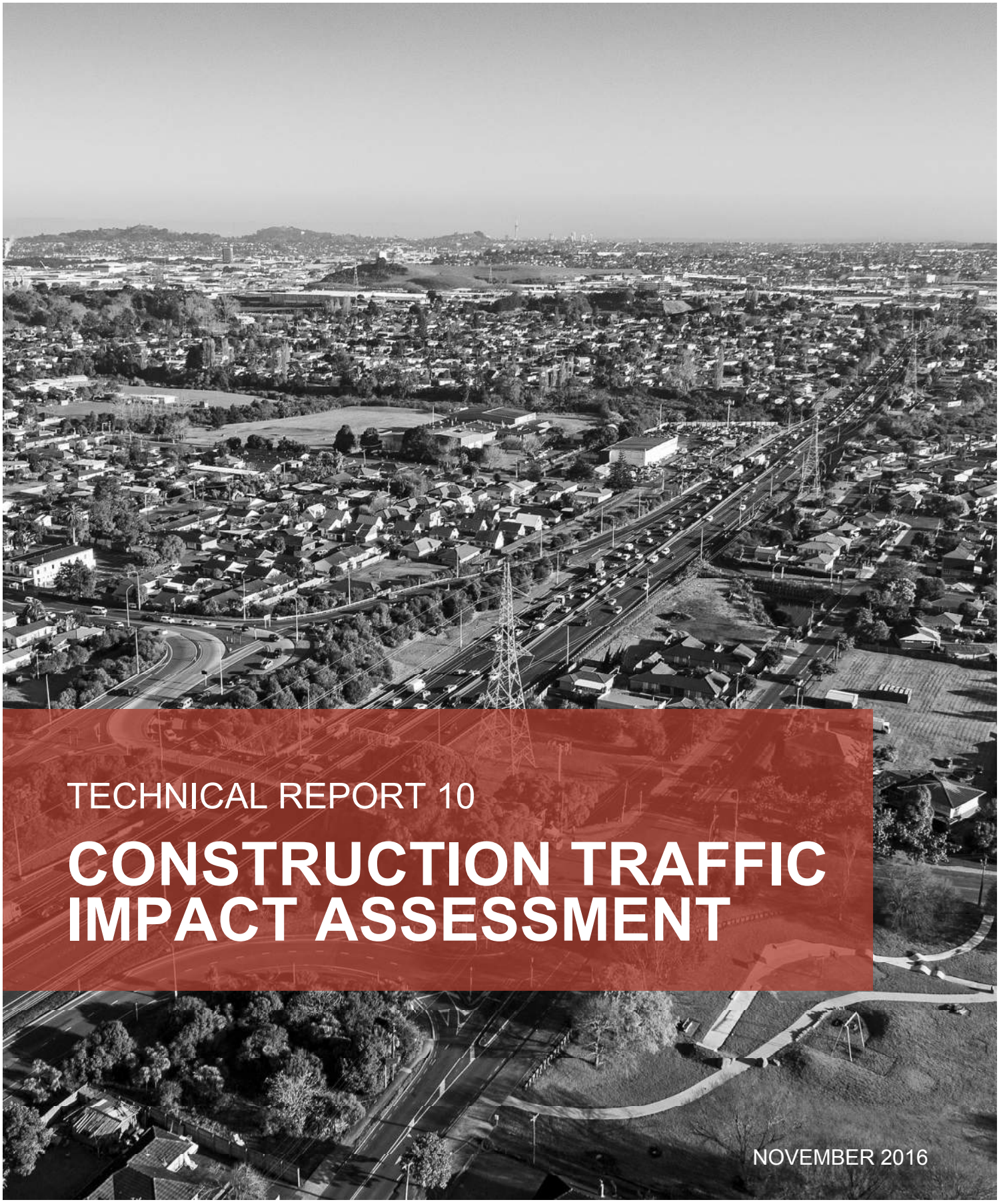


TECHNICAL REPORT 10

CONSTRUCTION TRAFFIC IMPACT ASSESSMENT

NOVEMBER 2016

NZ TRANSPORT AGENCY WAKA KOTAHI

East West Link

Quality Assurance Statement	
Prepared by	Wasim Sidyot
	Nick Guo
	Martin Peake
Reviewed by	Darren Wu
Approved for release	 Patrick Kelly (EWL Alliance Manager)

Revision schedule					
Rev. N°	Date	Description	Prepared by	Reviewed by	Approved by
0	November 2016	Final for Lodgement	Martin Peake, Nick Guo	Darren Wu	Patrick Kelly

Disclaimer

This report has been prepared by East West Link Alliance on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which East West Link Alliance has not given its prior written consent, is at that person's own risk.

EXECUTIVE SUMMARY

1. This Construction Traffic Impact Assessment report forms part of a suite of technical reports prepared for the NZ Transport Agency's East West Link Project (the EWL or Project). Its purpose is to inform the Assessment of Effects on the Environment Report (AEE) and to support the resource consent applications, new Notice of Requirement and an alteration to existing designation required for the EWL.

2. This report prepared by Beca Ltd considers the construction traffic effects of the proposed project alignment (broken down to six sectors) in order to:

   - Identify and describe the existing traffic environment;
   - Describe a representation of the potential construction staging and methodology;
   - Provide an appraisal of the traffic impacts arising from key features of the construction activity for the Project and associated temporary traffic management methodologies;
   - Recommend measures as appropriate to avoid, remedy, mitigate or manage potential adverse construction traffic effects (including any conditions / management plan required); and
   - Present an overall conclusion of the level of potential adverse construction traffic effects of the Project after recommended measures are implemented.

3. The Project involves the construction, operation and maintenance of a new four lane arterial road from SH20 at the Neilson Street Interchange in Onehunga, connecting to SH1 at Mount Wellington as well as an upgrade to SH1 between the Mount Wellington Interchange and the Princes Street Interchange at Ōtāhuhu. New local road connections are provided at Galway Street, Captain Springs Road, the port link road and Hugo Johnston Drive. Cycle and pedestrian facilities are provided along the alignment of the section between SH20 and SH1.

4. In undertaking this assessment, we have used COPTTM (part of TCD Manual) and ATCOP as the two overarching documents to inform all planning and arrangements of potential temporary traffic management activities required for the construction of the Project.

5. The assessment of temporary traffic effects is primarily based on traffic engineering first principles and has been supported by traffic modelling using the following available project SATURN models:

   - 2017 Do-Minimum1 (includes opening of the Waterview Connection); and
   - 2026 Do-Minimum (includes opening of the Waterview Connection, excludes EWL).

6. The EWL construction programme is estimated to take place between 2018 and 2025 post opening of the Waterview Connection (scheduled in early 2017). Based on the available traffic models, the 2017 DM traffic model has been used to represent the Base Case for the initial year of construction (2018) due to the similarity in the year of representation and more importantly because it captures the Auckland network after the Waterview Connection is open. On the other end of the construction programme spectrum, the 2026 DM traffic model has been used to represent the final year of construction namely the End of Construction Base Case.

7. Tests with 5% and 10% capacity reduction were conducted for both the Base Case and the End of Construction Base Case to assess the effects of temporary construction layout (due to lane narrowing and temporary speed limit). These reduction figures are assigned manually into the model test based on an understanding of capacity reduction from a number of completed projects in which both lane narrowing and temporary speed limit were applied.

[1] The 2017 Do-minimum model represents a 2017 Auckland road network with 2016 regional land use forecasts. This is further explained in the body of this report.

8. The construction traffic effects are assessed based on the following categories for each sector:
   - Impacts on capacity of existing carriageways;
   - Impacts arising from temporary closure of existing carriageways;
   - Impacts arising from site access locations and movements;
   - Impacts on public transport provision;
   - Impacts on pedestrians, cyclists, and mobility routes or crossings; and
   - Impacts on property access, parking and manoeuvring.

9. The sector specific key effects and mitigation plan is summarised in the table below:

Sector 1

1) SH20 construction works should be undertaken early in the construction programme. This will need to be considered in the early phases of procurement planning to ensure the feasibility of this is not precluded.
2) Construction works on SH20 and SH1 that concurrently reduce mainline capacity should be avoided where possible.
3) VMS signing should be used in advance of significant changes to the road layout or capacity.
4) Alternative routes or detour routes should be optimised to minimise the overall network delay caused by the works on SH20.
5) Point-to-Point Speed Enforcement (PPSE) should be implemented to improve compliance with lowered speed limits.
6) Close liaison with passenger transport agencies and operators to minimise the impact of traffic management measures on passenger transport services.
7) Close liaison with major traffic generating activities and sites and sensitive stakeholders in the area, for example the Ports of Auckland, Auckland International Airport and Dress Smart.
8) Communication campaigns should be aimed at diverting traffic onto alternative routes and minimising the level of demand through the project area and construction period.
9) Integration with employer travel plans to recommend alternative routes, modes or travel times to minimise the demand on the road network.

Sector 2

1) Programming of works shall be carefully planned to minimise the length of any closure period with Waikaraka cycleway and that temporary openings and closures are avoided to minimise confusion for users.
2) Early notification and consultation with affected pedestrians and cyclists should be undertaken.
3) Separate media campaigns should be devised to address the needs of recreational and commuter cyclists.
4) Safe alternative route(s) for commuter cyclists through the Onehunga area should be investigated and minor safety improvement works considered, if necessary, if the Waikaraka cycleway facility is to be closed for a significant period of time.

Sector 3

1) Measures to mitigate the effects on the Waikaraka cycleway as outlined for Section 2.

2) Consider restrictions to work site access points at Great South Road / Sylvia Park Road intersection on movements allowed and times for access and egress so not to adversely affect the road network.

3) Early engagement with AT and ATOC to discuss amended intersection arrangements and phasing at the Great South Road / Sylvia Park Road intersection.

4) Staging of the amendments to the Great South Road / Sylvia Park Road intersection including possible weekend or night works.

5) Alternative provision for pedestrians should be considered to provide a safe route along the western side of Great South Road or an additional signalised pedestrian crossing on the northern arm of the Great South Road / Sylvia Park Road.

6) Consider measures that reduce the impact on buses along Great South Road and through the Sylvia Park Road intersection, including discussions with AT Metro.

7) Early engagement with property owners and / or tenants should be undertaken where property access is affected.

8) Advanced notice provided to motorists and businesses should be provided of changes to parking so that motorists may be able to make alternative arrangements.

Sector 4

1) Introduce performance measures around queue lengths or delays or monitoring requirements at the Sylvia Park Road / Mount Wellington Highway intersection to minimise effects on the interchange and intersection.

2) Manage access and movements to site access on Mount Wellington Highway opposite Sylvia Park Road. Measures could include limiting traffic movements to left in and left out only as priority control rather than under signal control, or restricting the number of vehicle movements.

3) Early consultation where access is affected to properties.

4) Where pedestrian facilities are removed on Sylvia Park Road, alternative facilities or pedestrian routes should be considered.

Sector 5

1) Coordinate works on SH1 at Mount Wellington Highway Interchange and Princes Street Interchange to minimise traffic effects between the locations.

2) Construction works on SH1 and SH20 that concurrently reduce mainline capacity should be avoided where possible.

3) Keep Panama Road bridge open to traffic, at least as a single lane, due to minimise effects on the bus route along Panama Road and the local access function.

4) Manually operate any temporary signals at the Panama Bridge to minimise delays to buses, particularly at peak travel times.

5) Coordinate site access and egress points on the motorway mainline and ensure appropriate sight lines and signage provided to guide construction traffic and advise general motorists of the access/egress points.

6) Where construction activity may require access from private property, early consultation with affected property owners and tenants and the specific effects such as the number of truck movements carefully assessed.

7) For diversion / detour routes, where possible and practical, non-local roads (such as arterials or collector roads) should be used for diversion of traffic.

8) For any road closures, assess the volume of traffic affected and adjust timing of closure to minimise the effects on the operation of the diversion route and on those motorists affected by the proposal.

9) Provide sufficient advanced warning to motorists of road or lane closures through appropriate advertising in the media, websites and on motorway and / or local roads including utilising VMS (temporary or permanent).

10) Clear communication and guidance from temporary signs will be required for the bull-run lane arrangement on SH1 southbound at Ōtāhuhu Creek

Sector 6

1) Consultation with affected property owners and tenants should be undertaken early prior to works affecting access to local properties.

Table of Contents

Appendices

List of Figures

List of Tables

Glossary of Technical Terms/Abbreviations

Terms / Abbreviation	Term
AADT	Average annual daily traffic
ADT	Average daily traffic
AEE	Assessment of Effects on the Environment
AMETI	Auckland-Manukau Eastern Transport Initiative
AT	Auckland Transport
ATCOP	Auckland Transport Code of Practice
ATOC	Auckland Transport Operations Centre
BCR	Benefit Cost Ratio
CAR	Corridor Access Request
COPTTM	Code of Practice for Temporary Traffic Management
CTMPF	Construction Traffic Management Plan Framework
DM	Do-Minimum
EED	Engineering Exception Decision
EWL	East West Link
EWLA	East West Link Alliance
HCV	Heavy Commercial Vehicle
LTMA	Land Transport Management Act
MOTSAM	Manual of Traffic Signs and Markings
MVMS	Mobile Variable Message Signs
NB	Northbound Direction
The Transport Agency	The NZ Transport Agency
PCU	Passenger Car Units
PPSE	Point-to-point enforcement
PWA	Public Works Act 1981
RCA	Road Controlling Authority
RMA	Resource Management Act 1991
SH(x)	State highway (number)
SB	Southbound Direction
SCATS	Sydney Coordinated Adaptive Traffic System
SSTMP	Site Specific Traffic Management Plan
TCD Manual	Traffic Control Devices Manual
TMP	Traffic Management Plan
TMS	Traffic Monitoring System
TTM	Temporary Traffic Management
VMS	Variable Message Signs
vph	Vehicles per hour
vpd	Vehicles per day

Glossary of Defined Terms Used in this Report.

Term	Meaning
AM Peak	The morning peak traffic demand period typically experienced between 7am and 9am Monday – Friday in the Auckland region, however the busy traffic conditions may exceed these hours at some locations.
Alternating Flow	Temporary control of a roadway in a single lane with both directions operating in turn. Usually controlled with stop-go traffic control, temporary signals or in limited circumstances with priority (similar to a one-lane bridge)
Base Case	Refers to the traffic model which represents the 2018 (construction start) year traffic conditions and network layout. The model represents a 2017 Auckland road network with 2016 land use forecast traffic volumes. This model includes a network with post Waterview Connection opening conditions.
Bull-Run	A road layout which includes a single lane separated from other lanes in the same direction, often narrowed and / or contra-flowed onto the opposing carriageway and separated by barriers. Typically temporary in nature, it provides opportunities for maintaining the existing number of lanes during works.
Earthworks	Means the disturbance of land surfaces by blading, contouring, ripping, moving, removing, placing or replacing soil, earth, or by excavation, or by cutting or filling operations.
End of Construction Base Case	Refers to the traffic model which represents the 2026 (construction end) year traffic conditions and network layout. The model represents the 2026 traffic volumes with pre-opening of the EWL traffic conditions.
Alignment	Means the route and designation footprint shown in the plans attached with the AEE
Motorway	Means a motorway declared as such by the Governor-General under section 138 of the PWA or under section 71 of the Government Roading Powers Act 1989.
PM Peak	The evening traffic demand period typically experienced between 4pm – 6pm Monday – Friday, however the busy traffic conditions may exceed these hours at some locations.
Project	Means the East West Link Project as described in Chapter 3 of the AEE.
Rat Run	An alternative (and often more circuitous) route used to bypass parts of the network that are congested
State highway	Means a road, whether or not constructed or vested in the Crown, that is declared to be a State highway under section 11 of the National Roads Act 1953, section 60 of the Government Roading Powers Act 1989 (formerly known as the Transit New Zealand Act 1989), or under section 103 of the LTMA.
SATURN	SATURN stands for Simulation and Assignment of Traffic to Urban Road Networks and it is a traffic modelling tool.
SIDRA	The SIDRA Intersection is a programme used for evaluating traffic impacts at isolated intersections.

1 Introduction

1.1 Purpose and scope of this report

This report forms part of a suite of technical reports prepared for the NZ Transport Agency's East West Link Project (the EWL or Project). Its purpose is to inform the AEE and to support the resource consent applications, new Notice of Requirement and an alteration to the existing designation required for the EWL.

This report assesses the Construction Traffic effects of the proposed alignment of the Project as shown on the Project Drawings in *Volume 2: Drawing Set*.

The purpose of this report is to:

- Identify and describe the existing traffic environment;
- Describe a representation of the potential construction staging and methodology;
- Provide an appraisal of the traffic impacts arising from key features of the construction activity for the Project and the associated temporary traffic management methodologies;
- Recommend measures as appropriate to avoid, remedy, mitigate or manage potential adverse construction traffic effects (including any conditions / management plan required); and
- Present an overall conclusion of the level of potential adverse construction traffic effects of the Project after recommended measures are implemented.

This assessment has been developed based on the anticipated form of construction activities and traffic methodologies that will be necessary to facilitate the Project works. The assessment provides an evaluation of the network-wide effects, effects on key road corridors and, in some cases, the evaluations on the effects on sensitive areas have been developed to a greater level of certainty. These types of effects include:

- Capacity reduction on existing carriageways;
- Temporary closures of existing carriageways;
- Impacts from site access locations and construction traffic movements;
- Impacts on public transport provision;
- Impacts on pedestrians and cyclist routes; and
- Impacts on property access and parking.

The construction methodology will be refined by the contractor following award of their contract. At that time, the specific impacts of each activity will be better understood and detailed mitigation strategies will be able to be developed, agreed with RCAs and key stakeholders, and implemented.

While this assessment discusses physical works which will form part of the construction works, it is important to note that the nature of these works may evolve as part of the final design.

1.2 Project description

The EWL Project involves the construction, operation and maintenance of a new four lane arterial road from SH20 at the Neilson Street Interchange in Onehunga, connecting to SH1 at Mount Wellington as well as an upgrade to SH1 between the Mount Wellington Interchange and the Princes Street Interchange at Ōtāhuhu. New local road connections are provided at Galway Street, Captain Springs Road, the port link road and Hugo Johnston Drive. Cycle and pedestrian facilities are provided along the alignment of the section between SH20 and SH1.

The East West Link Project is considered to be a unique project with respect to temporary traffic as it spans across two major corridors serving the Auckland region connecting the north to the south. With the increasing importance of SH20, and once the Waterview Connection is open new network operational parameters will need to be considered for this.

The primary objective of the Project is to address the current traffic congestion problems in the Onehunga, Penrose and Mount Wellington commercial areas which will improve freight efficiency and travel reliability for all road users. Improvements to public transport, cycling and walking facilities are also proposed.

For description purposes in this report, the Project has been divided into six sectors. These are:

Sector 1. Neilson Street Interchange and Galway Street connections

Sector 2. Foreshore works along the Māngere Inlet foreshore including dredging

Sector 3. Anns Creek from the end of the reclamation to Great South Road

Sector 4. Great South Road to SH1 at the Mount Wellington Highway Interchange

Sector 5. SH1 at Mount Wellington Highway Interchange to the Princes Street Interchange

Sector 6. Onehunga local road works

A full description of the Project including its design, construction and operation is provided in *Volume 1: AEE, Part C: Description of the Project* and shown on the Drawings in *Volume 2: Drawing Set*.

1.3 Other Reports

As noted in **Section 1** of this report, this assessment is based on the anticipated form of construction activities and traffic methodologies outlined in Section 10 of the AEE which sets out the proposed construction methodology of the Project.

2 Typical Traffic Management Activity Framework

In addition to the RMA framework, Temporary Traffic Management (TTM) is governed by New Zealand legislation, in particular, the Land Transport Act 1998. Land Transport rules made pursuant to that Act, which relate to TTM, include:

- Land Transport (Road User) Rule 2004;
- Land Transport Rule: Traffic Control Devices 2004; and
- Land Transport Rule: Setting of Speed Limits 2003.

The Transport Agency's TCD Manual provides guidance on industry good practice, including, where necessary, practice required by law in relation to the use of traffic control devices. The primary standard reference (which forms part of the TCD Manual) that will be adhered to in planning, coordinating and implementing TTM for this Project is COPTTM - Part 8 of the TCD Manual.

The Transport Agency's COPTTM describes best practice for the safe and efficient management and operation of TTM on all roads in New Zealand. COPTTM includes practices for the development of TMPs for all roads in New Zealand and outlines requirements and guidelines for TTM.

The Auckland Motorway Alliance (AMA), on behalf of the Transport Agency, is the RCA for all state highways including motorways in the Auckland region. Therefore all traffic management activities affecting the State highway or motorway corridor for the Project are required to be approved by AMA.

Auckland Transport is the RCA for all local public roads within the Auckland Region (except motorways and State highways). All works and traffic management activities affecting the local road corridor will need to be approved by Auckland Transport through the CAR application process, as outlined in Section 26 of ATCOP. The approval of the CAR application is based upon strictly complying with the following key requirements:

- Plan / Implement TTM safely in accordance with the requirements in COPTTM;
- Minimise disruption and inconvenience for road users and adjoining residents and businesses; and
- Avoid unnecessary disruption and cost through conflicts in the timing of works and activities.

COPTTM and ATCOP are the two overarching documents used to inform all planning and arrangements of potential temporary traffic management activities required for the construction of the Project.

Further to the documents identified above, the engaged Engineer to the Contract for the Transport Agency will typically compile a set of Principal's Requirements that will form part of the binding contract in which Contractors must comply with during construction. The Principal's Requirements are specific to a project and are informed by detailed investigations during the development of the Specimen Design. The Principal's Requirements will consist of a section outlining specific requirements with respect to temporary traffic management activities. The detailed investigations during the Specimen Design phase often bring to attention, more specific requirements like maximum allowable delays, work hour restrictions and analysis requirements for work activities.

3 Assessment Methodology

This section outlines the methodology used for assessment of the temporary traffic effects associated with the construction of the EWL Project. The focus of the assessment is based on a representation of the key potential traffic management activities (required for the construction methodology and as informed by the Constructability Report) and seeks to identify and highlight key areas of potential impact. There is a large component of the proposed temporary traffic management activities that will be satisfactorily covered by the required procedures to obtain approval from the RCAs and it is not the intention of this report to cover these in depth.

The assessment of temporary traffic effects is primarily based on traffic engineering first principles and has been supported by traffic modelling (using the available project SATURN model). The traffic models were designed primarily for future forecasting of steady state and normal conditions but have been used with care to also inform this construction traffic effects assessment. Temporary traffic consists of discrete and highly variable circumstances which traffic models cannot respond to accurately. The extent of this model is from Mount Albert Road and Greenlane in the north (across SH20 and SH1 respectively) to Manukau City Centre in the south. Details of the model development, calibration and validation are detailed in the EWL Traffic Modelling Report.

The available project SATURN model consists of three modelling scenarios, namely:

- 2013 Base model;
- 2017 Do-Minimum[2] (includes opening of the Waterview Connection); and
- 2026 Do-Minimum (includes opening of the Waterview Connection, excludes EWL).

Both the 2017 and 2026 DM traffic models have had the additional auxiliary lanes included on SH20 in both directions (between Queenstown Road and Neilson Street interchanges) to reflect the early works programme currently scheduled for completion by early 2017.

SIDRA has been used to assess the effects of the anticipated temporary layout for the Sylvia Park Road / Mount Wellington Highway intersection.

The sections below further discuss the relevance of the model scenarios in relation to the temporary traffic assessment based on the construction programme schedule.

3.1 Setting the Base Case for Temporary Traffic Assessment

The base case represents the traffic conditions without any EWL Project construction activities taking place, and sets a benchmark for comparing the traffic conditions during the Project construction period.

The EWL construction programme is estimated to take place between 2018 and 2025, following the opening of the Waterview Connection scheduled in early 2017. The opening of the Waterview Connection itself is a significant change to the wider road network in Auckland which will present additional considerations for new network operational parameters relating to the traffic effects of this part of the network.

While traffic data has been collected for the existing traffic conditions (at the time of this report preparation), these were not considered to be an appropriate representation of the base case conditions as the Waterview Connection has yet to open.

Based on the available traffic models, the 2017 DM traffic model has been used to represent the base case for the initial year for construction (2018) due to the similarity in the year of representation and more importantly because it captures the Auckland road network after the Waterview Connection is open.

[2] The 2017 Do-minimum model represents a 2017 road network but with a 2016 regional land use forecast.

A further sense check was undertaken to validate the 2017 DM traffic forecasts for the base case initial year of construction. This was undertaken by applying the following method:

- Obtain the actual traffic counts for roads of key interest (from SCATS and TMS website) for the current 2016 year (before Waterview Connection is open);
- Adjust the current 2016 traffic counts by applying a Waterview Connection growth factor (this was obtained by comparing the 2013 Base model with the 2017 DM model) to obtain an alternative Waterview Connection post-opening scenario; and
- Compare the 2017 DM model traffic data with the adjusted traffic counts to check if they are similar.

The Waterview Connection growth factor was a representative factor that was determined by comparing the 2017 DM model flows and the 2013 base model flows, and then subtracting an estimation of the natural growth resulting from population or land use growth. Comparisons between the adjusted current 2016 traffic volumes and the 2017 DM model showed that the 2017 DM model had notably higher traffic volumes than what was forecasted for the adjusted current 2016 information (further details on this sense check can be found in Sections **4.1.1.3** and **4.5.1.3**). This finding provides confidence in the use of the 2017 DM model to represent the initial construction year (forecasted for 2018).

On the other end of the construction programme spectrum, the 2026 DM traffic model has been used to represent the final year of construction again because of similarities in the year of representation and because the effects of the Waterview Connection are represented. This helps to complete base year model for both the initial year of construction and the ending year of construction (estimated between 2018 and 2025).

Throughout the remainder of this report, the 2017 DM model will be referred to as the *Base Case* for the assessment and the 2026 DM model, the *End of Construction Base Case*.

3.2 Temporary Traffic Effects Assessment

Section 5 of this technical report outlines the categories of temporary traffic effects that will be assessed for this project. The potential effects as a result of the temporary traffic management activities will generally be assessed using first principles traffic engineering. This was the primary form of assessment for the construction traffic effects. First principles traffic engineering assessments include the impact of reduced capacities of road corridors compared with the background demand or closure of active mode facilities that require users to be displaced elsewhere.

The analysis has focused on the works that have the most significant effects, notably works on SH20 and SH1. Effects of works on the local road network are localised and therefore are not sufficiently significant to cause wider network impacts.

In terms of staging of construction in the Sectors listed in **Section 2**, the assessment has assumed that works that affect capacity on SH20 (Sector 1) and SH1 (Sector 5) are not undertaken concurrently to maximise resilience of the State highway network. Works in the other sectors either do not affect network capacity or are likely to have only localised effects. Therefore, the programming of works in the other sectors are not critical in terms of a traffic impact due to timing of construction.

3.3 Traffic Modelling

High level traffic modelling was undertaken to provide a supporting assessment of the construction traffic effects for the Project on SH20 and SH1 mainlines using the Base Case and End of Construction Base Case traffic models.

The SATURN model is most useful to assess wider network effects where for example, a particular travel route has reduced in its desirability due to increased travel time and therefore vehicles may choose to re-route to an alternative pathway. Assessing the effects of specific and localised changes (based on the traffic management activities such as reduced lane widths) are more challenging within

the model and may not accurately advise of the impacts. For this reason, the traffic modelling was coupled with experience from historical construction activities to understand capacity reductions based on a series of traffic management activities (e.g. temporary speed limits and reduced lane widths). This information provided suitable parameters to test the effects of the proposed work on SH20 and SH1 within the traffic models. Traffic model tests were not carried out in the SATURN model for the local road temporary traffic management effects or for construction traffic (truck) movements, as many of these cases consist of mainly localised effects that would not be within the accuracy limits of SATURN. Where appropriate, localised intersection modelling (SIDRA) has been undertaken.

3.3.1 Historical Temporary Traffic Management Effects

Lane narrowing, temporary speed limits, site access points etc. have been implemented to facilitate construction works in many locations across the motorway network in Auckland in recent years. Examples include:

- Manukau Harbour Crossing Project: Narrowing of nearly 5km of SH20 to 3.1m lanes with 80 kilometres per hour (km/h) temporary speed limit in between Queenstown Road Interchange and SH20 / SH20A Interchange, a stretch that experiences extreme recurrent congestion in both the AM and PM peak periods;
- Newmarket Connection Project: Narrowing of more than 3km of SH1 to 3.1m lanes in each direction with 70 km/h temporary speed limits and high-intensity work sites adjacent to temporary barriers;
- Victoria Park Tunnel Project: Narrowing of nearly 2.5km of SH1 to 3.1m lanes with 70 km/h temporary speed limits adjacent to Victoria Park Viaduct which is one of the most congested bottleneck areas in New Zealand;
- Upper Harbour Highway to Greville Road widening: Narrowing of approximately 1.5km of SH1 northbound to 3.1m lanes with an 80km/h temporary speed limit. Being an existing bottleneck, the effects were noticeable throughout the duration of the construction programme; and
- Western Ring Route Projects: Narrowing of nearly 7km of SH1 to 3.1m lanes with 80km/h temporary speed limits between Royal Road Interchange and the Central Motorway Junction for a series of Western Ring Route projects.

Experience on the above projects showed reductions to motorway capacity in the range of 5 to 10 per cent, however it is noted that this is dependent on a number of variables, as described below:

- **Work site intensity**, which affects the amount of 'rubber-necking' and distraction of passing road users. This distraction results in successive road users slowing to observe activities occurring in the site, which also affects the following distances left by each road user;
- **Upstream/Downstream constraints** of the motorway and arterial network can dictate whether the level of reduction in capacity on the carriageway is affected by the works;
- The **speed of vehicles** entering the project area can affect the capacity if there is a large discrepancy between the upstream speed and resulting speed of the affected section;
- The **geometric layout** of the road, in the form of the longitudinal/vertical geometry and lane width has potential to affect capacity by lessening the length of merges and diverges; and
- Presence, location and frequency of **site accesses** into work areas.

Each of these factors can be expected to play a part in the performance of SH1 and SH20 during the works, however the magnitude of each of these factors converging is difficult to predict at this time.

3.3.2 Traffic Model Tests

Tests were conducted for the Base Case and the End of Construction Base Case to assess the effects of a capacity reduction on the SH1 and SH20 mainlines as a result of the variables described in **Section 3.3.1**. The two tests carried out were:

1. 5% and 10% reduction in the capacity on SH20 mainline at the Neilson Street Interchange between the on and off-ramps; and

2. 5% and 10% reduction in the capacity on SH1 mainline from Mount Wellington Interchange to Princes Street Interchange and the conversion of the northbound off-ramp into a lane drop thus removing the three to two lane merge on the mainline.

Flow differences comparing the Base Case and the End of Construction Base Case models with the outputs from the capacity reduction are shown and discussed where applicable. Travel times were also estimated from the models and are also discussed where applicable.

It is noted that the SATURN models only represent the area described at the start of **Section 1** and therefore the outputs from the model are indicative only and may not represent the true impacts.

3.3.3 SIDRA Intersection Analysis

SIDRA intersection analysis of local intersections where there could be potential for significant concern was carried out to understand the likely effects and whether these would affect the neighbouring road network.

4 Existing Traffic Environment

This section provides an overview of the base traffic operations upon which the construction assessment has been compared with. As the base traffic operations are for a time in the future, they have been derived from the SATURN model for the established Base Case (2017 DM – representing the initial construction year of 2018) and End of Construction Base Case (2026 DM – representing a final construction year of 2025). Actual traffic counts from the Transport Agency's TMS website and also the traffic signal SCATS system have been used to undertake a sense check, as described in **Section 3.1**.

4.1 Sector 1

4.1.1 SH20 Motorway Mainline (Both Directions)

The existing SH20 Motorway, between the Neilson Street on and off-ramps consists of 3.5m wide lanes with the following configuration:

- Three lanes in the southbound direction; and
- Four lanes in the northbound direction. Note: the left hand side northbound lane (lane 1) terminates just prior to the merge with the northbound on-ramp.

Table 4-1 outlines the predicted traffic flows on SH20 mainline at the Neilson Street interchange for the Base Case (2017 DM) and End of Construction Base Case (2026 DM) in SATURN.

Table 4-1: Base Case and End of Construction Base Case Flows from SATURN at Neilson Street Interchange (nearest 50vph)[3]

	SH20 NB (vph)	SH20 SB (vph)
Base Case AM Hourly Peak	4,350	4,700
Base Case PM Hourly Peak	5,600	3,700
End of Construction Base Case AM Hourly Peak	4,900	5,800
End of Construction Base Case PM Hourly Peak	5,900	4,200
Vehicle Difference between End of Construction Base Case and Base Case AM	550	1,100
% Difference between End of Construction Base Case and Base Case AM	+12%	+23%
Vehicle Difference between End of Construction Base Case and Base Case PM	300	500
% Difference between End of Construction Base Case and Base Case PM	+5%	+14%

[3] Vehicles per hour volumes have been converted from PCUs assuming 7% HCVs and a PCU factor of 2 for HCVs and 1 for light vehicles.

This shows that the AM traffic flow is likely to increase by around 12% and 23% in the NB and SB directions respectively. An increase in traffic is also predicted in the PM peak period, although it is to a lesser extent than the AM peak period.

4.1.1.1 Base Case Traffic Conditions

Figure 4-1 shows the traffic flows on SH20 mainline between the Hillsborough Road interchange to Neilson Street. This figure also shows diagrammatically the lane configurations on SH20 incorporating the auxiliary lanes in both directions between Neilson Street and Queenstown Road as part of the East West Connections Stage 1 Early Works (estimated to complete by early 2017).

Figure 4-1: SH20 Mainline from Base Case Flows

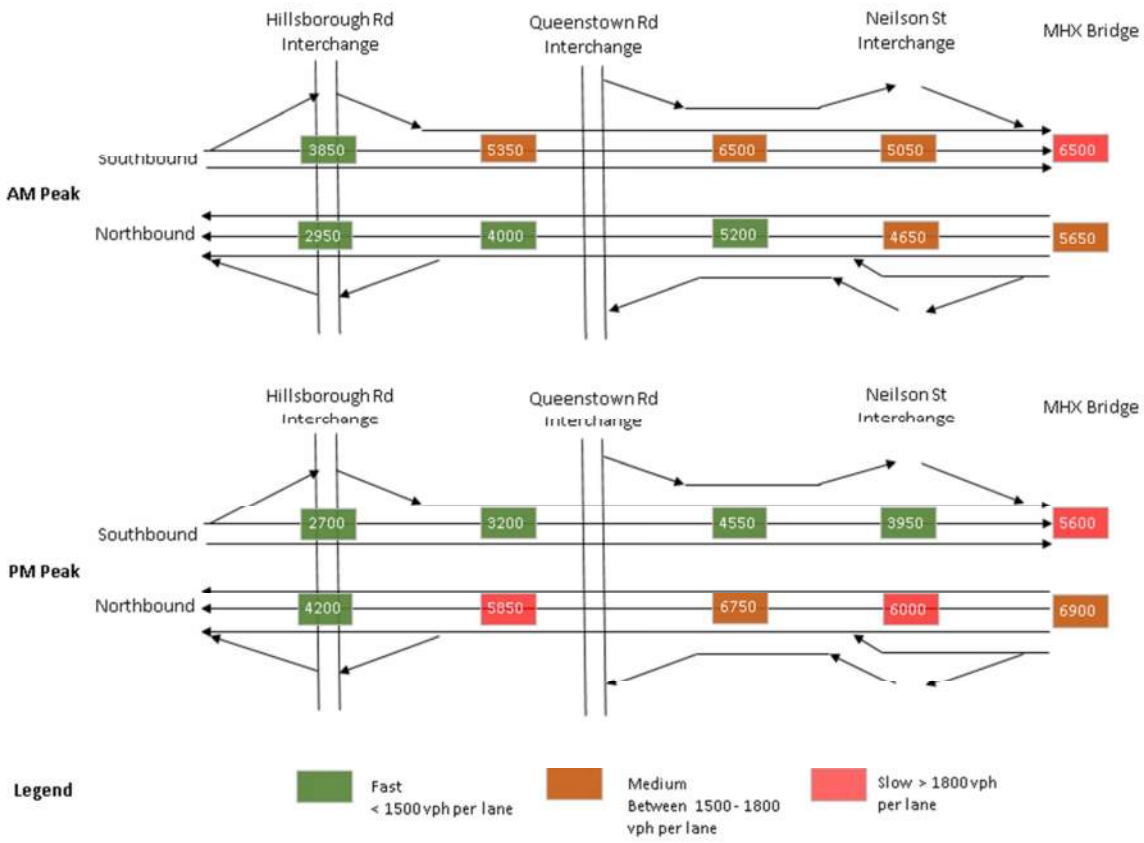


Figure 4-1 shows the Base Case AM and PM peak hourly traffic volumes on SH20 mainline. This indicates that the southbound direction is generally more critical during the AM peak period, and the critical direction changes to the northbound direction during the PM peak.

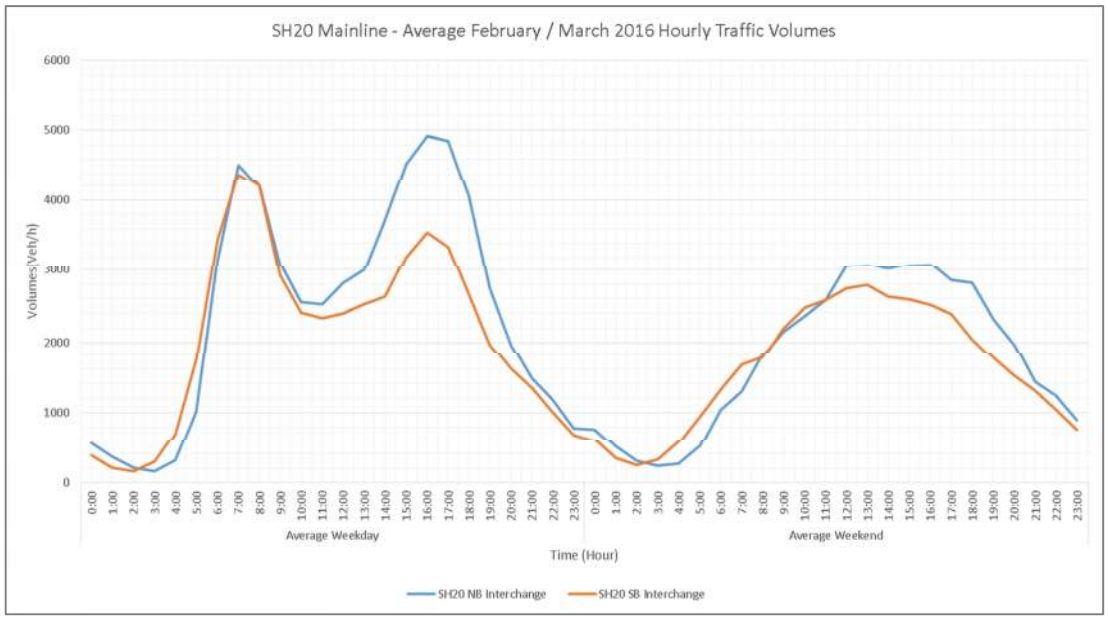
Figure 4-1 also shows the likely hotspots estimated based on comparing the demands against the lane capacity and the number of lanes available. It indicates that during the AM peak period, the hotspots in the southbound direction is likely to extend back from the Manukau Harbour Crossing (MHX) Bridge to around Queenstown Road Interchange. The critical hotspot in the northbound direction during the PM peak period is likely between Queenstown Road and Hillsborough Road, and at the Neilson Street interchange.

4.1.1.2 Actual Existing Traffic Flows (current year 2016)

Figure 4-2 indicates the actual SH20 mainline traffic flow profile at the Neilson Street Interchange (i.e. between the on and off-ramps) in each direction from March 2016. This figure indicates the AM peak period to be between the hours of 06:00 and 09:00. The traffic flows in both directions are similar for the AM peak but are significantly different in the PM peak period.

The PM peak period occurs between the hours of 15:30 and 18:00. During this period, the northbound direction traffic flow is more critical and exceeds the AM peak flow, while in the southbound direction, the traffic demand is noticeably less. The weekend peak traffic flow is significantly less than the weekday peak periods.

Figure 4-2: SH20 Mainline Traffic Flow Profile – March 2016



4.1.1.3 Sense Check between Existing and Modelled Flows on SH20

Table 4-2 below shows the differences in traffic volumes along SH20 between the 2013 Base model and the Base Case (2017 DM). It shows that traffic volumes from 2013 to 2016 (including the opening of Waterview Connection) generally increased by 20% in the southbound direction and 15% in the northbound direction. This proportion consists of the background growth and the growth due to the opening of the Waterview Connection.

Table 4-2: 2013 Base and Base Case Traffic Flows along SH20 from SATURN

	SH20 SB	SH20 NB
2013 Base AM	4,250	4,000
Base Case AM	5,050	4,650
% Differences between 2013 and Base Case models – AM Peak	20%	16%
2013 Base PM	3,550	5,200
Base Case PM	3,950	6,000
% Differences between 2013 and Base Case models – PM Peak	20%	15%

The background traffic growth was estimated by comparing the 2013 and the 2016 traffic counts at the Neilson Street interchange from the TMS website. This indicated that the traffic growth over the three year period from 2013 to 2016 was around 19%. This indicates (based on the 2013 and 2016 model differences calculated above) that the traffic growth associated with the Waterview Connection is around 1%.

The Waterview Connection growth factor is then applied to the actual 2016 traffic volumes for comparison with the outputs from the Base Case. The comparison between the adjusted flows and the modelled flows are outlined in Table 4-3 below.

Table 4-3: Sense Check between Adjusted and Base Case Model Traffic Volumes

	SH20 SB	SH20 NB
2016 Adjusted Traffic Flow AM	4,300	4,050
Base Case Model Flow AM	5,050	4,650
% Differences between the above	17%	15%
2016 Adjusted Traffic Flow PM	3,600	5,050
Base Case Model Flow PM	3,950	6,000
% Differences between the above	10%	19%

This table indicates that the outputs from the Base Case model are generally higher than the actual traffic flows (adjusted with the Waterview Connection growth factor).

4.1.1.4 Predicted Travel Times

The predicted travel times on SH20 from the Base Case and End of Construction Base Case Models in SATURN are described in Table 4-4 below. The travel time is estimated on routes connecting the key origin and destination within the extent of the SATURN model.

Table 4-4: Base Case and End of Construction Base Case Travel Times along SH20 from SATURN

	SH20 SBD Hillsborough Rd to SH20 / SH 1 Int (mins)	SH20 NBD SH 20 / 1 to Hillsborough Rd (mins)	SH20 SBD Hillsborough Rd to Airport (mins)	SH20 NBD Airport to Hillsborough Rd (mins)
Base Case AM	11	10	9	8
Base Case PM	11	10	9	10
End of Construction Base Case AM	17	11	17	9
End of Construction Base Case PM	14	19	10	19
% Difference between End of Construction Base Case and Base Case AM	+ 56%	+ 9%	+ 81%	+ 13%
% Difference between End of Construction Base Case and Base Case PM	+ 28%	+ 83%	+ 21%	+ 95%

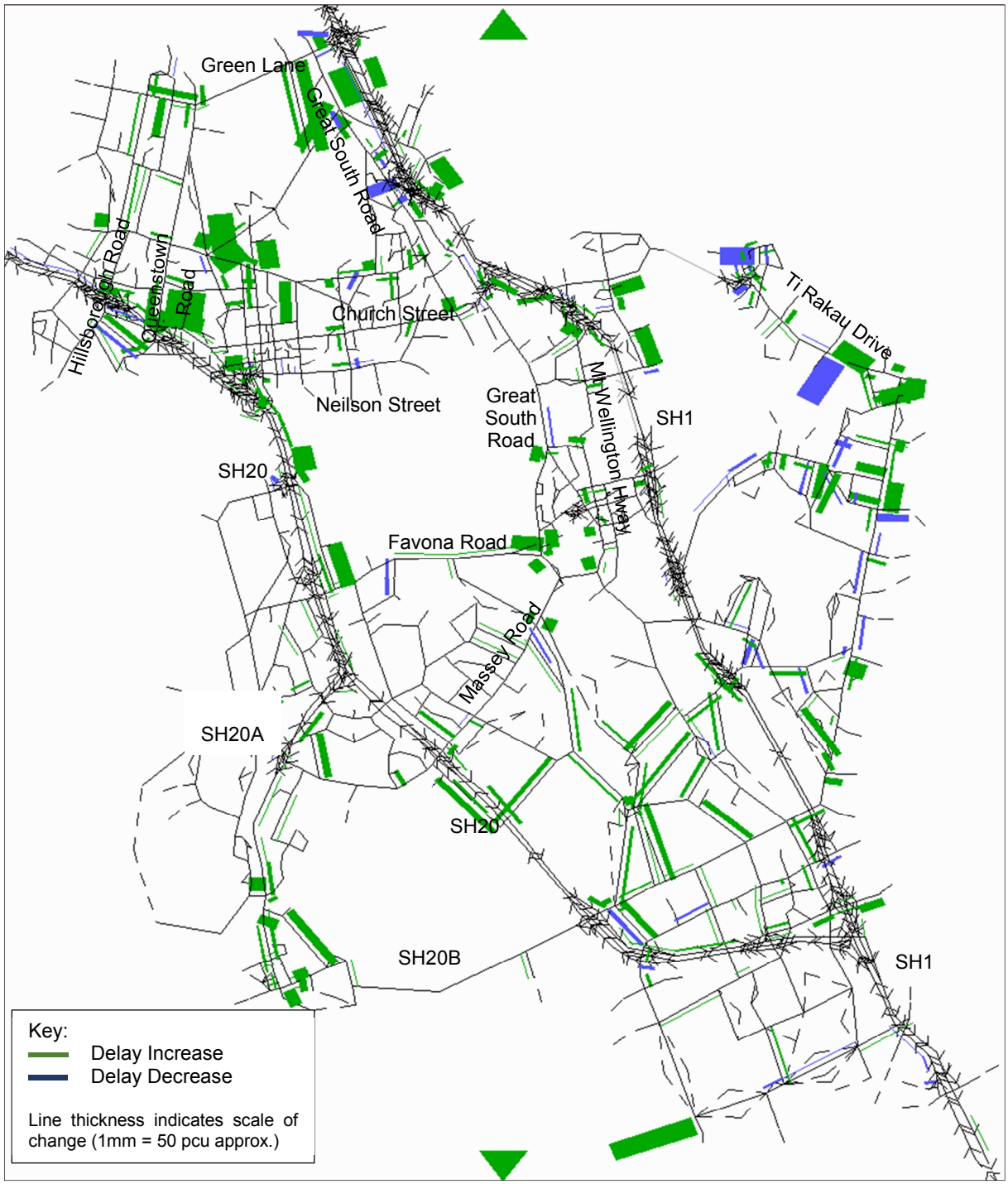
This shows that the travel times in 2026 will increase significantly compared to the base model. Whilst all directions and peak periods experience an increase in travel times, the greatest increase in travel time is expected to be in the southbound direction on SH20 during the AM peak period. Whilst in the PM peak, the increase in travel time is likely to be the greatest in the northbound direction.

4.1.1.5 Delay Difference Plots

Figure 4 - 3 shows the travel time differences between the Base Case and End of Construction Base Case models in order to further understand where the increased delay would occur. This figure shows that the greatest increases in travel times are estimated to be on the following key roads during the AM peak period:

- SH20 SB Mainline at Hillsborough Interchange;
- Queenstown Road Southbound;
- SH20 NB Mainline at Queenstown Road Interchange;
- SH20 Neilson Street SB off-ramp;
- SH20 Neilson Street NB on-ramp;
- SH20 Mahunga Drive SB off-ramp;
- SH20 Rimu Road SB off-ramp; and
- Neilson Street / Hugo Johnston Drive Intersection.

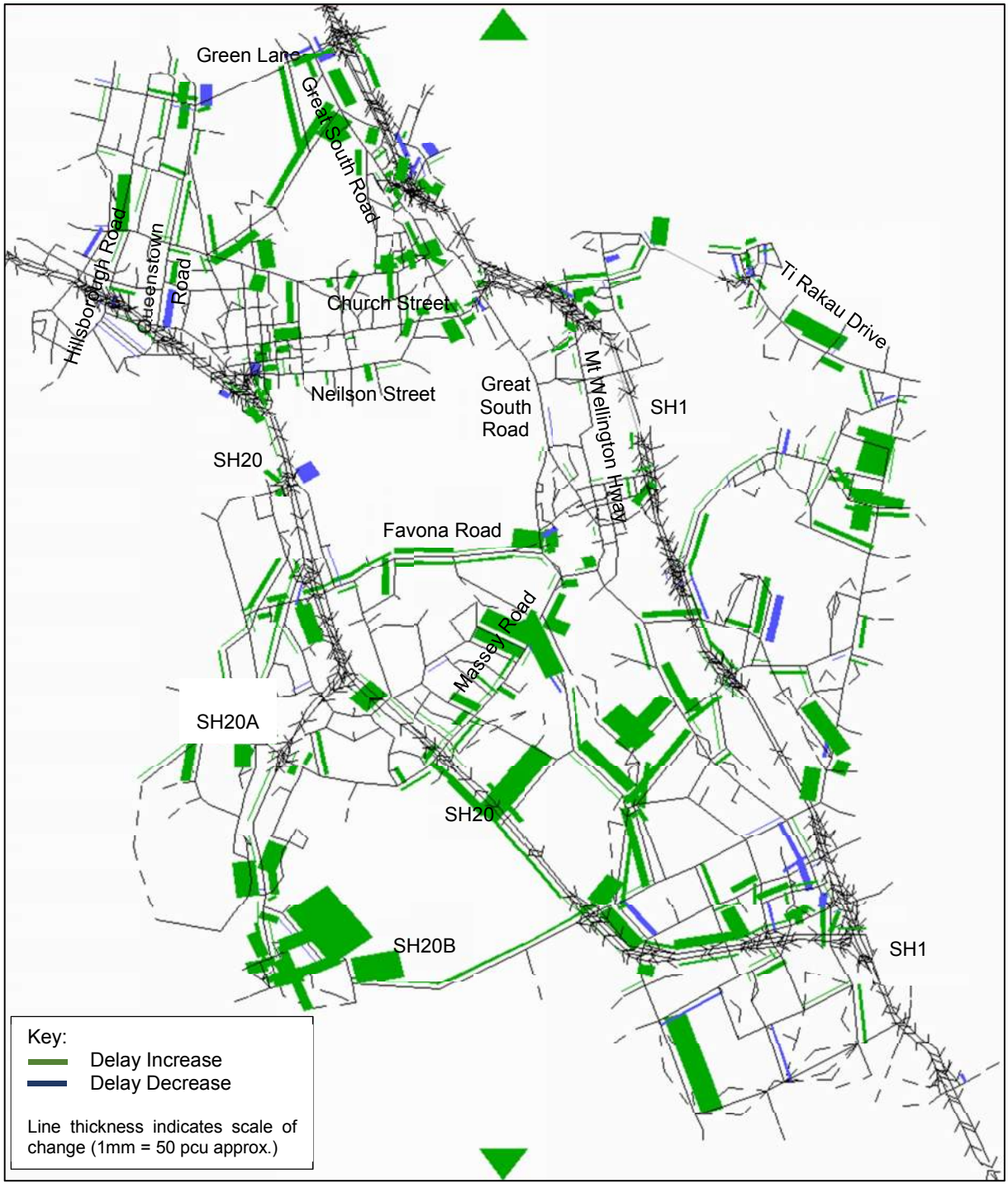
Figure 4-3: Delay Difference Plot between 2016 and 2026 AM Peak



During the PM peak period, the greatest increase in delays are expected to be on the following roads, as shown in Figure 4-4.

- Roads surrounding Auckland Airport;
- SH20 NB at Neilson Street Interchange; and
- SH20 Walmsley Rd NB Off-Ramp.

Figure 4-4: Delay Difference Plot between 2016 and 2026 PM Peak



4.1.2 SH20 Motorway Ramps at Neilson Street Interchange

Table 4-5 outlines the predicted traffic flows on SH20 Neilson Street Ramps from the Base Case (2016 DM) and End of Construction Base Case (2026 DM) SATURN models.

Table 4-5: Base Case and End of Construction Base Case Flows from SATURN[4]

	Neilson St SB Off-Ramp (vph)	Neilson St SB On-Ramp (vph)	Neilson St NB Off-Ramp (vph)	Neilson St NB On-Ramp (vph)
Base Case AM	1,350	1,350	950	550
Base Case PM	600	1,550	850	700
End of Construction Base Case AM	950	1,850	950	650
End of Construction Base Case PM	750	1,450	950	700
Vehicle Difference between End of Construction Base Case and Base Case AM	- 400	500	50	150
% Difference between End of Construction Base Case and Base Case AM	-30%	+ 36%	+ 3%	+ 23%
Vehicle Difference between End of Construction Base Case and Base Case PM	173	- 66	124	- 3
% Difference between End of Construction Base Case and Base Case PM	30%	0%	15%	0%

Table 4-5 shows that the Neilson Street SB off-ramp is expected to have approximately 30% less traffic during the AM peak period. The PM peak will experience a similar proportion of traffic increase between Base Case and End of Construction Base Case.

The Neilson Street SB on-ramp is expected to have approximately 36% more traffic during the AM peak period in 2026, and the PM peak period is expected to have a slight decrease in the traffic volume compared to the 2026 PM peak.

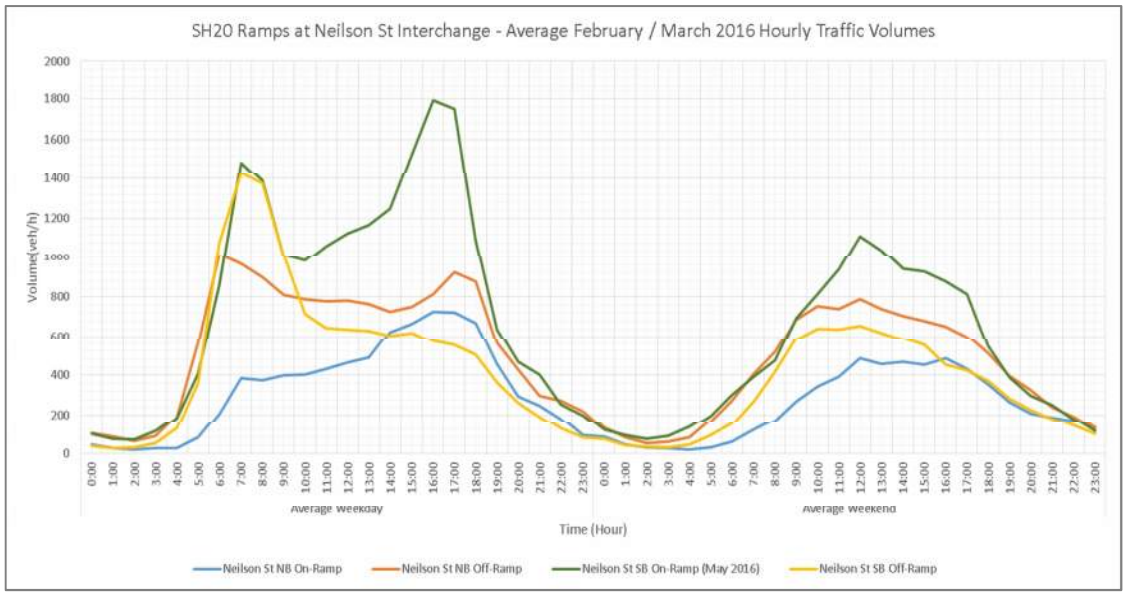
Both of the northbound ramps are generally expected to have an increase between 15% and 25% in the traffic demand. The Neilson Street NB off-ramp is shown to be more critical than the NB on-ramp.

[4] Vehicles per hour volumes have been converted from PCUs assuming 7% HCVs and a PCU factor of 2 for HCVs and 1 for light vehicles.

4.1.2.1 Actual Existing Traffic Flows (current year 2016)

Figure 4-5 shows the traffic profile along SH20 Motorway ramps at the Neilson Street Interchange in March 2016. Each of the ramps are discussed separately in the following sections.

Figure 4-5: SH20 Motorway Ramps Traffic Flow Profile – March 2016



4.1.2.2 SH20 Neilson Street SB off-ramp

The Neilson Street SB off-ramp consists of a single lane and then diverges to three lanes at the downstream intersection of SH20 SB off-ramp / Neilson Street / Gloucester Park Road.

Figure 4-5 indicates that the off-ramp experiences notably high traffic volumes (approximately 1400vph) in the AM peak period between 06:00am and 09:00 am. This likely represents the commuter / commercial traffic using this off-ramp to access the eastern areas. The PM peak period is less critical.

4.1.2.3 SH20 Neilson Street SB on-ramp

The traffic on the SB on-ramp appears to be the highest of all ramps with the PM peak period being the most critical. There are two lanes on the on-ramp for normal traffic in addition to a T2 lane which begins upstream from Neilson Street. After the traffic merge into a single lane, the on-ramp joins SH20 SB mainline as a lane gain.

The SB direction has a traffic demand of approximately 1800 vph during the PM peak and around 1500 vph during the AM peak.

4.1.2.4 SH20 Neilson Street NB off-ramp

The existing Neilson Street NB off-ramp consists of a single lane, and joins Onehunga Harbour Road as a continuous left turn. There is a right turn bay provided at the off-ramp leading into either Orpheus Drive or the northbound on-ramp, and is priority controlled. The peak hour volume is experienced most prominently in the AM peak period with approximately 1000 vph and the evening is slightly lower at approximately 900 vph. Slow moving queues are often seen for the majority of the length of the ramp and it is likely that the vehicle volumes are limited by this.

4.1.2.5 SH20 Neilson Street NB on-ramp

The NB on-ramp consists of two lanes one of which is a relatively short T2 lane. The on-ramp currently merges with the mainline traffic. However as part of the East West Link Early Works, an auxiliary lane is proposed between the Neilson Street SB on-ramp and Queenstown Road SB off-ramp.

4.1.3 Orpheus Drive

Orpheus Drive provides a connection between Seacliffe Road (northern end) and Onehunga Harbour Road (southern end). It primarily provides access to the Onehunga Foreshore area and a small number of properties such as the Manukau Cruising Club and Onehunga Wharf area. The road width is generally narrow on Orpheus Drive, particularly south of the Manukau Cruising Club.

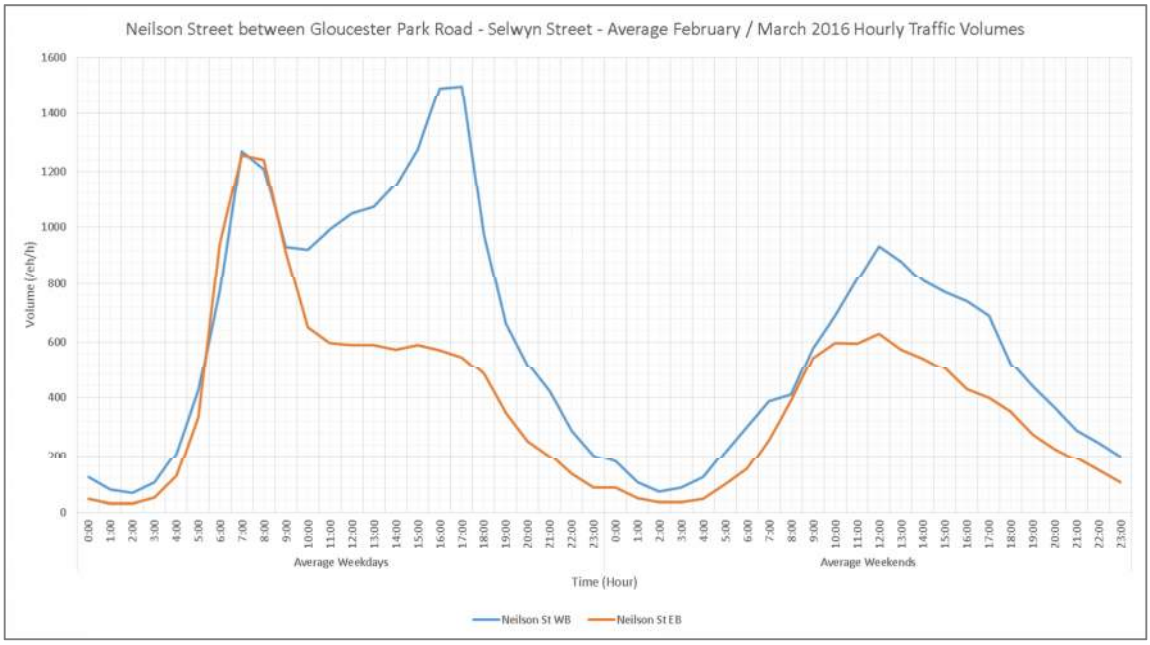
A traffic count undertaken in 2009 at a site between Seacliffe Road and Neilson Street SB on-ramp suggests there is approximately 420 vpd travelling on Orpheus Drive. However, more traffic is expected to be travelling on Orpheus Drive since the opening of the Onehunga Foreshore Restoration Project due to the greater accessibility to the foreshore. At the time of writing, post-construction traffic volumes are not available for Orpheus Drive.

4.1.4 Neilson Street

Neilson Street is a busy two-lane, two-way arterial road with a 5 day average daily traffic (ADT) of approximately 27,000 vpd. Parts of the corridor narrow to a single lane in each direction. While Neilson Street generally consists of two through lanes between SH20 ramps and Alfred Street with a solid median, this drops to a single lane between Alfred Street and Church Street. It is situated in a largely industrial and commercial area and is well used by heavy commercial vehicles (HCVs). Almost 12% of the total vehicle volumes are HCV's based on AT traffic count data from March 2015. Waikaraka Park stretches across the southern side of Neilson Street between Alfred Street and Captain Springs Road. The intersection with Captain Springs Road is a signalised intersection. All other intersections are priority controlled Give-way or Stop controlled in the Project area. The majority of the accesses from Neilson Street serve commercial properties.

As shown in Figure 4-6, during the AM Peak period Neilson Street carries approximately 1300 vph per direction. The westbound direction however is more critical in the PM peak period carrying approximately 1500 vph, while the eastbound direction has a significantly less traffic demand of approximately 600 vph in the PM peak period.

Figure 4-6: Neilson Street Traffic Flow Profile – March 2016



4.1.5 Onehunga Mall

Onehunga Mall (south of Neilson Street) predominantly consists of the SH20 NB on and off-ramps traffic as well as minor local access traffic off Onehunga Mall / Onehunga Mall / Orpheus Drive.

The average weekday traffic profile shows that Onehunga Mall (south of Neilson Street) carries approximately 950 vph in the northbound direction and around 500 vph in the southbound direction. In the PM peak hour the northbound and southbound directions have a demand of approximately 900 vph and 750 vph respectively.

4.2 Sector 2

4.2.1 Alfred Street (South of Neilson Street)

Alfred Street (south of Neilson Street) is a short cul-de-sac road, approximately 500m long. It primarily serves the adjacent industrial business properties on one side and therefore mainly consists of heavy commercial vehicles. The other side neighbours Waikaraka Recreational Park and the Waikaraka Cemetery. On road parking is provided on the western side of the street only. There are approximately 300 vehicles per day that use this street.

4.2.2 Captain Springs Road (South of Neilson Street)

The section of Captain Springs Road assessed is the section of the street south of Neilson Street and is a no exit local road that extends south from Neilson Street and ends at a cul-de-sac. This section of the road is approximately 500m long and acts predominantly as an access road to adjacent industrial businesses. It also provides access to Waikaraka Recreational Park.

Based on the SCATS data at the intersection of Captain Springs Road / Neilson Street, the ADT on Captain Springs Road (south of Neilson Street) was recorded to be 2500 vpd in both directions. The AM peak hour traffic volumes were recorded at 150 vph vehicles and 180 vph in the PM peak hour in both directions.

Parking occupancy and duration of stay surveys were undertaken during Tuesday and Saturday in May 2016 between the hours of 7:00am and 7:00pm. The Tuesday and a Saturday were chosen as these were the busiest days at the Onehunga Sports Club. The parking surveys were undertaken on the length of road between Neilson Street and the start of the private road accessing Seamount Glass.

The parking results reveal that the northern end of Captain Springs Road experiences a higher level of parking activity than the middle and southern sector.

4.2.3 Waikaraka cycleway

The Waikaraka cycleway is an off road cycle-way and footpath bordering the waterfront of the Māngere Inlet. The cycleway extends for approximately 4km from the south-western motorway in Onehunga and ends at Hugo Johnston Drive. The topography of the cycleway and surrounding environment is relatively flat which makes for an average cycle time of 40 minutes. This cycleway is used by both cyclists and pedestrians for both recreational and commuter trips.

To understand the number of cyclist and pedestrians using this cycleway, manual count surveys were undertaken on Sunday 18th June 2016 and Monday 19th June 2016 between 7am and 5pm. This provides a representation of the use during the weekend compared with the weekdays. Due to the long length of the cycleway, there were two surveyors positioned at the following locations:

1. Between Māngere Bridge and Alfred Street; and

2. Approximately 1km west of Hugo Johnston Drive.

It is noted that the surveys were conducted in winter. Count data from AT's website indicates a slightly higher use during summer weekdays (in March there were 75 cyclists compared to 55 in the winter survey). This shows that whilst there is likely to be higher use of the path in the summer, this does not appear to be significantly greater in absolute numbers of users compared to the winter.

4.2.3.1 Cyclist Survey Findings

- Notably less cyclists travel on Monday (55 cyclists) than on Sunday (250 cyclists);
- 25% of the total 250 cyclists observed changed their direction of travel on Sunday and 10% on Monday which effectively decreased the total number of cyclist to approximately 190 and 50 respectively. This user group are likely be using the facility for recreational purposes as they do not complete the full journey from one end to another;
- Majority of trips on Sunday are group trips (more than a single cyclist travelling together) while majority of the Monday trips are individual cyclists;
- Recreational trips are more likely to occur during the weekend (84%) while commuter trips are more likely to occur on weekdays (84%);
- AM peak hour occurred at 9am with a peak of 100 cyclists traveling both directions which decreased gradually every hour until 1pm to 20 cyclists on the Sunday;
- PM peak hour occurred at 3pm with 34 total cyclists traveling both directions on Sunday; and
- The cyclist volumes were relatively low throughout the day with only slightly distinguishable peaks morning and midday peak volumes at 7am and 12pm with 26 and 35 cyclists respectively on Monday.

4.2.3.2 Pedestrian Survey Key Findings.

- Significantly fewer pedestrians were counted on Monday (36) when compared to those on Sunday (135) at the west of Alfred St Survey Location;
- Approximately 98 pedestrians turned around midway along the cycleway on Sunday; and
- Approximately 11 pedestrians turned around midway along the cycleway on Monday.

4.3 Sector 3

4.3.1 Hugo Johnston Drive

Hugo Johnston Drive extends from the Neilson Street signalised intersection and continues south where it ends at the Waikaraka cycleway entrance. It serves as an access road for industrial businesses. There are three priority controlled intersections along the street with Southpark Place and Autumn Place cul-de-sacs.

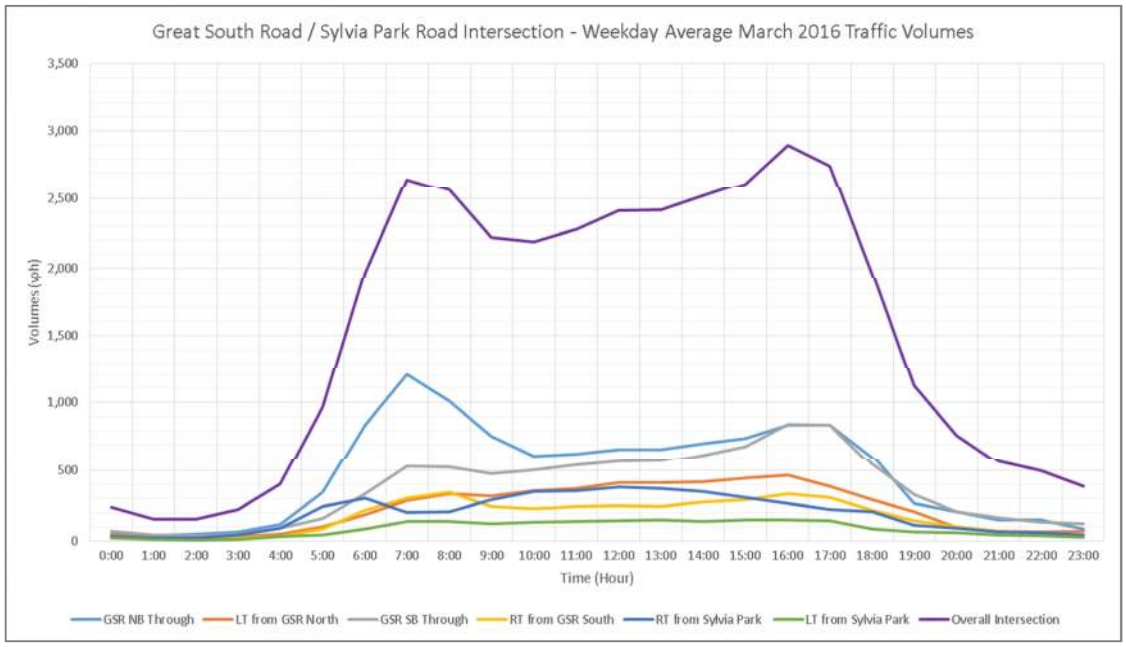
Traffic count data collected from SCATS showed that the 5 day ADT was 9088 vpd in both directions. In the AM peak hour traffic volumes were recorded at 777 vph vehicles and 645 vph in the PM peak hour in both directions.

Parking occupancy and length of stay surveys were undertaken on Hugo Johnston Drive, during a weekday in May 2016 between 7am and 7pm. The surveys showed that the northern end of Hugo Johnston Drive experiences a higher level parking activity (73% occupancy levels) compared to the southern end where average occupancy levels were around 40%. There is therefore more than sufficient parking capacity available on Hugo Johnston Drive.

4.3.2 Great South Road / Sylvia Park Road Intersection

The intersection of Great South Road / Sylvia Park Road is a signalised intersection consisting of three approaches. The traffic volumes on each of the three approaches are shown in Figure 4-7, and discussed further in the following sections.

Figure 4-7: Great South Road / Sylvia Park Intersection Traffic Flow Profile – March 2016



4.3.2.1 Great South Road South Leg

The south approach on Great South Road consists of two lanes and a right turn lane. Figure 4-7 shows that the south approach on Great South Road is the busiest of all approaches with approximately 1200 vph travelling in the morning. More vehicles travel straight through the intersection than those that turn right from Great South Road.

4.3.2.2 Great South Road North Leg

The north approach on Great South Road consists of two lanes and a left turn slip lane. More vehicles travel straight through the intersection than those that turn left from Great South Road. Traffic turning left peak in the evening at 500 vph while traffic travelling straight through peak at 700 vph.

4.3.2.3 Sylvia Park Road East Leg

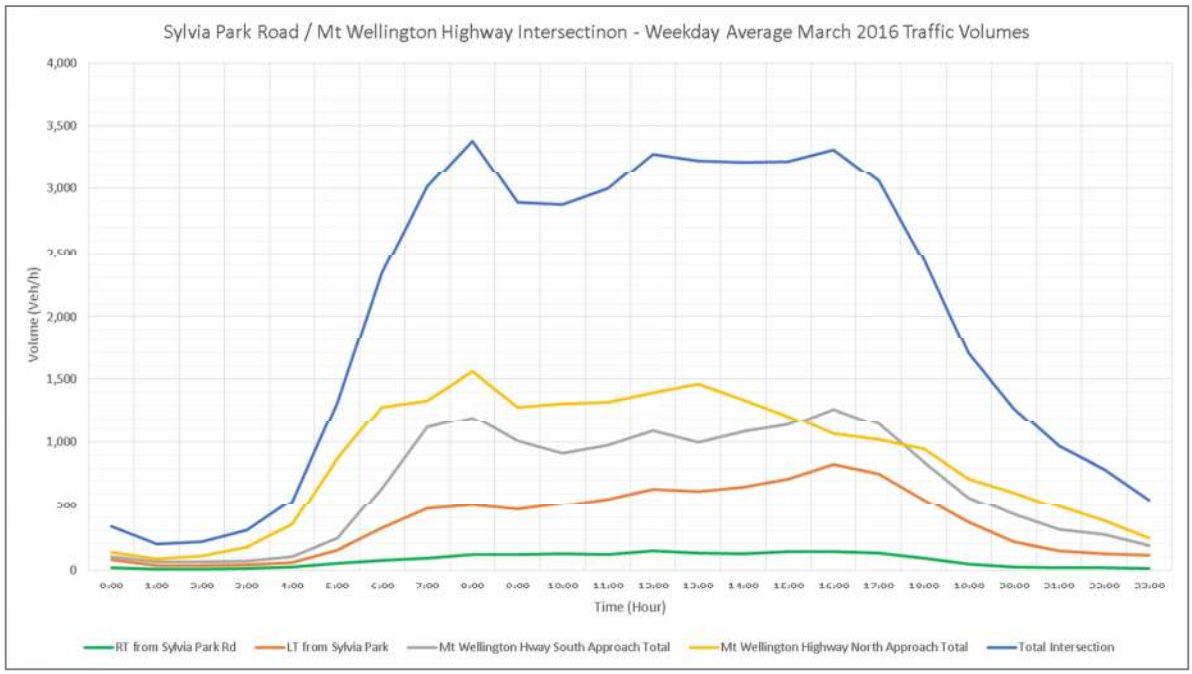
Sylvia Park Road consists of one left turn slip lane and two right turn lanes. The traffic turning right and left from Sylvia Park Road are relatively low. However the right turning traffic are slightly higher than those turning left. The traffic prolife show no significant hourly peaks in traffic demand during the entire day.

4.4 Sector 4

4.4.1 Sylvia Park Road / Mount Wellington Highway Intersection

Figure 4-8 shows the traffic profile along Sylvia Park Road / Mount Wellington Highway Intersection in March 2016. The vehicle volumes for each direction are discussed separately in the following sections.

Figure 4-8: Sylvia Park Road / Mount Wellington Highway Intersection Traffic Flow Profile – March 2016



Traffic travelling in both directions on Mount Wellington Highway are relatively higher than those turning from Sylvia Park Road. The right turning traffic from Sylvia Park Road are relatively low when compared to traffic turning left. The total traffic volume at the Sylvia Park Road / Mount Wellington Highway intersection peaks at 3,400 vph at 8am and again between midday to 4pm. It is suspected that downstream capacity constraints at the Mount Wellington Highway intersection would result in the slightly lower volumes in the evening peak. The site observations suggest that there is a greater level of congestion during PM peak.

4.5 Sector 5

4.5.1 SH1 Motorway Mainline (Both Directions)

The existing SH1 mainline consists of three lanes in the NB direction, which then reduces to two lanes after the Mount Wellington NB off-ramp (three lanes to two lanes merge). The southbound direction consists of two lanes at the interchange and becomes three lanes after the SB on-ramp.

Table 4-6 outlines the predicted traffic flows on SH1 mainline between Mount Wellington and Princes Street from the Base Case (2017 DM) and End of Construction Base Case (2026 DM) models in SATURN.

Table 4-6: Base Case and End of Construction Base Case Flows from SATURN at Mount Wellington Interchange[5]

	SH1 NB Mainline (vph)	SH1 SB Mainline (vph)
Base Case AM	5,200	5,000
Base Case PM	3,900	5,900
End of Construction Base Case AM	5,200	5,450
End of Construction Base Case PM	4,500	5,900
Vehicle Difference between End of Construction Base and Base Case AM	0	450
% Difference between End of Construction Base and Base Case AM	0%	+ 9%
Vehicle Difference between End of Construction Base and Base Case PM	600	0
% Difference between End of Construction Base and Base Case PM	14%	0%

This shows that traffic flows in the peak direction has minimal changes in the NB direction in AM peak and SB direction in the PM peak, respectively. This is likely due to flows already being near capacity but may also be attributed to the alternative motorway route via SH20 once the Waterview Connection is complete. Some increases in flows are noted in the non-commuter peak direction.

[5] Vehicles per hour volumes have been converted from PCUs assuming 6% HCVs and a PCU factor of 2 for HCVs and 1 for light vehicles.

4.5.1.1 Base Case Traffic Conditions

Figure 4-9 shows the traffic flows on SH1 mainline between the Mount Wellington Highway and Princes Street Interchanges. This figure also shows the existing lane configurations on SH1.

Figure 4-9: SH1 Mainline Flows from 2016 DM Model

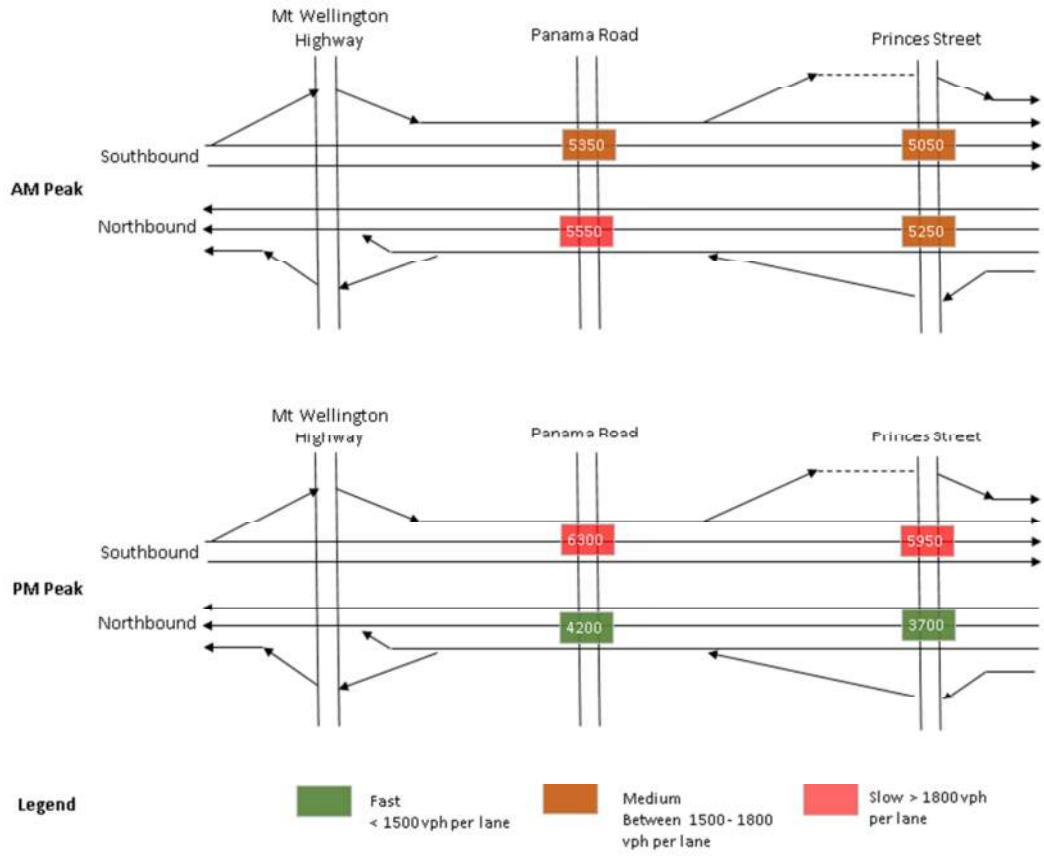
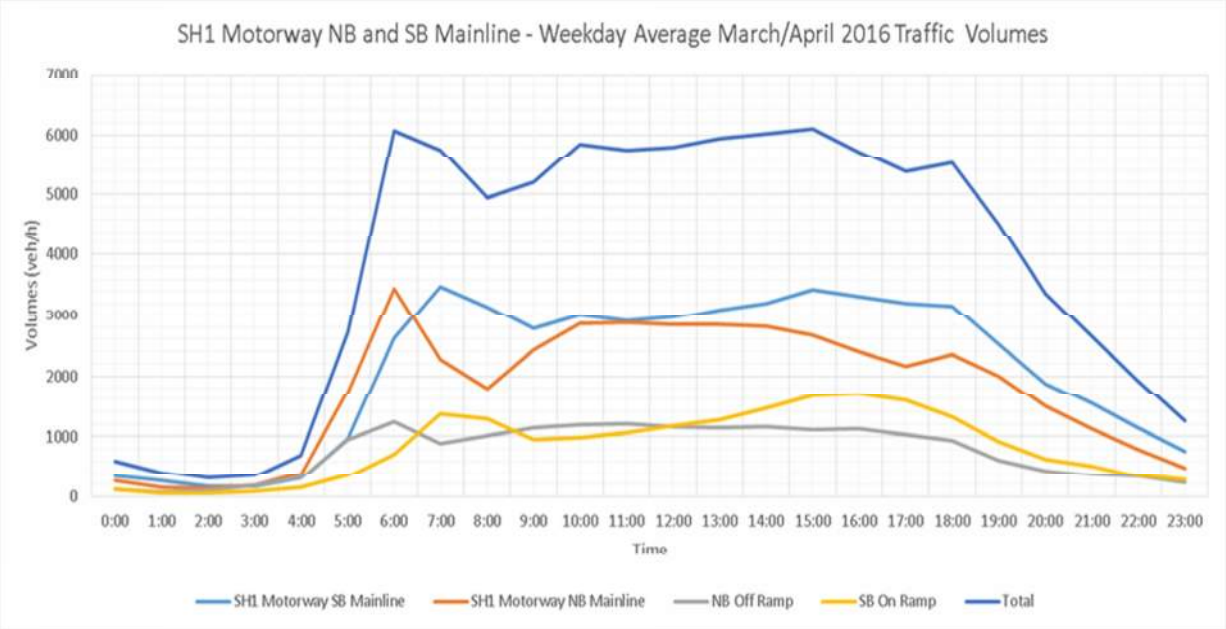


Figure 4-9 also shows the Base Case AM and PM peak hourly traffic volumes on SH1 mainline. This indicates that southbound direction generally remains busy during the both peak periods. The northbound direction is more critical during the AM peak period.

4.5.1.2 Actual Existing Traffic Flows

Figure 4-10 shows the traffic profile on SH1 main line and on the south facing ramps at the SH1 Mount Wellington Highway Interchange. Each of the mainline approaches, the southbound on-ramp and northbound off-ramp approaches are discussed separately in the following sections.

Figure 4-10: SH1 Motorway NB and SB Mainline Traffic Flow Profile - March 2016



a. SH 1 Motorway NB Mainline – March 2016

The traffic on the northbound mainline appears to reach an AM peak of 3500 vph. The demand decreases briefly between 6am and 8am then increases and remains steady at approximately 3000 for majority of the day until 5pm.

b. SH 1 Motorway SB Mainline – March 2016

The traffic demand increases to a peak of approximately 3500 vehicles at 6am. At 8am the traffic volumes decreases to 2000 vehicles then increase again until 3pm where the volumes begin to decrease again.

c. Northbound off-ramp – April 2016

The northbound off ramp traffic demand remains relatively low during daytime hours and peak slightly to 1000 vehicles at 3pm. The northbound off ramp and southbound on ramp have similar traffic flow profiles throughout the day.

d. Southbound on-ramp – April 2016

The southbound on ramp traffic demand is relatively low and remains fairly consistent at approximately 1500 between 5am to 6 pm.

4.5.1.3 Sense Check between Existing and Modelled Flows on SH1

Table 4-7 below shows the differences in traffic volumes along SH1 between the 2013 Base model and the Base Case (2017 DM) model. It shows that traffic volumes from 2013 to 20176 have generally remained unchanged in the southbound direction and increased slightly between 2 to 8% in the northbound direction. The background growth on SH1 estimated using the Transport Agency's TMS data is approximately 4% (average for both directions) over the three year period from 2013 to 2016. It is suspected that very minor growth would be associated with the opening of the Waterview Connection as flows are already close to or exceeding the capacity during peak periods.

[6] The 2017 DM model represents a 2016 regional land use forecast.

Table 4-7: 2013 Base and Base Case Travel Times along SH1 from SATURN

	SH1 SB	SH1 NB
2013 Base AM	5,362	5,450
Base Case AM	5,350	5,550
% Differences between 2013 and Base Case models – AM Peak	0%	2%
2013 Base PM	6,300	3,900
Base Case PM	6,300	4,200
% Differences between 2013 and Base Case models – PM Peak	0%	8%

The comparison between the adjusted flows and the modelled flows are outlined in **Table 4-8** below.

Table 4-8: Sense Check between Adjusted and 2016 DM Model Traffic Volumes

	SH20 SB	SH20 NB
2016 Adjusted Traffic Flow AM	5,350	5,450
Base Case Model Flow AM	5,350	5,550
% Differences between adjusted traffic flow and Base Case model AM	0%	2%
2016 Adjusted Traffic Flow PM	4,950	3,600
Base Case Model Flow PM	6,300	4,200
% Differences between adjusted traffic flow and Base Case model PM	27%	17%

This table indicates that the outputs from the Base Case model are generally higher than the actual traffic flows (adjusted with the Waterview Connection growth factor).

4.5.1.4 Predicted Travel Times

The predicted travel times on SH1 from Greenlane Interchange to SH20 / SH1 Junction are described in Table 4-9 below:

Table 4-9: Base Case and End of Construction Base Case Travel Times along SH1 from SATURN

	SH1 SBD Greenlane Int to SH20 / SH1 Int (minutes)	SH1 NBD SH20 / SH1 Int to Greenlane Int (minutes)
Base Case AM	11.81	22.33
Base Case DM PM	17.58	9.65
End of Construction Base Case AM	16.34	23.58
End of Construction Base Case PM	20.51	10.50

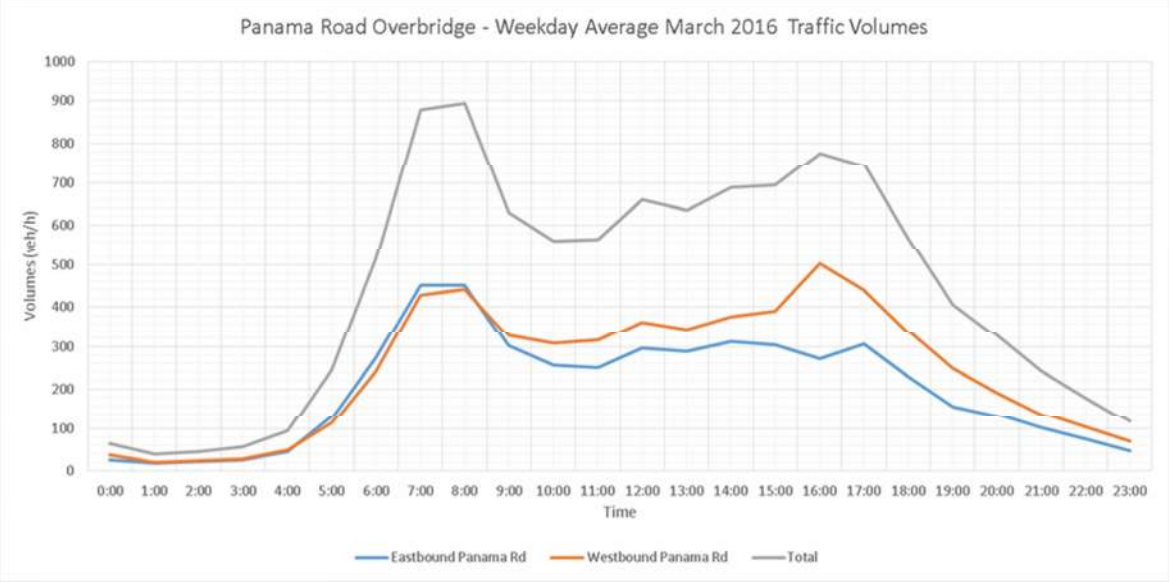
	SH1 SBD Greenlane Int to SH20 / SH1 Int (minutes)	SH1 NBD SH20 / SH1 Int to Greenlane Int (minutes)
% Difference between End of Construction Base Case and Base Case AM	38%	6%
% Difference between End of Construction Base Case and Base Case PM	17%	9%

This shows that the travel times in 2026 are expected to increase moderately between 15 – 40% in the southbound direction, while the northbound direction is expected to have an increase in travel times by around 10%. The greatest increase is likely to be in the AM peak period for the southbound direction and similarly the PM peak period for the northbound direction. This is consistent with the locations where traffic volumes are forecast to increase.

4.5.2 Panama Road

Figure 4-11 shows the traffic volumes on Panama Road over-bridge. The eastbound and westbound traffic flow profiles along Panama Road over-bridge are relatively similar during the morning hours where the morning peak reaches 450 vph in each direction. At midday the eastbound traffic reduces to 300 vph and stays relatively constant until 5pm. The westbound traffic reaches an evening peak of 500 vph at 4pm.

Figure 4-11: Panama Road Over-bridge Traffic Volumes



4.6 Sector 6

Sector 6 primarily consists of Hugo Johnston Drive and Captain Springs Road which are discussed in Sections 4.2 and 4.3.

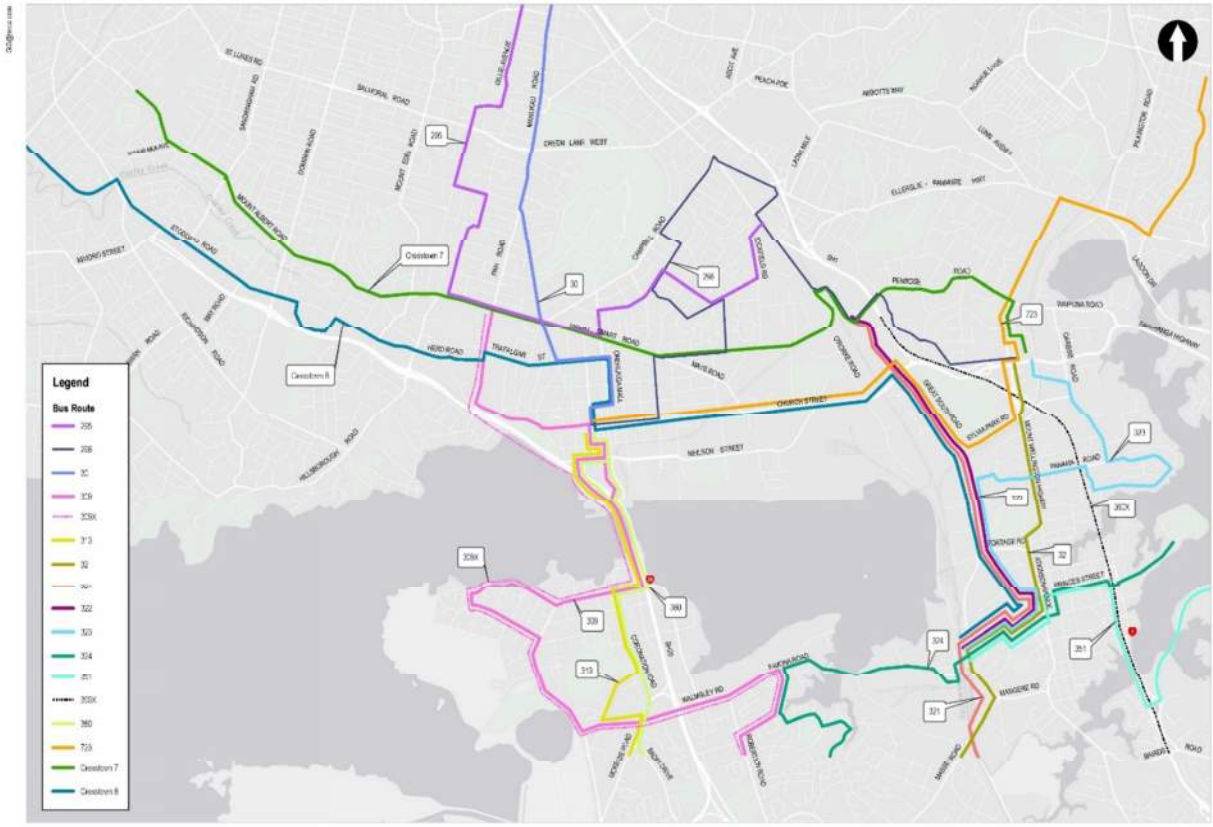
4.7 Public Transport

There are both bus and train services within the Project area. An overview of these services is provided in the following sections.

4.7.1 Bus Services

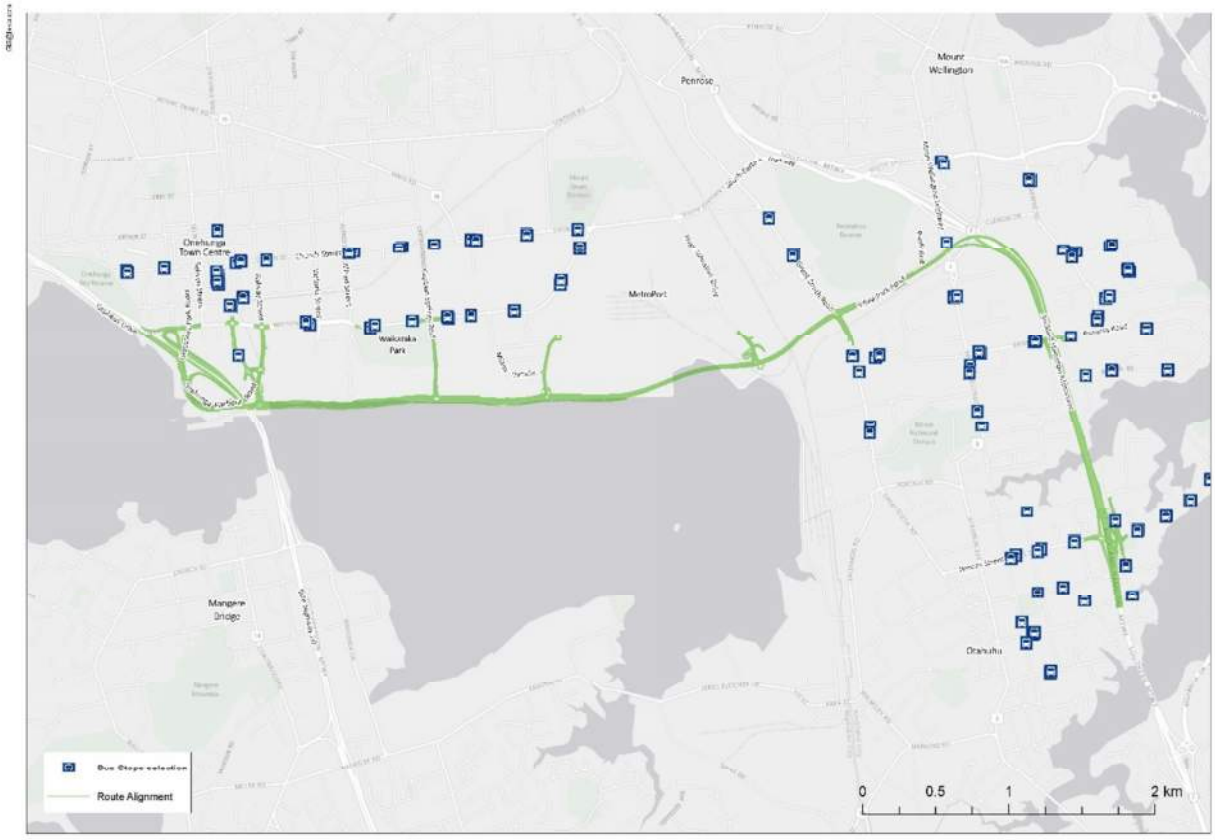
The existing bus services in the area have recently under gone a comprehensive review by Auckland Transport and a New Bus Network will be rolled out in the area from October 2016 and being completed in 2017, prior to commencement of construction works. The assessment of effects is made on this new network, not on the existing services. The routes of the New Network are generally shown in Figure 4-12. In addition to these routes, there are routes that use Great South Road and Panama Road (Routes 515, 532 and 757) and Route 351 which uses Princes Street and Princes Street / SH1 interchange to access the motorway to travel to and from Highbrook.

Figure 4-12: Proposed New South Auckland and Central Auckland Bus Networks in the Project area



Bus stop locations in relation to the proposed alignment are shown in Figure 4-13.

Figure 4-13: Existing bus stop locations in relation to the EWL alignment



The proposed frequency of services in the area are detailed in Table 4-10.

Table 4-10: Frequency of bus services in the EWL Project Area

Services	Type of Service	Frequency (Weekday)			Frequency (Weekend)		Location
		Peak	Peak	All Day	All Day	Evening	
32	Frequent	15	15	15	-	-	Mount Wellington Hwy
309X	Peak Period	30	30	-	30	-	Onehunga Interchange/SH20
309	Connector	30	30	30	30	30	Onehunga Interchange area/SH20
313	Connector	20	30	30	30	30	Onehunga Interchange area/SH20
321	Connector	15	15	30	-	-	Great South Rd
322	Peak Period	Every 30 minutes 5.30am-8.00am towards city and 3.00pm-6.30pm towards Ōtāhuhu			-	-	Great South Rd

Services	Type of Service	Frequency (Weekday)			Frequency (Weekend)		Location
		Peak	Peak	All Day	All Day	Evening	
323	Connector	20	20	30	30	30	
324	Connector	30	30	60	60	-	Māngere Town Centre to Ōtāhuhu Station
351	Connector	15	15	30	-	-	Neilson St
360X	Peak Period	3 inbound 20 minutes apart 3 outbound 30 minutes apart			-	-	SH1 South of South Eastern Hwy
380 (Airporter)	Connector	30	30	30	30	30	Onehunga Interchange area/SH20
723	Connector	15	15	30	30	30	Church St/South-eastern Hwy/Great South Rd/Sylvia Park Rd

There are limited bus priority facilities in the area at present. Those that are present are summarised as follows:

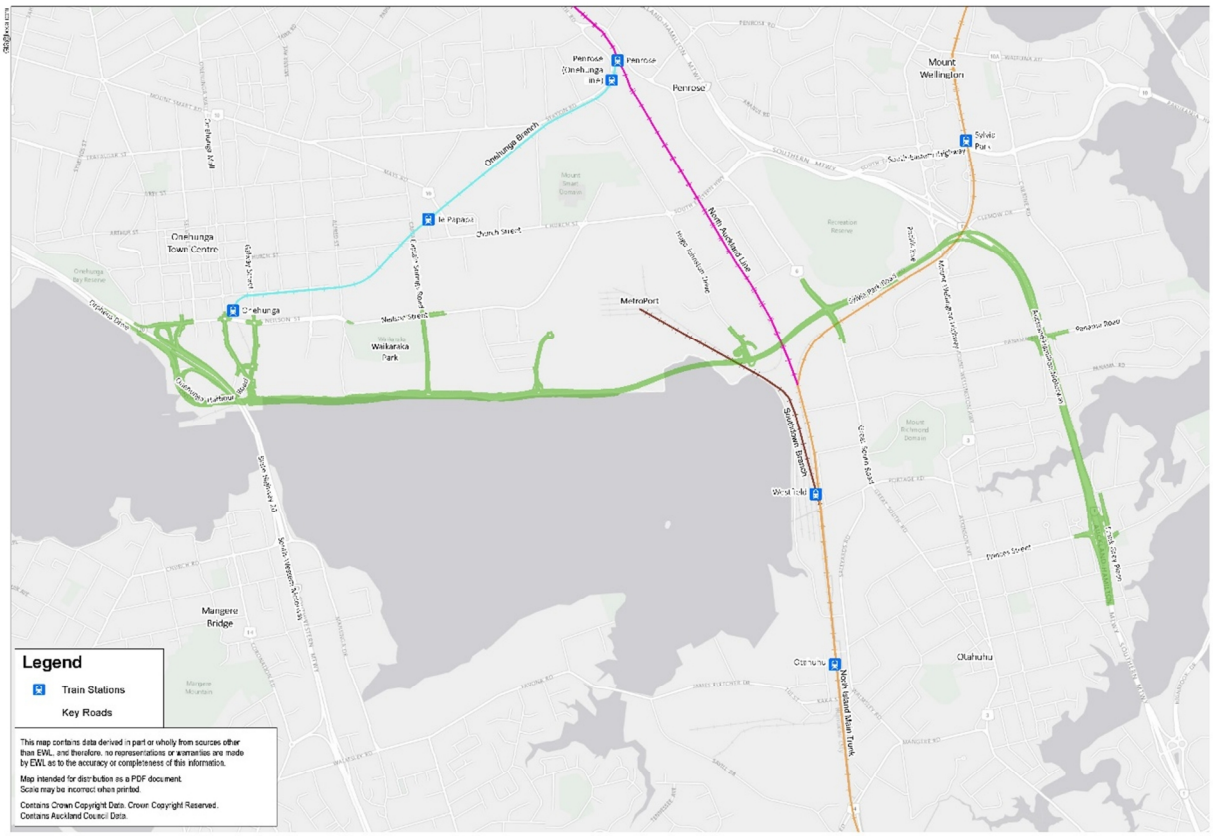
- Southbound T2 / Bus lane from Nielson Street onto and along SH20 Neilson Street southbound on-ramp;
- Northbound SH20 bus lane from the south side of the SH20 bridge at Māngere and terminating just before the Neilson Street northbound off ramp;
- Southbound SH20 bus lane commencing a short distance after the T2/Bus lane ends on the southbound on-ramp. The lane terminates at the southern end of the SH20 Bridge at Māngere; and
- T2 truck lane northbound on the SEART approach to the SH1 northbound on-ramp at SEART. This is not currently used by buses but will be used in the future by new Crosstown services (Routes 8 and 723).

4.7.2 Rail Services

There are three train stations within or in close proximity to the Project Area as seen in Figure 4-14. Onehunga and Te Papapa train stations are on the Onehunga line which travels between Britomart and Onehunga station. Sylvia Park Station is on the Eastern line which travels between Britomart through Mount Wellington and terminates at Manukau.

The route alignment crosses over three rail lines, two lines are passenger lines and the third rail line is for freight and serves MetroPort.

Figure 4-14: Existing rail network in relation to the EWL alignment



4.7.3 East West Link Early Works

As part of the early works for East West Link, the following works have been identified which will be constructed and operational by the Project commencement year. These have been included in the Base Case model layout.

- The construction of an auxiliary lane on either side of SH20 between Queenstown Road and Neilson Street including bus-shoulder lanes from Rimu Road to Walmsley Road;
- Replacement of the existing Neilson Street bridge over the railway line; and
- 4-laning of Neilson Street and MetroPort which includes provision of pedestrian crossing improvements at some of the intersections.

5 Overview of Traffic Impacts and Proposed Mitigation Measures

This section describes at a high level the traffic management activities and the associated impacts that can be expected as a result of the construction of the Project. Only once detailed construction planning has commenced can detailed site-specific work on traffic management and mitigation measures be confirmed. This allows traffic management measures to be refined to best meet the needs of stakeholders, affected parties and the needs of construction. This assessment therefore reflects the best understanding of the likely traffic management methodologies required for the construction of the Project is outlined in the Constructability Report which sets out the proposed construction of the Project

The high level traffic impacts of the traffic management activities are outlined in Table 5-1 below.

Table 5-1: Overview of the Traffic Impacts of the Traffic Management Activities

Impact Category	Traffic management activity
1. Impacts on capacity of existing carriageways	- Shoulder narrowing - Lane narrowing - Lane realignment - Temporary speed limit
2. Temporary closures of existing roads	- Lane closure - alternating flow operation - Lane closure - contra-flow operation - Lane closure - one-direction closure - Road closure / detour - On-ramp and off-ramp closures/ detour - Short term closures for installation of long-term closures / traffic control measures - Temporary speed limit - Intersection part closure (which may include installation of lane closures on the approaches to the intersection to safely divert traffic around the works) - Intersection full closure (which may include installation of full closures on the approaches to the intersection to safely divert traffic around the works)
3. Impacts arising from site access locations and movements	- Site access from a local road or motorway - Mobile escorted entry / exit manoeuvres
4. Impacts on public transport provision	- Bus lane closures / detours - Bus Stop closures / relocations
5. Impacts on pedestrians, cyclists, and mobility routes or crossings	- Footpath closure / detours - Temporary footpath realignment and narrowing - Pedestrian crossing closure - Cycle lane closures / detours - Temporary pedestrian / pedestrian / cycle way realignment and narrowing
6. Impacts on property access, parking, and manoeuvring	- Roadside car parking closures - Property access closures - Reduction/ closure of manoeuvring area

Specific impacts are identified for each sector and the associated mitigation measures are discussed in more depth in the following sections of the report.

6 Sector 1

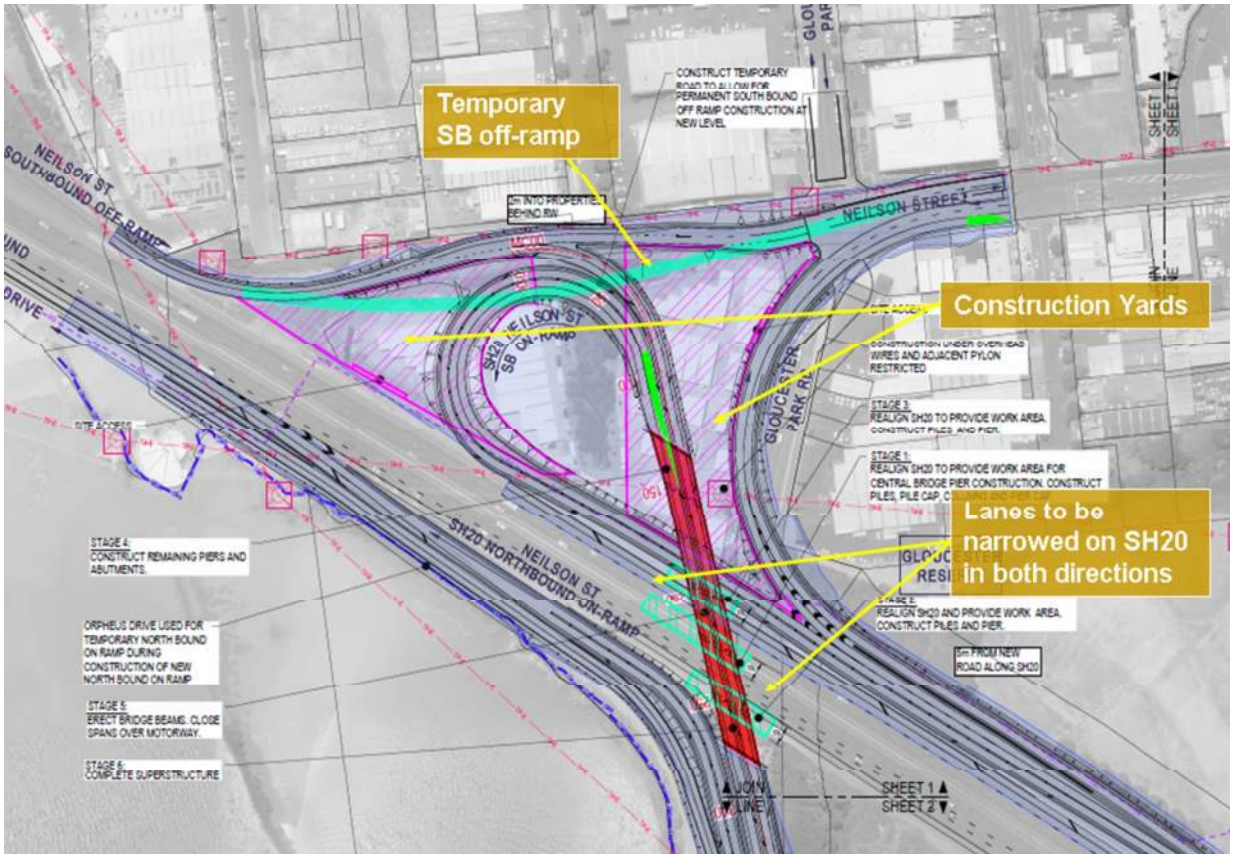
Sector 1 comprises of the construction of the upgraded Neilson Street Interchange with connections in-between SH20 and the EWL. It also includes the construction of the EWL portion south of the Neilson Street Interchange with the creation of a new intersection at Galway Street with EWL.

6.1 Indicative Traffic Management Measures

Construction works on SH20 will generally require the lanes in both the north and southbound directions to be narrowed and a temporary speed limit applied to establish work areas for the construction of the SH20 Neilson Street Interchange over-bridge piers and the new southbound on-ramp. Works would initially move lanes towards the median to create working space on the outside shoulders. Once widening and bridge piers have been constructed, lanes can be moved outward to form a working area in the median for the mid-span bridge pier.

The two construction yards proposed at the existing storage facility beside the Neilson Street southbound on-ramp and within the Onehunga Wharf are likely to have access points established from Gloucester Park Road.

The widening and associated retaining wall works for the southbound off-ramp will require lane widths to be narrowed with the potential for the right turn movement onto the existing Neilson Street southbound on-ramp to be temporarily closed. The traffic for this movement would need to follow a short detour to maintain access to affected properties.

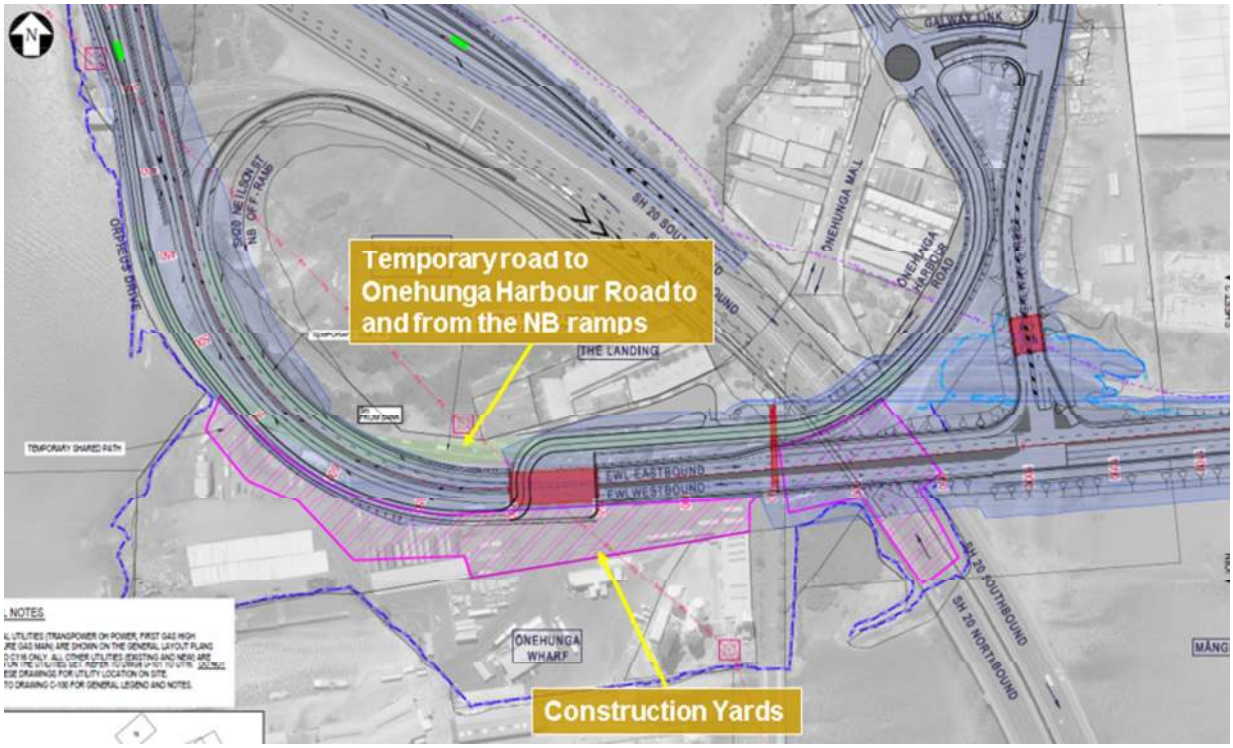


The construction of the northbound off-ramp will largely fall outside of the current off-ramp footprint, and will therefore not affect existing traffic for the most part. Construction of the northbound on-ramp will remain open for the full duration of the works but will likely require a number of temporary geometric arrangements to move the affected traffic around the various work areas for the SH20 Neilson Street

Interchange overbridge and Orpheus Drive. Lane widths will be narrowed and a temporary speed limit applied.

Much of the road on Galway Street, the associated new interchange with the EWL and Onehunga Harbour Link Road can be constructed in staging that isolates the current Onehunga Harbour Road traffic. This will also allow for much of the Onehunga Wharf overbridge to be constructed. Discrete closures outside of peak periods may be required for the lifting of the bridge deck beams.

Discrete closures of the interchange ramps or of the motorway may be required to construct tie-ins, for pavement surfacing or when lifting major structural components of bridge structures.



6.2 Identification and Mitigation of Traffic Impacts

Key traffic impacts arising as a result of the Sector 1 works are listed in this section, and appropriate mitigation measures are proposed where possible. It is noted that while the impacts in this report are described as accurately as possible, the actual scale of the impacts will not be known until the Site Specific Traffic Management Plan (SSTMP) planning and development stage when appropriate mitigation strategies will be developed and agreed with stakeholders and the appropriate road controlling authority. These processes are covered by the Construction Traffic Management Plan Framework (CTMP Framework) found in **Appendix A**.

6.2.1 Impacts arising from the temporary work sites

This section discusses the impact that temporary traffic management measures on SH20 and at the existing Nelson Street Interchange are likely to have on the surrounding road networks.

6.2.1.1 Impacts on SH20

A combination of temporary realignment and lane narrowing will be employed for completing construction of the EWL bridge piers and associated civil works on SH20. This enables the installation of temporary barriers to facilitate works to occur off line from live traffic where possible. This narrowing

and realignment will be coupled with the introduction of a temporary speed limit, which is currently expected to be 80 km/h.

Lane narrowing and speed limit reductions were implemented in the past on SH20 during the Manukau Harbour Crossing construction. However, the traffic flow operating conditions for the EWL Project will be different as this will be post-opening of the Waterview Connection and include East West Link early works including additional lanes on SH20 north of Neilson Street. The following section assesses the possible effects of the reduced capacity with the lane narrowing and reduced speed limit.

Table 6-1 and Table 6-2 shows the travel times for the Base Case (2017 DM) and the End of Construction Base Case (2026 DM) respectively and compares these to capacity reduction scenarios (-5% and -10% capacity reduction as described in Section 3.3.2). The assessment assumes that no works that affect capacity occur concurrently on SH1.

Table 6-1: Overview of Travel Time Impacts due to capacity reduction at Neilson Street Interchange

	SH20 SBD Hillsborough Rd to SH20 / SH1 Int	SH20 NBD SH20 / SH1 to Hillsborough Rd	SH20 SBD Hillsborough Rd to Airport	SH20 NBD Airport to Hillsborough Rd	SH1 SBD Greenlane Int to SH20 / SH1 Int	SH1 NBD SH20 / SH1 to Greenlane Int
2017 AM (Minutes)						
Base Case	11	10	9	8	12	22
Base Case – 5% capacity reduction	11	10	9	8	12	22
% change (5% reduction verses Base Case)	0%	0%	0%	0%	0%	0%
Base Case – 10% capacity	11	11	10	8	12	22
% change (10% reduction verses Base Case)	+ 3%	+ 3%	+ 4%	+ 4%	+ 1%	0%
2017 PM (Minutes)						
Base Case	11	10	9	10	18	10
Base Case – 5% capacity reduction	11	10	9	10	18	10
% change (5% reduction verses Base Case)	0%	0%	0%	0%	0%	0%
Base Case – 10% capacity	11	11	9	12	18	10
% change (10% reduction verses Base Case)	+ 1%	+ 3%	+ 2%	+ 19%	0%	0%

In the Base Case situation, there are generally no significant changes to SH20 journey times in both the AM and PM peaks for either 5% or 10% capacity reduction. The exception is for the PM peak in the northbound direction with the 10% reduction. The most significant effect is for traffic travelling northbound between the airport and Hillsborough Road with travel times forecast to increase by around

19% (2 minutes). There is no effect on SH1 journey times with either the 5% or the 10% capacity reduction.

Table 6-2: Overview of Travel Time Impacts due to capacity reduction at Neilson Street Interchange

	SH20 SBD Hillsborough Rd to SH20 / SH1 Int	SH20 NBD SH20 / SH1 to Hillsborough Rd	SH20 SBD Hillsborough Rd to Airport	SH20 NBD Airport to Hillsborough Rd	SH1 SBD Greenlane Int to SH20 / SH1 Int	SH1 NBD SH20 / SH1 to Greenlane Int
2026 AM (Minutes)						
End of Construction Base Case	17	11	17	9	16	24
End of Construction Base Case – 5% capacity reduction	21	11	20	9	17	24
% change (5% reduction verses End of Construction Base Case)	+ 24%	0%	+ 18%	0%	+ 6%	0%
End of Construction Base Case – 10% capacity	26	12	25	9	17	24
% change (10% reduction verses End of Construction Base Case)	+ 49%	+ 4%	+ 50%	+ 5%	+ 4%	+ 1%
2026 PM (Minutes)						
End of Construction Base Case	14	19	10	19	21	11
End of Construction Base Case – 5% capacity reduction	14	21	10	22	21	11
% change (5% reduction verses End of Construction Base Case)	0%	+ 11%	0%	+ 16%	0%	0%
End of Construction Base Case – 10% capacity	14	25	10	26	21	11
% change (10% reduction verses End of Construction Base Case)	0%	+ 33%	0%	+ 34%	0%	0%

For the End of Construction year (2026) there is a greater effect on the forecast journey times with the reduced capacity. Changes in journey times are generally affected southbound in the AM peak (up to 50% increase) and northbound in the PM peak (34% increase). The effect on journey times with 10% capacity reduction is forecast to be approximately twice that with a 5% capacity reduction. The increase in journey time ranges from 3 to 8 minutes southbound in the AM peak to between 2 to 7 minutes northbound in the PM peak; the higher increases are with the 10% capacity reduction.

As for the Base Case, there appears to be little change to journey times on SH1 as a result of the reduced SH20 capacity.

The effect on traffic flows and delays are discussed for the 5% and 10% capacity reductions below.

Figure 6-1 below indicates the possible traffic effects during the PM peak of a 10% reduction in capacity on SH20 in both directions at the Neilson Street interchange in the Base Case. In this figure, green denotes an increase in traffic flows, while blue denotes a decrease in traffic flows. The thickness of the line indicates the scale of change in traffic flow. In reviewing the model output it should be noted that limitations of the northern extent of the model boundary mean that route choice between SH20 and SH1 may be limited in the model.

The figure shows that the effects of 10% reduction in capacity are generally localised around SH20 Neilson Street Interchange. Traffic flows reduce on SH20 northbound mainline with around 125vph exiting on to the northbound Neilson Street off-ramp. This traffic uses a variety of local roads through Onehunga. The increase in volume of traffic using this off-ramp is similar to the reduction in flow at the Queenstown Road northbound off-ramp. This indicates that it is largely this traffic which chooses to exit the motorway prior to the restriction in capacity.

There are other minor increase on other traffic re-routes along SH1 northbound and Favona Road towards Great South Road. There is expected to be negligible difference in southbound traffic. In the AM peak period there is little change to traffic flows with the 10% reduction in capacity.

Figure 6-1: Flow Difference Plot between Base Case 10% capacity reduction vs Base Case - PM Peak

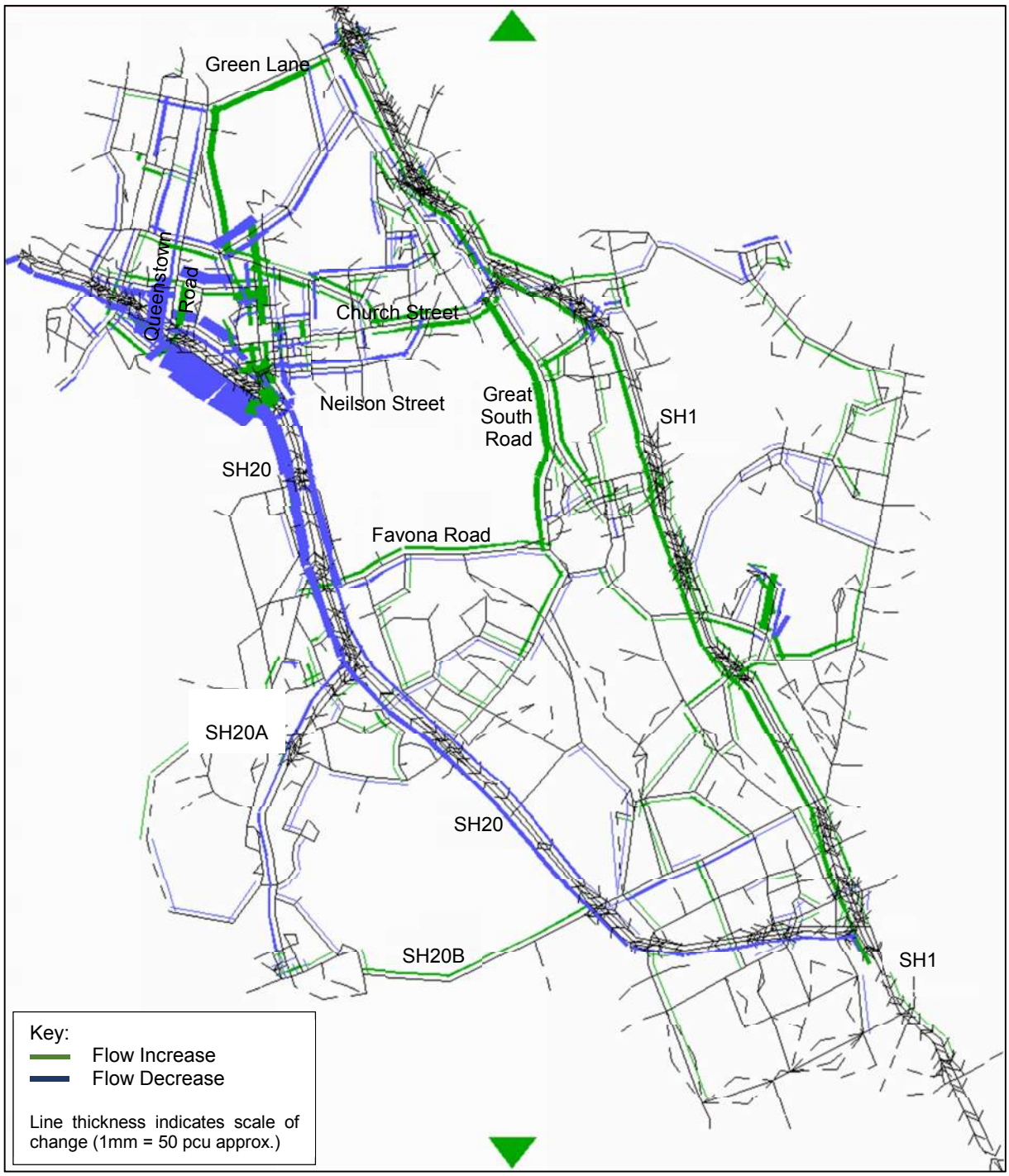
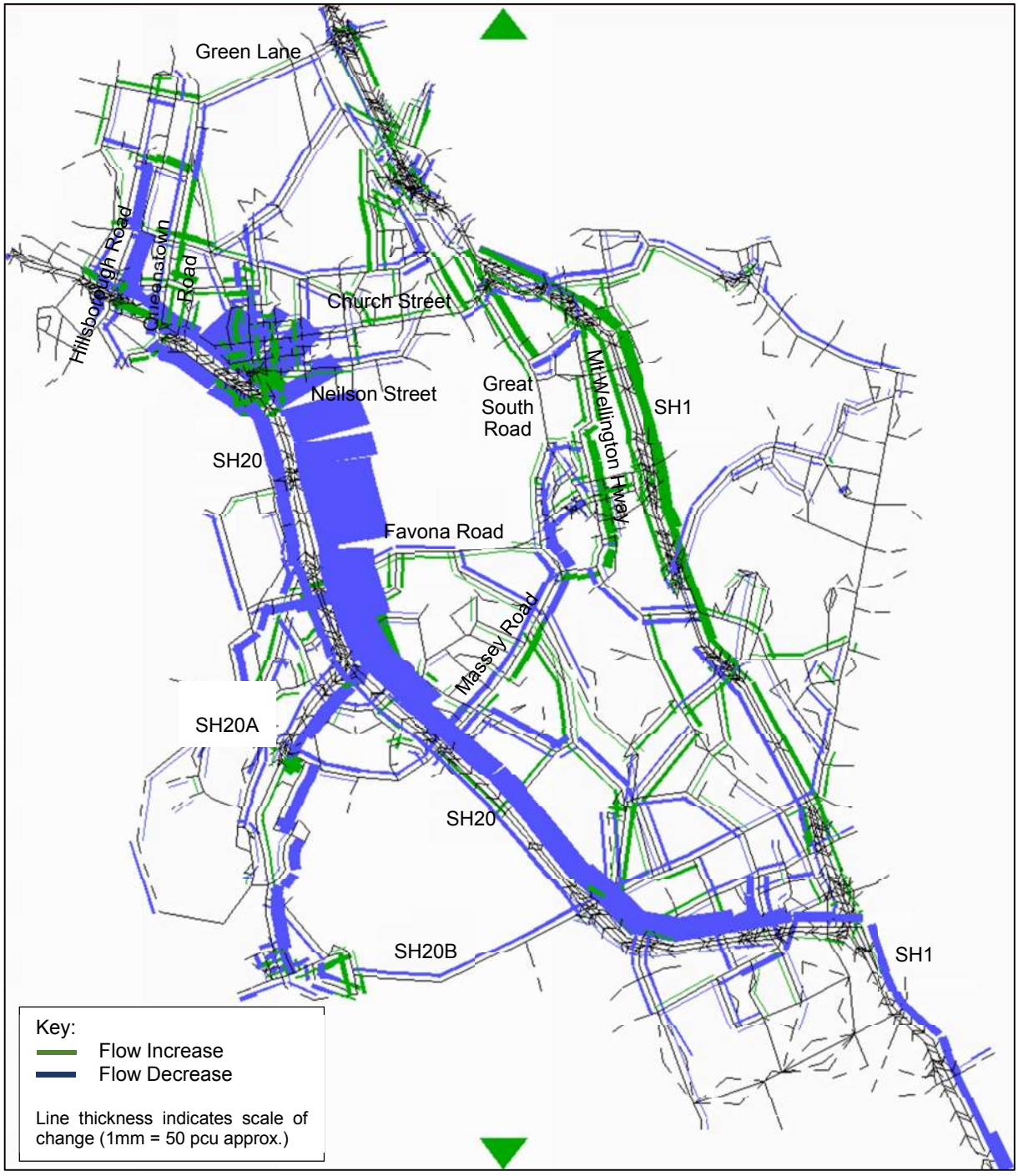


Figure 6-2 and Figure 6-3 below indicate the possible traffic effects during the End of Construction Base Case as a result of a 10% reduction in capacity on SH20 in both directions at the Neilson Street interchange for the AM and PM peaks respectively.

Figure 6-2: Flow Difference Plot between End of Construction Base Case 10% capacity reduction vs End of Construction Base Case – AM Peak

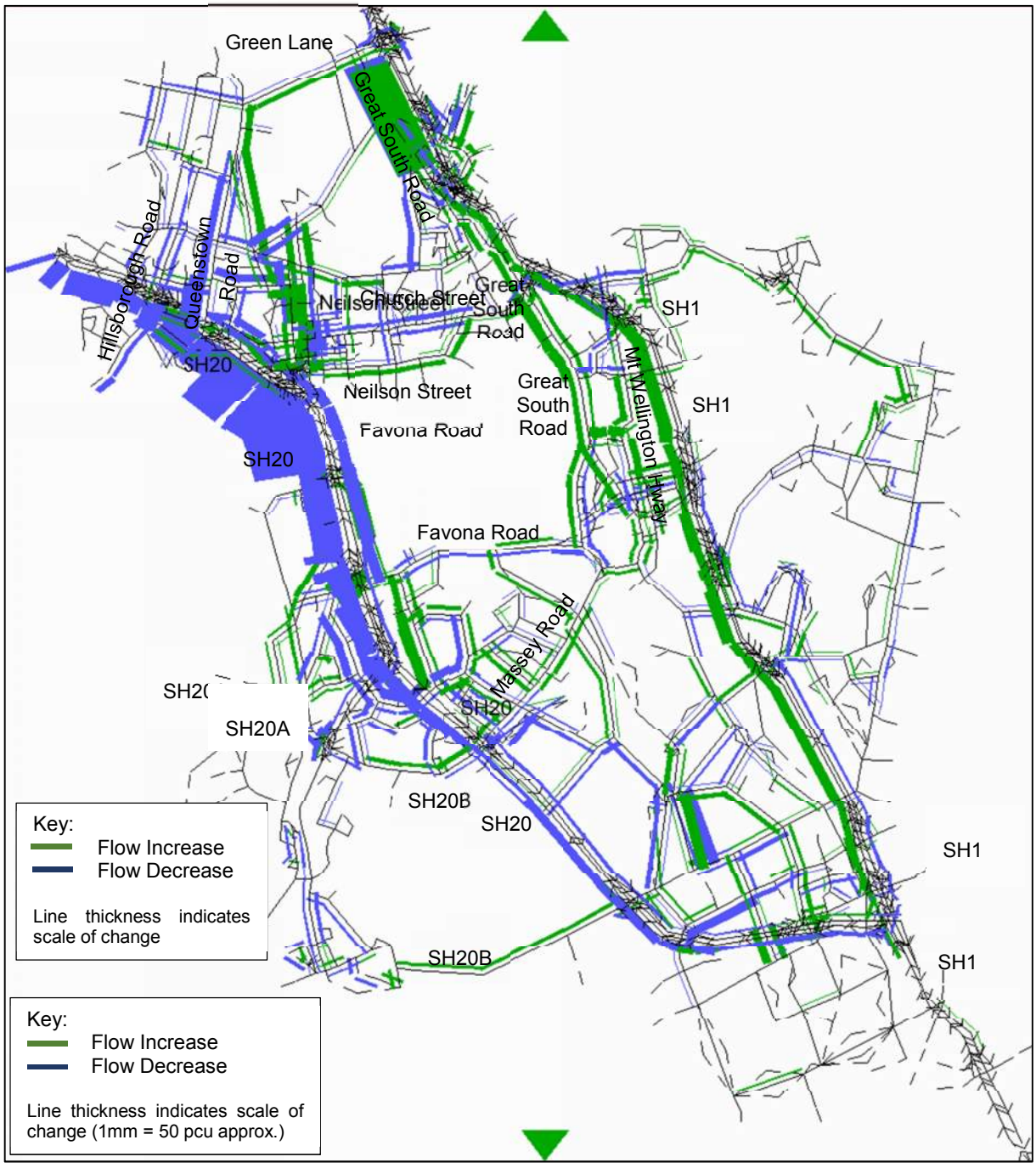


The AM peak figure shows that there is a reduction in southbound traffic on SH20 in the order of 800 vph. This is predominantly south of the southbound Neilson Street off-ramp. Some traffic appears to avoid using the Queenstown Road Interchange and filters through the local roads to use the southbound on-ramp at Neilson Street.

There is some traffic that transfers to SH1 southbound but as indicated by the travel times this does not impact on the operation of SH1.

There is a minor reduction in traffic northbound along SH20 in the order of 130 vph.

Figure 6-3: Flow Difference Plot between End of Construction Base Case 10% capacity reduction vs End of Construction Base – PM Peak



The change in traffic flows in the PM peak period for 10% capacity reduction in the End of Construction year has a similar pattern to the Base Case year but with a more pronounced effect. It is forecast that there would be around 630 vph fewer vehicles travelling northbound on SH20 at Neilson Street. This traffic is spread relatively evenly across SH1 northbound and the local road network between SH20 and SH1.

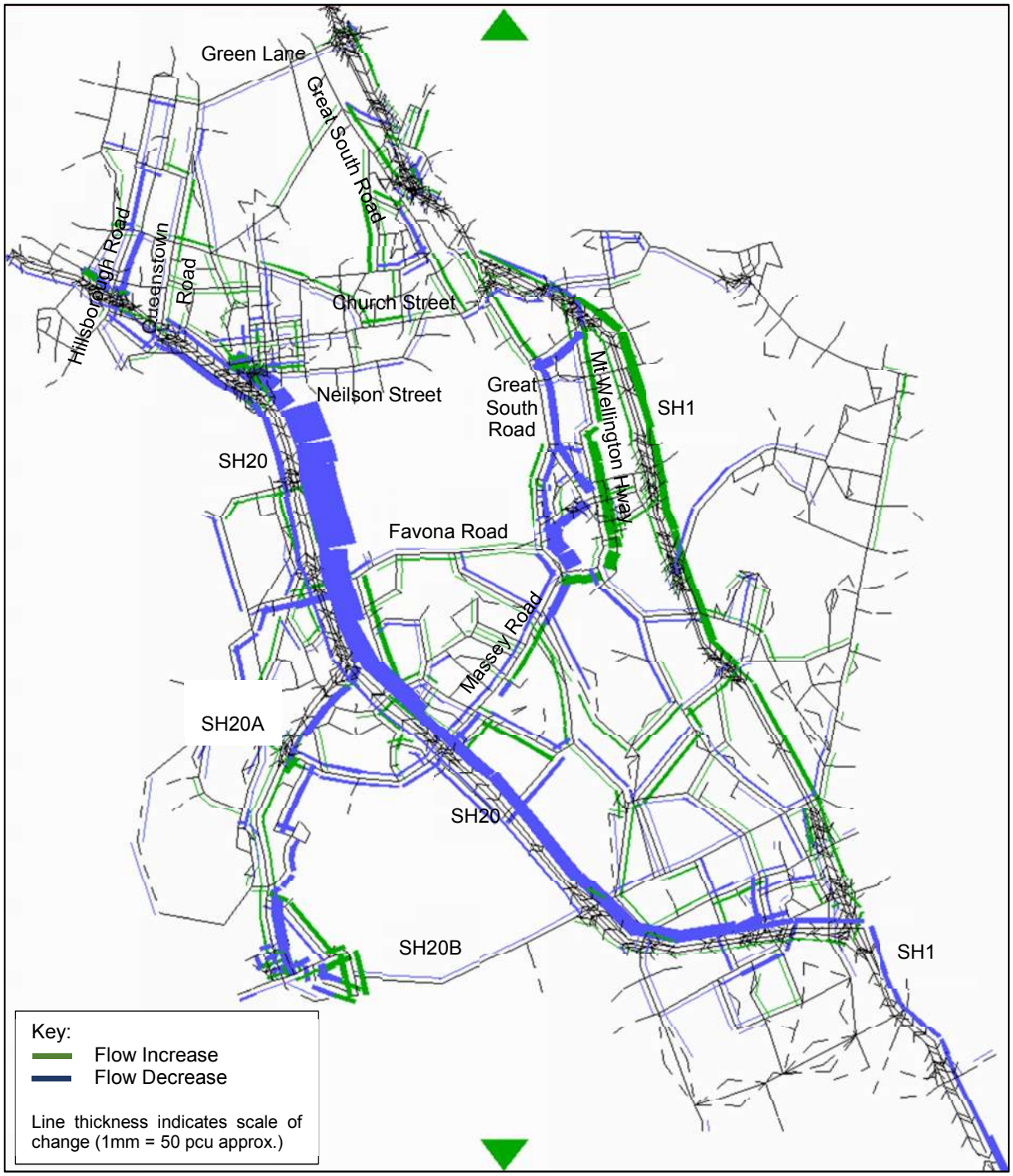
The figure indicates that there is both a significant increase and decrease in traffic flows on the northbound off-ramp at the Green Lane interchange. The indicated changes are as a result of the coding of the traffic model which includes am auxiliary lane and adjacent lane on the ramp. There is

actually no change in the total volume of traffic on the off-ramp; the changes indicated in the figure are due to the model switching flows between the auxiliary lane and adjacent lane on the ramp.

Considering the change in traffic flows in the Base Case with the 5% capacity reduction, there are only nominal changes in flows on SH20 and the wider road network (in the order of 20 vph).

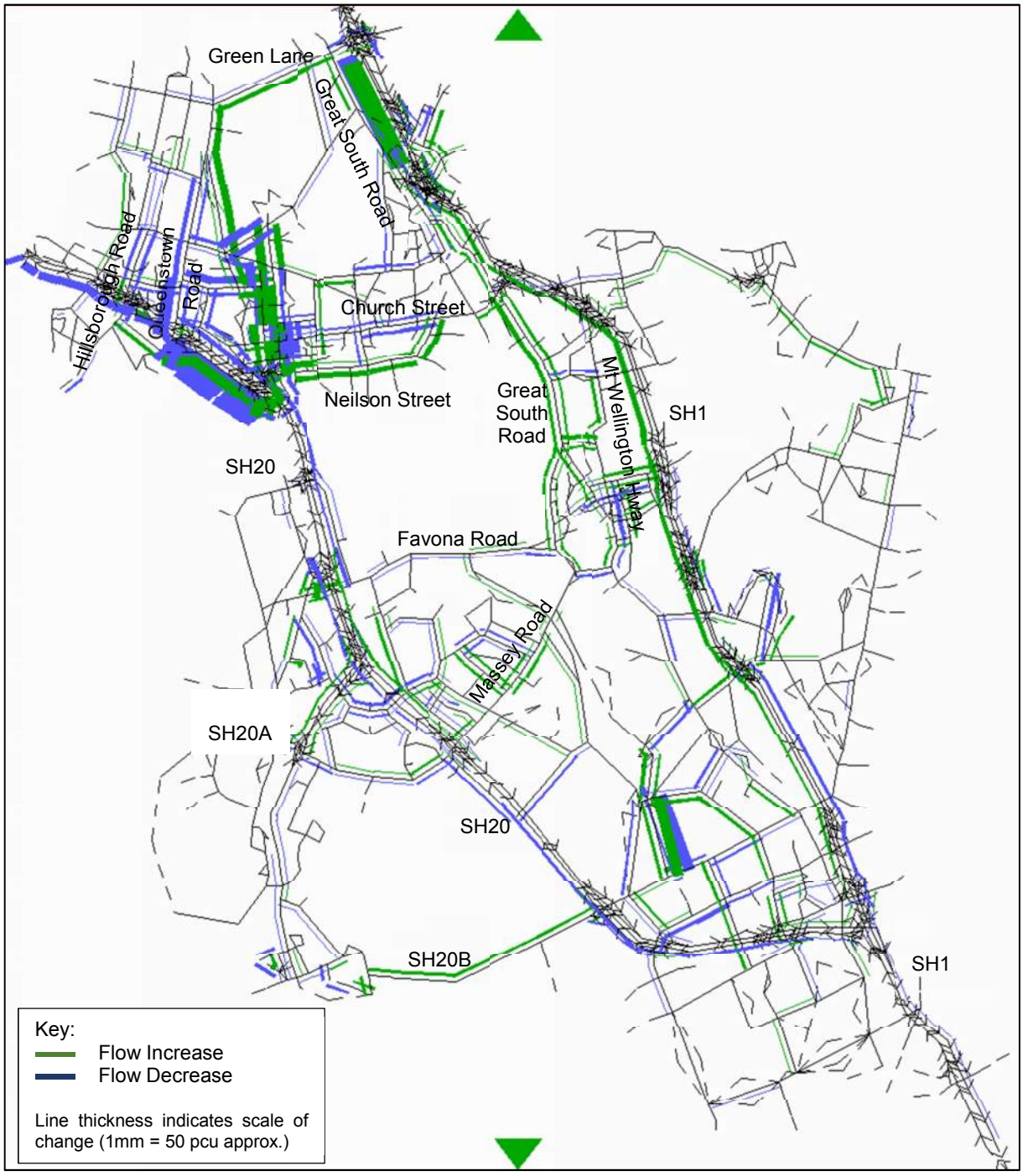
For the End of Construction Base Case with 5% capacity reduction, Figure 6-4 and Figure 6-5 indicates the possible change in traffic flows for the AM and PM peaks respectively.

Figure 6-4: Flow Difference Plot between End of Construction Base Case 5% capacity reduction vs End of Construction Base Case – AM Peak



The 5% capacity reduction on SH20 in the AM peak in the End of Construction Base Case results in similar patterns in changes to traffic flows as the 10% reduction but to a lesser scale (approximately 50%). Southbound traffic on SH20 is forecast to reduce by around 350 vph. There is also an increase in southbound traffic volume on Mount Wellington Highway and SH1 in the order of 35 to 70 vph. The changes in volumes on the various east-west routes to the north of Māngere Inlet resulting are indicated to be negligible.

Figure 6-5: Flow Difference Plot between End of Construction Base Case 5% capacity reduction vs End of Construction Base – PM Peak

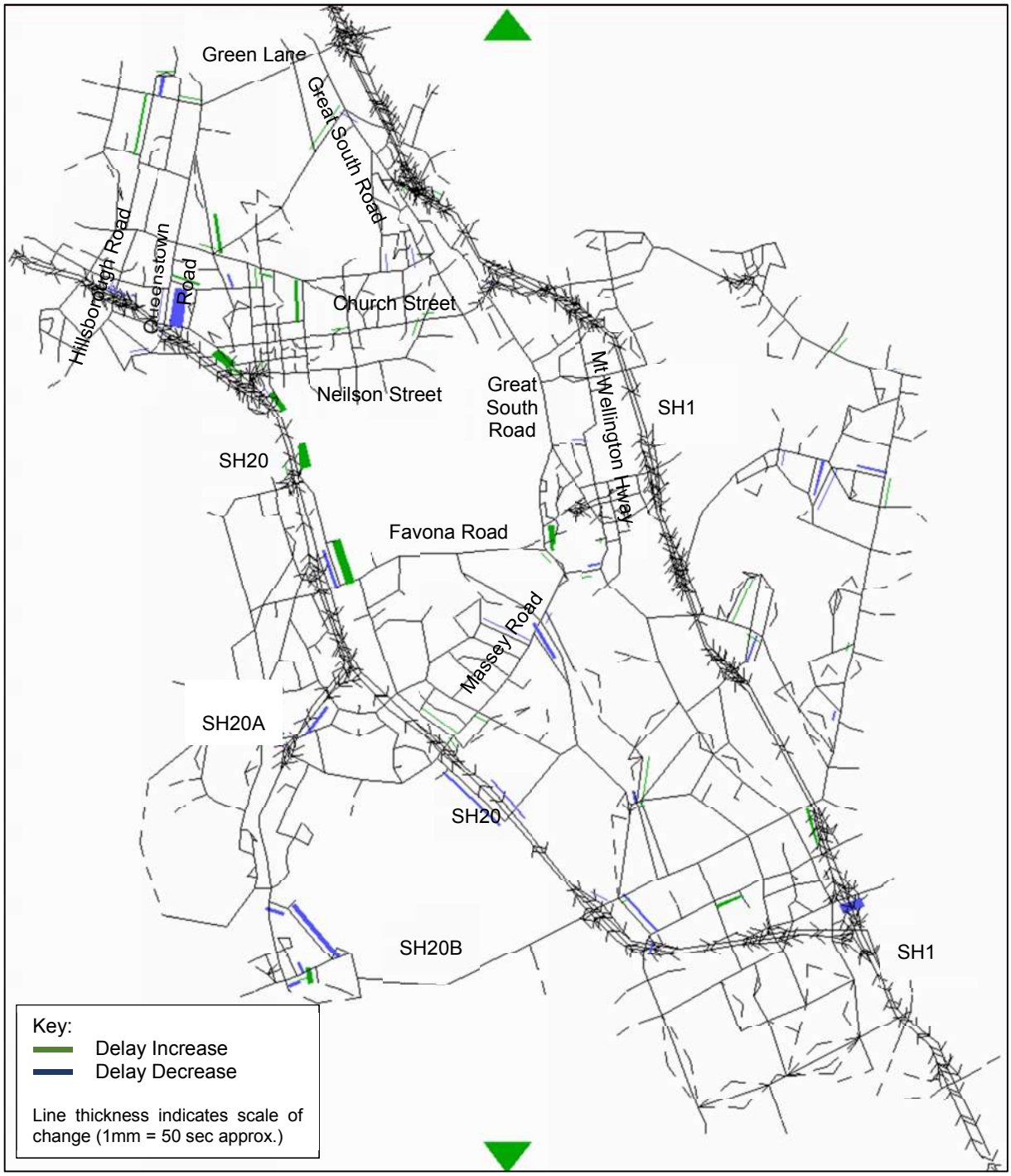


In the PM peak, the 5% reduction in capacity on SH20 has localised effects north of the northbound Neilson Street off-ramp. There is a reduction of around 300 vph on SH20 northbound. Some of this

traffic diverts off the Nielson Street northbound off-ramp and utilises a number of different routes through Onehunga to travel north and to the east along Neilson Street. There is also a minor transfer of traffic from SH20 to SH1 northbound. The increase in flow on SH1 does not adversely affect SH1 travel times.

Forecast changes in delays are presented in Figure 6-6 and Figure 6-7 between the End of Construction Base Case with 5% capacity reduction versus the End of Construction Base.

Figure 6-6: Delay Difference for End of Construction Base Case and 5% capacity reduction End of Construction Base – AM Peak

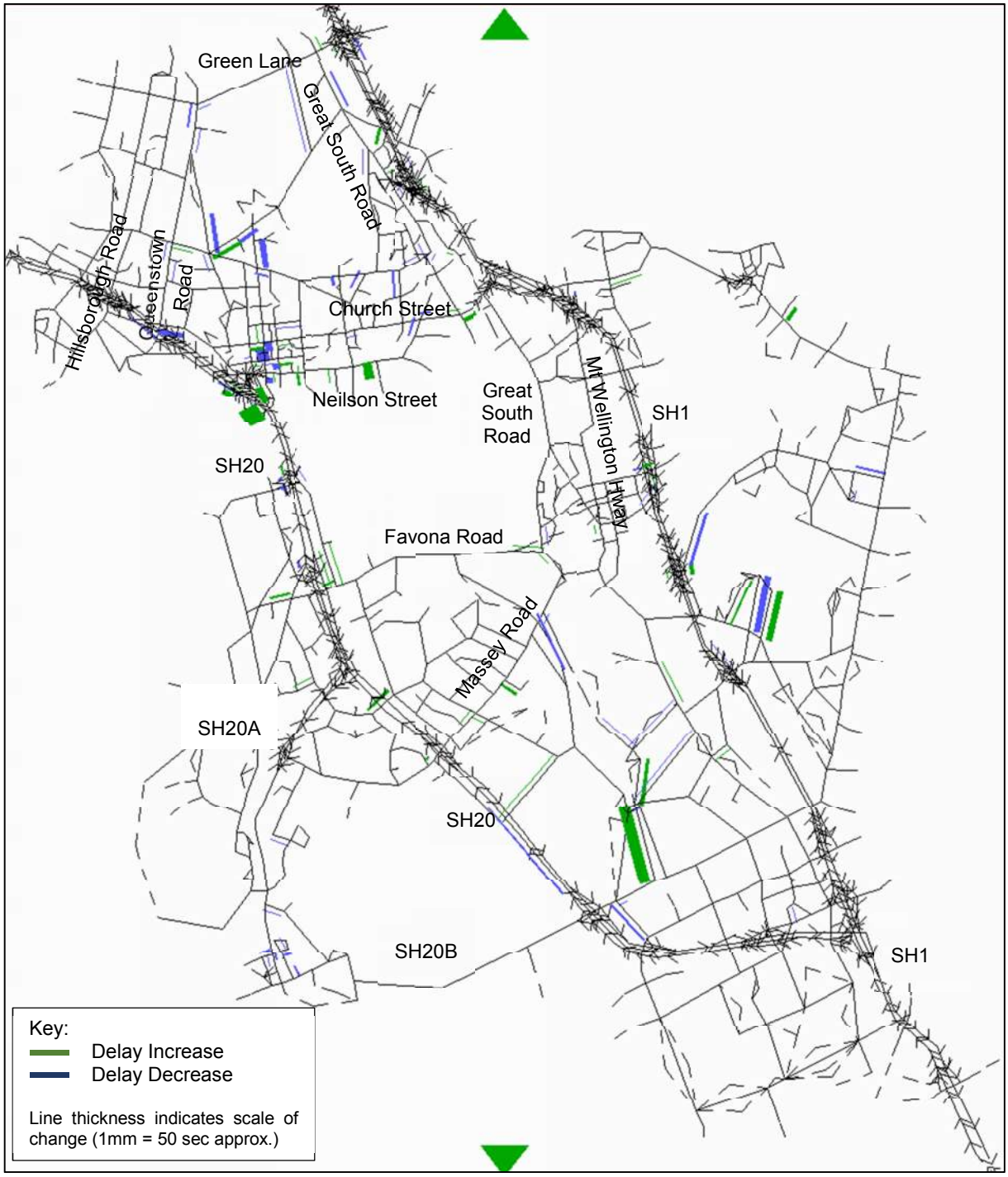


For the AM peak increased delays are forecast at:

- SH20 southbound approach to the area affected by the restricted capacity;
- SH20 in the area around Neilson Street southbound on-ramp merge;
- SH20 at the diverge for the Mahunga Drive southbound off-ramp; and
- Mahunga Drive approach to the Favona Road intersection.

The increase in delay on SH20 are connected with approaching the capacity restriction on the mainline or locations where changes to merging or diverging volumes occur.

Figure 6-7: Delay Difference for End of Construction Base Case and 5% capacity reduction End of Construction Base – PM Peak



In the PM peak delay is experienced only locally to the capacity reduction on SH20, namely SH20 main line northbound approach to Neilson Street and on the northbound Neilson Street off-ramp.

This assessment shows that the later works occur on SH20, the greater the impact on travel times, traffic flows and delays. As the works in Sector 1 will facilitate access to works in Sector 2, it is likely that Sector 1 construction works will occur closer to the commencement year (2018) rather than towards the end of construction (2026). Therefore, the impact of the reduction in capacity on SH20 is more likely to be towards the lower end of the forecast changes outline above.

6.2.1.2 Impacts at Neilson Street Interchange Ramps

For the construction of the proposed Neilson Street Interchange ramps (southbound on and off-ramps, and northbound on and off-ramps), construction activities will require shoulder narrowing/closure, lane narrowing, temporary realignment and the introduction of temporary speed limit.

It is anticipated that all four existing ramps will remain largely fully operational to traffic during construction. Discrete night time closures are likely to be required for activities which cannot be completed during the day time and this is further discussed in Section 6.2.2.

Temporary realignment of the ramps, lane narrowing and temporary speed limit are anticipated to affect these ramps over a short distance. The anticipated impacts to traffic are likely to be subtle and minor in comparison with those impacts where the same measures are applied on SH20 over a longer distance.

As discussed in Section 6.2.1.1 the reduction in capacity on SH20 mainline due to construction works will result in the diversion of traffic. This will affect the northbound off-ramp with traffic diverting off the motorway onto the local road network, particularly in the PM peak period. Forecast increases in traffic volumes of around 125 vph are forecast. Works on the off-ramp and the southern end of Onehunga Mall on the approach to Neilson Street will need to consider these potential increases in traffic volumes.

6.2.2 Impacts arising from temporary closures

6.2.2.1 Lane Closures

It is expected that a number of lane closures on SH20 and on the Neilson Street ramps will be necessary to facilitate construction works for the Project. These activities may require one or multiple lanes closed at any one time. Lane closure will typically be implemented at night following easing of traffic demands after the PM peak.

Lane closures will be planned by the Transport Agency's appointed contractor so that traffic demands can be accommodated by the remaining capacity following the closure of lanes.

COPTTM describes that lanes with a closure require a capacity of 1,500 vph, and that a lane into which two lanes have merged upstream requires a capacity of 1,300 vph. This means that a single lane closure on a two lane motorway will require a capacity of 1,300 vph (as two lanes merge to one), while a single lane closure on a three lane motorway will require a capacity of 2,800 vph (as two lanes merge to one = 1,300 vph + one unaffected lane = 1,500 vph = 2,800 vph total capacity).

This approach based on COPTTM capacities and traffic flow profiles will be used in development of SSTMPs in accordance with the CTMP. Where sufficient data is available, 85th percentile flows will be used in determining the appropriate time for the closure. By using the above approach, the traffic impacts arising from lane closures are expected to be minimal as there would be sufficient capacity remaining on the carriageway for the traffic demands. If closure times were necessary for longer periods, a greater level of analysis would be required and this would be conducted in consultation with project stakeholders and in accordance with the processes outlined in the CTMP.

6.2.2.2 Detour Routes

In addition to the lane closures, full motorway or on/off-ramp closures are also expected for construction activities such as placing EWL bridge beams over SH20, temporary tie-ins at ramps and pavement construction. As discussed above, the timing of the closure would be assessed with reference to the COPTTM capacities and flow profiles so that affected traffic can be accommodated on SH20 and on the available detour routes. Such closures are anticipated to be required only occasionally and generally only for a short duration, such as overnight.

Table 6-3 details detour routes that are anticipated as a result of closures to SH20 ramps. These detour routes will need to be agreed with the appropriate Road Controlling Authorities in accordance with the procedures outlined in the CTMP. Closure of the SH20 mainline would require significant

detour routes due to limitations in alternative routes across the Māngere Inlet. Possible routes would need detail planning with the appropriate RCA and assessment of potential traffic impacts to determine appropriate timing and effects. The on and off-ramps are unlikely to be able to be used as part of the diversion as these are likely to be required to be closed at the same time as the mainline. The assessment and agreement of routes would be determined using the processes described in the CTMP.

Table 6-3: Potential SH20 Detour Routes

Location of closure	Possible Detour Route
Neilson Street northbound on-ramp	Selwyn Street, Princes Street, Beachcroft Avenue, Queenstown Road
Neilson Street northbound off-ramp	SH20 northbound to Queenstown Road Interchange, Queenstown Road, SH20 southbound, Neilson Street southbound off-ramp
Neilson Street southbound on-ramp	Selwyn Street, Princes Street, Beachcroft Avenue, Queenstown Road, SH20 southbound
Neilson Street southbound off-ramp	SH20 southbound, Mahunga Drive southbound off-ramp, Rimu Road / Mahunga Drive northbound on-ramp, SH20 Neilson Street northbound off-ramp

SSTMPs will be prepared for individual closures which will identify appropriate times for closures to occur depending upon traffic flows. These closures are likely to occur at night.

6.2.2.3 Impacts on Onehunga Harbour Road

Access to Onehunga Harbour Road will be maintained for the most part. It is expected that some property access may be affected, however these are likely to be managed by the processes outlined in the CTMP. Property access on Onehunga Harbour Road is discussed in Section 6.2.5.

6.2.3 Impacts arising from construction vehicles that access the site

Site access movements may affect traffic capacity and safety on SH20 and local roads. Therefore, restrictions may be placed on the management of the site access, which could include restriction of the types of vehicles that are permitted to use the access during peak periods.

The site access points for each zone will be positioned on the local road network where possible. Site access points on SH20 will not be in operation during peak hours. Where safe acceleration and deceleration lanes cannot be provided for site access points on SH20, temporary lane closures will be installed outside of peak traffic periods to provide acceleration and deceleration lengths. The site access points will be located in accordance with COPTTM where possible.

Site access points will also be located on Onehunga Harbour Road and Galway Street.

6.2.4 Impacts on pedestrian and cyclists

It is expected that the existing link between Māngere Bridge cycleway and Orpheus Drive footpath will be maintained and therefore there are not likely to be significant impacts on pedestrians and cyclists within this sector. With the current connection between the Onehunga Foreshore and Old Māngere Bridge/Manukau Harbour Crossing being the only available route, it will be important that these link remain open at all times. The same is required for pedestrian and cycle access from Onehunga Mall Road and the Manukau Harbour Crossing.

6.2.5 Impacts on Property Access

The following summarises the key properties / roads where access may be affected from the construction works in Sector 1 and the relative impact on the operation of the access from a traffic perspective. Where access to properties are affected, this will be discussed with the property owners in accordance with the procedures in the CTMP.

Manukau Cruising Club – moderate impact

- The southern end of Orpheus Drive is likely to be temporarily closed during the construction of the Neilson Street northbound on-ramp and off-ramp. Vehicular access to the Manukau Cruising Club can be gained from the northern end of Orpheus Drive (via Seacliffe Road); and
- The pedestrian and cycle connection will be maintained via a temporary shared path provided at the southern end of the shared path.

Sea Scouts Building – low impact

- Access to the Sea Scouts building accessed off the westbound lanes off Orpheus drive will be maintained.

Gloucester Park Road, Neilson Street intersection – low impact

- The western side of Gloucester Park Road (currently the Storage King Onehunga) will be acquired for the construction laydown and the realignment of Gloucester Park Road and therefore access will not need to be maintained to this property;
- Access to properties (10, 12,14,18,20 Gloucester Park Road) alongside the eastern side of Gloucester Park Road is likely to be maintained. A northbound exit lane is to be provided on the realigned Gloucester Park Road to maintain the exit from these properties towards Neilson Street; and
- The existing Neilson Street and Gloucester Park Road intersection will be reconfigured during construction. Property access (37, 35, 33, 31 Neilson Street) is likely to be maintained during construction.

The Landing – moderate impact

- The Landing is currently accessed from the existing Onehunga Harbour Road eastbound near;
- A temporary road will be built adjacent to the existing eastbound lanes. This will allow for access into The Landing for eastbound traffic only;
- Both The Landing and the Airport Harbour View motel are currently accessed via Onehunga Harbour Road. Onehunga Harbour Road will be realigned during construction and a temporary access to both affected properties will be maintained; and
- The car parking at The Landing and the Airport Harbour View motel is impacted as some parking will be acquired for the construction of the new Onehunga Harbour Road. Mitigation of the loss of car parking would be addressed as part of the property acquisition.

Properties on Onehunga Harbour Road – low impact

- All properties on Onehunga Harbour Road (north of Onehunga Mall) will have their access maintained during construction.

Onehunga Mall Road – low impact

- The existing lane arrangement on Onehunga Mall Road will be maintained. Construction activities will involve mainly road marking activities. This will allow property access into the properties along Onehunga Mall to be maintained.

Onehunga Wharf – low impact

- Portions of the existing Onehunga Wharf will be acquired for construction of the EWL trench and will be used as a construction compound; and
- The access to the Onehunga Wharf will be maintained during construction. The access may need to be relocated slightly to the north. This temporary access is likely to be shared with the construction traffic access to the compound.

Galway Street– low impact

- Construction works at the proposed Galway Link will involve road widening. Access to affected properties will be maintained during construction; and
- The southern end of Galway Street will be extended to form a new link to the EWL. The affected property will be acquired for the construction of this new road.

6.3 Potential Mitigation Requirements

This section proposes a possible suite of mitigation measures that could be implemented to minimise the traffic effects of construction activities on SH20. As the full impacts of the necessary traffic management measures will not be known until the SSTMP planning and development stage, the appropriate mitigation strategies as indicated below will be developed in line with the CTMP and agreed with stakeholders and the appropriate road controlling authority.

Potential mitigation measures for minimising the effects of the works on SH20 could include:

1) Careful coordination and planning of the Construction Programme. As identified, there is significant traffic growth anticipated between 2016 and 2026. Therefore the earlier the works can be carried out on SH20 the lower the effect on SH20 and surrounding road network. As SH1 could be a key corridor to support some of the diverted traffic from SH20 whilst temporary traffic management measures are deployed on SH20 (and vice-versa), careful planning of the Construction Programme between SH20 and SH1 works will be required. This will need to be considered in the early phases of procurement planning to ensure the feasibility of this is not precluded;
2) Use of VMS messaging on SH20 in advance of significant changes to the road layout or capacity. These will warn motorists of upcoming changes or of altered layouts thereby enable them to plan journeys and be aware of new road layouts. This will improve safety and allow motorists to use alternative routes if necessary;
3) Optimisation of alternative routes or detour routes to minimise the overall network delay caused by the works on SH20;
4) Implementation of Point-to-Point Speed Enforcement (PPSE) on SH20 to improve compliance with lowered speed limits. Implementation of PPSE internationally has shown significant safety benefits for construction sites, with an extremely high proportion of vehicles adhering to the speed limit following implementation, leading to a safer and more reliable road environment;
5) Close liaison with passenger transport agencies and operators to minimise the impact of traffic management measures on passenger transport services. Development of appropriate mitigation measures may include additional services, refinement of timetables and dissemination of passenger information;
6) Close liaison with major traffic generating activities and sites and sensitive stakeholders in the area, for example the Ports of Auckland, Auckland International Airport and Dress Smart;
7) Communication campaigns aimed at diverting traffic onto alternative routes and minimising the level of demand through the project area and construction period; and
8) Integration with employer travel plans to recommend alternative routes, modes or travel times to minimise the demand on the road network.

7 Sector 2

Sector 2 covers the works along the foreshore of the Māngere Inlet from just east of the proposed Galway Street intersection to Ports of Auckland. Connections are proposed at Captain Springs Road and Ports Link.

7.1 Indicative Traffic Management Measures

The construction of the embankment alongside the Māngere Inlet will comprise of fill material that is envisaged to be provided through a combination of dredging from the harbour and imported material.

The two proposed construction yards in this Sector are located south of Waikaraka Park (accessed from the western side of Captain Springs Road) and within the wharf (accessed from Onehunga Harbour Road as identified for Sector 1). These will serve as the primary lay-down areas for site staff and delivery drop-offs.

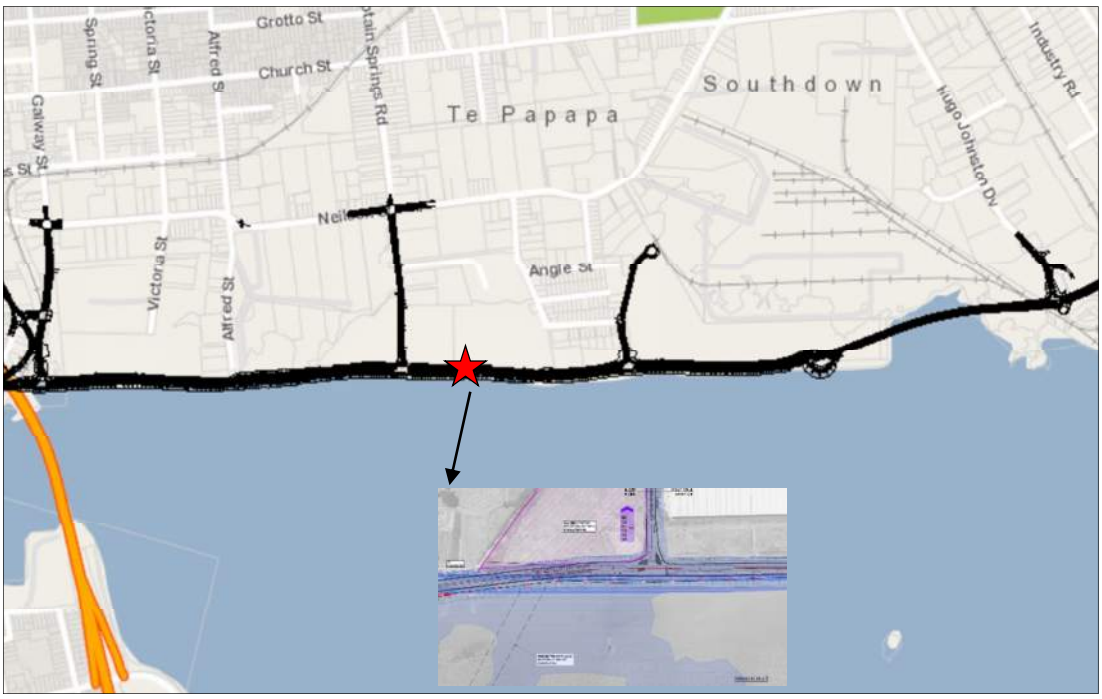
Access will also be generally available from side roads off Neilson Street (e.g. Alfred Street, Captain Springs Road and Angle Street) to certain areas of the project work area. The Galway Street link is likely to be built early as part of the Sector 1 works. Once this is constructed, it could potentially become an alternative construction access connecting to Neilson Street.

The Waikaraka cycleway facility which currently runs along the foreshore will likely need to be closed for some duration during construction; this will be dependent on the actual construction methodology. This currently connects between Orpheus Drive in the west and Hugo Johnston Drive in the east.

The Sector 2 construction is largely undertaken away from the existing road network. As a result, the construction activities are not expected to impact on capacity nor require temporary road closures on the adjacent road network. Measures that restrict parking or affect property access may be required.

The location of the site compound at Waikaraka Park is shown in Figure 7-1.

Figure 7-1 - Location of Site Compound - Sector 2



7.2 Identification and Mitigation of Traffic Impacts

Traffic impacts arising as a result of the Sector 2 works are listed in this section, and appropriate mitigation measures are proposed where possible. Note that the full impacts of the necessary traffic management methodology will not be known until the SSTMP planning and development stage, where appropriate mitigation strategies will be developed and agreed with stakeholders and the appropriate road controlling authority.

7.2.1 Impacts arising from site access locations and movements

The embankment along this section will be constructed using fill material. The construction yards that are proposed to service Sector 2 are:

1) The construction yard by the Wharf located in Sector 1 at the western end of this section. This will be shared for construction with Sector 1 works. It will be a secondary lay-down area for construction along the western end of the reclamation. Main access to this yard will be gained from Onehunga Harbour Road; and

2) Proposed construction yard located to the south of Waikaraka Park on the western side of Captain Springs Road. This will be accessed off Captain Springs Road. This yard falls across the boundary into Sector 6.

Access to the yard at Waikaraka Park will require the removal of some parking on Captain Springs Road. Parking surveys show that parking demand at the southern end of the street is lower than the other parts of the street. Therefore, it is anticipated that the displaced parking can be accommodated on Captain Springs Road.

With the proposed combination of dredging and import of fill, the number of truck movements to and from the site is expected to be significantly less than compared to all fill materials being imported to site via the adjacent road network.

At this stage it is estimated that the construction of the embankment will likely require 110 truck movements per day (55 movements in and 55 movements out). It is expected that most of these truck movements can take place during off-peak periods when the surrounding road network would have greater spare capacity compared to that in the peak periods and that truck movements would be spread across a number of accesses into the Sector.

7.2.2 Impacts on public transport provision

Public transport is not directly affected by the proposed works in Sector 2.

7.2.3 Impacts arising from the closure of Waikaraka cycleway

In order to construct the embankment along the Inlet, the Waikaraka cycleway is likely to be closed during construction. This is an important link connecting Onehunga to Māngere Bridge and Ambury Farm Park and is used by both cyclists and pedestrians. Based on the recent traffic survey counts, the cycleway features the following user patterns:

1. Approximately 55 cyclists with approximately 84% estimated as commuter trips during a weekday;

2. Approximately 36 pedestrians with approximately 70% estimated as commuter trips during a weekday; and

3. Approximately 250 cyclists and 135 pedestrians per day estimated during a weekend (Sunday) with the majority anticipated being recreational.

It is worth noting that the exact number of users is likely to vary from day to day and higher user numbers are expected in the summer months. The cyclist count information obtained from the AT's website suggests that there were approximately 75 cyclists on the Waikaraka cycleway in March 2016, which is slightly higher than the counts obtained from the manual surveys.

With the closure of the Waikaraka cycleway, commuter pedestrians and cyclists are expected to use Orpheus Drive and the pedestrian motorway over-bridge as an alternative route to connect from Manukau Harbour to Onehunga. Pedestrians and cyclists will then be able to navigate through the Onehunga local roads to as far as Church Street / Hugo Johnston Drive and vice versa to travel to and from their destinations / origins. It is acknowledged that Neilson Street is not a safe alternative corridor and should therefore not be promoted. The nature of the alternative corridor and the surrounding land use is less cycle / pedestrian friendly as there will not be dedicated facilities. The proposed utilisation of a greater proportion of residential area through Onehunga compared with the industrial corridor on Neilson Street offers a safer alternative. The primary exception will be the section of Church Street between Neilson Street and Hugo Johnston Drive where there are four lanes of traffic and a higher proportion of heavy vehicles. The availability of a wide median in this area could see a potential solution for evaluating possible cycle lanes here. This would need to be further considered in greater detail.

For recreational users, the closure of Waikaraka cycleway (between Onehunga Harbour Road and Hugo Johnston Drive) may make them switch to other facilities such as the Ambury Farm Park side of the Waikaraka cycleway, the nearby Onehunga Foreshore along Orpheus Drive, and the cycleway / shared path alongside SH20 as part of the Airport to CBD National Cycle Trail. It is anticipated that they are unlikely to walk or cycle using the alternative walking and cycling corridor on the surrounding streets.

While it is identified that the Waikaraka cycleway is to be closed for construction, the full impact of the closure will depend on further understanding the detailed construction staging and programme once developed by the appointed contractor. Where feasible, the contractor is expected to explore opportunities to implement the closure in portions so that localised access can still be maintained to use sections of the shared path. In addition, the duration of the closure shall be made as short as practicable with the path re-opened once construction activities are completed. With the full closure of the Waikaraka cycleway, the mitigation measures should be developed in accordance with the procedures in the CTMP and in consultation with affected stakeholders once the full scope and programme of the construction activities are understood.

7.3 Potential Mitigation Requirements

Potential mitigation measures for minimising the effects of the works in Sector 2 could include:

1. Programming of works shall be carefully planned to minimise the length of any closure period with Waikaraka cycleway and that temporary openings and closures are avoided to minimise confusion for users;

2. Early notification and consultation with affected pedestrians and cyclists should be undertaken so that affected users can plan their trips and consider other modes of transport where necessary;

3. Separate media campaigns should be devised to address the needs of recreational and commuter cyclists. Campaigns could include informing recreational cyclists of options for alternative facilities and providing commuter cyclists information about possible alternative routes;

4. Safe alternative route(s) for commuter cyclists through the Onehunga area should be investigated and minor safety improvement works considered, if necessary, if the Waikaraka cycleway facility is to be closed for a significant period of time. This includes the consideration of the section of Church Street between Neilson Street and Hugo Johnston Drive. This may include the temporary removal of parking on Church Street;

5. Truck movements to site for the importation of fill material could be spread across the various site access points to this Sector; and

8 Sector 3

This sector extends from Ports of Auckland to just east of the Great South Road / Sylvia Park Road intersection.

8.1 Preliminary Traffic Management Methodology

The majority of the construction activity for this sector is isolated away from the road traffic network and will have negligible traffic impact. The intersection of Great South Road and Sylvia Park Road will be the exception. It is assumed that as the proposed intersection footprint increases compared to the existing intersection, much of this can be constructed offline. However, lane widths may need to be narrowed and temporary speed limits applied for safety and to maximise the possible work area. As widening works at the intersection are completed, this provides flexibility to adjust lane locations to facilitate further pavement or utilities works. Temporary intersection arrangements are typically coordinated with the Auckland Traffic Operations Centre (ATOC) and AT as the RCA. No long term closures of intersection movements are anticipated.

There are four construction yards proposed for this sector which are illustrated in **Figure 8-1** and these will be located as described below:

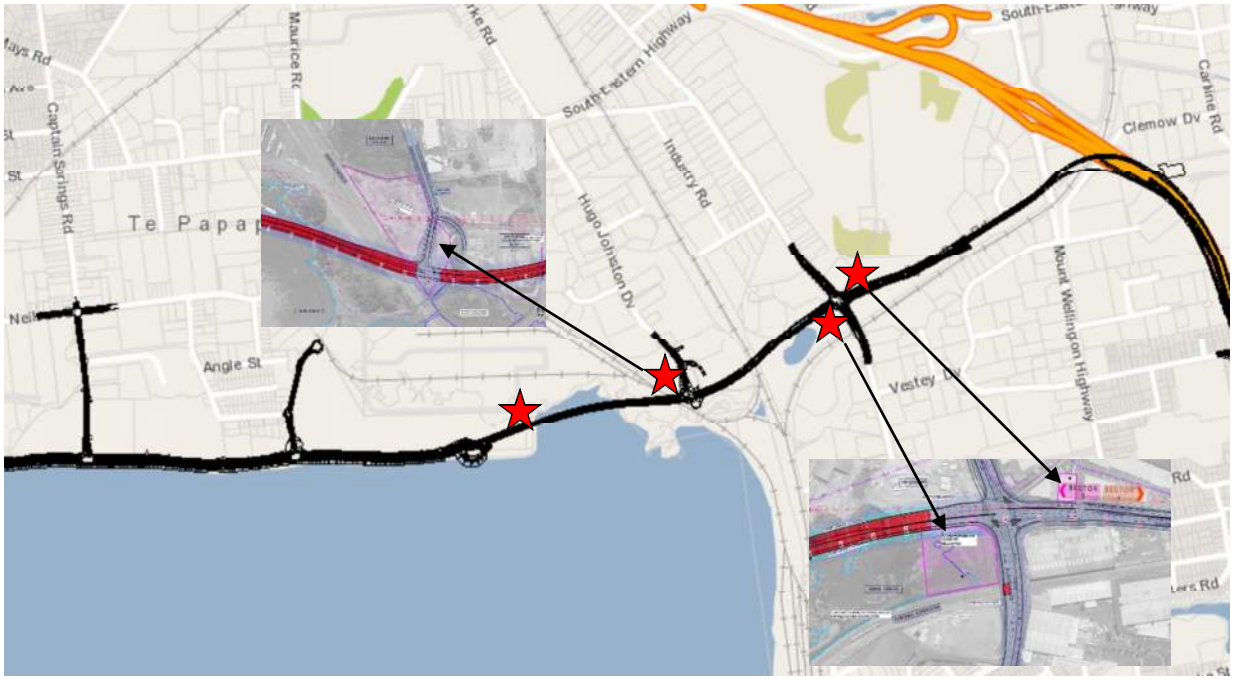
1. In the south east corner of the Port of Auckland land by Anns Creek.

2. At the end of Hugo Johnston Drive and will be used for the majority of work that will take place at Anns Creek.

3. West of the intersection of Great South Road and Sylvia Park Road (where the fourth arm of the intersection is being constructed). Access restrictions may be applied to manage vehicle movements into and out of Great South Road.

4. North of Sylvia Park Road east of the Great South Road / Sylvia Park Road intersection. Access restrictions may be applied to manage vehicle movements into and out from this yard.

Figure 8-1: Location of Site Compound - Sector 3



8.2 Identification and Mitigation of Traffic Impacts

8.2.1 Impacts arising from site access locations and movements

The construction yard in the Ports of Auckland land will be used to construct the embankment and the structures across Anns Creek. Access will be gained via the Port Link and along the embankment.

The construction yard at Hugo Johnston Drive will provide direct access to the construction activities for Sector 2 and 3. Access to the wider road network would be via Hugo Johnston Drive which is currently utilised by heavy vehicles servicing various industrial activities.

Access to the construction yard to the south west of the Great South Road / Sylvia Park Road intersection is anticipated to be gained from this intersection. This may include introducing an additional phase into the traffic signals to accommodate construction related vehicular movements. This access may need to be managed to reduce the effect on the operation of this intersection, particularly at peak times of day.

The construction yard on Sylvia Park Road is accessed from Sylvia Park Road. The form of this access will be dependent on the construction staging of EWL in this location. Consideration of restricting turning movements to and from the yard should be given in the detailed planning phase for the safe operation of Sylvia Park Road.

Part of the construction of the alignment involves the creation of a bridge structure over the KiwiRail corridor. Therefore access to the KiwiRail corridor will be required to undertake construction of the overhead bridge structures. It is expected that access will be requested via the standard KiwiRail procedures. Early engagement with KiwiRail and MetroPort will be required to ensure access to the rail corridor can be achieved, including any rail blockades needed for the safe construction of the structures over the rail corridor.

Access into Anns Creek will be required for construction of the bridge structure.

8.2.2 Impacts arising from lane closures at the Sylvia Park Road / Great South Road Intersection

For the expansion of the Sylvia Park and Great South Road intersection, it is expected that a number of temporary layouts will be required to build the outer portion of the intersection. The existing number of lanes and movements should be maintained. The temporary layouts are likely to include narrowing lane widths and temporarily removing the free left turn slip lanes during off-peak periods and enabling the left turn movement through the signalised lanes.

The impact of these changes are expected to be minor and can be managed upon confirming the construction methodology in conjunction with a more detailed traffic impact assessment at a later time. This assessment will be undertaken in accordance with procedures outlined in the CTMP.

Any changes to the operation of this intersection would need to be discussed and agreed with AT and ATOC. Changes to the intersection may need to be undertaken in stages. To minimise the impact on the operation of the intersection some works may need to be undertaken over weekends or at nights so as to minimise the impact on the operation of the intersection.

8.2.3 Impacts on rail services and public transport

The EWL alignment crosses over freight rail lines servicing MetroPort and passenger lines on the southern rail line at Great South Road. Works across the rail lines can only be undertaken when the lines are not operating. Blockades may need to be in place whilst works occur. This may require weekend closures of the rail lines and introduction of rail replacement bus services for passenger trains. Where works are across the freight line, this will affect the movement of goods to and from MetroPort.

In both cases early engagement with KiwiRail and MetroPort will be required to agreed methods of working and to plan closures well in advance of the works.

With regards to bus services, there are bus routes that use Great South Road, including Frequent Services (Route 32). These services will be affected by proposed works along Great South Road and at the Great South Road intersection with Sylvia Park Road. In planning works at this intersection, the impact on buses need to be considered and if necessary, measures such as bus lanes introduced to protect buses from increased delays.

8.2.4 Impacts on pedestrians and cyclists

Waikaraka cycleway will be required to be closed during the construction of the Sector 3 alignment. The impacts associated with this closure are likely to be similar to those discussed in Section 7.2.3. It is expected that during the construction of Sector 3, only the shared path sections that are affected within Sector 3 will be closed. It is envisaged that cyclists would share the footpath with pedestrians over these sections and continue to use the remaining portion of the cycleway. Appropriate signage would be required where pedestrians and cyclists are required to share.

The pedestrian footpath on the western side of Great South Road at the Sylvia Park Road intersection will be temporarily closed during the construction of the western EWL approach to this intersection. While there are pedestrian crossings on the southern and eastern approaches to the intersection, there are currently no pedestrian facilities on the northern side of the intersection. Consideration will need to be given to introducing a temporary signalised crossing on the northern approach to the intersection during periods when the footpath is closed. Alternatively, a safe route for pedestrians for pedestrians along the western side of the intersection should be maintained. This may necessitate supervision of pedestrians through the area.

8.2.5 Impacts on property access, parking and manoeuvring

The extension of the Hugo Johnston Drive cul-de-sac onto the EWL Main Alignment will affect access into private properties. Temporary access roads may be required for entry into the Southdown Co-Generation Plant. A number of on-street car parks will be removed on Hugo Johnston Drive south of Southpark Place as part of the construction of the road extension. Parking occupancy at the southern end of this street which is most affected by the proposed works is 40%. At the northern end of the street, occupancy is 73%. Therefore, it is considered that there is sufficient alternative parking on this street to accommodate displaced parking.

The Great South Road widening will impact access to private property. Therefore temporary access will be required to these properties. Adequate manoeuvring space will be required through the construction works particularly for truck movements.

A list of properties / roads that could be impacted are detailed below.

Southdown Co-Generation Plant – low impact

The construction of an embankment will be carried out at the existing access road into the Southdown Co-Generation Plant. Property access into the Southdown Co-Generation Plant will be maintained.

Hugo Johnston Drive – low impact

Property access to properties along Hugo Johnston Drive will be maintained. The properties with two points of access into the property may experience full closure of one of the property access ways, if required, while the other access will be maintained. Property access will be maintained to those properties with only one point of access.

Sylvia Park Road/ Great South Road – low impact

- Properties at the Great South Road and Sylvia Park Road intersection that have more than one access driveway into the property, one access point may be closed, if required, while the other accesses will be maintained. Property access will be maintained to those properties with only one point of access;
- Property access into Specialist Wheels & Castors and its adjacent properties will be maintained, however, entry and exit movements will be restricted to allow access only from the eastbound lanes due to the construction of the central median traffic island. This restriction on turning movements is proposed in the final EWL arrangement.

Stratex - low impact

Property access for Stratex will be maintained during road widening activities, however, entry and exit movements will be restricted to the westbound lanes only. This restriction on turning movements is proposed in the final EWL arrangement.

8.3 Potential Mitigation Requirements

Potential mitigation measures for minimising the effects of the works in Sector 3 could include:

1. Measures to mitigate the effects on the Waikaraka cycleway are outlined in Section 7.3;

2. If site access points are established at key locations such as the intersection of Great South Road and Sylvia Park Road, restrictions to work site access should be considered, as required, on movements allowed and times for access and egress so not to adversely affect the road network. The site access point at the Great South Road / Sylvia Park Road intersection may impact on the operation of this intersection and the adjacent network. Restrictions may be required to the proposed site access turning movements permitted at the intersection and / or the times of permitted access to this construction compound;

3. Early engagement will be required with AT and ATOC to discuss amended intersection arrangements and phasing at the Great South Road / Sylvia Park Road intersection. Staging of the amendments to the intersection may be required to minimise effects on the intersection including possible weekend or night works;

4. Alternative provision for pedestrians should be considered to provide a safe route along the western side of Great South Road through the construction area when the existing footpath along Great South Road is closed. If an alternative path cannot be provided, early engagement with AT and ATOC will be required to discuss the provision of an additional signalised pedestrian crossing on the northern arm of the Great South Road / Sylvia Park Road intersection to divert pedestrians;

5. Planning of works and assessment of the operation of the intersection need to consider measures that reduce the impact on buses along Great South Road and through the Sylvia Park Road intersection. Discussions with AT Metro should be undertaken at an early stage to discuss the implications of works at the intersection;

6. Early engagement with property owners and / or tenants should be undertaken where property access is affected to discuss the effects of these works on these property owners and to agree access amendments, either as a temporary or permanent solution; and

7. Parking at the southern end of Hugo Johnston Drive will be temporarily removed by the works which will displace parking. Whilst there appears to be sufficient capacity on the street for parking, advanced notice to motorists and businesses should be provided so that motorists may be able to make alternative arrangements, such as carpooling or using public transport.

9 Sector 4

Sector 4 extends from east of the Great South Road / Sylvia Park Road intersection along Sylvia Park Road to SH1.

9.1 Indicative Traffic Management Measures

The construction of the motorway over bridges connecting Sylvia Park Road and the SH1 Motorway are the primary component of works that has the potential to generate traffic effects.

The staging of the works can generally be differentiated between works on Sylvia Park Road and Mount Wellington Highway and works on SH1 Motorway and the associated ramps.

For Sylvia Park Road, the first stage of works will be to construct the new westbound carriageway offline. Westbound traffic would then be moved from the existing carriageway onto the new carriageway. This will establish a central work area between the existing eastbound carriageway and the new westbound carriageway that can be used for the construction of the bridge piers. There may be some narrow sections on the existing eastbound carriageway which will need particular traffic management measures. This may reduce capacity at the Sylvia Park Road / Mount Wellington Highway intersection, such as removal of one of the right turn lanes and upstream flush median.

For the SH1 works, the general construction methodology will be to construct the bridge piers and then use a gantry crane to build the deck. The temporary traffic effects by any lane width reductions or temporary speeds are covered in Section 10.

For the construction of the EWL bridge ramp superstructure joining SH1, the construction will most likely take place in stages. The first stage will involve the construction of a temporary staging structure in between the SH1 northbound mainline and the SH1 Mount Wellington Highway off-ramp to enable the construction of pile and pier for the bridge above Clemow Drive. Following that, the SH1 southbound mainline will be realigned in order to construct the pile and pier in the middle of the SH1 southbound mainline and SH1 southbound Mount Wellington Highway on-ramp. Stage 3 will involve the construction of the pile and bridge pier next to the SH1 Mount Wellington Highway on-ramp. All other bridge piles and piers can be constructed away from the existing SH1 mainline and ramps thus they do not require changes to the existing SH1 alignment.

The construction staging of the motorway over bridge piers will generally maintain the same number of lanes for the SH1 mainline carriageway and on and off-ramps. Geometric alignments, lane width reductions and temporary speed limits will be necessary to form the required work space.

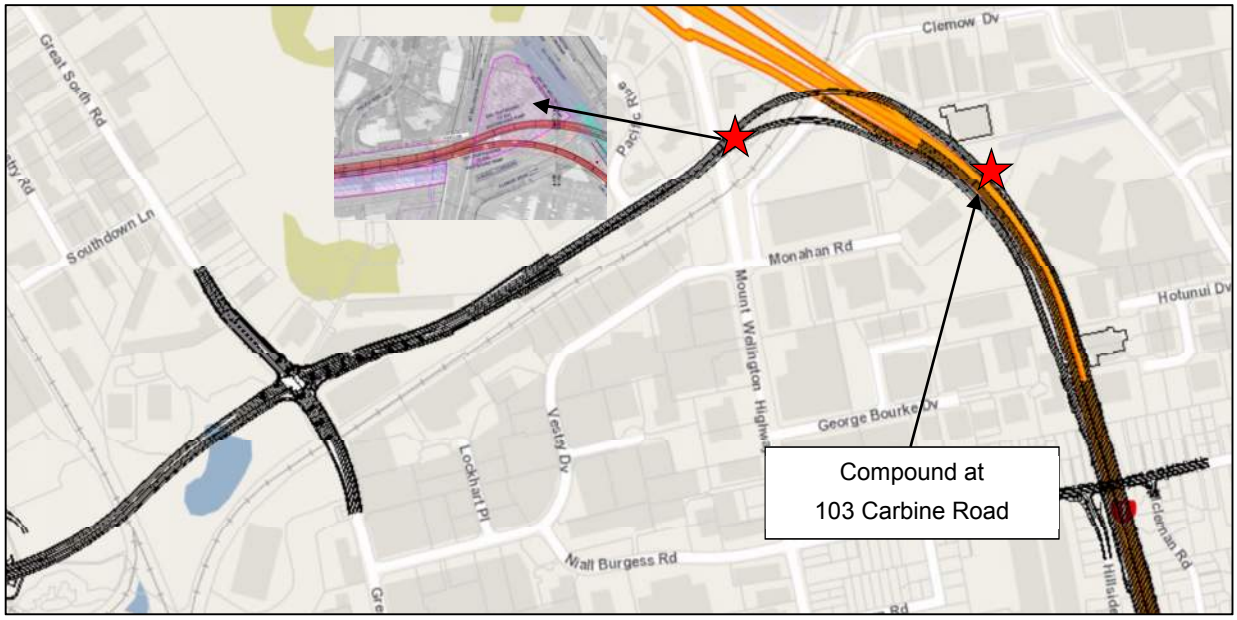
The existing mainline SH1 three northbound lanes that merge to two lanes after the northbound off-ramp will likely need to be removed at some stage so that the third lane would become a dedicated lane for the northbound off-ramp to Mount Wellington Highway northbound off-ramp.

There are two construction yards proposed for this Sector which will be located as described below and illustrated in Figure 9-1:

1. The existing car yard on the eastern side of Mount Wellington Highway opposite Sylvia Park Road at the intersection with Mount Wellington Highway:

2. The other occupies part of the car park at 103 Carbine Road (just south of the Tip Top corner). This property has been acquired for the project. Access will be gained via Carbine Road.

Figure 9-1: Location of Site Compounds – Sector 4



9.2 Identification and Mitigation of Traffic Impacts

Key traffic impacts arising as a result of the Sector 4 works are listed in this section, and appropriate mitigation measures are proposed where possible. Note that the full impacts of the indicated traffic management measures will not be known until the SSTMP planning and development stage, where appropriate mitigation strategies will be developed and agreed with stakeholders and the appropriate road controlling authority. The impacts arising from the realignment of SH1 is discussed in detail for Sector 5 works.

9.2.1 Impacts arising from the temporary work sites

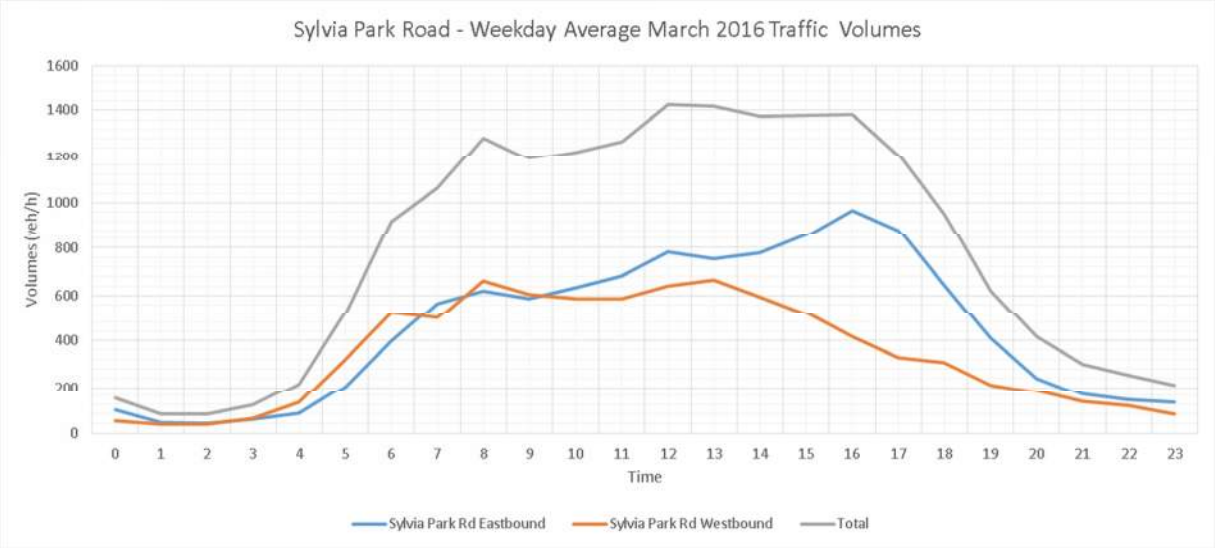
This section discusses the impact arising from temporary work sites on Sylvia Park Road and at the intersection of Sylvia Park Road and Mount Wellington Highway. The potential impacts at the Mount Wellington Highway ramps to SH1 are further discussed as part of the Sector 5 assessment.

9.2.1.1 Impacts on Sylvia Park Road

The western section of Sylvia Park Road is a two lane road with a single traffic lane in each direction. The eastern section generally consists of two traffic lanes in each direction with the eastbound carriageway widening to four lanes approaching the Mount Wellington Highway intersection. The construction staging will likely involve a single westbound lane along the entire length of Sylvia Park Road whilst maintaining the two lanes eastbound. The westbound arrangement is consistent with the final design with a single westbound lane.

The traffic flow profile along Sylvia Park Road is shown in Figure 9-2.

Figure 9-2: Traffic Flow Profile on Sylvia Park Road – March 2016



The figure shows that eastbound flow on Sylvia Park Road peaks around 950 vehicles per hour during the evening whilst the westbound flow has a maximum of flow of around 630 vph which is largely constant through much of the morning. Westbound flows steadily reduce from around 2pm.

It is observed that traffic generally flows well along Sylvia Park Road even in the western section with a single traffic lane in each direction. Queues are observed on Sylvia Park Road in peak periods, in particular during the evening peak, mainly due to the network capacity constraints at the Mount Wellington Highway Interchange with SH1 and the Mount Wellington Highway intersection with Sylvia Park Road as discussed further in Section 9.2.1.2.

The Base Case (2017 DM) traffic model shows that the demands along Sylvia Park Road is largely consistent with the existing demands. A single lane on a collector road generally has a capacity of approximately 1,000 vph. The demand for westbound traffic on Silvia Park Road is less than this single lane capacity and therefore it is expected that traffic would operate in a similar manner to the existing without experiencing additional delays of any note as a result of the proposed construction.

Once properties along the southern side of Sylvia Park Road are cleared during construction, this would provide room between the proposed EWL alignment and the rail corridor boundary. This is likely to be utilised to provide turning bays to Pacific Rise and median buffers to other property accesses along the northern edge without having turning vehicles potentially blocking westbound through traffic.

9.2.1.2 Impacts at Sylvia Park Road/ Mount Wellington Highway intersection

The existing intersection has two distinct peaks with similar levels of demand travelling through the intersection at these times. Operationally, the intersection performance is more critical during the evening peak. Its operation is largely dependent on how the adjacent Mount Wellington Interchange performs as well traffic conditions on SH1.

During the evening peak, the right hand lane (centre lane by the centreline) on Mount Wellington Highway northbound between the motorway interchange and the Sylvia Park Road intersection is constantly queued as a result of the downstream queuing at the southbound on-ramp merge to SH1. The adjacent northbound straight through lanes are sometimes queued but these typically clear within each signal cycle.

The queue on the Mount Wellington Highway centre lane interferes with the Sylvia Park Road approach to Mount Wellington Highway, particularly with Sylvia Park Road left turn queues spilling into the outer

right turn lane of Sylvia Park Road. Mount Wellington Highway northbound is also impeded by the downstream queues.

The other approaches at this intersection generally operate well with only minor queuing observed which clears within each signal cycle. It is noted that one of the southbound right turn lanes on Mount Wellington Highway to Sylvia Park Road is currently under-utilised by traffic and the queue for the adjacent right turn lane extends approximately halfway in between Sylvia Park Road and the Mount Wellington Highway Interchange.

The construction works is likely to have the following changes to the existing intersection layout:

1. Maintain the two left turning lanes from Sylvia Park Road to Mount Wellington Highway

2. Removal of one of the dedicated right turning lanes from Sylvia Park Road to Mount Wellington Highway

3. Reduction to a single right turning lane from Mount Wellington Highway to Sylvia Park Road

4. The Mount Wellington Highway traffic signal limit line on the southern approach is relocated south due to the realignment of the westbound lane on Sylvia Park Road

5. The left turn slip lane from Mount Wellington Highway to Sylvia Park Road may be converted to a signalised left turning lane shared with the through movement

SIDRA modelling was undertaken to assess the operational impact as a result of the proposed intersection layout change. SCATS data dated March 2016 was used as it is largely consistent with the Base Case (2017 DM) model flows with Waterview Connection in place. A base SIDRA model was developed to reflect the existing layout, utilising SCATS cycle times and was validated using site queue observations. A summary of modelling results is presented in Table 9-1 below:

Table 9-1: SIDRA Modelling Results

Approach	Base			Lane closures			Lane closures without slip lanes		
	AM			AM			AM		
	LoS	Average Delay (sec)	95%ile Queue (m)	LoS	Average Delay (sec)	95%ile Queue (m)	LoS	Average Delay (sec)	95%ile Queue (m)
Sylvia Park Road Eastbound	C	31	55	C	28	48	C	30	51
Car Yard Westbound	D	43	2	D	49	2	D	51	2
Mt Wellington Highway Southbound	C	24	119	C	25	157	C	24	162
Mt Wellington Highway Northbound	C	21	80	C	33	108	D	40	141

Approach	Base			Lane closures			Lane closures without slip lanes		
	PM			PM			PM		
	LoS	Average Delay (sec)	95%ile Queue (m)	LoS	Average Delay (sec)	95%ile Queue (m)	LoS	Average Delay (sec)	95%ile Queue (m)
Sylvia Park Road Eastbound	D	36	126	C	33	115	C	34	117
Car Yard Westbound	E	61	7	E	61	7	E	61	7
Mt Wellington Highway Southbound	C	24	95	C	27	112	C	17	114
Mt Wellington Highway Northbound	C	26	126	C	33	137	C	34	144

With the combination of the SIDRA model assessment, operational observations and an understanding of downstream capacity constraints, it is expected that the proposed intersection layout would have a similar overall operational performance to the existing intersection layout. As is the case for the existing intersection, it can be affected by delay or queues from the downstream SH1 / Mount Wellington Highway interchange. Therefore, the intersection performance may be affected accordingly, thus ongoing monitoring is recommended. As such delays or queues are currently variable from day to day (and peak to peak), it is not possible to effectively assess the effects on such variability on the operation of the Mount Wellington Highway / Sylvia Park Road intersection.

The proposed intersection layout will require modification to the existing traffic signals at the intersection. It is expected that this will be managed by the appointed contractor with liaison through ATOC in accordance with standard protocols by ATOC in relation to all signal works.

9.2.2 Impacts arising from the temporary closures

It is expected that a number of night time lane closures or closure of one direction of traffic may be required for undertaking various construction activities on Sylvia Park Road. Should a closure be required, one direction of traffic would need to be maintained to provide access to properties and businesses. It is expected that affected traffic can be detoured using Mount Wellington Highway, Vestey Drive and Great South Road at night.

Temporary lane closures or partial intersection closures are likely to be needed to facilitate the modification to the existing Sylvia Park Road / Mount Wellington Highway intersection. It is expected that these closures will only be undertaken at night time to minimise the impacts to traffic. The details and staging of the closure will be planned and managed by the appointed contractor in accordance with the processes and guidelines set out in the CTMP.

When placing bridge beams on the EWL over Mount Wellington Highway, a full night time closure of Mount Wellington Highway will be required. It is expected that the section of Mount Wellington Highway will be closed between the motorway interchange with SH1 and the roundabout with Vestey Drive.

The following routes are anticipated to be used for diverted traffic:

1. For northbound traffic on Mount Wellington Highway, traffic is likely to be routed via Clemow Drive, Carbine Road and Penrose Road for local road detour traffic and South-Eastern Highway for access to the motorway; and

2. For southbound traffic on Mount Wellington highway, the route via SH1 southbound on-ramp, Princes Street southbound off-ramp and Princes Street could provide the main detour route.

SSTMPs will be prepared for individual closures which will identify appropriate times for closures to occur depending upon traffic flows. The procedures for developing the SSTMPs is outlined further in the CTMP.

9.2.3 Impacts arising from work site access

A construction yard is proposed to be located to the east of the Sylvia Park Road intersection on Mount Wellington Highway occupying the current car dealership yard. This will be the main construction lay-down area for the construction activities along Sylvia Park Road. Access to this construction yard can be gained via the signalised intersection with Mount Wellington Highway. A signal phase is already provided for existing vehicle access to/from the car dealer yard and this will be utilised for construction vehicles.

An increase of vehicular trips will be expected for accessing this construction yard in comparison to the existing vehicle numbers generated by the car dealership. At this stage, the exact number of construction vehicular trips are not known as this is largely dependent on the detailed construction methodologies. It is understood that the site access can be managed in a way to give priority to general traffic with minimum signal phasing time assigned for construction access during the peak periods. Should the intersection experience additional queues or delays due to the operation of the site access, a potential mitigation measure is to introduce a left turn in and left turn out arrangement with give-way control during the peak periods. This means that no additional time would be required to operate the movements in/out of the site access as vehicles would enter and exit by taking gaps in the existing traffic flows along Mount Wellington Highway. A similar arrangement has been utilised at the construction site for the Waterview Connection project at the main construction yard established on Great North Road in the vicinity of the Great North Road Interchange. Each afternoon, the Great North Road site exit layout is manually altered to prevent site traffic turning right at the signals onto Great North Road. This helped to minimise the disruption to the main evening peak flow on Great North Road.

9.2.4 Impacts on pedestrians and cyclists

No formalised pedestrian crossings are present at the Sylvia Park Road intersection with Mount Wellington Highway. Sections of footpath are provided on both the northern and southern sides along the Sylvia Park Road. In the vicinity of the Sector 4 extent, there are no existing cycle facilities.

Minimal impact is anticipated to the walking and cycling environment with the proposed construction. The southern footpath along Sylvia Park Road will be removed as part of the establishment of the working area to constructing the EWL Project.

9.2.5 Impacts arising from property access

It is intended that access to properties will be maintained within the Sector 4 of the works. As the construction area on Sylvia Park Road will be established between the current eastbound lanes and the new westbound lanes, the current flush median would no longer be available. It is expected that temporary layouts will need to be established to facilitate right turning vehicles from the westbound lanes to the properties located on the northern side. This will be mainly required at the intersection with Pacific Rise.

The key properties that are likely to be affected are listed below:

Pacific Rise – high impact

- Access into Pacific Rise will be maintained where the existing road will act as the off-ramp from the proposed EWL eastbound alignment; and
- Construction works will include the construction of the retaining wall and EWL bridge structure along the existing central lanes of Sylvia Park Road. Access will be maintained, however, entry and exit movements will be restricted to allow access only from the eastbound lanes.

Sylvia Park Road and Mt Wellington Highway Car yard – no impact

- The existing car yard east of the Sylvia Park Road and Mt Wellington Highway will be acquired by the Project and used as a construction yard. Access will be required for construction traffic only, therefore there is no impact on private accesses at this location.

Southside of Sylvia Park Road – no impact

- The properties along the southern side of the Sylvia Park Road between 30 Sylvia Park Road and Mount Wellington Highway will be acquired as part of the construction. Therefore, no specific parking or property access impacts are relevant from construction; and
- The majority of the properties adjacent to the westbound lanes on Sylvia Park Road from the Great South Road and intersection onto the Mt Wellington Highway intersection will be acquired therefore no private property access will be required.

9.3 Potential Mitigation Measures

Potential mitigation measures for minimising the effects of the works in Sector 4 could include:

1. The effects from the intersection of Sylvia Park Road / Mount Wellington Highway on the Mount Wellington interchange will need to be carefully managed. This can be partially done in the Construction Programme to ensure significant effects of or on adjacent activities are avoided where possible. In addition, there may need to be certain performance measures around queue lengths or delays or monitoring requirements to ensure that the temporary traffic effects are managed appropriately to minimise effects on the interchange and intersection.

2. For access to the construction yard on the west side of Mount Wellington Highway opposite Sylvia Park Road, if vehicle movements cause delays at the intersection for non-construction traffic, then

measures to minimise the effects on the intersection should be considered. These could include limiting traffic movements to left in and left out only as priority control rather than under signal control, or restricting the number of vehicle movements.

3. Where construction activities may require access from private property, early consultation with affected properties and tenants would be required and the specific effects such as the number of truck movements carefully assessed and mitigation measures included in the CTMP. Measures could include limiting truck movements are particular times of day or restricting turning movements.

4. Where pedestrian facilities are removed on Sylvia Park Road, alternative facilities or pedestrian routes should be considered.

10 Sector 5

Sector 5 extends from the proposed EWL / SH1 Interchange by Mount Wellington Highway to the SH1 / Princes Street Interchange.

10.1 Indicative Traffic Management Measures

The work in Sector 5 primarily comprises of the replacement of Panama Road over bridge located above SH1, widening of the SH1 motorway and the replacement of the Princes Street interchange (including new over bridge and revised ramp connections).

The Panama Road over bridge will be built in two halves to always allow for a single lane to be operational across the motorway. The arrangement will likely be a temporary traffic signal that will allow for both directions of traffic to operate. Some diversion elsewhere could take place during peak periods if the signal operation is unable to cope with the traffic volumes during these times.

The widening works on SH1 will generally require narrow lanes and shoulders with an associated temporary speed limit to establish the required work areas. Traffic in both directions will be shifted into the median initially to construct the widened carriageway on the shoulders. The lane arrangement will then be moved out to the outside edge to enable the replacement of the median barriers.

Widening the motorway across Ōtāhuhu Creek will utilise a new local road bridge constructed to the east of the motorway to divert southbound traffic lanes. A number of stages of construction are anticipated with traffic being switched between new and reconstructed structures. A minimum of three lanes are anticipated to be maintained throughout the majority of the works. Some lane closures may be required to facilitate tie-ins and switching to occur safely. There may also be temporary arrangements where one of the three southbound motorway lanes are physically separated to form a construction area in the centre.

At the Princes Street Interchange, the most difficult component of the construction will be the Princes Street over-bridge. The existing bridge with its retaining wall structure limits the available motorway carriageway width. It is likely that lane widths will need to be reduced to the minimum desirable width of 3.1m per lane with 0.3m shoulders and zero-deflection delineation devices to maximise the space available to build the bridge piers. Temporary geometric layouts will be required for the on and off-ramps to facilitate these works.

Discrete closures of roads will likely be required for certain construction activities. An assessment of the affected traffic volumes will need to be carried out before closure times can be confirmed and these will need to be approved by the relevant road controlling authority in accordance with the CTMP.

A construction yard is proposed at 15 Coppins Road north west of the Ōtāhuhu Creek. Access will be provided from SH1 and restrictions to this access will be required. A number of other site access points are likely required for the work areas and procedures to safely establish these are outlined in the Construction Traffic Management Plan found in the appendices.

The location of site works compounds not on the motorway main line are illustrated in Figure 10-1.

Figure 10-1: Location of Site Compounds – Sector 5

10.2 Identification and Mitigation of Traffic Impacts

Key traffic impacts arising as a result of the Sector 5 works are listed in this section, and appropriate mitigation measures are proposed where possible. Note that the full impacts of the necessary traffic management methodology will not be known until the SSTMP planning and development stage, where appropriate mitigation strategies will be developed and agreed with stakeholders and the appropriate road controlling authority.

10.2.1 Impacts arising from temporary work sites

This section discusses the impact of temporary work sites on SH1 and at Panama Road, Princes Street and surrounding road networks.

10.2.1.1 Impacts on SH1

Detailed below is an assessment of the impacts on SH1 due to temporary work sites. The assessment includes:

- Travel time impacts;
- Effects on traffic flows; and
- Assessment of forecast delays.

A combination of temporary realignment and lane narrowing will be employed for completing construction of the EWL bridge piers, widening works and associated civil works on SH1. This enables the installation of temporary barriers to facilitate works to occur off line from live traffic where possible. This narrowing and realignment will be coupled with the introduction of a temporary speed limit, which is currently expected to be 80 km/h.

As discussed in Section 3.3.1 similar traffic management methodologies have been successfully implemented to facilitate construction works in many locations across the State highway motorway network in Auckland in recent years. From studies undertaken at Onewa Road and Upper Harbour Highway to Greville Road, a reduction in capacity of 4% to 6% is indicated which include the effects of gradients and lane merges.

As for SH20, the impacts to motorway capacity as a result of narrowing and temporary speed limits has been assessed assuming a reduction in capacity due to the lane narrowing. Assessments have been undertaken for a 5% reduction and 10% reduction in capacity. This section of SH1 has a straight alignment and is relatively short length (approximately 5.4 km) with no intersections except for Princes Street and Mount Wellington Highway at each end of this Sector. Therefore based on experience from other construction projects, this range of capacity reduction (5 to 10%) is considered to be appropriate to provide a robust level of assessment.

An assessment of the effects of the capacity reduction on SH1 on travel times in 20177 and 2026 is presented in Table 10-1. This assessment assumes no construction works affecting capacity on SH20 are undertaken concurrently.

Table 10-1: Overview of travel time impacts due to capacity reduction on SH1

	Hillsborough Rd to SH20 / SH1 Int	SH20 / SH1 to Hillsborough Rd	Hillsborough Rd to Airport	Airport to Hillsborough Rd	Greenlane Int to SH20 / SH1 Int	SH20 / SH1 to Greenlane Int
2017 AM (Minutes)						
Base Case	11.1	10.2	9.2	7.9	11.8	22.3
Base Case – 5% capacity reduction	11.1	10.3	9.2	7.9	11.8	22.6
% change (5% reduction versus Base Case)	0%	0%	0%	0%	0%	+ 1%
Base Case – 10% capacity	11.1	10.2	9.2	7.9	12.1	22.2
% change (10%	0%	0%	0%	0%	+ 2%	- 1%

[7] 2017 travel times are derived from the 2017 DM model which represents a 2017 Auckland road network with 2016 regional land use forecasts. Refer to Section 3 for more information.

	Hillsborough Rd to SH20 / SH1 Int	SH20 / SH1 to Hillsborough Rd	Hillsborough Rd to Airport	Airport to Hillsborough Rd	Greenlane Int to SH20 / SH1 Int	SH20 / SH1 to Greenlane Int
reduction versus Base Case)						
2017 PM (Minutes)						
Base Case	10.8	10.2	8.6	9.9	17.6	9.7
Base Case – 5% capacity reduction	10.8	10.3	8.6	9.9	18.9	10.8
% change (5% reduction versus Base Case)	+ 1%	0	0	0	+ 8%	+ 12%
Base Case – 10% capacity	10.9	10.2	8.6	10.0	22.0	10.3
% change (10% reduction versus Base Case)	+ 1%	0%	0%	0%	+ 25%	+ 7%
2026 AM (Minutes)						
End of Construction Base Case	17.3	11.7	16.6	8.9	16.3	23.6
End of Construction Base Case – 5% capacity reduction	17.3	11.2	16.7	8.9	16.4	24.1
% change (5% reduction versus End of Construction Base Case)	+ 1%	0%	0%	0%	0%	+ 2%
End of Construction Base Case – 10% capacity	17.6	11.2	16.9	8.9	18.0	24.6
% change (10% reduction versus End of Construction Base Case)	+ 2%	0%	+ 2%	0%	+ 10%	+ 4%
2026 PM (Minutes)						
End of Construction Base Case	13.8	18.8	10.4	19.6	20.5	10.5
End of Construction Base	13.9	19.1	10.3	19.5	22.3	11.8

	Hillsborough Rd to SH20 / SH1 Int	SH20 / SH1 to Hillsborough Rd	Hillsborough Rd to Airport	Airport to Hillsborough Rd	Greenlane Int to SH20 / SH1 Int	SH20 / SH1 to Greenlane Int
Case – 5% capacity reduction						
% change (5% reduction versus End of Construction Base Case)	+ 1%	+ 2%	- 1%	+ 1%	+ 9%	+ 13%
End of Construction Base Case – 10% capacity	14.2	19.2	10.3	19.6	26.0	12.5
% change (10% reduction versus End of Construction Base Case)	+ 3%	+ 2%	- 1%	+ 1%	+ 27%	+ 19%

The table shows that in the Base Case the effects of the capacity reduction in the AM peak is minor, however, there is a significant effect in the PM peak with travel times increasing by 25% southbound and 7% northbound. There is a negligible effect on SH20 with the reduced SH1 capacity.

In the End of Construction Base Case, there is a greater effect on travel times compared to 2016 in both AM and PM peaks. Both north and southbound directions are adversely affected but with the PM peak more critical than the AM peak. There is some effect on SH20 but this is not particularly significant.

Figure 10-2 illustrates the forecast change in traffic flows between the Base Case and the 10% capacity reduction for the more critical PM peak period for the commencement year (2018). The green lines represent increases in traffic volumes and blue lines reduction in traffic volumes. The thickness of the bars represents the relative change, the thicker the line the greater change.

The figure indicates that there is a forecast reduction in traffic volumes on SH1, particularly in the southbound direction (630 vph). This traffic diverts onto the local road network. There are three main routes that experience the most significant increase, these are:

1) Panmure Highway and Ti Rakau Drive to travel to the East Tāmaki area rather than using SH1 and Highbrook interchange (up to 230 vph)

2) Great South Road southbound (125-230 vph)

3) Mount Wellington Highway southbound (210 vph)

Where traffic reductions occur on northbound SH1 (130 vph), there are minor corresponding increases in traffic flows on Great South Road and Mount Wellington Highway northbound. Some soutbound Great South Road traffic that would normally use the Ellerslie- Panmure Highway interchange to access the motorway southbound chooses to remain on Great South Road rather than using the motorway.

The model forecasts that there is some traffic from the Neilson Street area that uses SH20 to travel south rather than SH1.

With the 5% reduction in capacity (refer Figure 10-3), around half the volume of southbound traffic diverts from SH1 when compared to the 10% reduction. In contrast, approximately twice the northbound volume of traffic diverts from SH1 with the 5% reduction in capacity. This northbound traffic

splits between Great South Road and Mount Wellington Highway with the latter accommodating 60% of the diverted northbound traffic. It is concluded that with the 5% reduction in capacity there is less overall effect on the local road network compared to the 10% reduction in capacity in the Base Case.

Figure 10-2: Flow Difference Plot between Base Case 10% capacity reduction vs Base Case - PM Peak

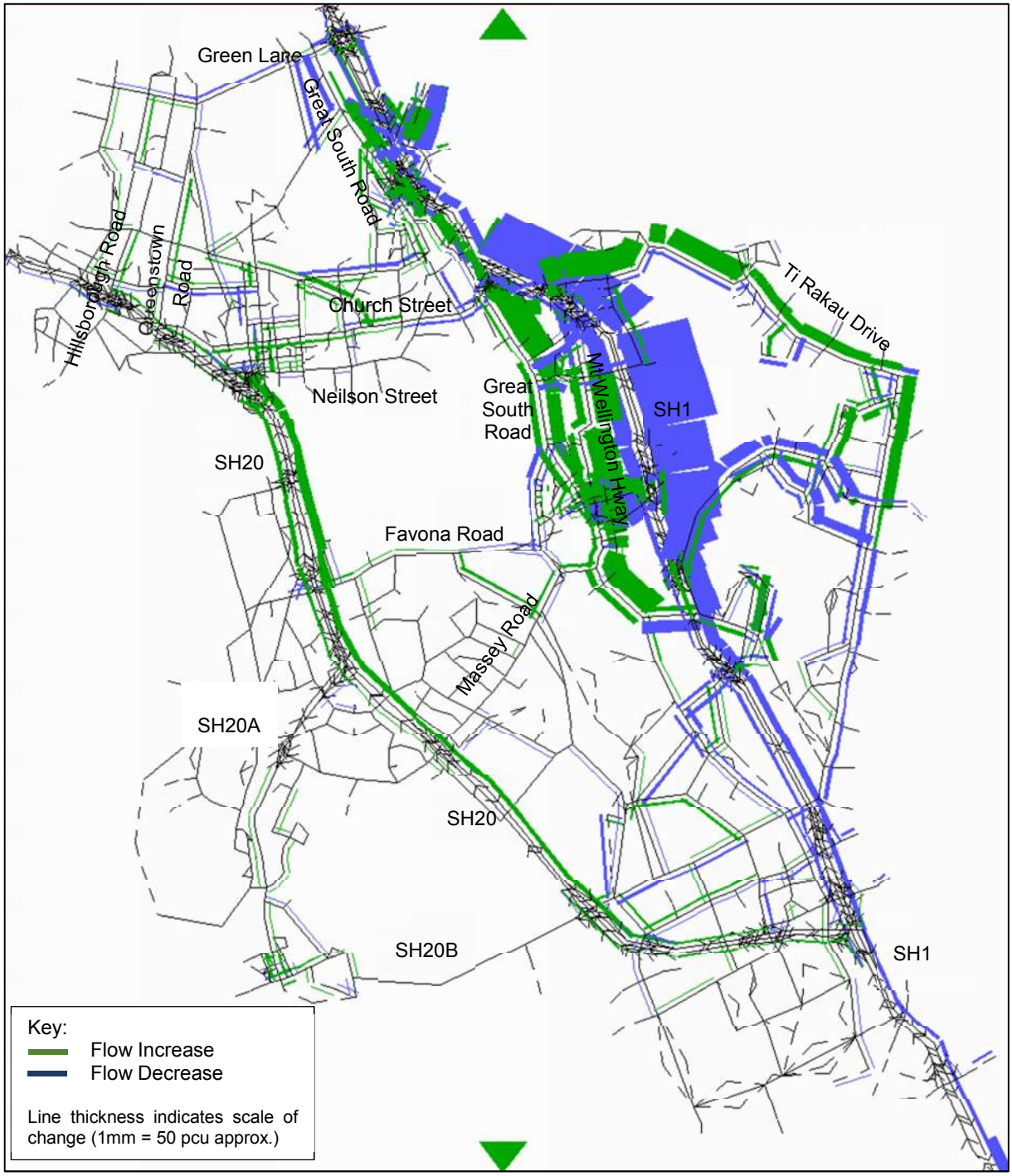
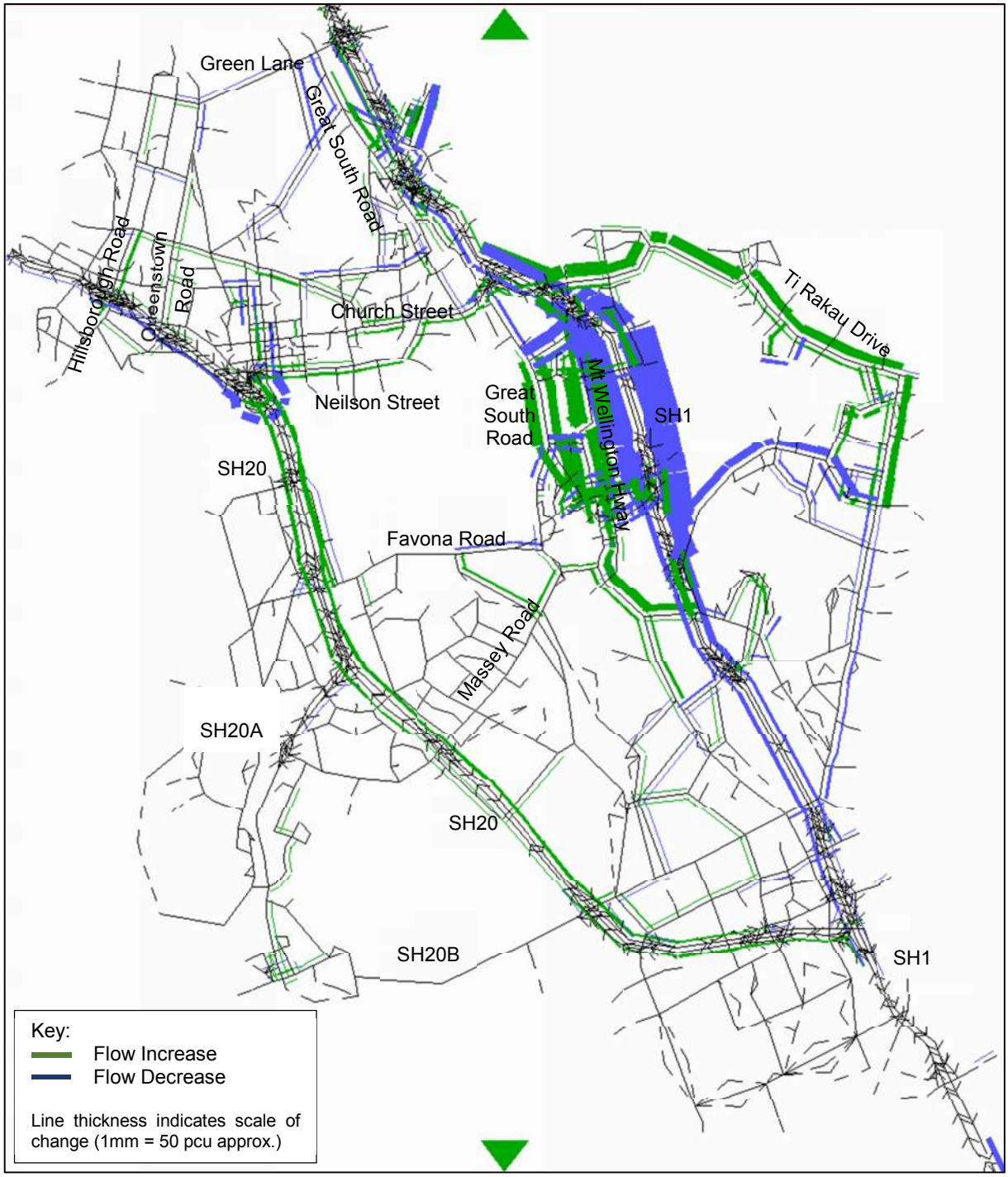


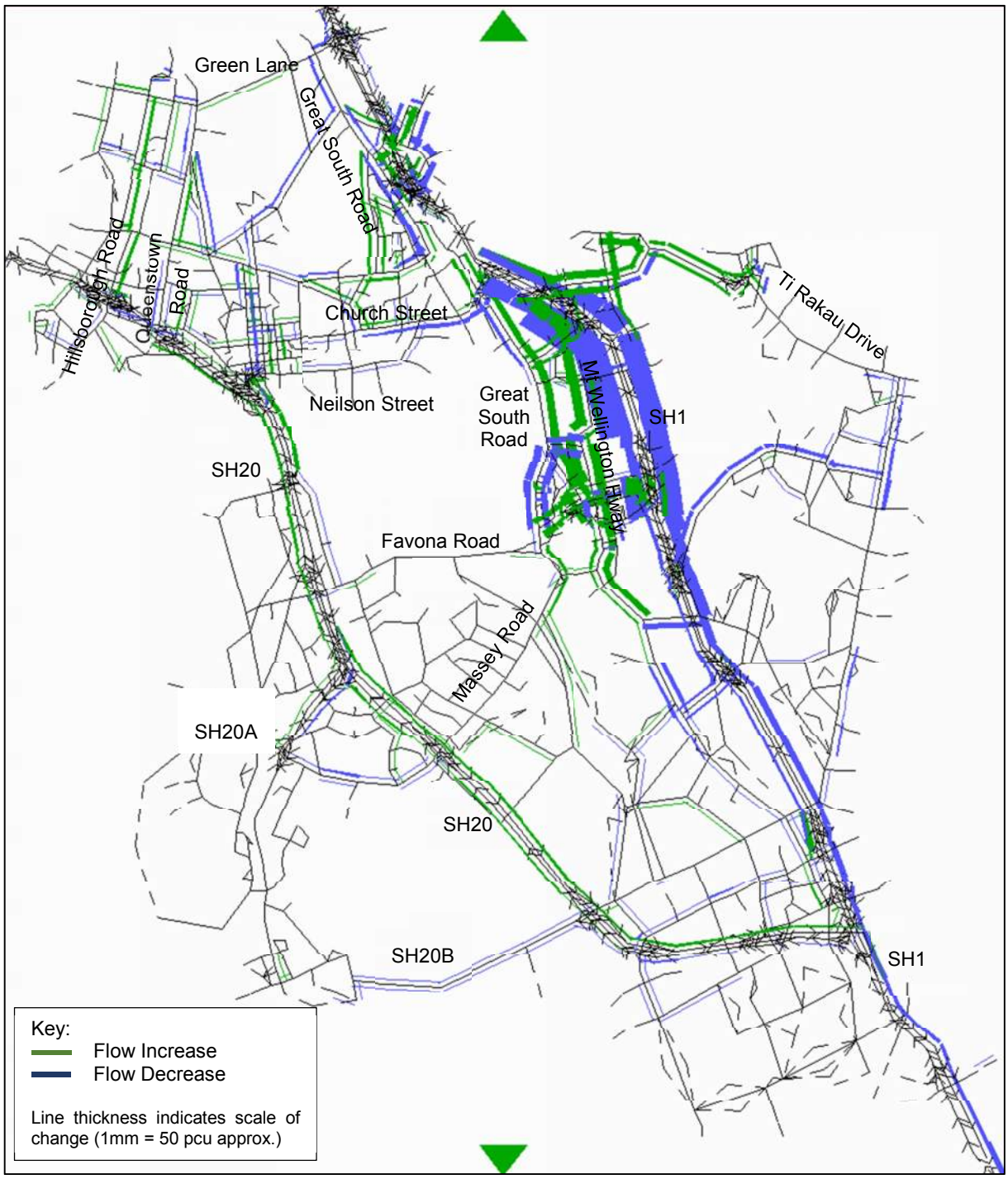
Figure 10-3: Flow Difference Plot between Base Case 5% capacity reduction vs Base Case - PM Peak



Local and Wider Network Effects – Future 2026 Year

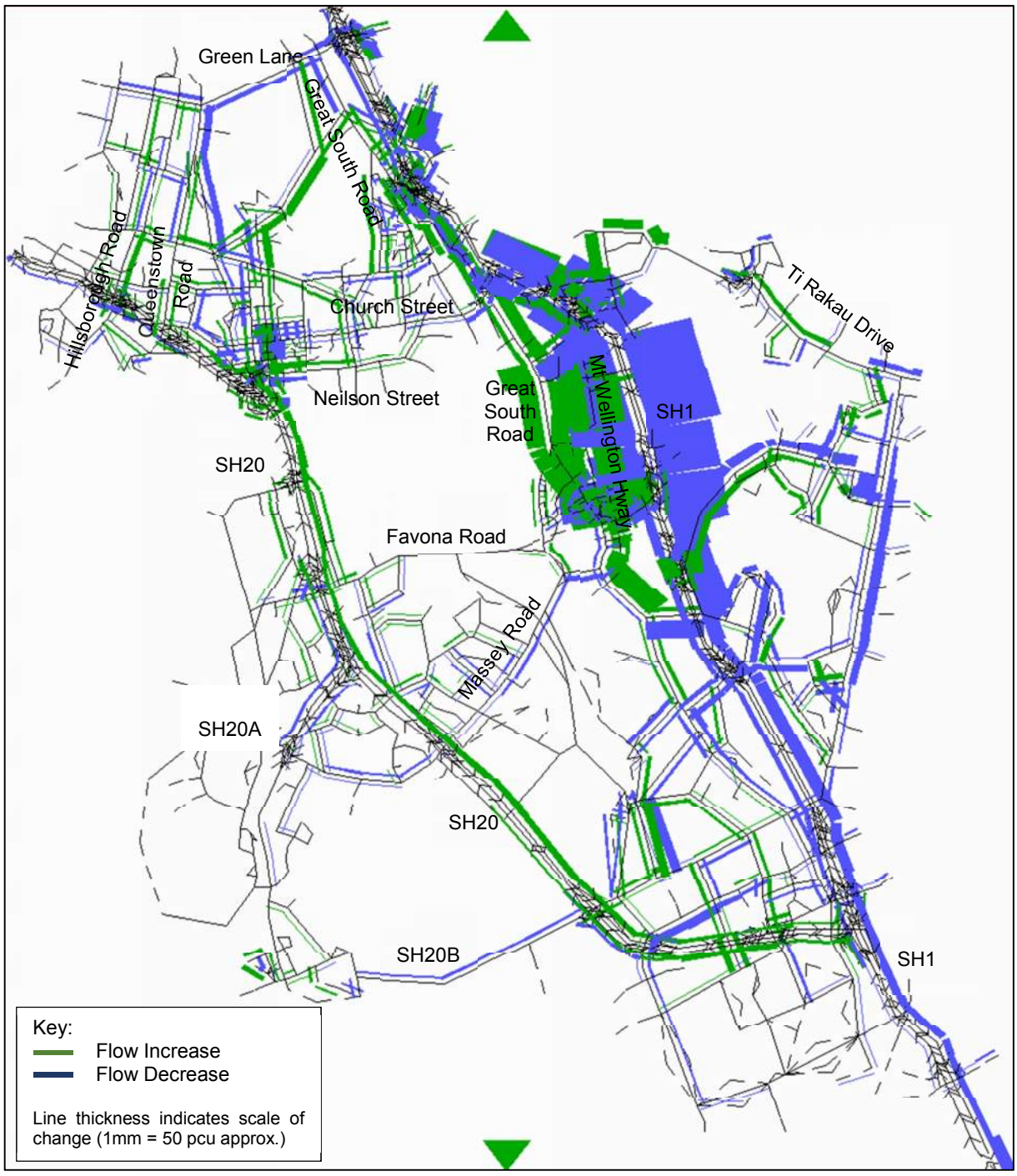
Figure 10-4 and Figure 10-5 present the modelled forecast changes in traffic volumes for the AM and PM peaks respectively in 2026 compared to the do minimum scenario in 2026 for 10% capacity reduction.

Figure 10-4: Flow Difference Plot between End of Construction Base Case 10% capacity reduction vs End of Construction Base Case - AM Peak



The model indicates that in the AM peak there are reductions in traffic volumes in the northbound (260 vph) and southbound directions on SH1 (200 vph). Northbound, there is a reduction in traffic using the Princes Street on-ramp and this traffic is forecast to divert to Mount Wellington Highway northbound on-ramp. Southbound traffic diverting from the motorway uses either Panmure Highway or Great South Road. There is very little change to traffic volumes on SH20.

Figure 10-5: Flow Difference Plot between End of Construction Base Case 10% capacity reduction vs End of Construction Base Case - PM Peak



In the PM peak there is a greater level of traffic diversion from SH1 compared to the AM peak; there is three times the level of diversion southbound (600 vph) and two times northbound (530 vph) compared to the AM. This reduction reflects the greater overall travel time between the Greenlane and the SH1/SH20 interchanges.

There are increased southbound traffic volumes on the SEART off ramp (250 vph) and on the southbound off ramp at Mount Wellington Highway (200 vph). Traffic is forecast to primarily divert along Great South Road and Mount Wellington Highway.

Volumes are reduced on SH1 northbound off ramp at Mount Wellington Highway (300 vph reduction) with consequential reductions westbound along Sylvia Park Road and Vesty Drive.

Minor transfer of traffic is indicated between the southbound routes along Manukau Road / Pah Road and Campbell Road / Onehunga Mall.

There is some minor increase in southbound traffic volumes on SH20 in this scenario.

A 5% capacity reduction in the AM peak period (Figure 10-6) has little effect on traffic volumes on SH1 even though there is forecast to be a slight increase in northbound delay. The PM peak (Figure 10-7) has similar patterns in traffic flow changes as the 10% reduction, but to a lesser extent; half the volume of southbound traffic diverts and around 80% northbound compared to the 10% capacity reduction. The impact of this diverted traffic is localised with traffic using Mount Wellington Highway and Great South Road. There is a reduction in flow in the northbound off ramp and southbound on ramps at Mount Wellington Highway.

Figure 10-6: Flow Difference Plot between End of Construction Base Case 5% capacity reduction vs End of Construction Base Case - AM Peak

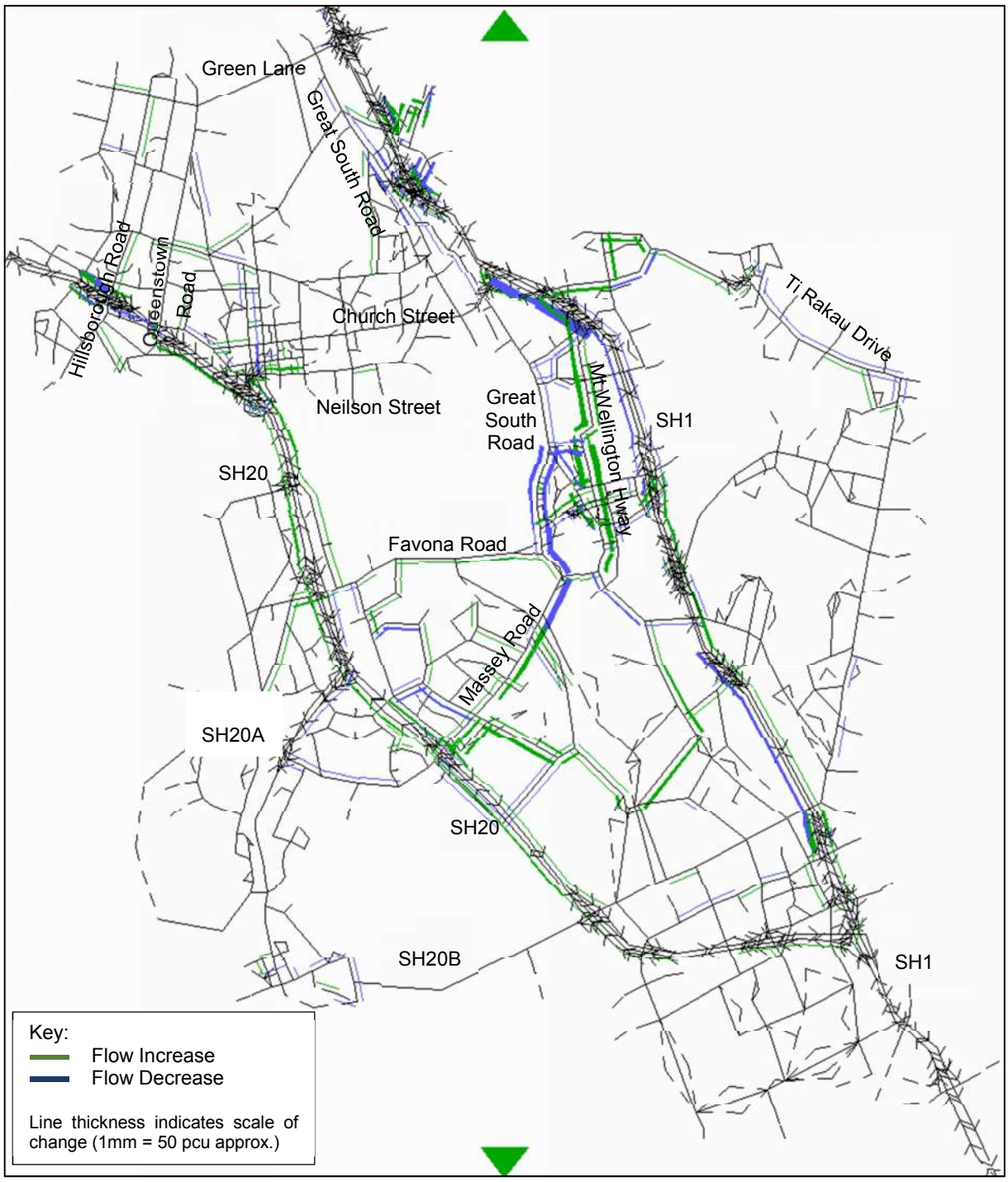
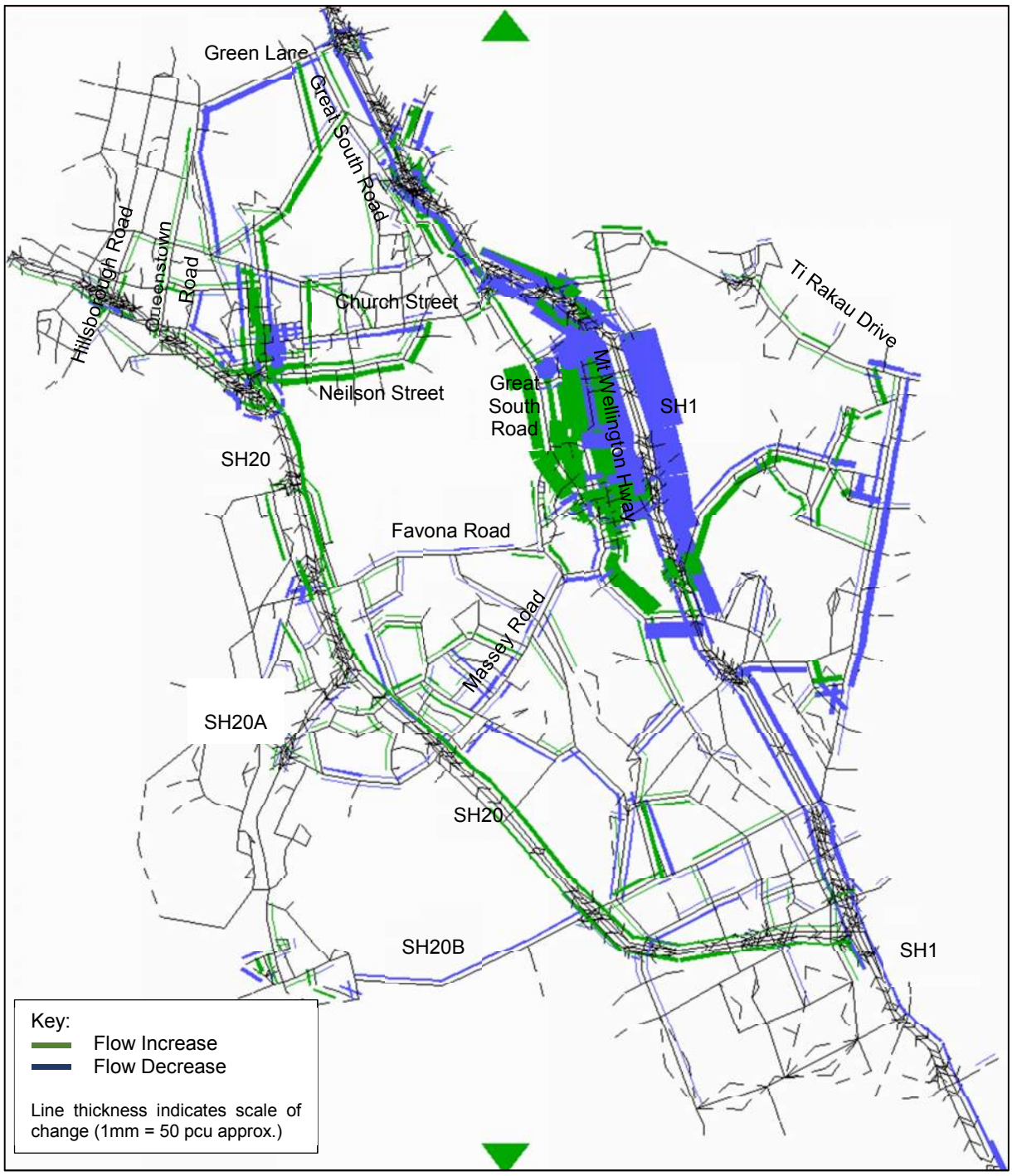


Figure 10-7: Flow Difference Plot between End of Construction Base Case 5% capacity reduction vs End of Construction Base Case - PM Peak



An assessment of the potential delays as a result of the narrowed lane widths has been modelled in SATURN. The change in delay in 2026 between the Do Minimum network and the proposed lane width reduction with the assessed 10% capacity reduction are presented in Figure 10-8 and Figure 10-9. The plots demonstrate that there is forecast to be a greater effect on delays in the PM peak compared to the AM peak. This is consistent with the forecast increased journey times discussed above.

The AM peak plot shows that there are increased delays along the motorway through the area where the lanes are restricted. This is accompanied by delays at the northbound merge at Princes Street and

the southbound merge from Mount Wellington Highway. This is likely to be due to the reduced mainline capacity. A minor increase in delay is forecast on the local road network particularly on Great South Road and Mount Wellington Highway. This is due to greater traffic volumes on these roads as a result of the traffic management measures on the motorway.

In the PM peak period, greater delays are experienced along the motorway compared to the AM peak. These are mainly experienced southbound in the vicinity of the Mount Wellington Highway merge and northbound through the proposed works. Some delay occurs at the Princes Street south facing ramps. This would appear to be due to diverted traffic on the local road network joining the motorway as described above.

As for the AM peak, Great South Road and Mount Wellington Highway are forecast to experience an increase in delay due to traffic diverting from the motorway onto these roads. Delays are also indicated to occur on the South Eastern Highway and on sections of Ti Rakau Drive due to traffic re-routeing onto these corridors.

The model indicates that although an increase in traffic is forecast along SH20, there are no significant adverse effects on delays as a result. There are some changes in delays on individual routes in Onehunga (some small increases and decreases) but this is likely to be due to minor re-routeing changes between the various parallel routes in the grid road network in this area.

Figure 10-8: Delay Difference Plot End of Construction Base Case SH1 10% capacity reduction vs End of Construction Base Case – AM Peak

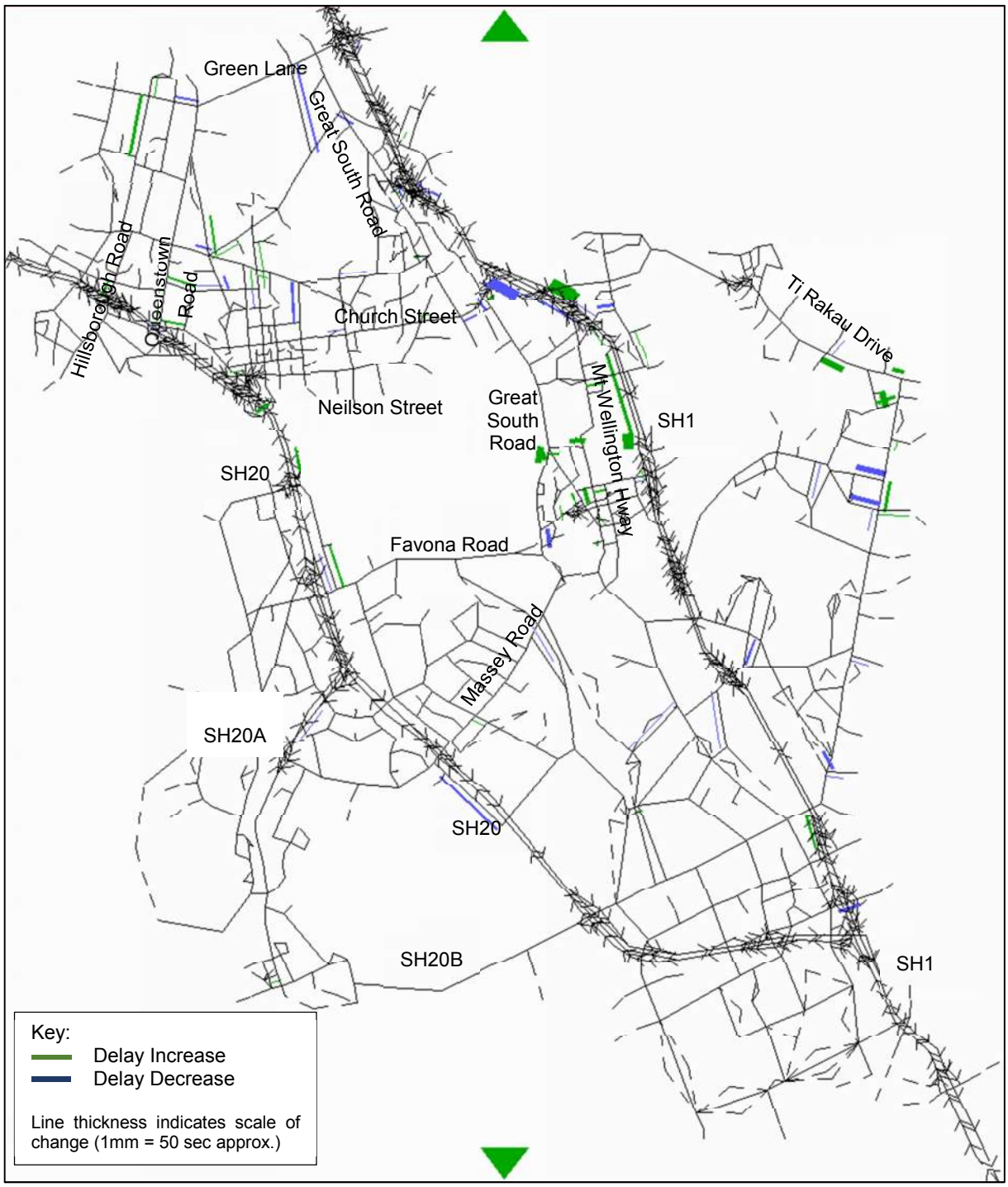
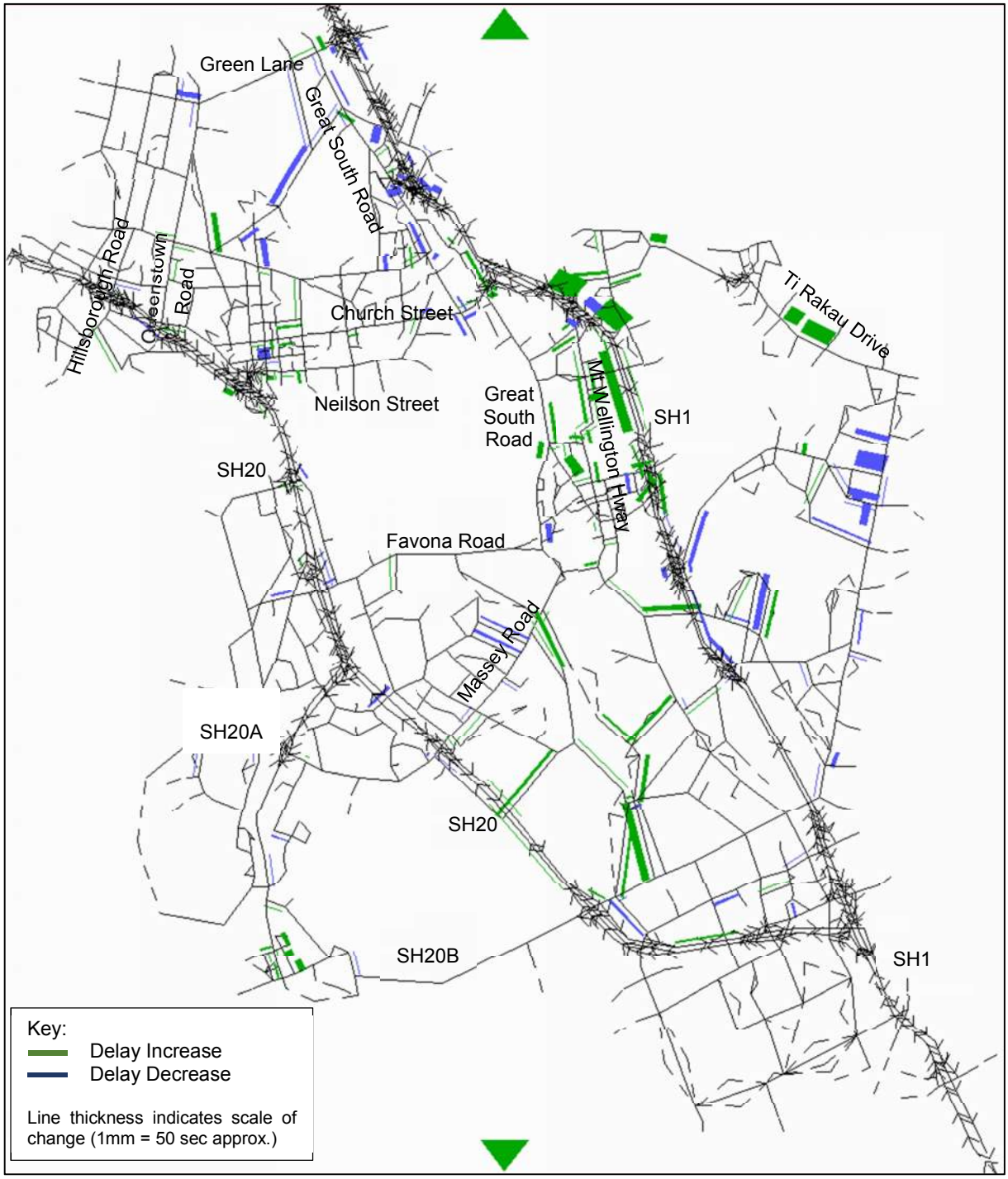


Figure 10-9: Delay Differences Plot End of Construction Base Case SH1 10% capacity reduction vs End of Construction Base – PM Peak



Comparing the delays with the 5% reduction in capacity with the 10% reduction, the SATURN delay plots indicate greater increases in delay on the motorway with the 5% reduction. This is likely to be due to the fact there is a lower level of diversion in the 5% scenario. This indicates that the overall journey time along the motorway is still more favourable than using the alternative routes on the local roads even with this reduction in capacity. As a result the model indicates that motorists remain on the motorway rather than diverting. The increased delays are most prominent for the northbound movements along the motorway where capacity is reduced. Delay also occurs at the merge along the main line of the motorway just south of the Mount Wellington Highway southbound on-ramp.

Figure 10-10: Delay Differences Plot End of Construction Base Case SH1 5% capacity reduction vs End of Construction Base Case – AM Peak

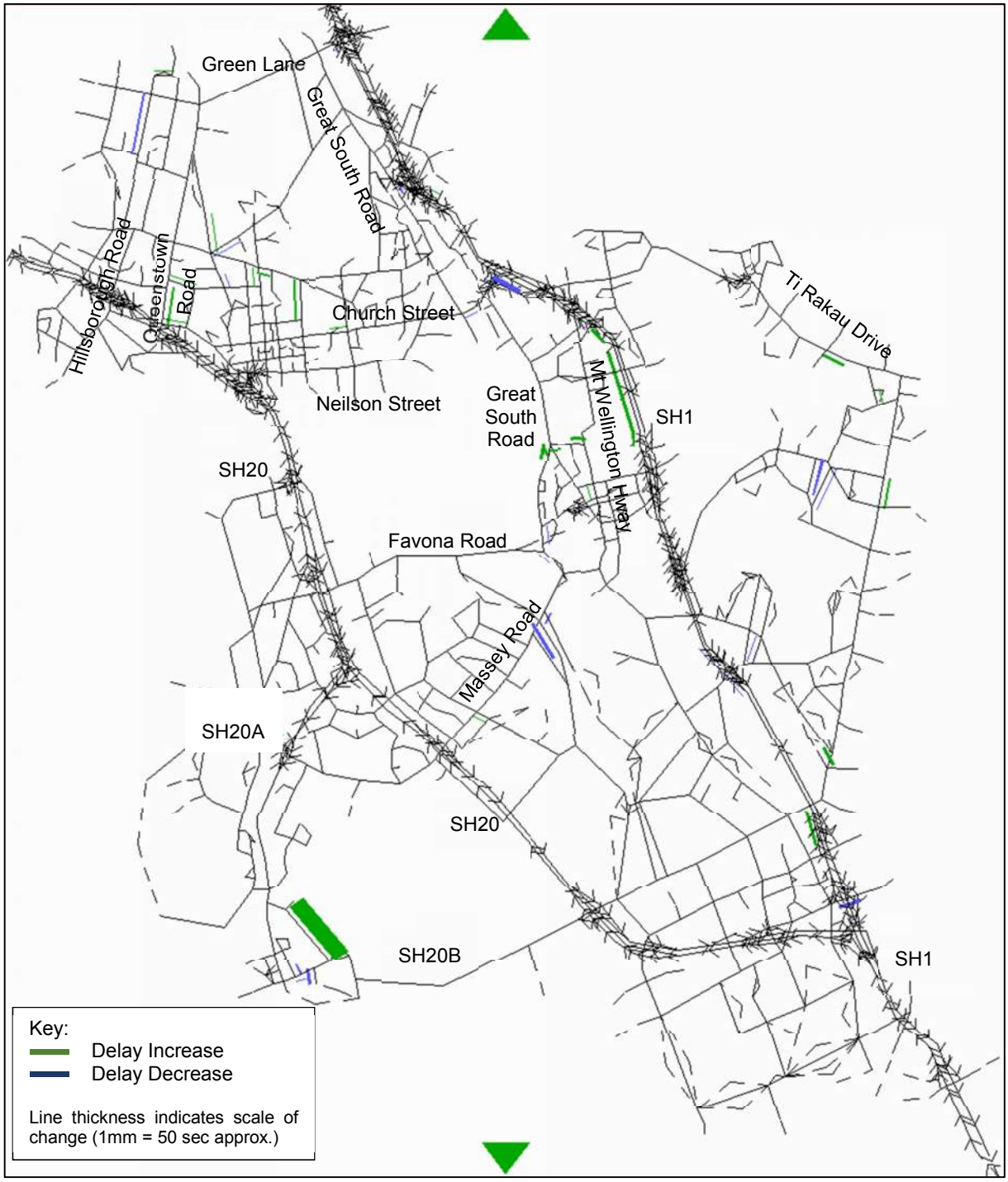
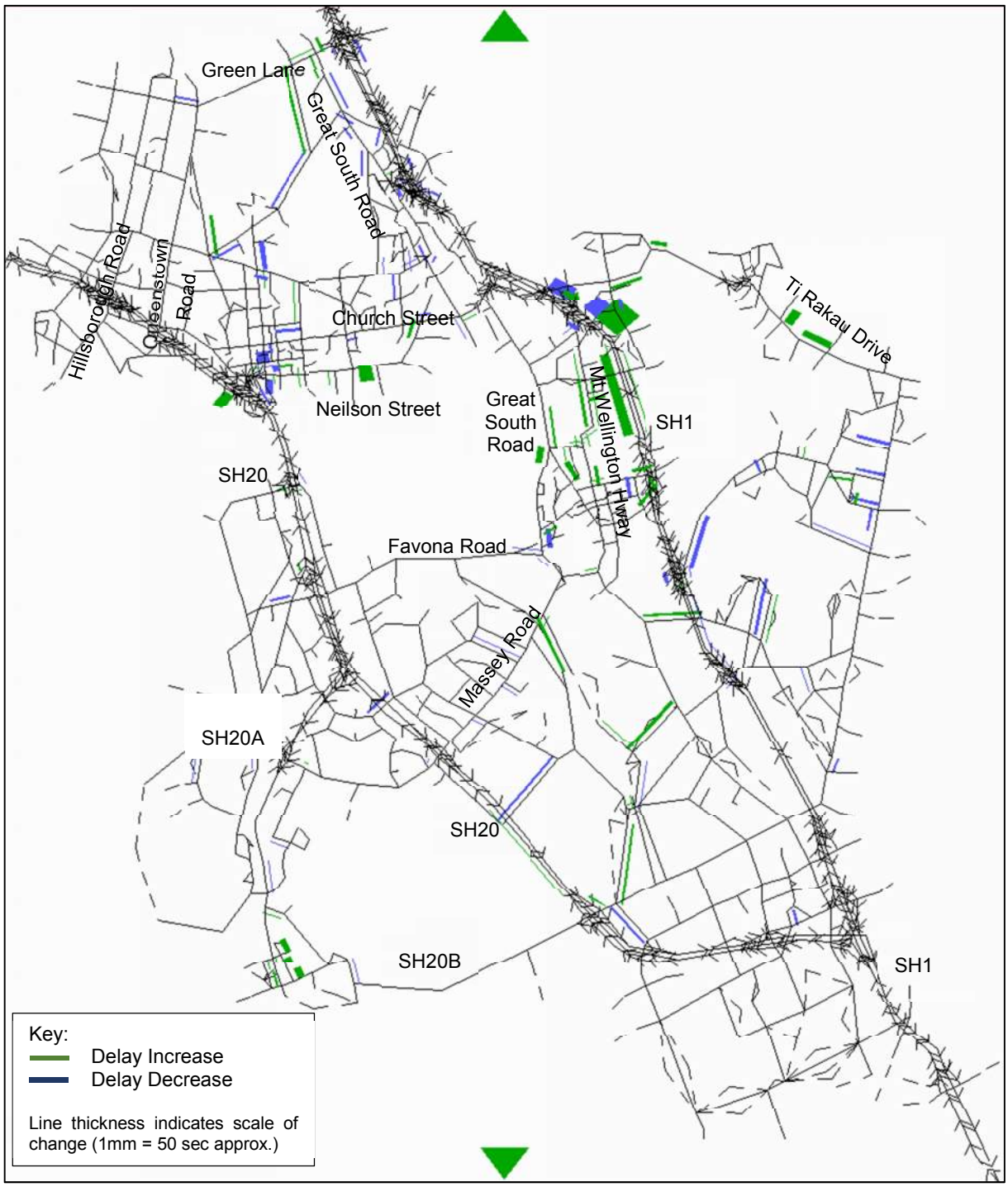


Figure 10-11: Delay Differences Plot 2026 SH1 5% capacity reduction vs 2026 Do Minimum – AM Peak



10.2.1.2 Impacts from constructing Ōtāhuhu Creek Bridge

To widen the motorway over Ōtāhuhu Creek a staged construction methodology is proposed that includes the construction of a new local road bridge to the east of the motorway. It is intended that this new bridge will be used for southbound motorway traffic whilst the existing southbound motorway bridge is demolished and new widened bridge constructed. A number of stages and switching of traffic between new and old structures will occur.

To maintain flow, three lanes will be required in both the north and southbound directions throughout the construction period. The existing southbound flow at the 30th highest hourly flow rate is approximately 5,700vph; the Princes Street off ramp has a peak flow of around 450vph. These flows dictate the need to maintain three lanes.

Where the new local road bridge is temporarily used for motorway traffic, works are likely to be required to the Princes Street southbound off-ramp, particularly in the gore area to tie in the southbound lanes from the local road bridge to the main line traffic lanes on the existing motorway carriageway. The Princes Street southbound off-ramp would be maintained with this proposed arrangement.

The assessed capacity reduction of 5 to 10% detailed above take into account the movement of traffic through this area assuming that three lanes are retained in both directions.

In order to utilise the local road bridge for motorway traffic, a bull-run facility will need to be utilised. This arrangement would have two southbound lanes on the new bridge and a third lane on the existing motorway bridge. This third lane would be physically separated from the other two lanes. Traffic in the third lane would not be able to exit SH1 on the Princes Street southbound off-ramp. Clear advanced signing would need to be provided to enable motorists to select correct lanes, particularly if they intend to exit at Princes Street. Based on the low vehicle volumes for the off-ramp, there is a low risk with vehicle capacities for each lane as the majority are travelling south past the Princes Street Interchange. Clear communication and guidance will be very important to minimise impacts by the non-standard motorway lane arrangement.

10.2.1.3 Impacts on SH1 Mount Wellington Highway Ramps

The Mount Wellington north facing ramps should be unaffected by traffic management during the construction works. The south facing ramps are adjacent to the construction works for the connections to EWL. These works may include measures such as traffic management on the ramps including lane narrowing, shoulder narrowing/closure, temporary re-alignments and temporary speed limits.

Both the south facing ramps are forecast to experience a reduction in traffic volumes.

Occasional closures of the ramps are anticipated to enable construction of over bridges or amendments to the tie-ins for the ramps. Diversion routes are discussed below. These closures would generally be undertaken at night but would be subject to detailed construction management planning, temporary traffic management and traffic assessment, as outlined in CTMP.

10.2.1.4 Impacts on SH1 Princes Street ramps

It is anticipated that the Princes Street ramps will be kept open through most of the construction period. However, they may be subjected to traffic management including lane narrowing, shoulder narrowing/closure, temporary re-alignments and temporary speed limits.

Occasional closures of the ramps are anticipated to enable construction of over bridges or amendments to the tie-ins for the ramps. Diversion routes are discussed below.

10.2.1.5 Impacts on Panama Road

The Panama Road Bridge is to be replaced with a new bridge located to the south of the existing structure. The bridge is to be constructed in two halves. This enables the road be kept open to traffic.

Once the new southern half of the bridge is constructed, it is proposed that it is opened as a single traffic lane to allow shuttle operation of traffic while the existing bridge is demolished and the new northern half of the bridge constructed.

To allow for the shuttle working, it is anticipated that temporary traffic signals would be installed to control traffic. The 2016 traffic volumes on the bridge are most significant in the AM peak with flows of around 450 vph in each direction. Such traffic volumes can be managed by shuttle signals although more detailed assessment would be required and to determine any effects on the adjacent McLennan Road intersection on the eastern side of the motorway.

Hillside Road intersection is to the west of the motorway. The exit from Hillside Road is left out only onto Panama Road and therefore this intersection should not be affected by the temporary signals.

10.2.1.6 Impacts on Princes Street

The Princes Street over bridge is a relatively narrow two lane bridge (single lane in either direction) with traffic signals at either end. The bridge is to be reconstructed to the north of the existing bridge and both signalised intersections are to be modified. The modification to the signalised intersection on the eastern side of the bridge (Frank Grey Place / Princes Street) can be modified whilst keeping Princes Street open.

The realignment of the western intersection (Princes Street / Motorway northbound ramps) is more significant as it involves the road to be realigned to tie into the new bridge. This intersection would be more complex to construct and is likely to require various re-alignments of the road to enable different parts of the intersection to be constructed. It is not envisaged at this stage that a full closure of the intersection (and northbound ramps) would be required; however, this would be subject to detailed traffic management planning at a later stage. The traffic management would need to ensure that queues on the motorway northbound motorway off-ramp are managed so that they do not affect the through lanes on the motorway.

The bridge is to be constructed in two halves, similar to the Panama Road Bridge. However, the new bridge is wider and therefore two way traffic can be maintained during construction. Traffic would utilise the new northern bridge while the existing structure is demolished and the new southern bridge constructed. Capacity at the bridge whilst traffic is only using the northern half would be similar to the existing bridge which is currently two lanes.

10.2.2 Impacts arising from the temporary motorway or ramp closures

It is expected that a number of lane closures on SH1 and across Mount Wellington Highway ramps will be necessary for facilitating construction works for the Project. These activities may require one or more lanes to be closed at any one time. Lane closures will typically be implemented at night following easing of traffic demands after the PM peak.

Lane closures will be planned by the Transport Agency's appointed contractor so that traffic demands can be accommodated by the remaining capacity following the closure of lanes.

Analysis of the effects of lane closures will be undertaken considering the guidelines and lane capacities set out in COPTTM. Lane closures would be undertaken at appropriate times of day subject to available capacity.

In addition to the lane closures, full motorway or on/off-ramp closures are also expected for construction activities such as placing EWL bridge beams over SH1, temporary tie-ins at ramps and pavement construction. As discussed above, the timing of the closure should be assessed with reference to the COPTTM capacities and flow profiles so that affected traffic can be accommodated to available detour routes.

The detour routes required for the closure of SH1 carriageway and the ramps at Mount Wellington Highway and Princes Street are described in the following section.

10.2.2.1 Detour Routes

Closure of SH1 and / or the motorway ramps at Mount Wellington Highway and Princes Street are only anticipated to be required occasionally and for a short duration, such as overnight, to enable existing bridges to be removed, new bridge beams to be constructed or tie-ins between different work areas to be completed.

Table 10-2: Potential Detour Routes details detour routes that are anticipated as a result of closures to ramps and / or the main SH1 carriageway.

Table 10-2: Potential Detour Routes

Location of closure	Detour Route
SH1 Northbound (north of Princes Street northbound on ramp) or Mount Wellington Highway Northbound off-ramp	Northbound Princes Street off-ramp, Princes Street, Atkinson Avenue, Mount Wellington Highway
SH1 northbound between Princes Street northbound on and off ramps	Northbound Princes Street off ramp, Northbound Princes Street on ramp
SH1 Princes Street Northbound off-ramp	SH1 northbound, Mount Wellington Highway Northbound off ramp, Mount Wellington Highway, Atkinson Avenue, Princes Street
SH1 Northbound Mount Wellington Highway off-ramp	Northbound Princes Street off-ramp, Princes Street, Atkinson Avenue, Mount Wellington Highway
SH1 Southbound or Mount Wellington Highway Southbound on-ramp	Mount Wellington Highway Northbound off ramp, Mount Wellington Highway, Atkinson Avenue, Princes Street
SH1 southbound between Princes Street on and off ramps	Southbound Princes Street off ramp, Southbound Princes Street on ramp

SSTMPs will be prepared for individual closures which will identify appropriate times for closures to occur depending upon traffic flows. These closures are likely to occur at night.

10.2.3 Impacts arising from work site access

Site access points to the work area on the motorway are anticipated to be provided at various locations from the main line carriageway. These access points will be provided in locations where there is good visibility and have appropriate spacing from adjacent on and off ramps. These will be signed appropriately to provide sufficient warning to motorists of the accesses and egresses and to guide construction traffic.

To construct the southbound link between EWL and SH1 access is proposed via 130 Carbine Road (refer to Figure 10-12). There is an access road to this property from Carbine Road that would be used by construction vehicles. This property will be acquired by the Project for use as a site compound.

Figure 10-12: Access across 103 Carbine Road

The northbound link between SH1 and EWL is proposed to be on an embankment. This affects properties on the western side of the motorway during construction and for the installation of a stormwater treatment plant. Property access has been acquired together with areas required for the construction works. Engagement will be necessary with property owners regarding the temporary traffic effects of the works in this area on these properties.

Compounds at Panama Road bridge are proposed. The main compounds are to be located in the area to the south west of the bridge and at 112 Hillside Road. A secondary laydown area is proposed at the south eastern corner of the bridge by McLennan Road. Access to these sites will be from the local roads. The main compounds are likely to need to have traffic movements managed, particularly for any movements across Hillside Road. At this stage the actual access points to these sites are unknown. Facilities for construction workers to cross Hillside Road need consideration as part of the site management strategy. 40 truck movements per day are anticipated (20 in and 20 out).

At Princes Street, compounds are proposed on the eastern side of the motorway at 16 to 32 Frank Grey Place and adjacent to the new northbound on and off ramps. These compounds would be accessed from the local road network only. Details of the exact access points to these sites is not currently known and therefore the exact management of traffic into and out of the sites would need to be determined. This may require manual traffic control to assist larger vehicles entering and leaving the compounds. As for Panama Road, 40 truck movements per day are anticipated (20 in and 20 out).

10.2.4 Impacts on public transport provision

There are currently scheduled bus services across Panama Road and Princes Street. Services will continue to operate along these roads with the introduction of the Auckland Transport's New Bus Network.

The Panama Road bus route is proposed to be a connector service with a frequency of 20 minutes at peak and 30 minutes off peak. This bus route would be affected by the proposed temporary traffic signals for the shuttle working across the bridge. However, the traffic volumes along Panama Road are not significant and hence bus journey times should not be significantly affected by the works. Whilst, operation of the signals has yet to be worked out, if the signals were to be operated manually at peak times, the signal operation can be adjusted to favour approaching buses to minimise adverse effects on buses.

At Princes Street, there is currently only one bus service that operates east-west across Princes Street and along Frank Grey Place. In the Auckland Transport New Bus Network this service is retained. In addition, a Connector bus route (Route 351) is proposed which utilises the south facing motorway ramps at Princes Street and along Princes Street. These bus services should be able to continue operating without being diverted.

Bus stops on Panama Road or Princes Street for these schedules services are not affected by the construction works. There is a bus stop on Frank Grey Place opposite the proposed location for the southbound off-ramp at Prince Street. This appears to be only used by express buses. This bus stop would need to be relocated as part of the permanent works for the project. It is likely to be able to be retained during construction.

10.2.5 Impacts on pedestrian and cyclists

Pedestrians are only affected by construction works at Panama Road and Princes Street due to the construction of the bridges and adjacent intersections. Pedestrian routes will be maintained during the works although some footpaths may need to be diverted or closed due to the construction works. Pedestrian facilities across the bridges may only be on one side of the bridge during the construction phase. Appropriate pedestrian crossing points would need to be identified during the detailed development of SSTMPs for these sites.

There are no dedicated cycle facilities that are affected by the construction works in this Sector.

10.2.6 Impacts on property access, parking and manoeuvring

The majority of the construction activities within this Sector are along the SH1 corridor. However, there are some local road works that affect properties at Panama Road and Princes Street.

At Panama Road the two adjacent intersections on either side of the bridge require modifications to tie into the new bridge. Property access on the western side of Hillside Road and accesses on both sides of McLennan Road may require some accommodation works to facilitate the re-aligned local roads. Access would be discussed with property owners as necessary during construction with disruption minimised as far as possible.

Some car parking on Hillside Road may need to be prohibited for the duration of the works to allow for access to the site compounds. This is most likely to be on the eastern side of the street alongside the site compound.

Parking along Panama Road is likely to be required to be prohibited on both sides of the road on either side of the bridge during the operation of the temporary traffic signals for the shuttle working. This would be necessary to ensure that the operation of the signals is not compromised by parked vehicles.

Access to 82-88 Panama Road may be affected by the construction works. This would be due to the amended alignment of the bridge and requirement to raise the height of the carriageway to tie into the new bridge. As there are no alternative accesses to these properties, specific arrangements would need to be developed to enable these properties to be accessed during the works. These arrangements should be developed in accordance with the CTMP.

At Princes Street, there are two locations for compounds. The compound on the eastern side of the motorway is located along side Frank Grey Place. This compound would remove the existing properties and therefore access to these sites does not need to be maintained for these properties. No Stopping At All Times restrictions are currently located along Frank Grey Place and therefore, it is not envisaged that additional parking restrictions are required in associated with the compound.

The compound on the western side of the motorway at the Princes Street Interchange is located on the eastern side of Todd Place. Access to this site is likely to be gained via Albert Street, Avenue Road and Todd Place. Depending on the type of vehicles needing to access this compound parking may need to be prohibited around some of the intersections, particularly Albert Street / Avenue Road.

No property accesses on the western side of Princes Street are currently envisaged to be affected by the construction works.

10.3 Potential Mitigation Measures

Potential mitigation measures for minimising the effects of the works in Sector 5 could include:

1. There is potential for combined traffic effects due to simultaneous works at Mount Wellington Highway Interchange and Princes Street Interchange as these are directly up and downstream of each other. Works shall be coordinated to minimise traffic management at one of these interchanges that may affect the other;

2. There is the potential for reliance on SH20 to provide relief to SH1 during construction where capacity is reduced as a result of temporary traffic effects. Works on SH20 and SH1 should be coordinated to minimise works that reduce capacity on both corridors simultaneously;

3. Reconstruction of the Panama Road bridge could affect local access and buses. The bridge will need to be kept open to traffic, at least as a single lane, due to the bus route along Panama Road and the local access function across the motorway performed by the bridge. Works should be programmed and staged to retain access across the motorway along Panama Road;

4. To safely operate the Panama Road bridge as a single lane with shuttle working, temporary signals would be required. These have the potential to create delays for buses if operated with fixed timings. To minimise delays to buses, the operation of any temporary signals on Panama Road should be performed manually, particularly at peak times. The operation of the temporary signals should be assessed in accordance with the requirements of the CTMP;

5. Site access and egress points on the motorway have the potential to effect traffic flows on the motorway mainline. These access points will need to be coordinated across the project with appropriate sight lines and signage provided to guide construction traffic and advise general motorists of the access/egress points. SSTMPs developed in accordance with the CTMP will need to provide details of site access and egress points;

6. Where construction activity may require access from private property, early consultation with affected property owners and tenants and the specific effects such as the number of truck movements carefully assessed. Stakeholder engagement plans should be developed as part of the project consistent with the requirements of the CTMP;

7. Diversion routes from the motorway have the potential to affect residential areas. Where possible and practical, non-local roads (such as arterials or collector roads) should be used for diversion of traffic. Diversion routes should be identified and agreed with the RCA in accordance with the procedures in the CTMP;

8. Road closures have the potential to create traffic effects if these occur at times of high traffic flows. To minimise effects any road closures should consider the volume of traffic affected and be timed so as to minimise the effects on the operation of the diversion route and on those motorists affected by the proposal. The CTMP shall identify appropriate times for anticipated closures or provide procedures to determine road closure times;

9. Road or lane closures have the potential to affect travelling motorists. Sufficient advanced warning should be provided to motorists of road or lane closures through appropriate advertising in the media, websites and on motorway and / or local roads including utilising VMS (temporary or permanent). Methods and procedures of notifying the public of closures should be included in the project's Communication Plan and CTMP; and

10. Clear communication and guidance from temporary signs will be required for the bull-run lane arrangement on SH1 southbound at Ōtāhuhu Creek.

11 Sector 6

Sector 6 includes all of the local road improvements in Onehunga including works on Captain Springs Road between EWL and Neilson Street, new link to MetroPort, reconfiguration of Great South Road and a priority lane on Church Street on the northbound approach to SH1.

11.1 Indicative Traffic Management Measures

Captain Springs Road will need to be widened south of Neilson Street with a new intersection with the EWL. This portion of Captain Springs Road is a cul-de-sac with access primarily for light industrial related businesses. Lanes are likely to be narrowed during the construction. Two narrowed lanes (one in each direction) can generally be maintained during this work and access to properties maintained in all cases. Works on Neilson Street itself will likely be minimal as a significant proportion of the proposed changes will be carried out by the East West early works programme in 2016/17.

Parking may be required to be removed temporarily on Captain Springs Road, Albert Street, Ports Link and Hugo Johnston Drive to facilitate construction activities. Specifics for these have been discussed above for Sectors 2 and 3.

The priority vehicle lane on Church Street on the approach to the SH1 northbound on-ramp is likely to consist predominantly of road markings. No significant traffic management is anticipated associated with this element of work.

11.2 Identification and Mitigation of Traffic Impacts

11.2.1 Impacts arising from the temporary work site

11.2.1.1 Captain Springs Road

Captain Springs Road will require temporary lane / shoulder closures to allow widening on both sides. Due to the low traffic volume on Captain Springs Road, there are no major impacts anticipated. Removal of parking on Captain Springs Road was discussed in Sector 2 (Section 7.2.1).

The intersection improvements at Captain Springs Road / Neilson Street consists of mainly line marking and addition of a left turn lane on Neilson Street East approach. Narrow lanes may be required for the widening works but the existing number of lanes would be retained. Therefore, intersection capacity will be largely unchanged.

11.2.2 Impacts arising from Site Access Points

Temporary Access Points from the following may be required:

Properties on Captain Springs Road – low impact

- Construction activities along Captain Springs Road from the proposed EWL alignment intersection will involve road widening activities. All existing access points as well as that from the roundabout into 69 Captain Springs Road will be maintained;
- The extension of Captain Springs Road to the EWL main alignment will partly occur on a section of private road to be acquired from Seamount. It is anticipated that access to Seamount will be maintained to Seamount during construction;
- The reconfiguration of the existing Neilson Street and Captain Springs Road intersection will involve road widening and road marking construction activities. Property access will be maintained.

Heliport – low impact

Property access into the Heliport will be maintained via the existing access road Miami Parade.

Great South Road/South-eastern Motorway – low impact

The construction activities near the Great South Road/South-eastern Motorway intersection will involve road marking. Property access will not be affected.

11.3 Potential Mitigation Measures

A list of potential mitigation measures for minimising the effects of the works in Sector 6 might include:

1. Consultation with affected property owners and tenants should be undertaken prior to works on local properties in accordance with the requirements of the CTMP.

12 Conclusion

The potential traffic effects of construction works on the road network, pedestrians, cycles, public transport and property access has been assessed. Possible measures to mitigate the effects have been identified as a basis for development of future SSTMPs.

The assessment undertaken has been split into a number of categories:

- Impacts on capacity of existing carriageways;
- Temporary closures of existing carriageways;
- Impacts arising from site access locations and movements;
- Impacts on public transport;
- Impacts on pedestrians and cyclists; and
- Impacts on property access, parking and manoeuvring.

The alignment of the EWL has been broken up into six sectors. Sector 1 is the SH20 Neilson Street interchange and immediate area, Sectors 2 and 3 are along the foreshore of the Māngere Inlet. Sector 4 is along Sylvia Park Road to SH1, with Sector 5 extending from Mount Wellington Highway interchange where EWL would connect to Princes Street Interchange. Sector 6 comprises local road works in Onehunga on Church Street by SH1.

The effects on capacity of existing carriageways has been assessed utilising the SATURN model that has been developed for the project. The model has been used to assess the effects on the road network due to capacity reduction in Sectors 1 and 5 for SH1 and SH20 with traffic management measures. A base year and future year has been assessed. The Base Case year represents the year in which construction starts and End of Construction year is the last year of construction. The model network had the anticipated road network at these dates including Waterview connection but excluding the completed Project.

Reduced capacities are anticipated on SH1 and SH20 due to traffic management such as lane narrowing, reduced speed limits and lane shifts required for construction. Based on experience from other projects undertaken on the Auckland motorway network, capacity reductions of 5% and 10% have been assessed. This is to determine the likely range of effects. Capacity reductions on SH1 and SH20 have been assessed separately as it is assumed that works which reduce capacity would not be undertaken on SH1 and SH20 simultaneously. This is because there is likely to be transfer of some traffic between the two routes.

For SH20, the effects of the reduced capacity affect a wider area of the network in the End of Construction year; the Base Case impacts are generally localised around the SH20 Neilson Street interchange where the capacity reduction will occur due to the works at the interchange. Journey times on SH20 are forecast to increase by between 19% and 50% depending on the year and the capacity reduction.

The assessment shows that there appears to be some transfer of traffic from SH20 to SH1 with the reduced capacity but that this does not impact SH1 journey times.

For SH1, the effects of reduced capacity largely occur on SH1 mainline and with some transfer of traffic to parallel routes of Great South Road and Mount Wellington Highway. Overall, there is little effect on SH20 due to capacity reduction on SH1. The impact of undertaken works on SH1 later in the overall construction programme appear to be less when compared to those of SH20. This is reflected in the forecast journey times on SH1. In the northbound direction along SH1 similar percentage increases in journey times are forecast between the Base Case year (25%) and the End of Construction year (27%). There is a greater effect on southbound traffic in the future year (19%) compared to the Base Case year (4%).

Based on the analysis, it is concluded that the works at SH20 should be undertaken towards the beginning of the overall works construction period so as to minimise adverse network traffic effects. SH1 works could be programmed later as this is less sensitive to future traffic growth.

Sectors 2 and 3 are constructed primarily off line and therefore there the works would not reduce network capacity. The exception to this is around the Great South Road /Sylvia Park Road intersection which is proposed to be enlarged to include the EWL into the intersection. It is anticipated that the existing number of lanes would be generally be retained at the intersection during construction at peak times, although some narrowing of lanes may be required. The actual operation of the intersection would be dependent on the construction staging which will determined by the chosen contractor and therefore cannot be assessed at this stage.

Sector 4 involves constructing the EWL along Sylvia Park Road. A single lane in each direction would be maintained along this road during the works. This has been assessed as having sufficient capacity for the traffic flows using Sylvia Park Road. Significant changes are required at the Sylvia Park Road / Mount Wellington Highway intersection as the EWL is grade separated at this intersection. The anticipated road layout during construction has been assessed using a SIDRA model. The tests indicate that the intersection would operate at a similar level of performance as the existing intersection. However, it is noted that its operation is dependent on queues extending back from the SH1 / Mount Wellington Highway Interchange which vary from day to day.

Works on Sector 6 are will generally not have a significant impact on capacity as these are generally minor works including road markings.

Access to work sites will be managed on a location by location basis. Restrictions on turning movements, number of vehicles using accesses or operation of intersections with site accesses may be required. Potential issues have been identified and possible mitigation measures proposed. Actual management of accesses will be developed as part of SSTMPs.

There is generally no significant impact on public transport. The exception is for rail where works are required for construction of bridges above freight lines into MetroPort and across the southern rail line. Blockades may be required to undertake these works. These would need to be planned in advance with discussions and agreement with KiwiRail and MetroPort. Rail replacement buses would be required where passenger lines are affected.

For pedestrians and cyclists, the most significant impact is on the Waikaraka cycleway. Full or partial closures of the route will be required for the construction of the EWL along the Māngere Inlet. Closures will be minimised in terms of length along the shared path and duration. Improvements may be required on alternative pedestrian and cycle routes. The extent of such works may be dependent on the timeframe of the closure.

Access to properties affected by the works are generally maintained. Some accesses may need to be temporarily relocated or where properties have more than one access, secondary accesses may require closing to facilitate works. Individual property owners will be consulted to discuss specific impacts and any organise alternative arrangements.

Possible mitigation measures have been identified to address the construction impacts on traffic and the road network for each of the sectors. These mitigation measures should be considered when detailed SSTMPs are produced. The CTMP Framework) provides guidelines and processes for the preparation of the SSTMPs.

A summary of the mitigation measures identified are provided in Table 12-1.

Table 12-1: Summary of Potential Mitigation Measures

Sector 1
• SH20 construction works should be undertaken early in the construction programme. This will need to be considered in the early phases of procurement planning to ensure the feasibility of this is not precluded. • Construction works on SH20 and SH1 that concurrently reduce mainline capacity should be avoided where possible. • VMS signing should be used in advance of significant changes to the road layout or capacity. • Alternative routes or detour routes should be optimised to minimise the overall network delay caused by the works on SH20. • Point-to-Point Speed Enforcement (PPSE) should be implemented to improve compliance with lowered speed limits. • Close liaison with passenger transport agencies and operators to minimise the impact of traffic management measures on passenger transport services. • Close liaison with major traffic generating activities and sites and sensitive stakeholders in the area, for example the Ports of Auckland, Auckland International Airport and Dress Smart. • Communication campaigns should be aimed at diverting traffic onto alternative routes and minimising the level of demand through the project area and construction period. • Integration with employer travel plans to recommend alternative routes, modes or travel times to minimise the demand on the road network.

Sector 2
• Programming of works shall be carefully planned to minimise the length of any closure period with Waikaraka cycleway and that temporary openings and closures are avoided to minimise confusion for users. • Early notification and consultation with affected pedestrians and cyclists should be undertaken. • Separate media campaigns should be devised to address the needs of recreational and commuter cyclists. • Safe alternative route(s) for commuter cyclists through the Onehunga area should be investigated and minor safety improvement works considered, if necessary, if the Waikaraka cycleway facility is to be closed for a significant period of time. This may include the temporary removal of parking on Church Street to provide an adequate alternative cycle facility. • Trucks movements importing fill should where possible be spread across the Sector 2 site access points.

Sector 3
• Measures to mitigate the effects on the Waikaraka cycleway as outlined for Section 2. • Consider restrictions to work site access points at Great South Road / Sylvia Park Road intersection on movements allowed and times for access and egress so not to adversely affect the road network. • Early engagement with AT and ATOC to discuss amended intersection arrangements and phasing at the Great South Road / Sylvia Park Road intersection. • Staging of the amendments to the Great South Road / Sylvia Park Road intersection including possible weekend or night works. • Alternative provision for pedestrians should be considered to provide a safe route along the western side of Great South Road or an additional signalised pedestrian crossing on the northern arm of the Great South Road / Sylvia Park Road. • Consider measures that reduce the impact on buses along Great South Road and through the Sylvia Park Road intersection, including discussions with AT Metro. • Early engagement with property owners and / or tenants should be undertaken where property access is

affected.

- Advanced notice provided to motorists and businesses should be provided of changes to parking so that motorists may be able to make alternative arrangements.

Sector 4

- Introduce performance measures around queue lengths or delays or monitoring requirements at the Sylvia Park Road / Mount Wellington Highway intersection to minimise effects on the interchange and intersection.
- Manage access and movements to site access on Mount Wellington Highway opposite Sylvia Park Road. Measures could include limiting traffic movements to left in and left out only as priority control rather than under signal control, or restricting the number of vehicle movements.
- Early consultation where access is affected to properties.
- Where pedestrian facilities are removed on Sylvia Park Road, alternative facilities or pedestrian routes should be considered.

Sector 5

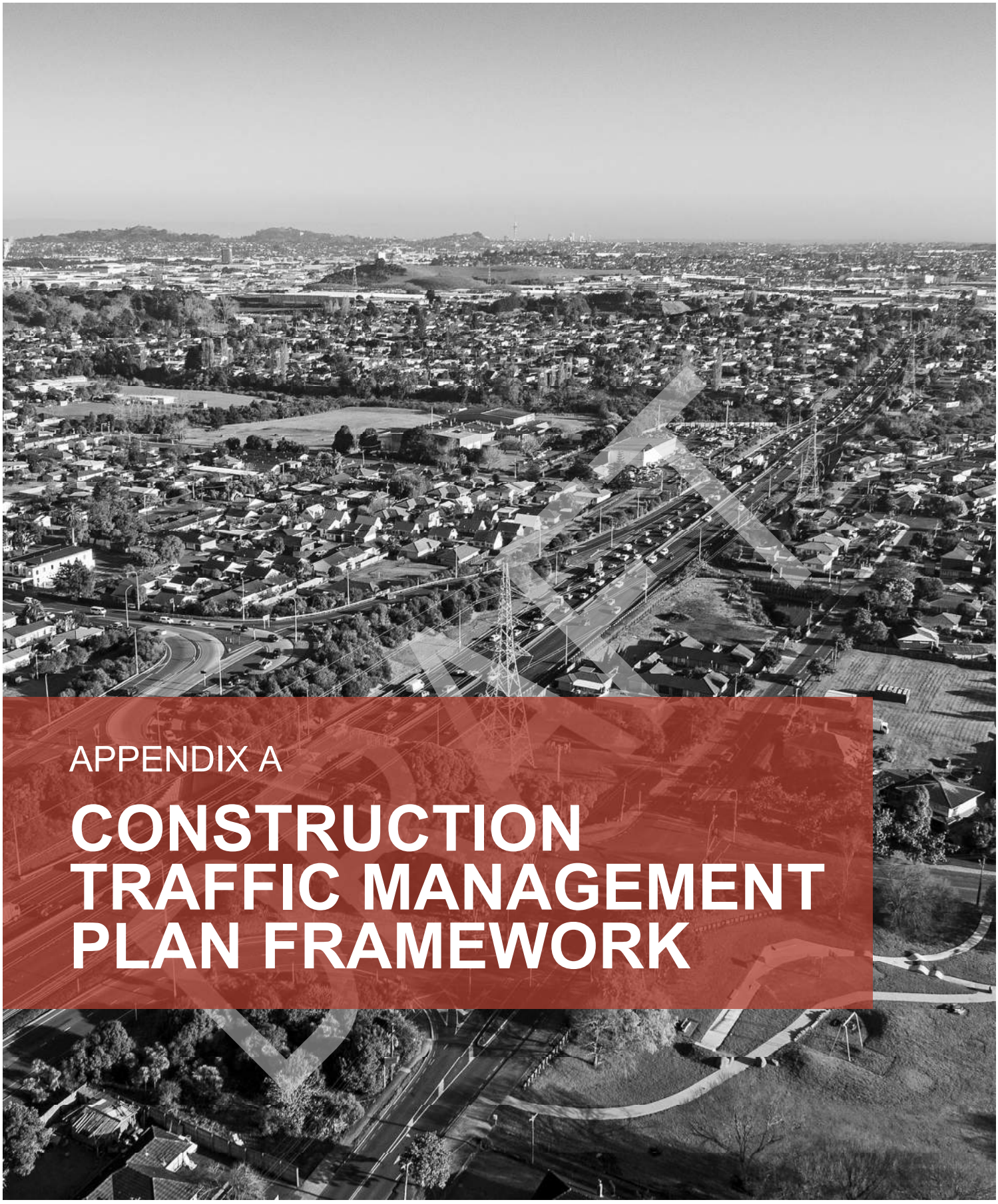
- Coordinate works on SH1 at Mount Wellington Highway Interchange and Princes Street Interchange to minimise traffic effects between the locations.
- Construction works on SH1 and SH20 that concurrently reduce mainline capacity should be avoided where possible.
- Keep Panama Road bridge open to traffic, at least as a single lane, due to minimise effects on the bus route along Panama Road and the local access function.
- Manually operate any temporary signals at the Panama Bridge to minimise delays to buses, particularly at peak travel times.
- Coordinate site access and egress points on the motorway mainline and ensure appropriate sight lines and signage provided to guide construction traffic and advise general motorists of the access/egress points.
- Where construction activity may require access from private property, early consultation with affected property owners and tenants and the specific effects such as the number of truck movements carefully assessed.
- For diversion / detour routes, where possible and practical, non-local roads (such as arterials or collector roads) should be used for diversion of traffic.
- For any road closures, assess the volume of traffic affected and adjust timing of closure to minimise the effects on the operation of the diversion route and on those motorists affected by the proposal.
- Provide sufficient advanced warning to motorists of road or lane closures through appropriate advertising in the media, websites and on motorway and / or local roads including utilising VMS (temporary or permanent).
- Clear communication and guidance from temporary signs will be required for the bull-run lane arrangement on SH1 southbound at Ōtāhuhu Creek.

Sector 6

- Consultation with affected property owners and tenants should be undertaken early prior to works affecting access to local properties.

Appendix A

Construction Traffic Management Plan



APPENDIX A

CONSTRUCTION TRAFFIC MANAGEMENT PLAN FRAMEWORK

NZ TRANSPORT AGENCY WAKA KOTAHI

East West Link

Quality Assurance Statement	
Prepared by	Wasim Sidyot
	Nick Guo
	Kathy Matete
Reviewed by	Darren Wu
Approved for release	Patrick Kelly (EWL Alliance Manager)

Revision schedule					
Rev. N°	Date	Description	Prepared by	Reviewed by	Approved by
0	November 2016	Final for Lodgement	Wasim Sidyot, Nick Guo, Kathy Matete	Darren Wu	Patrick Kelly

Table of Contents

List of Figures

List of Tables

Glossary of Technical Terms/Abbreviations

Terms / Abbreviation	Term
AADT	Average annual daily traffic
AEE	Assessment of Effects on the Environment
AMA	Auckland Motorway Alliance
AMETI	Auckland-Manukau Eastern Transport Initiative
AT	Auckland Transport
ATCOP	Auckland Transport Code of Practice
ATOC	Auckland Transport Operations Centre
BCR	Benefit Cost Ratio
CAR	Corridor Access Request
CoPTTM	Code of Practice for Temporary Traffic Management
CEMP	Construction Environmental Management Plan
CIMS	Coordinated Incident Management System
CTMP Framework	Construction Traffic Management Framework
CTMP	Construction Traffic Management Plan
EED	Engineering Exception Decision
EWL	East West Link
EWLA	East West Link Alliance
GPSLT	Government Policy Statement on Land Transport
LTMA	Land Transport Management Act
MOTSAM	Manual of Traffic Signs and Markings
MVMS	Mobile Variable Message Signs
The NZ Transport Agency	New Zealand Transport Agency
PWA	Public Works Act 1981
RCA	Road Controlling Authority
RMA	Resource Management Act 1991
SH(x)	State highway (number)
SCATS	Sydney Coordinated Adaptive Traffic System
SSTMP	Site Specific Traffic Management Plan
TCD Manual	Traffic Control Devices Manual
TMC	Traffic
TMP	Traffic Management Plan
TTM	Temporary Traffic Management
VMS	Variable Message Signs

1. Purpose of this document

This Construction Traffic Management Plan Framework (CTMP Framework) informs the actual Construction Traffic Management Plan (CTMP) that will be produced as part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP) for the construction phase of the East West Link (EWL or the Project). The CTMP Framework addresses the potential construction traffic effects associated with the construction of the Project. These have been assessed using a risk based approach following the NZ Transport Agency Risk Management Process.

It is important to note that the traffic impacts of the Project will not be fully understood until the detailed design, alignment and construction methodology are all finalised. These items cannot be finalised before consent for the Project has been achieved, so this document does not prescribe or limit the activities that will be required for construction of the Project. Instead, it outlines the methodology for managing the likely range of impacts, and provides a generic and preliminary appraisal of the potential impact on the road network.

This CTMP Framework will support the development of the CTMP once details for items like the construction methodology are finalised and the associated impacts re-assessed where required.

1.1 Overview of Contents

This CTMP Framework identifies or provides:

- The minimum standards necessary for management of traffic control on the Project, however it is acknowledged that at times it may not be possible to meet those standards and therefore outlines special approval procedures to be followed where those minimum standards cannot be met;
- A generic and preliminary appraisal of the potential impact of temporary traffic management activities on the road network;
- The methodology for managing the likely range of impacts; and
- Particular traffic management procedures to mitigate the identified impacts, minimise effects on health and safety and therefore reduce the impact on the environment.

1.2 Scope

This document is based on the current understanding of construction activities and traffic methodologies that will be necessary to facilitate the works. The traffic impacts of the Project will not be fully understood until the detailed design, methodology, consenting is finalised and detailed construction planning has commenced. Consequently this document does not prescribe or limit the activities that will be required for construction of the Project. Instead, it develops procedures under which traffic management will be implemented to the satisfaction of the stakeholders and road controlling authorities.

It is expected that the methodologies and mitigation measures specified in this document will be refined during the development of the Project CTMP and when Site Specific Traffic Management Plans (SSTMP) are prepared, at a time closer to commencement of construction.

1.3 Other relevant documents

This CTMP Framework should be read in conjunction with the following CEMP suite of documents:

- **Technical Report 10 – Construction Traffic Impact Assessment** - aims to estimate and appraise the impacts of the Project's temporary traffic management activities and the proposed mitigation measures; and

- **CEMP** - provides a more detailed description of the construction activities involved in the Project and procedures for how these will be managed.

While this CTMP Framework discusses physical works which will form part of the temporary construction works, it is important to note that this document does not prescribe or limit the activities that will become part of the final design.

Please refer to the relevant design related documents for final design related issues.

2. Temporary Traffic Management Framework

Temporary Traffic Management (TTM) is governed by New Zealand legislation, in particular, the Land Transport Act 1998. Land Transport Rules made pursuant to that act, which relate to TTM, include:

- Land Transport (Road User) Rule 2004;
- Land Transport Rule: Traffic Control Devices 2004; and
- Land Transport Rule: Setting of Speed Limits 2003.

The Project shall adopt the following standards and guidelines insofar as they are relevant:

- NZTA Traffic Control Devices Manual (TCD); and
- NZTA Code of Practice for Temporary Traffic Management (CoPTTM).

The NZ Transport Agency's TCD Manual - provides guidance on industry good practice, including, where necessary, practice mandated by law in relation to the use of traffic control devices. The primary standard (which forms part of the TCD Manual) that will be adhered to in planning, coordinating and implementing TTM for this Project is CoPTTM.

The NZ Transport Agency's CoPTTM - describes best practice for the safe and efficient management and operation of TTM on all roads in New Zealand. CoPTTM includes practices for the development of TMPs for all roads in New Zealand and outlines requirements and guidelines for TTM.

It should be noted that while the TCD Manual (CoPTTM) generally provides comprehensive guidance, there are likely to be circumstances where other manuals will be required for guidance on specific areas. These are:

- **Austroads Guide to Traffic Engineering Practice** - this document will be employed where design of traffic signals, road layouts, signage or other traffic engineering elements require more detailed analysis.

The TCD Manual includes and will supersede previous standalone documents relevant to TTM, such as CoPTTM and MoTSAM.

Approval of the Traffic Impact Assessment (TIA) for major road works is to be carried out by Auckland Transport (AT), The NZ Transport Agency and Auckland Motorway Alliance (AMA).

The appointed contractor(s) for the Project will liaise early with Regional Controlling Authority (RCA) and agree on traffic management methodologies for key areas before completion of the detailed design or commencement of construction in accordance with local authority regulations. This will allow for responsive traffic management methodologies that reflect the requirements of the RCAs and the need for flexibility over timing, design and construction methodology.

The relevant designation and consent conditions granted for the Project will also form part of the requirements for implementation of this Plan.

For further information on statutory requirements, refer to the Construction Traffic Impact report.

2.1 Special Approval Procedure - Engineering Exception Decision

Where it is not possible to adhere to this standard, the CoPTTM's prescribed Engineering Exception Decision (EED) process will be followed, which will include appropriate mitigation measures agreed with the RCA. However, as the timing of construction of the Project at specific locations remains uncertain, it is recommended that RCA specific requirements are addressed on a case-by-case

basis as deemed appropriate by the RCA during the Site Specific Traffic Management Plan (SSTMP) approval process.

3. Temporary Traffic Aspects

This section provides a description of the expected traffic management activities for the Project and an overview of the anticipated impacts of these activities. At the time of preparation of this report, the construction methodology was still under development, and will likely be in a state of flux until construction commences on site. This report therefore reflects the best understanding of likely traffic management methodologies for the required construction works, and is based on similar construction activities across the Auckland region.

3.1 Summary of traffic management activities

The Project comprises of the connection between the SH1 and SH20 motorways, and provides a vital east-west link through the Auckland region. The Project has been broken up into 6 sectors, based on the environment and construction activities expected in each sector.

A brief description of the expected traffic management activities for each sector based on the current understanding of construction methodology that will be adopted is provided below. For a full description of the construction activities expected for the Project, refer to the Section 12 of *Volume 1: Assessment of Effects on the Environment* (AEE).

3.1.1 Sector 1 - Neilson Street Interchange

Sector 1 covers the works on and surrounding Neilson Street Interchange at State highway 20 (SH20). The existing interchange will be reconfigured to establish a connection to the new East West Link (EWL) while maintaining access to the local area. The key features are:

- Lane and shoulder closures in both the northbound (NB) and southbound (SB) directions to allow for the construction of new SH20 ramps and the EWL alignment adjacent to the Onehunga Wharf;
- Temporary roads to realign traffic from the SH20 SB off ramp;
- Temporary detour road to maintain existing access to affected business properties along Gloucester Rd;
- Discrete closures of the interchange ramps or of the motorway;
- Partial intersection closure for the construction of the Galway Link;
- Site access provided on acquired private land to host construction yards at the interchange;
- Temporary detour bridge adjacent Onehunga Harbour Road to maintain shared path; and
- Lanes/shoulders narrowed and a lower temporary speed limits applied to establish work areas for the construction of the SH20 Neilson Street Interchange over-bridge piers and the new southbound On-Ramp.

3.1.2 Sector 2 - Foreshore works from the Neilson Street Interchange to Anns Creek

Sector 2 covers the works in the coastal marine area on the northern side of the Māngere Inlet from the Neilson Street Interchange to Anns Creek. The key features include:

- Cycle path and footpath closure along Waikaraka Shared Path to minimise pedestrian / cyclist hazards during embankment construction.

3.1.3 Sector 3 - Anns Creek works from the end of the embankment to Great South Road/Sylvia Park Road intersection

Sector 3 includes the construction of the east west link from the eastern end of the embankment, through Anns Creek to Great South Road. The key features include:

- Footpath / cyclist path closure on the Waikaraka Shared Path;
- Road closure / detours for the Southdown Co-Generation Plant access road off Hugo Johnston Drive;
- Temporary detour road constructed along the Māngere Inlet foreshore to allow for access to the Heliport during the construction of the EWL foreshore alignment;
- Footpath and cycle lane closures / path closures and pedestrian crossing closure during road reconfiguration at the Great South Road / Sylvia Park Road intersection and on Waikaraka Cycleway;
- Lower temporary speed limits to increase driver and construction worker safety; and
- The weekend closures of the rail lines and introduction of buses replacing rail services for passenger trains where the EWL alignment crosses the southern rail line.

3.1.4 Sector 4 - Sylvia Park Road/Sylvia Park ramps to end of Sylvia Park ramps (SH1)

Sector 4 includes the works from Great South Road to State Highway 1 (SH1). The key features include:

- Shoulder and lane closure to form the required work space along Sylvia Park Rd;
- Partial intersection / lane closure where some movement lanes will be restricted at the intersection of Sylvia Park Road and Mt Wellington Highway;
- Lower temporary speed limit to increase driver and construction worker safety for construction activities along SH1 near the Sylvia Park Road interchange;
- Site access into the construction yard at the signalised Sylvia Park Road and the Mt Wellington Highway intersection; and
- Private access into the existing car yard to undergo full closure due to land acquisition for the Project.

3.1.5 Sector 5 - SH1 to end of Sylvia Park ramps to Princes Street interchange

Sector 5 covers the works from TipTop corner to the eastern side of SH1 to Princes Street Interchange. The key features include:

- Shoulder and lane closures at the Panama Road and Ōtāhuhu Creek and Princes Street Bridges;
- Part and full intersection and road closure / detours for certain construction activities;
- Widening works on SH1 will generally require narrow lanes and shoulders with an associated temporary speed limit to establish the required work areas;
- Lower temporary speed limit to increase driver and construction worker safety;
- Footpath closure / detour and pedestrian crossing closure at the Panama Road and Princes Street bridges;
- Temporary motorway realignment at Ōtāhuhu Creek with bull-run lane arrangement; and
- Diversion routes for the SH1 Princes Street ramps.

3.1.6 Sector 6 - Local works on Neilson Street, Captain Springs Road, the proposed Metrolink, and Great South road/Church Street intersection

Sector 6 includes all of the local improvements in Onehunga, north of Sector 2. The key features include:

- Shoulder and lane closures to allow widening on both sides;
- Intersection part closure during line marking activities at the Captain Springs Road / Neilson Street intersection and along Southern Eastern Highway;
- Lower temporary speed limit to increase driver and construction worker safety; and
- Footpath closure / detour on local roads.

3.2 Temporary Traffic Impacts Summary

The following section provides an overview of the typical impacts that are anticipated to arise from temporary traffic management activities conducted for the Project.

The impacts included here are a summary of those assessed in *Volume 3: Technical Report 10 – Construction Traffic Impact Assessment* report. Methods for managing and mitigating those impacts are well developed and have been implemented successfully on a range of maintenance and infrastructure projects throughout the region.

The range of traffic control activities expected for the construction of the Project and identified impacts are shown in **Table 3.1** below. It has three components:

- **Traffic control activity.** This column lists the types of traffic control activities that may be implemented for construction of the Project.
- **Impacts.** This column outlines the impact of the traffic control activity on pedestrians, cyclists, residents, businesses, public transport, and general traffic.
- **Relevant Zone.** This column indicates which Zones are expected to experience each traffic control activity.

Table 3-1: Impact of Traffic Control Activities by Sector

Traffic Control Activity	Impact	Relevant Sector					
		1	2	3	4	5	6
Footpath closure / detour	▪ Inconvenience to pedestrians and residents along route ▪ Disconnection of access to bus stops ▪ Increased exposure of pedestrians to traffic	✓	✓	✓	✓	✓	✓
Cycle lane closures / path closures/ detours	▪ Inconvenience to cyclists along route ▪ Increased exposure of cyclists to traffic	✗	✓	✓	✗	✗	✗
Property access closures	▪ Inconvenience to residents and businesses along route	✗	✗	✗	✗	✗	✓
Shoulder closures	▪ Reduced safety	✓	✗	✓	✓	✓	✓

Traffic Control Activity	Impact	Relevant Sector					
		1	2	3	4	5	6
	▪ No room for incident management, breakdowns etc. ▪ Increased severity of recurrent and non-recurrent congestion						
Pedestrian crossing closure	▪ Inconvenience to pedestrians ▪ Reduced safety by removing access to existing crossing points	✓	X	✓	X	✓	✓
Bus lane closures	▪ Increased travel times ▪ Lower reliability ▪ Inconvenience to public transport users ▪ Reduced incentive to use public transport, i.e. mode shift to private vehicle	✓	X	X	X	X	X
Intersection full closure (which may include installation of full closures on the approaches to the intersection to safely divert traffic around the works)	▪ Disconnection of bus routes ▪ Disconnection of access to bus stops ▪ Inconvenience to road users ▪ Inconvenience to residents and businesses within closed road segment ▪ Congestion on detour routes	✓	X	X	X	✓	X
Intersection part closure (which may include installation of lane closures on the approaches to the intersection to safely divert traffic around the works)	▪ Diversion of traffic away from the closure onto inappropriate routes such as residential streets, past schools or other sensitive facilities ▪ Inconvenience to road users ▪ Inconvenience to residents and businesses within closed road segment	✓	✓	✓	✓	✓	✓
Lane closure – reduced number of lanes Lane closure - alternating flow operation Lane closure - contra-flow operation Lane closure - one-direction closure	▪ Inconvenience to road users ▪ Reduced traffic capacity through site as a result of: – Fewer lanes than existing corridor – Increased side-friction resulting from narrowed lanes and reduced shoulders ▪ Construction activities visible to motorists resulting in 'rubber necking' ▪ Reduced capacity across a link due to stop-go operations ▪ Diversion of traffic away from the closure onto inappropriate routes such as residential streets, past schools or other sensitive facilities ▪ Disconnection of bus routes ▪ Disconnection of access to bus stops	✓	X	X	✓	✓	✓

Traffic Control Activity	Impact	Relevant Sector					
		1	2	3	4	5	6
Road closure / detours	▪ Inconvenience to road users ▪ Inconvenience to residents and businesses within closed road segment ▪ Congestion on detour routes ▪ Congestion on alternative routes ▪ Diversion of traffic away from the closure onto inappropriate routes such as residential streets, past schools or other sensitive facilities ▪ Disconnection of bus routes ▪ Disconnection of access to bus stops	✓	✓	✓	X	✓	X
Short term closures for installation of long-term closures / traffic control measures	▪ Congestion through closure as discrete closures are required for installing long-term (i.e. greater than 24 hour) closures	✓	✓	✓	✓	✓	✓
Site access	▪ Truck movements reducing traffic capacity through a closure ▪ Reduced traffic safety due to truck manoeuvring in or out of the closure ▪ Impact on capacity of access routes arising from higher proportion of trucks ▪ Increased traffic on access routes resulting in congestion and increased travel times	✓	✓	✓	✓	✓	✓
Temporary speed limit	▪ Inconvenience to road users ▪ Slower operating speeds ▪ Potential non-compliance with speed limit	✓	✓	✓	✓	✓	✓

4. Traffic Management Controls

Traffic management measures will be planned and implemented to a level appropriate for the activity or work site. In accordance with CoPTTM, traffic management measures will be implemented in order to fully consider the safety and level of service provided as the travelling public approaches, pass through and continue beyond the Project area.

The following sets out broadly the proposed mitigation measures and the procedures which will be adopted to manage the impacts identified in **Section 3**.

4.1 Summary of Mitigation Measures

The range of traffic control mitigation measures expected to be implemented are summarised in **Table 4.1** below. It has three components:

- **Traffic control activity**. This column lists the types of traffic control activities that may be implemented for construction of the Project.
- **Impacts**. This column outlines the impact of the traffic control activity on pedestrians, cyclists, residents, businesses, public transport, and general traffic.
- **Typical mitigation measures**. This column outlines the types of measures that will be considered in development of SSTMPs and management of the Project.

Details of the most likely mitigation measures likely to be required in each sector are defined in the *Volume 3: Technical Report 10 - Construction Traffic Impact Assessment* report.

Table 4-1: Impact and Mitigation of Traffic Control Activities

Traffic Control Activity	Impact	Typical Mitigation Measures
Footpath closure / detour	▪ Inconvenience to pedestrians and residents along route ▪ Disconnection of access to bus stops ▪ Increased exposure of pedestrians to traffic	▪ Letter drops to affected residents in advance of works in the area ▪ Provision of warning and advisory signage prior to and during the closure ▪ Provision of pedestrian crossings and refuges or controlled crossing points ▪ The Project team to advise interested parties/ stakeholders of closures in heavily trafficked areas ▪ Provision of convenient pedestrian detour routes well in advance of the closure to provide safe and convenient crossing ▪ Provision of alternative footpath alongside footpath closure
Pedestrian crossing closure	▪ Inconvenience to pedestrians ▪ Reduced safety by removing access to existing crossing points	▪ Letter drops to affected residents in advance of works in the area ▪ Provision of warning and advisory signage prior to and during the closure ▪ Project ambassadors to advise of closures in heavily trafficked areas ▪ Provision of convenient pedestrian detour routes well in advance and at the closed crossing to provide safe and convenient crossing ▪ Installation of warning signage for road users to warn of crossing location changes where necessary ▪ Provision of alternative temporary road crossings and realign uncontrolled crossing points
Cycle lane closures / path closures / detours	▪ Inconvenience to cyclists along route ▪ Increased exposure of cyclists to traffic ▪ Reduced safety	▪ Letter drops to affected residents in advance of works in the area ▪ Provision of convenient detour routes well in advance of the closure to provide safe and convenient cycle routes ▪ Install signage along the cycle lane prior to construction commencing to allow cyclists to alter their travel patterns ▪ Install warning signage in advance of shoulder closures to alert motorists of cyclists ▪ Install a temporary speed limit ▪ Install signage along proposed alternative routes to inform motorists and increase cycle time

Traffic Control Activity	Impact	Typical Mitigation Measures
		▪ Install temporary cycle lanes and/or area segregated for cyclists by using safe hit posts to create temporary cycle lanes
Property access closures	▪ Inconvenience to residents and businesses along route	▪ Personal visit by the Project team to advise and discuss impacts of the closure with affected residents and businesses ▪ Letter drops to affected residents and businesses in advance of works in the area ▪ Provision of temporary car parking in an area within the length of the traffic control site ▪ Provision of metal-plate crossings into properties where feasible and safe ▪ Scheduling of works during holiday or low-demand periods of the year
Shoulder closures	▪ Reduced safety ▪ No room for incident management, breakdowns etc. ▪ Increased severity of recurrent and non-recurrent congestion	▪ Install a temporary speed limit ▪ Install Signage in Advance of shoulder closure ▪ Traffic control to direct motorists entering/leaving properties across the works area ▪ Coordination and programming of construction activities to limit impacts
Lane closure - alternating flow operation Lane closure - contra-flow operation Lane closure - one-direction closure	▪ Inconvenience to road users ▪ Reduced traffic capacity through site as a result of: ▪ Fewer lanes than existing corridor ▪ Increased side-friction resulting from narrowed lanes and reduced shoulders ▪ Construction activities visible to motorists resulting in 'rubber necking' ▪ Reduced capacity across a link due to stop-go operations ▪ Diversion of traffic away from the	▪ Public notification in appropriate media channels, where necessary ▪ Letter drops to residents and / or businesses (where necessary), which are located within the closure length or along detour routes ▪ Installation of concrete / water-filled barriers along site to isolate the site from public ▪ Installation of sight screens to reduce 'rubber necking' ▪ Installation of secondary detour routes where necessary ▪ Review and optimisation of traffic signals on detour and alternative routes where necessary ▪ Use of Variable Message Signs (VMS) for recommending alternative routes. Where possible, alternative routes will be recommended at a cordon around the closure, well in advance, in such a way to avoid traffic following the prescribed detour route where an alternative is a more convenient route to their intended destination. Install such signage in advance of the closure (e.g. a month prior, to inform road users)

Traffic Control Activity	Impact	Typical Mitigation Measures
	closure onto inappropriate routes such as residential streets, past schools or other sensitive facilities ■ Disconnection of bus routes ■ Disconnection of access to bus stops	■ Provision of access via a temporary corridor or narrow lane within the closure for residents and businesses within construction corridor, where possible. Access managed by traffic control where appropriate ■ Staging works for the night-time or weekend full closures ■ Scheduling of works during holiday or low demand period of the year. ■ Works conducted simultaneously on roads coordinated to minimise activities that reduce capacity or result in diversions simultaneously (e.g. works simultaneously occurring on SH1 and SH20)
Road closure / detours	■ Inconvenience to road users ■ Inconvenience to residents and businesses within closed road segment ■ Congestion on detour routes ■ Congestion on alternative routes ■ Diversion of traffic away from the closure onto inappropriate routes such as residential streets, past schools or other sensitive facilities ■ Disconnection of bus routes ■ Disconnection of access to bus stops	■ Personal visit by the Project team to advise and discuss impacts of the closure with affected residents and businesses; ■ Public notification in appropriate media channels, where necessary ■ Advertising on radio or through internet where necessary; ■ Letter drops to residents and / or businesses (where necessary), which are located: – within the closure length – along detour routes ■ Installation of secondary detour routes where necessary ■ Use of VMS for recommending alternative routes. Where possible, alternative routes will be recommended at a cordon around the closure, well in advance, in such a way to avoid traffic following the prescribed detour route where an alternative is a more convenient route to their intended destination. Install such signage in advance of the closure (e.g. a month prior, to inform road users) ■ Scheduling of works during holiday or low-demand periods of the year ■ Staging of works to require night time or weekend full-closures only ■ Consultation with the NZ Transport Agency / Auckland Transport / ATOC to develop detour routes and minimise bottle-necks on detours ■ Provision of temporary bus stops ■ Detour routes to follow arterial roads, where possible ■ Provision of barricades on the approaches to the closure to prevent public access and

Traffic Control Activity	Impact	Typical Mitigation Measures
		visibility to activities within the site ■ Extension of closures to intersections with arterial routes with access to residents only on the approaches to the works ■ Provision of access via a temporary corridor or narrow lane within the closure for residents and businesses within construction corridor, where possible ■ Review and optimisation of traffic signals on detour and alternative routes where necessary
Short term closures for installation of long-term closures / traffic control measures	■ Congestion through closure as discrete closures are required for installing long-term (i.e. greater than 24 hour) closures	■ Installation of long term work sites that require temporary barriers etc. to occur during night time or off-peak periods
Site access	■ Truck movements reducing traffic capacity through a closure; ■ Reduced traffic safety due to truck manoeuvring in or out of the closure; ■ Impact on capacity of access routes arising from higher proportion of trucks ■ Increased traffic on access routes resulting in congestion and increased travel times	■ Provision of site accesses at optimal and appropriate locations of the closure only ■ Development and distribution of site access plans which specify permitted access movements, times and procedures ■ Limiting site access movements / plant deliveries to off-peak periods or night time ■ Avoid peak traffic flow periods where possible ■ Optimise intersection arrangements and signal phasing along affected routes to maintain efficiency ■ Traffic control to manage truck movements into and out of the site ■ Site access to avoid residential or sensitive streets where possible ■ Restrictions on vehicle types or classes permitted to use the access

Traffic Control Activity	Impact	Typical Mitigation Measures
Temporary speed limit	■ Inconvenience to road users ■ Slower operating speeds ■ Potential non-compliance with speed limit	■ Public notification in appropriate media channels, where necessary ■ Monitor and review use of Temporary Speed Limits to ensure the speed limit is appropriate for the environment ■ Speed controlling measures may be put in place, such as: lane narrowing or introduction of horizontal curves ■ Speed enforcement including monitoring and enforcing average journey time through restrictions

4.2 Traffic Management Procedures

Traffic Management impacts will typically be mitigated through the measures described above. The mitigation measures will be governed by this document (to be reviewed and approved by a key stakeholders group – to be confirmed once Project team has been established) and implemented through the Traffic Management Plan (TMP) approval process with the key stake stakeholders and RCAs.

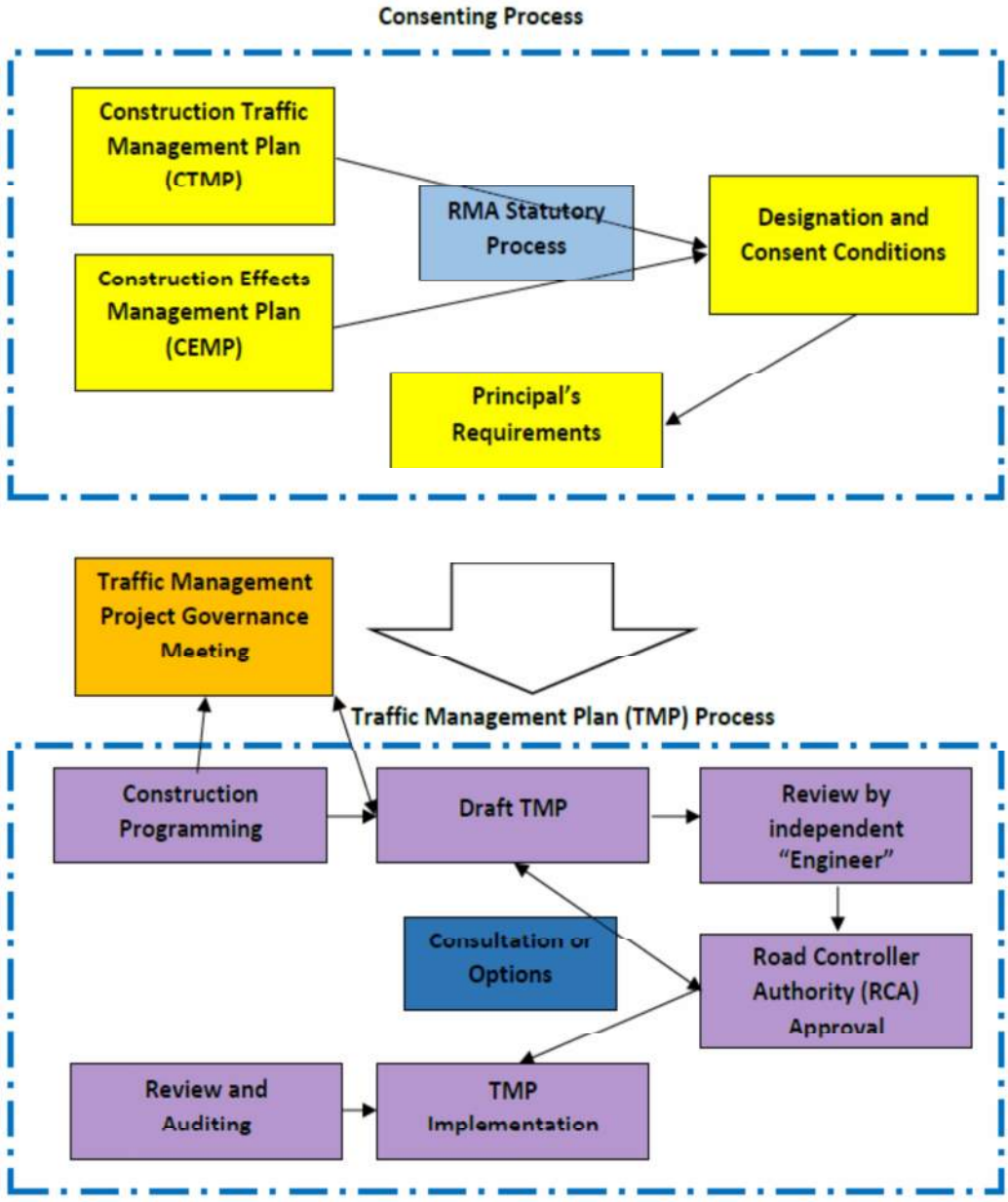
The complete Traffic Management procedure is illustrated in **Figure 4.1** below.

4.2.1 Operation / management procedures

Traffic Management impacts will typically be mitigated through the measures described above. The mitigation measures will be governed by this document (reviewed and approved by a key stakeholders group) and implemented through the Traffic Management Plan (TMP) process.

The complete Traffic Management procedure is illustrated in **Figure 4.1** below.

Figure 4.1: Traffic Management Procedure



4.2.2 Traffic Management Procedure Governance

The key stakeholders and their roles in Traffic Management Procedure Governance are explained below:

Traffic Management Project Governance Group (TMPGG) - will be established from members from each of the key stakeholders. These stakeholders are expected to include the NZ Transport Agency, AMA, Auckland Transport, the Police (where required), and the Engineer (depending on the procurement model adopted). The Project Team which will monitor Project progress and identify issues to be resolved on a regular basis.

Traffic management project co-ordination group (TMPCG) - will be set up to include a TTM representative from each sector. The group is expected to develop a collaborative strategy and co-ordinate interaction of TTM activities of the Project. It is expected the group would meet on a regular basis, and composition of a weekly list of Project wide TTM activities disseminated to each sector.

Governance Procedure

This CTMP Framework is envisaged to remain a working document throughout the Project and inform the CTMP and SSTMPs and therefore all associated traffic management activities. This governance procedure will allow for a 'no-surprises' approach to traffic management planning where temporary traffic management requirements will feed back into the construction planning process at an early stage. Following programming of construction tasks, associated traffic management requirements will need to be identified for each task. As part of the ongoing improvement, key stakeholders will be consulted on a regular basis on the requirements prescribed, and appropriate amendment will be undertaken where necessary.

Where possible, a collaborative approach with key stakeholders will be adopted.

4.2.3 Site Specific Traffic Management Plans

SSTMPs are documents that outline the procedures and measures to be implemented so that safety is maintained for road users and Project staff throughout every activity associated with the Project. Each SSTMP will therefore outline the measures to be implemented so that road users may negotiate the site safely, and it will also outline the procedures required to be followed by construction or road workers in order to maximise the safety of the site.

The relevant SSTMP must be identified at the construction planning stage for implementation along with work site mobilisation. If a SSTMP has not been developed previously, the need will be flagged for development of the document and the programme of works adjusted accordingly. The process employed for development and approval of SSTMPs is outlined in **Section 8.2**.

A SSTMP will be prepared so that every construction activity which impacts the road network is conducted using an approved methodology, with the agreed mitigation measures in place and to the correct standard. Every construction method plan which impacts on the road network will have an appended SSTMP.

4.2.4 Approval process

The CTMP shall be reviewed by a qualified independent engineer, prior to being submitted to the RCAs for approval in accordance with their procedures.

The CTMP should discuss the following topics:

- The certification process from the Council Manager;
- The details on the commencement of works;
- Satisfying conditions and any changes the Requiring Authority may make; and
- Need to make clear that the SSTMP is a living document.

5. Monitoring Requirements

The effectiveness of the mitigation measures described in the above section should be monitored by development and ongoing assessment of Key Performance Indicators (KPIs). The three KPIs which are proposed for the Project are Traffic Management Auditing, Operation Speeds, and Operating Efficiency. These KPIs are further discussed below. The KPIs proposed in this section are a minimum requirement, and it is expected that further KPIs and organisation monitoring instruments will be implemented, however the form and requirements of these will not be confirmed until the procurement model for each sector is confirmed.

5.1 Traffic management auditing

It is anticipated that traffic control measures will be subject to a random monthly audit by a party external to the preparation of SSTMPs and implementation of traffic control. Additional audits will be carried out following major control changes.

COPTTM audit scores (the site condition rating) will be generated for a number of sites within the Project for each sector (depending on the procurement model), which will then be weighted by Average Annual Daily Traffic (AADT) of the road affected by TTM. The AADT weighting system will draw attention to the higher volume roads (the State highways) where safety is more of a concern and quality and consistency of traffic control is more critical.

The auditors will assess all traffic control measures and will conduct their audit during both the day and night each month. The audit team will generally be a two-person team, however may be expanded as appropriate to include road safety auditors, independent auditors or other external parties. The auditors will provide their report to the Project team within one week of the site inspection.

The audit scores for the audit sector groups will be aggregated and reported to both the traffic management Project co-ordination group and the TMPGG.

5.2 Operating Speeds

The efficiency and safety of the roading network during road construction is a key objective of the Project. Efficiency and safety will be measured by monitoring of operating speeds through the site.

Operating speeds can be measured using radar or loops at long term sites and reported on at monthly intervals. A pre-construction survey will set a benchmark of operating speeds at specific agreed points. The locations will be established and agreed with the TMPGG prior to construction activities commencing on site.

5.3 Operating Efficiency

Efficiency of the road network will be monitored throughout the Project. Bi-directional traffic volumes will be collected at the same locations as the speed monitoring stations. The daily, peak hour and off-peak traffic volumes serviced by the affected parts of the road network will be observed on a continuous basis and reported on at monthly intervals.

Where necessary, additional traffic monitoring stations will be installed on areas of the network affected by Project activities, including diversion or alternative traffic routes.

The results of operating efficiency and operating speed monitoring will be recorded and discussed with the TMPGG, where measures for further minimising the effects arising from construction will be developed and subsequently implemented by the Project.

6. Reporting

Reporting will be conducted monthly in conjunction with the monitoring requirements described in Section 5. Results of speed monitoring will be reported to the TMPCG and TMPGG on a quarterly basis.

6.1 The NZ Transport Agency Manager to Contractors

The NZ Transport Agency Project Manager or appointed representative shall inform all contractors and relevant personnel on site of:

- Any instances where the requirements or limits imposed by the CTMP are breached or exceeded, probable causes and actions required to be taken to mitigate, remedy or isolate the impact arising from the non-compliance;
- The traffic management audit and monitoring results on a monthly or quarterly basis as agreed; and
- Any complaints received during the previous period regarding traffic and the remedial actions taken or required.

6.2 Contractors to the Transport Agency Project Manager

Site personnel shall inform the Transport Agency Project Manager or the appointed representative of the following:

- Any problems they foresee with traffic management on their site and any problems they have regarding the management of traffic on other contractor's sites; and
- The measures taken to improve traffic management during the previous reporting period.

6.3 The Transport Agency Project Manager to Regulatory Authorities

The Transport Agency Project Manager or the appointed representative will inform the regulatory authorities of the following:

- Any complaints received regarding traffic as soon as practical after receipt of the complaint; and
- Provide the road controlling or regulatory authorities and members of the TMPGG a copy of the CTMP annually and if any significant revisions of the CTMP are made during the year.

7. Roles and Responsibilities

At this time it is not known how the Project will be procured and as such it is not possible to fully define the roles and responsibilities required for implementation and administration of this plan.

This section provides guidelines on the expected roles and responsibilities however these shall be formally agreed between the road controlling authorities, the Transport Agency, the Contractor and other parties as part of the procurement process, either as specified in the Alliance agreement or Principal's Requirements.

The NZ Transport Agency Project Manager - or an appointed representative shall be responsible for monitoring to ensure planning and implementation of traffic management is conducted in accordance with this CTMP.

TMPGG - shall be to determine whether the construction and traffic management activities are being conducted in accordance with this CTMP Framework.

The Contractor - shall be responsible for documentation of traffic management activities and their accordance with this CTMP Framework and this will be available to the Transport Agency Project Manager or the appointed representative upon request. All traffic management activities shall be documented as required by this CTMP Framework in an appropriate SSTMP which will be available upon request by the road controlling authority, Transport Agency Project Manager or members of the TMPGG. They are also responsible for monitoring the impacts arising from construction and traffic management methodologies and insuring accordance with the CTMP. The results of this monitoring shall be shared with the Transport Agency Project Manager or the appointed representative and the TMPGG as appropriate.

Independent Party – shall conduct traffic management auditing. The results of these audits shall be provided to the Transport Agency Project Manager or the appointed representative immediately following the audit or following rectification of 'needs improvement' or 'dangerous scores' as required by CoPTTM.

8. Operating Procedures

This section sets out the general operational procedures for TTM activities for the entire Project. Consideration will be given to how each sector (and Contractor) shall co-ordinate their activities so as to ensure that TTM activities in each sector do not adversely affect one another.

8.1 SSTMP Development

A SSTMP will describe the measures that will be taken to manage the traffic effects associated with the construction of specific parts of the Project prior to construction of the relevant part/s of the Project commencing. The purpose of the SSTMP is to identify the specific construction traffic management methods proposed to address the particular circumstances, local traffic and community travel demands, and environmental context of each sector or stage of the Project.

Preparation and implementation of SSTMPs will be conducted so that a consistent approach is taken where practicable, and that adjacent activities are adequately. Coordinated, planned and integrated in order to mitigate concurrent effects.

Each SSTMP will comply with each of the relevant standards outlined in **Section 2**. Care will be taken in identifying the safety requirements of both road users and construction workers.

Each SSTMP will be developed with consideration given to the preliminary assessment of effects set out in this report. Each of the impacts and mitigation measures noted in the assessment of effects must be considered in development and documentation of the SSTMP. The acceptability of the proposed traffic management methodology will be determined by the relevant RCA.

At the completion of works under discrete traffic management closures the site must be made safe for the travelling public once all traffic control measures are lifted from the site, so that no hazard has been introduced or left behind as a result of the work. This philosophy does not explicitly limit the type of activity that may be conducted, however it limits the construction methodologies to those that allow for acceptable safety and level of service to the travelling public to be provided and maintained at all times.

The TMP process is illustrated in **Figure 4.1**.

Each SSTMP will comply with any relevant condition from the Environmental Management Plan.

8.1.1 SSTMP Structure

Each SSTMP will include:

- **SSTMP Proforma -** this is the text of the document, which outlines the requirements, methodologies and standards required in observing the SSTMP. Details included in each SSTMP Proforma will vary depending on the activity requiring traffic control;
- **Engineering Exception Decisions** - all EEDs applicable will be appended to the SSTMP.
- **CAD drawings** - CAD (or similar computer-generated) drawings will be employed for illustrating the closures defined by the Proforma, and will include all relevant road features that require consideration in managing the impacts of construction.
- **Communications strategy** - the communications strategy will outline the proposed strategy for informing the public and other stakeholder of the works. This may include public notifications in local newspapers, advertisements, radio communications, flyer or posters, VMS strategies, or driver information signage installed.

8.1.2 Specific Requirements

The following section describes in more detail the specific requirements that should be considered as part of the development of a SSTMP. Where the proposed temporary traffic management events carry a high potential for significant risk, the assessment of each of the items below may form a separate document that supplements the SSTMP. This is sometimes referred to as a Traffic Management Strategy and is often developed collectively with key affected and regulatory stakeholders.

8.1.2.1 Peak hour capacity

The effect of construction activities or TTM measures on traffic flows during peak hours will be mitigated where possible. Activities that may impact on the capacity of the adjacent carriageway will be restricted depending on the type of activity and the level and traffic characteristics of the affected carriageway.

Activities that impinge upon capacity for a brief period (less than 5 minutes) will be considered on a case-by-case and only conducted under an approved SSTMP. The restrictions will be outlined in each SSTMP, which will be agreed with the RCA on a case-by-case basis.

8.1.2.2 Network Capacity

The main indicator of the impact of traffic management on the road network is the delay caused by the activity. COPTTM states that delays are not permitted to be greater than 5 minutes. This applies to both the traffic passing through the closure and delays caused along diversions routes, and for the Project the delays experienced by vehicles passing through or directly affected by the construction site or the associated traffic management will be considered.

The impacts of construction activities or TTM measures on road network traffic capacity will be mitigated where possible.

The impact of traffic management will be considered in each SSTMP, with queue modelling, delay estimates or traffic modelling conducted where appropriate in order to satisfy the relevant RCA that the impacts are well understood and will be mitigated where possible. Information necessary to satisfy the RCA that impacts will be satisfactorily mitigated will be agreed on a case by case basis and agreed by the TMPGG.

Works may also be programmed for holiday periods during which traffic demands are reduced and there is a higher proportion of discretionary trips on the network. Such opportunities will be investigated on a case-by-case basis, with an approach agreed with the TMPGG and relevant RCAs prior to the proposed activity.

Construction activities and construction programmes will need to be coordinated to minimise impacts on capacity across the network. For instance majority of the construction works on SH1 and SH20 that occur simultaneously must be coordinated.

8.1.2.3 Site Access

Site access will be subject to the same restrictions as activities that impact upon the capacity of the network and peak hour activities. Each site access will be required to have an approved SSTMP (or be noted in the appropriate SSTMP covering the work site) which will outline the systems and procedures required for safe operation.

It is foreseen that a large number of truck movements will be required to and from the site accesses for transporting construction material. The frequency of these truck movements, their routes and access operational requirements will be outlined and appropriate mitigation measures agreed with the RCA in the appropriate SSTMP.

Site access points will be installed as detailed on the SSTMP drawing. The site specific requirements for installation and use of site accesses will be outlined in the SSTMP, which may include the following:

- Required signage and delineation;
- Permitted entry / exit movements to / from the site access;
- Permitted hours of use;
- Entry / exit escort procedures to be implemented;
- Types of vehicles allowed, and any procedures relating to particular classes of vehicles (articulated trucks or oversized vehicles); and
- Provision for manned accesses where required.

Entry and exit will be operated in a manner that will minimise disruption to road users. Accordingly, all drivers of vehicles using the access points will be specifically briefed.

8.1.2.4 Lane closures / traffic detours

All full closures or one-direction lane closures and associated detour routes will be implemented under an approved SSTMP. The RCA with roads affected by a detour will be consulted prior to finalisation of the SSTMP. Detour routes will follow arterial roads where possible, so that impacts on residential streets are minimised.

Where necessary, steps will be taken in order to improve the capacity of the detour route, by implementation of the following:

- Signal cycle time alterations (in consultation with the ATOC);
- Traffic modelling to determine the maximum theoretical capacity of intersection(s) along the detour route;
- Traffic management measures installed at critical intersection(s) to provide greater capacity;
- Splitting of the detour routes depending on approach to the closure; and / or
- Closure of local and collector roads on the approach to the closure.

Pre-conditioning of road users will also be considered and where deemed necessary it will be implemented through a communications campaign via VMS boards, Project information signs or advertising. This will attempt to reduce the demands on the road network so that delays are reduced. Alternative routes will be recommended at a cordon around the closure well in advance of the closure and in such a way to allow traffic to avoid following the prescribed detour route where an alternative route is a more convenient route to their intended destination.

Details of any analysis, modelling, mitigation measures or communications will be appended to the SSTMP for approval by the affected RCAs.

8.1.2.5 Passenger Transport Services

The effect of construction activities or TTM measures on passenger transport services will be mitigated where possible.

Activities likely to impact upon passenger transport services will be identified at the construction planning stage, such as traffic management measures impinging upon bus stops, bus lanes or train services. This will allow for the maximum possible available time to arrange for changes to be made to services, or for methodologies to be developed that minimise impacts.

Consultation with affected parties will determine the best way forward to mitigate impacts. This consultation will be undertaken as part of the SSTMP development process, with the following parties (or equivalents once the unitary Auckland Council is formed):

- Auckland Transport;
- AT Metro;
- ATOC;
- The NZ Transport Agency; and
- AMA.

Any impacts, mitigation or communications relating to passenger transport services will be outlined in the SSTMP for approval by the relevant RCA.

8.1.2.6 Property Access, Existing On-Site Parking and Manoeuvring Areas

The impact of construction activities or TTM measures on property access, on-site parking or manoeuvring areas will be mitigated where possible. Communications with the affected residences or businesses will be undertaken.

The impacts of such activities will be mitigated where possible, which may include:

- Temporary access ways using metal plates or other methods;
- Construction methodologies that allow access during critical time periods; and / or
- Provision of alternative parking or manoeuvring areas for the duration of the works.

8.1.2.7 Pedestrian, mobility and cycling access

The impact of construction activities or TTM measures on pedestrians and cyclists will be mitigated where possible. Likely impacts upon pedestrian, mobility or cyclist access will be identified at the construction planning stage.

Where access is impeded as a result of construction works, safe and clearly identifiable alternative access arrangements will be implemented, such as:

- Temporary access in accordance with CoPTTM;
- Temporary diversions;
- Safety fences for restricted access zones;
- Hoarding for long term work sites adjacent the excavations or other hazardous environments;
- Pedestrian bridges across uneven surfaces; and / or
- Pedestrian protection barriers for protection from traffic.

Long term closures or closures of significant pedestrian, mobility or cycling facilities will result in communications with the public, consideration of public events, school or stakeholder time tables.

Any impacts upon pedestrian, mobility or cycling access and associated mitigation will be outlined in the SSTMP for approval by the relevant RCA.

8.1.2.8 Traffic Management Communications

It is expected that communications campaigns will be undertaken for a wide variety of traffic management activities throughout construction of the Project.

Communications associated with traffic management activities will be undertaken on a case-by-case basis depending on the location and impact of the construction and traffic management activities. Communications may include some or all of the following, as part of a Project communication plan:

- Letter drops to affected residents and / or businesses which are located:
  - Within or adjacent to the construction zone;

  - Along detour routes;
  - Along approaches to the corridor that may experience congestion or queues.
- Communications for changes to passenger transport services such as signage in buses, at bus stops or letter drops to residents;
- Flier drops to cars parked in affected areas in advance of works in the area;
- Use of VMS for recommending alternative routes;
- Use of Project signage along the route;
- Public notification in appropriate media channels, where necessary;
- Notification to utility companies;
- Communications with high traffic operators such as Auckland Airport, MetroPort and Sylvia Park; and
- Assist high traffic operating businesses to develop or modify Traffic Management Plans to reduce dependence on use of private vehicles.

8.1.2.9 Emergency action plans

An emergency action plan will be produced prior to implementation of any traffic control activities associated with the Project.

The emergency action plan will outline the procedures, requirements and responsibilities of the Project team in the case of emergency, and will conform to the principles of CIMS (Coordinated Incident Management System) and related road network incident response plans identified by the RCA. In addition to the emergency action plan, each SSTMP will address site specific requirements in the case of emergency. The SSTMP will outline the following key issues, where applicable:

- Diversion routes in the case of delayed works;
- Secondary diversion routes in the case of incidents on diversion routes used under full closure SSTMPs;
- Methodologies for reducing the risk of construction over-run, where applicable.

The emergency action plan will be used in the case of an emergency within the site, and will include procedures for co-ordination with ATOC, the NZ Transport Agency, AMA, and the Police. Events that may require implementation of the emergency action plan include:

- Traffic accidents;
- Emergency services requiring access to or through the site;
- Natural disasters;
- Unplanned construction events;
- Emergency works;
- Significant traffic congestion on SH1 or SH20 Motorways within the Project site;
- Inclement weather.

In the event of an accident the Project will provide immediate assistance and where necessary contact the relevant emergency services. Full support to those organisations will be provided to manage traffic whilst the incident is being brought under control. An incident report will be completed for each incident or near-miss.

Significant incidents will require input from a variety of Project team members and may involve reporting to emergency services or other external parties.

In an emergency event the site traffic management supervisor (STMS) must ensure the traffic management staff protect their personal safety, the safety for continuing public access through the site then notify the necessary authority and then attend to the situation.

8.2 SSTMP Approval Process

The construction team will liaise early with RCAs and agree on traffic management methodologies for key areas before completion of the detailed design or commencement of construction in accordance with local authority regulations. This will take the form of agreed strategies with the TMPGG.

The impact of specific traffic management measures on the road network will be assessed on a case-by-case basis, and the relevant RCA will be contacted for approval of the SSTMP.

An Engineer who is independent of the preparation of the SSTMP (as included or delegated within the contract of engagement for construction of the Project) will be appointed by the Project team, and will review and approve the SSTMPs prior to submission to the relevant RCA.

For TTM exclusively on local roads, the SSTMP will go to the Auckland Transport's Corridor Access Request Team for approval.

Where traffic management activities encroach upon State highways, the SSTMP will go to the Auckland Motorways Alliance (AMA) Traffic Management Coordinator (TMC) team.

It is possible that some activities associated with construction or maintenance of the Project will affect more than one RCA's roads at a time. Where this is the case, the affected RCAs will be consulted in advance of submission of the SSTMP to confirm with each RCA whose road is affected directly by the works. Activities that will require consultation include:

- Traffic diversions onto adjacent RCA roads;
- Lane or full road closures that may have a significant impact on the operation of an adjacent RCA road; and / or
- Activities that require installation of VMS boards or other communications (such as information signage, overhead VMS signage etc.) on adjacent RCA roads.

9. Post-Construction Transition Phase

Once the majority of construction work has been completed on the Project and practical completion has been awarded, temporary traffic management procedures will return back to each RCAs original traffic management requirements.

10. Review of Construction Traffic Management Plan

The CTMP will require review over the duration of the Project. The review of the CTMP will be reported to the Key Stakeholders group and any required changes agreed.

This Plan will be reviewed by the Contractor and the Transport Agency Project Manager or the appointed representative upon award of the Project (prior to commencement of construction) and at regular defined intervals. The contractor will record decisions made, the reasoning behind these decisions then make subsequent changes to the Plan in agreement with the Transport Agency Project Manager and the TMPGG. A revision of this plan will be submitted for agreement by the TMPGG and the road controlling authorities. The Project team will be informed of any changes to this CTMP Framework through the regular Project communications processes.

The review of the CTMP will consider the following:

- Any significant changes to traffic management processes;
- Key changes to roles and responsibilities within the Project and the implementation of this plan;
- Changes in industry best practice standards;
- Changes in legal or other requirements (social and environmental legal requirements, the transport agency objectives and relevant policies, plans, standards, specifications and guidelines;
- Results of: inspection and maintenance programmes, and logs of incidents, corrective actions, internal or external assessments; and
- Public complaints.