautiful city, celebrating and building on its sense-of-place, capital city status, distinctive landform and landmarks, defining features, heritage and high quality buildings and spaces.
	Relevance to Transmission Gully Whilst there is no specific mention of Transmission Gully in the strategy, the improvement in connectivity which Transmission Gully will provide is not considered to be inconsistent with the strategy.	

Kapiti Coast Sustainable Transport Strategy (2008) (STS)	The Kapiti Coast STS outlines the directions transportation should take in the Kapiti Coast District to ensure sustainability. This includes meeting the following objectives: ▪ The establishment of a nationally famous cycle network in the district; ▪ The level and quality of access within and between communities is improved; ▪ The linkages between Paraparaumu and Waikanae are improved; ▪ The district develops a role as a transport hub; ▪ Improved internal transport access to the labour force; ▪ Improved public transport; ▪ Extensive linkages in the district in addition to SH1. **Relevance to Transmission Gully** Whilst there is no specific mention of Transmission Gully in the strategy, the improvement in connectivity which Transmission Gully will provide is not considered to be inconsistent with the strategy.
Draft Porirua Transportation Strategy (2008) (PTS)	The Draft PTS is a non-statutory document that complements national and regional transportation policy, while being specifically applicable to Porirua City. **Relevance to Transmission Gully** Planning of the transportation network in Porirua has for many years been predicated upon the eventual construction of the Transmission Gully Project, and this is reflected in the draft PTS. Accordingly, the construction of the project is strongly aligned with the draft PTS.

Appendix G Additional Reports

G.1 WTSM 2006 Update Peer Review report, By ARUP

Greater Wellington
Regional Council

WTSM 2006 Update Peer Review

Final Report

Greater Wellington Regional Council

WTSM 2006 Update Peer Review

Final Report

June 2008

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Job title	WTSM 2006 Update Peer Review	Job number
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Document title	Final Report	File reference

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Revision	Date				
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		Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Dan Jones	Peter Dunn	
		Signature			
Draft 2	09/06/08	Filename	DraftReport_rev2.doc		
		Description	Update to incorporate changes made by the modelling consultants in response to the First Draft		
			Prepared by	Checked by	Approved by
		Name	Dan Jones	Peter Dunn	
		Signature			
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			Prepared by	Checked by	Approved by
		Name	Dan Jones	Peter Dunn	
		Signature			
Final	30/06/08	Filename	FinalReport.doc		
		Description	Final Report		
			Prepared by	Checked by	Approved by
		Name	Dan Jones	Peter Dunn	Peter Dunn
		Signature			

Issue Document Verification with Document ✓

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1 Executive Summary

Arup was appointed to peer review the Wellington Transport Strategy Model (WTSM) 2006 Update. We have undertaken a detailed review and sensitivity testing.

Our overall assessment is that the updated model is compliant with the Greater Wellington (GW) briefed requirements. We are satisfied that the work has been carried out accurately and professionally, and that the 2006 model represents an improvement on the 2001 model it replaces. We consider that sound modelling principles have been applied, and good use has been made of the available data.

The validation of the highway assignment model has been reviewed and is considered to be of a high standard for a four-stage model.

We have some reservations about the quality of the bus and rail data used for model validation, firstly the age of the rail data and secondly the lack of consistency of the bus data. Notwithstanding this, the rail validation aligns reasonably well against the limited data available and the growth in modelled bus use[1] is replicated satisfactorily.

Tests we have undertaken to establish the sensitivities of the model indicate elasticities are reasonable, lying within the expected ranges. Cross-elasticities of car travel with respect to public transport costs are low, meaning that even quite significant improvements to public transport are likely to have only a small effect on region-wide car trips and kilometres. In individual corridors the effect may be stronger, we have not tested this. This is noted as a key feature of the model, not as a technical criticism.

It is the nature of a peer review to focus on the negative issues. A small number of components that we feel merit further discussion are addressed in this report. This does not reflect on the appropriateness of the model overall - the great majority of components require little or no comment because they function well.

In summary, WTSM 2006 meets and in many ways exceeds international standards for four-stage models, and we recommend that the updated model is fit-for-purpose.

[1] Between 2001 (WTSM Base) and 2006 (WTSM 2006 update)

2 Introduction

Arup was appointed to undertake the peer review for the Wellington Transport Strategy Model (WTSM) 2006 Update. This report presents our findings.

2.1 Background

In 2001, Beca and Sinclair Knight Merz (SKM) were appointed by Wellington Regional Council to develop WTSM to a new base year of 2001. This was a comprehensive redevelopment of the existing WTSM, including re-specification of procedures and model structures. An extensive dataset of travel and traffic data for model calibration was collected, supplemented by socio-economic data from the 2001 Census. The model was peer-reviewed and signed-off by Arup, late in 2003, and since then it has been used successfully on many projects.

Late in 2006, Greater Wellington (GW) invited bids to update WTSM to a new base year of 2006 using 2006 Census and other newly collected data, and to address some perceived technical deficiencies specified in the brief. SKM was appointed to the role of modelling consultant, and Arup to the role of peer reviewer.

2.2 Objectives and Approach

The objective of the peer review is to ensure satisfactory completion of the agreed modelling brief for the 2006 Update to WTSM in line with GW expectations and international best practice, by review and provision of comments on:

- technical scoping papers produced throughout the duration of the project
- the base year validation report
- the future year forecasting report
- the electronic models (to confirm the coding, verify the validation, undertake sensitivity tests and to assess usability).

To achieve the objectives, we have checked that amendments have been applied correctly, the changes to inputs and assumptions, the validation, the sensitivity characteristics, and the usability of the updated model.

2.3 Outputs

The outputs from the peer review are:

- provision of comments on the technical scoping papers during the course of the study
- a letter of support or otherwise for the completed model
- this report, outlining the methodology, findings and recommendations.

2.4 Documents Received

The following documents have been received and reviewed:

Table 1 – Documents from Greater Wellington

Name	Version	Date
Brief for Modelling Consultant Wellington Transport Strategy Model 2006 Update – Provision of Professional Services, Contract 3073	-	November 2006
Brief for Peer Reviewer WTSM 2006 Update Peer Review – Provision of Professional Services, Contract 3074	-	January 2007

Table 2 shows the Scoping Notes provided to Arup by SKM for review. Arup returned comments on the scoping notes prior to the model development phase.

Table 2 – Scoping Notes from SKM

Name	Version	Dated
Task 5.3.5: CV Route Choice	3	14/03/07
Task 5.2.6: CV Matrix and Forecasting Model	2	16/03/07
Task 5.2.7: Review 2001 Trip Rates	4	16/03/07
Task 5.3.2: Park-and-Ride Sub Mode Choice	3	19/03/07
Task 5.3.3: PT Capacity Constraint	2	19/03/07
Task 5.3.4: Multiclass Assignment	2	20/03/07
Task 5.2.9: CV PCE Factor	2	20/03/07
Task 5.2.13: Traffic Data and Screenlines	2	20/03/07
Task 5.2.8: Actual vs. Usually Resident Population	2	28/03/07
Task 5.2.1: Updated Input rates	2	28/03/07
Task 5.3.1: Intersection Delays and Merges	3	02/04/07
2006 CV Matrices	-	22/08/07
Updated Input Values	-	22/08/07

Table 3 – Reports from SKM

Name	Version	Dated
WTSM Update Specification Report	-	May 2007
WTSM Update Validation Report	Final	Feb 2008
Baseline Forecasting Report	Final	Feb 2008
WTSM Update – New Validation and Forecasting Results	-	28/05/08
WTSM Update – Validation Results	-	20/06/08
WTSM Update Validation Report	Final	June 2008

Table 4 – Electronic Models from SKM

Name	Version	Dated
Base Year, 2006	-	15/02/08
Future Year Do-Minimum and RTP, 2016, 2026	-	15/02/08

2.5 Report Structure

This remainder of this report is structured as follows:

- Section 3 – Scope of Work
- Section 4 – Review of Tasks
- Section 5 – Review of Base Model and Validation
- Section 6 – Review of Future Year Model
- Section 7 – Model Usability
- Section 8 – Recommendations and Conclusions

3 Scope of Work

3.1 Brief to the Modelling Consultant

The brief to the modelling consultant prescribed the tasks to be undertaken to update the model to a 2006 base. The tasks were arranged into two groups: primary (essential) and secondary (optional).

A series of scoping notes were prepared by SKM containing analysis and recommendations for each task. These were forwarded to Arup for comment. Discussions between GW and SKM culminated in an agreed list of the tasks to be taken forward and confirmation of the scope of work. This was set out in 'WTSM Update Specification Report'.

3.2 Primary Tasks

Fifteen primary tasks were identified in the brief. These are the key tasks considered necessary by GW to update the model to a new base year of 2006, and to develop future year models for 2016 and 2026.

During the scoping phase, it was agreed that 3 of the 15 tasks (5.2.7, 5.2.8, 5.2.9) would be removed from the project scope.

Table 5 – Primary Tasks

Task	Description	Actioned?
5.2.1	Update input rates for vehicle operating costs and values of time	Yes
5.2.2	Review the road network coding and update the transit lines	Yes
5.2.3	Enhance the road network detail	Yes
5.2.4	Validate the auto assignment	Yes
5.2.5	Validate the passenger transport assignment	Yes
5.2.6	Revisions to the commercial vehicle matrix	Yes
5.2.7	Change 2001HTS trip rates	No
5.2.8	Actually vs. usually resident population	No
5.2.9	Higher PCE factor for CVs	No[2]
5.2.10	Update the vehicle fleet emissions factors	Yes
5.2.11	Update demographic projections	Yes
5.2.12	Car ownership model	Yes
5.2.13	Traffic data and screenline review	Yes
5.2.14	Bus patronage data and screenline review	Yes
5.2.15	Rail patronage data and screenline review	Yes

[2] In the Update Specification Report for Task 5.2.9 the approach was scoped to extend the current process of capacity reductions based on fixed M/HCV PCEs, but in the event this could not be done (see Section 7.2)

3.3 Secondary Tasks

Eight secondary tasks were identified in the brief as optional improvements, to be discussed and implemented only if cost effective. Discussions between GW and SKM led to the decision to take three of these tasks forward.

Table 6 – Secondary Tasks

Task	Description	Actioned?
5.3.1	Intersection delays and merges	Yes
5.3.2	Park and ride sub mode choice model	No[3]
5.3.3	Passenger capacity constraint for rail and bus services	No
5.3.4	Multi-class assignment	Yes
5.3.5	CV route choice function	No[4]
5.3.6	Adjust flight related airport trips	No
5.3.7	Including traffic from the Interisland ferry	No
5.3.8	Industry specific employment forecasts	Yes

[3] It was agreed that some changes would be made to existing 'p-connector' approach.
[4] It was agreed that CVs should be banned from selected links in the final assignment.

4 Review of Tasks

Our comments on the completion of the primary and secondary tasks are provided in this section, with the exception of Task 5.2.4, Auto validation, and Task 5.2.5, PT validation, which are reviewed in Section 5.

4.1 Task 5.2.1 – Input Rates

The values of time and vehicle operating costs were updated to 2006. The new values are provided in Chapter 5 of the Validation Report. These appear to be soundly derived and appropriate for demand modelling and economic evaluation purposes.

The revised values of time have also been used to update the route choice equation (the balance of time and distance costs in assignment). In our experience, route choice parameters would normally be calibrated as part of an assignment calibration process, and would not be periodically updated. But in this case, the changes made were small, and SKM advised that small changes in the route choice equation have had little impact. Given the restricted routes available in the region, this seems reasonable. There is also the benefit that consistency has been maintained between assignment and demand models.

In future years, values of time and vehicle operating costs have been updated for demand forecasting, based on forecast increases in income per head and fuel cost/efficiency expectations respectively. For assignment, no changes were made in future years to the base year ratio of time and distance costs. We support this approach.

A 10% real increase in rail fares between 2001 and 2006 has been applied to PT generalised costs between zone pairs that are likely to use rail as the main mode, representing the average change to the real rail fare over this period. The rail fare increase has been applied to all PT (including bus), restricted to broad sector movements where rail is likely to be the main mode. This approximation is reasonable for a strategic model - fares are added to generalised costs after assignment, which restricts the options. There may be advantages in applying fares in the assignment[5] in future model updates and we would recommend that this be considered.

Parking costs have been updated for Wellington CBD only, the review of parking charges in other locations being outside the scope.

4.2 Task 5.2.2 – Road network coding and transit lines

Spot checks on changes to the base road network coding indicate that coding has been carried out satisfactorily.

The HOV scheme at Mana has been defined as 1.3 lanes per direction, on the basis that there are 2 lanes per direction but only 27% of vehicles have access to the inner lane (2+ occupants only). This is a reasonable approach for strategic modelling.

The transit line coding has become more complicated in the updated model through separation of the rail station nodes into two: one for car access and one for walk/bus access. This is to avoid misuse of p-connectors (see Section 4.12) but it means that extra care is required in transit line coding. We understand that GW has developed a bespoke spreadsheet to automate this process, to minimising such errors.

We have made a comparison of modelled rail headways and journey times against current timetables and found it to be satisfactory.

[5] This would allow separate testing of bus and rail fare policy. A secondary benefit may be to improve the realism of routing. In one sensitivity test that we ran, a proportion of rail travellers from Linden to Wellington first travelled north to Porirua, and then changed to a southbound train, some of which stop at Linden. This is a minor problem for a strategic model, but with fares coded on the network this type of 'U-turning' behaviour would be less likely to occur.

4.3 Task 5.2.3 – Enhance the road network detail

Spot checks on the revised road network suggest that coding has been carried out accurately.

4.4 Task 5.2.6 – Revisions to the commercial vehicle matrix

This task has highlighted the relatively poor quality of data currently available. The three data sets available – the 2001 and 2006 screenline counts, and the 2005 matrix produced by Booz Allen Hamilton – being somewhat inconsistent.

The approach taken to estimate a new CV matrix for the 2006 model was to factor the existing 2001 CV matrix at a sector-to-sector level to replicate, as closely as possible, the 2006 CV counts taken at screenlines. The multiplicative factors derived for the base year were then applied to the 'raw' future year CV matrices. This, we would agree, is the best approach available given the restricted data.

Some of the multiplicative factors shown in Tables 14 to 16 of the Validation Report are quite significantly different to 1, For projects focusing on commercial vehicle movements, we recommend that CV trip end locations are reviewed against land use data, and that modelled CV flows in the area of interest are sense-checked and confirmed against observed flows.

4.5 Task 5.2.10 – Update the vehicle fleet emissions factors

Assumptions for reduced vehicle emissions in future years have been applied to the evaluation of future year modelling results. There are some large differences between car and HCV emission rate reductions (Baseline Forecasting Report, Table 41), which we would not expect. These emission factors were provided from the Vehicle Fleet Emission Model (VFEM) and are known by GW to be out-of-date. It is understood that these are to be updated as better information becomes available.

4.6 Task 5.2.11 – Update demographic projections

SKM obtained socio-economic data for 2006, 2016 and 2026 from MERA Ltd for use in WTSM base and future year models. In the Baseline Forecasting Report, the changes between 2001 and 2006 are summarised as: population +7%, households +6%, employment +9%, and education places +24%. Arup has not been provided with the trip generation models, therefore the use of this data could not be peer reviewed.

The MERA future year projections for 2016 and 2026 were developed with considerable input from the territorial authorities, and issued in 2007. The forecasts were reissued twice, firstly in December 2007 to incorporate growth in some specific areas, and secondly in January 2008 to control to newly revised Statistics NZ 2006 totals.

4.7 Task 5.2.12 – Car ownership model

The car ownership sub-model of 2001 WTSM was not able to accurately replicate the growth in car ownership between 2001 and 2006, particularly in respect of growth in multiple-car households (Validation Report, Table 18). The 2001 car ownership sub-model has also been criticised for having no saturation (maximum) level to car ownership although, in practice, this does not appear to have led to unrealistic car ownership estimates over the forecasting horizon of WTSM.

SKM has addressed both issues by respecifying the car ownership model in line with the car-ownership sub-model developed for ART3, the strategic model of Auckland. The new model has a saturation parameter set to 0.8 cars per person and is demonstrated to replicate the observed total car ownership growth between 2001 and 2006 (Baseline Forecasting Report, Appendix C). We consider that the new car-ownership sub-model is a significant improvement on the previous one.

4.8 Task 5.2.13 – Traffic data and screenline review

It is clear that SKM went to considerable efforts to obtain a consistent and plausible set of traffic counts data for the auto validation. Where counts obtained from territorial and roading authorities were found to be inconsistent with 2001 data, or implausible, further data was obtained or new surveys commissioned[6].

New journey time survey data was collected over the same routes as in 2001[7].

SKM reviewed screenlines definitions and we agree with their conclusions.

A thorough review was undertaken, resulting in a good quality data set for auto validation.

4.9 Task 5.2.14 – Bus data and screenline review

A complete set of Electronic Ticket Machine (ETM) data was obtained from bus operators. No details of its processing are documented, though we understand that the quality of it was found to be uncertain, and that it required considerable interpretation to convert it into useable spatial data. We have had similar experiences with ETM data in other studies.

We have concerns about some large and unexplained differences between the 2001 and 2006 ETM data. Changes in the location of screenlines have made comparison difficult, but comparisons can be made at screenlines W2 (Miramar), W3 (Karori) and W4 (Johnsonville and Hutt), which have not changed. At these locations we found considerable differences between 2001 and 2006 ETM datasets that cast doubts over the quality, or at any rate the consistency, of the bus data.

Independent data suggests that overall growth in bus patronage over the period was around 22%[8]. In the absence of supporting evidence that bus patronage is changing in the ways implied in ETM data, we have doubts about its reliability. The implications of this for validation are discussed in Section 5.

4.10 Task 5.2.15 – Rail data and screenline review

No new rail data was collected, though it states in the brief that “if observed data is not available, it will be necessary to commission the appropriate surveys” (Modelling Brief, Task 5.2.5). It also appears that the March 2006 ticket data and guards counts referred to in the brief under Task 5.2.15 could not be obtained. Instead, the data used for development of the 2001 model was again used for the 2006 update, uplifted by global factors of 10% for peak and 14% for interpeak, representing GW’s best estimate of rail patronage growth over the period.

Late in the project, some limited rail count data from 2006 was obtained, and was used as independent source for verification of peak rail volumes arriving at Wellington.

[6] Given these problems, consideration could be given to creation of a count database to hold multiple observations over a number of years. This would allow for weighted average or time-series-based estimates to be made for the counts used in future validations.
[7] For validation of alternative strategic routes between Kilbirnie and the CBD, and between the CBD and Ngauranga, it might be worth considering an additional route from Kilbirnie to Ngauranga via Evans Bay Parade, Jervois Quay and Hutt Road.
[8] From “4760_monthlypassenger_s9595.xls” posted on the GW website

4.11 Task 5.3.1 – Intersection delays and merges

The procedures have been improved in two ways:

- correction of errors found in the specification of the Q and Ja parameters in the volume-delay functions;
- improved convergence of intersection delays through amendments to the convergence procedures and the capping of green times at 50% of cycle time

Consideration was given to specification of a merge function, but this was rejected at the scoping stage. Our experience with WTSM and other models is that a merge function could still be a valuable addition, even for a strategic model, in the next upgrade.

SKM advises that the correction of the volume-delay function error had a significant impact on speeds on certain roads – Paekakariki Hill Road was given as the example – but the strategic (corridor level, sector-to-sector) speeds and capacities did not change significantly.

4.12 Task 5.3.2 – Park and ride sub-choice model

The option of respecifying the choice model to include an additional sub-choice for park-and-ride was rejected, a decision with which we agree, as it would require a significant overhaul of the model structure and necessitate recalibration.

Two enhancements were made to the existing p-connector approach:

- Recoding of p-connector links to ensure that p-mode-only 'through trips' via station nodes cannot be made on these links;
- Assigning the car part of the p-connector demand.

The first amendment is a sensible solution to what has been a problem with the 2001 model; the second amendment does no harm, though given the approximations involved the benefits seem quite minor.

P-connectors are now coded in one direction only (from zone to station in AM, the reverse in PM), and the problem of p-mode 'through trips' has been solved.

On reviewing the results, we have doubts about whether an assignment based approach to determine the rail-access mode can work effectively (see our further comments in Section 5).

4.13 Task 5.3.4 – Multi-class assignment

It was agreed with GW that a multi-class assignment would be adopted in the final assignment (only), allowing HCVs and other vehicles to be separated for reporting purposes. This allows for HCV bans to be effected on selected streets, improving the plausibility of model outputs for the non-technical audience.

4.14 Task 5.3.5 – CV route choice function

A CV specific route choice function was deemed unnecessary at the scoping stage. This seems reasonable for most applications of the strategic model, but in some corridors, the performance difference of cars and HCVs (and therefore route choice) might be an important consideration, for example in the modelling of Transmission Gully where HCV performance would be severely affected by the ascent to and descent from the Wainui Saddle and, furthermore, HCVs could potentially obstruct general traffic, depending on lane usage. For studies such as this, a refined model may be required.

4.15 Task 5.3.8 – Industry-specific employment forecasts

This was not reviewed.

5 Review of Base Model and Validation

5.1 Trip matrices

The modelled growth in trips between 2001 and 2006 of 5-8%[9] is reasonable, given the changes in population, households and employment of 6-9% over the same period[10]. There is greater growth in the AM peak than the PM peak[11], perhaps reflecting the fact that capacity is more constrained.

Public transport patronage shows a higher growth rate than car in the peak, which is as expected given the higher traffic congestion in the peak than the interpeak. The small changes in peak mode share appear reasonable[12].

Comparison of Census and modelled PT shares by sub-region are very consistent[13], which gives confidence in the quality of the mode choice modelling.

No changes were made of the daily to assignment-period factors, as this was not in the agreed scope.

5.2 Auto validation

The auto assignment has been validated for AM peak (07:00-09:00), Inter-peak (IP, 2 hour average from the period 09:00-16:00), and PM peak (16:00-18:00).

The approach to auto validation is appropriate and makes good use of the extensive data set collected for model validation. The changes made to calculation of intersection delay lead to an efficient and stable assignment convergence for all periods.

Overall we consider the validation to be as good as can reasonably be expected from a four stage model and to a standard consistent with the 2001 model. Some changes were made to trip attraction factors in a bid to improve the screenline volumes - a fairly major change - but we are satisfied that the approach is justified.

In all time periods, there is a deficit of traffic travelling between Wellington and Porirua (screenline P3), which should be taken into consideration when modelling this movement.

The journey time validation[14] shows generally very accurate representation of journey times. The section of highway that has been difficult for SKM to validate is SH2 between Petone and Ngauranga (Route 2, Nbnd, PM). We understand that a great deal of time and effort was expended by SKM on this, with various tests undertaken, but no satisfactory solution could be found.

An unusual feature is that in the PM peak, both speeds and vehicle kilometres increase between 2001 and 2006[15]. Overall, the changes in the model between 2001 and 2006 look reasonable and the validation is better than we might have reasonably expected.

The HCVs are now validated as a separate class (in 2001 HCVs and car were not separated for validation), adding further confidence.

[9] Validation Report, Table 23
[10] Ditto, Table 1
[11] Ditto, Table 24
[12] Ditto, Table 26
[13] Ditto, Tables 27 and 28
[14] Ditto, Appendix B
[15] Ditto, Table 25

5.3 Public transport validation

The PT assignment has been validated for AM peak and IP periods, as was the case in 2001. A PM peak PT assignment has also been produced, for completeness, though its validation was not required in the scope.

5.3.1 Rail validation

The rail assignment has been validated by comparison of observed and modelled:

- rail passengers alighting at Wellington station; and
- build up of loadings on inbound rail services, by station.

Tables 7 and 8 show the comparison of observed and modelled rail passengers arriving at Wellington station for AM and IP periods respectively.

Table 7 – Rail Validation at Wellington Station: Arrivals (AM, 2 hour)

Model	Inbound rail passengers at Wellington	Difference
2006 AM observed (calculated from 2001 observed plus 10%)	9,736	
2006 AM modelled	11,278	+16%

Source: WTSM Update – Validation Results 20 June 2008

Table 8 – Forecasts of Wellington rail passenger arrivals (IP, 2 hour)

Model	Inbound rail passengers at Wellington	Difference
2006 IP observed (calculated from 2001 observed plus 14%)	943	
2006 IP modelled	928	-2%

Source: WTSM Update – Validation Results 20 June 2008

The number of inbound passengers into Wellington shows a satisfactory match in the IP, within 2% of observed.

In the AM peak, the modelled flow is 16% higher than observed. This may indicate that the model is predicting too many rail trips, or there may be an error in the assumption that rail use in the AM peak has grown by only 10% since 2001. To check this, we examined an independent data source: 2006 guards' counts, provided by GW. The data is incomplete but, nevertheless, it gives an indication that arrival loads in the AM peak at Wellington station are around 4,800 from the Western line and 4,200 from the Hutt line. If 1,300 passengers are added for the Johnsonville line[16] and a further 800 for the Capital Connection, Wairarapa and Melling services combined[17], this gives a total of around 11,100 passengers arriving at Wellington in the AM peak. If this is estimate is reliable, the model would be within 2% in the AM peak. To confirm usage, we would recommend a survey is commissioned at Wellington station to verify current rail use by time period and route group.

The build-ups of demand on each line in the inbound direction are closely matched in the AM peak, and acceptable in the IP.

No validation of rail journey times was provided, though the GW brief states that assignment validation will include "comparison of bus and rail journey times against observed data". Our

[16] From Validation Report, Figure 23.
[17] Arup assumption.

checks on rail journey times indicate that the modelled and timetable times are in close agreement.

Link Amendments

In early stages of the update, a range of walk and rail-access link lengths were amended in a bid to improve the rail validation. Whilst theoretically it is possible to replicate train boarding locations accurately with sufficient link amendments, presenting the appearance of a very good base year validation, it can be to the detriment of the model for forecasting and it is usually better to accept a small degree of error in the base year and avoid arbitrary link amendments. On review, the decision was made to remove the link amendments in the final updated model. We support this decision, and the validation of both rail volumes and boarding locations shows that the rail validation is satisfactory.

No validation is provided of observed and modelled access modes though the brief states that transit assignment will include "comparison of observed and modelled access modes at the major rail stations that have bus interchange and park & ride".

We have checked access modes to rail. There are two ways that individuals can access rail: (1) via the dedicated 'p-connectors', representing multi-modal access, coded with times that weighted averages of the various access modes available including bus, car, cycle and walk; and (2) via the street network and bus services that run thereon.

In general, where a p-connector option is provided, 100% will use it[18]. This is satisfactory in terms of demand modelling – the generalised costs are reasonable. The problem arising is that multi-modal passengers (e.g. those who use bus feeder services to access rail) cannot be assigned to the services they use, which limits the ability of the model to assess bus sub-area networks, station catchments, and feeder interactions between bus and rail. This feature is common to both WTSM 2001 and the 2006 update, and we note this as an item for future review.

If changes to bus/rail connections are to be studied in sub-areas such as Wainuiomata, Porirua or Paraparaumu, further attention to rail access behaviour in the local area may be warranted.

It is not clear from the documentation what the correct methodology is for coding p-connectors to new rail stations, advice should be sought from SKM on this, though for studies of new stations, it may be more appropriate to investigate station choice outside WTSM.

5.3.2 Bus validation

The bus assignment has been validated by comparison of observed and modelled bus passengers crossing screenlines.

The validation tables[19] show some very considerable differences between the ETM data and the model, but it is unclear whether there is a problem is with the model, the ETM data, or both.

Our main concern is that the 2001 ETM data used to develop the original model and the 2006 ETM data used to update it to 2006 show some considerable differences. Our analysis revealed inferred growth rates over 5 years of the order of 50-100% which appear unrealistic. In our view, the model could not reasonably be expected to replicate this growth, given that the principal inputs of population, households and employment grow by less than 10%.

Comparison of 2001 and 2006 models[20] gives a forecast increase in bus use of 27% in the AM peak, and 23% in the interpeak over the period, which aligns well with independent

[18] Between 98% and 100% of passengers gain access to Porirua, Waterloo, Paraparaumu, Linden and Johnsonville via the p-connectors.
[19] Validation Report Tables 34 and 35 (removed in the published report for reasons of data confidentiality

advice from GW that bus patronage growth has grown by 22% overall. This provides some assurance that the model responds appropriately to a period of strong growth.

Given that this is a four stage model, a difference between observed and modelled flows of 30% at the screenline level would be a reasonable target for screenlines with flows above 100 passengers per hour. There are 12 screenlines, each with two directions, making 24 in total. In the AM peak, 16 of the 24 have more than 100 passengers per hour, and 12 of these are match within 30%. In the IP, there are 9, of which 7 are within 30%.

Overall, it is difficult to identify where the main errors lie given the uncertainties with the ETM data. Our advice is therefore similar to that given in the 2001 model peer review: that a lack of reliable data is a significant constraint to understanding the reasons for the discrepancies, and verification or refinement of the bus validation may be required in local areas for specific studies, using new data.

No validation of bus journey times was provided, though it is stated in the brief that there will be "comparison of bus journey times against observed data" and that "the Golden Mile of Wellington is of key importance".

5.4 Model performance

We have assessed the performance and response of the updated model by setting up a series of sensitivity tests to estimate the elasticities of demand to 10% increases in key inputs.

The percentage change in AM peak trips and trip kilometres forecast by the model, resulting from a 10% increase in the input - all other parameters being held constant - are given in Table 9.

Table 9 – Results of AM Sensitivity Tests (% changes)

Test	Description	Bus		Train		Car	
		Boardings	Pass km	Boardings	Pass km	Trips	Veh kms
1	PT fare	-2.2	-3.1	-2.4	-3.4	0.2	0.4
2	Rail speed	0.1	-1.3	5.3	3.9	-0.1	-0.2
3	Bus speed	3.3	6.6	-2.2	-1.4	-0.1	-0.1
4	Train frequency	-0.1	-1.0	2.3	2.3	-0.1	-0.2
5	Bus frequency	1.8	1.9	-0.4	-0.1	-0.1	-0.1
6	Fuel price	2.1	3.5	1.8	3.0	-0.9	-2.5
7	Highway speed	-0.9	1.0	-3.9	-4.6	1.2	2.6
8	Parking charges	1.2	1.3	1.0	0.9	-0.3 (note 1)	0.0

Source: Arup sensitivity tests. Note 1: percentage change in car trips to CBD only = -1.6

[20] Modelled bus passengers (2 hr): 01AM = 17315, 01IP = 6775; 06AM = 22000, 06IP = 8800.

The demand elasticities (**in bold**) and cross-elasticities (*in italics*) are given in Table 10.

Table 10 – Results of AM Sensitivity Tests (elasticities)

Test	Description	Bus		Train		Car	
		Boardings	Pass km	Boardings	Pass km	Trips	Veh kms
1	PT fare	**-0.23**	**-0.33**	**-0.26**	**-0.37**	*0.02*	*0.04*
2	Rail journey time	*-0.01*	*0.14*	**-0.54**	**-0.40**	*0.01*	*0.02*
3	Bus journey time	**-0.34**	**-0.67**	*0.24*	*0.15*	*0.01*	*0.01*
4	Train frequency	*-0.01*	*-0.11*	**0.24**	**0.24**	*-0.01*	*-0.02*
5	Bus frequency	**0.19**	**0.20**	*-0.04*	*-0.01*	*-0.01*	*-0.01*
6	Fuel price	*0.22*	*0.36*	*0.19*	*0.31*	**-0.09**	**-0.27**
7	Highway journey time	*0.10*	*-0.11*	*0.41*	*0.47*	**-0.12**	**-0.28**
8	Parking charges	*0.13*	*0.14*	*0.11*	*0.10*	**-0.03** **(note 1)**	**0.00**

Source: Arup sensitivity tests. Note 1: elasticity with respect to CBD car trips only = **-0.17**

The key elasticities that are often examined for model validation purposes are for car: fuel costs, journey times, and parking charges; and for PT: fares and journey times.

The elasticity of car kilometres with respect to fuel prices is -0.27 is a very plausible result and similar to the -0.26 of the 2001 model. Benchmark values from models elsewhere are in the range -0.1 to -0.4. In the UK, a value of -0.3 is well established.

The elasticity of car kilometres to car journey time is -0.28, which is within the -0.2 to -0.33 range recommended in the EEM (A11.7).

The elasticity of CBD car trips to CBD parking charges is -0.17, again seems reasonable and in line with our expectations.

The elasticity of bus and rail trips with respect to PT fares are -0.23 and -0.26 respectively, again a plausible result, and close to the benchmark range for urban transport of -0.2 to -0.4 over the short to medium term. The PT journey time elasticities are between -0.34 and -0.67, which we also consider to be reasonable, and similar to the 2001 model.

The tests were also run for the IP period, giving similar results.

Our conclusion is that the principal direct (own-mode) elasticities are all reasonable.

Regarding the cross-elasticities, it is more difficult to benchmark against other models because the strength of this response varies with the level of competition between the modes. It is a key feature of this model that sensitivity of car demand (trips and kilometres) to changes in public transport costs and levels of service is small, which means that, overall, significant improvements to public transport may not have much effect on car congestion, though in individual corridors there could be some effect, this was not tested. As an example, a 30% increase in rail speed and service frequency across the network would, according to this model, reduce overall car kilometres travelled by 1%. We note this as a key feature of the model, not as a technical criticism, as we have no evidence to either support or reject it.

6 Review of Future Year Model

We have reviewed the Baseline Forecasting Report and the future year do-minimums for 2016 and 2026. The 2016 and 2026 Regional Transport Plan (RTP) scenarios were not peer reviewed.

6.1 Model Inputs

The land use and socio-economic data for future years has been provided by MERA. The growth in socio-economic variables appears to be much stronger for the first ten years (06-16) than the second 10 years (16-26), which is a feature of the Statistics NZ projections used by MERA.

6.2 Do Minimum

In general, the changes between 2006 and the two future years look plausible, and the model responds appropriately to changes in the inputs.

In the AM peak, growth in car use between 2006 and 2016 is forecasts around 1% a year for peak and inter-peak. Over the same period, PT use is predicted to grow by 1.6% a year in the peak and 0.6% a year inter-peak. Peak rail use at Wellington (alighters in the AM peak) is forecast to grow by 3.6% a year. Given the increasing congestion affecting cars and buses, these forecast growth rates seem plausible.

Spot checks were made on the road and PT network coding changes, and no problems were found. On a note of detail, the peak capacity on the approach to the Basin Reserve from Adelaide Road is very restrictive, leading to diversionary routes along unsuitable residential streets; further examination of the assumptions may be warranted.

WTSM converges satisfactorily in all scenarios, though in AM and PM models in 2016 and 2026, the model stops due to the maximum number of iterations being reached (set to 320) rather than through achieving the convergence criteria. Given this, we recommend that for future year projects, a sensitivity test is undertaken with the maximum iterations increased.

6.3 Regional Transport Plan (RTP)

No review has been undertaken for the RTP scenario.

7 Model Usability

7.1 Macros

The macro structure developed in 2001 to automate WTSM runs has been retained and further developed. We note that some parameters that the user may need to edit are hidden away inside macros. An example of this is the fuel cost. In order to test the effect of a change in fuel price, the user must search through and edit many lines of code in several different macros to run this test. It would be more straightforward for the user if the global model parameters[21] were collected together into a single user-friendly (i.e. well annotated) control file.

There are files in the 'macros' and '311' directories that are not longer used in the current implementation of the model. It would help in model maintenance if these unused files were moved to a separate directory.

7.2 Tracking of ad-hoc coding amendments

One of the tasks[22] was to give consideration to extending/reviewing the existing practice of applying capacity reductions to links with high M/HCVs flows. But, in the event, the modelling consultants could find no documentation of what was done previously, and the amended links could not be reliably located.

We recommend that, in future, where a non-standard assumption is made, that this is applied as an update to the 'pure' network under macro control, producing a self-documenting record of network elements that differ from the default WTSM coding approach.

7.3 Software

The delivered model is an application of emme/2 software. Since the update project was commissioned, the software has been updated and released as emme/3. The new software, as far as we are aware, gives identical results to emme/2, but has a better graphical interface and additional interactive features that will benefit model users and managers. GW will be running the updated model on the new emme/3 software.

[21] I.e. parameters that apply across the model, rather than to specific origins, destinations, and OD pairs.
[22] Update Specification Report, page 5, Task 5.2.9

8 Recommendations and Conclusions

8.1 Summary of key findings

Our overall assessment is that the tasks set out in the brief have been completed and the resulting model is compliant with the GWRC's briefed requirements. The work has been carried out accurately and professionally, and we consider that the 2006 model represents a significant improvement on the 2001 model it replaces. Sound modelling principles have been applied, and good use has been made of the available data.

A good quality and comprehensive dataset was used for the highway validation. This gives significant credibility to the validation.

Our reservations about the quality of the bus and rail data used for model validation are firstly the age of the rail data and secondly the lack of consistency of the bus data.

The scope did not include the collection of a comprehensive set of public transport data. No new data was collected to validate rail movements, though some useful limited rail count data from 2006 was obtained late in the project, which was invaluable. And for bus, despite the acquisition of patronage data, we have doubts about its quality and consistency for validation purposes. Our review of the bus validation does not provide us with confidence in the derived validation data.

Notwithstanding this, the rail validation aligns reasonably well against observed data presented in the validation report, and with independent data provided subsequently; and a comparison of 2001 and the updated 2006 models shows that growth in bus demand is modelled with reasonable accuracy.

The match between census and modelled PT shares by area is very good - a considerable achievement for a model that has no geographical constants in the mode choice sub-model. We consider this is a strong validation of the underlying model and gives a good degree of confidence.

Sensitivity tests we have undertaken on fuel costs, PT fares, parking charges, car, train and bus speeds, and train and bus service frequencies all gave plausible elasticities, within internationally established normal ranges. A key feature of WTSM is its relatively small cross-elasticities of car demand with respect to PT generalised costs; we have no evidence to support or refute this.

Improvements have been made to p-connectors though our advice is that the ability of the model to forecast use of bus feeders to rail, park and ride use, and station catchment areas is limited.

8.2 Recommendations

Our recommendation is that the updated model is fit-for-purpose for strategic modelling purposes, with the following qualifications:

- analyses that require accurate representation of rail station catchment and access modes will require some model refinement or may be better treated outside WTSM
- for detailed project level modelling, the general advice would be to develop a sub-area model, based on WTSM but with enhanced detail and refined validation in the local area.

Based on the key findings above, we further recommend that:

- if and when new rail and bus data is collected, the public transport validation is verified
- as part of the next model upgrade, a comprehensive and consistent dataset is obtained for bus and rail movements, as well as highway. WTSM is a multi-modal model and PT

is an increasingly important part of transport packages: good modelling of bus and rail requires good data.

8.3 Conclusions

Arup was appointed to peer review the Wellington Transport Strategy Model (WTSM) 2006 Update. We have undertaken a detailed review and sensitivity testing.

Our overall assessment is that the updated model is compliant with the Greater Wellington (GW) briefed requirements. We are satisfied that the work has been carried out accurately and professionally, and that the 2006 model represents an improvement on the 2001 model it replaces. We consider that sound modelling principles have been applied, and good use has been made of the available data.

The validation of the highway assignment model has been reviewed and is considered to be of a high standard for a four-stage model.

We have some reservations about the quality of the bus and rail data used for model validation, firstly the age of the rail data and secondly the lack of consistency of the bus data. Notwithstanding this, the rail validation aligns reasonably well against the limited data available and the growth in modelled bus use[23] is replicated satisfactorily.

Tests we have undertaken to establish the sensitivities of the model indicate elasticities are reasonable, lying within the expected ranges. Cross-elasticities of car travel with respect to public transport costs are low, meaning that even quite significant improvements to public transport are likely to have only a small effect on region-wide car trips and kilometres. In individual corridors the effect may be stronger, we have not tested this. This is noted as a key feature of the model, not as a technical criticism.

It is the nature of a peer review to focus on the negative issues. A small number of components that we feel merit further discussion are addressed in this report. This does not reflect on the appropriateness of the model overall - the great majority of components require little or no comment because they function well.

In summary, WTSM 2006 meets and in many ways exceeds international standards for four-stage models, and we recommend that the updated model is fit-for-purpose.

[23] Between 2001 (WTSM Base) and 2006 (WTSM 2006 update)

G.2 Transmission Gully Draft Review of Transport Assessment Report, By Flow Transportation Specialists Ltd

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Transmission Gully

Review of Transportation Assessment

May 2011

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EXECUTIVE SUMMARY

This report provides a review of the Traffic and Transportation Assessment of the Transmission Gully project, prepared by consultants Sinclair Knight Merz (SKM). We have provided a separate review of the traffic model.

Potential gaps in the draft Traffic and Transportation Assessment dated August 2010, are set out below. These gaps were identified in our preliminary review of August 2010 as representing the key risks to NZTA, at that time.

- Most of the RoNS have a Network Plan. Flow was advised that this Plan was being prepared, so this represented a gap in the transportation assessment at that stage
- Section 6 referred to an appendix relating to a construction traffic management plan, but that appendix had not been provided. However, it appeared (from the text at Section 6) that it may not identify possible temporary layouts, which will presumably be needed at the tie ins at either end of the project and where the project crosses or intersects with existing roads
- Similarly, the assessment did not identify potential effects relating to local access and property access issues
- The scoping report noted that there was no need for an economic assessment at that stage. This could be considered by some to be a gap (and therefore a risk to NZTA)
- The Transport Assessment report did not provide any results of tolling the project. This may be a gap (and therefore a risk to NZTA), if tolling is to be considered at a later stage
- Page 12 of the Scoping Report stated that a sensitivity test on the assumed fuel price increase was to be undertaken "at a later time". This appeared not to have been undertaken, so this was considered to be a gap
- There was reference to SIDRA assessments of the key intersections, but no details had been provided of how (or if) the SIDRA results had been fed back into the SATURN models
- We noted that there appeared to be a possibility that the Transmission Gully project could be confirmed but that all Porirua Link Roads are declined. This possibility had not been modelled (noting that Scenario E assumes that the Waitangirua and James Cook link roads are not provided)
- The Scoping Report referred to the provision of information on public transport patronage by link and station and origin – destination changes. This had not been provided
- The SKM report set out the proposed upgrades to the railway network, but there had not been a full analysis of the potential growth in rail based transport. Such an option may be put forward by submitters
- We were not aware of any assessment of the localised land use effects that may be directly attributed to the Project, both along parts of the existing SH1 route or adjacent to new interchanges along the Transmission Gully route. It may be necessary for local authorities to either take measures to encourage desirable land use outcomes or inhibit undesirable outcomes
- It may be that NZTA "rolls out" the ramp signalling programme, from Auckland to motorways within the other main urban centres. This may lead to minor modifications along the Transmission Gully route, which would probably only offer significant costs if it requires extensions to the designation

- We noted that the Coastal Road package was described as including designs that are not committed. We were unclear if there was full commitment to the measures and if they were to be offered as conditions of the Transmission Gully project. If so, we were unclear whether this package would introduce any unexpected costs.

Subsequent to the completion of our preliminary review in August 2010, SKM responded to address the majority of issues previously raised. Our response on each of these issues, based on the revised version of the SKM report (Version F, dated April 2011) is provided at Appendix A of this report. The outstanding issues (being either issues from our first review, or additional issues raised in our review of an interim version of the SKM report, in February 2011) are as follows:

- Some of the figures given in the crash analysis are significantly different from those in the earlier version of the report. The reasons have not been explained
- We have requested confirmation that whether the reported levels of service in the SIDRA analysis at Table 4.16 relate to the overall intersection performance and whether this should be changed to report the worst approach or the worst movement
- We are advised that the Network Plan document is still under preparation
- We are advised that NZTA considers that an Economic Assessment is not required at this stage
- SKM consider the question of ramp signals to be a design issue, not an issue related to traffic effects. This may be a relevant comment, but presumably NZTA will wish to be assured that the designation is adequate
- We are advised that the measures included in the Coastal Road package are intended only to be an indication of what could be implemented along the route, to improve amenity etc. This may be a reasonable position at this stage, with the precise nature and extent of works to be confirmed as a result of negotiations between NZTA and the local authorities, but it would be desirable for there to be a commitment to implement "appropriate measures" as a consequence of the Transmission Gully project. It may be that these negotiations should follow the completion of the Network Plan.

We have also provided responses on particular issues raised by the Regulatory Authorities' Technical Advisory Group (RATAG), in letters dated 25 November 2010 and 14 March 2011. These letters addressed the following issues:

- The extent of the simulation and buffer networks within the SATURN traffic model
- The use of one hour models, preload models and the lack of weekend and holiday period models
- The modelled operation of intersections and merges
- The status of certain projects that were included within the Do Minimum scenario
- The extent of SIDRA modelling
- The adequacy of the crash analysis

These letters confirmed that we considered the SKM treatment of and response to these issues to be satisfactory.

CONTENTS

APPENDICES

1 INTRODUCTION

This report provides a summary of the peer review of the transportation assessment of the Transmission Gully project, undertaken by SKM and reported on in their report "*Transmission Gully – Traffic & Transportation Assessment Report"*, Rev B, dated 10 August 2010. We have also been provided with the report "*Transmission Gully Phase 2 Investigations, Workstream 6: Transportation Planning and Traffic Engineering, Final Scoping Report"*, dated 22 December 2009.

Flow has been asked to focus on the following:

- Achievement against the required purpose
- Resolution of issues raised by the Regulatory Authorities Technical Advisory Group (RATAG)
- Potential gaps
- Risks to NZTA
- Unexpected costs
- Other issues

We have reported separately on a more detailed review of the traffic modelling undertaken to facilitate the overall transport assessment.

SKM have provided a response to the issues raised in this review. The resolution of the issues raised, as set out in Version F of the SKM report, dated April 2011, is discussed at Appendix A. However, it should be noted that references to page, section, figure and table numbers in Sections 2 to 5 of this review, below, relate to Version B of the SKM report.

2 ACHIEVEMENT AGAINST THE REQUIRED PURPOSE

2.1 Objectives of the Project

The objectives for the project have been defined by NZTA (in the SKM report) and are set out below.

2.1.1 Objective 1

Objective 1 is *"To provide an alternative strategic link for Wellington that improves regional network security".*

The route does provide an alternative strategic link between Linden and MacKays Crossing that will improve regional network security. Its connection to SH58 provides east-west connections to SH2 and the existing SH1.

2.1.2 Objective 2

Objective 2 is *"To assist in remedying the safety concerns of and projected capacity problems on the existing State Highway 1 by providing a safe and reliable route between Linden and MacKays Crossing in an environmentally sustainable manner".*

The project will help to address safety concerns and projected capacity problems on the existing state highway, through the removal of through traffic. Measures are proposed at a number of intersections that are identified as having sub standard conditions, as part of the Coastal Route package. The report notes that the proposed designs along this route are not committed but should reflect the effects of expected changes for assessment purposes.

2.1.3 Objective 3

Objective 3 is *"To assist in enabling wider national economic development by providing a cost-optimised route that better provides for the through movement of freight and people".*

We are unable to comment on whether or not the preferred solution can be considered to be "cost optimised". However, we concur that it will better provide for the through movement of freight and people than the existing state highway.

2.1.4 Objective 4

Objective 4 is *"To assist integration of the land transport system by enabling the existing State Highway 1 to be developed into a safe multi-functional alternative to the proposed strategic link".*

There are minimal details or assessed changes to the existing SH1 with regards to making it a safe *multi-functional* alternative. Lower traffic volumes and correspondingly reduced exposure and chance of crashes will occur. Whilst reduced traffic volumes will provide the opportunity for enhancing multi-functionality and some measures are mentioned, such as signalisation of four side road intersections at Pukeroa Bay, no specific cycle/walking, public transport, HOV facilities, land use planning or urban design initiatives are identified in the report. Some roads and intersections have been identified as having sub-standard conditions. As noted above, the report notes that the proposed designs along the Coastal Route are not committed, but should reflect the effects of expected changes for assessment purposes. Flow understands that a Network Plan is being developed that will identify improvements that will better meet this objective.

2.2 Purposes of the Transport Assessment

The Scoping Report states that the purpose of the transport assessment is to assist the NZTA to lodge and obtain the required statutory consents to construct the Transmission Gully project. It states the information required and the paragraphs below include our comments on the adequacy of the information provided.

2.2.1 Traffic Volumes

Existing and forecast (2026) traffic volumes are provided.

As minor points of detail, we note that Figure 3-3 is slightly misleading. It would be preferable for the X axis to be to scale (eg reflecting the greater time between 2006 and 2026 than 2026 to 2031). Also, the traffic flow diagrams (Figures 3-3 to 3-5 and 4-3 to 4-4) are very hard to read (although it is acknowledged that the daily flows are set out in the tables at Appendix H).

2.2.2 Vehicle Kilometres Travelled

Existing and forecast (2026) total travel distances are provided at Figure 3-3.

2.2.3 Travel Times / Delay on Key Routes and at Key Intersections

Existing and forecast (2026) traffic times are provided along key routes. Details of the predicted level of service at key intersections are provided, which implicitly includes information on delays at these intersections.

2.2.4 Trip Induction and Mode Transfer

Some information on these issues is provided at Section 4.6 of the Transport Assessment.

2.2.5 Public Transport Impacts

Information on this issue is provided only briefly, at Section 4.9 of the Transport Assessment.

2.2.6 Pedestrian and Cycle Impacts

Information on these issues is provided only briefly, at Section 4.9.3 of the SKM report.

2.2.7 Safety Effects

Existing and forecast (2026) crash records are provided at midblocks. SKM acknowledge in a footnote on page 53 that the crash analysis of the Transmission Gully project is not intended to be comprehensive.

3 RESOLUTION OF ISSUES RAISED BY RATAG

Table 1 identifies each of the issues raised by Regulatory Authorities Technical Advisory Group (RATAG), the SKM response and our conclusions regarding whether or not there has been resolution.

It is noted that some of the section numbers referred to by RATAG have changed in the updated version of the report.

Table 1: Resolution of RATAG Comments

Number	Section WS6[a]	Issued Raised	SKM Response (April 2010)	Resolution of Issues (Flow August 2010)
1	Section 3	List of 'policy & legislative context' needs to include both the Proposed Regional Policy Statement and operative RPS, relevant regional plans (e.g. the Regional Freshwater Plan) and city and district plans, and any proposed plan changes and variations.	*The transportation assessments need to be seen in the context of a comprehensive suite of documents that will include a detailed statutory assessment report addressing all the relevant statutory documents, and a separate land use and transportation integration assessment (being prepared by the Planning Resource Services team with close input and review from the Traffic and Transportation team). The relevant designation provisions of the RMA will also be covered.* *There is a desire (and it is good planning practice) to eliminate repetition wherever possible, and the integrated team approach is being used to assist this aim.*	Resolved. Appendix I provides a review of the regional policy statement and local plans and how the project relates to these.
2	Section 9.9	It is specified that the task will analyse the performance of the preferred scenario against the objectives of the LTMA, NZTA and GPS. There is no reference to the list of other, more local documents, as itemised on Page 7 (task 1 – to review policy and legislative context). RATAG suggests task 7.9 must also analyse the performance of the preferred scenario against these documents.	*It is appropriate that this assessment is a high level assessment given that there is a detailed statutory assessment as part of the wider suite of project documents (refer above comment under Section 3).*	Resolved. Appendix I provides a review of national and regional transport policies, strategies and plans and how the project relates to these.

Table 1: Resolution of RATAG Comments

Number	Section WS6[a]	Issued Raised	SKM Response (April 2010)	Resolution of Issues (Flow August 2010)
3	MWH Review Report (Section 2.3.2)	Contains a statement 'the connection at James Cook Drive is largely constructed' – this is incorrect. As there is no certainty that it will eventuate, a NoR will need to be applied for, as with the Waitangirua link.	*Comments relates to the MWH report.* *It is accepted that a NoR is required, with PCC being the requiring authority.*	This issue appears to have been adequately addressed. However, it raises an issue that may be a gap in the assessment. If PCC is the requiring authority for the NoRs for the Porirua Link Roads, is there a possibility that the Transmission Gully project could be confirmed but all Porirua Link Roads declined? This possibility has not been modelled (noting that Scenario E assumes that the Waitangirua and James Cook link roads are not provided)
4	MWH Review Report (Section 2.3.3)	Notes correctly that there is a requirement to consider alternatives for the link roads as part of the NoR. While the earlier proposal for an additional interchange and link road to Porirua East has been replaced with the joint interchange and new Waitangirua link in the current proposal, consideration must be given as to the way the previous proposal is presented. It would be appropriate for it to be addressed as an option that was rejected after public consolation, as with the Coastal Route. However, RATAG is not clear about how much specific written justification for that decision exists, and it may be a necessary task to collate and prepare a note on the reasons for the decision.	*This was part of the logic behind revisiting the existing designation (as well as to assist and inform the consultation process) and modelling the existing and comparing it to the proposed.* *There has been an extensive consultation process undertaken by the PCC (which is the other requiring authority for this project) which has gauged public opinion on the change. We are confident that the alternatives - both the old and new designation options - and alternatives within the proposed new alignment have been well canvassed in the context of what the RMA requires.*	The report covers a scenario with the Transmission Gully project as now proposed (Scenario B) and the original proposal (Scenario C), with the main difference being the Porirua Link Roads. We are not aware of what other options have been considered and therefore whether there has been an adequate assessment of alternatives. Also, while information may be provided in other reports, we suggest that the Transport Assessment provides inadequate detail on the definition of the Porirua Link Roads at Section 4.1.2. (Note this may be addressed by Section 1.2: Project Description, which is currently blank)

Table 1: Resolution of RATAG Comments

Number	Section WS6[a]	Issued Raised	SKM Response (April 2010)	Resolution of Issues (Flow August 2010)
5	Section 6.2	Mention is made of the Aotea Block and Silverwood subdivisions which will result in the future establishment of residential dwellings. No mention is made, however, of subdivisions by Whitby Coastal Estates Ltd being undertaken/or anticipated to be undertaken.	*Reference in the report is to areas <u>including</u> the Silverwood and Aotea subdivisions, and only in relation to the zonal disaggregation process. Allowance will be made in the modelling for progress on the WCE development, as appropriate.*	This issue may well be adequately addressed, but the response is not considered to be entirely adequate. That is to say, we are unclear what quantum of development is proposed by WCE and what allowance has been made in the modelling. As such we cannot comment on whether the modelling allowance was "appropriate"
6	Section 6.4.3	No mention is made of James Cook Drive or Warspite Ave links.	*(It is assumed that this comment relates to the PARAMICS modelling).* *The interchange between these links and the main TG alignment will be assessed using SIDRA. It has been agreed with the NZTA that SIDRA modelling will be undertaken for those intersections which experience volumes increases of at least 10% as a result of the TG project – this ensures that any potential adverse effects upon performance are assessed.*	We concur with the SKM comment that a traffic assessment based on a SATURN model, supplemented by SIDRA, is entirely adequate for this assessment. However, we are not clear if the SIDRA modelling results have been fed back into the SATURN models. Further, we are not sure that this adequately addresses the issue raised, and greater detail could perhaps be provided in the Transport Assessment on the predicted effects, including the predicted flows, on each of the proposed Porirua Links. For example, Section 4.7.2 does refer to the effect of the proposed Kenepuru Link, but not the other Links. Section 5.1.4 does make reference to the James Cook Drive and Waitangirua (Warspite Ave) links.

Table 1: Resolution of RATAG Comments

Number	Section WS6[a]	Issued Raised	SKM Response (April 2010)	Resolution of Issues (Flow August 2010)
7	Section 8.4	The need for micro-simulation modelling should extend to the Warspite / link road intersection and possibly the James Cook / link road intersection. The listing of scenarios for testing is unclear as to the inclusion or otherwise of the link roads. This needs to be reconsidered in conjunction with the comments on the Whitby link in relation to Section 2.3.3.	*SIDRA assessments are sufficient for a determination of the operational performance of these intersections and hence micro-simulation is not justified.* *The agreed scenarios for assessment purposes and inclusion of link roads are clarified in the attached file note dated 21 April 2010. SIDRA modelling will be undertaken (refer above).*	As above, we consider that a traffic assessment based on a SATURN model, supplemented by SIDRA, is entirely adequate for this assessment
8	Section 6.4	Appears to identify three possible approaches to the modelling technique. However, item 6.4.3 appears to be the only option that identifies downstream effects on the local roading network from the link roads. The effect of the link roads on the existing network may well need to be addressed in the application as they have the potential, for instance, to increase traffic volumes on certain roads (e.g. James Cook Drive, Kenepuru Drive) and also change intersection characteristics. Assessment of the effects of the link roads on existing roads and intersections, particularly where there is going to be a noticeable increase in traffic volumes, would appear to be an aspect that should be addressed in the application with appropriate technical input.	*(Comments relate to an earlier version of the Scoping Report which presented options in terms of SIDRA, Paramics and Paramics (network) modelling has since been superseded with a decision to use SIDRA for operational assessments of the key intersections downstream of the link road).* *SATURN modelling (combined with scenarios to be tested) will identify volume changes on roads in the area as a result of the in/exclusion of the link roads (together, not individually).* *Effects upon more remote intersections can be inferred by reference to these flow changes – NZTA believe that effects on remote intersections will be negligible and therefore detailed simulation of these intersections is not justified.*	As above, we consider that a traffic assessment based on a SATURN model, supplemented by SIDRA, is entirely adequate for this assessment

4 POTENTIAL GAPS

4.1 Information not Provided for Review

We note that the following items have not been provided for review.

- The SATURN files for the sensitivity tests (Scenarios C to F) have not been provided for our review
- The report refers to SIDRA analysis. We have not been provided with any SIDRA files or modeling results for review
- The scoping report refers to other workstreams that will be using the outputs of the models, to address issues such as severance, noise and emissions. Again, this information has not been provided for our review.

The above do not necessarily indicate a gap in the assessment, although the information has not been subject to review.

4.2 Issues that are not considered to be Gaps

We also note the following points, that we consider do not constitute "gaps":

- The assessment is based on 2026. We concur with the comment that an assessment against an earlier year (such as 2016) is not necessary
- The demands for 2026 are based on the regional transport model (known as WTSM)). This is based on a medium growth scenario, which is considered appropriate
- Page 9 of the Transport Assessment notes that WTSM uses a range of inputs including land use data by zone, fuel price, parking costs, car ownership levels, public transport fares and values of time
- Appendix B refers to PARAMICS models, which are not reported in the assessment. This may not be a gap in itself, as an assessment based on SATURN (supplemented by SIDRA) would appear to be entirely adequate for this stage
- Our previous (2008) review noted that SATURN (and indeed many other traffic modeling packages) does not model roundabouts particularly well. This has been addressed by the inclusion of SIDRA models to check the SATURN assessments, so it is not considered to be a gap (although as noted above, the SIDRA results have not been provided for review)
- No assessment has been undertaken of the likely effects of the project at weekends or during holiday periods. This is quite normal practice, so it is not considered to be a gap
- The core scenarios include the assumption that other parts of the RoNS and other projects will have been constructed. Flow considers that assessments should be undertaken to identify the effects of the project should these not occur, particularly those ones that have not been consented. This issue is covered by Scenario F, meaning that this is not a gap.

4.3 Potential Gaps

Potential gaps in the transportation assessment are identified below. These are considered to represent the key risks to NZTA.

- Most of the RoNS have a Network Plan. Flow understands that a Plan is in preparation, so this represents a gap in the transportation assessment at this stage. Such a Network Plan should fill a number of the gaps identified below
- Section 6 refers to an appendix relating to a construction traffic management plan, but that appendix has not been provided. However, it appears (from the text at Section 6 of the Transport Assessment) that it may not identify possible temporary layouts, which will presumably be needed at the tie ins at either end of the project and where the project crosses or intersects with existing roads
- Similarly, the assessment does not identify potential effects relating to local access and property access issues. This may be considered to be a point of detail, and we do not have any specific sites in mind, but such issues are fairly often raised at hearings, and they can undermine the perception of the rigour of the assessment
- The scoping report notes that there is no need for an economic assessment at this stage. This could be considered by some to be a gap (and therefore a risk to NZTA)
- The Transport Assessment report does not provide any results of tolling the project. While the issue of tolling is referred to briefly at Appendix B, in response to the MWH comments, the assessment of effects relates only to untolled scenarios. This may be a gap (and therefore a risk to NZTA), if tolling is to be considered at a later stage
- Page 12 of the Scoping Report states that a sensitivity test on the assumed fuel price increase is to be undertaken “at a later time”. This appears not to have been undertaken, so presumably this should be considered to be a gap
- There is reference to SIDRA assessments of the key intersections, but no details have been provided of how (or if) the SIDRA results have been fed back into the SATURN models. For example, page 30 of the Transport Assessment states that the level of service at the Kenepuru Drive/Titahi Bay Road roundabout will decline from D to F in the evening peak, according to SIDRA, but the SATURN model indicates that the roundabout will operate satisfactorily in 2026 in the evening peak
- Page 39 of the Transport Assessment states that the four signalized intersections at Pukerua Bay (proposed as part of the Coastal Route Package) are to include pedestrian phases but these have not been modeled. The assumed phasing also assumes a number of give way turns which may over emphasize the efficiency of the intersections if these turns (such as right turns from the main road, giving way to oncoming through traffic) operate only in exclusive phases
- As noted in response to Issue 3 in Table 1, we note that there appears to be a possibility that the Transmission Gully project could be confirmed but all Porirua Link Roads are declined. This possibility has not been modelled (noting that Scenario E assumes that the Waitangirua and James Cook link roads are not provided)
- The Scoping Report refers to the provision of information on public transport patronage by link and station and origin – destination changes. This has not been provided

- The SKM report sets out the upgrade to the railway network, but it appears that there has not been a full analysis of the growth in rail based freight transport, or the potential effects of significant additional investment in passenger rail. We do not consider this to be a viable alternative to the Transmission Gully, but it may be an option that is put forward by submitters. There may be some merit in providing greater detail to demonstrate the maximum realistic potential for rail along this corridor
- The assessment is based on an agreed land use scenario which would appear to be entirely appropriate. However, we are not aware of any assessment of the localised land use effects that may be directly attributed to the project, both along parts of the existing SH1 route, where the removal of traffic may improve amenity or may facilitate intensification at key nodes and adjacent to new interchanges along the Transmission Gully route, which may become attractive for land uses such as out of town retail or distribution centres. Clearly it is difficult to accurately predict the scale and nature of these effects, but it may be necessary for local authorities to either take measures to encourage desirable land use outcomes or inhibit undesirable outcomes

5 UNEXPECTED COSTS

The majority of items identified at Section 4.3 as gaps and therefore risks generally refer to the need for comprehensive information. The unexpected costs associated with these items would presumably relate to the costs of delay to the project. However, we note the following potential unexpected cost items:

- It may be that NZTA "rolls out" the ramp signalling programme, from Auckland to motorways within the other main urban centres. This may lead to minor modifications along the Transmission Gully route, which would probably only offer significant costs if it requires extensions to the designation
- We note that the Coastal Road package is described as including designs that are not committed. We are unclear if there is full commitment to the measures and if they are to be offered as conditions of the Transmission Gully project. If so, we are unclear whether this package will introduce any unexpected costs.

APPENDIX A Resolution of Issues

Our initial review of August 2010 was based on the draft Transportation Assessment (Version B, dated August 2010). The latest version (Version F, dated April 2011) includes the following sections, which respond specifically to issues raised in our August 2010 review:

- Sections 1.1 to 1.4 include details of the project description, including the associated links to be progressed by Porirua City Council. This allows us to correct our previous comment (bullet 8 on our August 2010 review) around the Transmission Gully project being confirmed but the Porirua Links not being confirmed. In fact the Kenepuru Link is to form part of the Transmission Gully project, with the potential exclusion of the Whitby and Waitangirua Links covered by a sensitivity test
- Section 4.9 of the report now provides information on the effect of the Transmission Gully project on rail patronage. This information relates to the section south of Pukerua Bay, which SKM consider to be the likely section with greatest changes. The information indicates that the Transmission Gully project will have some effect on rail patronage, but we concur with the comment that the assessment of the (road) project needs to be seen in the context of a previously identified package, comprising investment in both road and rail
- Section 5.1.6 now includes a consideration of the effects of increases in fuel prices. This indicates that the conclusions of the Transport Assessment are relatively unaffected by the assumptions on this issue
- Section 6 includes a section on Land Use and Transport Integration, with a separate report on this provided at Appendix 4.E
- Section 7 includes an assessment of temporary traffic effects, identifying the main principles of the Construction Traffic Management Plan, the locations of the main activities that can be expected to temporarily affect the operation of existing routes and the locations of proposed construction accesses. This section refers to potential temporary layouts and locations where local access and property issues will need to be mitigated
- The traffic flow diagrams (Figures 4.5 to 4.7 and 4.13 to 4.14 in Version F) have been updated such that they are now legible.

The following other changes have also been made to the report which require some comment.

- Section 2.2.3.2 on page 28 includes the comment that the more intense congestion experienced at weekend and holiday periods (which have not been modelled) means that some of the benefits are understated. This comment is supported, as traffic modelling generally tends to focus on "neutral" time periods (for example a "normal" weekday, not a busy weekday, such as a Monday morning or a Friday evening). The inadequacies of the existing SH1 route would become all the more apparent during the busier periods (both busy weekdays and at peak weekends)
- The crash analysis has been updated from 2004-2008 to 2005-2009. The information is now provided in a different format, but while it appears to cover a similar area (ie SH1, SH58 and Grays Road), the totals for the same year are different when combined over the information previously provided for the rural and urban areas. For example, the total number of crashes in 2006, according to Table 4.3 of the new version of the report, was 209, whereas according to Tables 3-1 and 3-2 in the August 2010 report the total was 123 + 76 = 199. These differences are probably not significant, and they probably relate to a slightly different specification of the study area for the crash search

- The information for crashes at key intersections has also been updated, but while the total numbers of crashes over the (different) five year periods are similar in some cases (eg at the Mungavin Interchange the total of 69 crashes between 2004-2008 compares with 67 between 2005-2009) the number of crashes at some other locations is quite different (with the extreme example being 1 crash at Pa/Toenga Road between 2004-2008 but 63 between 2005-2009). The validity of the new figures should therefore be checked
- The information regarding the level of service at the new intersections in 2026 has not been changed from the August 2010 version. However, we wonder whether the reported levels of service at Table 4.16 relate to the overall intersection and whether this should be changed to report the worst approach or the worst movement.

To ensure that this review provides an update on all issues raised previously, we note that the following points **have been addressed** (for issues other than those noted above, with this list based on the bullet points in the Executive Summary of our August 2010 report):

- The report states that it is currently not intended that the project will be subject to toll, so no tolling assessment has been provided
- SIDRA to SATURN: as noted in our response on the Traffic Model (provided as Appendix 4.G3 to the SKM report), some work has now been undertaken to demonstrate the effects of changes in the modelled operation of key roundabouts in SATURN.

On the other hand, we note that the following points **have not been addressed** (with this list again based on the bullet points in the Executive Summary of our August 2010 report):

- Network Plan: we are advised that this document is still under preparation
- Economic assessment: we are advised by SKM that NZTA still considers that an Economic Assessment is not required at this stage
- Ramp signals: SKM consider this to be a design issue, not an issue related to traffic effects. This may be a relevant comment, but presumably NZTA will wish to be assured that the designation is adequate
- Commitment to Coastal Road package: we are advised that the measures are intended to be an indication of what could be implemented on the coastal route, to improve amenity etc, and there is no firm commitment to these particular works. This may be a reasonable position at this stage, with the precise nature and extent of works to be confirmed as a result of negotiations between NZTA and the local authorities, but it would be desirable for there to be a commitment to implement “appropriate measures” as a consequence of the Transmission Gully project. It may be that these negotiations should follow the completion of the Network Plan.

G.3 Transmission Gully, Review of Traffic Model, By Flow Transportation Specialists Ltd

flow
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Transmission Gully

Review of Traffic Model

October 2010

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Project: **Transmission Gully**
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EXECUTIVE SUMMARY

This report summarises our peer review of the SATURN traffic model developed by consultant Sinclair Knight Merz (SKM), to assess the proposed Transmission Gully project.

Base Model

The main points associated with our review of the base model are as follows:

- The flow validation across the screenlines is generally satisfactory
- The consultant has provided sufficient detail to demonstrate that the flow validation along SH1, which will be the main route to feed the Transmission Gully project, is satisfactory. However, further checks should be undertaken on the validation of the model adjacent to the proposed Porirua Links, between SH1 and SH58, to demonstrate that the basis of the operational analysis of the key intersections in this area is sufficiently robust
- The journey time validation (particularly along SH1) is generally satisfactory
- There is no observed data on travel patterns. The model sits under the regional model, and the consultant has demonstrated that the patterns have not been changed from those in the regional model. Also, the detailed validation along SH1, which will be the main route to be affected by the Transmission Gully project, is reasonable. As a result, this issue may not be particularly significant.

Future Model

Future models have been developed for the years 2026 and 2031, but the Transport Assessment Report has focussed on the 2026 models. These seem to be working reasonably well and we make the following observations:

- The level of growth between 2006 and 2026, seems relatively modest, but the background material provided demonstrates that this is consistent with the region's expectations
- The level of the predicted changes in heavy vehicles seem high, but the overall increases in demands are still modest
- No changes in overall heavy vehicle trips are predicted as a result of the Transmission Gully project
- The level of congestion in the future Do Minimum networks is relatively modest
- We have not encountered any unusual routings in the future Do Minimum models, which probably reflects the absence of severe congestion
- The list of major transport infrastructure projects included in the future models appears to accord with the region's expectations. However, we have not seen any documented evidence to demonstrate that sufficient attention has been given to more subtle changes, which could, cumulatively, influence the routing of traffic in some areas
- The predicted effects of the Transmission Gully project seem sensible, with the primary beneficiary being through traffic on SH1
- Sensitivity tests should be undertaken on the assumed capacities of key roundabouts
- We have made comments on a number of detailed network assumptions, which should be checked.

Subsequent to the completion of our review, SKM have responded to address the issues raised. Our response on each of these issues is provided at Appendix A of this report, which demonstrates that SKM have satisfactorily addressed these issues.

CONTENTS

APPENDICES

1 INTRODUCTION

1.1 General

This report summarises our peer review of the traffic model developed by consultant Sinclair Knight Merz (SKM), to assess the proposed Transmission Gully project for the NZ Transport Agency (NZTA).

The history of the model is as follows:

- We reviewed the Scoping Report, Model Validation Report, Future Model Development Report and what was termed a Consolidated Report[1] relating to the Transmission Gully project during 2007 and 2008. We accepted the model as being fit for the purpose of that assessment, but noted that additional work may be required to confirm the validity of the model for other purposes
- We reviewed the modifications to the base model for the purposes of the Ngauranga Triangle project in early 2009 and for the purposes of the Hutt Bridges assessment at Melling in September 2009. The effects of this most recent model update in the areas relevant to the Transmission Gully project were reviewed at that stage.

The update of the assessment of the Transmission Gully project[2] (termed here the "Transport Assessment Report"), uses the same base model as that used for the Hutt Bridges project. We consider that this is appropriate, as the Hutt Bridges model is the most recent model, and as noted above, attention was given to the effects of enhancements to the model in the Hutt Bridges area on the performance of the model in the area of influence of the Transmission Gully project.

SKM have provided a response to the issues raised in this review. The resolution of the issues raised is discussed at Appendix A.

2 MODEL HIERARCHY

The main modelling tool used for the transport assessment of the Transmission Gully project is a SATURN traffic model. The SATURN model has been informed by demands from the Wellington Regional Council's Wellington Transport Strategy Model (WTSM), while more detailed intersection assessments have been undertaken using SIDRA.

This modelling hierarchy used is quite standard and we note the following:

- WTSM is a fairly well established regional model that has been used for a wide variety of applications. The model is based on the EMME software
- SATURN is a well established modelling tool that has been used for a variety of applications around New Zealand (and indeed in many other countries)
- Likewise, SIDRA is an intersection modelling package that is in very wide use throughout New Zealand.

[1] "Transmission Gully: SATURN Model Report" (June 2008). SKM
[2] Transmission Gully – Traffic and Transportation Assessment Report, Version B (10 August 2010), prepared for NZTA by SKM

This report focuses on the development and use of the SATURN model.

We note that Appendix B of the Transport Assessment Report refers to PARAMICS microsimulation modelling but this has not been relied on in that report and it has not been provided for review.

3 BASE MODEL VALIDATION

3.1 Base Network

The model extends to the same boundaries as the WTSM, but it has been coded to two levels of detail. The areas away from the Transmission Gully project have been coded as what SATURN terms the "buffer" network. The detail within this outer area is fairly coarse, with no intersection details. We have previously commented that the level of validation within this area is not particularly good, nor should it be expected to be for the purposes of this assessment.

The area of the more detailed model, which SATURN terms "simulation" network, is satisfactory for the evaluation of the Transmission Gully project in that it covers the area of influence of the project, to the extent that no significant effects are anticipated outside the simulation network and within the buffer network.

3.1.1 Simulation Network

Appendix A of the Consolidated Report provided detail of the saturation flows to be used in the model, in the first instance. We commented that these seemed generally to be acceptable, but that the calibration/validation process would determine whether the values needed fine tuning (either globally or at particular intersections).

The model includes a number of level crossings and signalised pedestrian crossings, in order to improve the validity of the model.

The Consolidated Report indicated that speed flow curves were not used extensively. We recommended that these should be included on "rural" links, and any links of significant distance and/or speed limits of over 50 kph. We noted that coding speed flow curves on short links are of limited value for the effort required, and curves on links feeding intersections (particularly signalised ones) are fraught with danger, as the capacity of the curve may overwrite the capacity of a flared approach.

3.1.2 Assignment and Convergence

We previously confirmed that the Wardrop assignment method suggested is appropriate.

The Consolidated Report stated that there is "relative insensitivity" to the generalised cost functions used. We previously accepted that the generalised cost function should be reviewed as part of the calibration and validation, and again for the future models. Previous values used for the WTSM and adjacent SATURN models were considered to offer a useful guide, but we noted that these should not necessarily be assumed to be optimum for this project.

3.2 Data Sources

During our 2008 review, we provided comment on the data collection exercise proposed and to the need for an independent count set for the matrix estimation.

3.3 Matrix Development

3.3.1 Time periods

Models have been developed for the weekday morning peak, inter peak and evening peak hours. No weekend or holiday period models have been developed. This is consistent with standard practice where the weekend/holiday periods do not generate high demands or congestion.

The Consolidated Report provided traffic flow profiles for a number of key sites to justify the suggestion of a weekday morning peak model of 0700-0800 and a weekday evening peak model of 1700-1800. Our initial review had commented that the evening peak time appeared to be appropriate, but that further analysis was required to confirm the morning peak.

We previously commented that peak hour models are appropriate for operational analysis, while average (ie peak period) models are more appropriate for economic analysis. It is apparent from the Transport Assessment Report that the models are being used for operational analysis, meaning that the use of peak hour models is entirely appropriate for this task.

The final 2008 Validation Report included additional commentary on the morning peak hour suggested for analysis and flow profiles were provided within the Consolidated Report, which adequately addressed this issue.

3.3.2 User Classes

We previously commented that the proposed approach, with the model considering light and heavy vehicles separately and modelling buses as preloaded fixed trips, was appropriate. However, we recommended that consideration should be given to whether the future model will need to assess priorities for high occupancy vehicles (HOVs), in which case a further user class may need to be added.

We note that the counts have been converted to passenger car units (PCUs). This needs to be borne in mind when interpreting outputs from the model. For example, the flows provided at Figures 3-4 to 3-6 and 4-3 to 4-4 of the Transport Assessment Report state that they give flows from the SATURN model, in vehicles/hour and vehicles/day. We have checked to confirm that these flows have been correctly converted back from PCUs to vehicles.

3.3.3 Matrix Development – Base Model

Manual manipulations have been made to the base matrices from WTSM, followed by matrix estimation. This approach is considered acceptable. We understand that the manual manipulations were made to the prior matrices only.

We noted previously that it should not necessarily be assumed that the WTSM matrices are “correct”, as there are bound to be local flaws in any strategic model. Rather, we suggested that if estimation is forcing significant changes to the matrix, it may be worthwhile returning to the origin-destination data used to develop the WTSM model. This proved not to be possible, so we requested separate checks on the trip patterns along SH1. These checks are referred to later.

It has been demonstrated as part of our September 2009 review that the total trips had been subject to very minor modification in the morning and inter peak periods. The greatest changes were necessary with the evening peak model, which at less than 4%, are quite modest. Information was provided at that time which demonstrated that the matrix estimation had made very minor changes to the trip length distribution, which is a good thing.

The scatter plots and the R squared values indicated a very good correlation at the end of the calibration stage between the observed and modelled flows, for all vehicles. The correlation with heavy commercial vehicles (HCVs) was also reasonable.

3.4 Model Validation

The validation criteria suggested are generally appropriate and are consistent with the requirements of the Economic Evaluation Manual (EEM).

3.4.1 Traffic Flow Validation

The EEM requires that these values are "less than 4 in most cases". It also indicates that the percentage error in link flows across screenlines should be less than 10% "in the majority of cases".

The screenlines of greatest relevance to the Transmission Gully project are Screenlines P1, P3 and A1. Table 1 sets out the GEH[3] values across these screenlines.

Table 1: GEH Values for Screenlines

	Northbound	Southbound
Screenline A1		
Morning Peak	0.1	2.1
Inter Peak	2.2	2.7
Evening Peak	0.0	2.2
Screenline P1		
Morning Peak	1.2	**5.0**
Inter Peak	1.5	0.3
Evening Peak	1.4	1.1
Screenline P3		
Morning Peak	0.1	0.5
Inter Peak	1.1	0.3
Evening Peak	2.0	0.3

[3] The GEH Statistic is a formula used in traffic engineering, traffic forecasting, and traffic modelling to compare two sets of traffic volumes. Although its mathematical form is similar to a chi-squared test, is not a true statistical test. Rather, it is an empirical formula that has proven useful for a variety of traffic analysis purposes.

The validation of these screenlines with the model is generally very good. The one outlier is southbound across Screenline P1 in the morning peak, where the GEH value is 5, which is far from poor.

3.4.2 Key Area Count Validation

We requested greater detail regarding the validation of trip patterns, due to the absence of available origin – destination data. Clearly the validation of the model along SH1 is of key importance to the Transmission Gully project, so we asked the consultant to examine the level of traffic flow validation along this corridor in detail, to consider whether the patterns seem reasonable.

Section 6.3 of the 2008 Transmission Gully report provided details of the traffic flow validation of the model along the section of SH1 that will be affected by the proposed project.

Our September 2009 review concluded that the revised model was also generally performing well along this route in all three time periods. The exception is northbound in the evening peak at Paremata, but the issue appears to be an inconsistent count, as the counts on two successive links differ by 200 vehicles (with no intervening interchange or connection).

The morning peak flows along SH1 are reasonable, which would appear to be inconsistent with the comment above that the only outlying screenline is P1 in the morning peak. However, we note that while the modelled flow on SH1 is close to the observed volume, the modelled flow on Paekakariki Hill Road is more than 130 vehicles/hour higher than that observed, leading to a total overestimate in the model of 190 vehicles/hour across the screenline. This would not appear to be a particularly significant issue, although it would suggest that the model may slightly overpredict the demand for the Transmission Gully southbound in the morning peak, if traffic using the hill road is long distance through traffic.

We previously commented that the above comparison gave some comfort that the model is adequately reflecting the travel patterns along SH1, which indicates that it is likely to give a reasonable estimate of the future attraction of Transmission Gully. However, we note that the proposed connections to the proposed route have now been firmed up and Notices of Requirement are being progressed for the Porirua Link Roads. Operational analysis is now being undertaken through SIDRA to confirm the adequacy of the layouts proposed at key intersections at or adjacent to proposed intersections. Presumably this operational analysis is based on flows output from the SATURN models. While the correlation between the observed and modelled flows is good away from the main screenlines, we note with concern that the count data set in the vicinity of the proposed Porirua Link Roads connecting into Porirua East and Waitangirua appears to be quite sparse. Therefore we consider that, even though it may be suggested that this issue should have been picked up by our earlier reviews, it would be desirable for the validation of the model in this area (between SH1 and SH58) to be checked and confirmed as adequate for the operational analysis.

3.4.3 Journey Time Validation

The EEM does not set any targets for journey time validation, but SKM has set a target for this assessment of 15%. We previously noted that the modelled times are being compared with the average observed times, and it may be that a range of greater than 15% is acceptable if the modelled value fits within the observed minimum and maximum figures.

The journey time routes of greatest relevance to the Transmission Gully project are Route 1, along State Highway 1 and, to a lesser extent, Route 2, along SH58. The journey time validation along these routes is generally good.

The main points to note with Route 1 are as follows:

- Southbound in the morning peak, the modelled time is trending above the average observed time
- The modelled times in the inter peak were good in both directions
- Northbound in the evening peak, both models are predicting longer journey times than observed through Mana.

3.4.4 Sensibility Checks

SKM previously undertook what were termed "sensibility checks".

In our review of the Scoping Report we suggested that some form of matrix check should be undertaken, comparing the results of any origin destination surveys collected for the development of the WTSM against the SATURN model. This comparison has not been carried out. Instead the trip length distribution plots and the detailed comparison of the flows along SH1, noted above, gave comfort on this issue.

A further issue worth mentioning relates to the coding of the HOV lane along Mana Esplanade. The journey time validation here seems to be quite good, although we previously commented that the assumed saturation flow of 2,700 vehicles/hour southbound in the morning peak and northbound in the evening peaks seems high as the higher value assumes that there is about 50% use of the HOV lane. The consultant explained that compliance was a problem, so the use of the lane is quite high. This is acceptable as the model needs to reflect the observed condition rather than the theoretical condition. However it could be that a test should be carried out on the future models with a much lower flow in the HOV lane, to reflect the possibility of strict compliance (as now operates along Onewa Road on Auckland's North Shore).

3.5 Base Model Validation Summary

The main points associated with our review of the base model are as follows:

- The flow validation across the screenlines is generally satisfactory
- The consultant has provided sufficient detail to demonstrate that the flow validation along SH1, which will be the main route to feed the Transmission Gully project, is satisfactory. However, further checks should be undertaken on the validation of the model adjacent to the proposed Porirua Links, between SH1 and SH58
- The journey time validation (particularly along SH1) is generally satisfactory
- There is no observed data on travel patterns. The model sits under the regional model, and the consultant has demonstrated that the patterns have not been changed from those in the regional model. Also, the detailed validation along SH1, which will be the main route to be affected by the Transmission Gully project, is reasonable. As a result, this issue may not be particularly significant.

4 DEVELOPMENT OF FUTURE YEAR MODEL

4.1 Future Year Network Development

We noted previously that the list of projects included within the future model only relates to significant new investment in roads and public transport. We suggested that it will be necessary to confirm the nature of other projects, such as HOV facilities, local area traffic management and greater emphasis on active modes of transport in certain areas, all of which may affect the capacity for general traffic in particular areas.

4.2 Future Year Network Coding

We noted previously that the projects included in the future networks include several with roundabouts, which are to be coded as a series of give way intersections. This is a valid modelling technique, but the operation of these roundabouts will depend heavily on the input capacities and gaps.

We also suggested that checks should be made on key roundabouts of relevance to the Transmission Gully project, maybe using SIDRA, to confirm that the delays (or in many cases, the lack of delays) seem reasonable, both where the roundabout is coded as a series of give ways, or where it is coded as a single node. The latter is also necessary as SATURN generally assumes that European practices at roundabouts apply, with all movements possible from all approach lanes, whereas in New Zealand there tend to be more markings on the approaches, restricting lane usage. We note that this issue has been taken on board in the Transport Assessment Report, with SIDRA analyses undertaken for several key intersections. We note that the SIDRA analyses have not been provided for review and we are unclear if they have been based directly on the forecast flows from the SATURN model or if any checks have been made to confirm the local validity of the base model at each of the identified intersections.

4.3 Future Year Matrix Development

Forecasts have been developed for the years 2026 and 2031, based on forecast demands from WTSM. We understand that the differences between the 2006 WTSM model and the future (2026 and 2031) WTSM demands have been added to the 2006 SATURN model to derive future demands. This process is acceptable.

We previously requested that a sensitivity test should be undertaken on the generalised cost functions. A test was provided in the Consolidated Report, which indicated that the predicted flows along the Transmission Gully project were fairly stable.

4.4 Future Year Forecasts

We have been provided with a copy of the report “Wellington Transport Strategy Model (WTSM) Update 2006: Baseline Forecasting Report” (February 2008). This report notes that the future population within the region is expected to increase from 167,000 in 2006 to 205,000 in 2026. This represents an increase of 23% between 2006 and 2026.

The future models for the Do Minimum scenario include total increases of 25 to 29% between 2006 and 2026. These figures indicate that the forecasts are broadly consistent with regional growth expectations. However, a significant proportion of the growth in demands relates to HCVs. The growth in user class 1 (light vehicles) is only 18% over the twenty year period, while the increase in user class 2 (heavy vehicles) is 89% over the same period. We previously commented that we were not totally comfortable with the high rate of increases in user class 2, but given that the total growth is quite modest, the significance of this issue may also be quite modest (unless used for economic evaluation purposes).

The assessment of the project has been based on separate runs in WTSM that include the Transmission Gully project, in order to explore the issue of induced traffic. This is an important step, as it is now increasingly accepted that overall travel patterns will change as a result of significant transport infrastructure, but analysis of the matrix totals indicate that the predicted effects are quite modest. This may be reasonable, as the congestion in the Do Minimum models, which could be expected to deter trip making, is quite modest. Also, the percentage of trips by public transport in the area as a whole (and therefore the number of trips that may divert to road based travel) is fairly low.

However, we note that while modest changes in overall demands of around 300 vehicles/hour in the morning and evening peak hours are predicted, these all relate to user class 1, with no change at all in the user class 2 demands. This may be explained as a modelled assumption that essential movements by heavy vehicles are expected to take place whether the Transmission Gully project proceeds or not, but we found this prediction of zero change somewhat surprising and it should be confirmed.

4.4.1 Operation of Do Minimum

There is relatively little congestion predicted in the future Do Minimum and this is clearly a function of the relatively modest growth predictions.

The areas of delay seem intuitively reasonable and we have checked that there are no areas of excessive delays (eg on zone loads where growth is predicted). This probably reflects the relatively modest growth and it means that the checks that we have made on the models have not revealed any unusual routings (which would normally be a function of excessive delays).

Only modest congestion is now predicted through Mana, southbound in the morning peak and northbound in the evening peak. This is mainly due to the assumption that there will be two lanes per direction in the future, with one of these for HOVs southbound in the morning peak and northbound in the evening peak. This is coded in the base model through the assumption of a total saturation of 2,700 vph southbound in the morning peak and 2,200 vph northbound in the evening peak. We have commented on this at Section 3.4.4 above, as presumably congestion in this area will increase (particularly in the morning peak) if greater enforcement is imposed on the use of the HOV lane. On the other hand, significant congestion is predicted at the SH1/Acheron Road intersection (the southernmost signalised intersection through Mana, northbound in the evening peak. This is clearly a function of the assumption of the assumed capacity of 2,200 vehicles/hour for this time period, which is lower than the assumed capacity southbound in the evening peak.

Fairly significant delays are predicted on the right turn toward Whitford Brown Avenue, at the SH1 Papakowhai (Whitford Brown) interchange in the morning peak, which would be resolved by a very minor change in the assumed signal times.

The Mungavin Avenue/Champion Street roundabout (just east of the SH1 Mungavin interchange) is one location that is predicted to be operating at its theoretical capacity in the evening peak and is one area where the sensitivity of the coding should be checked.

4.4.2 Operation of Network with Transmission Gully

The predicted effects of the Transmission Gully project seem sensible, with the primary beneficiary being through traffic on SH1. The model is showing some induced traffic in the vicinity of the project, with increases in demands for SH1, to the north of the project.

The modelling indicates that no traffic is predicted to continue to travel along the length of SH1 in the vicinity of the Transmission Gully project (ie from north of the project to beyond the south of the project). That is to say, it is attracting as much traffic as can reasonably be expected.

The capacity of the southbound merge of Transmission Gully with SH1, at Linden, was previously predicted to be right at capacity in the morning peak, at around 4,000 vehicles/hour in two lanes. An auxiliary lane is now proposed at this point. In the northbound direction, three lanes are coded at the northbound diverge at the start of the Transmission Gully project, but a midblock constraint of 4,000 vehicles/hour has been included. We understand that this coding was intentional, with two lanes widening out with a short auxiliary lane.

We commented earlier about the assumed capacities at roundabouts, generally. The capacities at the Transmission Gully/SH58 interchange in particular seem high.

It is worth commenting that SH58 is predicted to see an increase in flows as a result of the Transmission Gully project. This seems intuitively reasonable, but the fact that no changes in demands are predicted at on other routes within the Hutt Valley means that the changes must be an input from the WTSM runs.

There is reference to SIDRA assessments of the key intersections, but no details have been provided of how (or if) the SIDRA results have been fed back into the SATURN models. For example, page 30 of the Transport Assessment Report states that the level of service at the Kenepuru Drive/Titahi Bay Road roundabout will decline from D to F in the evening peak, according to SIDRA, but the SATURN model indicates that the roundabout will operate satisfactorily in 2026 in the evening peak.

Page 39 of the Transport Assessment Report refers to the removal of the HOV lane through Mana, leaving only one through lane per direction (southbound in the morning peak and northbound in the evening peak). However this has been implemented in the model through introducing a constraint of 1,800 vehicles/hour on the midblock capacity on SH1 through Mana. This is quite different from decreasing the capacity of the through movement from 2,700 to 1,800 vehicles/hour. This may have a modest impact on the assessment of the Transmission Gully project, but it may be worthwhile rerunning the 2026 morning and evening peak models with the project, to confirm that this issue does not significantly affect the predicted flows (and significant changes are considered unlikely) and journey times along the existing SH1 route (with some changes quite probable).

Page 39 of the Transport Assessment Report states that the four signalised intersections at Pukerua Bay (proposed as part of the Coastal Route Package) are to include pedestrian phases but these have not been modelled. The assumed phasing also assumes a number of give way turns which may over emphasise the efficiency of the intersections if these turns (such as right turns from the main road, giving way to oncoming through traffic) operate only in exclusive phases.

4.5 Future Year Model Summary

The future model seems to be working reasonably and we make the following observations:

- The level of growth between 2006 and 2026, seems relatively modest, but the background material provided demonstrates that this is consistent with the region's expectations
- The level of the predicted changes in heavy vehicles seem high, but the overall increases in demands are still modest
- No changes in overall heavy vehicle trips are predicted as a result of the Transmission Gully project
- The level of congestion in the future Do Minimum networks is relatively modest
- We have not encountered any unusual routings in the future Do Minimum models. This probably reflects the absence of severe congestion
- The list of major transport infrastructure projects included in the future models appears to accord with the region's expectations. However, we have not seen any documented evidence to demonstrate that sufficient attention has been given to more subtle changes to the network, for example, in response to initiatives to promote travel demand management (such as traffic calming around schools, or the provision of additional pedestrian crossings). Such measures could, cumulatively, influence the routing of traffic in some areas
- The predicted effects of the Transmission Gully project seem sensible, with the primary beneficiary being SH1
- Sensitivity tests should be undertaken on the assumed capacities of key roundabouts
- We have made comments on a number of detailed network assumptions, which should be checked.

APPENDIX A Resolution of Issues

SKM provided a File Note on 6 September setting out the proposed response to the Flow review, followed by a second File Note, on 19 October providing the results of the additional assessment (termed here "the SKM response"). This Appendix therefore provides details of the resolution of issues.

PORIRUA AREA VALIDATION

Section 3.4.2 of our review commented that the validation of the base model should be confirmed for the Porirua area, between SH1 and SH58. This is addressed at Section 5 of the SKM response. The information provided indicates that the traffic flow validation in this area is satisfactory, with the vast majority of links counted having GEH values of under 5. The response questions whether additional count information should have been collected for the intersections of SH58 with James Cook Drive and Joseph Banks Drive, but it notes that development has occurred since 2006 which would make the comparison somewhat difficult.

DO MINIMUM CAPACITY THROUGH MANA

Sections 3.4.4 and 4.4.1 of our review referred to the possible need for tests on the future Do Minimum models with lower assumed capacity for the HOV lane through Mana. The 6 September File Note referred to a range of capacity assumptions to be tested for the Mana foreshore, but this test on the Do Minimum has not been carried out. On reflection we consider the need for this test is marginal, as it would only give greater delays in the Do Minimum scenario, emphasising the need for the project.

EFFECTS OF MINOR TRANSPORT INVESTMENT

Section 4.1 of our review suggested that consideration should be given to minor transport investment projects. The response from SKM noted that the effect of such measures would be unlikely to significantly affect the route decisions of potential Transmission Gully users. This response is accepted, particularly as TDM measures are reflected in the WTSM runs, and known potential improvements, such as possible signals at the intersections through Pukerua Bay, have been included in the future models.

OPERATION OF KEY ROUNDABOUTS

Section 4.2 of our review suggested that checks should be made on the operation of key roundabouts of relevance to the Transmission Gully project. This issue has been addressed at Section 3 of the SKM response, which assessed the Champion Street/Mungavin Avenue and Titahi Bay Road/Mungavin Avenue roundabouts with reduced capacity and/or increased gaps, both of which would reduce the predicted capacity. The SKM response reported on the predicted changes in delays and vehicle routing as a result of these changes in assumptions, providing useful information on the local effects of potential delays at these locations.

GENERALISED COST FUNCTIONS

Section 4.3 of our review noted the need for sensitivity tests on the generalised cost functions. This issue has been addressed at Section 1 of the SKM response, which provided results of two sensitivity tests, with one giving sole emphasis on time and the other giving greater emphasis on distance. The results provide useful information on the likely range of flows likely to be attracted to the Transmission Gully project, namely:

- A cost function with sole emphasis on time leading to greater flows along the Transmission Gully route
- A cost function with greater emphasis on distance will lead to lower flows along the Transmission Gully route

The changes in flows are predicted to be generally less than 150 vehicles/hour in the peak direction, or less than 15%.

HCV FLOWS

Section 4.4 of our review noted that no changes in HCVs are predicted as a result of the Transmission Gully project. SKM have confirmed that this is an output from WTSM.

CAPACITY THROUGH MANA WITH TRANSMISSION GULLY

Section 4.4.2 of our review suggested that a test should be carried out with a different capacity assumption through Mana, following the removal of the HOV lane. This has been addressed at Section 4 of the SKM response, which notes that the alternative capacity assumption is predicted to have an insignificant effect on the flows and delays through Mana (and therefore an insignificant effect on the predicted attraction of the Transmission Gully route).

PUKERUA BAY SIGNALS

Section 4.4.2 of our review also commented on the assumed signal phasing at the signalised intersections proposed along Pukerua Bay as part of the Coastal Route Package. This issue has been addressed at Section 2 of the SKM response, which has satisfactorily demonstrated that this issue is not critical to the outcome of the assessment.

G.4 Letter from Flow Transportation Specialists Ltd, 25 November 2010

flow
TRANSPORTATION SPECIALISTS

25 November 2010

Mr G Prince
New Zealand Transport Agency
PO Box 6057
Marion Square
WELLINGTON

Dear Glen

TRANSMISSION GULLY

This letter provides a response to the review undertaken for the Regulatory Authorities' Technical Advisory Group (RATAG) relating to the Traffic and Transport Impact Assessment prepared by SKM for NZTA for the above project. You will recall that the RATAG reviewer requested confirmation on several issues "from a suitably qualified person (preferably the independent peer reviewer of the traffic model)".

The following sections refer to our recent reviews. The details of these reviews are as follows:

- "Transmission Gully: Review of Traffic Model", dated 29 October 2010. This was based on an initial review dated 31 August, which was updated to reflect the response from SKM to our various queries.
- "Transmission Gully: Review of Transportation Assessment", dated 31 August 2010. We note that this is to be finalised following the provision of a final report from SKM.

Section 2.2.2.1 of SKM Report: extent of "simulation" and "buffer" areas within traffic model

We have previously considered the boundaries of the simulation and buffer areas of the traffic model. Our review of the traffic model (dated 29 October 2010) noted that the area of the more detailed model, which SATURN terms "simulation" network, is satisfactory for the evaluation of the Transmission Gully project in that it covers the area of influence of the project, to the extent that no significant effects are anticipated outside the simulation network and within the buffer network.

Section 2.2.2.2 of SKM Report: one hour model periods, preload models and weekend and holiday models

Our October 2010 review of the traffic model stated that we had previously considered the use of one hour models to represent the weekday morning peak, inter peak and evening peak periods.

We previously commented that peak hour models are appropriate for operational analysis, while average (ie peak period) models are more appropriate for economic analysis. It is apparent from the Transport Assessment Report that the models are being used for operational analysis, meaning that the use of peak hour models is entirely appropriate for this task.

Our previous reviews considered the peak hours being modelled (0700-0800 and 1700-1800) and concluded that these periods were appropriate for the analysis.

It is quite standard practice for SATURN traffic models to include preloads. The preload models are not subject to validation, but they are designed to ensure that the assignment of traffic recognises congested conditions within the modelled area at the start of the peak hours. In this case, the congestion within the model is not particularly severe, even with the 2026 Do Minimum scenario, meaning that the impact of the preload models on the operation of the peak hour models will have been quite modest.

Models have been developed for the weekday morning peak, inter peak and evening peak hours. No weekend or holiday period models have been developed. Our October 2010 review of the traffic model noted that this is consistent with standard practice where the weekend/holiday periods do not generate high demands or congestion.

Section 2.3 of SKM Report: operation of intersections and merges

The RATAG reviewer has requested comment on the statement that the performance of the motorway merges were quantified separately using calculations consistent with the Highway Capacity Manual formulae. We have not specifically asked for any comment from SKM on what was meant by the phrase "quantified separately". However, we note that the merges have been coded in the traffic model in the standard manner for SATURN models. That is to say, the merging on ramp is not coded using SATURN's "M" notification for merges, as past experience indicates that this over-estimates delays to traffic on the on ramps and under-estimates delays to through traffic on the motorway. Instead, a downstream bottleneck is coded, just beyond the merge. Where the flows at this downstream point are within capacity, then there will be no (or negligible) delay to the merging traffic or to through traffic. However, where the downstream point reaches capacity, delays will start to form, affecting both merging traffic and through traffic, according to the relative capacities assumed for the upstream approaches (from the on ramp or the motorway).

Our experience in coding these situations suggests that the capacity of the on ramp merge should be reduced from a full lane capacity (of around 2,000 vehicles/hour) to around 1,300 vehicles/hour, with a higher value of 1,800-2,000 where the on ramp joins the motorway as a lane gain. By comparison, SKM have assumed capacities on the merging on ramps of 2,000. This difference in coding has no impact until the flow on the ramp exceeds 1,300 vehicles/hour, or until the downstream bottleneck reaches capacity, at which point there will be a slight difference in the predicted delays on the on ramp compared with those on the motorway. This difference is unlikely to significantly affect the assessment of the Transmission Gully project.

The RATAG reviewer also requested comment on the assessment of existing intersections within the wider area. There are no firm guidelines in New Zealand on the percentage or absolute changes in flows that trigger the need for an assessment, although we are aware of Australian Guidelines (which

relate to the assessments of developments rather than infrastructure projects)[1]. However the thresholds given in the SKM report (more than 10% and more than 50 vehicles/hour) seem reasonable.

The first draft of our review of the traffic model (August 2010) made a few comments on relationship between the SIDRA modelling and the SATURN modelling and we noted in the October 2010 version of our review that these comments had been addressed by SKM.

Our understanding of the reference to the SIDRA results being "broadly calibrated" means that no formal comparison has been undertaken, relative to observed queue or delay data, but that the results of the models have been checked against the modeller's understanding of the operation of the network. This is not an uncommon approach, especially where the absolute magnitude of delay is not central to the assessment.

Section 3.1 of SKM Report: Status of Future Projects

The RATAG reviewer has made a number of comments on the specification of the Do Minimum scenario, which he considers to be "unusual and not considered best practice". We do not totally agree with this comment and we can name several, perhaps many, cases where the Do Minimum scenario includes uncommitted projects, for a variety of reasons. However, we fully accept that the implications of including uncommitted projects need to be properly established.

We considered this issue within our review of the Transportation Assessment (dated August 2010). We noted that "The core scenarios include the assumption that other parts of the RoNS and other projects will have been constructed. Flow considers that assessments should be undertaken to identify the effects of the (Transmission Gully) project should these (other projects) not occur, particularly those ones that have not been consented. This issue is covered by Scenario F, meaning that this is not a gap" (in the Transportation Assessment).

In other words, for this assessment we consider that the Board of Inquiry should be made aware that there are a number of possible permutations in terms of the future road networks and therefore a range of forecast flows. It would be "not best practice" for the assessment to be based solely on a scenario which includes uncommitted projects, but it would equally be "not best practice" for the assessment not to acknowledge the possible future situation if the full RoNS package is delivered.

We trust that these are useful comments in response to the RATAG review.

Yours sincerely

Ian Clark

Ian Clark
DIRECTOR

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[1] See for example Vicroads (2006) "Guidelines for Transport Impact Assessment Reports for major land use and development proposals" or Queensland Government, Department of Main Roads (2006) "Guidelines for Assessment of Road Impacts of Development"

G.5 Letter from Flow Transportation Specialists Ltd, 14 March 2011

flow
TRANSPORTATION SPECIALISTS

14 March 2011

Mr G Prince
New Zealand Transport Agency
PO Box 6057
Marion Square
WELLINGTON

Dear Glen

TRANSMISSION GULLY

This letter provides a response to two issues raised in the review undertaken for the Regulatory Authorities' Technical Advisory Group (RATAG) relating to the Traffic and Transport Impact Assessment prepared by SKM for NZTA for the above project.

SIDRA Modelling

We understand that the RATAG reviewer has questioned the validity of the SIDRA Modelling undertaken as part of the assessment.

The methodology regarding the use of SIDRA is set out at Section 2.3 of the Traffic and Transport Impact Assessment (January 2011 Version, termed Revision E), with the assessment of the effects of the Transmission Gully project set out at Section 4.5.1.

We suggest that the use of SIDRA for this assessment, in addition to SATURN, stems from the comments in our 2008 review of the Transmission Gully project. That 2008 review suggested that:

"Checks should be made on key roundabouts of relevance to the Transmission Gully project, maybe using SIDRA, to confirm that the delays (or in many cases, the lack of delays) seem reasonable, both where the roundabout is coded as a series of give ways, or where it is coded as a single node."

Our understanding is therefore that the SIDRA is being used primarily to check SATURN, at key locations. These checks have been undertaken where existing intersections are expected to come under additional pressure as a result of the Project, or at new intersections. That is to say, this is intended to be a relative assessment rather than an absolute assessment. It would appear to be valid to note as well that this modelling is to inform a traffic and transport assessment and not an economic assessment. Absolute effects would be more important for an economic assessment.

Our 2010 review of the traffic modelling of the Project noted that the results of the SIDRA had not been fed back into the SATURN model. Additional information was subsequently provided on the effects of different saturation and gap assumptions on the predicted operation of key intersections in SATURN.

We accept that the term used in the SKM report, referring to the fact that the SIDRA models have been "broadly calibrated" could be open to debate. However, given the limited role of SIDRA in the assessment, we do not consider that this is a significant concern.

Crash Benefits

We understand that the RATAG reviewer has also questioned the validity of the assessment of the predicted effects of the Transmission Gully project on crashes. The methodology regarding the expected crash reductions is set out at Section 4.5.2 of the Traffic and Transport Impact Assessment (again referring to the January 2011 Version, termed Revision E).

The number of crashes has been calculated from the observed crash history for sections of SH1, SH58 and local roads. The percentage changes in traffic volumes forecast as a result of the Project have been used to estimate the percentage changes in the number of crashes on each road section, to give an overall indication of the likely effects of the Project upon crash performance. Estimates of crashes along the proposed Transmission Gully itself have been based on default rates for roads of this nature, based on the Economic Evaluation Manual.

Once again, we consider that it is necessary to understand the purpose of the assessment. The purpose is not to facilitate an economic assessment, which would require a more detailed quantification of the potential crash benefits, but to give a broad indication of the likely crash benefits of the Project. We accept that the benefits may not be linear with the rate of change in flow, particularly where intersections are governed by signals. However, the level of assessment undertaken is considered sufficient for a report of this nature. The limitations of the assessment are accepted in the footnotes to Tables 4-6 to 4-8, and these limitations seem reasonable.

We trust that these are useful comments in response to these two issues raised by the RATAG review.

Yours sincerely

Ian Clark
DIRECTOR

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