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SUPPORTING GROWTH

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Takaanini Level Crossings Assessment of Transport Effects

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Appendices

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4 Appendix D – Construction Scenarios traffic flow difference plots

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Glossary of Defined Terms and Acronyms

We note that 'Takaanini' (with double vowels is used throughout the Report Acknowledging the ongoing kōrero and guidance from Manawhenua on the cultural landscape. 'Takanini' is used where reference is made to a specific and existing named place (e.g., Takanini Road, Takanini Town Centre etc.). Manawhenua is also used throughout the Report as while gifting the programme name as Te Tupu Ngātahi, Manawhenua confirmed this was an appropriate spelling (capital 'M' and one word). Notwithstanding this, the term is spelled as two words in other fora and the proposed designation conditions – Mana Whenua.

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AADT	Average Annual Daily Traffc
ADT	Average Daily Traffic
AFC	Auckland Forecasting Centre
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
AUP-OP	Auckland Unitary Plan: Operative in Part
CAS	Crash Analysis System
CFAF	Corridor Form and Function
CoPTTM	Code of Practice for Temporary Traffic Management
Council	Auckland Council
CRL	City Rail Link
CTMP	Construction Traffic Management Plan
DBC	Detailed Business Case
DSI	Death or Serious Injury
FDS	Future Development Strategy
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GPS	Government Policy Statement
HCV	Heavy Commercial Vehicle
IBC	Indicative Business Case
KiwiRail	KiwiRail Holdings Limited
LCSIA	Level Crossing Safety Impact Assessment
LCSS	Level Crossing Safety Score
LOS	Level of Service

Acronym/Term	Description
MDRS	Medium Density Residential Standards
MSM	Macro Strategic Model (regional multi-modal model)
NIMT	North Island Main Trunk rail line
NPS-UD	National Policy Statement on Urban Development
NoR	Notice of Requirement
NoR 1	Notice of Requirement 1: Takaanini Level Crossings Project (Spartan Road, Manuia Road, Manuroa Road, and Taka Street)
NoR 2	Notice of Requirement 2: Takaanini Level Crossings Project (Walters Road)
NZ	New Zealand
NZUP	New Zealand Upgrade Programme
ORA	Operating Reporting Architecture
PBC	Programme Business Case
PC78	Plan Change 78 to the Auckland Unitary Plan: Operative in Part
PT	Public transport
RASF	Roads and Streets Framework
RMA	Resource Management Act 1991
SAMM	Strategic Active Mode Model
SATURN	Simulation and Assignment of Traffic to Urban Road Networks model
SH1	State Highway 1
SIDRA	Signalised/ unsignalised Intersection Design and Research Aid model
SME	Subject matter experts
SSTMP	Site-Specific Traffic Management Plan
TERP	Transport Emissions Reduction Pathway
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth
TDM	AT's Transport Design Manual
TLC DBC	Takaanini Level Crossings Detailed Business Case
TLC / the Project	Takaanini Level Crossings Project
V/C	Vehicle to Capacity
Veh-hr	Vehicle Hours
VKT	Vehicle Kilometres Travelled
vpd	Vehicles per day
vph	Vehicles per hour
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

Executive Summary

Overview

This Assessment of Transport Effects Report (**Report**) has been prepared to inform the Assessment of Effects on the Environment (**AEE**) for two Notices of Requirement (**NoR**) being sought by Auckland Transport (**AT**) for the Takaanini Level Crossings Project (**TLC / the Project**) under the Resource Management Act 1991 (**RMA**). Specifically, this Report considers the actual and potential effects associated with the construction and operation of the TLC on the existing and likely future environment as it relates to transport effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects. The NoRs seeks to protect land to construct, operate and maintain five grade separated rail crossings over the North Island Main Trunk (**NIMT**) rail line in Takaanini (Spartan Road, Manuia Road, Manuroa Road, Taka Street and Walters Road).

The Project proposes the removal and/or replacement of four existing level crossings at Spartan Road, Manuroa Road, Taka Street and Walters Road in Takaanini. The Project responds to functionality and safety issues anticipated at these crossings from the increasing number of train movements along the NIMT line. The Project and indicative design also respond to the long-term planned expansion of the NIMT from the current two rail tracks to up to four tracks. Without the Project, the increased rail frequency will lead to greater barrier arm down-time and therefore increased severance and congestion in the area.

Methodology

Approach to Assessment of Operational Transport Effects

Potential operational transport effects are assessed using:

- Transport planning assessment of expected outcomes and effects
- Transport modelling to inform demands and network performance
- Alignment with policy documents

An assessment of each key element of the transport system has been undertaken including effects on safety, different modes, and property access. The assessment criteria and methodology are summarised in Table 9 of this Report.

Because this Project is not funded for immediate delivery, the assessment has been undertaken on a future receiving environment that includes planned or expected changes to the existing land use and transport environment. Specifically, this includes urban growth as indicated in the Auckland Unitary Plan - Operative in Part and changes in the rail network operation expected following completion of the City Rail Link (**CRL**). To define this future transport environment and identify the changes resulting from the Project, a range of different transport modelling tools have been used to undertake quantitative assessments of the transport system as a whole. The impacts of the Project on the future transport environment are assessed using forecasting transport models, owned by the Auckland Forecasting Centre (**AFC**). The models include:

- The regional multi-modal model (**MSM**);
- A traffic assignment model (**SATURN**);
- A strategic active mode (walk/cycling) model (**SAMM**); and

- Intersection models (**SIDRA**) at key locations.

The main assessment of transport operational effects is based on a 2048 forecast year horizon. This aligns with the available regional models and represents the long-term future environment, providing a better understanding of the intergenerational nature of the infrastructure investment.

Approach to Assessment of Construction Effects

Based on the indicative construction methodology as defined in the AEE, an assessment of construction effects has been completed to support the AEE. This assessment considers:

- Speed management, potential impacts to general traffic, freight accessibility, pedestrians and cyclists and property access;
- Identification of works that should not occur at the same time to manage the cumulative network impacts; and
- Potential conflict areas with vulnerable road users that will need specific mitigation.

The impact of any temporary traffic management measures implemented to undertake the Project will be re-assessed to validate this assessment in the future, prior to construction, when a greater level of detail is available in terms of the specific construction methodology and the surrounding land use and traffic environment.

The construction effects are based on a 2038 forecast year horizon that aligns with the likely timeframe of construction of the Project.

Summary of Future Receiving Environment

The likely future transport environment assumes that, in addition to traffic growth, various existing and planned projects on the southern rail line proceeds. This includes the completion of the CRL, additional track capacity between Pukekohe and Wiri, and increased train frequencies.

Assuming that the existing level crossings are retained, the likely future transport environment is expected to comprise of the following outcomes:

- Increased safety risks at level crossings resulting from the combination of traffic growth and increased barrier closures and train movements;
- Level crossing barriers may be down for 61% to 64% of the peak hour, with approximately one minute of delay expected per vehicle due to barrier closures;
- Increased delays may result in greater frustration and increase the likelihood of people taking risks at the level crossings to avoid delays;
- Congested transport corridors, due to traffic and queues from barrier closures overflowing to adjacent intersections and impacting the wider network; and
- Decreased east-west connectivity due to minimal walking and cycling facilities in the TLC area and the increased delay.

Summary of Assessment of Effects and Recommendations

The identified construction and operational transport effects of the Project are summarised below, along with the recommended methods to avoid or mitigate such effects.

Effect	Assessment	Recommendation
Construction Effects		
Temporary disruption to people movement and vehicle movement in the area for an indicative construction duration of 2.5 – 3 years. Reduced network resilience due to multiple level crossing closures during construction. If one corridor is closed for construction without an alternative, the network will see an increase in congestion and reduction in network resilience.	Testing of various construction sequencing scenarios were undertaken to assess impact on community access in the network and the impact on each transport mode. The network of east-west connections was assessed under three geographic areas based on inter-dependency between connections. Community access, diversion routes for all road users, vehicle-to-capacity ratios, delays to vehicles, freight routing, safety implications, and impacts on bus routes were considered as part of this assessment.	A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of Spartan Road or Manuroa Road level crossings such as constructing **Manuia Road** bridge. A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Taka Street** level crossing during construction. This could mean the following: • Partial closure; and/or • Reroute traffic to an alternative connection such as Manuroa Road A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Walters Road** level crossing during construction. This could mean undertaking offline construction or partial closure. Appropriate timing of closures and community engagement can mitigate impacts.
Traffic generated during construction, including construction vehicle movements to and from the construction areas, partial or full road closure, temporary speed limits restriction around site access, and impacts to vulnerable road users. Points of conflict along the TLC corridors include access points along each corridor.	Construction of the Project will likely involve disruption to the surrounding existing road network and property access. Additional traffic will be generated from general staff and workforce for the Project as well as construction specific traffic such as traffic movements for material delivery and movement within construction areas. There are a few schools and early childhood centres in or surrounding the Project areas. This may indicate a potential increase of heavy traffic movements near sensitive areas.	Effects to be managed/ mitigated through temporary traffic management planning, such as Construction Traffic Management Plan(s) (**CTMP**), including engagement before construction commencement. Access to compound sites, laydown areas and construction zones for construction vehicles, plant and materials will be via site access points identified as part of future CTMPs. Sufficient space for construction laydown areas is to be provided to allow for construction vehicles to be stored off the transport corridors and to reduce impact on through movement in the network.
Access to properties along the TLC corridors may be impacted by temporary traffic	Construction works may impact property access for residents and businesses in the Project areas. This will lead to temporary inability to get in and out of driveways and	Existing driveways that remain during construction will be required to have safe temporary access provision to mitigate this effect identified in the CTMP.

Effect	Assessment	Recommendation
management controls during the construction works.	allow for business operations to occur. This construction effect may adversely impact business operations and restrict movement for residents in the area.	Site Specific Traffic Management Plan (**SSTMP**) to be developed to manage constraints on access to affected properties during construction.
Construction vehicles parking in the surrounding network.	Additional construction traffic is expected to be entering the network and may be parking along the TLC corridors and affecting.	Provide construction parking facilities within the site footprint. In the CTMP, construction site workers should be provided with allocated parking facilities to access the site so that local business parking will not be impacted.
Operational Effects		
Closure of **Takaanini Road** at Taka Street effects community access to the Takaanini Hall	Closure of Takaanini Road with Taka Street will affect the environment as vehicle users who would typically traverse through this link will have to divert via Glenora Road or Beach Road to access Great South Road and Taka Street. While this would be known to residents and regular visitors to the area, it may cause confusion to new visitors to the Takaanini Hall Community facility.	Provide wayfinding signage on Taka Street which will help direct the community to the Takaanini Hall which is a community facility. There is also an opportunity at the time of implementation, to provide a connection for pedestrians and cyclists between the northern end of Takanini Road and the Taka Street bridge via stairs/ ramp.
The current **over-dimension freight** route is not suitable in the future network due to closure of Manuroa Road level crossing.	The alternative over-dimension route from Porchester Road to Great South Road, through the industrial area will be via Manuroa Road, Oakleigh Avenue and the Manuia Road connection. This alternative route has been agreed with AT freight subject matter experts (**SMEs**).	Alternative over-dimension route will need to be provided via the future Manuia Road connection to Great South Road. The Manuia Road bridge should be designed to accommodate over-dimension vehicles as per relevant engineering standards. The alternative route should have a clear width and height to accommodate over-dimension vehicles and any overhead powerlines may need to be undergrounded. The roundabout at Manuia Road / Oakleigh Ave intersection should be designed to allow for enough turning space for over-dimension vehicles.
Routing from the businesses on Spartan Road (west of the railway) northbound onto Great South Road and access to SH1	VTNZ and Hall's Cold Chain Logistics are typically required to travel northbound onto Great South Road to access the SH1 northbound on-ramp for the operation of their businesses.	Discussions with landowners are currently underway to understand the operation of the business and typical access movements. It is recommended that prior to the start of construction, a design safe system audit is undertaken for the Project. This will determine if

Effect	Assessment	Recommendation
northbound on-ramp are affected due to **Spartan Road level crossing closure**.	These businesses would normally travel via a U-turn manoeuvre at the Takaanini interchange (0.5km, 2 minutes), or re-route east over the rail line, through Oakleigh Avenue and Manuroa Road (1.8km, 4 minutes). The option to route via Manuroa Road will no longer be possible due to the closure of the Spartan Road level crossing. The alternative route will be via Manuia Road and using the Manuia Road/ Oakleigh Avenue roundabout to perform a U-turn. This route would be 1.7km and take approximately 4 - 5 minutes to reach the NB on-ramp. This routing distance and expected travel time is approximately equivalent to the current routing via Manuroa Road.	any additional mitigation measures are required to address safety risks in regards to the U-turning of heavy vehicles at the Takaanini Interchange. The U-turn manoeuvre at the Takaanini interchange southern intersection should be assessed to understand if U-turning of heavy vehicles can be accommodated, as Hall's Cold Chain Logistics are expected to generate a high number of heavy vehicle trips. The road safety assessment may consider possible mitigation measures to make the movements around the interchange safer. These may include: • Providing a U-turn pocket by widening the corridor out towards the west within Waka Kotahi land to accommodate a safer U-turn movement for large heavy vehicles. • Banning the U-turning of large vehicles at the interchange and limiting the movement to the alternative route. The alternative route available for vehicles is via Manuia Road / Oakleigh Avenue roundabout. The roundabout should be designed to accommodate heavy vehicles U-turning.
Existing **property access may be altered** in the surrounding network with potential land take.	The proposed works may cause parcels to be landlocked if existing property access is altered and a safe alternative access is not provided.	Property access impacts and related safety implications are to be validated through site visits prior to the implementation of the Project. Access should be provided to properties; therefore, mitigation is required to ensure legal access is retained.

Positive Effects Summary

A significant increase in train frequencies (and ultimately additional tracks) through this area is expected to significantly worsen the existing safety, resilience, congestion, and connectivity issues associated with the barrier closures at the existing level crossings. The Project will address those issues with significant positive effects identified for accessibility of all modes, VKT reduction and safety, as summarised below.

Positive Effect	Description
General traffic accessibility	The Project achieves the following outcomes relating to general traffic: • Greater network reliability and resilience from removal of the existing level crossings; • Increases to local connectivity in the Takaanini area between the western and eastern parts of Takaanini, e.g. saving 1.3 minutes of travel time between Takaanini East and Manukau (a key metropolitan area); • The three multi-modal bridges increase east-west network capacity significantly in the morning and evening peak periods; and • Reduces existing rat running via Takaanini Road.
VKT reduction	The Project reduces 49,300 vehicle kilometres travelled daily compared to the Do Nothing scenario as a result of the better network connectivity and reliability.
Freight accessibility	The proposed Manuia Road bridge provides a direct east-west connection to the Takaanini industrial area for freight to use in the future network. Currently there is no clear freight connection which is not logistically constrained by banned intersection movements or level crossings.
Safety	Project is expected to have a positive impact on the safety of the future network through the: • Removal of level crossings will eliminate crashes relating to level crossings occurring in the area; and • Reduction of high severity crashes occurring in a future network, which is anticipating growth, increased train frequencies and four-tracking of the rail line. The Project could save 0.14 railway crossing related injury crashes per year. • In relation to system-wide crashes, the Project could save 1.1 deaths and serious injuries per year, 78 total crashes per year and $1.18m of social crash costs per year. The Project saves an estimated 36 DSIs over 40 years compared to the Do Nothing scenario. Project aligns with the Road to Zero strategy, GPS 2021 direction and Ministry of Transport's outcomes.
Walking and cycling accessibility	The Project provides many positive benefits for walking and cycling in the network, including: • Increase active mode east-west permeability across the southern rail line in the Takaanini network; • Accessibility to employment and social amenities (such as the Takaanini industrial zone, Takaanini Station, Te Mahia Station, Takanini Town Centre) will be made attractive through multi-modal use; • No delays associated with barrier-down time for walking and cycling users, increasing walkability and safety. The Project makes the network safer for 1,840 pedestrians and 660 cyclists by eliminating the likelihood that pedestrians and cyclists would take risks to cross the rail line to avoid the increased barrier-downtime. This reduces the fatal and serious incidents related to rail-crossings; • Exclusivity of the Spartan Road and Manuroa Road bridges to active mode users leads to travel time savings and increased safety for cyclists and

Positive Effect	Description
	pedestrians using these connections. Active mode bridge replacements would mitigate the effects of level crossing closures at these locations; • Opportunity to increase commuter trips to rail given the planned train frequencies, due to the active modes bridge providing a connection to Te Mahia Station and Takaanini Station; • The active modes connections will integrate with the wider walking and cycling network such as the Southern Path along SH1; and • Increased modal choice via active modes will have positive environmental and health benefits by increasing the number of active mode trips and reducing the reliance on vehicle trips.
Public transport	The Project contributes to the wider mode-shift strategy regarding the Southern rail network. Decongestion on transport corridors due to the Project would improve overall network public transport reliability. There is also the potential for connector and local east-west bus services to route via the proposed grade-separated Taka Street in the long-term network and to tie in to the Takaanini Station. The Project will also remove the risks of system vulnerability associated with level crossings, for example hardware faults such as gates malfunctioning, or barrier arms being hit leading to incidents causing unexpected delays and cancelled train services.

1 Introduction

1.1 Purpose and scope of this Report

This Report has been prepared to inform the AEE for two NoRs being sought by AT for the Project under the RMA. The Project proposes to construct five new bridges across five project areas: NoR 1 relates to four of the proposed project areas (referred to as Spartan Road, Manuia Road, Manuroa Road and Taka Street) while NoR 2 relates to the remaining project area (referred to as Walters Road). Specifically, this Report considers the actual and potential effects associated with the construction and operation of the TLC on the existing and likely future environment as it relates to archaeological and heritage effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

This Report should be read alongside the AEE, which contains further details on the history and context of the TLC. The AEE also contains a detailed description of works to be authorised within the NoRs, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this Report and have been considered as part of this assessment of transport effects. As such, they are not repeated here. Where a description of an activity is necessary to understand its effects, it has been included in this Report for clarity.

1.2 Report Structure

The structure of the report is set out in Table 1 below. The assessment considers the actual and potential effects of the Project as a whole in the first instance. Where required, the assessment then focusses on the actual and potential effects arising within individual project areas (i.e., Spartan Road, Manuia Road, Manuroa Road, Taka Street which falls within NoR 1 and Walters Road which falls within NoR 2). Where appropriate, measures to avoid, remedy or mitigate effects are also recommended.

Where the individual project areas are discussed, sub-sections are arranged by project area in geographical order along the North Island Main Trunk (**NIMT**) line moving north to south.

Table 1: Report Structure

Sections	Section number
Description of the TLC	**2**
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	**3**
Identification and description of the existing and likely future transport environment	**4**
Assessment of construction effects (overall network)	**5**
Assessment of operational effects (overall network)	**6**

Sections	Section number
Assessment of corridor-specific operational effects	**7**
Assessment of specific transport matters for Spartan Road	**7.1**
Assessment of specific transport matters for Manuia Road	**7.2**
Assessment of specific transport matters for Manuroa Road	**7.3**
Assessment of specific transport matters for Taka Street	**7.4**
Assessment of specific transport matters for Walters Road	**7.5**
Overall conclusion of the level of potential adverse transport effects of the TLC.	**8**

2 Project Description

The overall Project proposes the removal and/or replacement of four existing road over rail level crossings at Spartan Road, Manuroa Road, Taka Street and Walters Road in Takaanini. As further discussed in the AEE, the Project responds to functionality and safety issues anticipated at these crossings from the increasing number of train movements along the NIMT. The Project and indicative design also take into account the long-term planned expansion of the NIMT from the current two rail tracks to up to four tracks. The increased rail frequency will lead to greater barrier arm down-time and therefore increased severance and congestion in the area.

The Project primarily involves the construction of five new bridges to support safe and reliable east-west transport movement across the NIMT in Takaanini. This includes dedicated active mode bridges at Spartan Road and Manuroa Road, and two-lane arterial road bridges with active mode facilities at Manuia Road, Taka Street and Walters Road. Manuia Road is a new east-west connection in the network, acting as a replacement for vehicular trips that would have used the closed Spartan and Manuroa Road level crossings. The bridges and associated works/improvements are located across five project areas and will be progressed as two NoR packages (refer to Figure 1 and Table 2).

The indicative design has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final design will be refined and confirmed at the detailed design stage. Key features of the works common across project areas include the following:

- Bridge structures across the NIMT with a vertical clearance from existing ground level to road surface of approx.7.8m;
- Works to tie in with existing roads;
- Batters and/or retaining and associated cut and fill activities;
- Vegetation removal within the project areas to enable construction; and
- Areas identified for construction related activities including site compounds, construction laydown, alternative access, and construction traffic manoeuvring.

Further details of each project area are provided in the following sections below.

Table 2: The TLC project areas and NoR package

NoR Reference	Project area	Description	Requiring Authority
Takaanini Level Crossings Project NoR 1	**Spartan Road**	Closure of the existing level crossing, construction of a new bridge with walking and cycling facilities across the NIMT and associated works.	Auckland Transport
	Manuia Road	Construction of a new bridge with general traffic lanes and walking and cycling facilities across the NIMT and associated works.	
	Manuroa Road	Closure of the existing level crossing, construction of a new bridge with walking and cycling facilities across the NIMT and associated works.	
	Taka Street	Closure of the existing level crossing, construction of a new bridge with general traffic lanes and walking and cycling facilities across the NIMT and associated works.	
Takaanini Level Crossings Project NoR 2	**Walters Road**	Closure of the existing level crossing, construction of a new bridge with general traffic lanes and walking and cycling facilities across the NIMT and associated works.	

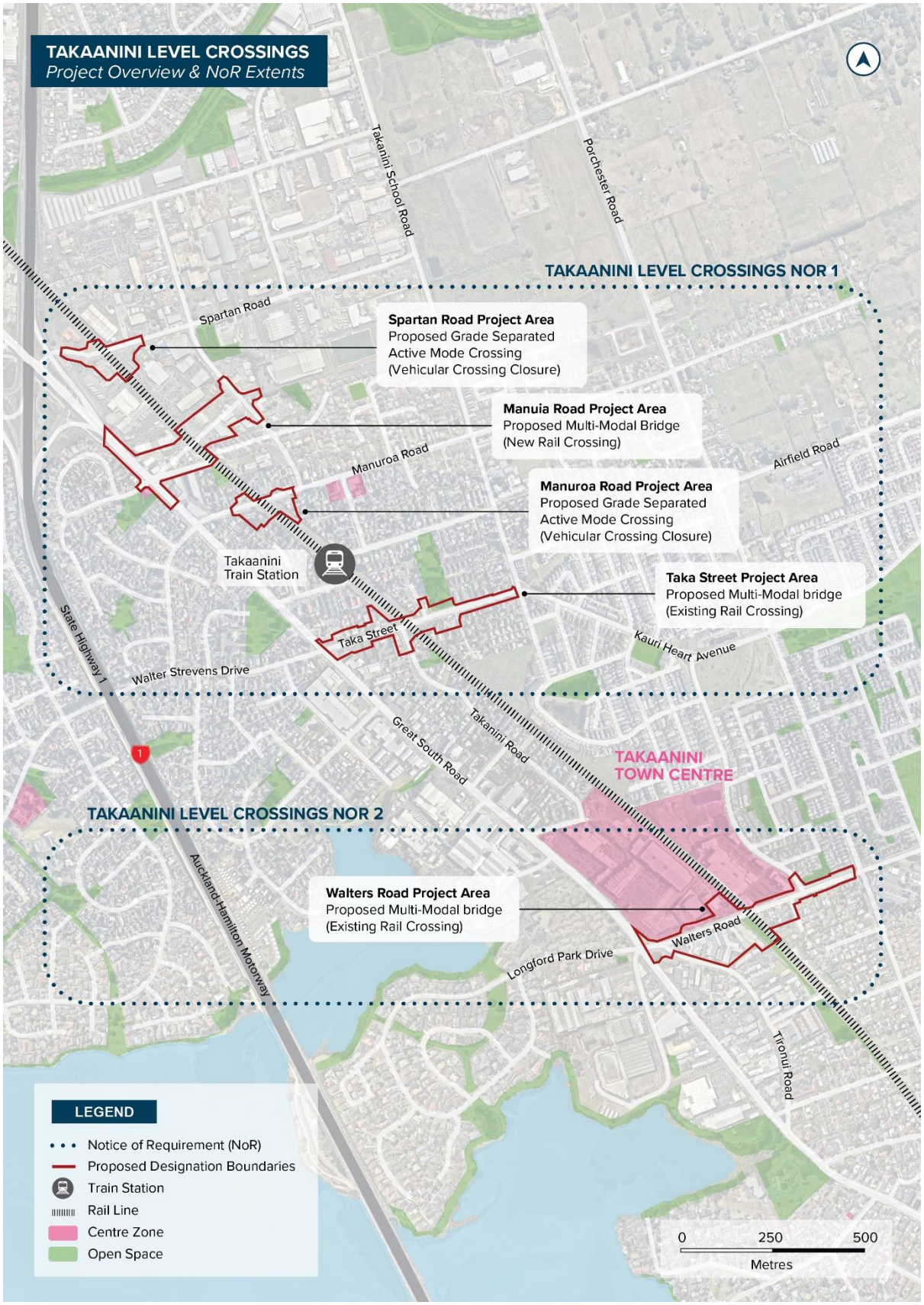


Figure 1: Overview of the Project, project areas and extent of the NoRs

2.1 NoR 1 – Spartan Road, Manuia Road, Manuroa Road and Taka Street

2.1.1 Spartan Road project area

As set out in Table 3 below, the proposed works within the Spartan Road project area include closure of the existing level crossing and replacement with a new active modes bridge across the NIMT.

Table 3: Overview of Spartan Road project area

NoR 1 - Spartan Road project area	
	
Key features	
Overview	• Closure of the existing road corridor to vehicular traffic across the NIMT. • Construction of an active mode bridge across the NIMT. • Construction of cul-de-sacs (accommodating footpaths) and works to tie into the existing corridor on either side of the NIMT along Spartan Road. • Ramps and stairs will connect to the bridge on either side (east and west) of the NIMT and will tie into the cul-de-sacs.
Other structures	• None
Other road closures / cul-de-sacs	• None

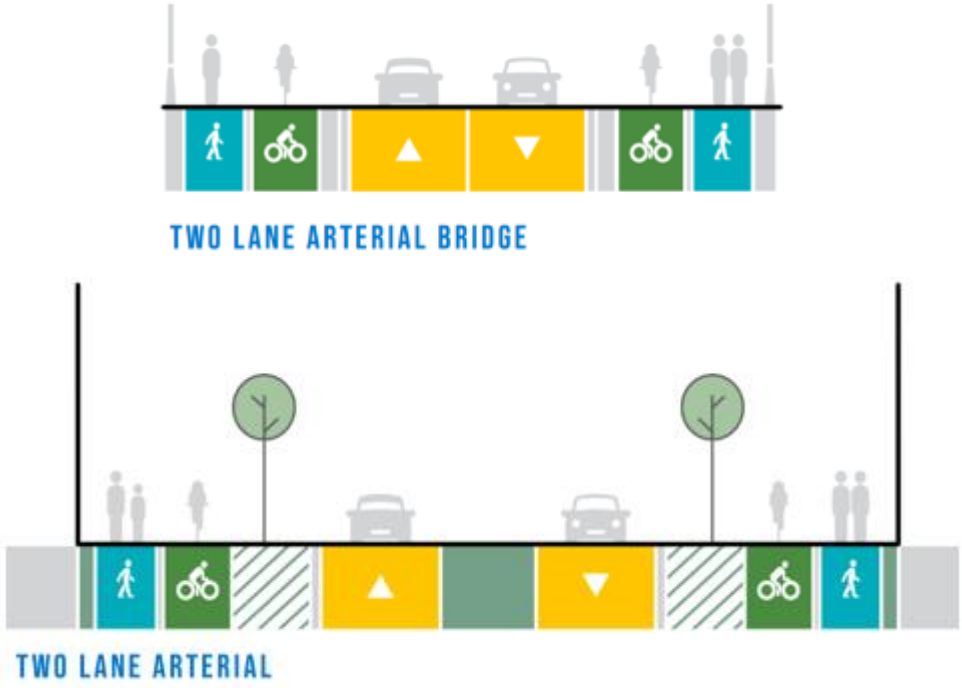
Speed environment	• 50km/h (where it is trafficked)
Access lanes	• None
Intersections	• None
Stormwater infrastructure	• Kerb and channel along road edge
Typical cross sections	

2.1.2 Manuia Road project area

As set out in Table 4 below, the proposed works within the Manuia Road project area include construction of a new grade-separated road crossing (bridge) across the NIMT. The new bridge will accommodate one vehicle lane in each direction and active mode facilities.

Table 4: Overview of the Manuia Road project area

NoR 1 – Manuia Road project area	
	
Key features	
Overview	• There is currently no existing east-west corridor / level crossing across the NIMT in this project area. • Construction of a new arterial road bridge across the NIMT accommodating two lanes (one in each direction) and separated active mode facilities. • Construction of new arterial road corridors tying into either side of the bridge (east and west of the NIMT) accommodating two vehicle lanes (one in each direction) and separated active mode facilities.
Other structures	• Retaining/abutment walls (either side of the NIMT)
Other road closures / cul-de-sac	• Reconstruction of existing cul-de-sac at Hitchcock Road (east of the NIMT) to tie into the new intersection at Oakleigh Avenue/ Manuia Road / Hitchcock Avenue (as described below) and upgrade with footpath.
Speed environment	• 50km/h
Access lanes	• Existing Manuia Road will be reconfigured into an access lane for remaining properties, tying in with the new Manuia Road corridor/ bridge (west of NIMT).
Intersections	• Upgrade of the existing Great South Road/ Challen Close/ Manuia Road intersection to provide for signalisation, footpath upgrades and tie in works with the existing roads.

	• New roundabout intersection at Oakleigh Avenue/ Manuia Road / Hitchcock Avenue with active mode facilities and tie in works.
Stormwater infrastructure	• Stormwater culvert and associated flood offset storage area • Kerb and channel along road edge *Note: NoR has also considered space requirements for future stormwater treatment devices (though subject to future Regional Plan consenting process)*
Typical cross sections	

2.1.3 Manuroa Road project area

As set out in Table 5 below, the proposed works within the Manuroa Road project area include closure of the existing level crossing and replacement with a new active modes bridge across the NIMT.

Table 5: Overview of the Manuroa Road project area

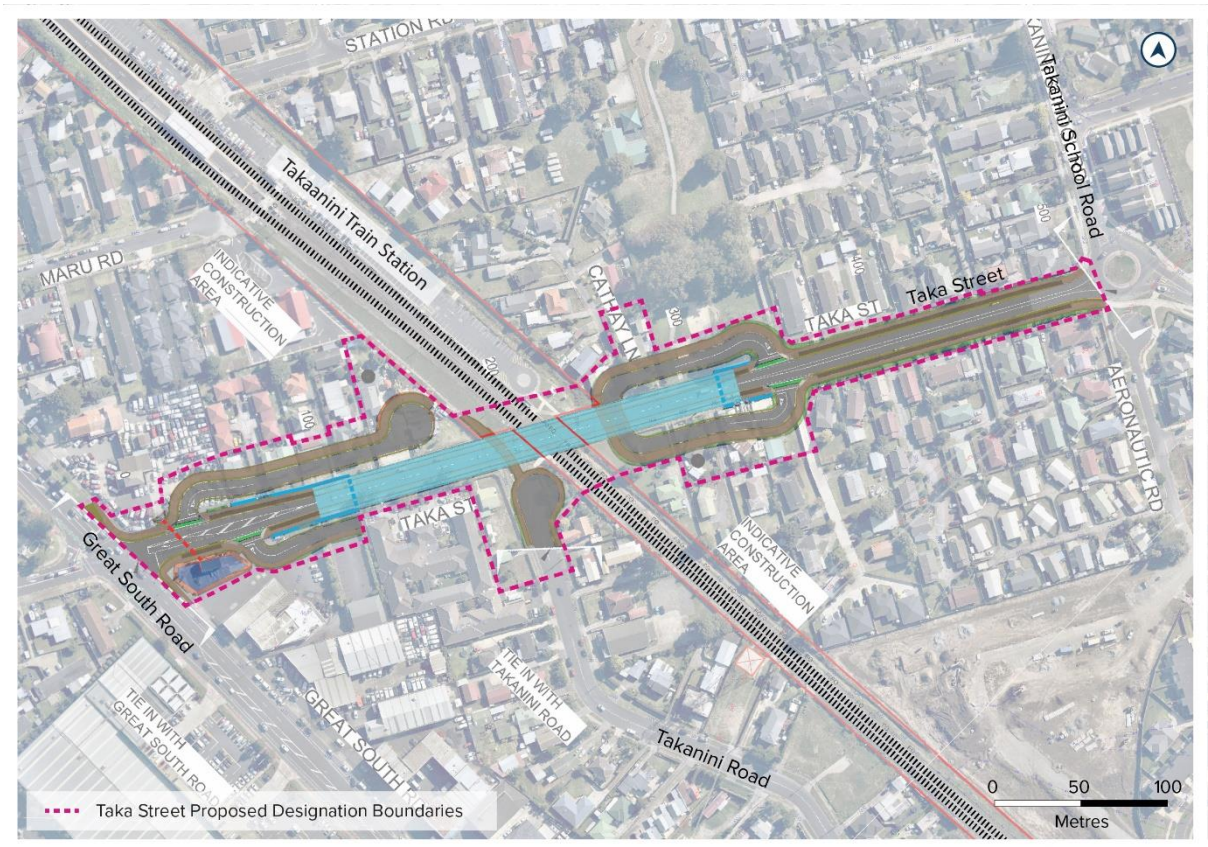
NoR 1 – Manuroa Road project area	
	
Key features	
Overview	• Closure of the existing road corridor to vehicular traffic across the NIMT. • Construction of an active mode bridge across the NIMT. • Construction of cul-de-sacs (accommodating footpaths) and works to tie into the existing corridor on either side of the NIMT along Manuroa Road. • Ramps and stairs will connect to the bridge on either side (east and west) of the NIMT and will tie into the cul-de-sacs.
Other structures	• None
Other road closures / cul-de-sac	• None
Speed environment	• 50km/h (where it is trafficked)
Access lanes	• None
Intersections	• None
Stormwater infrastructure	• Kerb and channel along road edge

Typical cross sections	

2.1.4 Taka Street project area

As set out in Table 6 below, the proposed works within the Taka Street project area include closure of the existing level crossing and replacement with a new grade-separated road crossing (bridge) across the NIMT. The new bridge will accommodate one vehicle lane in each direction and active mode facilities.

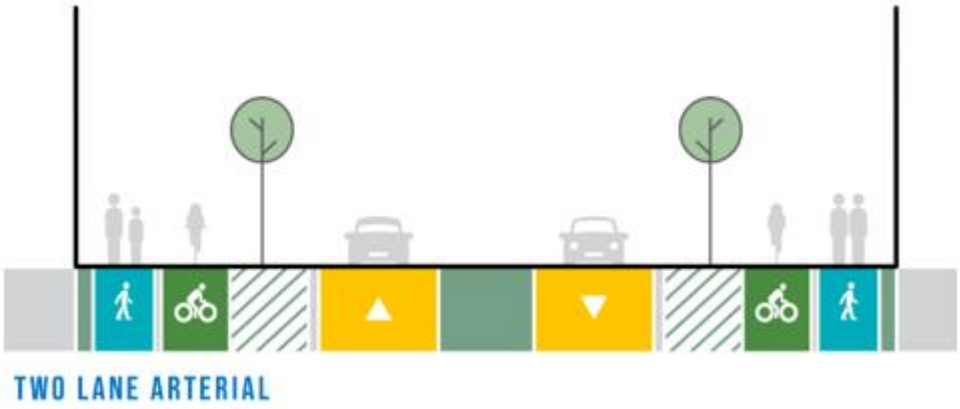
Table 6: Overview of the Taka Street project area

NoR 1 – Taka Street project area


Key features	
Overview	• Construction of an arterial road bridge across the NIMT accommodating two vehicle lanes (one in each direction) and separated active mode facilities. • Construction of arterial road corridors tying into either side of the bridge and existing intersections (east and west of the NIMT). The corridors will accommodate two vehicle lanes (one in each direction) and separated active mode facilities.
Other structures	• Retaining / abutment walls
Other road closures / cul-de-sac	• Closure of existing Takanini Road (north) to vehicular traffic at the intersection with Taka Street bridge i.e., no through-traffic provision. Replacement with a cul-de-sac and works to tie into the existing corridor of Takanini Road to the south. Active modes connection from Takanini Road to Takaanini Station (under the new Taka Street bridge).
Speed environment	• 50km/h

Access lanes	• Construction of four access lanes:
	  • Construction of a new access lane (cul-de-sac) located west of the NIMT and north of the Taka Street road corridor. It accommodates a footpath on the northern side and bi-directional traffic. The access lane will tie in with the Taka Street corridor and allows access to existing properties to remain and Takaanini Station.
	  • Construction of a new access lane located west of the NIMT and south of the Taka Street road corridor. It accommodates a footpath on the southern side and bi-directional traffic. The access lane will tie in with the Taka Street corridor and allows access to existing properties to remain.
	  • Construction of two access lanes located west of the NIMT (north and south of the Taka Street road corridor and looping under the new Taka Street bridge). They accommodate a footpath on the outer edge and bi-directional traffic. The access lane(s) will tie in with the Taka Street corridor and allow access to existing properties to remain including Takaanini Reserve and Cathay Lane.

Intersections	• None
Stormwater infrastructure	• Stormwater culvert and associated flood offset storage area • Kerb and channel along road edge *Note: NoR has also considered space requirements for future stormwater treatment devices (though subject to future Regional Plan consenting process)*
Typical cross sections	

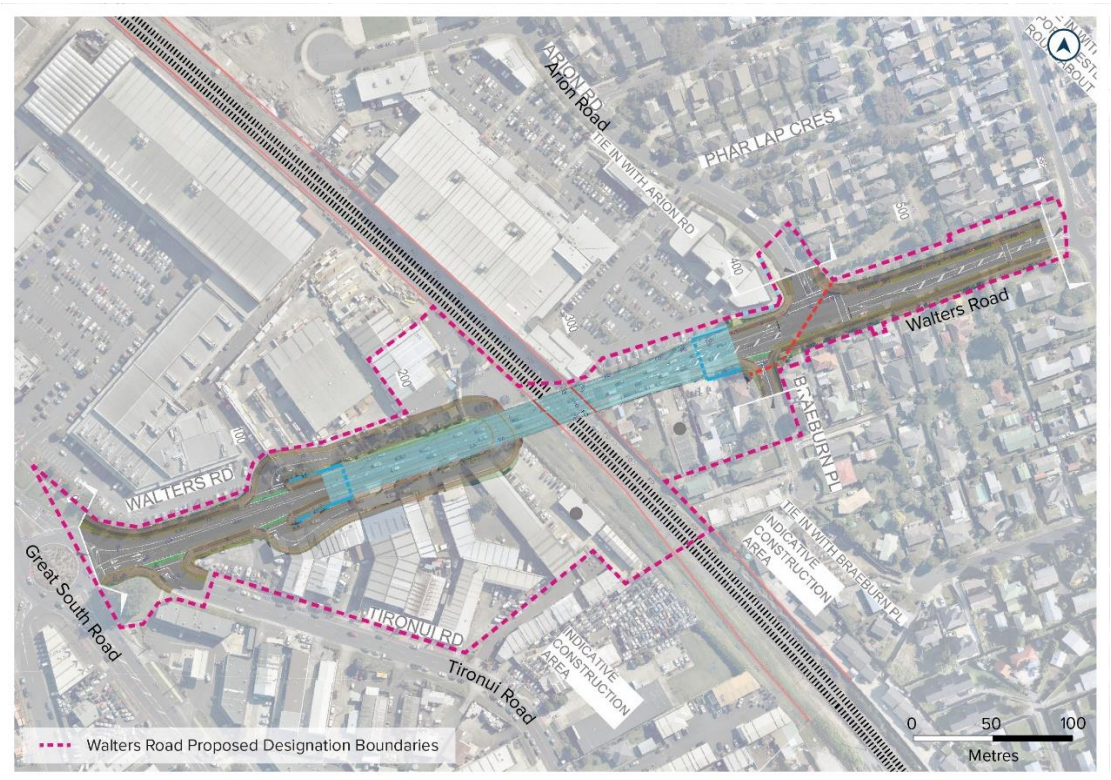


2.2 NoR 2 – Walters Road

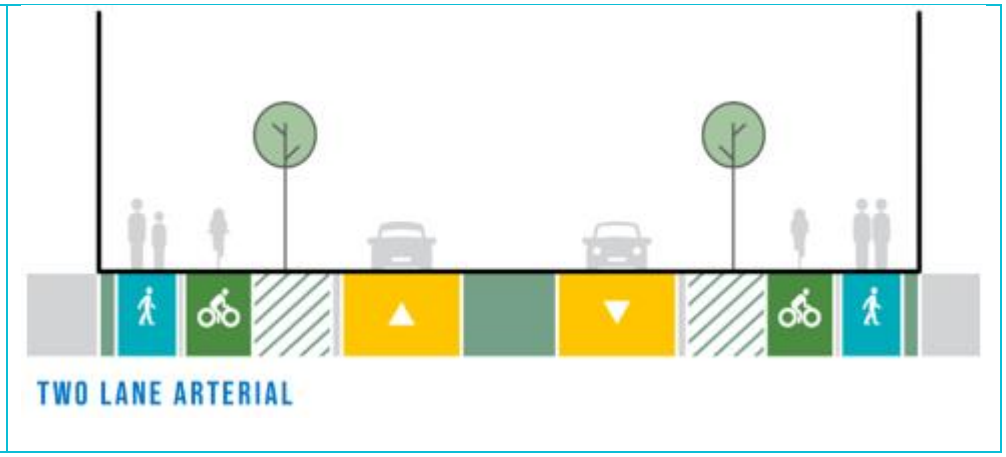
2.2.1 Walters Road project area

As set out in Table 7 below, the proposed works within the Walters Road project area include closure of the existing level crossing and replacement with a new grade-separated road crossing (bridge) across the NIMT. The new bridge will accommodate one vehicle lanes in each direction and active mode facilities.

Table 7: Overview of Walters Road project area

NoR 2 – Walters Road project area


Key features	
Overview	• Construction of an arterial road bridge across the NIMT accommodating two vehicle lanes (one in each direction) and separated active mode facilities. • Construction of arterial road corridors tying into either side of the bridge and existing intersections (east and west of the NIMT). The corridors will accommodate two vehicle lanes (one in each direction) and separated active mode facilities.
Other structures	• Retaining / abutment walls
Other road closures / cul-de-sac	• None
Speed environment	• 50km/h
Access lanes	• Construction of two access lanes located west of the NIMT (north and south of the Walters Road corridor and looping under the new Walters Road bridge). They accommodate a footpath on the outer edge and bi-directional traffic. The access lane(s) will tie in with the Walters Road corridor and allow access to remaining properties.
Intersections	• Upgrade of the existing Arion Road / Walters Road intersection to provide for footpath upgrades and works to tie into existing Arion Road. • Upgrade of the existing Braeburn Place / Walters Road intersection to provide for footpath upgrades and works to tie into existing Braeburn Place. • Upgrade of the existing Tironui Road / Walters Road intersection to provide for footpath upgrades and works to tie into existing Tironui Road.
Stormwater infrastructure	• Stormwater culvert • Kerb and channel along road edge *Note: NoR has also considered space requirements for future stormwater treatment devices (though subject to future Regional Plan consenting process)*
Typical cross sections	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3 Assessment Methodology

3.1 Preparation for this Report

A series of business cases and public engagement activities have been undertaken for Te Tupu Ngātahi Supporting Growth Alliance (**Te Tupu Ngātahi**) South projects including the TLC. This package of works has been developed over several years as part of a wider programme of transport initiatives needed to support the growth in this southern part of Auckland. These include:

- Transport for Future Urban Growth Programme Business Case (2016) (**PBC**);
- South Indicative Business Case (2018) (**IBC**); and
- Takaanini Level Crossings Detailed Business Case (2022) (**TLC DBC**), which set out the case for route protection of the Project (the subject of this assessment).

Several resources were used to support the Assessment of Transport Effects, including:

- Modelling inputs for operational effects (which are discussed in Section **3.4.2** of this Report below);
- A Construction Method Statement provided for the Project (summarised in the AEE), which was used to assess the actual and potential transport effects of the construction of the Project; and
- Data on current usage of crossings based on Level Crossing Safety Impact Assessment (**LCSIA**), level crossing fault incident data (provided by Kiwi Rail) and crash data (Waka Kotahi Crash Analysis System).

In addition, two site visits with other specialists working on the Project were undertaken on 17 May 2022 and 30 June 2022. Workshops with other relevant technical specialists were undertaken through the process.

3.2 Approach to the existing and likely future environment

The Project is not anticipated to be constructed or operational in the short-term future. Accordingly, as noted in the AEE, assessing the effects of the Project on the environment as it exists today (i.e. at the time of this assessment) will not provide an accurate reflection of the environment in which the effects of the construction and operation of the Project will be experienced. For this reason, land use and transport scenarios representing likely future environments have been adopted for the purposes of this assessment.

In relation to land use, it is noted that the Project is located within a predominantly urban area which will evolve over time and is likely to experience change before the implementation of the Project. Growth within the Project area is anticipated to be enabled through Plan Change 78 to the Auckland Unitary Plan: Operative in Part (**PC78**) which gives effect to the enabling directives of the National Policy Statement on Urban Development (**NPS-UD**) through both the enablement of high density development within walking distance of centres; and widespread medium density development through implementing the Medium Density Residential Standards (**MDRS**). Moreover, the Project is also located near greenfield land zoned for future urbanisation in the Auckland Unitary Plan: Operative in Part (**AUP-OP**), which in turn is sequenced through the Council's Future Urban Land Supply Strategy (**FULSS**). It is noted that the FULSS sequencing may be revisited through the Council's Future Development Strategy (**FDS**) which remains incomplete at the time of writing. The AFC develops land use scenarios which reflect projected and enabled growth over time. These land use scenarios have been applied as appropriate to the assessment of construction and operational

effects (see section 3.3 of this Report). As noted in section 3.4.2 of this Report below, land use forecasts reflecting PC78 and the FDS remain incomplete at the time of writing.

It is arguable that the Project may itself induce some change in the urban environment, or conversely, that the planned urban development may be less likely to emerge without the Project. It would be highly speculative to estimate where the planned growth may be displaced to without the Project in place. Given that land use decisions are made by Auckland Council (**Council)**, no deviation from AFC land use scenarios has been assumed for the purposes of this AEE.

Similarly, to land use, the transport environment is anticipated to evolve over time and is likely to experience change before the implementation of the Project. For this reason, modelling assessment has assumed and accounted for various other interdependent transport projects over time including the CRL, South Frequent Transit Network (**FTN**), and wider transport infrastructure improvements such as rail station upgrades and quadruplication of the NIMT. The various changes to the future transport network assumed in this assessment are set out in **Appendix A** of this Report.

More detailed discussion on the existing and likely future environment in relation to this transport assessment is provided in sections 4.1 and 4.2 of this Report below.

3.3 Assessment Parameters

3.3.1 Assessment years

In light of the aforementioned approach to the existing and likely future environment, this assessment has adopted the following temporal parameters for construction and operational effects assessment:

- **Construction effects** of the Project are assessed in the context of the land use and transport environment as it is assumed to exist in 2038. A 2038 assessment scenario is considered the likeliest time for construction to occur (from the available scenarios), and ensures that some future contextual changes are accounted for; and
- **Operational effects** of the Project are assessed in the context of the land use and transport environment as it is assumed to exist in 2048. This longer-term scenario has been adopted to ensure that the maximum extent of impacts is assessed for a period beyond initial implementation, as well as to capture the inherently longer-term positive effects associated with large-scale infrastructure.

These model years have been assessed under scenarios where the Project is included in the network, and where it is excluded.

3.3.2 Approach to staging and sequencing

Given the long-term nature of the designation being sought by the NoRs, the operational effects assessment does not assess the interim staging of individual corridors. Instead, it places a greater focus on the ‘full build-out’ of the Project to support future communities and assesses the transport effects of this project on that likely future environment. The TLC DBC suggested a staged implementation approach with the full scheme operational by 2035, (noting this date is uncertain as funding for this full scheme has not been committed).

The construction effects did consider a range of possible sequencing plans during construction. This included several construction scenarios based on geographic areas and assessing construction of a crossing in isolation and simultaneous crossing construction works.

3.3.3 Summary of assessment scenarios

The above parameters have informed the various scenarios adopted throughout this assessment. These are summarised at Table 8 below.

Table 8: Assessment of transport network against land use

	Existing land use	Future land use (2038)	Future land use (2048)
Existing transport network	Existing environment – not assessed.	-	-
Future transport network (without TLC Project) – at 2038	-	Construction effects assessment – Do Nothing	-
Future transport network (with TLC Project under construction) – at 2038	-	Construction effects assessment – with Project (noting a range of possible construction sequencing plans)	-
Future transport network (without TLC Project) – at 2048	-	-	Operational effects assessment – Do Nothing
Future transport network (with TLC Project) – at 2048	-	-	Operational effects assessment – with Project

3.3.4 Assessment limitations

The assessment is intended to support long-term route protection, rather than imminent implementation. The following stages would need to be undertaken prior to implementation:

- Business Case for implementation, including any concept design review / update to contemporary information or standards
- Updated transport modelling;
- Detailed design;
- Consent applications;
- Construction planning and approvals; and
- Construction.

Given the above, the NoRs are based on only concept-level design and relies on outline plans of work, conditions, and future management plans to confirm design detail and address local effects. As such, the NoRs:

- Makes greater use of generic cross sections and design standards;

- Focuses more on desired outcomes and full build footprints;
- Takes a longer-term view, with its inherent uncertainties; and
- Assumes more use of recommended management plans and planning processes rather than specific design details to manage the potential effects.

3.4 Approach to assessment of operational transport effects

Potential operational transport effects are assessed by:

- Testing alignment with policy documents (see section 3.4.1 of this Report);
- Transport planning assessment of expected outcomes and effects; and
- Transport modelling to inform demands and network performance (see section 3.4.2 of this Report).

3.4.1 Transport guidance and documents

Assessment of the Project against the relevant objectives and policies of the AUP-OP is contained in the AEE. Within this Report, the Project has also been considered against the outcomes and objectives of applicable transport design guidance and policy directives including:

- AT's Transport Design Manual[1] (**TDM**), which sets out outcomes, engineering design and construction requirements for the Project;
- AT's Vision Zero, and the Waka Kotahi Road to Zero policy, which adopt a "Safe System" approach to focus on road safety for all road users;
- AT's Auckland Network Operating Plan[2] which sets out how the transport network should be operated at different times of day for the different transport modes;
- AT's Roads and Streets Framework (**RASF**) was also used to qualitatively assesses the typology (movement and place value) and modal priority for each corridor; and
- Government Policy Statement (**GPS**) on land transport policy priorities.[3]

3.4.2 Transport modelling

Throughout the transport network analysis process, a range of different transport modelling tools have been used to undertake quantitative assessments of the transport system. These tools inform decisions about planning the transport network, corridors, and intersections. These, or similar, tools were used in the TLC DBC to develop the recommended Project, with further refinement of the project design and the tools undertaken for this AEE.

The impacts of the Project on the future transport environment are assessed using forecasting transport models, owned by AFC. The models include:

- The MSM. This model creates estimates of car, truck, and PT movements at a regional level, based on land use, network, and policy inputs. This model is the primary tool to estimate future PT usage. Generally, this model is run using regional assumptions as per recent Auckland Transport Alignment Programme (**ATAP**) planning, with project-specific inputs in the TLC study area;

[1] Auckland Transport, Transport Design Manual, 2021 update: Transport Design Manual (at.govt.nz).
[2] Auckland Transport, Auckland Network Operating Plan, version 3, 2020.
[3] Te Manatū waka (MoT), Government Policy Statement on land transport 2021, (published September 2020).

- A local traffic model (SATURN)**.** This uses the traffic demands from MSM on a more detailed representation of the road network. This model is the main tool used to estimate potential changes in traffic flows and road network performance because of the Project;
- A strategic active modes (walk/cycling) model (SAMM). This tool gives strategic-level estimates of walking and cycling demands, including those expected to be induced because of the Project;
- Intersection models (SIDRA) at key locations. These models were used to check concept designs and report the expected intersection performance at key locations. SIDRA models use expected traffic flows at key locations from the SATURN model.

In addition to modelling software, Crash Analysis System (**CAS**) data has also been extracted to determine crash rates over the past 10 years on any existing corridors. The purpose of extracting this data was to assess trends in the existing environment and signify the importance of change required to mitigate any existing patterns.

The assessment of operational effects is informed by modelled estimates of travel and network performance for a future full build-out scenario. Each of the models used (except the small, localised SIDRA models), have been subject to a review process, in relation to general model function.

A key input to the models is regional land use forecasts, which influence the future quantum and location of travel. Regionally agreed land use forecasts are prepared by Council via the AFC, with the most recent available forecasts (at the time of this assessment), referred to as Scenario I11.6. Those forecasts are based on regional population forecasts from Statistics New Zealand, with spatial allocation to individual spatial areas based on the AFC land use model and known detail around specific land use planning processes.

Land use forecasts have inherent uncertainty, in terms of the specific rate of new growth in particular areas. Currently, there is additional uncertainty around the likely outcomes and rate and location of higher-density development sought through central Government policies such as the National Policy Statement on Urban Development 2020 (**NPS-UD**), which directs councils to enable higher density development within walking distance of centres and rapid transit stations (via policy 3c); as well as widespread medium density development through implementing the MDRS. The specific planning response to those policies is currently being progressed by Council through proposed PC78. A possible corollary of PC78 is the possible reprioritisation of future development areas by the Council through its FDS, which was incomplete at the time of writing.

Revised land use forecasts reflecting any expected changes from PC78 and FDS were not available at the time of preparing this assessment. However, it is generally considered that the TLC is not inconsistent with such policy direction, regarding supporting higher density urban development in the existing brownfields, particularly around the rapid transit corridor. Given this context, the use of those available I11.6 forecasts is considered acceptable for this assessment.

The potential for the Project to generate diversion of traffic to other routes or corridors was primarily assessed via the traffic models, albeit augmented by local knowledge of the area and data on existing behaviour and network issues. Although the transport models include detailed assessment of three weekday peak periods (morning and evening commuter peaks plus the interpeak), the assessment has focussed on predicted change in daily[4] flow to better reflect sustained change, rather than impacts that could be more fleeting during peak periods. Daily flows can be a useful measure of a range of traffic

[4] Weekday daily traffic flows were estimated as a weighted aggregation of the three peak periods.

effects, including noise, amenity, safety, and likely congestion. The assessment of effect on potential network delay did consider each peak period.

For traffic modelling analysis at key intersections, level of service (**LOS)** metrics were used to quantify the potential change in system efficiency (for vehicles) because of the Project. LOS is a qualitative measure used to explain the quality of motor vehicle traffic service. LOS is used to analyse roads and intersections by categorising traffic flow and assigning quality levels to traffic based on a performance measure ranging from A to F. These are summarised as follows:

- **LOS A:** free flow. Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes;
- **LOS B:** reasonably free flow. LOS A speeds are maintained, manoeuvrability within the traffic stream is slightly restricted;
- **LOS C:** stable flow, at or near free flow. Ability to manoeuvre through lanes is noticeably restricted and lane changes require more driver awareness;
- **LOS D:** approaching unstable flow. Speeds slightly decrease as traffic volume slightly increase. Freedom to manoeuvre within the traffic stream is much more limited and driver comfort levels decrease;
- **LOS E:** unstable flow, operating at capacity. Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to manoeuvre in the traffic stream and speeds rarely reach the posted limit; and
- **LOS F:** forced or breakdown flow. Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity

It is important to note that the transport modelling is used to inform, rather than act as a pure basis for, decisions on the design and planning of the transport network, corridors, and intersections.

Given the above, the assessment did not define minimum LOS standards to be met at intersections. Rather, the LOS measures were generally used to easily identify the likely performance of key intersections, and more importantly the potential change because of the Project.

3.4.2.1 Modelling uncertainties

As with any modelling, there are uncertainties that results from the assumptions made. These assumptions are based on the best information available at the time, however changes in the future may occur which will mean the assumptions made today may no longer be relevant. This could potentially result in an over or under estimation of the projected growth and demand. However, what is presented in this document is a snapshot based on the best current knowledge at hand. Sensitivity tests around the rate of growth were undertaken of the TLC DBC.

3.4.3 Assessment methodology - transport elements

Table 9 summarises how the operational effects resulting from the Project have been assessed for each component of the transport network.

Table 9: Summary of assessment methodology

Network Component	Information Source	Assessment Method
Safety	CAS Database Project design drawings, modelled network-reduction in total vehicle travel	Assessment to determine alignment with Vision Zero and Road to Zero standards, design compliance with Transport Design Manual and network-wide estimate in reduced crashes from less vehicle travel.
Public Transport (PT)	Transport Model tools (MSM) SGA Remix File[5]	Quantification of expected change in accessibility, mode share and PT travel, including on other parts of the PT network.
Walking and Cycling	Walking and Cycling Network Plans Proposed cross sections Model forecasts of change in active model travel from Project	Assessment to determine alignment with walking and cycling strategic documents and design compliance with Transport Design Manual. Estimation of uplift in walk and cycle travel, including potential associated reductions in vehicle travel.
General Traffic	Transport Model tools: MSM (changes in overall demand), SATURN (changes in traffic flows and network performance) and SIDRA (changes in intersection efficiency at key locations) Project design drawings	Assessment using key model outputs including traffic volumes, levels of service for corridor midblock performance and intersection performance. Assessment of surrounding network connections and the impact on the strategic network.
Property access	Engineering Standards Project design drawings	Assessment identifying where there is a potential effect on access in the existing environment.
Parking	Engineering Standards and existing on-street parking provisions	Assessment identifying where there is a potential effect on both on-street and on-site (private) parking in the existing environment Alignment with the draft Auckland Parking Strategy[6].
Freight	Auckland Strategic Freight Network Plan, traffic models	Assessment to determine alignment with the Auckland Strategic Freight Plan and to identify any potential effect on the freight movements and over dimension/ overweight routes.
Note: A Road Safety Audit and Safe System assessment will be completed as part of the implementation business case / detailed design stage, prior to implementation, and have not been undertaken during this route protection phase.		

[5] SGA Remix file provided by Auckland Transport, June 2022, showing draft bus network plan to be implemented by 2038
[6] Draft Auckland Parking Strategy, April 2022

3.5 Approach to assessment of construction effects

3.5.1 Construction traffic effects

An assessment of construction effects has been completed. The project specific construction effects will be managed via a Construction Traffic Management Plan (**CTMP**) and/or Site-Specific Traffic Management Plans (**SSTMP**). Assessment of potential conflict areas with vulnerable road users will need specific mitigation within a CTMP and/or SSTMP. The CTMP and/or SSTMP will be developed immediately prior to implementation, when the greatest certainty is available. The Project works are generally within the existing road corridors, so major movement of trucks for earthworks or bulk materials is not anticipated. While construction traffic will still be present, the corridors are generally within dense urban road networks with multiple alternative routes. Given this context and the uncertainty of the future construction methodologies, this assessment has not assessed detailed estimates of construction traffic movements.

The impact of any temporary traffic management measures implemented to undertake the Project will be re-assessed in the future, prior to construction, when a greater level of detail is available in terms of the specific construction methodology and traffic environment. It is noted that the proposed CTMP condition requires methods to manage the effects of temporary traffic management measures to be identified. In turn, the CTMP is proposed in the conditions to be triggered as part of the Outline Plan for a Stage of Work. This ensures that the CTMP is undertaken when the appropriate level of detailed information is available.

It is anticipated that most of the project works will be undertaken ‘online’, within or immediately adjacent to operational corridors. Any future assessment should be required to consider network capacity reductions through potential road closures, capacity reductions on key corridors through lane closures, effects on property access through road or lane closures, and any other ancillary effects such as shoulder closures or temporary loss of access to individual properties.

An indicative construction methodology has been prepared to enable assessment of the construction traffic effects of the Project. This can be found in the AEE. Given the long-term nature of the Project, these construction methodologies are indicative only to identify the general type of transport effects that could eventuate, and thereby inform the scope of proposed management plans. The scope of this assessment is for impacts on the operation of the transport system and does not directly address any potential business economic impact because of potential temporary access disruption.

The main construction effects assessment in this Report considers:

- A number of scenarios where the level crossings are closed during the construction of the bridges to assess various scenarios of traffic impact on the network;
- Community access and the expected travel time under the scenarios;
- Impact of the construction scenarios on the various transport modes including general traffic, freight, buses, pedestrians and cyclists;
- An overview of key considerations including speed, potential impacts to pedestrians and cyclists and property access; and
- Identification of any works that should not occur at the same time.

The focus of this key assessment is to identify characteristics or potential effects that may not be readily captured in the proposed management plans, and therefore require specific requirements to be assessed.

4 Existing and likely future environment

The high-level approach to assessing the existing and likely future environment is covered above at section 3.2 of this Report. Sections 4.1 and 4.2 of this Report below provide further detailed description on the existing environment and the likely future environment conditions without the Project. These sections constitute the context for the assessment of the Project.

4.1 Existing transport network

4.1.1 General traffic

The current land use surrounding the Project is in urban environment, within proximity to the existing State Highway 1 (**SH1**), the NIMT and Great South Road (see Figure 2 below). The existing level crossings intersect with the NIMT and Great South Road.

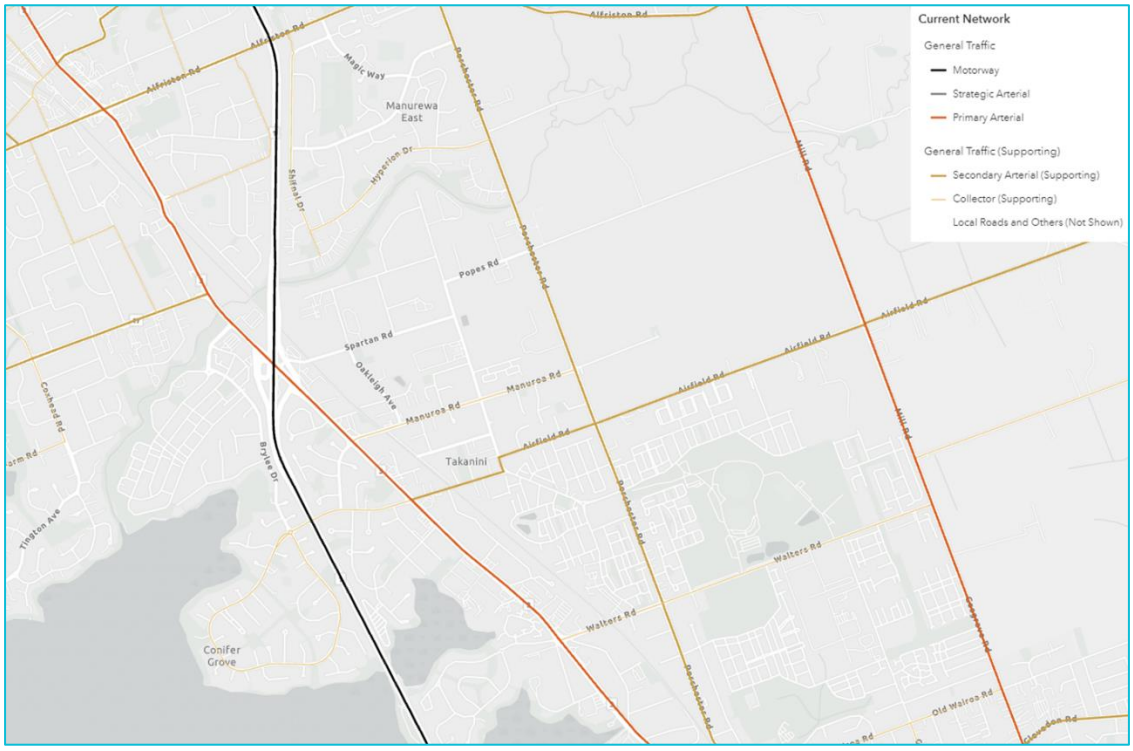


Figure 2: Current network

The existing transport network surrounding the five Project areas can be summarised as follow:

- **SH1** is a six-lane, 100 km/h, high volume state highway that provides a connection between Takaanini and Papakura;
- **Great South Road** is a high volume, arterial road which intersects with the Takaanini SH1 Motorway interchange and with the western end of the Project areas. Great South Road has four lanes near the interchange and has two lanes south of Manuroa Road. Near the Takaanini Interchange, the speed limit is 70km/h. South of the Takaanini Interchange, the speed limit is 50km/h;
- **Takaanini Interchange** is the intersection of SH1 and the Great South Road strategic arterial. Both SH1 on-ramps are situated on the western side of Great South Road;

- **NIMT** is a two-track existing rail line. This section of the rail line is used by rail freight and passenger trains from Britomart to Papakura (6 trains in each direction per hour in the peak period);
- **Spartan Road** is a two-lane, 50km/h local road[7] with a rail level crossing. The intersection at Spartan Road and Great South Road is located within the signalised Takaanini interchange and the right turn movement out of Spartan Road is banned. Spartan Road serves light and heavy industrial land uses;
- **Manuia Road** is a two-lane, 50km/h cul-de-sac which provides local access to a small number of residential properties and a car dealership. This cul-de-sac also provides an access point to the Takaanini Gateway shopping complex and the BP truck stop and Beaurepaires Tyre & Battery Shop;
- **Manuroa Road** is a two-lane, 50km/h collector that provides access from a number of local streets onto Great South Road. There is a neighbourhood centre zone located within Manuroa Road. This corridor intersects with the NIMT;
- **Taka Street** is a two-lane, 50km/h secondary arterial and connects with Airfield Road to provide a key east-west connection out towards Ardmore in the east. Taka Street provides access for residential areas and intersects with the NIMT; and
- **Walters Road** is a two-lane, 50 km/h collector which intersects with Great South Road and the NIMT. This corridor provides access to a number of commercial land uses such as the Southgate Shopping centre, industrial and residential properties.

Table 10 summarises the average daily traffic (**ADT**) with the percentage of heavy commercial vehicles (**HCVs)** on each road retrieved from Mobile Roads data as well as the existing General Traffic classifications from Future Connect. Survey states can be actual or estimated – referred to as "Act" or "Est" in Table 10 below.

Table 10: Existing Traffic Volumes on roads surrounding the network

Road Name	Adjacent land use	Future Connect Classification	Survey Data	ADT	% HCV
SH1	Mixture of land use	Motorway	Dec 2021 (Est)	71,800	8%
Great South Road (Takaanini Interchange to Walters Road)	• Business - Light industry • Residential – Mixed housing suburban and urban • Business – town centre	Primary arterial	June 2020 (Est)	30,700	8%
Spartan Road	• Business – Heavy and light industry	Local road	June 2020 (Est)	4,900	15%
Manuia Road	• Business - Light industry • Residential – Mixed housing suburban	Local road	June 2020 (Est)	80	5%

[7] Auckland Transport's Future Connect, 2022.

Road Name	Adjacent land use	Future Connect Classification	Survey Data	ADT	% HCV
Manuroa Road	• Residential – Mixed housing suburban and urban	Collector road	June 2020 (Est)	12,900	6%
Taka Street	• Residential – Mixed housing suburban and urban	Secondary arterial	June 2020 (Est)	4,100	4%
Walters Road	• Business – town centre • Business - Light industry • Residential – Mixed housing urban	Collector road	June 2020 (Est)	15,400	4%

There are a number of intersections in the project areas which can be impacted by activity at the level crossings. The form of these existing intersections are summarised in Table 11.

Table 11: Existing intersection form summary

Intersection	Existing intersection form
Spartan Road/ Great South Road	Signals - right turn movement out of Spartan Road onto Great South Road is not possible
Spartan Road/ Oakleigh Avenue	Priority Controlled
Manuia Road/ Great South Road	Priority Controlled
Hitchcock Road/ Oakleigh Avenue	Priority Controlled
Manuroa Road/ Great South Road	Signals
Manuroa Road/ Oakleigh Avenue	Priority Controlled
Taka Street/ Great South Road	Signals
Taka Street/ Takanini School Road	Single lane roundabout
Walters Road/ Great South Road	Dual lane roundabout
Walters Road/ Tironui Road	Priority Controlled
Walters Road/ Braeburn Place	Priority Controlled
Walters Road/ Arion Road	Signals

Figure 3 shows the form of existing intersections in the surrounding transport network.

Figure 3: Existing intersection form summary

Great South Road and SH1 experience lengths of congested sections during commuter peaks. SH1 is a key north-south route which operates at capacity in peak directions. This means on-ramp flows are constrained resulting in queues from the on-ramp impacting Great South Road which is the key arterial providing access to the state highway. The SH1 performance results in extra traffic diverting to use north-south arterials such as Great South Road.

The existing traffic volumes on Spartan Road, Manuia Road, and Taka Street operate at lower demands, whereas Manuroa Road and Walters Road are moderately congested during peak periods. However, all corridors with level crossings can become congested due to the level crossing barrier downtimes.

The Takaanini Interchange at the intersection of SH1 and Great South Road, provides on and off ramps to allow vehicular traffic to travel both northbound and southbound on SH1 (see Figure 4 & Figure 5) and Great South Road. There is a loop ramp which enables traffic to enter onto SH1 to travel northbound. Currently there is ramp signalling to manage traffic entering SH1, specifically in the morning peak period. There are two lanes for general traffic to use to enter the state highway at this location. There is also a separate lane for heavy vehicles above 3.5 tonnes, to enter SH1. The ramp signalling does not apply to heavy vehicles.

Figure 4: SH1 on-ramp – travelling northbound[8]

There are two lanes for general traffic along the on-ramp to allow vehicular traffic to enter SH1 to travel southbound. The SH1 southbound on-ramp is also signalised to manage traffic during the evening peak period. There is no specific freight lane at this on-ramp.

[8] Taken from google street view (March 2023).

Figure 5: SH1 on-ramp – travelling southbound[9]

4.1.2 Level crossing safety

The current form and function of the existing at-grade level crossings inherently poses actual and perceived safety risks for all users of the network.

Level crossing crashes are generally low in frequency but have severe consequences. Due to the low train frequency, it is important to consider safety from a potential risk perspective and not solely based on recorded incidents at these specific level crossings.

On average, between 2012 to 2021, 483 incidents[10] occurred at level crossings each year in New Zealand (**NZ**). 49 deaths and serious injury incidents were reported in the five-year period between 2017 to 2021 as reported in Waka Kotahi New Zealand Travel Agency's (**Waka Kotahi**) rail safety statistics.[11]

Figure 6 shows the existing vehicular and pedestrian level crossing on Manuroa Road, which is also representative of the other three level crossings within the Project. The current treatments include:

- Active protection through automatic barriers for both vehicles and pedestrians;
- Audible warning through flashing lights; and
- Warning signs and markings leading up to and at the level crossing.

[9] Taken from google street view (March 2023).
[10] These are occurrences where a train has struck or nearly struck a motor vehicle, pedestrian, cyclist, or other objects. Also includes damage and vandalism to level crossings.
[11] https://www.nzta.govt.nz/resources/rail-safety-statistics/.

Figure 6: Manuroa Road Level Crossing

To assess the risk at level crossings, KiwiRail Holdings Limited (**KiwiRail**) has developed a LCSIA to provide a Level Crossing Safety Score (**LCSS**). A LCSIA undertaken by AT*, "Auckland Metro South Pedestrian Crossing LCSIA", (Stantec, October 2018)* has indicated the following risk rating for each of the level crossings in question (see Table 12). The assessment assumes there will be future pedestrian growth and applied a 4% increase per annum at Walters Road given its surrounding land use and 2% for all other locations. It is also noted that at the time of writing, a network wide update of the LCSIA is currently being undertaken.

Table 12: LCSIA Risk Rating[12]

Level Crossing	LCSS Risk Band[1]
Spartan Road	**Low**
Manuroa Pedestrian Up Crossing	**Medium**
Manuroa Pedestrian Down Crossing	**Medium-Low**
Taka St Pedestrian Up and Down Crossing	**Medium**
Walters Road Pedestrian Up and Down Crossing	**Medium**

[1] Note the risk rating shown is as per the future score which has the improvements implemented after the study was undertaken representative of what is on site today.

As shown in Table 12**,** except for Spartan Road and Manuroa Road Pedestrian Down crossings, the other level crossings have a risk rating of 'Medium'. This is stated within the "Level Crossing Risk Assessment Guide" is 'neither overly dangerous, nor particularly safe and has a medium risk of death or serious injury (**DSI**) to users crossing the railway line.' The 'low' rating assessed for Spartan Road is mainly attributed to the low pedestrian demand due to the surrounding industrial land use.

Although these crossings are not necessarily assessed as having a high-risk rating, they ultimately still pose a safety concern as barriers cannot prevent a vehicle and / or a vulnerable road user from moving onto the track whether intentionally or unintentionally. Thus, the industry recognises this and as such KiwiRail adopts an elimination first approach when upgrading an existing level crossing with

[12] Auckland Metro South Pedestrian Crossing LCSIA, (Stantec, October 2018).

grade-separation assessment being the first requirement before other treatments are considered. If this cannot be achieved, it is a requirement when modifying an existing level crossing to achieve at least an LCSS of 'Medium-Low'.

Crash history for the TLC corridors have been obtained from the Waka Kotahi's CAS and KiwiRail's Operating Reporting Architecture (**ORA**) database to provide a high-level understanding of crash patterns and safety concerns at the level crossings. The crash data has been extracted for a ten-year period from January 2012 to December 2022 (inclusive).

Overall, there were 15 crashes reported along the TLC corridors in the ten-year period. 2 minor and 13 non-injury crashes occurred during this period. Table 13 summarises the types of crashes at each level crossing during the 10-year crash period. Figure 7 shows the location of the crashes at each of the level crossings.

Table 13: Historic recorded crash analysis summary

Level Crossing	CAS Summary	ORA Summary
Spartan Road	• **2** recorded crashes where trucks have hit the level crossing barrier arms.	• None
Manuroa Road	• **7** recorded crashes with **4** being rear ends resulting from vehicles having to stop at the level crossing and vehicles from behind rear ending. • One incident involved a vehicle overtaking and colliding with the vehicle in front waiting for barrier clearance.	• 3 recorded near collision incidents between 2015 and 2017. One incident occurred when a pedestrian got stuck between two passing trains at the Pedestrian Down crossing.
Taka Street	• **3** recorded crashes with one vehicle colliding with the train where the driver did not stop for the flashing red lights. Another involved a truck being struck by the barrier arm as the vehicle tried to clear the crossing.	• 2 recorded near collision incidents between 2015 and 2017. One incident occurred when a pedestrian got stuck between two passing trains at the Pedestrian Down crossing. • One fatal collision with a pedestrian in November 2013 at Pedestrian Down crossing.
Walters Road	• **3** recorded crashes with **2** rear end crashes and **1** where the vehicle was struck by the barrier arm as it tried to clear the crossing.	• 2 recorded incidents involved cyclists. • 5 involved pedestrians • One fatal collision with a pedestrian in August 2015 at Pedestrian Up crossing.

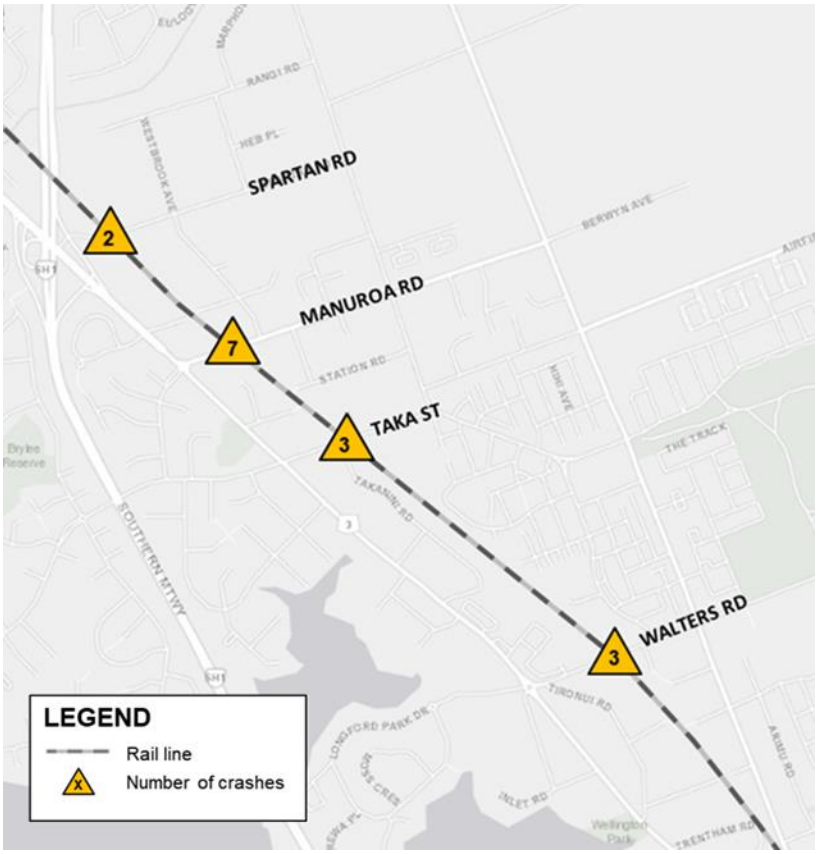


Figure 7: Level crossing related crashes recorded in 2012 - 2022

Figure 7 above only consists of CAS crashes and does not include pedestrian related crashes.

The immediate existing corridors surrounding the Project areas all have a posted speed limit of 50km/h. There are variable speed limits between 40km/h – 50km/h, due to the school zone around the intersection of Manuroa Road and Takanini School Road.

4.1.3 Walking and cycling

There are minimal active mode facilities in the area, resulting in high conflict and unsafe conditions between general traffic and vulnerable road users. Whilst each TLC corridor has separated footpaths, they are no cycling facilities, with the exception of Walters Road (between Arion Rd and the level crossing) where there is a shared path on the northern side of the corridor.

Great South Road (between Takaanini Interchange and Walters Road) has active mode facilities in the form of separated footpaths and on-road, un-protected cycle lanes. Around the Takaanini Interchange, Great South Road has a shared use path which connects to the Southern Path. The Southern Path is a 4.5km off-road shared walking and cycling path, constructed alongside the western side of SH1 and connects communities, between Takaanini and Papakura. Figure 8 shows the existing cycle network in Takaanini.

Figure 8: Existing cycle network (Waka Kotahi, 2021)

Spartan Road is considered to have a secondary walking classification based off AT's Future Connect network, shown in Figure 9. This classification indicates Spartan Road is a key walking spine providing access to and between major destinations. Manuroa Road, Taka Street and Walters Road are considered Primary walk connections, indicating that they provide high quality access to adjacent commercial, retail, school, employment land uses and to the PT network.

In terms of the Future Connect cycling network shown in Figure 10, Spartan Road is considered a connector as it provides a connection to the major routes; Great South Road and the Southern Path. Manuroa Road and Taka Street are both considered local connections as they are routes within neighbourhood centres. Walters Road is considered a major connection as it is a key spine providing a connection to regional routes and key destinations such as the Takaanini Village and the Southgate Shopping Centre.

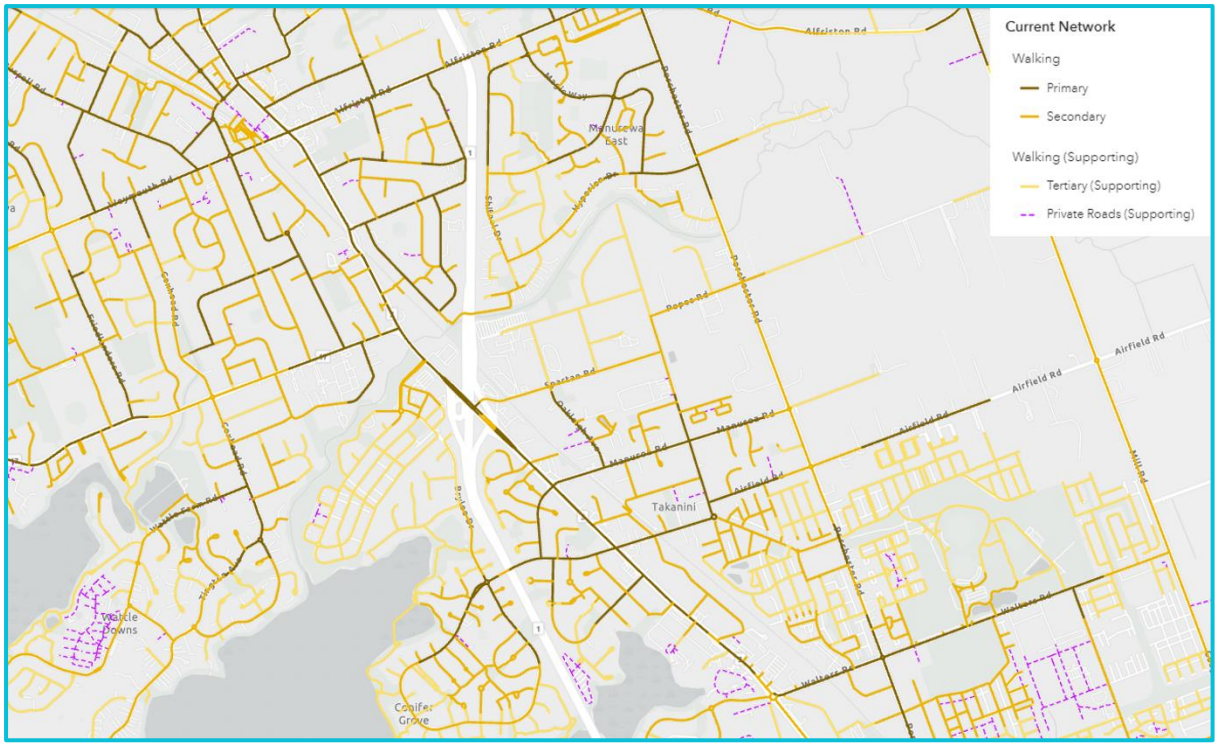


Figure 9: Future Connect Walking network (current)

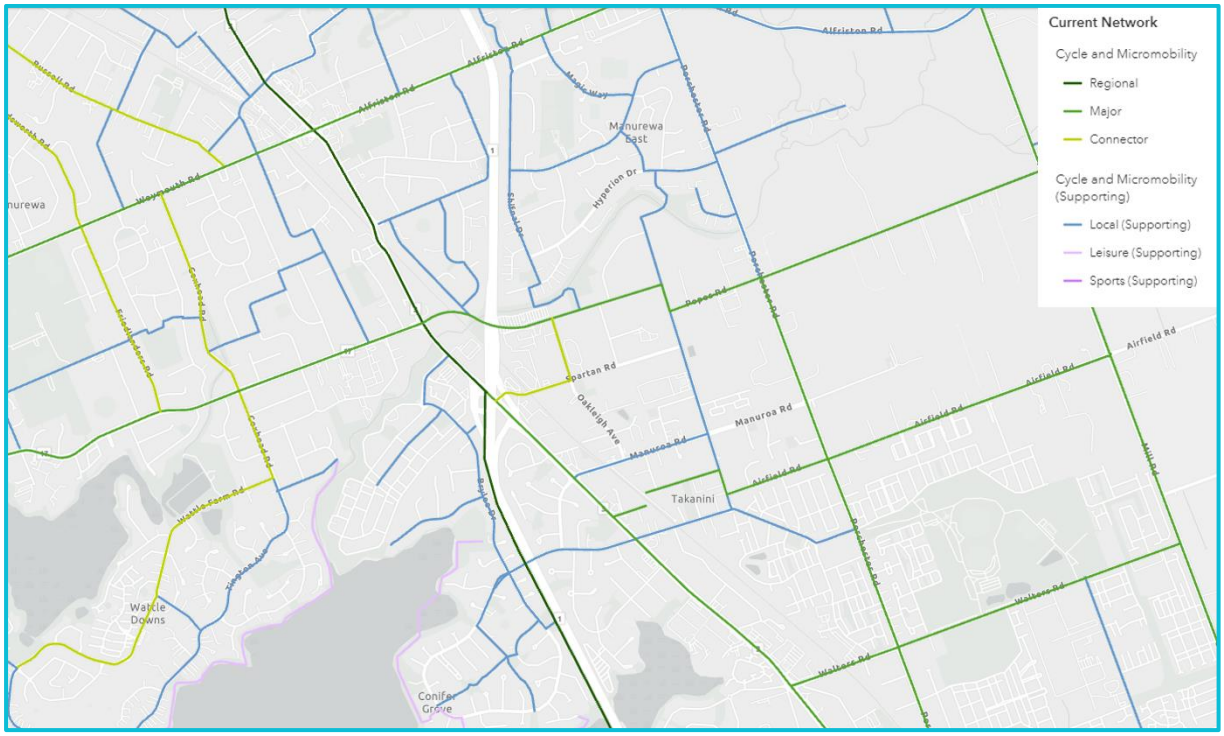


Figure 10: Future Connect Cycling network (current)

The SAMM model indicates that the existing (2018) pedestrian and cyclist demand at each of the level crossings are shown in Table 14.

Table 14: SAMM pedestrian and cyclist modelling data (daily trips)

Crossing	2018 Pedestrian Volume	2018 Cyclist Volume
Spartan Road	78	37
Manuroa Road	180	12
Taka Street	26	6
Walters Road	126	10

The SAMM model is calibrated across Auckland at a strategic level but not in detail for each crossing, hence, is used to predict expected increase in active mode movement due to growth and other Projects.

4.1.4 Public transport

4.1.4.1 Rail services & stations

Access to the rail services in the Project areas is via Takaanini Station. Train services connecting Papakura and Britomart (the Southern Line services) operate every 10 minutes during weekday peak morning and evening periods, and between 20-30 minutes outside of the peak periods. Te Mahia Train Station is approximately 1.6km north of the Takaanini Station and Papakura Train Station is 3.5km south of Takaanini Train Station.

Takaanini Station has 284 park and ride spaces, mobility parking spaces, bike shelter and bike racks. The NIMT is currently two tracks and runs six rail services per hour during the weekday peak period. Access to the park and ride is via Station Road, on the east of the rail line. Pedestrian and cyclist access is provided from both the east and west via Station Road and Maru Road, respectively.

The existing average barrier downtimes at each level crossing is noted below. These barrier downtimes were recorded on site and reflect the expected time for commuter/ passenger rail services passing at the crossing. It is expected that the barrier downtime would be longer for freight/ inter-regional rail services due to the length of the freight trains.

- Spartan level crossing: 80 seconds (barrier down for approximately 27% of the peak hour);
- Manuroa level crossing: 40 – 50 seconds (barrier down for approximately 15% of the peak hour);
- Taka level crossing: 40 – 50 seconds (barrier down for approximately 15% of the peak hour); and
- Walters level crossing: 40 – 50 seconds (barrier down for approximately 15% of the peak hour).

From 2017 to 2022, there were 170 recorded fault incidents at the level crossings:[13]

- 33 at Spartan Road;
- 79 at Manuroa Road;
- 15 at Taka Street; and

[13] Data provided by Kiwi Rail on 6th July 2022

- 43 at Walters Road.

These include broken barrier arms, failed lights and warning bells not working. Hardware faults such as gates malfunctioning, or barrier arms being hit can lead to incidents causing unexpected delays and cancelled train services. These fault incidents are shown in

Figure 11 below.

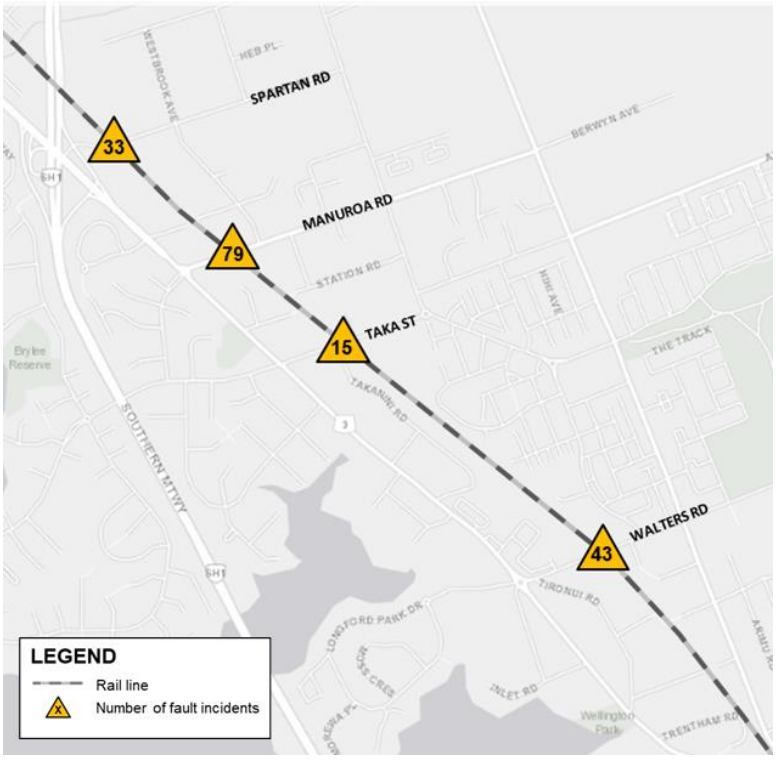


Figure 11: Fault incidents recorded (2017 - 2022)

The delays caused by these incidents result in lost productivity and are a cost to the road users. In addition, when this happens, train speeds must reduce at these locations until a full safety inspection is carried out causing further delay to services reducing capacity. Thus, time may be lost due to unplanned stops and speed restrictions limits capacity when an incident occurs. Further, level crossings limit the placement of signals in ideal locations which prevents the optimisation of headways between trains, reducing the potential train capacity.

Thus, if left as is, the potential north-south rail capacity is limited, restricting rail freight efficiency and accessibility to economic and social opportunities for rail users. This leads to reduced productivity impacting economic growth.

4.1.4.2 Buses

AT's existing Public Transport (**PT**) system is based on a hub and spoke model. Buses tend to operate more frequently and connect with other service routes in this model; however, more transfers are required between routes. The network is based on three principles: frequency, connectivity, and simplicity, and aims to maximise the resources within the network.[14] Figure 12 highlights the bus routes surrounding the Project areas. There are no bus services running along TLC corridors.

[14] https://at.govt.nz/projects-roadworks/new-public-transport-network/.

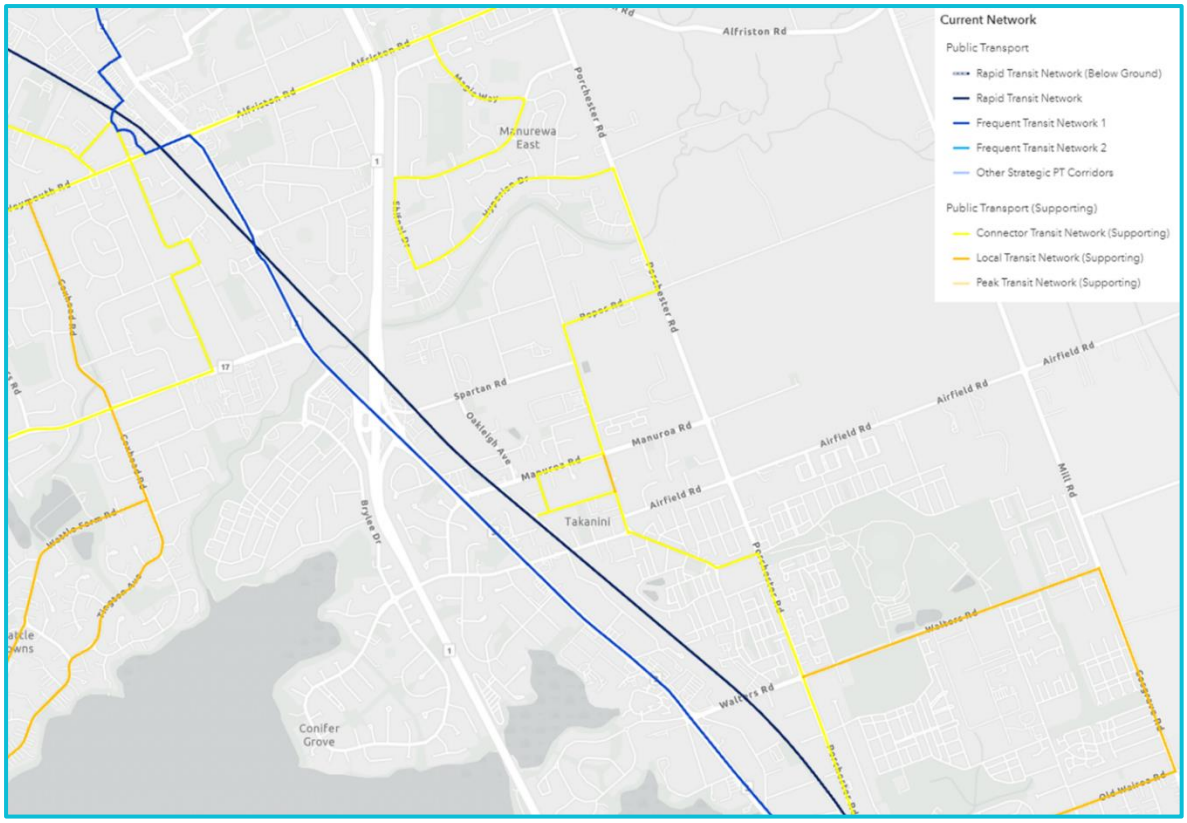


Figure 12: Future Connect PT network (current)

Frequent services (at least every 15 minutes):

- Bus service 33 operates along the Great South Road corridor every 10 minutes during peak hours and every 15 minutes during non-peak hours. The bus service connects Manukau Station, Manurewa Station, Takaanini Station and Papakura Station.

Connector services (at least every 30 minutes):

- Bus service 365 serves the eastern side of the NIMT, operating every 20 minutes connecting Takaanini Station to Manurewa Station and Papakura Station.

4.1.4.3 AT Local

AT Local is an on-demand rideshare service that is currently being trialled in the Takaanini area.[15] AT Local replaced service 371 and serves the green area indicated in Figure 13. This area includes Waiata Shores, Conifer Grove, Takaanini, Kauri Flats and Papakura metropolitan centre.

[15] https://at.govt.nz/bus-train-ferry/bus-services/at-local/.

Figure 13: AT Takaanini Public Transport Map[16]

4.1.5 Freight

Currently, the area adjacent to the SH1, Takaanini Interchange and the NIMT is zoned as light and heavy industrial as indicated in Figure 14. There is slow uptake in development of the industrial area east of Takanini School Road. This land use and number of jobs have been discussed with Council, Waka Kotahi and AT. Council wishes to maintain the industrial land use, and AT acknowledges the slow land use uptake which has been reflected in the modelling.

[16] https://at.govt.nz/media/1986831/integrated-networks-map-sep-2021.pdf

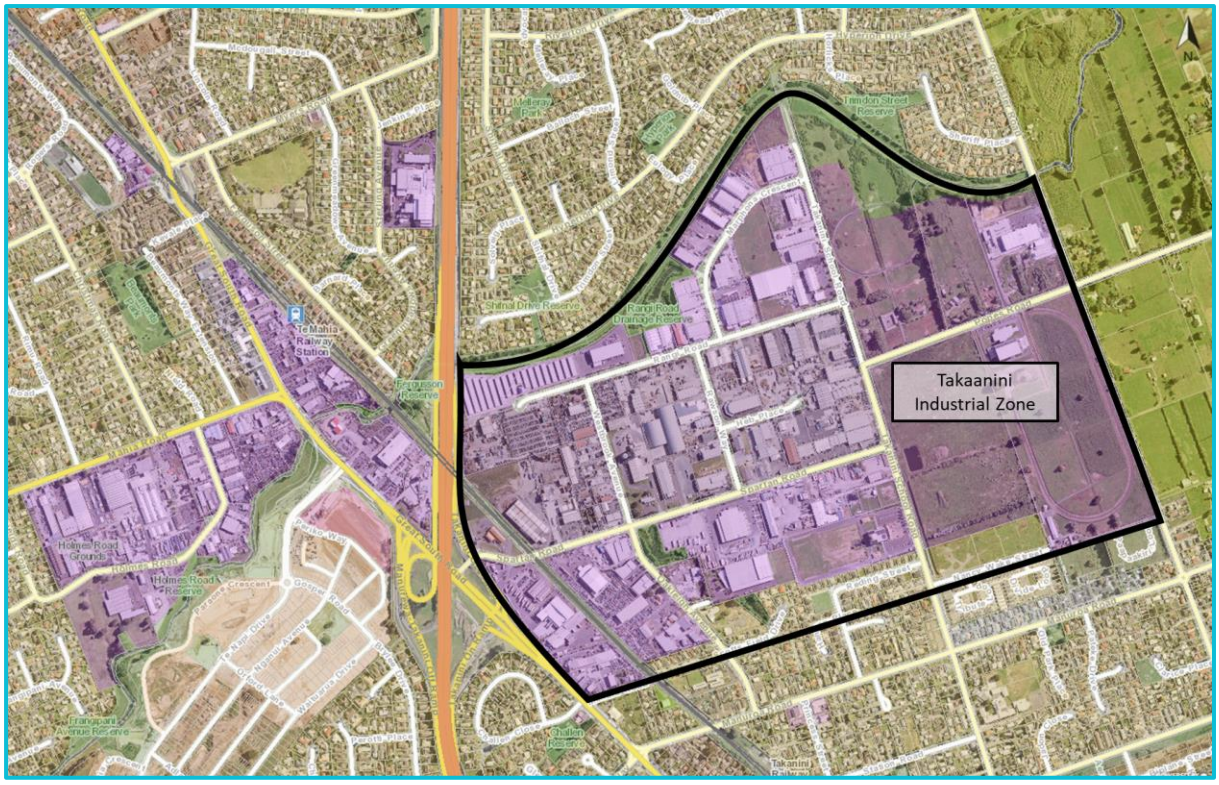


Figure 14: Takaanini Industrial Area

Figure 15 shows AT's Future Connect current strategic freight and over dimension network.

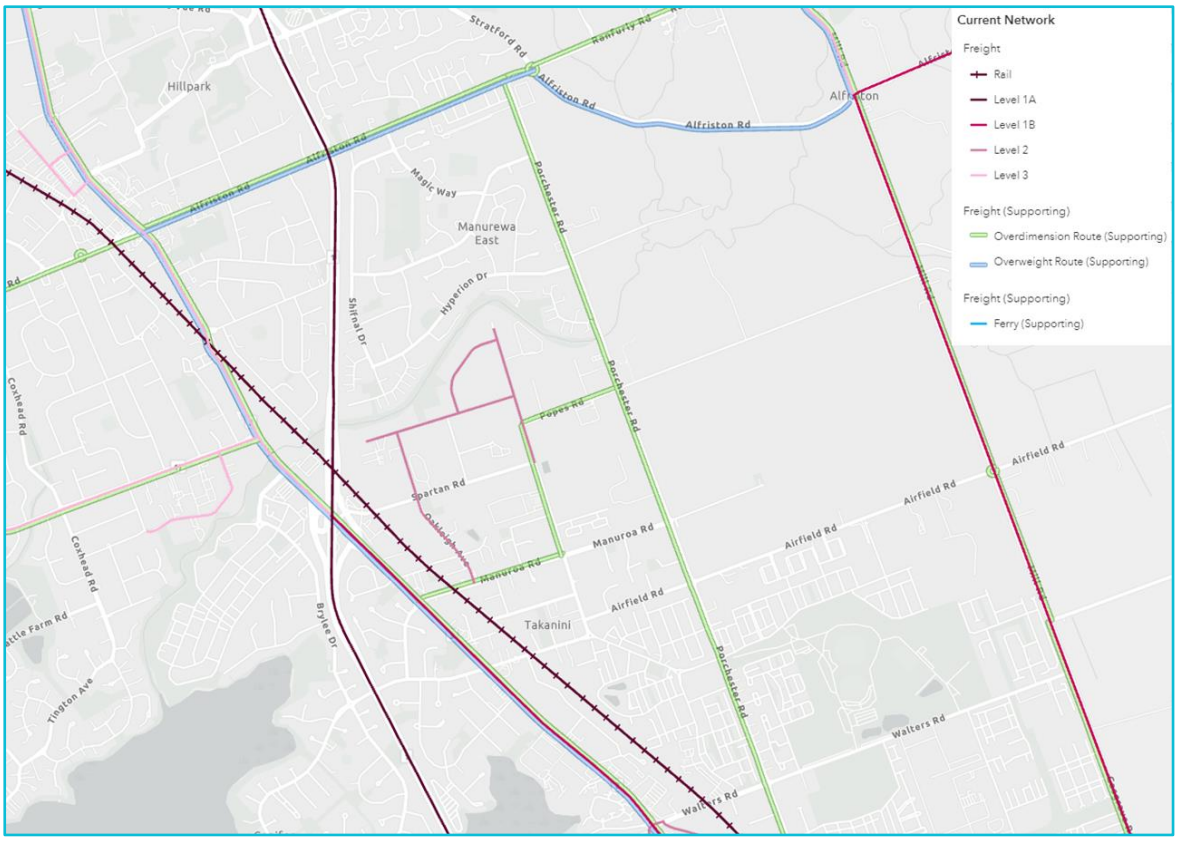


Figure 15: Future Connect strategic freight network (current)

The NIMT has the highest strategic value for freight movement alongside SH1 with a freight classification of Level 1A.

Great South Road, south of Takaanini Interchange, is currently a Level 1B freight route, an over-dimension and overweight route. The daily freight volumes on Great South Road are roughly 8% of the overall daily flows. Level 1B freight classification indicates this corridor has high strategic value to freight movement being an arterial where efficient freight movements must be actively supported to maintain a good level of service. It is a critical north-south freight route, serving the industrial land use adjacent to Great South Road and the Takaanini industrial area. This route is also a key freight route providing access to SH1 via the Takaanini Interchange.

Current access to the industrial area is via Spartan Road and Manuroa Road. Manuroa Road is largely a residential street however, a high number of heavy vehicles are using Manuroa Road to turn right and travel northbound on Great South Road. This is due to the logistical constraints at the Spartan Road and Great South Road intersection, where the right turn movement from Spartan Road onto Great South Road is banned. Hence, any freight traffic being generated from the Takaanini industrial area that wish to travel northbound on Great South Road, will be traversing via Manuroa Road. The current over-dimension route between Great South Road and Porchester Road runs along Manuroa Road, Takanini School Road and Popes Road. Spartan Road, Taka Street and Walters Road have no freight over-dimension/ overweight classification. The internal network within the industrial area consists of over-dimension routes and Level 2 corridors indicating that these corridors are local freight routes within strategic freight areas with no competing land use demands.

4% of the traffic on Taka Street and Walters Road are freight which reflects the surrounding residential land use. High freight proportions of 15% of the daily traffic are recorded on Spartan Road, which reflects the industrial land use while 6% of the traffic on Manuroa Road is heavy traffic.

4.1.6 Local/ property access

Currently there are residential dwellings and businesses (industrial, commercial, local and town centres) along the TLC corridors. The existing properties along the TLC corridors have access onto the corridor via direct property access (driveways) or via an accessway. The current low density land use surrounding the TLC corridors results in low property access / egress turn exposure. However, some businesses such as VTNZ and the industrial businesses may generate a high number of daily trips.

Sections 7 to **7.5** of this Report include specific information around local access for each Project area.

4.2 TLC likely future environment (without the Project)

This section provides information on the planned surrounding future environment that the Project will sit within, which includes all planned projects in the area being implemented. This section assesses the environment without the TLC.

4.2.1 Proposed future land use

Based on AFC i11.6 land use forecasts, the anticipated growth set to occur within the TLC study area is an increase from a current population of around 17,900 to a population of around 34,300 by 2053, with the Takaanini Future Urban Zone (**FUZ**) contributing an increase of 9,700 people. The provision of employment opportunities is expected to rise from 5,400 in 2018 to 17,900 in 2053. The number of dwellings is expected to increase from 5,800 in 2018 to 12,500 in 2053.

The NPS-UD took effect on 20 August 2020 and is expected to further enable intensification around stations. Among other things, the NPS-UD and Council's specific response through PC78 to the AUP-OP enables “building heights of at least 6 storeys within at least a walkable catchment of existing and planned rapid transit stops.” Figure 16 below displays the planned future environment around the project areas. In this regard, policy and zoning changes along the corridor are anticipated, with future residential development within the vicinity of the rapid transit stations likely to be of multi-storey developments to better support transit-oriented development.

PC78 also integrates the MDRS into the AUP-OP with immediate legal effect, which allows landowners to develop up to three homes of up to three stories on most sites without the need for a resource consent.

Specific growth forecasts in the Takaanini industrial zone are discusses in detail in Section 4.2.7 of this Report.

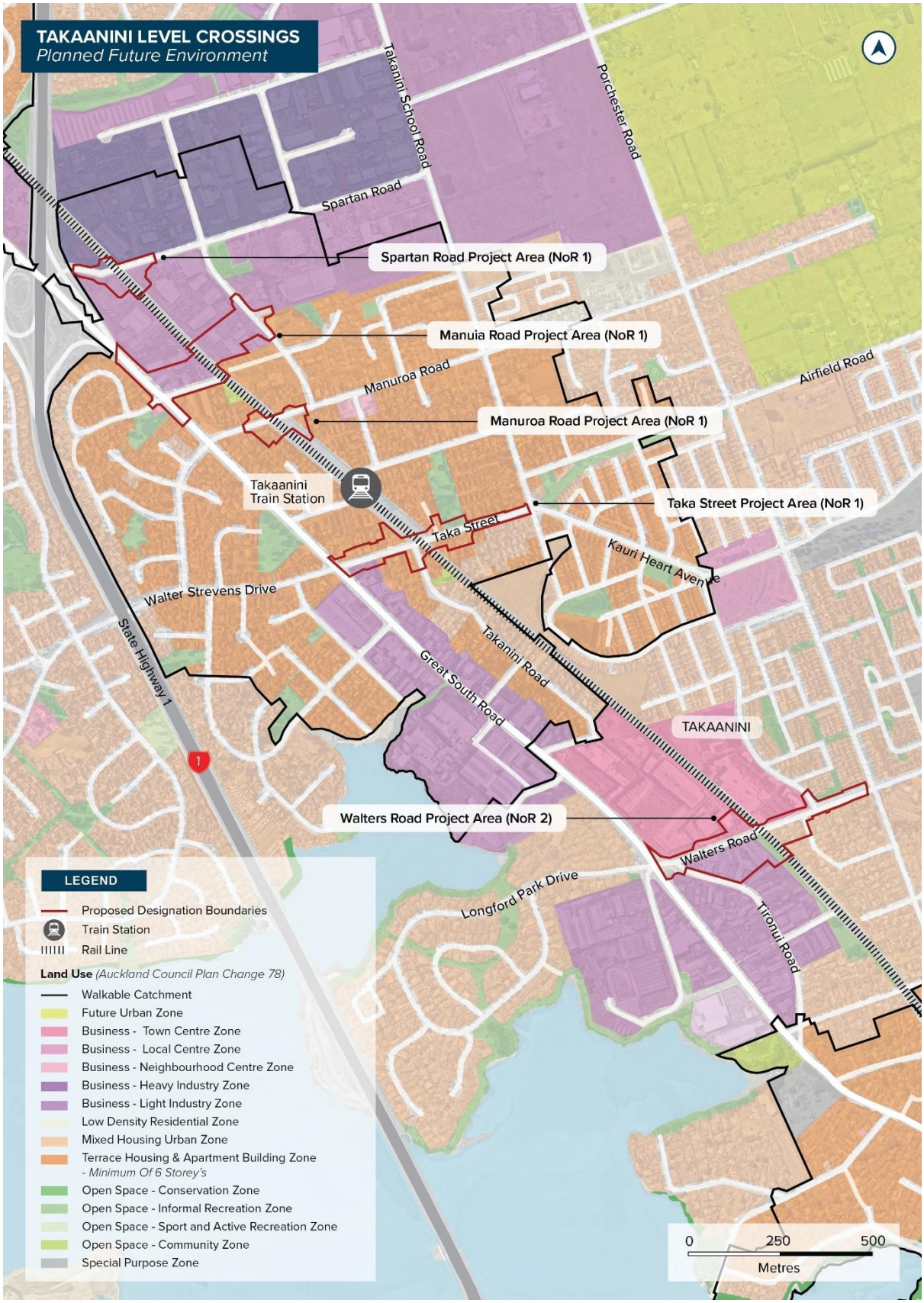


Figure 16: Planned land use surrounding Takaanini Level Crossings

4.2.2 Planned transport network

The TLC is part of a wider planned Strategic Transport network planned by Te Tupu Ngātahi, as shown in Figure 17.

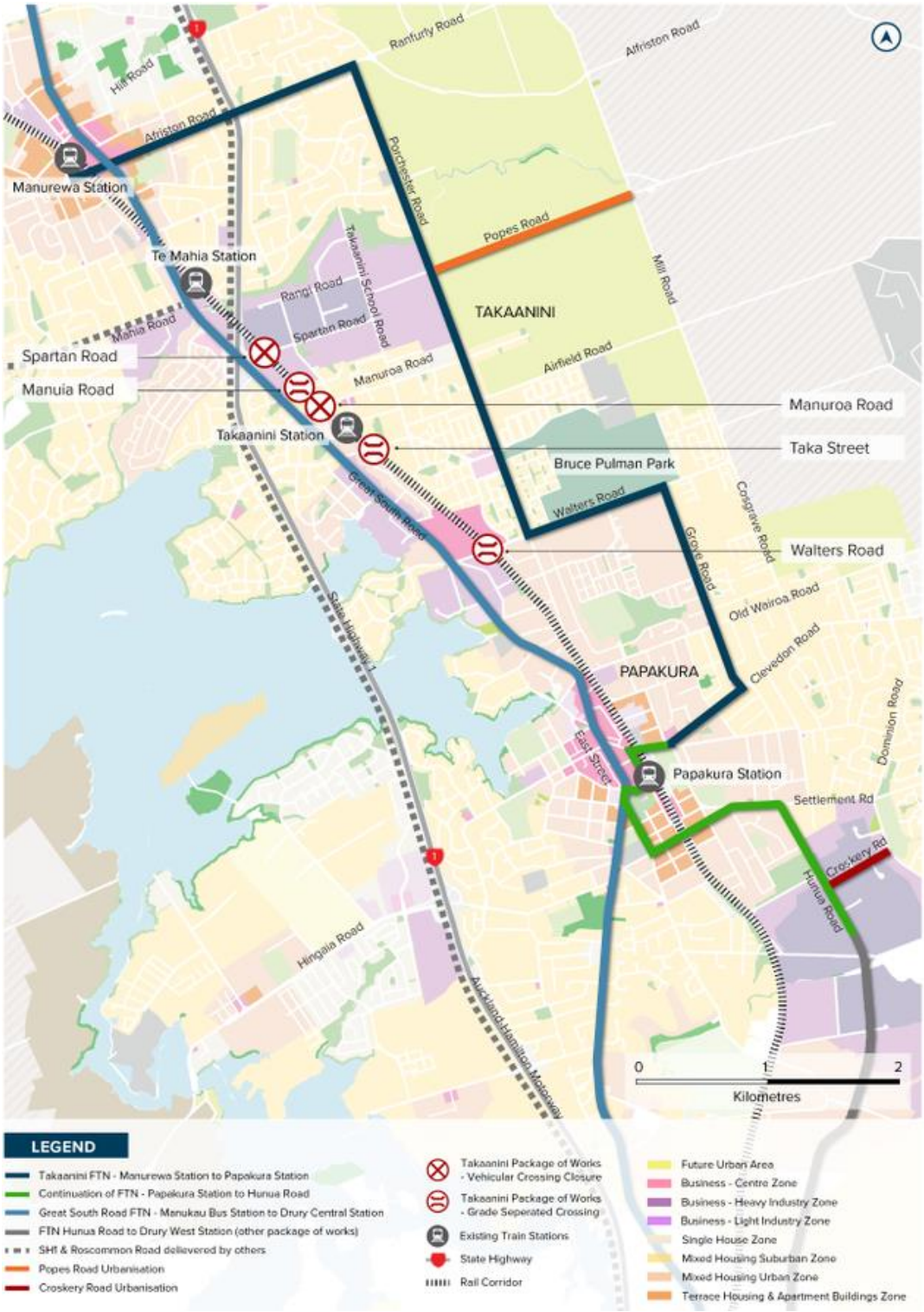


Figure 17: Te Tupu Ngātahi Takaanini Projects

The future transport projects surrounding the TLC areas planned by Te Tupu Ngātahi include:

- Great South Road FTN upgrade between Manukau Station and Drury Central Station;
- Takaanini FTN upgrade between Manurewa Station and Papakura Station via Porchester Road
- Popes Road urbanisation upgrade; and
- Croskery Road urbanisation upgrade.

Other planned or proposed transport projects related to bus infrastructure outside of Te Tupu Ngātahi scope include:

- Annual Budget 2022/23 Mayoral Proposal proposing two frequent bus routes in the Manurewa area:
    - Route 37: Manurewa, Mahia Rd, Clendon (Roscommon Rd), Puhinui Interchange (connects with trains and Airport Link), Ōtara (Preston Rd), Highbrook; and
    - Route 39: (currently 361) (Manurewa, Weymouth Rd, Clendon, Manurewa Marae, Super Clinic, Manukau, Papatoetoe East, Ōtara North).

AT is also currently investigating the closure of seven existing pedestrian-only level crossings across Auckland, including the Tironui Station (east-west) pedestrian crossing approximately 300m south of Walters Road. The roject referred to as the 'pedestrian level crossing removal project' aims to improve safety and enable more frequent trains following completion of the CRL. The closure of Tironui Station pedestrian crossing is anticipated to occur prior to construction of the TLC and is outside of the TLC scope. It is noted that the AT removals project has considered the proposed Walters Road grade separation within the TLC scope to be a potential alternative crossing for the closure of the Tironui Station pedestrian crossing.

4.2.2.1 Rail network changes

Passenger rail is planned to provide the core rapid transit functionality for southern Auckland to drive significant mode shift away from reliance on passenger cars. Various existing and planned projects are progressing the expansion of the southern rail line capacity and attractiveness, including:

- CRL, an underground rail link making Britomart Station a two-way through station, doubling the capacity of the entire rail network, allowing it to carry up to 54,000 passengers an hour at peak times. CRL will enable higher train frequencies in the future with approximately 24 trains per hour at peak periods in 2031. Implementation works are currently underway with completion expected by 2025;
- Papakura to Pukekohe rail line electrification, with enabling works currently underway;
- Additional rail capacity at key locations such as Wiri;
- Additional track capacity (4-track) planned from Pukekohe to Wiri (longer-term);
- Proposed rail stations in Drury West, Drury Central and Paerātā (planned by Te Tupu Ngātahi). These rail stations are included in the New Zealand Upgrade Programme (**NZUP**) and are expected to be operational by 2025; and
- Potential station upgrade works across rail stations in Auckland through the Rail PBC.

These projects related to rail in the area are assumed to proceed irrespective of the TLC being in the future network. Refer to **Appendix A** of this Report for details on the planning and funding status of the projects.
Collectively, the above upgrades are estimated to result in a significant mode shift to PT, to address both existing needs and accommodate the high growth planned in both southern Auckland and northern Waikato regions.

The rail upgrade projects will also increase train frequencies in the future, resulting in increased barrier downtime and progressively worsening delays and safety risks at the level crossings in the southern network. There is the possibility that these consequential impacts are considered so significant that the level crossings are fully closed in the likely future network.

4.2.3 General traffic

The four existing level crossings in Takaanini each represent a conflict point between trains and road traffic including cars, trucks, cyclists and pedestrians. With increased train frequency, there will be increased barrier-down time, resulting in a constraint to road capacity and decreasing east-west connectivity in the Takaanini network. The ability to clear the queue of vehicles at the level crossings before the level crossing barrier arm lowers will be increasingly more critical with the higher rail service frequency. The overflow of traffic and queues due to the level crossings will impact the adjacent intersections and the wider network. Hence, the longer barrier-down time, results in greater queues, and time to dissipate the traffic impacting the adjacent intersections.

Without the Project, in the likely environment, the below four corridors are expected to be constrained by the level crossing barrier downtime during peak periods:

- Spartan Road;
- Manuroa Road;
- Taka Street; and
- Walters Road.

The increased train frequency and increased barrier down-time in the future will result in reduced east-west corridor capacity for vehicular traffic. With planned growth in the area, there is expected to be more general traffic movement in the area, hence, increased vehicular demand across the east-west connections in the network. Figure 18 shows the relationship between increased crossing demand and reduced crossing capacity over time. The east-west crossing demand will begin to exceed the available crossing capacity resulting in a transport network with no resilience.

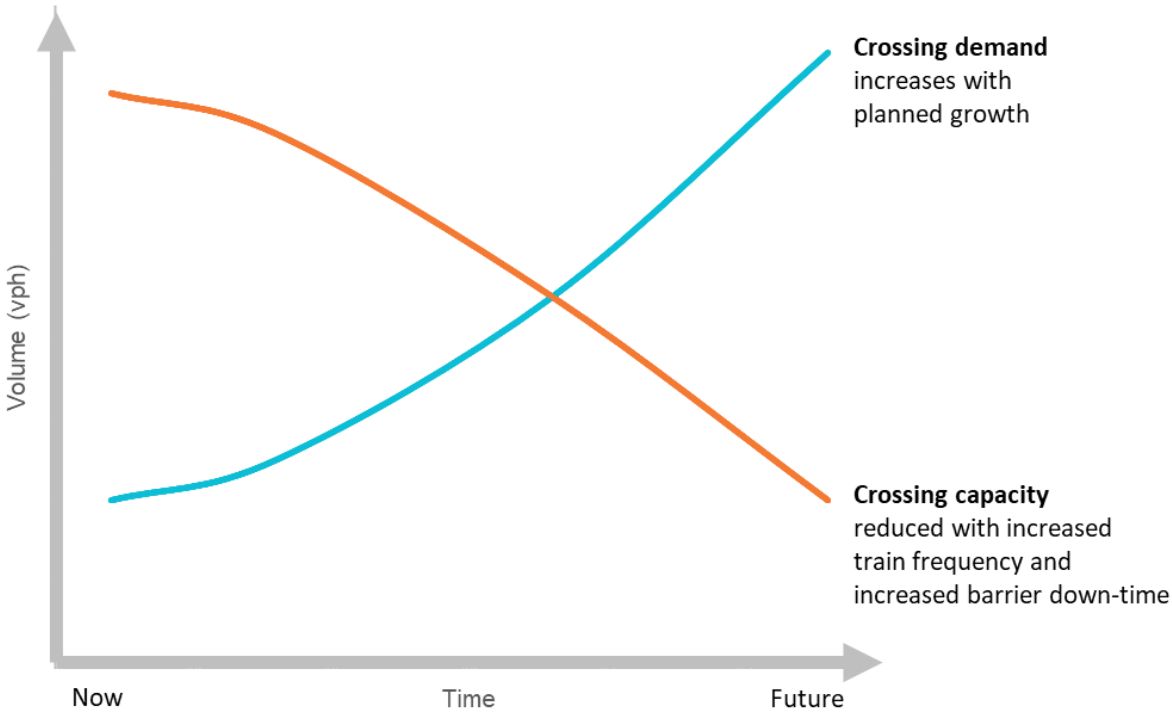


Figure 18: increased east-west crossing demand and reduced crossing capacity.

The combination of increasing demand to use the crossings but reduced available capacity of the crossings will result in an exponential growth in delay for vehicles at the crossings. Increased demand, barrier down-time and delays result in increased driver frustration and crash risk.

A simple bottleneck model was employed to investigate the effect of the level crossing barrier downtime at each existing Takaanini level crossing. This model estimates queues and delay at the crossings based on train frequency and the duration of the barrier being down. The model operates in small time increments to identify the build-up of traffic queues and the time it takes for traffic queues to dissipate once the barriers are lifted.

The CRL rail plan provided by AT, anticipates that 24 trains per peak hour are expected to operate on the southern rail line, between Puhinui and Pukekohe, in 2031. A range of barrier downtime of 91 - 96 seconds (96 seconds for the Spartan Road level crossing and 91 seconds for the level crossings at Manuroa Road, Taka Street and Walters Road) was assumed for the peak periods for each time a train passes in the network. A range of 85 – 90 seconds was assumed in the interpeak (90 seconds for the Spartan Road level crossing and 85 seconds for the level crossings at Manuroa Road, Taka Street and Walters Road). This indicates that the barrier at the existing Takaanini level crossings may be down for 61% to 64% of the peak hour and around 30% of an hour during the interpeak period. It is worth nothing, that the barrier arm may be down for extended periods of time during the peak period when trains passing the level crossing are within a few minutes of each other.

The duration and length of queueing estimated from the bottleneck models was tested under a range of traffic flows, as indicated in Figure 19. For example, this suggests that flows of 600 vph could generate delays of 5 minutes per vehicle in the peak period. The high frequency of closures from the high train frequencies would make the connections highly unreliable, unsafe and unattractive.

This delay function was used in the traffic network model to predict diversion due to the delays.

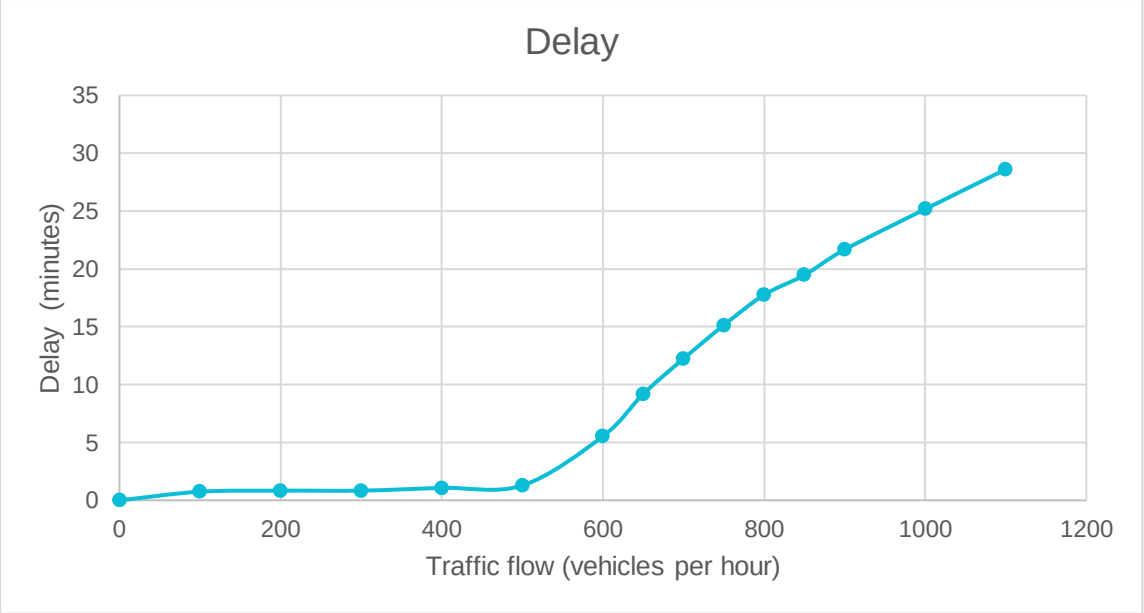


Figure 19: Delay caused by barrier downtime in the future network

Using the predicted traffic flows across each TLC corridor, the bottleneck models indicated that the expected delay per vehicle due to barrier downtime in the future network is approximately 1 minute in the AM and PM peak periods but could reach up to 4 minutes of delay per vehicle with a queue between 10 and 34 vehicles.

If general traffic were to use a diversion route in order to avoid the rail crossing signals, the next existing southern grade-separated east-west connection is Subway Road which is approximately 1.5km south of Walters Road (southern TLC corridor). Alfriston Road is also an alternative east-west route, which is approximately 2km north of Spartan Road (northern TLC corridor).

4.2.4 Safety

Crashes at high-risk areas like level crossings are typically statistically rare and random, however have severe consequences. As such, historic recorded crash numbers at specific locations are not always a reliable indicator of the risk, and therefore the future likelihood of crashes. Historic crashes relating to the level crossings in the Takaanini area are low, but the chance of a crash of this nature occurring in the future is likely to increase with anticipated growth.

The risk at the crossings is also expected to increase in the future due to the combination of increased frequent barrier closures, higher crossing movements and more delays. The increased delays result in greater frustration and increases the chance that people will take risks at the level crossings to avoid delays. The anticipated growth in the area will also result in increased traffic and overall people movement at the level crossings, resulting in increased risk likelihood of deaths and serious injuries.

There would also be an increased number of vehicles being displaced across the wider network as delays at the level crossings may cause drivers to take alternative routes, increasing Vehicle Kilometres Travelled (**VKT**). The outcome is higher crash risk exposure and greater deaths and serious injuries in the wider network.

4.2.5 Walking and cycling

Figure 20 shows the indicative active modes corridor and cycling network planned in and surrounding the Project areas by Te Tupu Ngātahi in the future scenario.

Te Tupu Ngātahi is route protecting for walking and cycling facilities along the following routes/ projects:

- Great South Road FTN upgrade - separated walking and cycling facilities;
- Porchester Road as part of the Takaanini FTN upgrades - separated walking and cycling facilities; and
- Popes Road urbanisation - separated walking and cycling facilities.

For the wider programme, a future cycling network has been planned along all arterial/ strategic routes to increase connectivity and mode choice. However, the local, collector and greenway connections are generally expected to be delivered by developers in the area which will link the strategic cycle routes proposed.

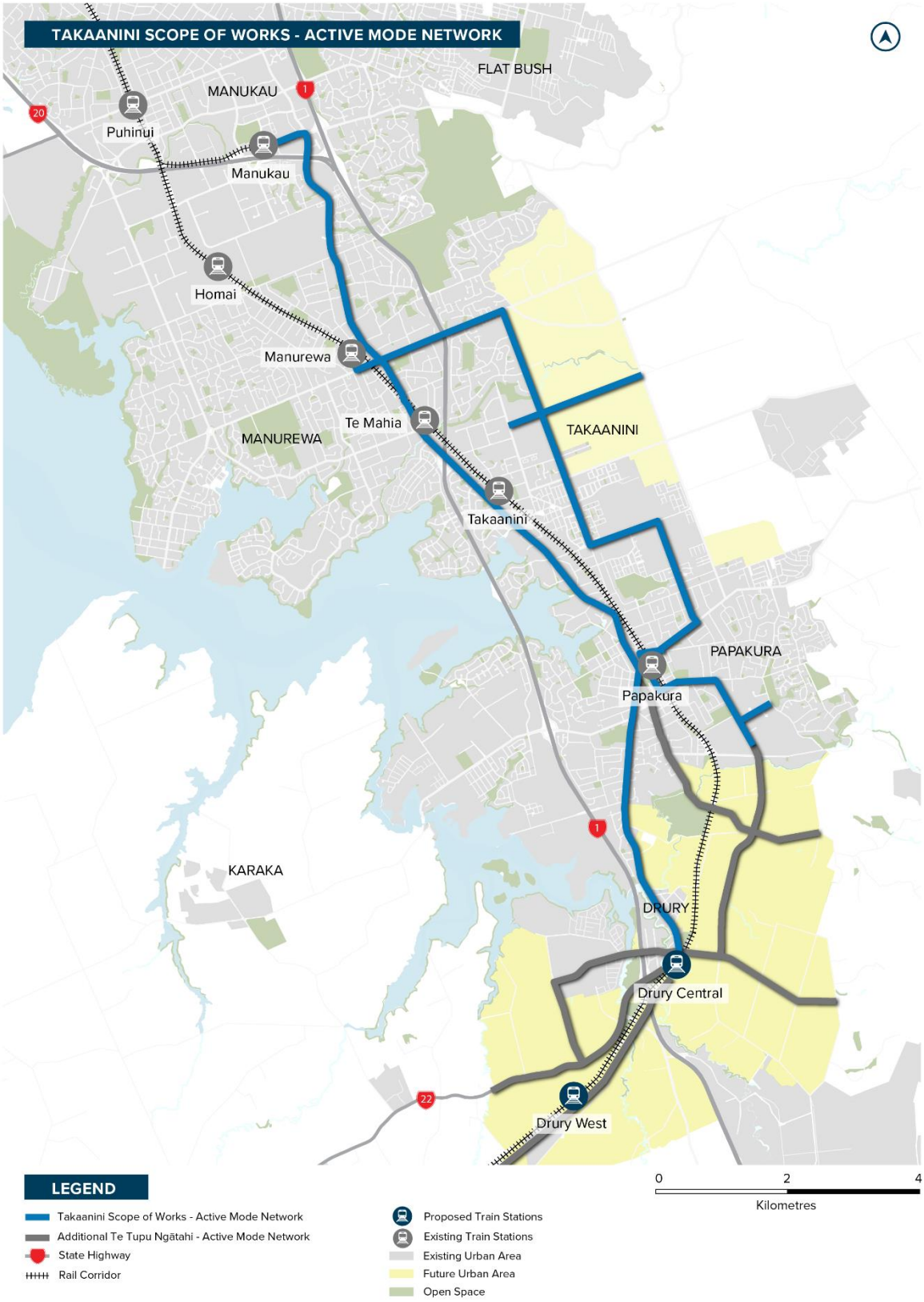


Figure 20: Te Tupu Ngātahi Indicative Active Modes Corridor Network (Takaanini Scope of Works)

The proposed walking and cycling facilities that are in the immediate vicinity of the project areas include the FTN corridors and Popes Road. It is to be noted that the Southern Path will be extended in the future between Papakura and Drury as part of the NZUP Papakura to Drury South project.

Along the TLC corridors, in the likely future environment without the Project, it is likely that the existing footpaths will be retained, with existing or potential proposed level crossing features such as warning devices (lights/ bells) and automatic gates.

There is expected to be an increase in pedestrians and cyclists in the area through the implementation of PC78 which is discussed in Section 3.2 of this Report. PC78 enables intensification of the residential zones surrounding the Project areas and based on this intensification, there is expected to be increased walking and cycling movement towards key attractors which include:

- Takaanini Train Station;
- Takaanini industrial/ employment area;
- Takaanini School; and
- Community/ neighbourhood centres.

With anticipated growth in the area, there is expected to be increased delays to pedestrians and cyclists wishing to cross the TLC corridors at the location of the level crossings.

Without the Project in the likely future environment, the implications for walking and cycling are as follows:

- Walking and cycling trips that would have occurred for commuting purposes (i.e., travelling to / from the station), are expected to still exist as pedestrian / cyclist access to Takaanini Station will remain, albeit with increased safety risk and delay due to the higher frequency of rail services and increased barrier-down time;
- Pedestrians and cyclists travelling east-west over the rail line will experience additional delay at the rail crossing signals due to increased barrier down times;
- Pedestrians and cyclists may take risks due to the increased barrier-down times resulting in fatal and serious incidents as well as disruption to the rail network;
- The future walking and cycling network will be less utilised as there will be limited active mode facilities in the TLC area, restricting the connectivity of the walking and cycling network e.g. with the Southern Path and walking and cycling facilities on Great South Road; and
- A reduction in walking and cycling in the network will lead to further reliance on low occupancy vehicle use, further exacerbating congestion and safety issues both locally and on the wider network.

4.2.6 Public transport

There are expected to be additional planned bus services surrounding the TLC areas, especially where buses are expected to tie into the Takaanini Train Station. The assessment of effects is developed in an integrated approach with the FTN routes being planned for by Te Tupu Ngātahi. Hence, the Great South Road FTN and Takaanini FTN projects are assumed to be in the network by 2048+. The exact timing of these projects is currently unknown. These projects include the provision of bus lanes, bus priority measures and active mode provision along these routes to enable frequent and reliable services in the future. Buses are expected to operate along these routes at least every 15 minutes between 7am and 7pm (or longer), 7 days a week. There will be an increase in bus services operating along Great South Road between Manukau Station and the proposed Drury Central Station. The Takaanini FTN is expected to connect Manurewa Station to Papakura Station via Porchester Road. This route connects further with the Drury FTN route at Hunua Road which connects to the wider Drury-Ōpāheke area.

Figure 21 shows the indicative PT services surrounding the Project areas.

The future PT network services for the area surrounding the Project include[17]:

- #33 Great South Road, one service in each direction every 10 minutes in peak periods;
- #365 Papakura Interchange to Manurewa, one service in each direction every 15 minutes in peak periods;
- #369 Alfriston, one service in each direction every 15 minutes in peak periods;
- #37 Manurewa to Highbrook, one service in each direction every 15 minutes in peak periods; and
- NIMT rail service, 12 services in each direction in peak periods.

There is expected to be a connector service operating in the Takaanini FUZ contingent on how the area develops in the future. This service would run from Manurewa Station to Takaanini Station, via Alfriston Road, Wastney Road (collector through the Takaanini FUZ) and Airfield Road. This service would run every 15 minutes during peak hours and 30 minutes during non-peak hours. It is expected that there will be no FTN or connector services operating east-west along the each of the TLC areas, apart from potential connector services running along Taka Street.

Figure 21: Public Transport Routes in Takaanini (2048+) – AT Remix[18]

With increased barrier downtimes and delays, traffic is expected to be displaced and diverted onto the wider network, including the intended FTN routes. There is expected to be increased traffic on Porchester Road which will impact bus reliability and the wider PT outcomes.

Moreover, with the level crossings still in place, the rail line is subject to issues following incidents that occur at the crossings. These include broken barrier arms, faulty lights and warning bells, or

[17] Based on the Auckland Transport 2048+ Remix file, accessed 21/02/2023.
[18] https://platform.remix.com/project/1372212e?latlng=-37.04031,174.89847,12.756.

malfunctioning gates, which cause unexpected delays and train service cancellations, and subsequently impacts the wider transport system. Accidents may also result in disruption in rail operations and delays to train passengers. In many instances, the disruption can necessitate the use of supplementary bus services.

The disbenefit per major incident that would cause rail network disruption is $0.93 million and $0.42 million for 2048+ and 2028, respectively.

Without the Project in the future environment, the implications for PT are as follows:

- In the future environment, the longer barrier down time and its effects on queues on the TLC corridors and adjacent intersections has the potential to overflow onto bus routes such as the Takaanini FTN route along Porchester Road and Alfriston Road. This network impact has the potential to significantly delay PT trips; and
- Any incidents / hardware faults at the level crossings will have the potential to limit north-south rail capacity, restricting rail freight efficiency and accessibility to economic and social opportunities for rail users. This leads to reduced productivity impacting economic growth.

4.2.7 Freight

Employment growth is expected in the Takaanini industrial area in the likely future environment. Depending on the nature of employment growth, there is expected to be an increase in freight in the area.

The AFC i11.6 land use forecasts predicts that there will be 9,620 jobs in this industrial zone in 2048+, which is indicating that there will be approximately 7,960 more jobs in the future compared to current levels (1,670 jobs in 2018). This forecasted employment density is high compared to other established employment areas such as Wiri and Manukau employment zones.

The high level of predicted jobs directly affects the forecasted amount of traffic generated by this employment zone. Unusually high yield numbers should not be used as the basis for understanding the scale of transport infrastructure needed to support growth. The 9,620 jobs predicted in the Takaanini industrial area in 2048+ results in 64,500 vehicles per day (**vpd**) being generated from this employment zone, with approximately 46% of this traffic being heavy vehicles.

Typically, around 30-50 employees per hectare (gross area) is considered plausible for light industrial zones. The revised AFC models suggests 7,400 employees in 54 ha, which amounts to a density of 137 jobs per hectare. This density is considered unlikely in a light industrial zone in this particular location. The Takaanini industrial area is measured out to be 71 hectares (excluding the Sikh community facilities). At 50 jobs per hectare this would give approximately 3,500 employees. Having more commercial activities will possibly increase this number, however, the 9,600 number is still considered very high. Hence, sensitivity testing of the 2048+ forecasted number of jobs in the Takaanini industrial area was undertaken to assess the scale of impact on the surrounding transport network.

Two scenarios of employment growth in the industrial zones were tested.

- ‘Aspirational’ scenario: 75% of 2048+ forecasted employment growth
- ‘Likely’ scenario: 50% of 2048+ forecasted employment growth

Table 15 shows the general and heavy vehicle traffic demand generated from the Takaanini industrial zone in each of the three scenarios. Sensitivity testing was undertaken to understand the risk profile and potential overestimation.

Table 15: Takaanini industrial demand sensitivity test – i11.6 land use forecasts

	50% forecasted daily industrial daily demand (likely)	75% forecasted industrial daily demand (aspirational)	100% forecasted industrial daily demand (unlikely)
2048+ number of jobs in industrial zone	4,800	7,200	9,600
Traffic generated by Takaanini industrial zone	32,200	48,300	64,500
Heavy vehicle traffic being generated from industrial zone	14,800 (46%)	22,200 (46%)	29,700 (46%)

It was considered that the predicted 9,620 jobs in 2048+ is not to be applied for modelling purposes and the 'aspirational' employment growth scenario was to be progressed as it provided a balance in the risk profile.

As such, the 'aspirational' scenario (75% Takaanini industrial employment build-out) has been adopted and traffic flows scaled accordingly for the following construction and operational effects sections.

Spartan Road and Manuroa Road level crossings will continue to be the key access points to the Takaanini industrial area. Each of the employment growth scenarios above will generate a certain level of heavy vehicles in the area, indicating more heavy vehicles will be traversing along Spartan Road and Manuroa Road level crossings. Increased freight demand will result in more pressure at Spartan Road / Great South Road intersection, resulting in adverse operational issues at the Takaanini Interchange. There would also be increased freight demand using Manuroa Road which serves a residential area. Increased freight traffic through this corridor will result in adverse safety issues on residential areas / neighbourhoods leading to detrimental effects. The risk on vulnerable road users such as pedestrians and cyclists will be heightened and there would be more severe crash consequences due to the size of heavy vehicles. Heavy vehicles would also have limited sight visibility, resulting in further adverse impacts on vulnerable road users and other vehicular traffic. There would also be additional noise and vibration issues experienced by the surrounding residential areas.

4.2.8 Local/ property access

There is expected to be growth surrounding the TLC corridors in the future network increasing turn exposure and in turn the safety risk.

4.2.9 Summary of likely future environment without the Project

The likely future transport environment is expected to comprise of the following outcomes:

- High risk level crossings;
- Congested transport corridors;
- Poor walking and cycling network and east-west connectivity; and
- Impact of SH1 and Great South Road will worsen overtime.

5 Assessment of construction effects (overall network)

This section assesses construction effects of the Project at a network level. Construction of the TLC bridges are expected to commence in approximately 15 years, around 2038. As set out in the AEE, a staged approach to construction is expected in order to implement the Project.

Construction of the Project includes:

- **closing existing level crossings** at Spartan Road, Manuroa Road, Taka Street and Walters Road (not necessarily simultaneously);
- constructing **grade-separated multi-modal bridges** at Manuia Road, Taka Street and Walters Road;
- constructing **grade-separated active mode bridges** at Spartan Road and Manuroa Road and constructing **cul-de-sac turning heads** either side of the rail line at these locations;
- constructing **a cul-de-sac turning head** on the northern end of Takanini Road;
- constructing **accessways** along Taka Street and Walters Road; and
- constructing the **roundabout** and **signalised intersection** either side of the Manuia Road bridge and the **signalised intersection** at Arion Road.

This section will primarily assess the construction effects of a range of scenarios of closing level crossings and building the multi-modal and active mode bridges to assess the effects on the network. The construction effects of constructing accessways, intersections and the Takanini Road closure are briefly discussed under **Section 5.5** of this Report.

Construction effects of the Project on the network can be further validated closer to the time of Project implementation and at detailed design phase.

5.1 Construction effects areas

There is an existing business case which is looking at the prioritisation of the level crossing closures across the Auckland-wide rail network. The business case is currently underway, hence, the construction staging / sequencing of the level crossings is unknown at the time of this assessment.

Hence, a number of scenarios reflecting construction sequencing of the bridges are assessed to determine construction effects. The purpose of assessing such scenarios is to identify which construction staging would have significant adverse effects and would therefore need to be avoided or mitigated.

The construction effects of the level crossing closures and grade-separated bridges scenarios were grouped under the following three geographic areas:

Area 1:

- Construction of **Manuia Road** multi-modal bridge
- Testing two scenarios where Manuia Road bridge has not been built yet:
    - Closure of only Spartan Road level crossing
    - Closure of only Manuroa Road level crossing

Area 2:

- Closure of Taka Street level crossing and construction of **Taka Street** multi-modal bridge under the following two scenarios:
    - Manuia Road bridge built, Spartan Road and Manuroa Road level crossings closed
    - Spartan Road and Manuroa Road level crossings remain open, Manuia Road bridge not yet built

Area 3:

- Closure of Walters Road level crossing and construction of **Walters Road** multi-modal bridge

The above geographic areas were chosen due to the limited inter-dependency between the connections in each area. Scenarios were assessed under each area to understand the interdependencies of construction sequencing.

The construction of the Manuia Road bridge is associated with the level crossing closures at Spartan Road and Manuroa Road. All three connections are in close proximity and are related to the Takaanini industrial area.

The effects of closing the Taka Street level crossing for the construction of the bridge has been explored based on the different scenarios under Area 2. The construction effects of Taka Street bridge has different effects based on what occurs in Area 1.

Walters Road is isolated from the other east-west connections in the Takaanini network and therefore is able to be considered and assessed separately from the others.

Table 16 provides further detail on the scenarios described above.

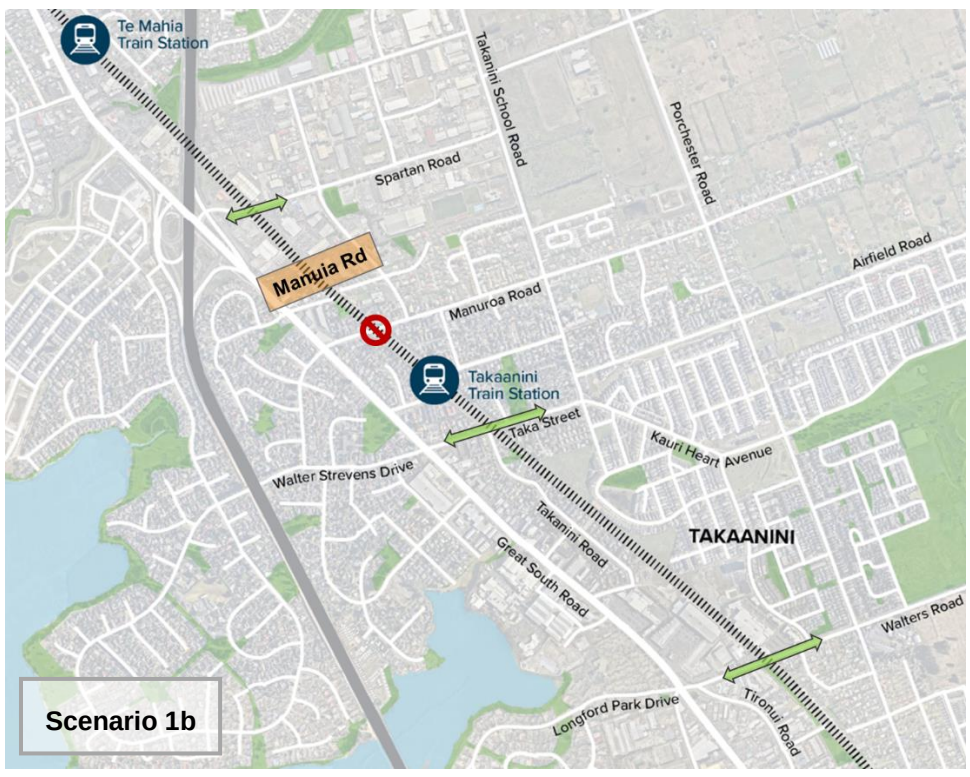
Table 16: Construction effects assessment categories

Geographic area	Description	Scenario Image

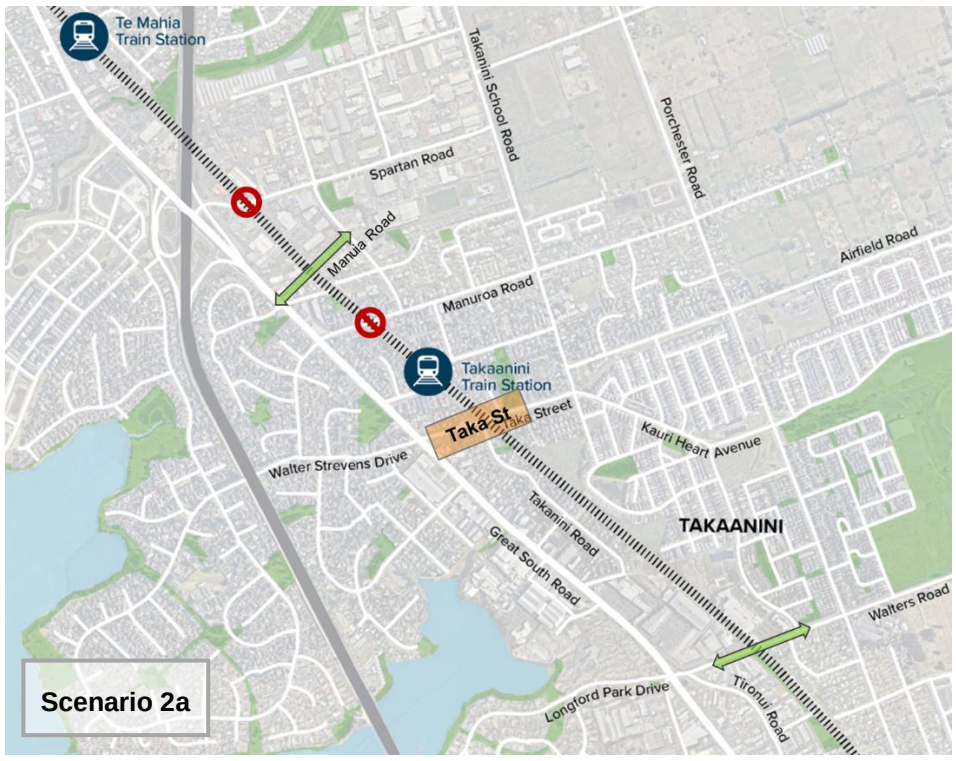
1 – Construction of Manuia Rd bridge	• Construction of **Manuia Road** multi-modal bridge
	• Testing two scenarios where Manuia Road bridge has not been built yet:
	  • Closure of only Spartan Road level crossing
	  • Closure of only Manuroa Road level crossing
		

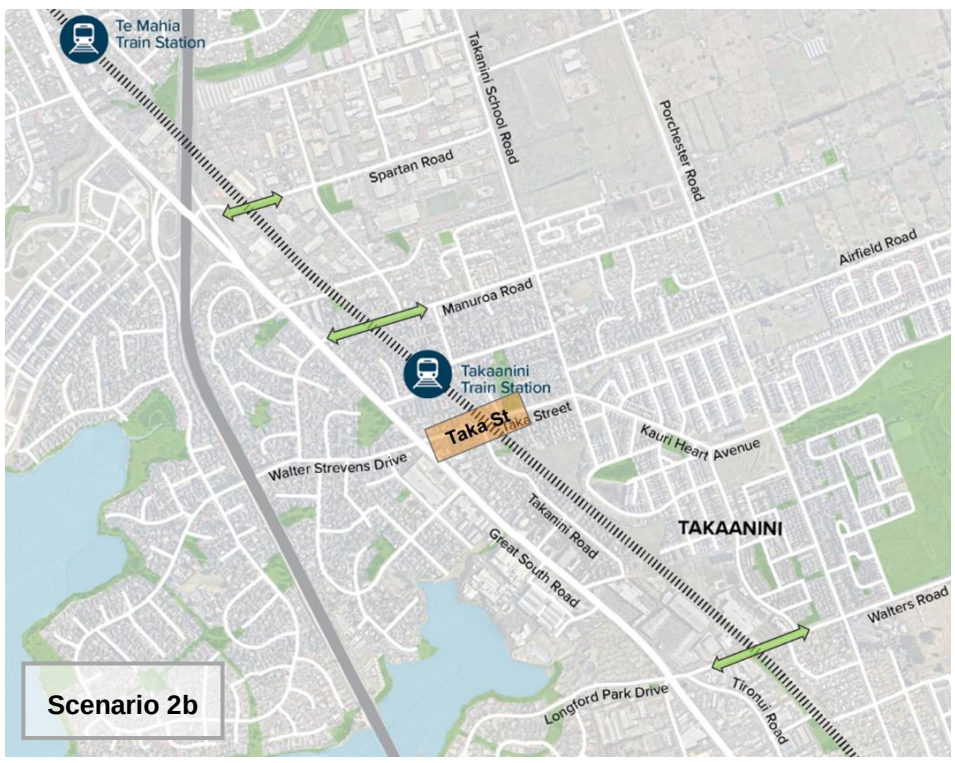
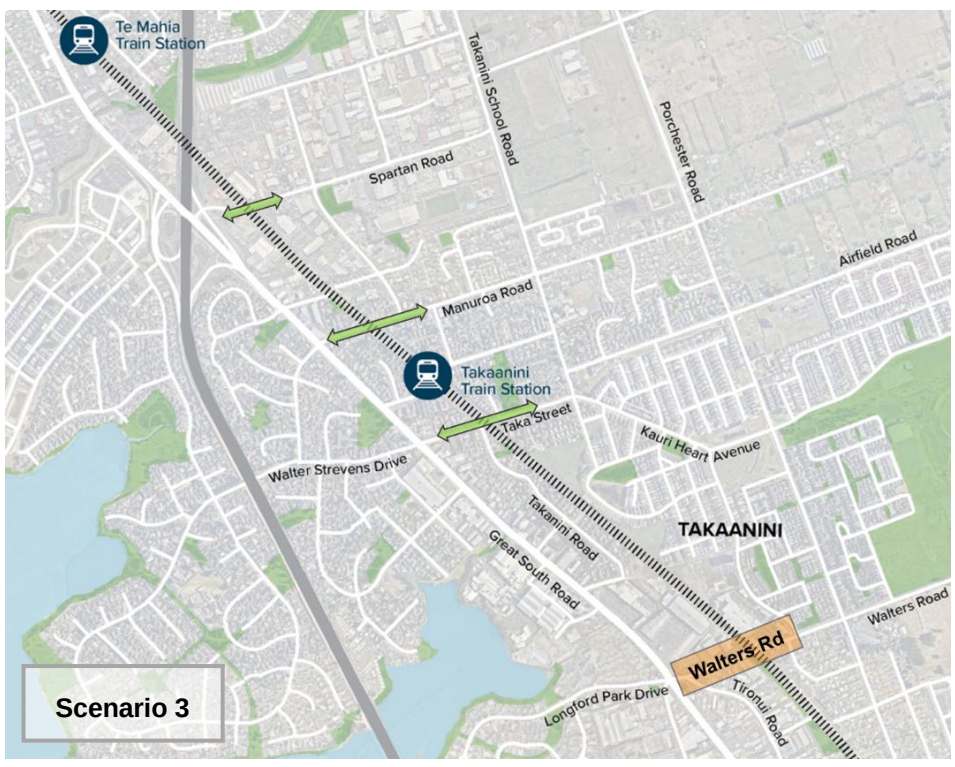
East-west connection	Scenario 1a	Scenario 1b
Spartan Road	Closed	Open
Manuia Road	**Construction**	
Manuroa Road	Open	Closed
Taka Street	Open	
Walters Road	Open	

It is to be noted that the Manuia Road bridge can be built without closing either Spartan Road or Manuroa Road level crossings. Hence, the purpose of the above scenarios is to identify which construction staging scenarios would have significant adverse effects and would therefore need to be avoided or mitigated.



Geographic area	Description	Scenario Image

2 - Construction of Taka St bridge	• Closure of **Taka Street** level crossing and construction of Taka Street multi-modal bridge under the following two scenarios:
	  • Manuia Road bridge built, Spartan Road and Manuroa Road level crossings closed
	  • Spartan Road and Manuroa Road level crossings remain open, Manuia Road bridge not yet built
		

		
3 - Construction of Walters Rd bridge	• Closure of **Walters Road** level crossing and construction of Walters Road multi-modal bridge	

East-west connection	Scenario 2a	Scenario 2b
Spartan Road	Closed	Open
Manuia Road	Built	N/A
Manuroa Road	Closed	Open
Taka Street	**Construction**	
Walters Road	Open	

East-west connection	Scenario 3
Spartan Road	Open
Manuia Road	N/A
Manuroa Road	Open
Taka Street	Open
Walters Road	**Construction**

The indicative construction duration for each bridge is summarised in Table 17.

Table 17: Indicative construction duration for each project area

Project area	Estimated duration
Spartan Road	1 - 2 years
Manuia Road	2.5 – 3 years
Manuroa Road	1 - 2 years
Taka Street	2.5 – 3 years
Walters Road	2.5 – 3 years

Table 18 below displays the assessments undertaken to assess the construction effects on each mode in the network for each scenario per geographic area.

Table 18: Assessment of construction effects on transport modes

Transport mode	Assessment	Description
General traffic	Role of the corridors being closed in the network	Understanding the role of the corridor being closed and whether there is a suitable alternative connection that would provide the same corridor function.
	Community access – diversion routes	Assess expected diversion route distance and travel time for traffic due to corridor closures during construction. Understand which routes traffic are primarily diverted to due to specific corridor closures during construction. Maps showing the predicted change in daily traffic flows with closures were used as a tool for this assessment. These plots are shown in **Appendix D** of this Report.
	V/C (vehicle to capacity) ratio in the AM and PM peak periods	The vehicle to capacity (**V/C**) ratio provides an indication of the level of congestion on a road. At 80% to 90% capacity, the network would be impacted significantly by incidents such as breakdowns. At 100%, this would indicate significant queuing, congestion and lack of network resilience to absorb any incidents. Hence, to ensure the corridors still functions satisfactorily and minimise effects, it is considered desirable that the vehicle capacity not exceed 80%. Any worsening of V/C ratio on the network between the construction scenario and the Do-Nothing network is noted. V/C ratio outputs were obtained from the SATURN model.
	Delay difference in the AM and PM peak periods	Assess any notable increase in delay on the network between the construction scenario and the Do-Nothing network. Delay is measured in seconds. Delay outputs were obtained from the SATURN model.

Transport mode	Assessment	Description
Freight	Freight operations	Assessment of: • Diversion routes for freight; • Access to/ from the Takaanini industrial area; • Access to SH1; and • Over dimension and overweight routes.
	Safety of the receiving environment	Assessing the effect of freight diversion routes on the receiving environment by analysing the effect on surrounding residential / neighbourhood areas and on vulnerable road users.
Pedestrians & cyclists	Community access - diversion routes	Assess expected diversion route distance and travel time for pedestrians and cyclists due to corridor closures during construction. Diversion distance and time for pedestrians is assessed in particular as this mode is more sensitive to diversion routes.
Public transport	Amount of increased traffic on bus routes	Assess the effect of increased traffic on key bus routes and how this may impact bus service reliability and attractiveness.

5.2 Area 1 construction effects – Manuia Road bridge

This subsection explores the construction effects of Manuia Road bridge and the effect of closing either Spartan Road or Manuroa Road level crossings before a connection is provided at Manuia Road. These scenarios are displayed in Figure 22.

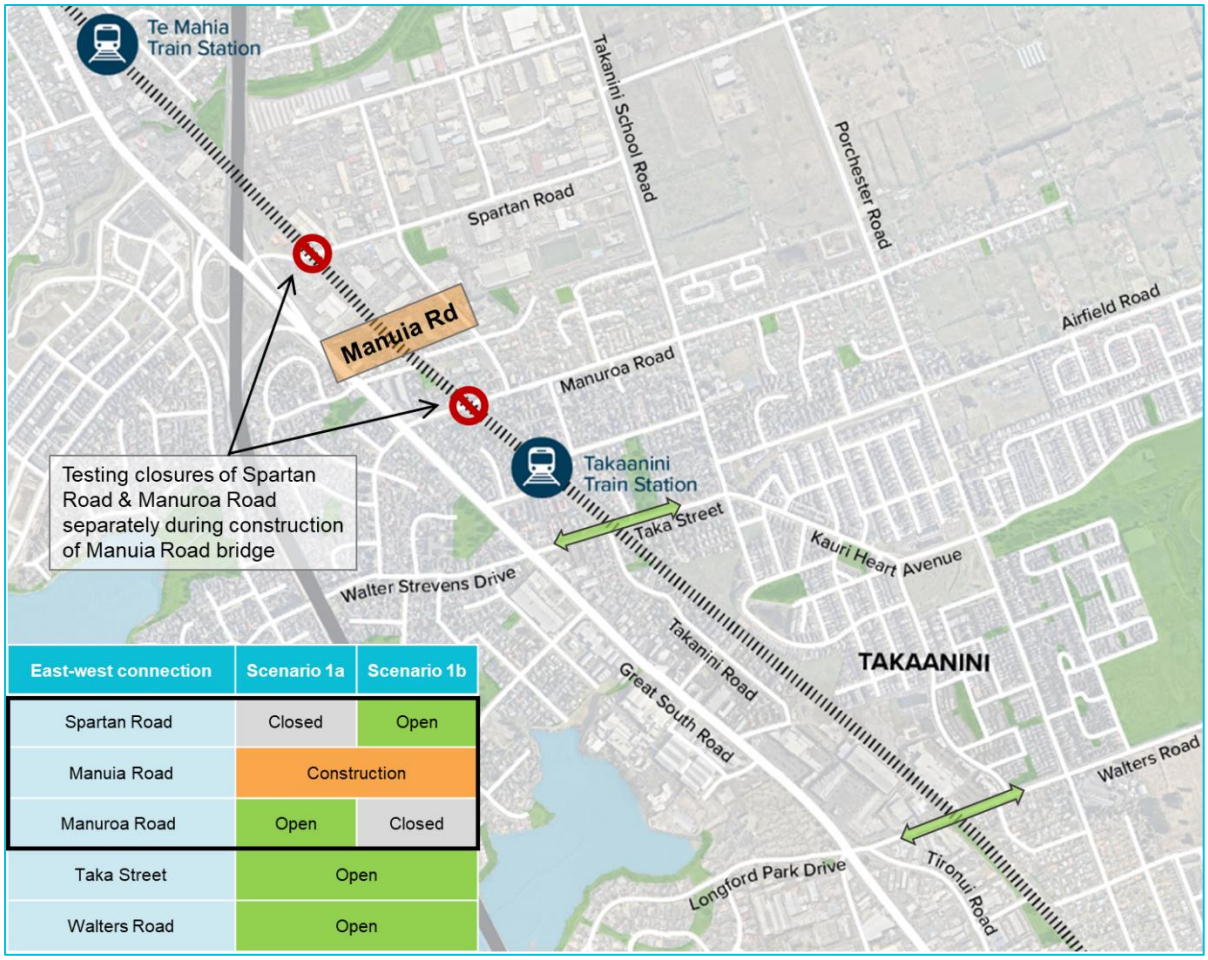


Figure 22: Area 1 construction of Manuia Road bridge scenarios

The Manuia Road grade-separated bridge will take approximately 2.5 – 3 years to build. This bridge can be constructed offline without having to close any existing level crossings. Hence, the wider network will not be significantly affected during the construction of this bridge. The construction of the Manuia Road / Oakleigh Avenue roundabout and the Great South Road / Manuia Road signalised intersection will need to be managed through the CTMP discussed further in **Section 5.5** of this Report.

5.2.1 Scenario 1a: Closure of Spartan Road level crossing

This subsection explores the effect on the network of closing Spartan Road prior to a connection being provided at Manuia Road. Figure 23 displays scenario 1a as described in Table 16.

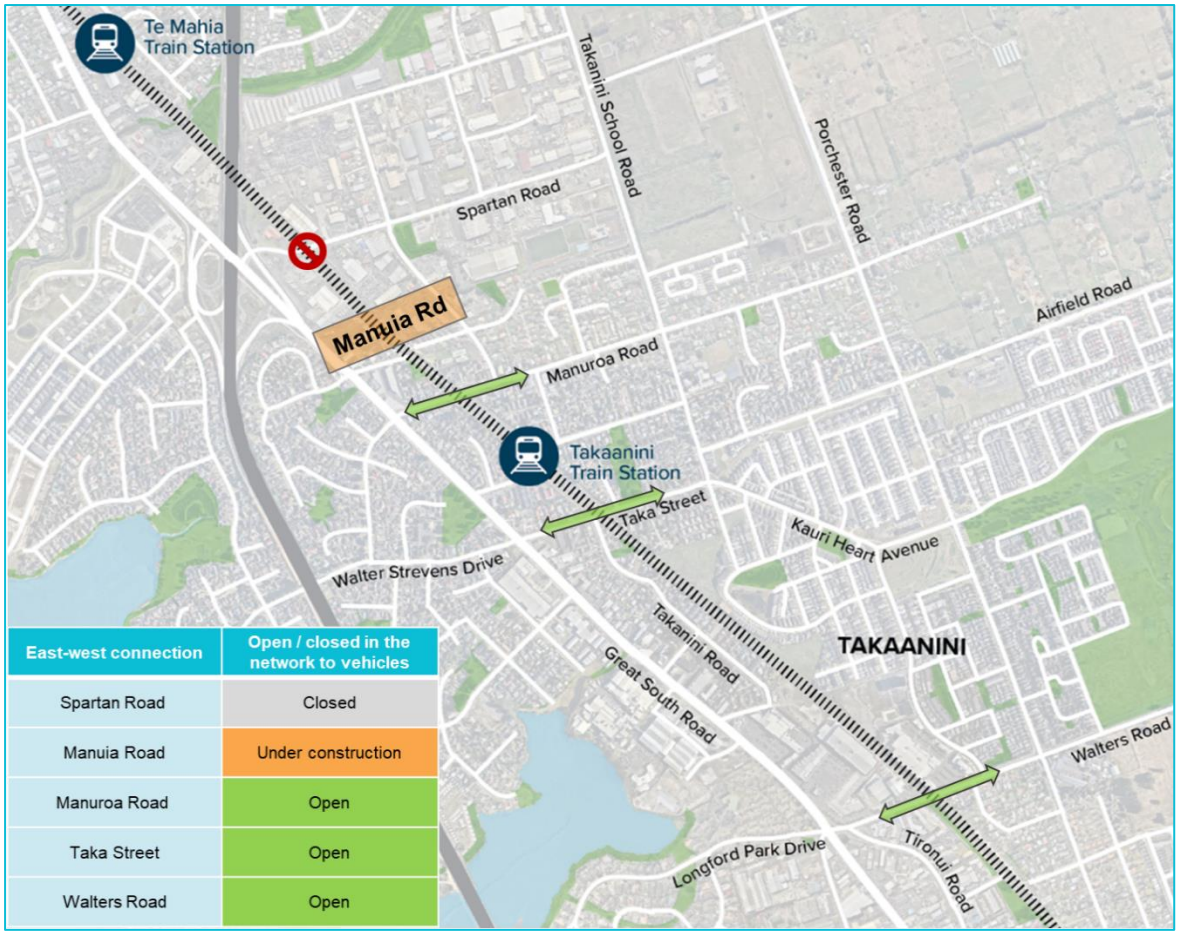


Figure 23: Scenario 1a

General traffic

10,900 daily vehicles are expected to use the Spartan Road level crossing in the 2038 network. If Spartan Road is closed prior to the implementation of the Manuia Road bridge, there will be roughly 11,000 vehicles diverted to other parts of the network. This amount of traffic is expected to divert onto adjacent level crossings to the north or south, such as Alfriston Road, Taka Street and Manuroa Road. Table 19 compares the V/C ratio for key east-west connections in the 2038 network between the Do Nothing and the construction scenario: Scenario 1a.

The coloured cells indicate where there is expected to be an increase or change in the V/C ratio for a particular direction in the network. The red cells indicate where the V/C for that direction on the corridor has increased and is 80% or higher, indicating significant queuing and congestion. The orange cells indicate where the V/C ratio has increased to 60-80%, indicating that traffic speed is affected.

Table 19: V/C ratio comparison between Do Nothing and Scenario 1a

East-west connection	Do Nothing V/C Ratio		Scenario 1a V/C Ratio	
	Eastbound	Westbound	Eastbound	Westbound
AM Peak				
Alfriston Road	40% – 60%	60% - 80%	40% – 60%	60% - 80%

East-west connection	Do Nothing V/C Ratio		Scenario 1a V/C Ratio	
	Eastbound	Westbound	Eastbound	Westbound
Spartan Road	100%	100%	N/A	N/A
Manuroa Road	60% - 80%	60% - 80%	100%	80%
Taka Street	40% - 60%	20% – 40%	40% - 60%	20% – 40%
Walters Road	20% – 40%	60% - 80%	20% – 40%	60% - 80%
Subway Road	60% - 80%	60% - 80%	60% - 80%	60% - 80%
PM Peak				
Alfriston Road	90% - 110%	40% - 60%	90% - 110%	40% - 60%
Spartan Road	100%	100%	N/A	N/A
Manuroa Road	60% - 80%	80%	100%	90%
Taka Street	40% - 60%	40% - 60%	60% - 80%	40% - 60%
Walters Road	40% - 60%	90%	40% - 60%	90%
Subway Road	90%	60% - 80%	90%	90%

Key conclusions are that the closure of Spartan Road level crossing during construction results in:

- The V/C ratio exceeding 80% in both directions at the Manuroa Road level crossing in the morning and evening peak period. This indicates that the Manuroa Road level crossing is reaching capacity at peak periods when Spartan Road level crossing is closed in the network.
- The V/C ratio is expected to increase on Taka Street in the eastbound direction to 60%-80%, indicating traffic speeds become affected.

Regarding expected traffic delay, the key points to note include:

- 90 second delay increase on the eastbound (**EB**) approach at Manuroa Road level crossing in the morning peak period;
- 30 second delay increase on the westbound (**WB**) approach at Manuroa Road level crossing in the morning peak period;
- 110 second delay increase on the eastbound approach at Manuroa Road level crossing in the evening peak period;
- 15 second delay increase on the westbound approach at Manuroa Road level crossing in the evening peak period; and
- Traffic primarily diverts to Porchester Road, Alfriston Road and Taka Street.

Conclusion: The V/C and delay outputs are not significant as these are endured for a short period of time in the future network (2.5 – 3 years)

Community access – travel time

- The closure of the Spartan Road level crossing during construction of Manuia Road increases the average travel time between Takaanini industrial area and Southmall by approximately 40 seconds.
- The closure of the Spartan Road level crossing during construction of Manuia Road increases the average travel time between the Takaanini industrial area and Southgate by approximately 10 seconds.

- Expected diversion routes for vehicular traffic are via Manuroa Road and Porchester Road/ Alfriston Road.

Conclusion: general traffic travel time and diversion routes are not significant as these are endured for a short period of time in the future network (2.5 – 3 years)

Freight

Spartan Road is expected to continue serving freight movement to the Takaanini industrial area in the 2038 network. There is expected to be 5,300 heavy vehicles traversing Spartan Road in the Do-Nothing network.

If the Spartan Road level crossing is closed and Manuia Road has not been built yet, it is expected that freight will be diverted to alternative routes through residential areas such as Manuroa Road, Alfriston Road, and Porchester Road. The models indicate 4,300 heavy vehicles are expected on Manuroa Road due to closure at Spartan Road. This is an increase of 1,800 heavy vehicles over the Do-Nothing network. There is expected to be 2,400 heavy vehicles on Alfriston Road due to closure at Spartan Road. This is an increase of 1,200 heavy vehicles over the Do-Nothing network. This will result in diversions that will impact freight operations due to the longer journey time, particularly with the Alfriston Road and Porchester Road diversion routing.

Manuroa Road is not a suitable alternative freight route for Spartan Road due to the surrounding residential environment. The diverted freight through residential streets will also result in safety issues on residential areas/ neighbourhoods leading to detrimental effects. There are key concerns of having freight trucks traversing through residential / neighbourhood areas as the risk on vulnerable road users such as pedestrians and cyclists will be heightened and there would be more severe crash consequences due to the size of heavy vehicles. Heavy vehicles would also have limited sight visibility, resulting in further adverse impacts on vulnerable road users and other vehicular traffic. There would also be additional noise and vibration issues experienced by the surrounding residential areas.

This construction effect can be mitigated by providing a suitable alternative connection for freight in the network, prior to closing the Spartan Road level crossing. This could be done by constructing the Manuia Road multi-modal bridge prior to the closure at Spartan Road as the Manuia Road bridge will be the freight connection in the long-term network.

Conclusion: Significant potential impact to freight and the surrounding area, however, this effect can be mitigated by constructing Manuia Road bridge prior to the closure of Spartan Road level crossing.

Pedestrians and cyclists

Pedestrians and cyclists would have to divert to use the next southern connection, Manuroa Road if Spartan Road is closed. There are no active mode connections north of Spartan Road as the Papakura Stream acts as a barrier for active modes users travelling to and from the north. Figure 24 shows the expected diversion route for pedestrians travelling north from the industrial area.

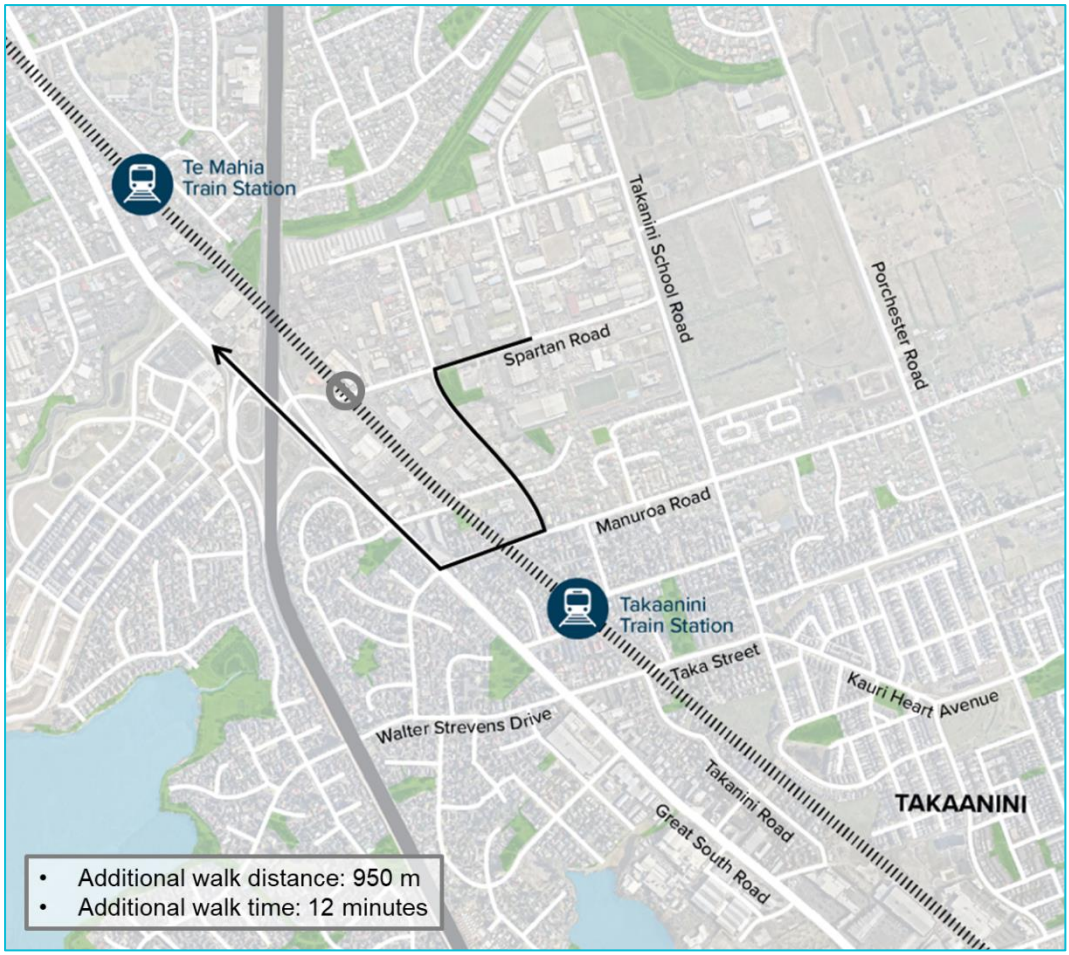


Figure 24: Walk diversion route for those travelling north

Key points to note include:

- Diverted routes are approximately 950m longer for those travelling north. This diversion distance equates to an additional 12 minutes of walk time; and
- If no active mode replacement is provided at the proposed Spartan Road closure, there would be no significant adverse diversion effects for pedestrians and cyclists who wish to travel south from the industrial zone, as they will be able to use Manuroa Road which provides a more direct route.

The above points regarding severance for those travelling north, emphasise the importance of an east-west connection for Spartan Road pedestrian and cyclists during construction of Manuia Road, in order to access destinations to the north such as Te Mahia Station. An east-west connection within the area will mitigate any potential risky/ unsafe behaviour due to no formal safe crossing over rail in this area.

Conclusion: There is the potential for pedestrians and cyclists travelling north, to take risks during construction, hence, it is recommended that Manuia Road bridge is constructed prior to the closure of Spartan Road level crossing.

Public transport

Daily diverted traffic will be using and adding pressure to bus routes such as Alfriston Road and the northern end of Porchester Road. The model indicates there is expected to be an additional 3,200 daily vehicles traversing on Alfriston Road when Spartan Road is closed in the 2038 network. There is

also expected to be an additional 4,400 vehicles traversing on the northern end of Porchester Road (north of Popes Road). Both sections of corridors are part of the connector transit bus network, hence, any pressure on these routes may impact services, further impacting bus reliability during construction. Mode shift to buses will reduce during this 2-3.5 years construction period and buses will be seen as a less attractive travel option.

Conclusion: There will be increased general traffic on bus routes however, the effects of this are not significant as these are endured for a short period of time in the future network (2.5 – 3 years).

5.2.2 Scenario 1b: Closure of Manuroa Road level crossing

This subsection explores the effect on the network of closing Manuroa Road prior to a connection being provided at Manuia Road. Figure 25 displays scenario 1b as described in Table 16.

East-west connection	Open / closed in the network to vehicles
Spartan Road	Open
Manuia Road	Under construction
Manuroa Road	Closed
Taka Street	Open
Walters Road	Open

Figure 25: Scenario 1b

General traffic

11,700 daily vehicles are expected to use the Manuroa Road level crossing in the 2038 network. If Manuroa Road is closed prior to the implementation of the Manuia Road bridge, there will be roughly 11,700 vehicles diverted to other parts of the network. This amount of traffic is expected to divert onto adjacent level crossings to the north or south, such as Spartan Road and Taka Street.

There will be increased traffic coming out of Spartan Road. Due to the configuration of the Spartan Road intersection in the middle of the Takaanini interchange, any additional traffic coming out of the Spartan Road connection will adversely impact the operation of the Takaanini interchange.

Table 20 compares the V/C ratio for key east-west connections in the 2038 network between the Do Nothing and the construction scenario: Scenario 1b.

The coloured cells indicate where there is expected to be an increase or change in the V/C ratio for a particular direction in the network. The red cells indicate where the V/C for that direction on the corridor has increased and is 80% or higher, indicating significant queuing and congestion. The orange cells indicate where the V/C ratio has increased to 60-80%, indicating that traffic speed is affected.

Table 20: V/C ratio comparison between Do Nothing and Scenario 1b

East-west connection	Do Nothing V/C Ratio		Scenario V/C Ratio	
	Eastbound	Westbound	Eastbound	Westbound
AM Peak				
Alfriston Road	40% – 60%	60% - 80%	40% – 60%	60% - 80%
Spartan Road	100%	100%	100%	100%
Manuroa Road	60% - 80%	60% - 80%	N/A	N/A
Taka Street	40% - 60%	20% – 40%	60% - 80%	60% - 80%
Walters Road	20% – 40%	60% - 80%	20% – 40%	60% - 80%
Subway Rd	60% - 80%	60% - 80%	60% - 80%	60% - 80%
PM Peak				
Alfriston Road	90% - 110%	40% - 60%	90% - 100%	40% - 60%
Spartan Road	100%	100%	100%	100%
Manuroa Road	60% - 80%	80%	N/A	N/A
Taka Street	40% - 60%	40% - 60%	90%	80%
Walters Road	40% - 60%	90%	60% - 80%	90%
Subway Road	90%	60% - 80%	90%	90%

Key points indicate that the closure of Manuroa Road level crossing during construction results in:

- The V/C ratio exceeding 80% in both directions at the Taka Street level crossing in the evening peak period. This indicates that the Taka Street level crossing is reaching capacity in the PM period when Manuroa Road level crossing is closed in the network;
- The V/C ratio is expected to increase on Taka Street in both directions to 60%-80% in the morning peak period, indicating traffic speeds become affected; and
- The V/C ratio is also expected to increase on Walters Road in the eastbound direction to 60%-80% in the evening peak period, indicating traffic speeds become affected.

Regarding expected traffic delay, the key points to note include:

- 130 second delay increase on the eastbound approach at Spartan Road level crossing in the morning peak period;

- 90 second delay increase on the westbound approach at Spartan Road level crossing in the morning peak period;
- 30 second delay increase on the eastbound approach at Taka Street level crossing in the morning peak period;
- 40 second delay increase on the westbound approach at Taka Street level crossing in the morning peak period;
- 50 second delay increase on the eastbound approach at Spartan Road level crossing in the evening peak period;
- 200 second delay increase on the westbound approach at Spartan Road level crossing in the evening peak period;
- 70 second delay increase on the eastbound approach at Taka Street level crossing in the evening peak period;
- 50 second delay increase on the westbound approach at Taka Street level crossing in the evening peak period; and
- Traffic primarily diverts to Taka Street.

Community access – travel time

The closure of the Manuroa Road level crossing during construction increases the average travel time between east of the rail line or the Takaanini industrial area and Southgate by approximately 45 seconds.

Conclusion: general traffic travel time and diversion routes are not significant as these are endured for a short period of time in the future network (2.5 – 3 years)

Freight

Although Manuroa Road is a route through a residential area, this connection is currently being used by freight to access Great South Road to travel north as the key freight connection at Spartan Road is logistically constrained due to the particular movements being banned at the Great South Road / Spartan Road intersection. Spartan Road cannot be used as a suitable alternative for freight movement due to this constraint.

If Manuroa Road is closed and Manuia Road has not been built yet, there may be additional freight (2,500 daily heavy vehicles) having to reroute through alternative routes such as Alfriston Road / Porchester Road, and Taka Street. This will result in diversions that will impact freight operations due to the longer journey time. These diversions will also increase the routing distance of freight through residential areas. The diverted freight through residential streets will result in safety issues on residential areas / neighbourhoods leading to detrimental effects. There are key concerns of having freight trucks traversing through residential / neighbourhood areas as the risk on vulnerable road users such as pedestrians and cyclists will be heightened and there would be more severe crash consequences due to the size of heavy vehicles. Heavy vehicles would also have limited sight visibility, resulting in further adverse impacts on vulnerable road users and other vehicular traffic. There would also be additional noise and vibration issues experienced by the surrounding residential areas.

This construction effect can be mitigated by providing a suitable alternative connection for freight in the network, prior to closing the Manuroa Road level crossing. This could be done by constructing the

Manuia Road multi-modal bridge prior to the closure at Manuroa Road as the Manuia Road bridge will be the freight connection in the long-term network.

Conclusion: Significant potential impact to freight and the surrounding area, however, this effect can be mitigated by constructing Manuia Road bridge prior to the closure of Manuroa Road level crossing.

Pedestrians and cyclists

Pedestrians and cyclists would have to divert to use the next northern connection, Spartan Road or Taka Street, which is to the south. Figure 26 shows the expected diversion route for pedestrians travelling north or south from the residential area along Manuroa Road. It is recommended that the CTMP should identify how pedestrian access from Manuroa Road to the Takaanini Station will be maintained during construction.

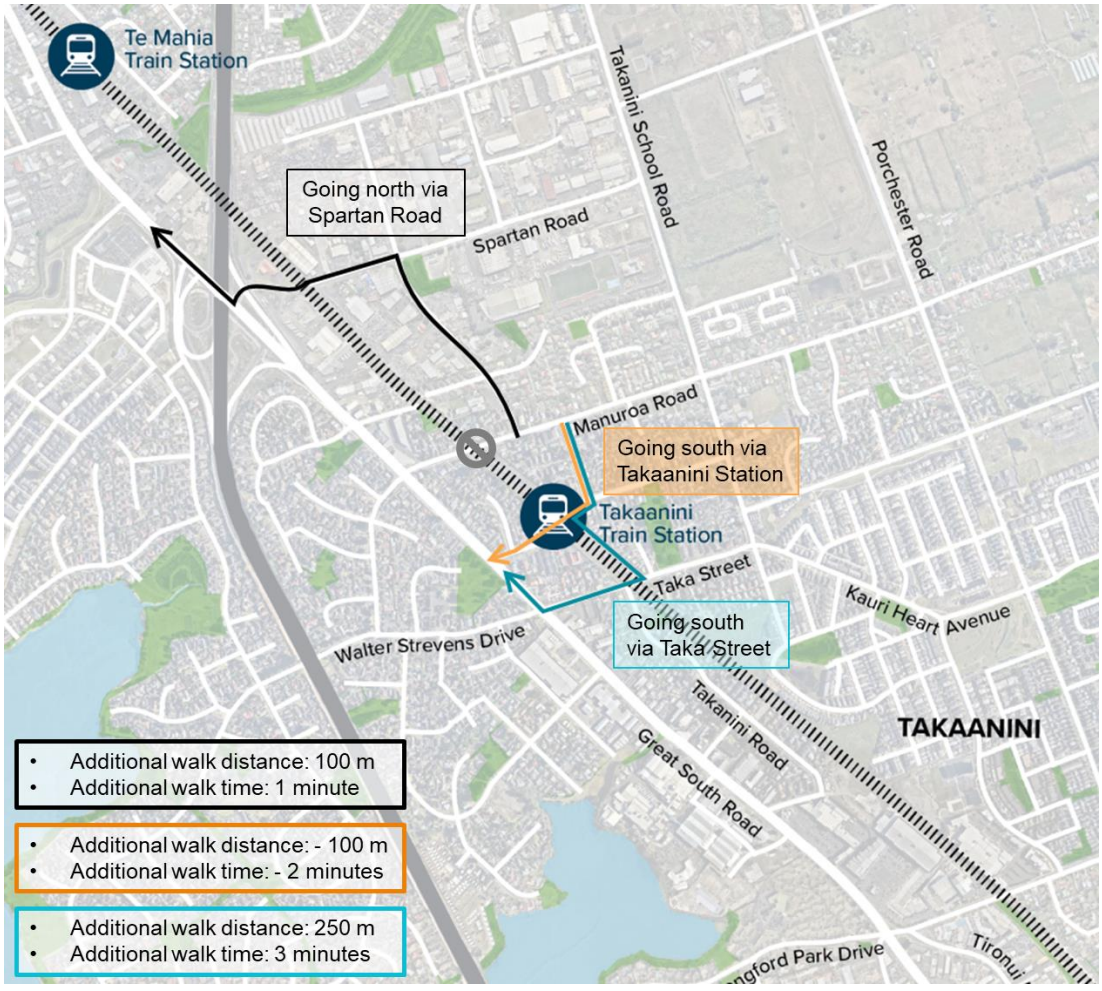


Figure 26: Walk diversion routes for pedestrians travelling north/ south from Manuroa Road

Key points to note include:

- Diverted routes are approximately 100m longer for those travelling north. This diversion distance equates to an additional 1 minute of walk time;
- Diverted routes are not adversely impacted for those travelling south if through movement is permitted though the Takaanini Station (via Maru Road and Station Road). This diversion distance and time of this route is shorter than via Manuroa Road; and

- If no east-west through movement is permitted through Takaanini Station in the future at the time of construction, then pedestrians and cyclists are expected to travel approximately 250m more for those travelling south. This diversion distance equates to an additional 3 minutes of walk time.

Conclusion: The above diversion route additional distance and travel times are not considered a significant adverse effect and are not permanent effects in the network.

Public transport

Daily diverted traffic will be using and adding pressure to bus routes such as Alfriston Road, Porchester Road and Great South Road. However, the model does not indicate that the additional daily vehicles traversing on the bus network will significantly worsen these routes compared to the Do-Nothing network.

Conclusion: There will be a slight amount of pressure on the bus networks, however, the effects of this are not significant as these are endured for a short period of time in the future network (2.5 – 3 years).

5.2.3 Area 1 summary

Table 21 below provides a summary and comparison of area 1 scenarios.

Table 21: Summary of Area 1

Scenario	General Traffic	Freight	Walking & Cycling	Public Transport
Scenario 1a	Manuroa Road becomes increasingly congested.	Additional freight on Manuroa Road	Walk time could increase to be an additional 12 minutes.	Diverted traffic adds pressure on bus network
Scenario 1b	Taka Street becomes increasingly congested.	Increased freight on Residential streets	No significant increase in walk time	Diverted traffic on bus routes are not too significant

5.2.3.1 Conclusions

Key points to note include:

- Manuia Road bridge should be constructed and operational before the level crossings at Spartan Road and Manuroa Road are closed. Manuia Road bridge will resolve the issues that would otherwise have occurred in Scenario 1a and 1b.

5.3 Area 2 construction effects – Taka Street bridge

This subsection explores the construction effects of the closure of Taka Street level crossing for the construction of the Taka Street multi-modal bridge under the following two scenarios:

- Manuia Road bridge built, Spartan Road and Manuroa Road level crossings closed; and
- Spartan Road and Manuroa Road level crossings remain open, Manuia Road bridge not yet built.

Walters Road level crossing is assumed open in both scenarios as displayed in Figure 27. Walters Road is geographically remote from Area 2 and the effects of the closure of Walters Road connection is explored in Section 5.4 of this Report. Hence to assess the isolated effects of the construction of Taka Street bridge for the Area 2 scenarios, a connection at Walters Road was assumed.

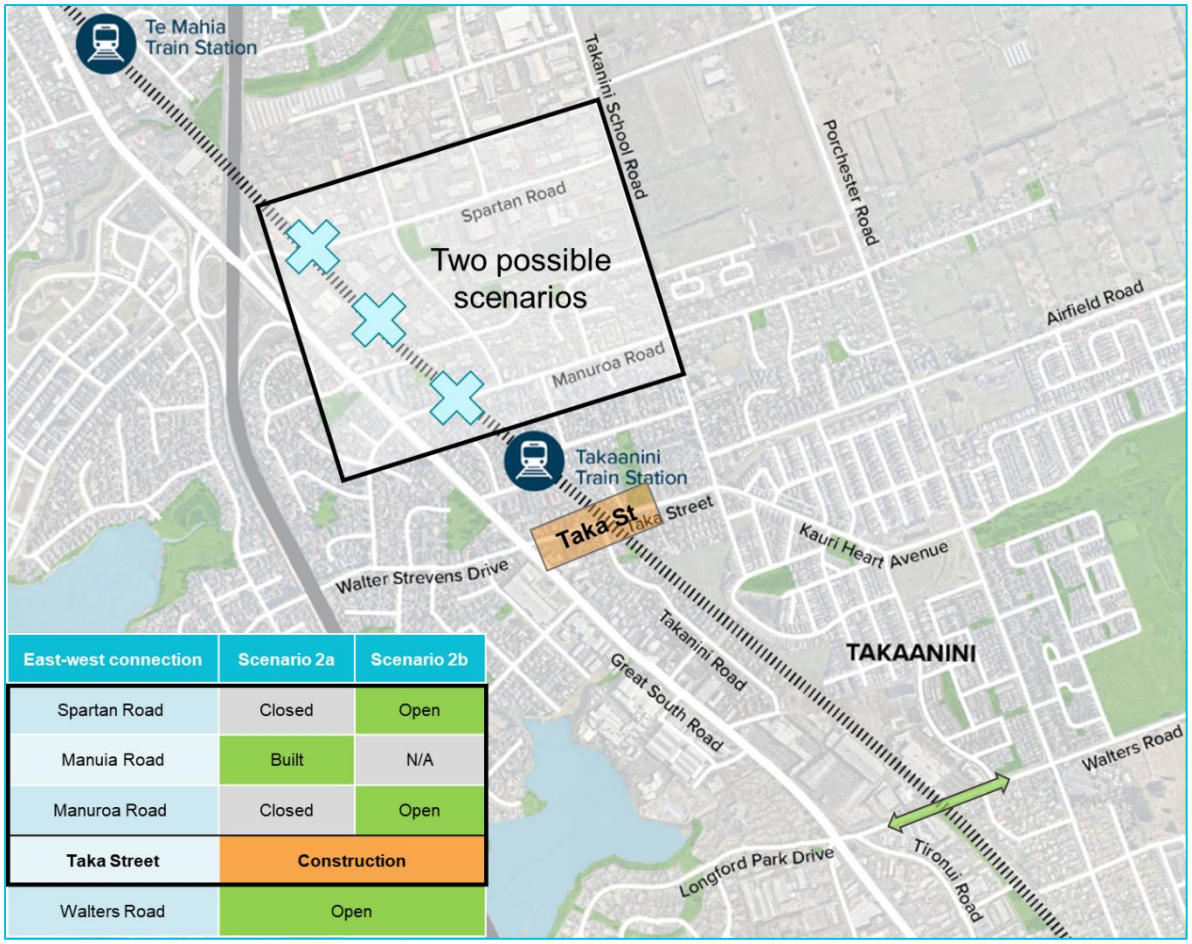


Figure 27: Area 2 construction of Taka Street bridge scenarios

5.3.1 Scenario 2a: Manuia Road bridge built

This subsection explores the effect on the network of Scenario 2a during the construction of the Taka Street bridge. This scenario assumes the following:

- Spartan Road, Manuroa Road and Taka Street level crossings are closed;
- Manuia Road bridge has been built; and
- Walters Road level crossing is open in the network.

Figure 28 displays scenario 2a as described in Table 16.

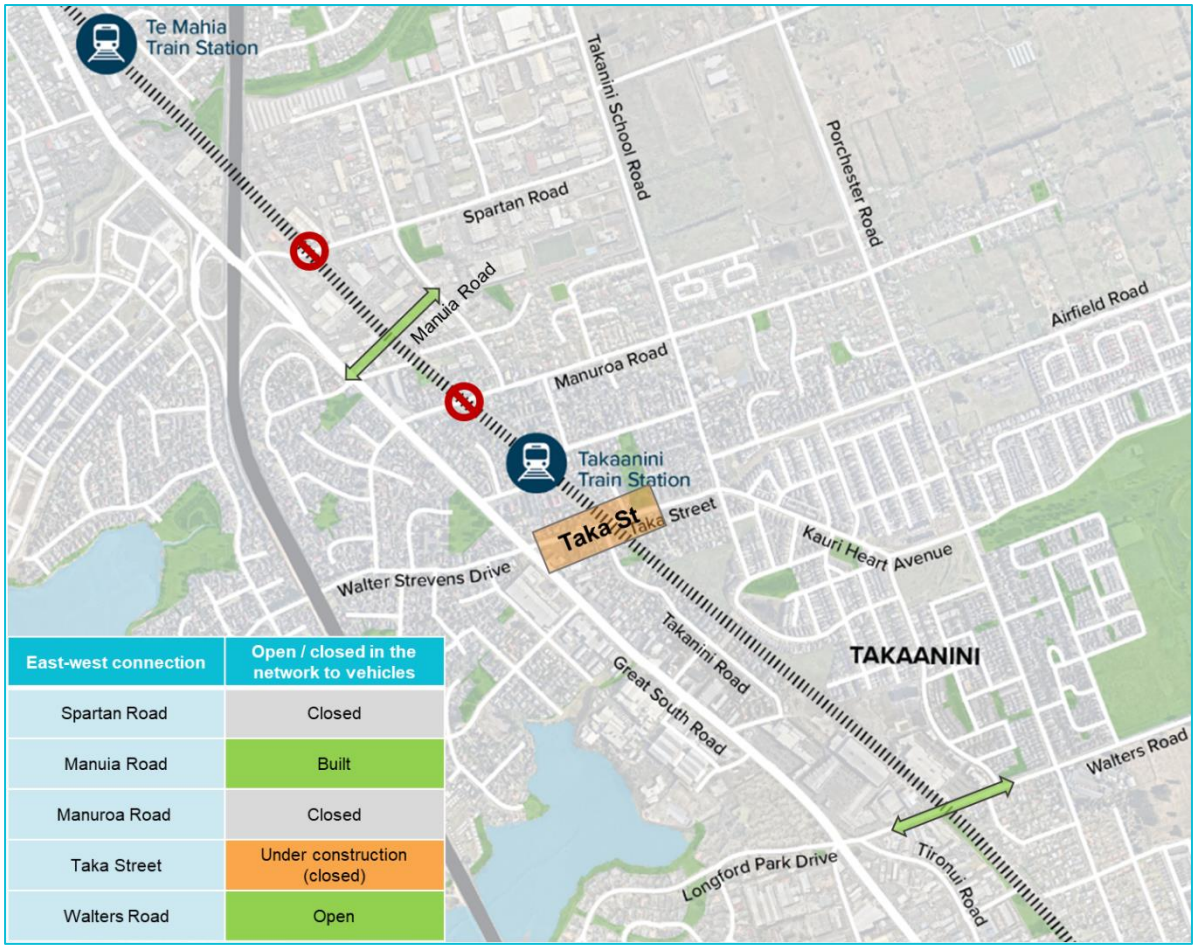


Figure 28: Scenario 2a

General traffic

Approximately 28,400 daily vehicles are expected to be using Spartan Road, Manuroa Road and Taka Street level crossings in the 2038 network. If all three level crossings are closed for the implementation of the Taka Street bridge, there will be roughly 28,400 vehicles diverted to other parts of the network. This amount of traffic is expected to divert onto adjacent level crossings to the north or south, such as the new Manuia Road bridge and the Walters Road level crossing. It should be noted that the Manuia Road bridge would not be constrained by rail services at a level crossing as it would be grade-separated. Traffic would primarily divert to the new Manuia Road bridge which is expected to be heavily congested. There is expected to be approximately 21,900 daily vehicles traversing on the Manuia Road bridge. Table 22 compares the V/C ratio for key east-west connections in the 2038 network between the Do Nothing and the construction scenario: Scenario 2a.

There will be a significant gap in east-west connectivity in the network for this construction scenario. There is approximately a distance of 2km between the proposed Manuia Road bridge and the Walters Road level crossing.

The coloured cells indicate where there is expected to be an increase or change in the V/C ratio for a particular direction in the network. The red cells indicate where the V/C for that direction on the corridor has increased and is 80% or higher, indicating significant queuing and congestion. The orange cells indicate where the V/C ratio has increased to 60-80%, indicating that traffic speed is

affected. The light orange cells indicate the V/C for that direction on the corridor has increased to 40-60%.

Table 22: V/C ratio comparison between Do Nothing and Scenario 2a

East-west connection	Do Nothing V/C Ratio		Scenario V/C Ratio	
	Eastbound	Westbound	Eastbound	Westbound
AM Peak				
Alfriston Road	40% – 60%	60% - 80%	40% – 60%	60% - 80%
Spartan Road	100%	100%	N/A	N/A
Manuia Road	N/A	N/A	100%	40% – 60%
Manuroa Road	60% - 80%	60% - 80%	N/A	N/A
Taka Street	40% - 60%	20% – 40%	N/A	N/A
Walters Road	20% – 40%	60% - 80%	40% - 60%	60% - 80%
Subway Road	60% - 80%	60% - 80%	60% - 80%	60% - 80%
PM Peak				
Alfriston Road	90% - 110%	40% - 60%	90% - 110%	40% - 60%
Spartan Road	100%	100%	N/A	N/A
Manuia Road	N/A	N/A	100%	40% – 60%
Manuroa Road	60% - 80%	80%	N/A	N/A
Taka Street	40% - 60%	40% - 60%	N/A	N/A
Walters Road	40% - 60%	90%	60% - 80%	100%
Subway Road	90%	60% - 80%	90%	90%

Key points indicate that the closure of Spartan Road, Manuroa Road and Taka Street level crossings during construction results in:

- Just two east-west connections being provided in the network; Manuia Road bridge and Walters Road level crossing;
- The V/C ratio is expected to exceed 80% in the eastbound direction on the Manuia Road bridge in both the morning and evening peak periods. This indicates that the Manuia Road bridge is reaching capacity at peak periods due to the closures of the level crossings in the network; and
- The V/C ratio is expected to reach 60-80% in the westbound direction on the Manuia Road bridge in both the morning and evening peak periods, indicating traffic speeds become affected on this link during these periods.

Regarding expected traffic delay, the key points to note include:

- 110 second delay on the eastbound approach on Manuia Road bridge in the morning peak period;
- 40 second delay on the westbound approach on Manuia Road bridge in the morning peak period;
- 150 second delay on the eastbound approach on Manuia Road bridge in the evening peak period.

- 180 second delay on the westbound approach on Manuia Road bridge in the evening peak period; and

- Traffic primarily diverts to the new Manuia Road bridge which is expected to be heavily congested.

Community access – travel time

The closure of the Spartan Road, Manuroa Road and Taka Street level crossings during construction increases the average travel time between the Takaanini industrial area and Southmall by approximately 30 seconds.

The closure of the Spartan Road, Manuroa Road and Taka Street level crossings during construction increases the average travel time between east of the rail line and Southgate by approximately 3 minutes. This is a relatively significant effect, given that the current travel distance between these locations is about 1.8 to 2.4 kilometres and typically takes 3 to 10 minutes in present day.

Conclusion: there is the potential for general traffic travel time and diversion routes to become significant. However, these are not permanent effects and are endured for a short period of time in the future network (2.5 – 3 years).

Freight

The freight that would have used Spartan Road and Manuroa Road to access the industrial area, will now use the Manuia Road bridge. There will be approximately 7,100 heavy vehicles traversing on Manuia Road in this 2038 network. This scenario will see a decrease in the number of heavy vehicles traversing through residential corridors such as Manuroa Road and Alfriston Road. This is a positive effect of this construction scenario.

There will be a lot more mixing between heavy vehicles and light vehicles on the Manuia Road bridge due to the limited number of east-west connections in this construction scenario. It is expected that roughly 32% of the overall traffic traversing on Manuia Road in 2038 would be heavy vehicles. The combination of industrial heavy traffic and general light traffic should be limited in the network due to road safety concerns. The impact heavy vehicles have on smaller light vehicles can be detrimental and result in serious crash effects on light vehicle users in the case of a collision with a larger, heavier vehicle. Hence, the combination of the mixture of heavy and light vehicles can result in adverse effects.

Conclusion: There are no significant adverse effects on freight and the surrounding area the mixing of freight and general traffic is temporary and are endured for a short period of time in the future network (2.5 – 3 years).

Pedestrians and cyclists

Pedestrians and cyclists who would typically use Spartan Road level crossing to travel north, will have to traverse via the new Manuia Road bridge. As displayed in Figure 29, those travelling south or directly west from the Takaanini area and who would typically use the Taka Street connection, will have to divert via the Takaanini Station (i.e. via Maru Road and Station Road). If through movement via the Takaanini Station is not possible in the future, then active mode users will have to divert via the new Manuia Road bridge. It is recommended that the CTMP should identify how pedestrian access from Taka Street to the Takaanini Station will be maintained during construction.

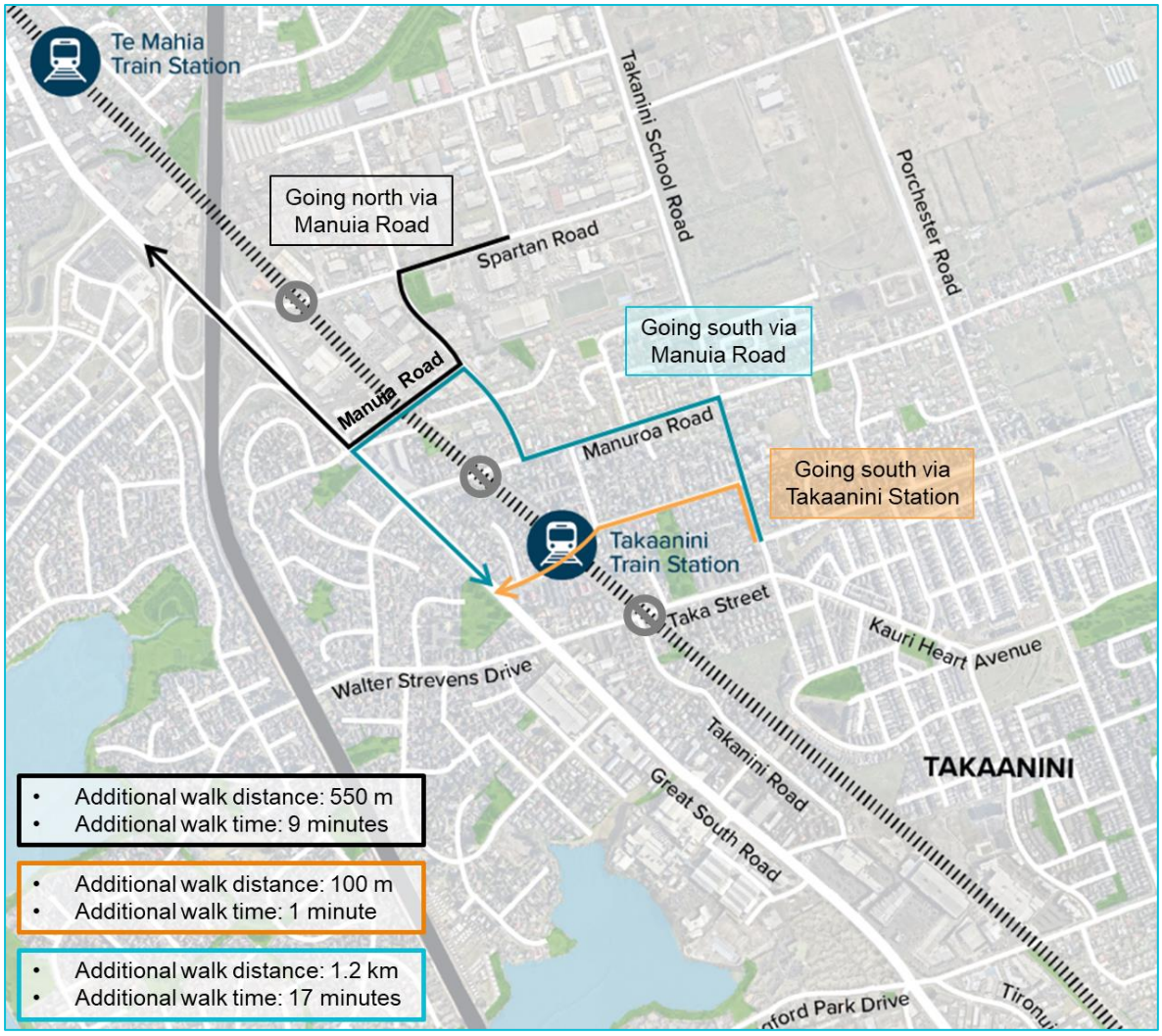


Figure 29: Walk diversion routes

Key points to note include:

- Diverted routes are approximately 550m longer for those travelling north. This diversion distance equates to an additional 9 minutes of walk time;
- Diverted routes are not adversely impacted for those travelling south/ west if through movement is permitted though the Takaanini Station (via Maru Road and Station Road). This diversion distance and time of this route is 100m and requires an additional 1 minute of walk time; and
- If no east-west through movement is permitted through Takaanini Station in the future at the time of construction, then pedestrians and cyclists are expected to travel approximately 1.2km more for those travelling south/ west. This diversion distance equates to an additional 17 minutes of walk time which is considered significant.

The above diversion route additional distance and time are considered significant especially if no through movement is permitted through Takaanini Station in the future.

Conclusion: The above diversion route additional distance and travel times can become significant if no through movement is allowed through Takaanini Station. Despite, this being a temporary effect, there is a risk that vulnerable road users may take risks in crossing the rail line due to the limited

active mode permeability. Hence, it is recommended that a suitable alternative is provided for when Taka Street is closed for construction.

Public transport

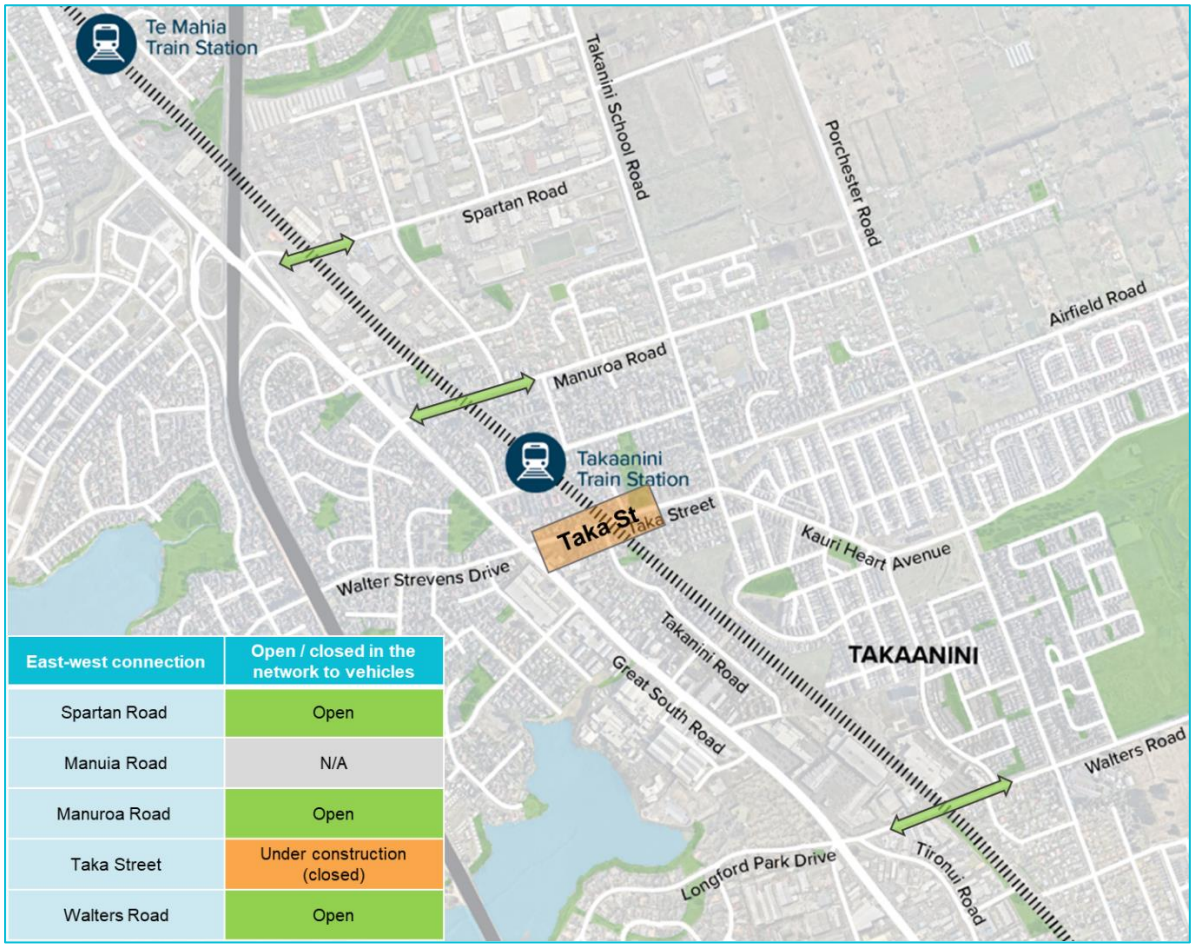
The model does not indicate a significant amount of additional traffic being diverted onto the bus network as Manuia Road is considered to be the key diversion route for traffic.

Conclusion: There will be a slight amount of pressure on the bus networks, however, the effects of this are not significant as these are endured for a short period of time in the future network (2.5 – 3 years).

5.3.2 Scenario 2b: Manuia Road bridge not yet built

This subsection explores the effect on the network of Scenario 2b (displayed in Table 16 & Figure 30) during the construction of the Taka Street bridge. This scenario assumes the following:

- Taka Street level crossing is closed for the construction of the bridge;
- Manuia Road bridge is not in the network; and
- Spartan Road, Manuroa Road and Walters Road level crossings are open in the network.



East-west connection	Open / closed in the network to vehicles
Spartan Road	Open
Manuia Road	N/A
Manuroa Road	Open
Taka Street	Under construction (closed)
Walters Road	Open

Figure 30: Scenario 2b

Approximately 5,800 daily vehicles are expected to be using Taka Street level crossings in the 2038 network. If this connection is closed for the implementation of the Taka Street bridge, there will be

roughly 6,000 vehicles diverted to other parts of the network. This amount of traffic is expected to divert onto adjacent level crossings to the north or south, such as the Manuroa Road or the Walters Road level crossing. Table 23 compares the V/C ratio for key east-west connections in the 2038 network between the Do Nothing and the construction scenario: Scenario 2b.

The coloured cells indicate where there is expected to be an increase or change in the V/C ratio for a particular direction in the network. The red cells indicate where the V/C for that direction on the corridor has increased and is 80% or higher, indicating significant queuing and congestion. The orange cells indicate where the V/C ratio has increased to 60-80%, indicating that traffic speed is affected. The light orange cells indicate the V/C for that direction on the corridor has increased to 40-60%.

Table 23: V/C ratio comparison between Do Nothing and Scenario 2b

East-west connection	Do Nothing V/C Ratio		Scenario V/C Ratio	
	Eastbound	Westbound	Eastbound	Westbound
AM Peak				
Alfriston Road	40% – 60%	60% - 80%	40% – 60%	60% - 80%
Spartan Road	100%	100%	100%	100%
Manuroa Road	60% - 80%	60% - 80%	90%	60% - 80%
Taka Street	40% - 60%	20% – 40%	N/A	N/A
Walters Road	20% – 40%	60% - 80%	40% - 60%	60% - 80%
Subway Road	60% - 80%	60% - 80%	60% - 80%	60% - 80%
PM Peak				
Alfriston Road	90% - 110%	40% - 60%	90% - 110%	40% - 60%
Spartan Road	100%	100%	100%	100%
Manuroa Road	60% - 80%	80%	100%	100%
Taka Street	40% - 60%	40% - 60%	N/A	N/A
Walters Road	40% - 60%	90%	60% - 80%	100%
Subway Road	90%	60% - 80%	90%	90%

Key points indicate that the closure of Taka Street level crossing during construction results in:

- The V/C ratio exceeding 80% in the eastbound direction at the Manuroa Road level crossing in both the morning and evening peak periods. This indicates that the Manuroa Road level crossing is reaching capacity when Taka Street level crossing is closed in the network.
- The V/C ratio is also expected to increase on Walters Road in the eastbound direction to 60%-80% in the evening peak period, indicating traffic speeds become affected.

Regarding expected traffic delay, the key points to note include:

- 40 second delay increase on the eastbound approach at Spartan Road level crossing in the morning peak period;
- 10 second delay increase on the westbound approach at Spartan Road level crossing in the morning peak period;
- 40 second delay increase on the eastbound approach at Manuroa Road level crossing in the morning peak period;

- 30 second delay increase on the westbound approach at Manuroa Road level crossing in the morning peak period;
- 10 second delay increase on the eastbound approach at Spartan Road level crossing in the evening peak period;
- 60 second delay increase on the westbound approach at Spartan Road level crossing in the evening peak period;
- 60 second delay increase on the eastbound approach at Manuroa Road level crossing in the evening peak period;
- 30 second delay increase on the westbound approach at Manuroa Road level crossing in the evening peak period; and
- Traffic primarily diverts to Manuroa Road.

Community access – travel time

The closure of the Taka Street level crossing during construction increases the average travel time between east of the rail line and Southgate by approximately 3 minutes. This is a relatively significant effect, given that the current travel distance between these locations is about 1.7 to 2.1 kilometres and typically takes 3 to 7 minutes in present day.

Conclusion: general traffic expected delay in this scenario is not significant, however, the travel time is relatively higher but is also not considered significant as these are endured for a short period of time in the future network (2.5 – 3 years).

Freight

The model indicates that this construction scenario is not expected to have a significant effect on diversions to freight as freight can continue to primarily use Spartan Road and Manuroa Road in the 2038 network.

Conclusion: There are no significant adverse effects on freight and the surrounding area.

Pedestrians and cyclists

Pedestrians and cyclists travelling north from Takaanini will not be affected by the level crossing closure at Taka Street as they can use the connection at Manuroa Road. Active mode trips travelling south from Takaanini are affected by the closure at Taka Street. Pedestrians and cyclists will have to traverse either via Station Road and through the Takaanini Station, or via the pedestrian access through Manuroa Road as indicated by the orange and blue routes shown in Figure 31. It is recommended that the CTMP should identify how pedestrian access from Taka Street to the Takaanini Station will be maintained during construction.

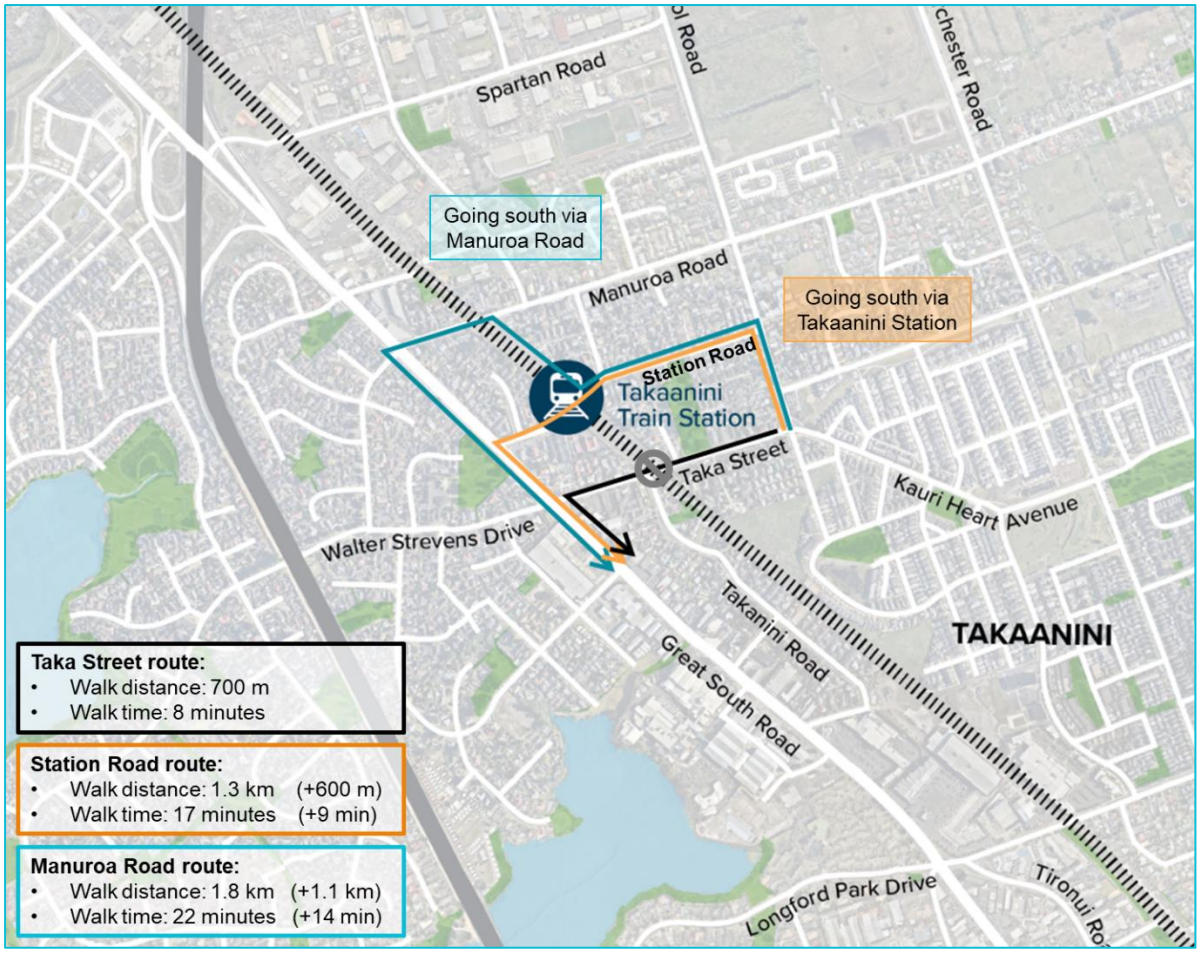


Figure 31: Walk diversion routes for pedestrians travelling south

Key points to note include:

- Pedestrians and cyclists travelling north from Takaanini will not be affected by the level crossing closure at Taka Street as they can use the connection at Manuroa Road;
- Diverted routes are approximately 600m longer for those travelling south via Station Road and through Takaanini Station. This diversion distance equates to an additional 9 minutes of walk time; and
- If no east-west through movement is permitted through Takaanini Station in the future at the time of construction, then pedestrians and cyclists are expected to travel approximately 1.1km more for those travelling south. This diversion distance equates to an additional 14 minutes of walk time.

The above points regarding severance for those travelling south, emphasise the importance of an east-west connection at Taka Street for pedestrians and cyclists to use. An alternative east-west connection within the area will mitigate any potential risky/ unsafe behaviour due to no formal safe crossing over rail in this area.

Conclusion: There is the potential for pedestrians and cyclists travelling south, to take risks during construction, hence, it is recommended that a suitable alternative is provided for construction of Taka Street.

Public transport

The model does not indicate a significant amount of additional traffic being diverted onto the bus network as Manuia Road is considered to be the key diversion route for traffic.

Conclusion: There will be a slight amount of pressure on the bus networks, however, the effects of this are not significant and are endured for a short period of time in the future network (2.5 – 3 years).

5.3.3 Area 2 summary

Table 24 below provides a summary and comparison of area 2 scenarios.

Table 24: Summary of Area 2 scenarios

Scenario	General Traffic	Freight	Walking & Cycling	Public Transport
Scenario 2a	Only two east-west connections in the network. Manuia Road is very congested in peak periods. Drive time for locals east of the rail line travelling to/from Southgate could increase by 3 minutes.	Industrial and residential traffic mixing on Manuia Road.	Walk time could increase to be an additional 9 minutes or 17 minutes (if no through-movement pedestrian access is permitted via Takaanini Station).	Diverted traffic on bus routes are not too significant.
Scenario 2b	Manuroa Road worsens, however, delay increase is not significant. Drive time for locals east of the rail line travelling to/from Southgate could increase by 3 minutes.	No effect on freight access or surrounding residential neighbourhoods.	Walk time could increase to be an additional 9 minutes or 14 minutes (if no through-movement pedestrian access is permitted via Takaanini Station).	Diverted traffic on bus routes are not too significant.

5.3.3.1 Conclusions

A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of Taka Street during construction. This could mean the following:

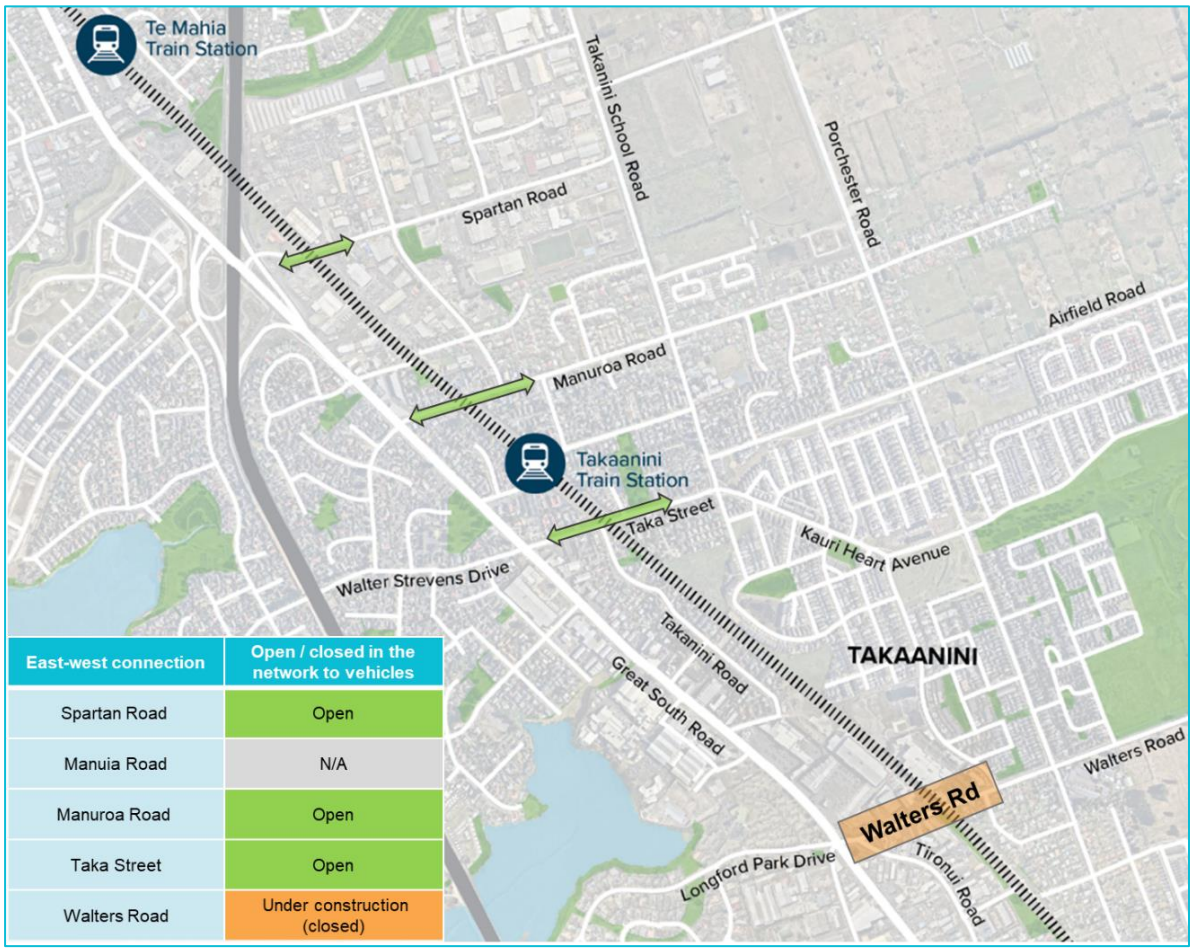
- Partial closure with some movements retained on Taka Street; and/or
- Reroute traffic to an alternative connection such as Manuroa Road or Manuia Road (with Spartan Road open in either option). This would mean at least three connections are provided in the Takaanini network.

5.4 Area 3 construction effects – Walters Road bridge

This subsection explores the construction effects of the construction of Scenario 3; Walters Road multi-modal bridge and assumes:

- Spartan Road, Manuroa Road, Taka Street level crossings remain open;
- Manuia Road bridge is not yet built;
- Walters Road level crossing is closed; and
- Tironui Station Road East-West pedestrian level crossing is closed.[19]

Construction works for Area 3 only consists of one scenario where Walters Road is closed, to assess whether a connection is required at this location during the construction of the bridge of Walters Road. Walters Road is remote from the other connections, hence is able to be considered and assessed separately from the others (see Figure 32).



East-west connection	Open / closed in the network to vehicles
Spartan Road	Open
Manuia Road	N/A
Manuroa Road	Open
Taka Street	Open
Walters Road	Under construction (closed)

Figure 32: Area 3

General Traffic

Walters Road is a key east-west connection in the network as the adjacent east-west crossings are located relatively far from Walters Road. The next vehicular east-west crossing to the south is Subway Road, which is approximately 1.3km south of Walters Road. The next vehicular east-west

[19] Closure of the existing Tironui Station Road east-west pedestrian level crossing is being investigated by Auckland Transport as part of a separate programme of works (i.e. the pedestrian level crossing removal project) and is not within the scope of the TLC (refer to Section 4.2.2).

crossing to the north of Walters Road is Taka Street, which is approximately 1.2km north of Walters Road. Without the Walters Road connection in the network, there would be a significant gap of 2.5km in east-west connectivity in this part of the network. Walters Road provides access to key destinations such as the Southgate Shopping Centre, Takaanini town centre, Papakura Normal Primary School and Bruce Pulman Park.

8,500 daily vehicles are expected to use Walters Road level crossing in the 2038 network. If Walters Road is closed in this network, there will be roughly 9,000 vehicles diverted to other parts of the network. This amount of traffic is expected to divert onto adjacent level crossings to the north or south, such as Taka Street and Subway Road. There is expected to be an increase of daily traffic with approximately 21,000 vehicles on Subway Road when Walters Road is closed in the network. This amount of traffic will add a lot of pressure through Subway Road in the Papakura network.

Table 25 compares the V/C ratio for key east-west connections in the 2038 network between the Do Nothing and the construction scenario: Scenario 3.

The coloured cells indicate where there is expected to be an increase or change in the V/C ratio for a particular direction in the network. The red cells indicate where the V/C for that direction on the corridor has increased and is 80% or higher, indicating significant queuing and congestion. The orange cells indicate where the V/C ratio has increased to 60-80%, indicating that traffic speed is affected. The light orange cells indicate the V/C for that direction on the corridor has increased to 40-60%.

Table 25: V/C ratio comparison between Do Nothing and Scenario 3

East-west connection	Do Nothing V/C Ratio		Scenario V/C Ratio	
	Eastbound	Westbound	Eastbound	Westbound
AM Peak				
Alfriston Road	40% – 60%	60% - 80%	40% – 60%	60% - 80%
Spartan Road	100%	100%	100%	100%
Manuroa Road	60% - 80%	60% - 80%	60% - 80%	60% - 80%
Taka Street	40% - 60%	20% – 40%	40% - 60%	40% - 60%
Walters Road	20% – 40%	60% - 80%	N/A	N/A
Subway Road	60% - 80%	60% - 80%	60% - 80%	80%
PM Peak				
Alfriston Road	90% - 110%	40% - 60%	80% - 110%	40% - 60%
Spartan Road	100%	100%	100%	100%
Manuroa Road	60% - 80%	80%	90%	80%
Taka Street	40% - 60%	40% - 60%	80%	60% - 80%
Walters Road	40% - 60%	90%	N/A	N/A
Subway Road	90%	60% - 80%	90%	100%

Key points indicate that the closure of Walters Road level crossing during construction results in:

- The V/C ratio exceeding 80% in the westbound direction on Subway Road in both the morning and evening peak periods. This indicates that Subway Road is at capacity when no connection is provided at Walters Road; and
- The V/C ratio is also expected to exceed 80% on Manuroa Road and Taka Street in the eastbound direction in the evening peak period, indicating these connections are at capacity when no connection is provided at Walters Road.

Regarding expected traffic delay, the key points to note include:

- 10 second delay increase on the eastbound approach at Taka Street level crossing in the morning peak period;
- 20 second delay increase on the westbound approach at Taka Street level crossing in the morning peak period;
- 50 second delay increase on the eastbound approach at Taka Street level crossing in the evening peak period;
- 20 second delay increase on the westbound approach at Taka Street level crossing in the evening peak period; and
- Traffic primarily diverts to Great South Road (north of Subway Road), Subway Road and Taka Street.

Community access – travel time

The closure of the Walters Road level crossing during construction increases the average travel time between east Walters Road / Bruce Pulman Park and the Tironui shops by approximately 2.5 minutes.

Conclusion: there is the potential for general traffic travel time and diversion routes to become significant. However, these are not permanent effects and are endured for a short period of time in the future network (2.5 – 3 years).

Freight

The model indicates that this construction scenario is not expected to have a significant effect on diversions to freight as freight can continue to primarily use Spartan Road and Manuroa Road in the 2038 network. Hence, there is expected to be no adverse effect on freight compared to the Do-Nothing scenario.

Conclusion: There are no significant adverse effects on freight and the surrounding area.

Pedestrians and cyclists

The current Walters Road connection provides for local movements and accessibility to key destinations such as the Southgate Shopping Centre, Takanini Town Centre, Papakura Normal Primary School and Bruce Pulman Park. Closing Walters Road in the network, will severe the community. The existing Tironui Station Road pedestrian level crossing is located 300m south of Walters Road. Tironui Station Road pedestrian level crossing is expected to close as part of AT's pedestrian level crossing removals programme (as noted in Section 4.2.2 of this Report above).

Walters Road is planned as an alternative route for active modes for when Tironui Station Road level crossing is closed. The closure of Tironui Station Road level crossing is expected to occur prior to the construction of the Project.

Without the Walters Road connection in the network, there would be a significant gap of 2.5km in east-west connectivity in this part of the network. This may result in the potential for risky/ unsafe behaviour with no formal safe crossing over rail in this area.

Figure 33 shows the diversion routes for those travelling directly west to the Southgate shopping centre.

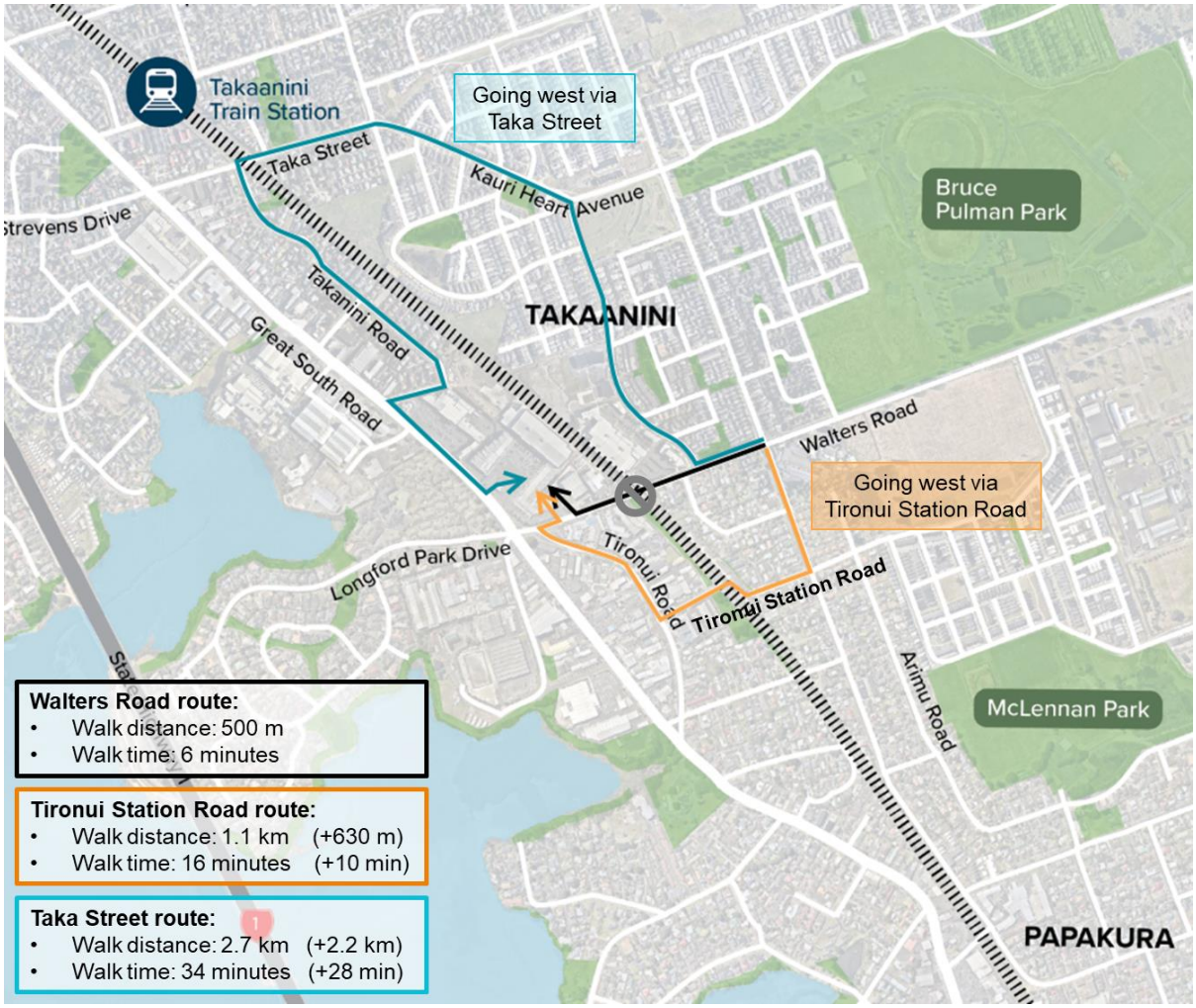


Figure 33: Walk diversion routes for pedestrians travelling west

Key points to note include:

- Diverted routes are approximately 630m longer for those travelling via Tironui Station Road pedestrian crossing. This diversion distance equates to an additional 10 minutes of walk time. It is expected that Tironui Station Road pedestrian crossing would be closed prior to the construction of the Project. In this case, the alternative routes are via Taka Street or Subway Road; and
- As it is highly likely east-west movement would not be provided through Tironui Station Road pedestrian crossing in the future at the time of construction, pedestrians and cyclists would be

expected to travel approximately 2.2km more via Taka Street which is the next shortest route. This diversion distance equates to an additional 28 minutes of walk time.

The above points regarding severance, emphasise the importance of an east-west connection at Walters Road. An east-west connection within the area will mitigate any potential risky / unsafe behaviour due to no formal safe crossing over rail in this area.

Conclusion: There is the potential for pedestrians and cyclists, to take risks during construction, hence, it is recommended that a suitable alternative is provided for vulnerable road users at Walters Road.

Public transport

The model does not indicate a significant amount of additional traffic being diverted onto the bus network as Manuia Road is considered to be the key diversion route for traffic.

Conclusion: There will be a slight amount of pressure on the bus networks, however, the effects of this are not significant and are endured for a short period of time in the future network (2.5 – 3 years).

5.4.1 Area 3 summary

Table 26 below provides a summary of area 3 scenario.

Table 26: Summary of Area 3 scenario

Scenario	General Traffic	Freight	Walking & Cycling	Public Transport
Scenario 3	There is a significant gap in east-west connectivity. Drive time for locals east of the rail line travelling to/from the Tironui Road shops could increase by 2.5 minutes.	No effect on freight access or surrounding residential neighbourhoods	Walk time could increase to be an additional 10 minutes or 28 minutes (if pedestrian access is closed at Tironui Station Road).	Diverted traffic on bus routes are not too significant

5.4.1.1 Conclusions

Walters Road is a key connection in the Takaanini network, providing access to the Takanini Town Centre. Not providing a connection at this location will result in a significant gap in east-west connectivity in the network. Hence offline construction is recommended to retain movements in this corridor.

A suitable alternative to facilitate traffic movement will be provided for the closure of Taka Street and / or Walters Road during construction. This could entail offline construction or partial closure.

5.5 Construction traffic management plan (CTMP)

Construction of the Project will involve disruption and short-term traffic effects which is dependent on the timing and staging of the construction of the TLC corridors. Measures to mitigate these potential construction traffic effects can be achieved through the requirement of a CTMP to be prepared by the nominated contractor prior to works commencing. The below sections identify matters to be considered as part of the development of the CTMP.

It is recommended that residents and stakeholders be kept informed of construction times and progress. General observations of pedestrian and cyclist activity should be used to inform appropriate traffic management measures in the CTMP.

5.5.1 Traffic routes

Construction of the Project will likely involve disruption to the surrounding existing road network and property access. Additional traffic will be generated from general staff and workforce for the Project as well as construction specific traffic such as traffic movements for material delivery and movement within construction areas. There are a few schools and early childhood centres in or surrounding the Project areas. This may indicate a potential increase of heavy traffic movements near sensitive areas, hence should be managed via a CTMP. Generally, access along the existing Project alignment will be maintained, however, some closures will be needed for critical activities at night or on weekends.

The increase in construction vehicles in the network may result in increased vehicles parking in the network, along the corridors. This may result in implications on traffic moving along the corridors hence, it is recommended that sufficient space for construction laydown areas is provided to allow for construction vehicles to be stored off the corridors to reduce impact on through movement in the wider network.

Given the timing and staging of the construction of the TLC corridors is yet to be determined, there is a degree of uncertainty associated with any predicted construction methodology and associated traffic routes. This means:

- The routes that will be used by construction vehicles will depend on the location of quarries and disposal sites, which are not yet certain;
- The exact location and extent of compound sites/ lay down areas has yet to be determined; and
- The timing of construction of each TLC grade-separated bridge may impact the likely construction of the alternative vehicle routes/ bridges, for example, if Taka Street is constructed prior or after to the construction of Walters Road.

Access to compound sites, laydown areas and construction zones for construction vehicles, plant and materials will be via site access points identified as part of future CTMPs.

Details of routes and time restrictions will need to be updated and refined as part of the CTMP process. Heavy construction traffic movement may pose safety issues on sensitive areas such as schools, early childhood centres and community centres. To mitigate this effect, it is recommended that routes for construction traffic are to be limited to arterial corridors such as Great South Road and the adjacent state highway network (SH1). It is also likely that construction traffic routes will also be limited to intersections which provide adequate vehicle tracking for trucks.

The specific CTMPs will need to consider the suitability and effects prior to the use of those other road corridors and may require specific mitigation, such as restrictions on the number or time of day / week that construction vehicles could utilise those corridors.

Other key considerations relating to the construction traffic and transport effects of the TLC corridors are discussed below, such as speed limits, pedestrians and cyclists, property access and parking, as well as on-street and public parking.

5.5.2 Speed limits

To maintain the safety of all road users, it is recommended to implement a safe and appropriate temporary speed limit during the construction period on the network within the extent of works, and along construction routes, if needed. This should be in accordance with the latest traffic management standards at the time of construction. These recommended measures and other measures highlighted in the CTMP are expected to reduce the potential safety risks that may be associated with construction traffic.

5.5.3 Property access for residents and businesses

The construction works may impact property access for residents and businesses in the Project areas. This will lead to temporary inability to get in and out of driveways and allow for business operations to occur. This construction effect may adversely impact business operations and restrict movement for residents in the area.

During construction, temporary traffic management controls such as temporary concrete or steel barriers will be required along the corridor. Existing driveways that are required to remain operational during construction will require temporary access provision. It is anticipated that the contractor would undertake a property-specific assessment of any affected driveways and provide temporary access arrangements if required. Temporary access should ensure the ability for residents to safely access and exit the property. These requirements should be captured in the CTMP or SSTMP.

Consideration could include access to the properties, restricted truck movements during school pick up and drop off times, or additional controls at key access locations. Loading and servicing arrangements for commercial and industrial properties should also be considered as part of the CTMP where necessary.

The construction of the following project elements may have an impact on surrounding property access:

- Manuia Road/ Oakleigh Avenue/ Hitchcock Road roundabout - construction works will need to be managed so that access to the adjacent sites is maintained;
- Effect on Manuia Road access – access to properties along the cul-de-sac street should be maintained;
- Manuia Road/ Great South Road intersection - works will primarily consist of shoulder widening. Access to adjacent sites should be maintained;
- Closure of Takanini Road - access to adjacent sites should be maintained; and
- Accessways on Taka Street and Walters Road - access to adjacent sites should be maintained.

Generally, access along the existing Project alignment will be maintained, however, some closures will be needed for critical activities at night or on weekends. The construction staging may need to

prioritise the construction of the new access lanes for access to the existing residents and stakeholders along the Project alignment to minimise any access disruptions.

5.5.4 Temporary traffic management effects assessment

It is considered that temporary effects on the network from construction activities can be adequately managed through the implementation of a CTMP during the construction phase of each TLC grade-separated bridge. The purpose of the CTMP is to ensure the construction of each bridge is managed in such a way that enables safe and efficient movement of local traffic throughout the construction period and to minimise disruption to road users, particularly adjacent businesses, and residential properties and local, social and community activities. If required, SSTMPs should be developed to manage constraints on access to affected properties.

It is anticipated that the larger part of works required for this package of projects will likely be adjacent to or on the live carriageway, which means that temporary traffic management will be required. The scale of temporary traffic management to delineate live traffic away from the construction zones is largely dependent on the various stages and requirements of the construction activities. The rail works could be undertaken during scheduled line shut down periods and night works will be limited.

It is expected that short term temporary road closure for nights or weekends may be required for specific activities, such as road surfacing, traffic switches and gas / other utilities relocation. Other activities may require stop / go or contraflow traffic management, such as drainage, utility relocation, survey, and investigation work. The effect here is that the road(s) may still need to be closed during certain periods such as during nights or in the weekend. This will still have an impact on people in the area and access in the area. As mitigation, a CTMP is to be prepared that addresses how these works should be managed.

The effect of temporary road closure or other traffic management methods to existing traffic on the specific corridor and adjacent road network should be confirmed in the future as part of the CTMP for each project, based on the current traffic environment at the time of construction. This will consider the level of growth and activities that has occurred in the surrounding area, the availability of alternative routes, and any additional sensitive land use activities.

Current vehicular access to the Takaanini Station park and ride is via Station Road and pedestrian access to the station is provided via Maru Road, Station Road, Manuroa Road, and Taka Street. Accesses via Manuroa Road and Taka Street fall within the Project area and will be impacted by construction. Continued access to Takaanini station during construction of the bridges will be very important and should be managed via the CTMP. This should also consider the requirements of those with mobility and sight challenges as well as other disabilities.

5.6 Recommended measures to avoid, remedy or mitigate construction effects

It is recommended that the potential construction traffic effects be accommodated and managed appropriately via a CTMP. Based on the assessment of transport construction effects, it is recommended:

- A CTMP be prepared prior to the Start of Construction for a Stage of Work. Any potential construction traffic effects shall be reassessed prior to construction, considering the specific construction methodology and traffic environment at the time of construction;
- The objective of the CTMP is to avoid, remedy or mitigate, as far as practicable, adverse construction traffic effects. To achieve this objective, the CTMP shall include:
    - Methods to manage the effects of temporary traffic management activities on traffic;
    - Measures to ensure the safety of all transport users;
    - The estimated numbers, frequencies, routes, and timing of traffic movements, including any specific non-working or non-movement hours to manage vehicular and pedestrian traffic near schools or to manage traffic congestion;
    - Size access routes and access points for all construction vehicles, the size and location of parking areas for plant, construction vehicles, and the vehicles of workers and visitors;
    - Identification of detour routes and other methods to ensure the safe management and maintenance of traffic flows, including pedestrians and cyclists, on existing roads;
    - Methods to maintain vehicle access to property and/or private roads where practicable, or to provide alternative access arrangements when it will not be;
    - The management approach to loads on heavy construction vehicles, including covering loads of fine material, the use of wheel-wash facilities at site exit points and the timely removal of any material deposited or spilled on public roads;
    - Method that will be undertaken to communicate traffic management measures to affected road users (e.g., businesses, residents, public, stakeholders, emergency services);
- Auditing, monitoring, and reporting requirements relating to traffic management activities shall be undertaken in accordance with Waka Kotahi's Code of Practice for Temporary Traffic Management (**CoPTTM**); and
- Any CTMP prepared for a Stage of Work shall be submitted to Council for information ten (10) working days prior to the Start of Construction for a Stage of Work.

In addition to the above, the management plan is required to mitigate the effects of closure of east-west connections during construction. The plan should consider the following:

- The construction of crossings are to be coordinated in order to mitigate effects;
- A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of Spartan Road or Manuroa Road level crossings such as constructing **Manuia Road** bridge. i.e., Spartan Road and Manuroa Road level crossings will not be closed until Manuia Road grade-separated bridge is constructed;
- A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Taka Street** level crossing during construction. This could mean the following:
    - Partial closure (provide a temporary road); and/or
    - Reroute traffic to an alternative connection such as Manuroa Road
- A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Walters Road** level crossing during construction. This could mean undertaking offline construction or partial closure; and
- Appropriate timing of closures and community engagement can mitigate impacts.

5.7 Summary of adverse construction effects and mitigation

Potential adverse construction effects have been identified, which are determined to be temporary impacts during the time of each construction period. The potential adverse effects and recommended measures to mitigate these effects are summarised in Table 27.

Table 27: Potential construction adverse effects

Anticipated effect	Mitigation	Scale of anticipated effect (with mitigation in place)
Temporary disruption to people movement and vehicle movement in the area for an indicative construction duration of 2.5 – 3 years. Reduced network resilience due to multiple level crossing closures during construction. If one corridor is closed for construction without an alternative, the network will see an increase in congestion and reduction in network resilience.	A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of Spartan Road or Manuroa Road level crossings such as constructing **Manuia Road** bridge. A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Taka Street** level crossing during construction. This could mean the following: • Partial closure; and/or • Reroute traffic to an alternative connection such as Manuroa Road. A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Walters Road** level crossing during construction. This could mean undertaking offline construction or partial closure. Appropriate timing of closures and community engagement can mitigate impacts.	Low to moderate adverse effect.
Traffic generated during construction, including construction vehicle movements to and from the construction areas, partial or full road closure, temporary speed limits restriction around site access, and impacts to vulnerable road users. Points of conflict along the TLC corridors include access points along each corridor.	Able to be managed/ mitigated through traffic management such as CTMPs and engagement before construction commencement. Short term in nature.	Low adverse effect.
Access to properties along TLC corridors may be impacted by temporary traffic management	Existing driveways that remain during construction will be required to have	Low adverse effect.

Anticipated effect	Mitigation	Scale of anticipated effect (with mitigation in place)
controls during the construction works.	safe temporary access provision to mitigate this effect.	
Construction vehicles parking in the surrounding network.	Provide construction parking facilities within the site footprint. Construction site workers should be provided with allocated parking facilities to access the site so that local business parking will not be impacted.	Low adverse effect.

The adverse effects will be temporary although under some extended periods and the effects are able to be appropriately mitigated. The temporary adverse effects are in the context of addressing constraints and problems in the transport system for the public good.

It is recommended that the potential construction traffic effects are accommodated and managed appropriately via a CTMP for each stage of construction.

6 Assessment of operational effects

This section describes how each element of the transport system will function operationally after construction of the Project, and therefore the effect it will have on the existing and likely future environment. Given the intention of the Project is to provide for and support the future urban development planned in the area, the future environment has been informed by 2048+ land use forecasts. This is expected to identify the broadest envelope of effects, noting that the scale of impact could be positive or adverse to a smaller scale in the shorter term.

This section compares the Project in the future environment, against a baseline scenario where the Project does not exist in the future environment in order to assess the transport effects. The baseline scenario assumes that the rail upgrade projects such as CRL proceed (as separate projects), with consequential impact in Takaanini from the progressively worsening delays and safety risks at the level crossings.

6.1 Design philosophy

The overall purpose of the Project is to provide for the future growth and deliver on the outcomes relating to safety, resilience, climate change, travel choice and accessibility.

Transport modelling is used to inform, rather than as a pure basis for, decisions on the design and planning of the transport network, corridors, and intersections. While the Project improves local connectivity in the network, the purpose is not to be able to accommodate all traffic demand in the network as to avoid a ‘predict and provide’ approach.

This design philosophy is relevant to the assessment of operational effects as it covers the approach taken to assess the Project.

6.2 Overall system outcomes summary

Figure 34 summarises the system-level outcomes expected of the TLC package, as identified in the TLC DBC. The information is focussed on the investment outcomes of the TLC DBC and provides background context for the Project. Some indicators from the TLC DBC have been updated in the following sections due to updated model inputs, however the outcomes are largely consistent with the TLC DBC.

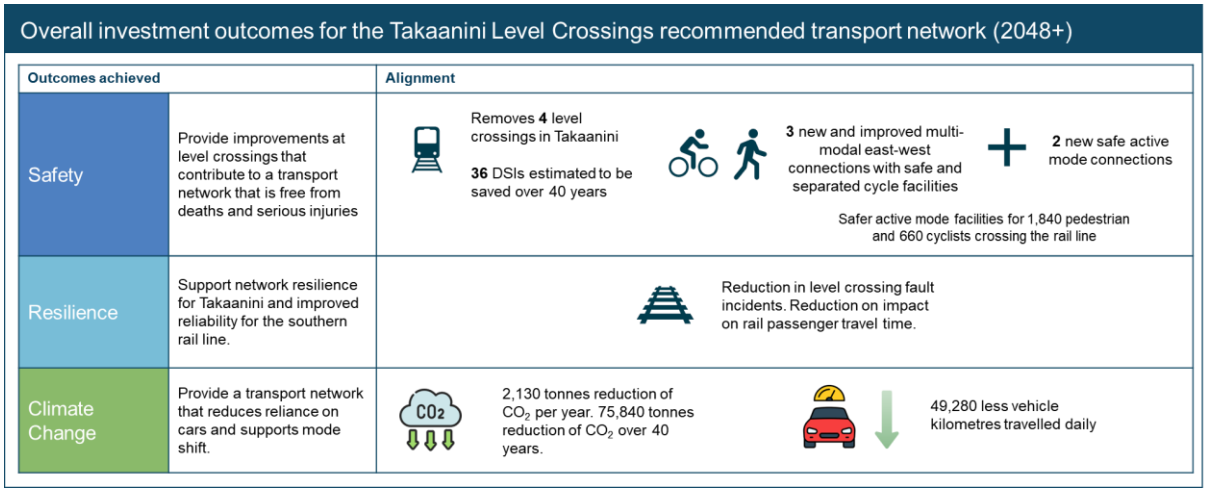


Figure 34: Overall outcomes summary

The key east-west corridors that are recommended in the Takaanini network are as follows:

- **Spartan Road** – A key walking and cycling connection providing access between Great South Road and the Takaanini industrial area. This active mode facility will provide connectivity to the Southern Path which is part of the regional cycle network. A Spartan Road active mode connection will reduce severance caused by the Papakura Stream to the north. It is expected that walking and cycling demand will increase on Spartan Road, contingent on the development of the industrial zone surrounding Spartan Road. This walking and cycling connection will provide access to employment in the future, given the expected increase in jobs in the Takaanini industrial area.
- **Manuia Road** – A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. Manuia Road will connect Great South Road to the Takaanini industrial area and will be a key freight connection, enabling access to employment.
- **Manuroa Road** - A key walking and cycling connection providing access between Great South Road and key destinations on the eastern side of the rail line such as Takaanini School, Takaanini Train Station and the neighbourhood centre. Manuroa Road will increase active mode permeability across the southern rail line in the Takaanini network.
- **Taka Street** - A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. Taka Street has a wider strategic function of connecting with Airfield Road to provide an east-west connection through to Clevedon. Taka Street also provides connectivity to the Conifer Grove residential catchment on the western side of SH1.
- **Walters Road** - A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This connection will provide access to adjacent retail and nearby recreational activities. Walters Road has a wider function of providing an east-west link between Great South Road and the N-S Mill Road strategic arterial.

The east-west connections in the recommended network are recommended to be in the form of a bridge (road-over-rail). The alternatives considered for the east-west connections, along with the rationale for bridges, is set out in the Assessment of Alternatives (refer to Appendix A of the AEE).

6.3 Assessment of project objectives

There is one overarching project set of objectives for the NoRs sought by AT. The Project objectives in their entirety are of particular relevance to the assessment of the operational effects of the Project,

as they cover themes of safety, movement, supporting growth and accessibility, resilience of the network and mode shift, which are measures relevant to the operation of the Project. The assessment of how the Project achieves these objectives is set out in detail in the AEE.

6.4 General traffic

Figure 35 shows the expected future network for general traffic based on the Project being in the network. All TLC corridors that are proposed as a multi-modal grade-separated bridge (Manuia Road, Taka Street and Walters Road) will have a 'secondary arterial' role in the network:

- **Taka Street** is classified as a secondary arterial with and without the Project in the likely future environment. This is due to the strategic east-west function that Taka Street plays with Airfield Road and connecting further east to the Ardmore/ Clevedon area;
- **Manuia Road** connects Great South Road through the industrial area to Popes Road which is expected to urbanise in the future environment; and
- **Walters Road** is also expected to be a secondary arterial connecting Great South Road to Mill Road.

Spartan Road and **Manuroa Road** are expected to play a local function around the level crossings specifically as they will be closed and form cul-de-sacs on either side of the rail line. The role of these corridors is to provide access to adjacent properties and provide active mode connections over the rail line.

Since the Project is proposing to close two existing level crossings: Spartan Road and Manuroa Road, this will have an effect on the environment and vehicular traffic, as vehicles that would typically use these connections will have to use alternative routes. Manuia Road is proposed as the alternative vehicular route for these existing level crossings. Manuia Road will provide a more functional industrial connection compared to the existing Spartan Road level crossing connection. The heavy freight traffic that currently uses Manuroa Road will also use the new Manuia Road connection. This will limit heavy freight movement through a residential environment. Manuroa Road will be replaced by an active mode connection which is expected to enable sustainable outcomes, given this connection is directly adjacent to the Takaanini Train Station.

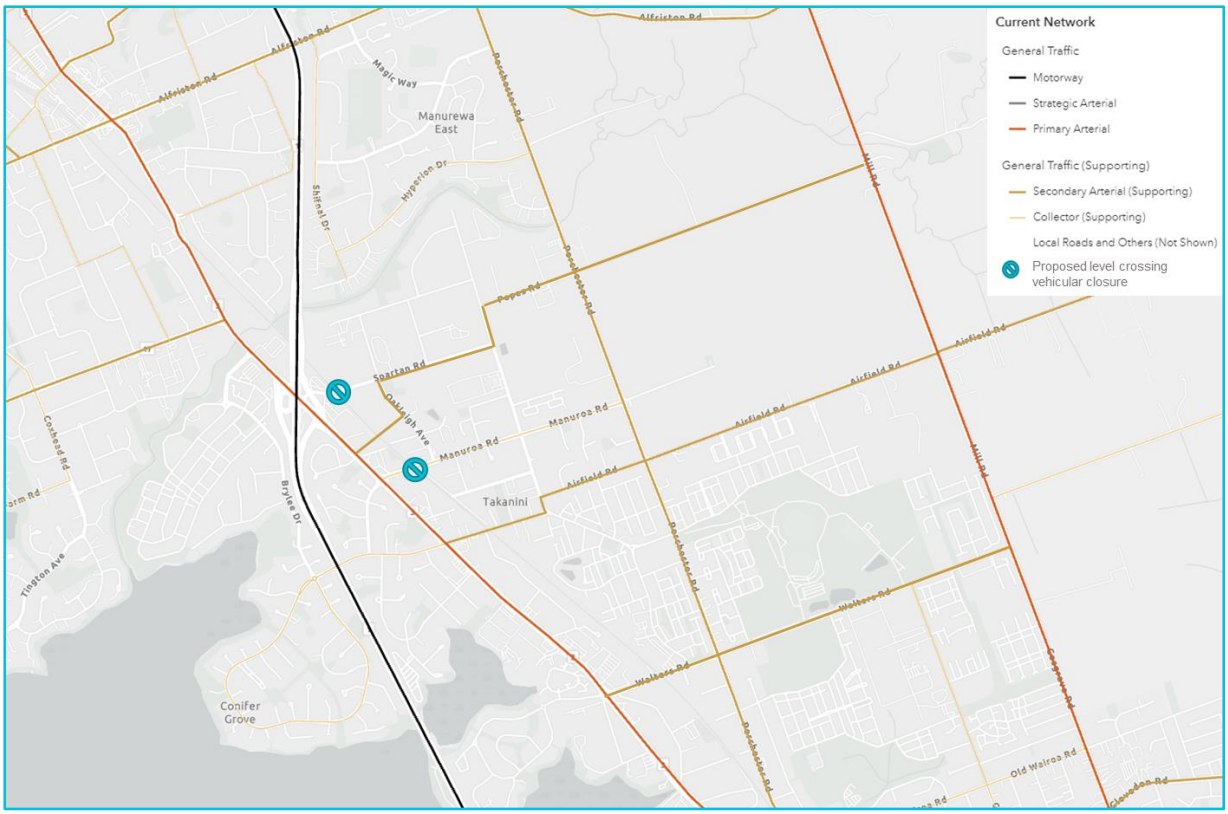


Figure 35: Future general traffic network (Future Connect)

The forecasted 2048+ daily traffic flows and peak hour volumes for the grade-separated corridors are summarised in Table 28.

Table 28: Forecasted 2048+ daily and peak hour volumes for the grade-separated bridges

Corridors	2048+ daily volumes (vpd) (two-way)	2048+ maximum peak hour volumes (two-way)
Manuia Road	23,600 vpd	1,720 vph
Taka Street	16,900 vpd	1,150 vph
Walters Road	12,600 vpd	1,130 vph

The proposed typical corridor cross section design for the bridges (one general traffic lane in each direction), shown in Figure 36, is considered to meet the forecasted needs and is suitable to achieve the desired outcomes on the corridor. It is to be noted that the expected daily flows on Manuia Road is comparatively high. However, this is contingent on the development of the aspirational employment growth forecasted in the Takaanini industrial area. If this growth does eventuate, then there is a risk that the queues on the Manuia Road intersection arm may extend quite far during the peak periods. To mitigate this effect, a full width flush median has been allowed for in the designation. This flush median extends to the full length of the Manuia Road bridge, hence the stacking queue length on the Manuia Road arm can accommodate the queues without impacting the adjacent intersections.

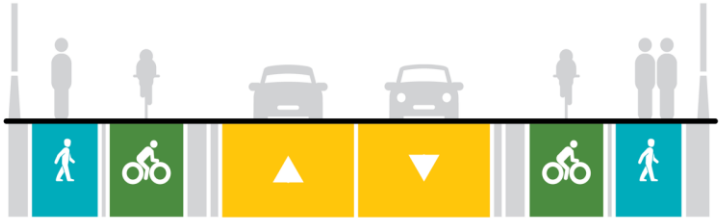


Figure 36: Two lane bridge cross section

6.4.1 Network performance

The Project closes four level crossings and replaces them with three multi-modal connections and two active mode connections. Table 29 shows which east-west connections will be kept open or closed for both vehicular traffic and for active modes.

Table 29: TLC corridors proposal

East-west connection	Vehicular traffic (open/ closed)	Active modes (open/ closed)
Spartan Road	Closed	Open
Manuia Road	Open	Open
Manuroa Road	Closed	Open
Taka Street	Open	Open
Walters Road	Open	Open

Table 30 displays the capacities of the east-west connections in the scenario without the Project, which consists of the existing level crossings, and with the Project. Table 30 shows that the Project will provide for increased movement capacity across the east-west connections across all peak periods, compared to the Do-Nothing scenario. This is because the multi-modal bridges are not constrained by the level crossings and associated barrier down-time. In the morning and evening peak period the Project provides for 2,080 more vph across the east-west connections. In the interpeak period, the Project provides for 660 more vph across the east-west connections.

Table 30: East-west connections capacities

East-west connection	Do Nothing				With Project			
	Open/ closed	AM/ PM link capacity[20] (vph)	IP link capacity (vph)	Daily link capacity (vpd)	Open/ closed	AM/ PM link capacity (vph)	IP link capacity (vph)	Daily link capacity (vpd)
Spartan Road	Open (restricted movement turning right out of Spartan Road onto Great South Road)	380	650	4,300	Closed	N/A	N/A	N/A
Manuia Road	N/A	N/A	N/A	N/A	Open	1,200	1,200	8,930
Manuroa Road	Open	460	820	5,380	Closed	N/A	N/A	N/A
Taka Street	Open	540	930	6,140	Open	1,400	1,400	10,420
Walters Road	Open	540	940	6,200	Open	1,400	1,400	10,420
Total veh capacity	-	**1,920**	**3,340**	**22,020**	**-**	**4,000**	**4,000**	**29,770**

To summarise:

- The Project would increase east-west network capacity significantly in the morning and evening peak periods and to a lesser extent in the interpeak period; and
- The Project thereby, improves local connectivity, access and wider network resilience.

[20] Estimated link capacity based on barrier closure times and flows.

Table 31 below provides a summary of east-west daily demands.

Table 31: East-west capacity demands (AADT)

East-west connection	Do Nothing Demand	With Project Demand
Alfriston Road	17,390	17,250
Spartan Road	9,270	N/A
Manuia Road	N/A	23,620
Manuroa Road	12,820	N/A
Taka Street	6,980	15,480
Walters Road	9,120	13,350
Subway Road	20,510	17,230
TOTAL	76,100	86,920

Figure 37 shows the difference in daily traffic flows with and without the Project in the network. The green bands indicate there is greater traffic daily traffic flow on the link due to Project, while the blue bands indicate there is expected to be less traffic on the link. The width of the bands indicates the scale of difference between the two scenarios.

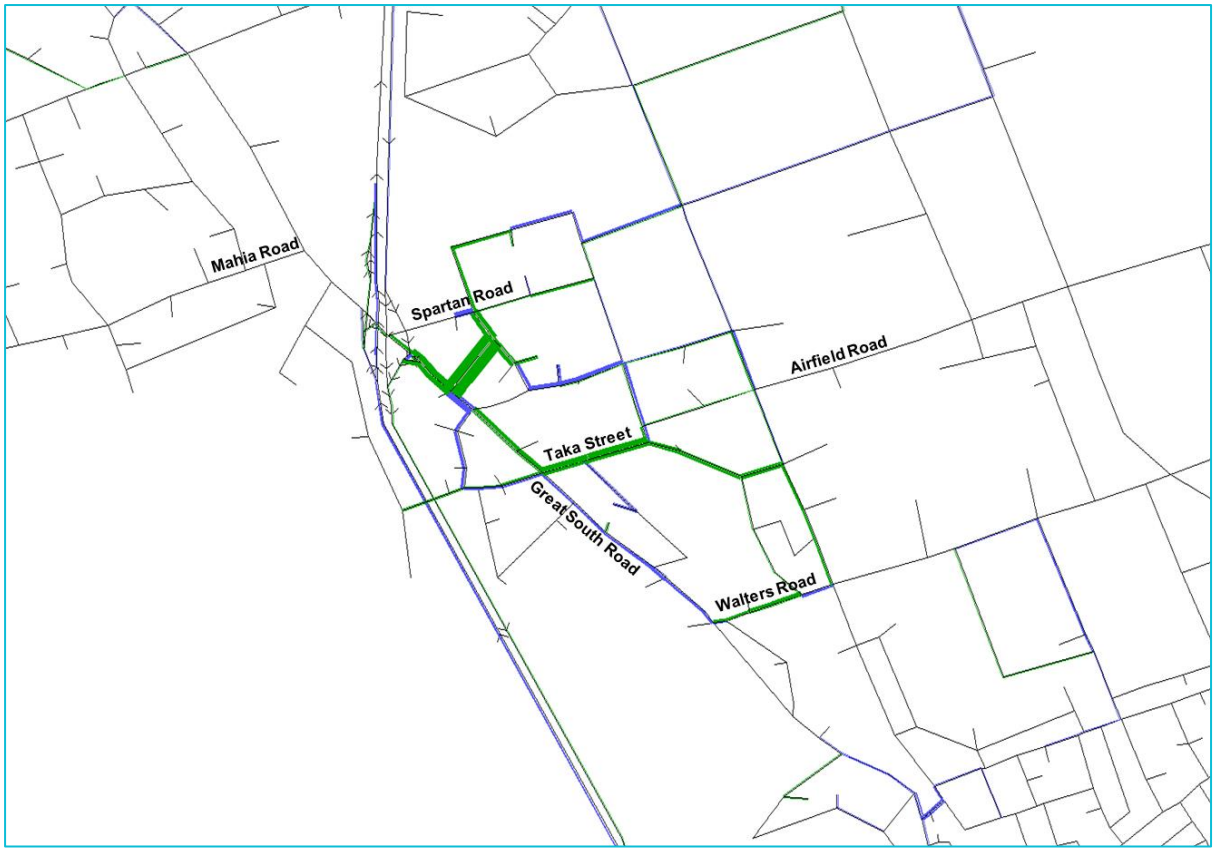


Figure 37: 2048+ daily traffic flow difference plot (with the Project – without the Project)

Key findings:

- There is expected to be a large amount of daily traffic on Manuia Road as it is a new connection in the network;
- Less daily traffic is expected to traverse on Manuroa Road in the eastbound direction as Manuroa Road is being closed
- There is expected to be an uplift of 8,500 daily traffic traversing on the new Taka Street bridge compared to the Taka Street level crossing in the Do-Nothing scenario; and
- There is expected to be an uplift of 4,200 daily traffic traversing on the new Walters Road bridge compared to the Walters Road level crossing in the Do-Nothing scenario.

6.4.2 Accessibility

It is expected that without the Project, future increased activity relating to the NIMT will increase severance to east-west movement and connectivity in the Takaanini network. The long-term (future environment) will also generate more growth in the Takaanini area and consequently a larger catchment of those wishing to travel. Travel time for east-west trips across the rail line will be impacted by the increased barrier-down time at the existing level crossings.

The grade separation of the TLC corridors reduces severance caused by the NIMT in the Takaanini network. Table 32 shows the expected average travel time via car between Takaanini east and Takaanini west and to key employment areas such as Manukau and Wiri, for both with and without the Project. Table 32 shows that having the Project in the network increases accessibility across the rail line by reducing travel times to key destinations. Between the eastern and western side of

Takaanini, the average travel time is expected to reduce by 1.2 minutes. Travel time between Takaanini East and Manukau, a key metropolitan area, is also expected to reduce by 1.3 minutes.

Table 32: Average travel time via car between Takaanini east and key employment areas (minutes)

	Takaanini West	Manukau	Wiri
Do Nothing	4.5	13.7	19.6
With Project	3.3	12.4	19.3
Difference	1.2	1.3	0.3

Without the TLC corridors in the network, it is expected that people will have increased travel times for their east-west trips due to the need to divert onto alternative routes such as Porchester Road, Alfriston Road and Great South Road. Consequently, this would increase traffic pressure on the proposed FTN route. The attractiveness of the travel time savings is viewed to be a key factor for mode shift in the area. Table 32 above which extracts data from the model, depicts the average travel time, however, does not convey travel time reliability and therefore, the overall experience for a driver. The model cannot predict travel time reliability and thus driver frustration.

The proposed closures at Spartan Road and Manuroa Road will have specific effects on accessibility for those living in the area. The separate effects of closure at Spartan Road and Manuroa Road are noted in **Sections 7.1.3.1** and **7.3.3.1** of this Report respectively.

Takanini Road closure effects

Takanini Road currently intersects with Taka Street. It is to be noted that the Taka Street grade-separated bridge will result in the closure of Takanini Road, forming a cul-de-sac. Takanini Road largely serves residential properties as well as the Takanini Hall which is used by the community. The southern section of Takanini Road, which becomes Glenora Road, provides a vehicular access point to the Takanini Countdown car park and other amenities.

Takanini Road is within the walkable catchment of the Takaanini Station under PC78 as depicted in Figure 38. This indicates that development up to six storeys is possible along Takanini Road in the future. Hence, the amount of traffic wishing to access to and from the development along this area may increase in the future. Hence, closing Takanini Road / Taka Street and the additional traffic generated by any potential future development may put additional pressure on the following intersections:

- Glenora Road/ Great South Road – signalised intersection;
- Taka Street/ Great South Road – signalised intersection; and
- Beach Road/ Great South Road – priority stop-controlled intersection.

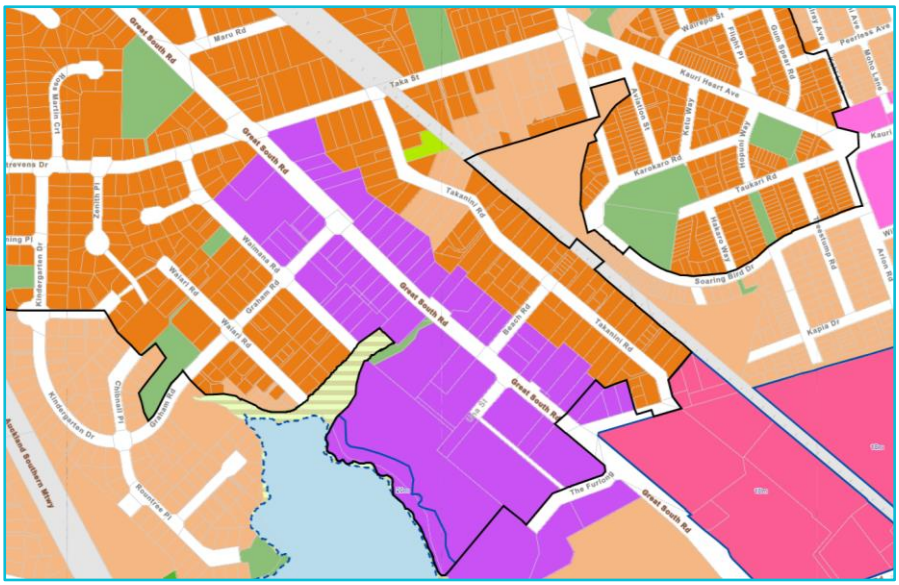


Figure 38: Takanini Road is within the walkable catchment under Plan Change 78

The closure of Takanini Road with Taka Street will have an effect on the environment as vehicle users who would typically traverse through this link will have to divert via Glenora Road or Beach Road to access Great South Road and Taka Street. Pedestrians and cyclists can continue to have access from Takanini Road to Taka Street as the proposed cul-de-sac head on Takanini Road will not prohibit this movement for these road users. There is also an opportunity at the time of implementation, to provide direct access from Takanini Road, onto the Taka Street bridge via stairs / ramp.

Takanini Road is currently used as a rat-running route for vehicles to avoid congestion and signalised intersections along Great South Road. There is expected to be around 3,300 vehicles traversing along Takanini Road, without the proposed closure at the northern end of Takanini Road. From the 3,300 vehicles, only 1,500 vehicles are estimated[21] to enter / leave the properties in this zone, while the rest of the traffic (40% - 50%) is using this route to rat-run. The closure of Takanini Road is expected to significantly reduce rat running along this corridor in the network. There will however be an increase of 1,400 daily vehicles accessing Takanini Road either through the intersection at Beach Road / GSR or Glenora Road / GSR as the northern access is proposed to be removed. Some traffic may also be rerouted to the east of the rail line to use Walters Road, Arion Road, Kauri Heart Avenue and Taka Street. However, this diversion of traffic is not considered significant.

It is the trips between the north / northeast and the northern end of Takanini Road i.e. Takanini Hall which would be diverted to detour via Great South Road Beach Road or Glenora Road. Figure 39 and Figure 40 show the expected diversion route due to the closure of Takanini Road / Taka Street.

[21] Based on local transport model (SATURN) and observations.

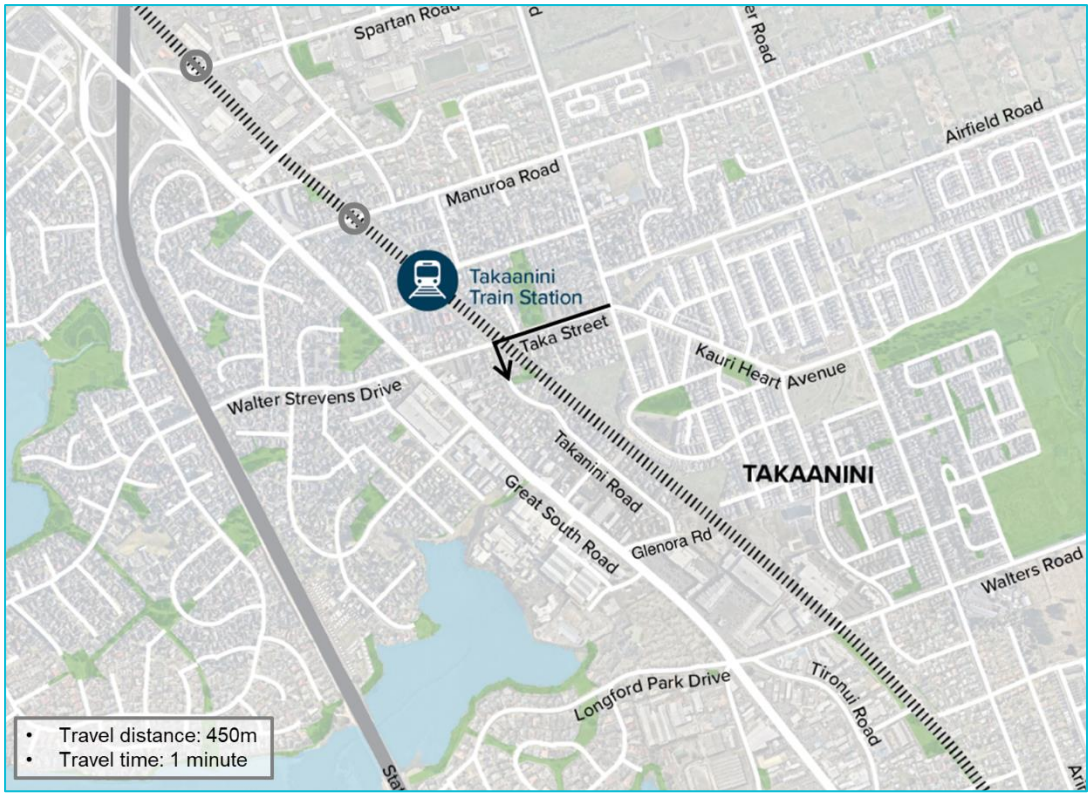


Figure 39: Current routing to Takanini Hall from the north-east

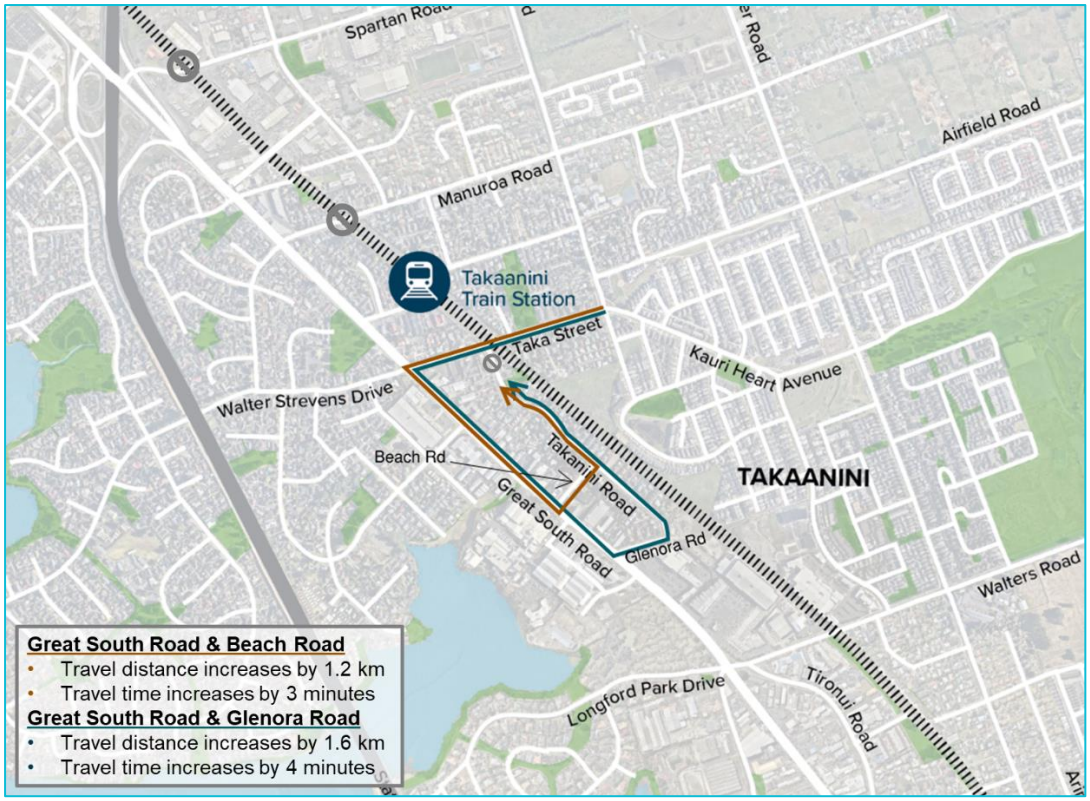


Figure 40: Routing to Takanini Hall from the north-east (due to the proposed Takanini Rd/ Taka St closure)

Key points to note include:

- Travel distance and time are expected to increase by 1.2 - 1.6 km and 3 - 4 minutes, respectively for those traveling to/ from the north and the northern end of Takanini Road;
- Trip routing to the southern end of Takanini Road is unaffected by the closure at Takanini Road / Taka Street;
- Rat-running via Takanini Road is expected to reduce significantly;
- An increase of approximately 1,400 daily vehicles is expected to access Takanini Road either through the intersection at Beach Road / GSR or Glenora Road / GSR; and
- Development traffic may increase as future development is enabled via PC78.

Overall, the proposed closure at Taka Street / Takanini Road does not have significant adverse effects on the surrounding environment. However, recommended mitigation is for signage to be provided on Taka Street which would help the community with wayfinding to the community hall.

6.4.3 Impacts on strategic network

Figure 41 shows the difference in delay between the networks with and without the Projects for the morning peak period. The green sections on the plot show where the delay has increased in the scenario with the Project, compared to without the Project. While the blue sections indicate where the delay is expected to reduce due to the Project. The width of the lines indicates the scale of increase or decrease in delay between the two scenarios. Figure 41 shows there is a delay increase of 168 seconds on the SH1 on-ramp in the morning peak period due to the Project. This indicates that it takes an additional 2.8 minutes to get onto the motorway, relative to the future Do-Nothing scenario.

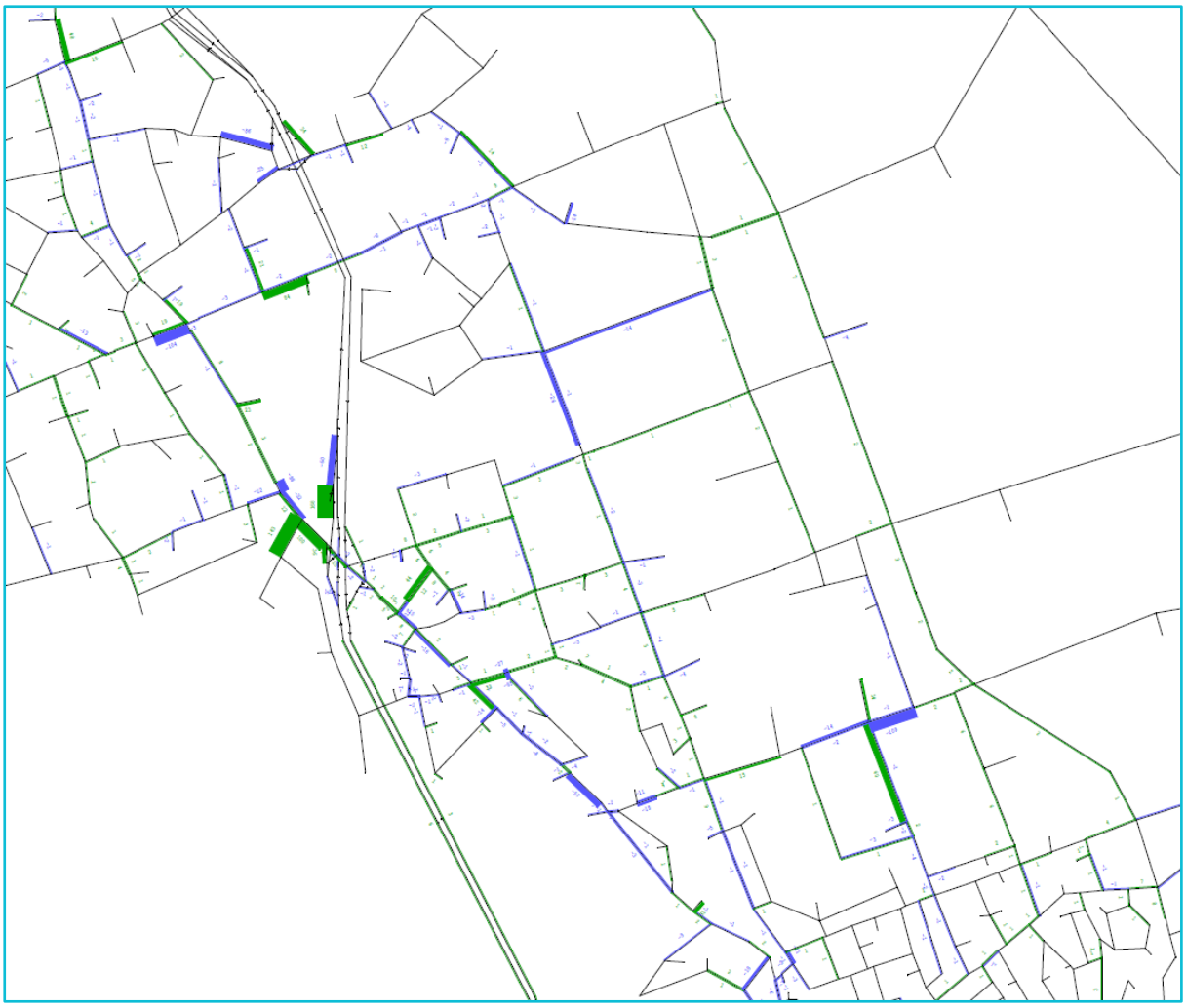


Figure 41: SATURN delay comparison for AM peak with and without the Project

The plot also shows increased delay at the intersections on the northern side of the interchange such as at Te Napi Drive of approximately 1.6 – 2.3 minutes. Overall, the impact of these increases in delay in the network are minor compared to the local accessibility provided by the new east-west connections.

The Project improves local access for Takaanini and increases access between the area and the strategic network (SH1). However, the increased local accessibility could impact movements on SH1 if the on-ramp is not managed appropriately. Currently, ramp signalling is used at both on-ramps to manage the effect. It is expected that such on-ramp management will continue as normal operation of SH1, however, the need to expect and accommodate the ramp flow changes would need to be proactively considered at the time of implementation. It is to be noted that if the on-ramp traffic is not managed via the ramp signals, the increased on-ramp demand could worsen merge disruptions and increase delays to through traffic on SH1 during congested peak periods. Delays would be increased specifically in the northbound direction on SH1.

Both state highway on-ramps are situated on the western side of Great South Road. This means that the Great South Road left-hand lane going northbound becomes congested during peak periods. SH1 is and will continue to be protected by the ramp signals. However, it is expected that queuing on the on-ramp loop may worsen due to increased accessibility in the network. It is to be noted that the SH1 on-ramp forms a loop, hence, there is a relatively long length provided to allow for queuing space.

However, ramp signalling may lead to queues stacking along the stretch of the loop to back onto Great South Road during the morning peak period. This could lead to a negative effect of causing increased congestion on Great South Road. The morning peak delay difference plot shows that there is an additional 8 second delay in the NB direction, on Great South Road, south of the Manuia Road intersection due to the Project. This delay difference increases through the interchange to 15 seconds, to 36 seconds and 168 seconds along the length of the on-ramp. This indicates that there is a risk that queues can back onto the left turning lane on Great South Road in the northbound approach. It should be noted that the model does not show congestion on individual lanes and depicts a delay that is averaged across all lanes in that direction. Hence, the model does not fully depict the congestion in the left lane as, in reality, this lane would experience more congestion during peak periods. Hence, there is a greater negative traffic effect on the left lane in the peak periods.

With the increased accessibility in the Takaanini network, the local community will have a choice to use alternative routes to access SH1 such as the Hill Road / SH1 on-ramp.

Figure 42 shows the difference in delay between the networks with and without the Projects for the evening peak period.

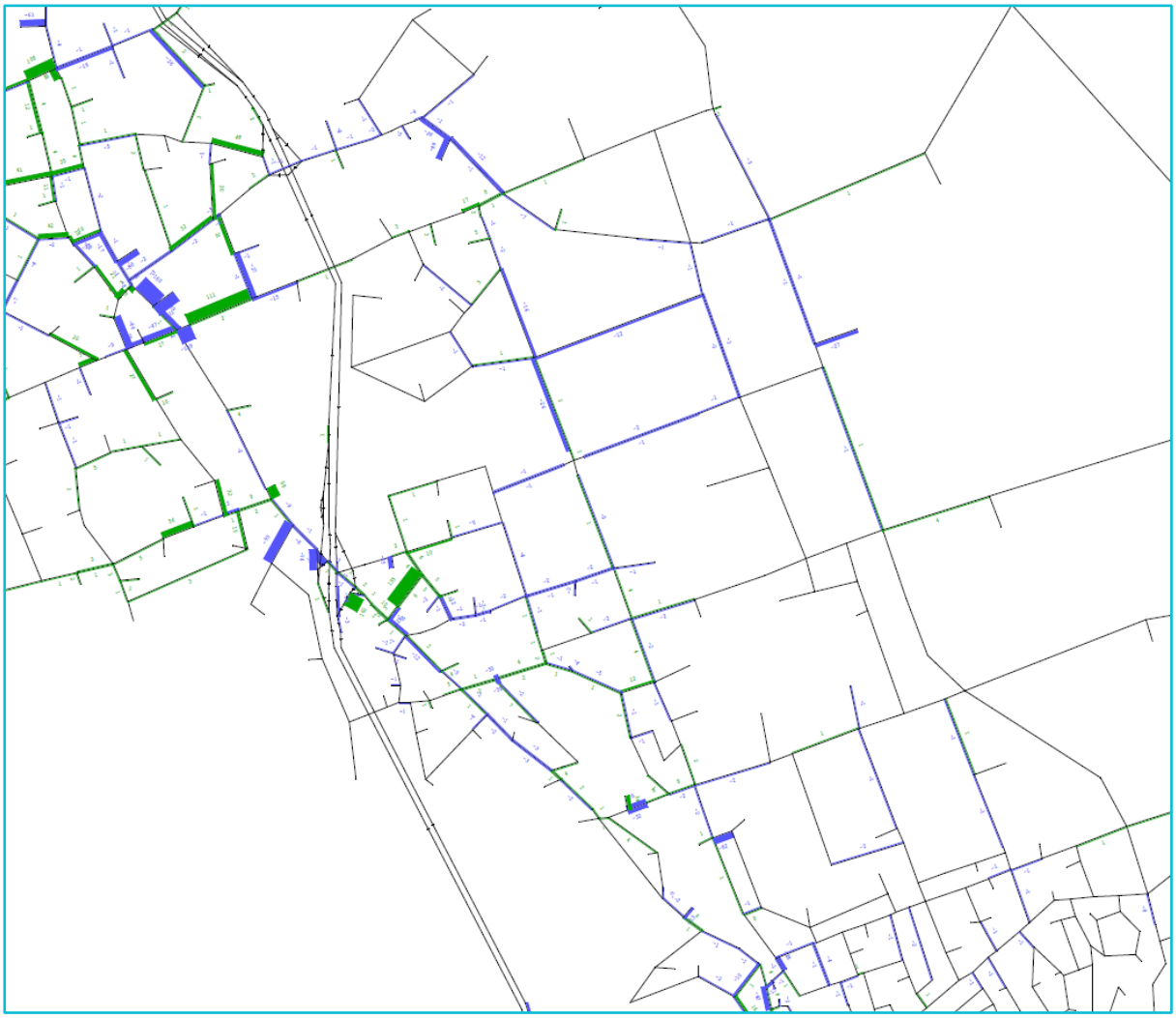


Figure 42: SATURN delay comparison for PM peak with and without the Project

There is an increase of 160 seconds in delay for traffic getting onto the SH1 motorway to travel southbound from Great South Road. The delay difference plot shows minimal increase in delay on

Great South Road itself. However, it should be noted again, that the model does not depict delay per individual lane, and rather, depicts delay averaged out for all lanes in that particular direction. Hence, there may be more delay on the left lane in the evening peak period. There appears to be reduced delay due to the Project, in Manurewa at the Alfriston Road / Great South Road major intersection. However, there is an increase in delay of 1.9 minutes for traffic travelling eastbound on Alfriston Road to access Claude Road which is a motorway access via Hill Road.

Figure 43 shows the total delay across the TLC corridors vehicle hours (**veh-hr**) with and without the Project in 2048+. It should be noted that the total delay on the TLC corridors is less with the Project compared to without the Project, for all three peaks.

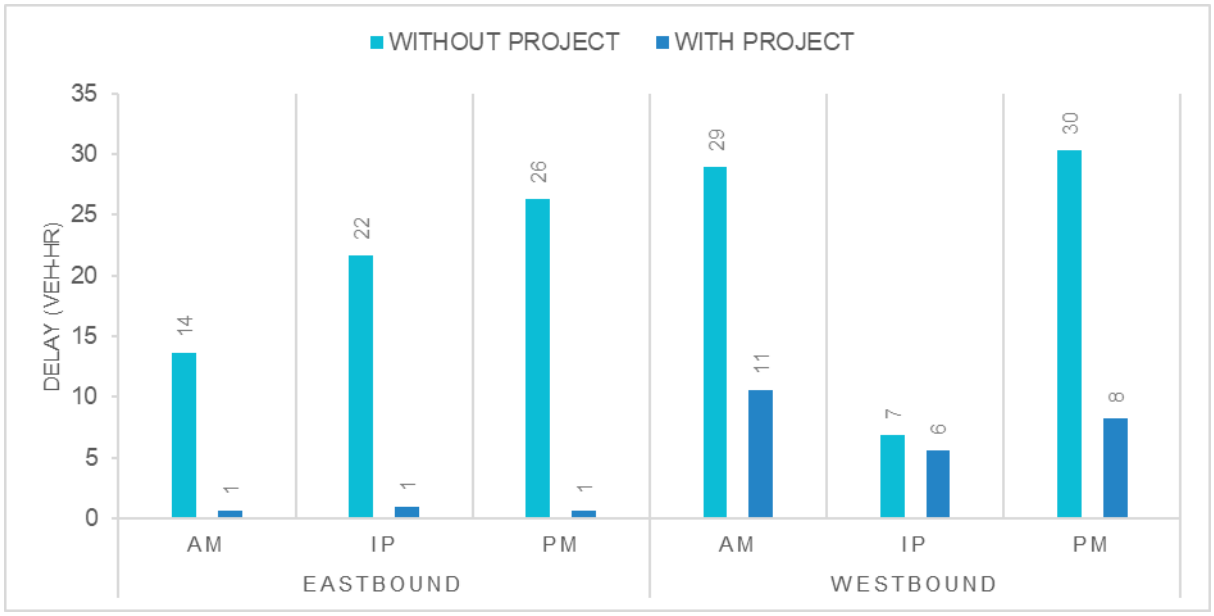


Figure 43: Total delay (veh-hr) across TLC corridors in 2048+

A detailed graph of the average total delay across the TLC corridors (veh-hr) with and without the Project in 2048+ is included in **Appendix E** of this Report.

6.4.4 Intersections

Outputs from SATURN have been used to understand the performance of key intersections. SIDRA has also been used to understand isolated intersection performance with respect to capacity, predicted LOS and anticipated queue lengths.

The SIDRA analysis of key intersections that are part of the Project is undertaken for the 'with Project' scenario for the 2048+ design year. For the degree of saturation and queue distance measures, the difference in outputs between the with and without Project scenarios has been reported. A summary of the key performance outputs is shown in Table 33. More detailed SIDRA analysis is included in **Appendix B** of this Report.

The Level of Service measures 'control delay' on intersections in seconds. AT's Auckland Network Operating Plan[22] provides a benchmark to design intersections which achieve a minimum LOS of C / D for vehicles in the strategic general traffic network during commuting peaks. Typically, LOS rating A, B or C is considered as a positive outcome for traffic, whereas D, E or F increasingly highlights a

[22] Auckland Network Operating Plan, Version 3, November 2020

deficiency for vehicles in that peak. Table 33 shows the three intersections of interest, perform at a minimum of LOS C, indicating that vehicles are not adversely impacted.

Table 33: Summary of intersection performance 2048+ (with Project)

Intersection	Peak Period	Overall Level of Service	Overall Average Delay (s)	Overall Queue Length (m)
Manuia Road / Great South Road	Morning	LOS C	29	260
	Interpeak	LOS C	29	260
	Evening	LOS C	23	150
Manuia Road / Oakleigh Avenue	Morning	LOS B	17	190
	Interpeak	LOS B	11	110
	Evening	LOS B	11	90
Walters Road/ Arion Road (existing layout)	Morning	LOS B	14	80
	Interpeak	LOS B	14	50
	Evening	LOS B	16	50
Walters Road/ Arion Road (added pedestrian crossing on western arm)	Morning	LOS D	40	200
	Interpeak	LOS C	22	80
	Evening	LOS B	18	57

It is to be noted that the distance between the Takaanini SH1 interchange southbound off-ramp and the proposed Manuia Road signalised intersection is roughly 250m. There is the potential that the intersection with Manuia Road and Great South Road will be busy in the peak periods, contingent on the development of the Takaanini industrial zone in the future. This intersection is expected to perform at a LOS C in the morning, interpeak and evening peak periods. There is a risk that queues on the northern arm of Manuia Road / GSR intersection could back to the interchange, impacting the operation of the interchange in busy peak periods. There is a safety risk that if not managed, the queue could extend up through the southbound off-ramp of the SH1 interchange, and vehicles travelling southbound may hit the back off the queue. However, this risk is reduced due to proposed increased stacking length on the northern arm of the intersection. Additionally, this queue could be managed via change in signal operation to reduce safety risks of SH1 ramps, albeit with potentially more delay on other approaches to the intersection.

Heavy queuing is expected on the southern approach of the Great South Road / Manuia Road intersection during the morning peak period. The 95th percentile back of queue shown in **Appendix B** of this Report indicates the queue could extend further, past the Manuroa Road intersection to the south. The 95th percentile back of queue has only a 5% chance of being exceeded, and this metric is not typical of what an average driver would experience in the analysis period. The 50th percentile back of queue for this intersection approach indicates that there is a 50% chance of the queue extending to the Manuroa Road intersection during the morning peak hour. Manuroa Road will be a cul-de-sac and

a local road, indicating the operational importance and significance of this corridor is lower in the future transport network. Hence, the optimisation and effects on the Manuroa Road / Great South Road intersection will be less critical.

The effective stop rate measure in SIDRA is the average number of stops per vehicle in the queue. It is to be noted that the effective stop rate is below 1 on all intersection approaches of Great South Road / Manuroa Road. This indicates that vehicles typically only stop once at the signals, meaning they can get through the intersection within one signal cycle and the intersection is not significantly inefficient.

The current design proposes to retain the existing signalised intersection at Arion Road / Walters Road. This design only has two pedestrian crossings on the northern and eastern intersection legs as per the existing layout. The expected operational performance of the current intersection layout is efficient. A further assessment was undertaken to assess the efficiency of the intersection with pedestrian crossings on all intersection approaches. This will assist in understanding the effects of future designers increasing pedestrian crossings at the intersection. The results shown in Table 33 notes that the pedestrian crossings result in the overall intersection performing with less efficiency for vehicles, particularly for traffic on the eastern arm of Walters Road during the morning peak period. The SIDRAs are based on assumed future pedestrian volumes, hence, this intersection layout would need to be reassessed in the future with more certainty around pedestrian volumes. Minor adjustments can then be made to the intersection within the designation.

Key points to note include:

- The anticipated performance results indicate that the Project generally does not result in adverse intersection performance, with regards to LOS, and difference in average delay and queue length;
- The increase stacking length on the northern arm of the Manuia/ Great South Road intersection mitigates the potential risk of congestion and operational impact on the Takaanini Interchange during busy peal periods; and
- Recommended mitigation is to review the signal operation at the time of implementation and provide sufficient signal green time for the northern arm of Manuia/ Great South Road intersection.

Overall, the Project generally does not result in adverse performance at the key intersections.

6.4.5 VKT Reduction

The Project is estimated to reduce 49,300 **VKT** daily compared to the Do-Nothing scenario. As an indication, the average car user in NZ travels approximately 28 vehicle kilometres daily[23]. At an annual level, the Project reduces 16,188,500 vehicle kilometres travelled compared to the Do-Nothing scenario. VKT reduction is due to the improved local east-west connectivity provided in Takaanini, for traffic that would otherwise be diverted to longer routes.

This reduction in overall VKT in the network is expected to contribute to broader benefits such as reduced crashes, congestion and vehicle emissions.

Key conclusions to note include:

- As displayed in Table 34, the Project reduces 49,300 vehicle kms travelled daily compared to the Do Nothing scenario.

[23] Based on 2020 VKT per capita from the Ministry of Transport, assuming 329 operational days in a year (https://www.transport.govt.nz/statistics-and-insights/road-transport/sheet/vehicle-kms-travelled-vkt).

Table 34: Summary of VKT with and without Project in 2048+

	Without Project	With Project	Difference
Daily VKT	11,352,700	11,303,400	-49,300

6.5 Freight

Current access to and from the Takaanini industrial area is via Spartan Road and Manuroa Road. Since the Project is closing both freight connections and replacing them with Manuia Road, the future freight access will be via the new Manuia Road grade-separated connection. More of the internal industrial network, including Spartan Road and Popes Road in the industrial area will be classified as 'Level 2', a local freight network within a strategic freight area with no competing adjacent land use. It is expected that Popes Road in the FUZ will be classified as a Level 3 and this corridor will be connecting strategic freight areas and providing a connection out to Mill Road. Figure 44 shows the indicative future freight network due to the level crossing closures proposed by the Project.

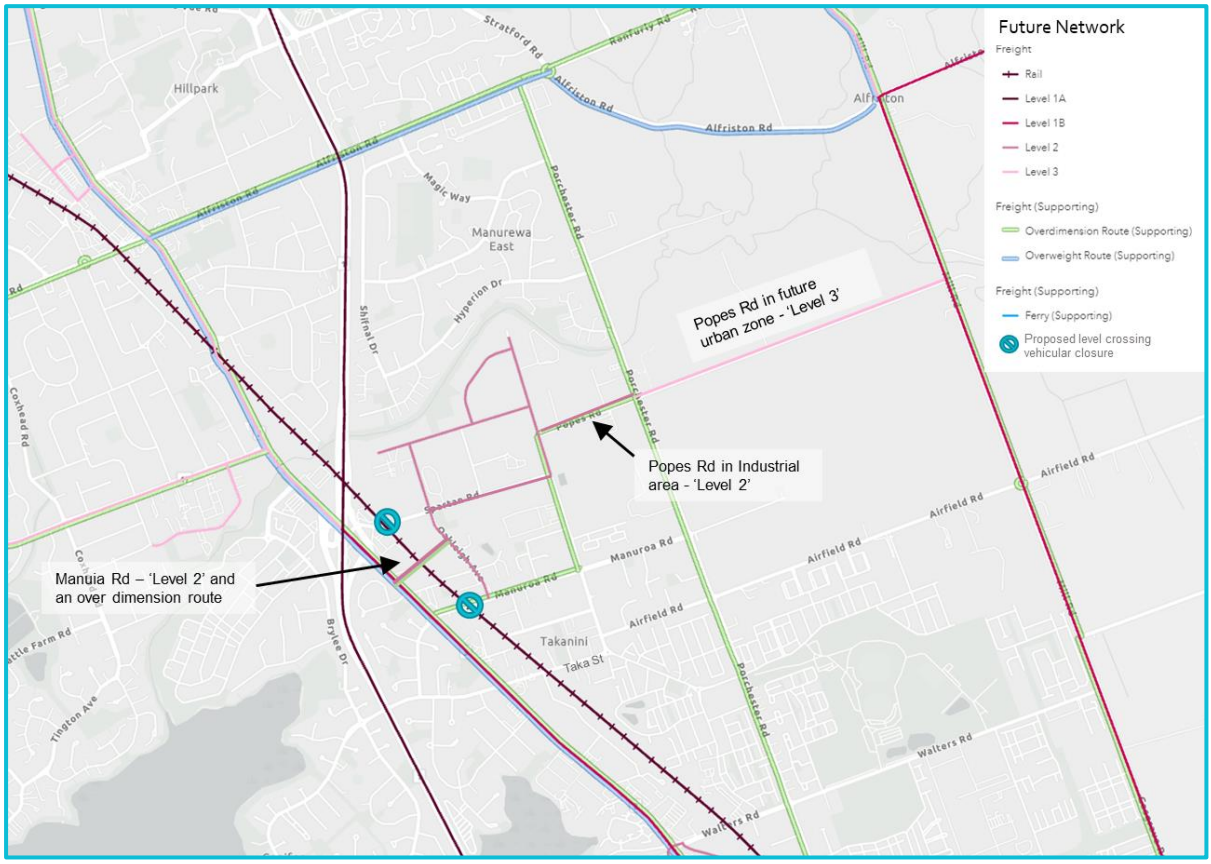


Figure 44: Proposed over-dimension and freight routing through Takaanini industrial area

The vast majority of loads transported on New Zealand roads can be transported within the normal maximum dimensions. Some industries and activities require use of trucks larger than standard vehicles and there can be a number of loads that may exceed these dimensions. Such over-dimension loads place demands on the roading network hence, over-dimension routes are defined as a network across the country, with special design rules that apply to these routes.

The current over-dimension route through the Takaanini industrial area, traverses along Porchester Road, Popes Road, Takanini School Road, onto Manuroa Road to connect with Great South Road. Figure 44 shows that the proposed closure of Manuroa Road level crossing, will impact the current over-dimension routing through the Takaanini industrial area. This is a key effect of the Project, as there will need to be a change in the over-dimension route with a suitable alternative provided to mitigate this effect. The alternative over-dimension route will need to be provided via the future Manuia Road connection to Great South Road. The proposed over-dimension route has been discussed with AT freight SMEs and the NZHHA (New Zealand Heavy Haulage Association). It has been agreed that the new over-dimension route should be provided via Porchester Road and then turn onto Manuroa Road, Oakleigh Avenue, and onto the new Manuia Road bridge. The alternative route should have a clear width and height to accommodate over-dimension vehicles and any overhead powerlines may need to be undergrounded. The roundabout at Manuia Road / Oakleigh Avenue intersection should be designed to allow for enough turning space for over-dimension vehicles. As Manuroa Road is a residential street, it is not ideal to have heavy trucks traversing through this environment. However, the movement of wide loads on over-dimension routes are typically a rare occurrence, hence under these circumstances, Manuroa Road is able to accommodate wide loads as it currently does.

6.6 Safety

Future growth, increased train services and four tracking of the rail corridor will exacerbate the current safety risks at the level crossings. The safety issue will be further exacerbated with the expected growth especially given the intensification around the train stations.

The closure of the existing level crossings with replacement grade separated connections eliminates the safety issues associated with level crossings and the higher frequency of rail services, i.e. the risk of conflict between trains and vehicles and/or active mode users. The Project is expected to have a positive impact on the safety of the future network, given the removal of level crossings will eliminate crashes relating to level crossings occurring in the area. This will specifically reduce the chance of high severity crashes occurring.

The Project is well aligned with the Government Policy Statement on Land Transport 2021 as the Project improves the safety of the rail network and mode shift will make the overall land transport system safer. The Project supports the Government's Road to Zero strategy by providing safer transport options and reducing the chance of death and serious injury crashes occurring in the Takaanini level crossing network. Overall, this Project aligns with the Road to Zero strategy, GPS 2021 direction and Ministry of Transport's outcomes.

Safe system guidance provides that crash risk can be addressed through reducing exposure levels and specifically reducing exposure of pedestrians to crashes. The Project reduces exposure between rail, vehicles and pedestrians through grade separation of the rail level crossing.

The impact on railway crossing related crashes on the TLC corridors has been estimated using a crash rate analysis as per the Crash Estimation Compendium. The crash rate analysis indicated that the Project would save 0.14 railway crossing related injury crashes per year. Although, this statistic seems small, it is important to note that the Project reduces rare, but severe crash consequences in the future network which is to experience anticipated growth.

Aside from reduction of level crossing-related crashes, there is also overall system-wide safety improvements through the reduction of VKT. The impact on overall network crashes has been estimated based on the change in vehicle kilometres travel. The historic crash rates across the whole Auckland network over the 5-year period between 2013 and 2017 were assessed to estimate crash rates by different road types. These crash rates were assessed in terms of death and serious injury crashes, total crashes, and monetised crash costs.[24] The rates were applied to the predicted change in vehicle travel across the whole Auckland region, as shown in Table 35. That system-wide analysis indicated that the mode shift effects of the Project could save some 1.1 deaths and serious injuries per year, 78 total crashes per year and $1.18m of social crash costs per year. The Project saves an estimated 36 DSIs over 40 years compared to the Do-Nothing scenario (based on a crash rate analysis).

Table 35: Yearly regional crash cost analysis

Road Type	Speed Limit	Rates, $/km	DSI/100m VKT	Crashes/100m VKT	VKT Change	Cost Change, $m	DSI Change	Total Crashes Change
Motorway	<=60	2.69	1.59	256.94	- 1,267,068	-$ 0.03	-0.02	-3.26
	<80	2.69	1.59	256.94	153,392	$ 0.00	0.00	0.39
	>=80	2.69	1.59	256.94	781,045	$ 0.02	0.01	2.01
Arterial	<=60	11.28	11.99	838.32	- 4,957,923	-$ 0.56	-0.59	-41.56
	<80	11.28	11.99	838.32	- 321,237	-$ 0.04	-0.04	-2.69
	>=80	14.56	9.34	1092.93	- 10,952	-$ 0.00	0.00	-0.12
Local	<=60	8.22	7.14	745.70	- 1,185,965	-$ 0.10	-0.08	-8.84
	<80	8.22	7.14	745.70	- 14,615	-$ 0.00	0.00	-0.11
Rural	<=60	4.43	3.63	213.05	2,185	$ 0.00	0.00	0.00
	<80	4.43	3.63	213.05	54,661	$ 0.00	0.00	0.12
	>=80	17.46	13.42	881.27	- 2,760,829	-$ 0.48	-0.37	-24.33
All categories					**- 9,527,306**	**-$ 1.18**	**-1.1**	**-78**

Key points to note include:

- Project is expected to have a positive impact on the safety of the future network through the:
  - Removal of level crossings, which will eliminate crashes relating to level crossings occurring in the area;
  - Reduction of high severity crashes occurring in a future network, which is anticipating growth, increased train frequencies and four-tracking of the rail line;
- Project is estimated to save 0.14 railway crossing related injury crashes per year;
- In relation to system-wide crashes, the Project is estimated to save 1.1 deaths and serious injuries per year, 78 total crashes per year and $1.18m of social crash costs per year. The Project saves an estimated 36 DSIs over 40 years compared to the Do-Nothing scenario; and
- Project aligns with the Road to Zero strategy, GPS 2021 direction and Ministry of Transport's outcomes.

6.7 Walking and cycling

The east-west connections at Spartan Road, Manuroa Road, Taka Street and Walters Road in the future Do-Nothing network would remain as vehicular and pedestrian level crossings. It is expected that the pedestrian level crossings would have existing treatments such as automatic barriers, audible warning, flashing lights and warning signs / markings leading up to and at each level crossing.

Policy context regarding climate change, such as the Transport Emissions Reduction Plan (**TERP**) provides clear indication and guidance for the provision of active modes where possible. It is expected

[24] Based on Waka Kotahi's Monetised Benefits and Costs Manual

that the east-west active mode connections in the Takaanini network will accommodate the anticipated uptake of active modes and/or encourage people to shift to active modes.

The Project comprises the following active mode elements:

- Separated walking and cycling facilities along the multi-modal grade-separated corridors at Manuia Road, Taka Street and Walters Road (as shown in Figure 45); and
- Separated walking and cycling connection at Spartan Road and Manuroa Road as shown in Figure 46.

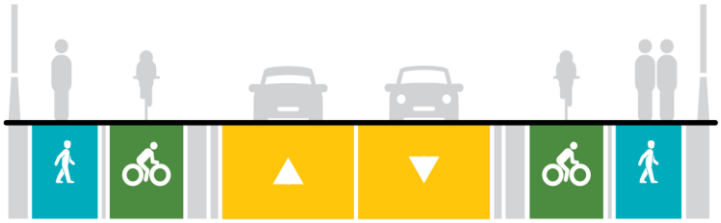


Figure 45: Typical cross section at bridge

Figure 46: Typical cross section for active mode bridges

These walking and cycling facilities will be separated from traffic so will provide safer and more attractive travel by alternative modes. The improvements will be relatively modest for walking as dual-sided footpaths already exist on most of the TLC corridors. However, there will be safety improvements for pedestrians. The improvements to cycling will be significant as there is a lack of existing protected cycle facilities along the TLC corridors.

The goal of the walking and cycling facilities in the network is to:

- Increase active mode east-west permeability;
- Enable more modal options for access and encourage walking and cycling generally; and
- Provide safer walking and cycling connectivity in the area.

Given the focus on long-term route protection for the Project corridor, the Project has focused on providing sufficient footprint to allow separated walk/cycle facilities within the corridor, with the flexibility to align with the future networks that exist or are planned at the time that the Project is implemented. The NoRs have not attempted to specify exact design details for walking and cycling facilities.

It is expected that walking and cycling demand will increase in the future, especially given evolving land use decisions on intensification around stations with the NPS-UD, MDRS and PC78. All the east-west connections, apart from Walters Road, are within the walkable catchment of the Takaanini Station (RTN stop). Walters Road will still continue to have an important role in the network as is it provides local connectivity to the Business - Town Centre Zone which includes the Southgate Shopping Centre and the Takanini town centre. All east-west connections play a critical role for access in the future network and will continue to provide active mode permeability in the network. The Project provides an additional active mode connection via the proposed Manuia Road bridge, further increasing active mode permeability in the network. The provision of active mode connections at the TLC locations will mitigate the effects of level crossing closures at the localised areas as well as the wider network.

The Project will improve the safety of the existing connections for pedestrians and cyclists as it provides grade-separated active mode connections at the locations where closure of the level crossings is expected. Pedestrians and cyclists will not experience delay at the level crossing signals hence, will reduce the likelihood that pedestrians and cyclists would take risks to cross the rail line to avoid the increased barrier-downtime. This reduces the fatal and serious incidents related to rail-crossings.

The SAMM was used to estimate the change in active mode usage in response to the Project. The with and without Project models were run under a network which assumed active mode improvements in the wider network such as the South FTN project, which proposes walking and cycling facilities along Great South Road and Porchester Road. This project is not considered committed or certain but were included as the Takaanini Level Crossings project and the South FTN project has been developed in an integrated approach.

The change in the total daily walk and cycle trips across the five east-west connections (Spartan Road, Manuia Road, Manuroa Road, Taka Street, Walters Road) are presented in Table 36.

Table 36: 2048+ daily walk and cycle trips across the TLC corridors

Scenario	Daily Walk Trips	Daily Cycle Trips
Without Project	1,730	550
With Project	1,840	660
Change	110	110

Table 36 above indicates the following:

- Some 2,500 pedestrians and cyclists would benefit from these safer east-west connections
- There is an overall increase of 110 walk trips across the five east-west connections due to the Project;
- There is an overall increase of 110 cycle trips across the five east-west connections due to the Project; and
- The model indicates there is expected to be a decrease in walk and cycle trips on Spartan Road and Manuroa Road active mode bridges in the Project, compared to the level crossings at these locations in the Do-Nothing scenario.

The forecasted uplift of walk and cycle trips as a result of the Project is small. However, it is important to note that the Project as a whole, significantly improves the safety for a total of 1,840 pedestrians and 660 cyclists across the east-west connections, each day. This is due to the Project eliminating the risk that pedestrians and cyclists will perform unsafe behaviour by crossing the rail tracks to reach their destinations.

In the scenario without the Project, pedestrians and cyclists will be required to wait when the level crossing barrier arm is down. However, there will be no queue of people that would take time to dissipate, like a queue of vehicular traffic would experience. This means, that each time the barrier arm is lifted, a queue of pedestrians and cyclists will clear quickly. Hence, pedestrians and cyclists do not experience an extended period of delay due to the barrier arm as vehicles would. In the scenario with the Project, the design consists of switch-back ramps and grades that pedestrians and cyclists will have to travel up and down, leading to a longer distance to walk or cycle compared to crossing at-grade level crossings in the Do-Nothing scenario. The active mode model considers these design parameters, hence, forecasts a small uplift of walk and cycle trips in comparison to the Do-Nothing scenario.

The Project is focused on improving safety by providing safer east-west active mode facilities for the overall total number of pedestrians and cyclists using the new, safer connections in the future network. Hence, the inconvenience of the active mode bridges and vertical grades, is considered tolerable compared to the delay and severe safety risks posed by the pedestrian level crossings.

The Project provides many positive benefits for walking and cycling in the network, including:

- Increase active mode east-west permeability across the southern rail line in the Takaanini network;
- Accessibility to employment and social amenities (such as the Takaanini industrial zone, Takaanini Station, Te Mahia Station, Takaanini Town Centre) will be made attractive through multi-modal use;
- No delays associated with barrier-down time for walking and cycling users, increasing walkability and safety. The Project makes the network safer for 1,840 pedestrians and 660 cyclists by eliminating the likelihood that pedestrians and cyclists would take risks to cross the rail line to avoid the increased barrier-downtime. This reduces the fatal and serious incidents related to rail-crossings;
- Exclusivity of the Spartan Road and Manuroa Road bridges to active mode users leads to travel time savings and increased safety for cyclists and pedestrians using these connections. Active mode bridge replacements would mitigate the effects of level crossing closures at these location;
- Opportunity to increase commuter trips to rail given the planned train frequencies, due to the active modes bridge providing a connection to Te Mahia Station and Takaanini Station;
- The active modes connections will integrate with the wider walking and cycling network such as the Southern Path along SH1; and
- Increased modal choice via active modes will have positive environmental and health benefits by increasing the number of active mode trips and reducing the reliance on vehicle trips.

6.8 Public transport

Removal of the level crossings increases the north-south passenger rail capacity, enabling access to economic and social opportunities.

The implementation of the TLC will be a component of the wider mode-shift strategy in the South network as it is part of supporting increased rail capacity in the future. This is due to the closure of the existing level crossings contributing to allow existing and planned projects to progress the expansion of the southern rail line capacity and attractiveness, including:

- Higher train frequencies enabled by the CRL project;
- Additional rail capacity at key locations such as Wiri;
- Electrification of the passenger rail services to Pukekohe;
- New rail stations in Drury and Paerātā;
- Inter-regional passenger rail service to Hamilton;
- Potential station upgrade works across rail stations in Auckland through the Rail PBC; and
- Additional track capacity (4-track) planned from Pukekohe to Wiri (longer-term).

The benefits from the above projects are not claimed as part of this assessment and are being claimed by projects outside of this assessment however, in any transport network the outcomes are only delivered by the sum of the parts due to the inter-dependencies between projects.

Collectively, these upgrades are estimated to result in a significant mode shift to PT, to address both existing needs and accommodate the high growth planned in both southern Auckland and northern Waikato regions.

The grade-separation of the TLC corridors are expected to improve overall network PT reliability by avoiding route diversions of traffic along the FTN routes of Porchester Road and Alfriston Road corridors. There is also the potential for connector and local bus services to route via Taka Street in the long-term network and to tie in to the Takaanini Station. A grade-separated bridge at Taka Street will remove any constraints related to the level crossing, providing for buses on this east-west route.

The Project will also remove the risks of system vulnerability associated with level crossings, for example hardware faults such as gates malfunctioning, or barrier arms being hit leading to incidents causing unexpected delays and cancelled train services.

The main vehicular access to the Takaanini Station and the station park & ride is via Station Road Station Road is not directly affected by the Project. There is existing pedestrian access to the station from Taka Street and Manuroa Road which are both within the project areas. Pedestrian access to the Takaanini Station from Taka Street and Manuroa Road will continue to be provided post construction. It is noted that the overlap of the proposed designation boundaries with the existing Station does not preclude opportunities to integrate with potential upgrades to Takaanini Station in the future which may occur as a result of Four Tracking (e.g., providing ramps and stairs to the future station platforms).

6.9 Parking

On-street Parking

All TLC corridors have existing on-street parking. The Manuia Road local street also has existing on-street parking. The Project will remove all existing on-street parking spaces along the TLC corridors and there will be no on-street parking on the grade-separated bridges.

The purpose of the existing on-street parking that may be impacted by the Project are highlighted in Table 37.

Table 37: On-street parking purpose along the project areas

Corridor where on-street parking is affected	Purpose of on-street parking
Spartan Road	Serves the surrounding industrial area.
Manuia Road	Serves the nearby commercial / retail centres and residential properties.
Manuroa Road	Serves residential properties and services such as the laundromat and the BestStart childcare centre.
Taka Street	Largely serves residential properties and the Takaanini Reserve.
Walters Road	Largely serves the commercial / industrial area and residential properties.

The indicative number and location of these existing on-street parking spaces and the spaces that are affected by the Project are summarised in Table 38.

Table 38: Summary of affected on-street parking spaces[25]

Location	Length / Number	Total On-street Parks Affected
Spartan Road	There are 139m of on-street parking (approx. 23 spaces) on Spartan Road, to the east of the level crossing (between the level crossing and Oakleigh Avenue). On-street parking will be removed at the cul-de-sac heads as this space is needed for maneuvering/ turning and to provide for safety of such movements. Approximately 8 of the parking spaces directly east of the rail line will be removed due to the cul-de-sac.	8
Manuia Road	There are 86m of on-street parking (approx. 14 spaces) on Manuia Road. One of these parks will be removed due to the Project. There are 22 existing parking spaces in the 90-degree parking bay which serves the shopping area, south of Manuia Road. These will be removed due to the Project.	22
Manuroa Road	There are 38m of on-street parking (approx. 6 spaces) on Manuroa Road, to the west of the level crossing. On-street parking will be removed at the cul-de-sac heads as this space is needed for maneuvering/ turning and to provide for safety of such movements. Two parking spaces outside 10 Manuroa Road will be removed due to the Project. There are 78m of on-street parking (approx. 13 spaces) on Manuroa Road, to the east of the level crossing (between the level crossing and Oakleigh Avenue). These parking spaces will be removed due to the implementation of the cul-de-sac head.	15

[25] Assumes 6m length for one on-street space.

Location	Length / Number	Total On-street Parks Affected
Taka Street	There are 197m of on-street parking (approx. 32 spaces) on Taka Street, to the west of the level crossing. There is also a 'Small PSV stand' which provides for 2 parking spaces. There are 327m of on-street parking (approx. 54 spaces) on Taka Street, to the east of the level crossing.	89
Walters Road	There are 132m of on-street parking (approx. 22 spaces) on Walters Road, to the west of the level crossing. Some of these parks have a 90-minute time restriction. There are 4 parking spaces in the indented parking bay, directly east of the level crossing	26

The TLC corridors are designed to provide more transport options which consist of safe walking and cycling facilities which will provide more accessible opportunities for travel.

The removal of on-street parking is a consequence of providing space for berms and separated walking and cycling facilities. Removal of on-street parking is expected at all Project areas, however, is more evident along Taka Street and Walters Road as these existing corridors are being upgraded to bridges, while on-street parking is only be removed at the cul-de-sac turning heads on Spartan Road and Manuroa Road. The removal of on-street parking is anticipated, and encouraged, by AT's policy direction regarding on-street parking on arterial roads. In this regard, the removal of on-street parking along the TLC corridors is in accordance with the Auckland Parking Strategy.[26]

On-site Parking

In some locations of the Project areas, the Project intends to widen the existing designation and alter the cross section of the corridor to incorporate separated walking and cycling facilities, provide space for the bridge or to incorporate space for the accessways. As a result, existing car parking provision for properties adjacent to the Project corridor will be affected.

The indicative number of the on-site parking spaces which are affected by the Project are summarised in Table .

Table 39: Summary of affected on-site parking spaces

Location	Site	Total on-site parks affected and description
Spartan Road active mode bridge		
1 Spartan Road	Halls Refrigerated Transport Ltd/ Hall's Cold Chain Logistics	Approx. space for 20-80 parking spaces being removed (depending on how the site is utilised internally). This removal is more of an operational impact for the business.

[26] Room to Move: Tāmaki Makaurau Auckland's Parking Strategy 2023

Location	Site	Total on-site parks affected and description
21 Spartan Road	Mitsi Galore for Mitsubishi Part	Approx. space for 90 car parks falls within the designation. This removal of space for parking is more of an operational impact for the business.
Manuia Road multi-modal bridge		
39 Oakleigh Ave	Industrial site (name unknown)	Approx. 7 on-site parks are affected on the edge of the property.
15 Oakleigh Ave	Business (name unknown - residential land use)	Approx. 7 on-site parks are affected.
20 Oakleigh Ave	Takanini Engineering	A low number of parks / space for the operation of the business may be impacted during construction.
Manuroa Road active mode bridge		
18 Manuroa Road	BestStart Manuroa Road	It is noted that people are parking on the grass-crete carparks within the property which fall within the designation. Approx. 12 on-site car parks are affected.
Taka Street multi-modal bridge		
162 Great South Road	Takanini LDV Auckland Supersite	Approx. space for 26 car parks falls within the designation. Cars are stored for selling purposes. This removal of space for parking is more of an operational impact for the business as opposed to a parking effect.
166 – 168 Great South Road	Z - Takaanini Service Station & Burger King Takaanini	A total of 9 on-site car parks are within the designation. 5 car parks are close to the Z Station, 4 car parks are near the Burger King.
7 Taka Street	Religious church	Approx. 10 on-site car parks are within the designation to provide for the proposed accessway. These car parks appear to be under utilised.
9-13 Taka Street	Takaanini Care Centre	Approx. 8 on-site car parks are within the designation to provide for the proposed accessway. Opportunity to purchase 15 Taka Street to provide parking via Takanini Road
Walters Road multi-modal bridge		
Walters Road	Southgate shopping Centre (Takanini Fish mart, Fruit world, Mad Butcher, LiqourLand, Mini Ciam, Marcel Bakery Ltd, Stationery city)	Approx. 4 on-site parks near the loading/ servicing lane may need to be removed due to the accessway. Approx. 28 parks serving the amenities, may be removed due to construction.
12 Walters Road	Carters	Approx. 10 on-site parks require removal. Reconfiguration of the site may be required.

Location	Site	Total on-site parks affected and description
30 Walters Road	Takaanini Town Centre & Library (eastern side of rail line)	24 car parks are being removed for construction. One of these car parks include a Vector EV charging station.

Further discussions will be required with impacted parties following construction to understand on-site parking requirements and whether any on-site car parks could be reinstated based on the operational needs of the affected properties/ businesses. This can be addressed at the time of construction and can be determined by understanding the utilisation of the site, any existing consent conditions and the quantum of parking versus actual utilisation. Any reinstating of on-site parking following construction will also depend on detailed design.

Approximately a total of 273 on-site parking spaces (excluding sites that will be fully designated) will be affected within the Project boundary. These are typically along site frontages. In some instances, the Project designation includes the entirety of the property, therefore eliminating residual parking effects.

An assessment was undertaken to determine the severity of on-site parking impacts specifically for commercial properties to ensure that parking spaces affected by the Project would not result in substantial adverse effects for the operation of each business. The following was identified:

- Of the 273 onsite parking spaces located within the TLC designation, a total of 67 carparks are not located within the TLC corridor cross section. These parking spaces may only be required temporarily for construction purposes, and therefore may be reinstated and returned to affected landowners for use as parking spaces once the works are complete;
- All impacted properties are considered to have sufficient alternative parking available on-site such that the operation of these businesses is not impacted significantly; and
- In addition, the NPS-UD was published on 23 July 2020 and took effect from 20 August 2020. This statement specifically removes all parking minimum requirements from the Auckland Unitary Plan. In this regard, the removal of on-site parking spaces because of the Project does not infringe any relevant standards.

6.10 Property access

The Project alters the elevation of the corridors at Taka Street and Walters Road, which impacts existing access arrangements to surrounding properties. The grade-separation of the new alignment at Manuia Road will also impact the surrounding properties and any access arrangements.

Access to the adjacent lots surrounding the multi-modal bridges should be provided to prevent the landlocking of parcels. Mitigation will be required to ensure access is retained, however, where this is not possible, the full parcel is included in a designation. Accessways (service lanes) are proposed in areas where access is being restricted due to vertical level differences of the new vertical alignment (bridge) over the rail line. In other locations where there is limited change to vertical levels, accessways are generally to be retained and modified to suit changes to the roadside including active modes.

The anticipated traffic volumes and multi-lane crossing manoeuvres could undermine Vision Zero as vehicles using driveways would conflict with other modes. In addition, driver and active mode safety would be compromised through merging movements into the traffic flow.

The approach to turn movements into and out of accessways varies. Various options exist, including restriction of turn movements into accessways to left-in left-out only, allowing unrestricted access (no flush median) or unrestricted access (with flush median). Some safety benefits can be achieved by restricting right turn movements, although this may create distance delays for drivers. Provision of a full width flush median for sheltering of turning vehicles would further increase the size of the designation. The designation provides sufficient flexibility to determine in future whether provision of flush medians for access, raised medians to restrict access to left-in left-out or no median provision is most suitable. Hence, future exploration of different solutions as best suited for the location, can occur at the time of implementation.

The use of service lanes will minimise the number of points for merging movements into the main traffic stream and crossing movements conflicting with the active mode facilities, limiting safety risks.

Properties that will have their access impacted are summarised in Table 40.

Table 40: Summary of properties where access is affected

Location	Site	Property access effect/ mitigation
Spartan Road active mode bridge		
2-14 Spartan Road	VTNZ	Access will need to be reinstated with the configuration of the cul-de-sac.
1 Spartan Road	Halls Refrigerated Transport Ltd/ Hall's Cold Chain Logistics	Access will need to be reinstated with the configuration of the cul-de-sac.
Manuia Road multi-modal bridge		
39 Oakleigh Ave	Industrial site (name unknown)	Access is off Hitchcock Road on the eastern arm of the proposed roundabout. Access will need to be reinstated after the roundabout is implemented.
15 Oakleigh Ave	Business (name unknown - residential land use)	Access is off Hitchcock Road, on the eastern arm of the proposed roundabout. Access can be reinstated after roundabout is implemented.
20 Oakleigh Ave	Takanini Engineering	Access is off Oakleigh Avenue, south of the proposed roundabout. Access can be reinstated after roundabout is implemented.
Manuroa Road active mode bridge		
10 Manuroa Road	Residential property	Existing access falls into the designation of the cul-de-sac. Driveway access will need to be reinstated with the cul-de-sac configuration.
18 Manuroa Road	BestStart Manuroa Road	Entry and exit accesses will need to be reinstated with the configuration of the cul-de-sac.

Location	Site	Property access effect/ mitigation
20 Manuroa Road	The Lawndromat	The driveway access will need to be reinstated with the configuration of the cul-de-sac.
Taka Street multi-modal bridge		
162 Great South Road	Takanini LDV Auckland Supersite	Access point off Taka Street will need to be reconfigured and reinstated with the new accessway.
166 – 168 Great South Road	Z - Takaanini Service Station & Burger King Takaanini	Access will need to be reconfigured and reinstated with the new accessway.
7 Taka Street	Religious church	Access will need to be reconfigured and reinstated with the new accessway.
9-13 Taka Street	Takaanini Care Centre	Access will need to be reconfigured and reinstated with the new accessway. There is an opportunity to provide primary access from Takanini Road in the future, within the proposed designation.
6-12 Taka Street	Residential properties	Access to these properties will need to be reconfigured and reinstated with the new accessway.
24 Taka Street	Takaanini Reserve	Access to the Takaanini Reserve will need to be reinstated with the new accessway.
23 - 33 Taka Street	Residential properties	Access to these properties will need to be reconfigured and reinstated with the new accessway.
Walters Road multi-modal bridge		
Walters Road	Southgate shopping Centre (Takanini Fish mart, Fruit world, Mad Butcher, LiqourLand, Mini Ciam, Marcel Bakery Ltd, Stationery city)	An entry and exit access point to the amenities is currently provided off Walters Road. This access point also provides access to the loading/ servicing area behind Carters. This access will need to be reconfigured and reinstated with the new accessway.
12 Walters Road	Carters	The site currently has an internal traffic circulation system which loops around the Carters building. Entry and exit points are separated. This access will need to be reconfigured and reinstated with the new accessway.
30 Walters Road	Takaanini Town Centre & Library (eastern side of rail line)	There is an entry access point from Walters Road to the Takaanini Town Centre/ commercial area.

It is recommended that the above property access impacts and related safety implications are to be validated through site visits prior to the implementation of the Project, following detailed design.

It should be noted that there is a key entry access point to the Takaanini Town Centre development (30 Walters Road) that will be affected by the Project. It should be noted that the conditions on the approved resource consent[27] for the town centre development required the applicant to close and

[27] Condition 101 on the 2012 resource consent decision.

reinstate the Walters Road access in the event that road-over-rail grade separation were to take place. The effect has therefore been considered previously, and there is scope/opportunity for the Project to work collaboratively with the consent holder on implementing this mitigation. Moreover, it is noted that the effect is not a complete loss of access given that there are two further existing access points on Arion Road which are unaffected by the Project.

6.11 Positive Effects Summary

The Project will have several positive transport effects once implemented. To assess the full extent of the impact of having the Project in the network, a future scenario (2048+) has been used for all impacts, given this scenario assumes all future development and planned projects are in the network (refer to **Appendix A** of this Report on inclusions). The effects shown are therefore the direct impact of having and not having the Project in the future network. It is noted that for some effects, scenarios have been tested where no level crossings exist in the future network, as a comparison.

The positive effects identified include benefits for accessibility of all modes, VKT reduction, and safety, as summarised in Table 41 below.

Table 41: Summary of positive effects

Positive Effect	Description
General traffic accessibility	The Project achieves the following outcomes relating to general traffic: • Increases local connectivity in the Takaanini area • The three multi-modal bridges increase east-west network capacity significantly in the morning and evening peak periods • Reduces rat running via Takaanini Road.
VKT reduction	The Project reduces 49,300 vehicle kilometres travelled daily compared to the Do Nothing scenario.
Freight accessibility	The proposed Manuia Road bridge provides a direct east-west connection to the Takaanini industrial area for freight to use in the future network. Currently there is no clear freight connection which is not logistically constrained by banned intersection movements or level crossings.
Safety	Project is expected to have a positive impact on the safety of the future network through the: • Removal of level crossings will eliminate crashes relating to level crossings occurring in the area. • Reduction of high severity crashes occurring in a future network, which is anticipating growth, increased train frequencies and four-tracking of the rail line. The Project could save 0.14 railway crossing related injury crashes per year. • In relation to system-wide crashes, the Project could save 1.1 deaths and serious injuries per year, 78 total crashes per year and $1.18m of social crash costs per year. The Project saves an estimated 36 DSIs over 40 years compared to the Do Nothing scenario

Positive Effect	Description
	Project aligns with the Road to Zero strategy, GPS 2021 direction and Ministry of Transport's outcomes.
Walking and cycling accessibility	The Project provides many positive benefits for walking and cycling in the network, including: • Increase active mode east-west permeability across the southern rail line in the Takaanini network; • Accessibility to employment and social amenities (such as the Takaanini industrial zone, Takaanini Station, Te Mahia Station, Takaanini Town Centre) will be made attractive through multi-modal use; • No delays associated with barrier-down time for walking and cycling users, increasing walkability and safety. The Project makes the network safer for 1,840 pedestrians and 660 cyclists by eliminating the likelihood that pedestrians and cyclists would take risks to cross the rail line to avoid the increased barrier-downtime. This reduces the fatal and serious incidents related to rail-crossings; • Exclusivity of the Spartan Road and Manuroa Road bridges to active mode users leads to travel time savings and increased safety for cyclists and pedestrians using these connections. Active mode bridge replacements would mitigate the effects of level crossing closures at these locations; • Opportunity to increase commuter trips to rail given the planned train frequencies, due to the active modes bridge providing a connection to Te Mahia Station and Takaanini Station; • The active modes connections will integrate with the wider walking and cycling network such as the Southern Path along SH1; and • Increased modal choice via active modes will have positive environmental and health benefits by increasing the number of active mode trips and reducing the reliance on vehicle trips.
Public transport	The Project contributes to the wider mode-shift strategy regarding the Southern rail network. The Project will also remove the risks of system vulnerability associated with level crossings, for example hardware faults such as gates malfunctioning, or barrier arms being hit leading to incidents causing unexpected delays and cancelled train services.

6.12 Recommended measures to avoid, remedy or mitigate operational effects

There are some adverse operational effects that have been identified as a result of the Project in the future environment. The future impacts, including mitigation and effect level, are summarised in Table .

Table 42: Potential adverse effects and proposed measures to avoid, remedy or mitigate these effects

Anticipated effect	Scale of effect (pre-mitigation)	Mitigation	Scale of effect (post-mitigation)
Closure of **Takaanini Road** at Taka Street effects community access to the Takaanini Hall	Low – moderate adverse effect	Provide wayfinding signage on Taka Street which will help direct the community to the Takaanini Hall which is a community facility. There is also an opportunity at the time of implementation, to provide a connection for pedestrians and cyclists between the northern end of Takanini Road and the Taka Street bridge via stairs / ramp.	Low adverse effect
Manuia Road / Great South Road **intersection** queues blocking back and impacting Takaanini Interchange resulting in potential operational and safety risks	Low - moderate adverse effect	There is a potential that the intersection with Manuia Road and Great South Road will be busy in peak periods, contingent on the development of the Takaanini industrial zone in the future. To mitigate the effects of the queues on the Great South Road northern approach blocking back to the Takaanini Interchange and onto the southbound SH1 off-ramp / SH1, it is recommended to manage this via managing signal operation through providing additional signal green time for the northern arm in peak periods.	Low adverse effect
The current **over-dimension freight** route is not suitable in the future network. The alternative over-dimension route from Porchester Road to Great South Road, through the industrial area will be via Manuroa Road, Oakleigh Avenue and Manuia Road. This is less direct compared to the current over-dimension route.	Low – moderate adverse effect	Alternative over-dimension route will need to be provided via the future Manuia Road connection to Great South Road. The Manuia Road bridge should be designed to accommodate over-dimension vehicles as per relevant engineering standards. The alternative route should have a clear width and height to accommodate over-dimension vehicles and any overhead powerlines may need to be undergrounded. The roundabout at Manuia Road/ Oakleigh Ave intersection should be designed to allow for enough turning space for over-dimension vehicles.	Low adverse effect
Parking Removal of on-site parking on affected land.	Low – moderate adverse effect	Discussions will be required with impacted parties following construction to understand on-site parking requirements and whether any on-site car parks could be reinstated based on the operational needs of the affected properties/ businesses. This mitigation measure will depend on detailed design.	Low adverse effect

Anticipated effect	Scale of effect (pre-mitigation)	Mitigation	Scale of effect (post-mitigation)
Property access Existing property access may be altered in the surrounding network with potential land take	Low – moderate adverse effect	Property access impacts and related safety implications are to be validated through site visits prior to the implementation of the Project. Access should be provided to properties; therefore, mitigation is required to ensure legal access is retained.	Low adverse effect

Some potential adverse effects are identified but these can be adequately managed and mitigated either by standard approval processes/ practices[28] or proposed conditions.

6.13 Summary and Conclusions

Table 43 summarises the construction effects and operational transport effects of the Project.

Table 43: Summary of Assessment of Effects and Recommendations - Overall network

Effect	Assessment	Recommendation
Operational Effects		
Closure of **Takaanini Road** at Taka Street effects community access to the Takaanini Hall	Closure of Takanini Road with Taka Street will affect the environment as vehicle users who would typically traverse through this link will have to divert via Glenora Road or Beach Road to access Great South Road and Taka Street.	Provide wayfinding signage on Taka Street which will help direct the community to the Takaanini Hall which is a community facility. There is also an opportunity at the time of implementation, to provide a connection for pedestrians and cyclists between the northern end of Takanini Road and the Taka Street bridge via stairs / ramp.
Manuia Road/ Great South Road **intersection** queues blocking back and impacting Takaanini Interchange resulting in potential operational and safety risks	There is a potential that the intersection with Manuia Road and Great South Road will be busy in peak periods, contingent on the development of the Takaanini industrial zone in the future. SIDRA analysis indicates the northern intersection approach operates at a LOS B and the queues on this approach do not indicate queuing back onto the interchange.	To mitigate the potential effects of the queues on the Great South Road northern approach blocking back to the Takaanini Interchange and onto the southbound SH1 off-ramp / SH1, it is recommended to manage this via managing signal operation through providing additional signal green time for the northern arm in peak periods.

[28] Standard practices may comprise of safety audits, engineering approvals

Effect	Assessment	Recommendation
The current **over-dimension freight** route is not suitable in the future network due to closure of Manuroa Road level crossing.	The alternative over-dimension route from Porchester Road to Great South Road, through the industrial area will be via Manuroa Road, Oakleigh Avenue and the Manuia Road connection. This alternative route has been agreed with AT freight SMEs.	Alternative over-dimension route will need to be provided via the future Manuia Road connection to Great South Road. The Manuia Road bridge should be designed to accommodate over-dimension vehicles as per relevant engineering standards. The alternative route should have a clear width and height to accommodate over-dimension vehicles and any overhead powerlines may need to be undergrounded. The roundabout at Manuia Road/ Oakleigh Ave intersection should be designed to allow for enough turning space for over-dimension vehicles.
Existing **property access may be altered** in the surrounding network with potential land take	The proposed works may cause parcels to be landlocked if existing property access is altered and a safe alternative access is not provided.	Property access impacts and related safety implications are to be validated through site visits prior to the implementation of the Project. Access should be provided to properties; therefore, mitigation is required to ensure legal access is retained.

7 Corridor-specific operational effects

This section assesses specific transport matters relating to the individual corridors. This section also recommends measures to avoid, remedy, or mitigate actual or potential adverse effects considering the network as a whole.

7.1 Spartan Road

This section assesses specific transport matters relating to the Spartan Road corridor.

7.1.1 Overview and description of works

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

Spartan Road is located in Takaanini in the south of Auckland. It is predominantly industrial in nature, situated adjacent to businesses such as VTNZ, Hynds and the Hall's Group Ltd haulage yard. Spartan Road is currently a relatively light-trafficked two-lane corridor carrying approximately 4,900 vpd with 15% heavy vehicles, where the majority of heavy vehicles are associated with the industrial businesses. There is a road crossing and pedestrian crossing on the south side of Spartan Road currently as seen in Figure 47 below.

Figure 47: Spartan Road level crossing

The proposed design of the existing Spartan Road pedestrian and road level crossings involves the closure of the existing at grade level crossings and replaced with a grade separated active modes bridge.

7.1.2 Assessment features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

Traffic from Great South Road and SH1 enters Spartan Road on the west side via signalised intersections. The SH1 Takaanini off-ramp overbridge is approximately 130m west of the level crossing on Spartan Road. In order for vehicles on SH1 to access Spartan Road, they must first get onto Great South Road via signalised intersection.

Egress movements for Spartan Road are restricted to left-only; however, both right and left turn entry movements are permitted. To access Spartan Road from Great South Road, vehicles queue in the relatively short right-turn bay which has the capacity to hold approximately 7 vehicles. Additional vehicle wishing to turn right onto Spartan Road will spill into the right-most through-lane, and potentially lead to unsafe passing manoeuvres from through vehicles. There is limited green-time for vehicles on Spartan Road compared to Great South Road, resulting on queues forming on Spartan Road back towards the level crossing.

There is approximately 170m (capacity of 28 vehicles) between the vehicle limit line for the level crossing and the intersection of Spartan Road / Great South Road. There is a significant number of vehicles traversing Spartan Road in the PM peak where the PM peak hour flow is noted as 525 vph, or 9 vehicles per minute, resulting in approximately 3 minutes of queuing space before vehicles spill into and congest the intersection.

The nearest train stations are Te Mahia Station and Takaanini Station, both of which are approximately 1,100m walking distance from the level crossing. The nearest bus stop for southbound services is 210m from the level crossing, located by the Spartan Road and Great South Road intersection. The nearest bus stop for northbound services is 550m away from the level crossing, located on Great South Road by Te Napi Drive.

Currently there is no pedestrian level crossing facility on the northern side of Spartan Road. There is an existing pedestrian level crossing facility on the southern side of Spartan Road. The pedestrians currently using Spartan Road are likely associated with the adjacent industrial businesses. The existing pedestrian level crossing on Spartan Road[29] has an estimated level crossing safety score (LCSS) of 27/60 which corresponds to a Medium-Low LCSS risk band. In the likely future receiving environment in 2028, the LCSS for the Spartan Road pedestrian level crossing is expected to be 7/60 corresponding to a Low LCSS risk band.

7.1.3 Assessment of operational effects

This section addresses operational transport effects specific to Spartan Road only. **Section 1** of this Report describes broader effects of the Project on the overall transport network.

7.1.3.1 General Traffic & Freight

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

The existing level crossing at Spartan Road will be closed in the future and replaced by a walking and cycling bridge. This means that vehicular traffic that would have used Spartan Road to travel east or west of the NIMT will be required to reroute to use alternative east-west connections. The new Manuia Road bridge is seen as the replacement vehicular connection for the closure of Spartan Road.

[29] Based on the Auckland Metro South Pedestrian Crossing LCSIA prepared for Auckland Transport by Stantec in October 2018.

The existing intersection at Spartan Road/ Great South Road emerges into the middle of the signalised Takaanini Interchange. This intersection is not a full movement intersection as the right turn out of Spartan Road is restricted. Hence, vehicular traffic turn left out of the Spartan Road to travel southbound on Great South Road. Some vehicular traffic currently perform a U-turn at the next southern interchange intersection (permitted) in order to travel northbound on Great South Road.

It is known that VTNZ and Hall's Cold Chain Logistics are located on the western side of the rail line and currently travel northbound on Great South Road by either:

- turning left onto Great South Road and performing a U-turn at the Takaanini Interchange to travel north as shown in Figure 48**.** This movement is known to be performed at the interchange southern intersection to allow for northbound trips; or
- travelling east via Spartan Road level crossing and routing via Oakleigh Avenue, onto Manuroa Road and Great South Road as shown in Figure 49**.**

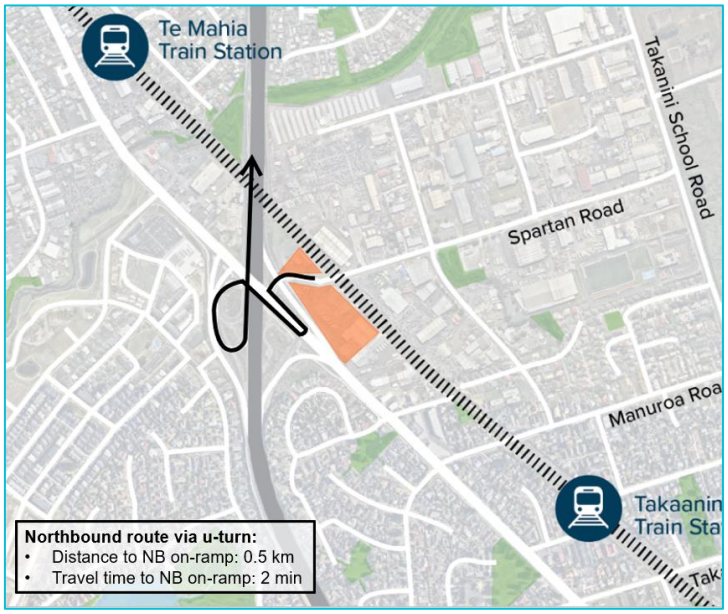


Figure 48: Current northbound route via U-turn manoeuvre at Takaanini Interchange

This U-turn movement has a travel distance of 0.5km and equates to a travel time of two minutes.

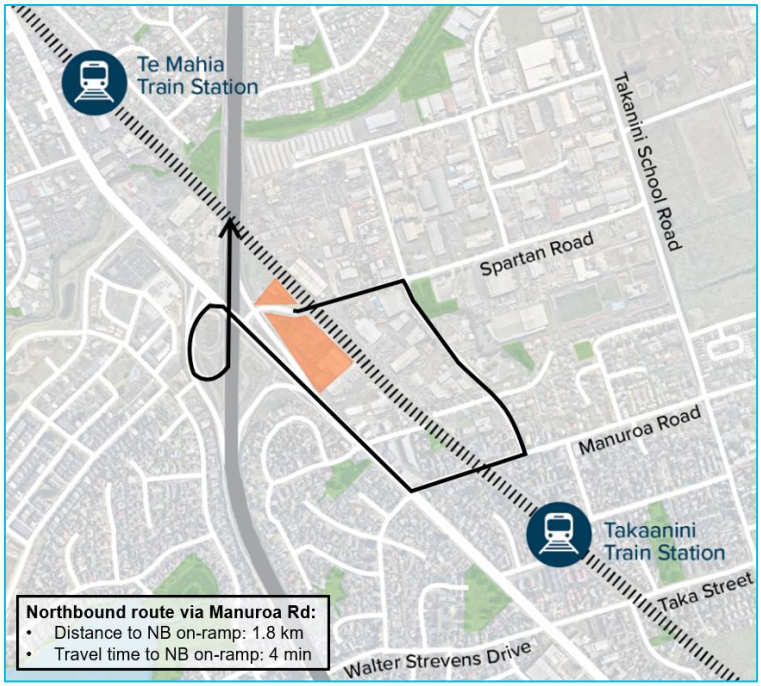


Figure 49: Current northbound route via Manuroa Road

The current northbound movement shown in Figure 49, has a travel distance of 1.8km and equates to a travel time of four minutes.

The closure of Spartan Road level crossing will affect vehicular traffic that would normally use this east-west connection. VTNZ and Hall's Cold Chain Logistics will no longer be able to travel east along Spartan Road however, may continue to perform the U-turn manoeuvre at the interchange intersection. It should be noted that there would be a high amount of heavy vehicle trips generated from Hall's Cold Chain Logistics. Hence, a road safety assessment should be undertaken at the time of implementation to test if U-turn manoeuvre would be able to accommodate heavy vehicles in the future. It should be noted that the closing of the rail crossing will limit this U-turn manoeuvre to only traffic exiting from the two properties on the Spartan Road cul-de-sac west of the railway. Hence, the Project has a positive safety effect as it prevents these road users from performing this U-turn manoeuvre (as they have an alternative route which is safe via Manuia Road). However, the Project reduces movement options for the two existing businesses; VTNZ and Hall's Cold Chain Logistics as they have to turn left from Spartan Road to Great South Road. The current U-turn manoeuvre will be increasingly appealing for the traffic generated from these two businesses as vehicles will have to pass the U-turn point if they were to use an alternative route to travel northbound. Observations on site at the Takaanini Interchange showed that there is evidence that larger vehicles traverse the shared path on the western side of Great South Road due to the U-turn manoeuvre. Whilst an existing issue, this may be exacerbated if a larger number of trucks generated from the Hall's Cold Chain Logistics perform this manoeuvre with the closure of the Spartan Road level crossing.

The alternative route for VTNZ and Hall's Cold Chain Logistics, is to turn left onto Great South Road, turn onto the Manuia Road link and use the Manuia Road/ Oakleigh Avenue roundabout to U-turn and be able to turn right onto Great South Road to travel northbound. This routing is shown in Figure 50. The Manuia Road / Oakleigh Avenue roundabout should be designed to accommodate U-turns performed by heavy vehicles.

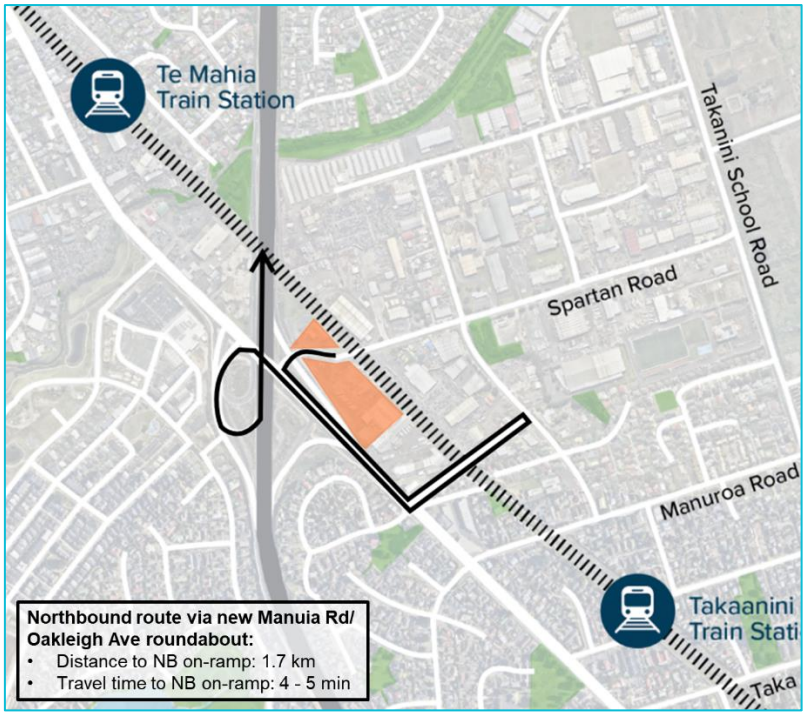


Figure 50: Proposed route via Manuia Road

The proposed movement shown in Figure 50 requires 1.7km distance travelled and equates to an approximate travel time of 3.5 to 4 minutes.

Businesses that exist on the eastern side of the rail line can use Oakleigh Avenue to travel to the Manuia Road east-west connection in order to travel west. Businesses that exist on the western side of the rail line, such as VTNZ and Hall's Cold Chain Logistics will only be able to turn left out of Spartan Road to travel southbound on Great South Road.

It is to be noted, that closing the Spartan Road level crossing will reduce the amount of traffic coming in and out of Spartan Road, onto Great South Road in the middle of the Takaanini interchange. This may indicate that green time can be reduced for the Spartan Road intersection arm, and improve the operation of the Takaanini interchange as a whole.

It should also be noted that VTNZ assess practical driving tests and these tests are normally carried out within the Takaanini industrial area, east of the rail line. With the closure of the level crossing, parts of the standardised practical tests may be affected, and new routes may need to be considered.

Prior to the start of construction, it is recommended that a preliminary design safe system audit is undertaken for the Project. This will determine if any mitigation measures are required to address any safety risks to the businesses/ properties which exist on the western side of the rail line at the time of implementation.

Manuia Road is the proposed alternative to go northbound for those existing out of Spartan Road. There is potential for U-turns to occur at the Takaanini interchange southern intersection if the safety audit considers this suitable. Further alternatives include allowing a right-turn movements out of Spartan Road onto Great South Road. This will require further signalisation of certain movements at the interchange to provide for this movement. This would reduce the operational performance of the Takaanini Interchange due to the additional green time. However, this may not be significant since

there would be less movement coming out of Spartan Road onto Great South Road due to the level crossing closure.

Another possible alternative is to provide a U-turn pocket by widening the corridor out towards the west within Waka Kotahi land to accommodate a safer U-turn movement for large heavy vehicles. Other alternatives consist of possibly banning the U-turn movement for heavy vehicles if this is deemed unsafe. This would be subject to the result of the safety audit.

In summary, a design safe system audit / road safety assessment should be undertaken at implementation to understand what interventions may be required.

7.1.3.2 Local access

The Spartan Road level crossing closure effects to property access within the affected area are detailed below.

West of the level crossing

Spartan Road, between Great South Road and the level crossing, provides access to industrial businesses such as VTNZ and Hall's Cold Chain Logistics.

Egress trips out of the catchment area can be seen below in Figure 51Error! Reference source not found.. Southbound and westbound movements for the catchment area are unaffected by the closure of the level crossing; however, in order to complete northbound and eastbound trips from the Spartan Road / Takanini School Road intersection, an 800m detour is needed via the Manuia Road vehicle overpass.

Entry trips to the catchment area are shown in Figure 52. All movements are unaffected except for westbound trips which will operate the same as the egress movements, via the Manuia Road vehicle overpass. This results in an 800m detour westbound.

Figure **51:** Spartan Road egress movements west of the level crossing

Figure **52:** Spartan Road entry movements west of the level crossing

To summarise:

- Manuia Road is seen as the replacement connection for the closure of Spartan Road level crossing; and
- The closure of Spartan Road level crossing will result in an additional detour distance of 800m for the businesses/ properties located on the west of the rail line on Spartan Road. This roughly equates to an additional travel time of 2 minutes which is not a significant adverse effect.

East of the level crossing

Spartan Road between the level crossing and Takanini School Road provides approximately 32 accessways for a number of dwellings.

Egress trips out of the catchment area can be seen below in Figure 53. Eastbound movements for the catchment area are unaffected by the closure of the level crossing; however, in order to complete westbound, northbound and southbound trips, detours are required via the Manuia Road vehicle overpass as shown below.

Entry trips to the catchment area can be seen below in Figure 54**.** Westbound trips to the catchment area are unaffected by the closure of the Spartan Road level crossing. Southbound, eastbound and northbound trips to the catchment area are rerouted via the Manuia Road vehicle overpass with distances shown below.

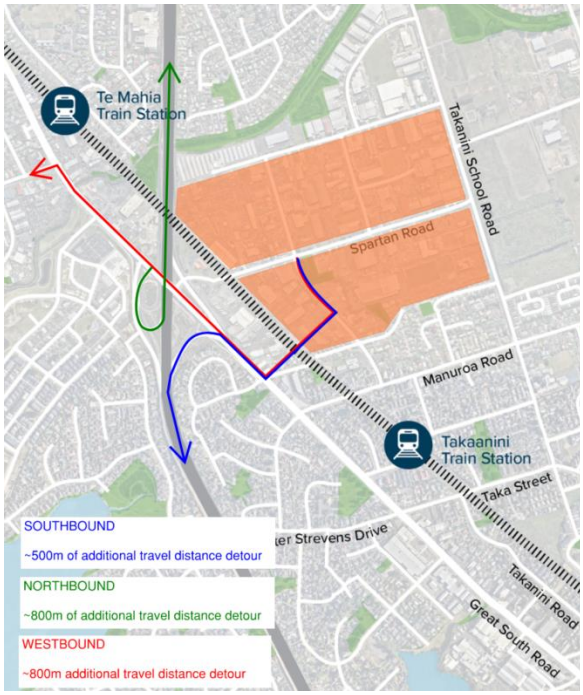


Figure 53: Spartan Road egress movements east of the level crossing

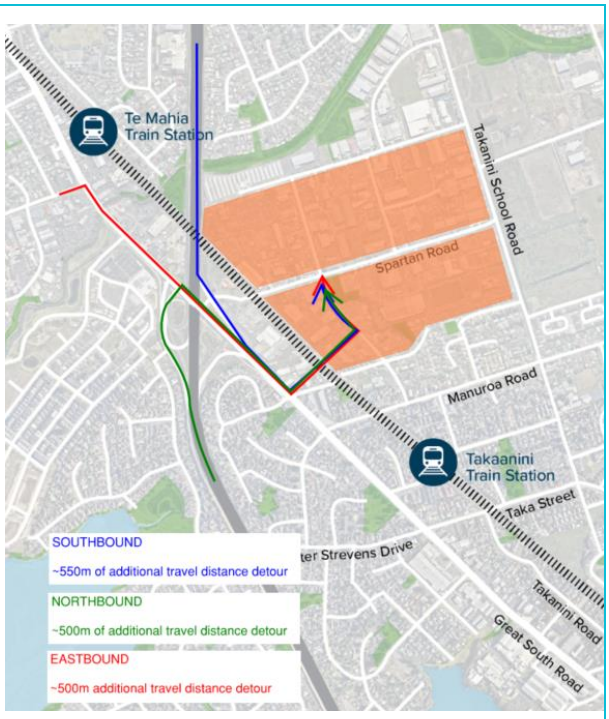


Figure 54: Spartan Road entry movements east of the level crossing

To summarise:

- Manuia Road is seen as the replacement connection for the closure of Spartan Road level crossing; and
- The closure of Spartan Road level crossing will result in an additional detour distance of 500-800m for the businesses/ properties located on the east of the rail line on Spartan Road. This roughly equates to an additional travel time of 2 minutes which is not a significant adverse effect.

7.1.3.3 Walking and cycling

Walking and cycling demand along Spartan Road is expected to increase in the future, contingent on the development of the industrial zone surrounding Spartan Road. The Project provides an active modes connection which will provide access to employment in the future, given the expected increase in jobs in the Takaanini industrial area. An east-west walking active mode connection at Spartan Road will provide a connection to the regional network via the Southern Path.

It should be noted that there are no other active mode connections north of Spartan Road in the industrial area, and south of the Papakura Stream. The Papakura Stream acts as a barrier for active modes users travelling to and from the north, as people would have to divert to Takanini School Road, Popes Road, Porchester Road, Hyperion Drive and Trimdon Street, in order to use the next northern walking and cycling connection (Trimdon Street underpass). Otherwise, pedestrians and cyclists will have to divert south to the new Manuia Road connection in order to reach a destination to the north.

Route distances are impacted for those travelling north from the industrial area, if a walking and cycling connection is not provided at the proposed Spartan Road level crossing. Figure 55 and Figure

56 compares the walk route distance and travel time between the industrial area and a point to the north-west.

Figure 55: Walking route to a location to the north with a connection at Spartan Road

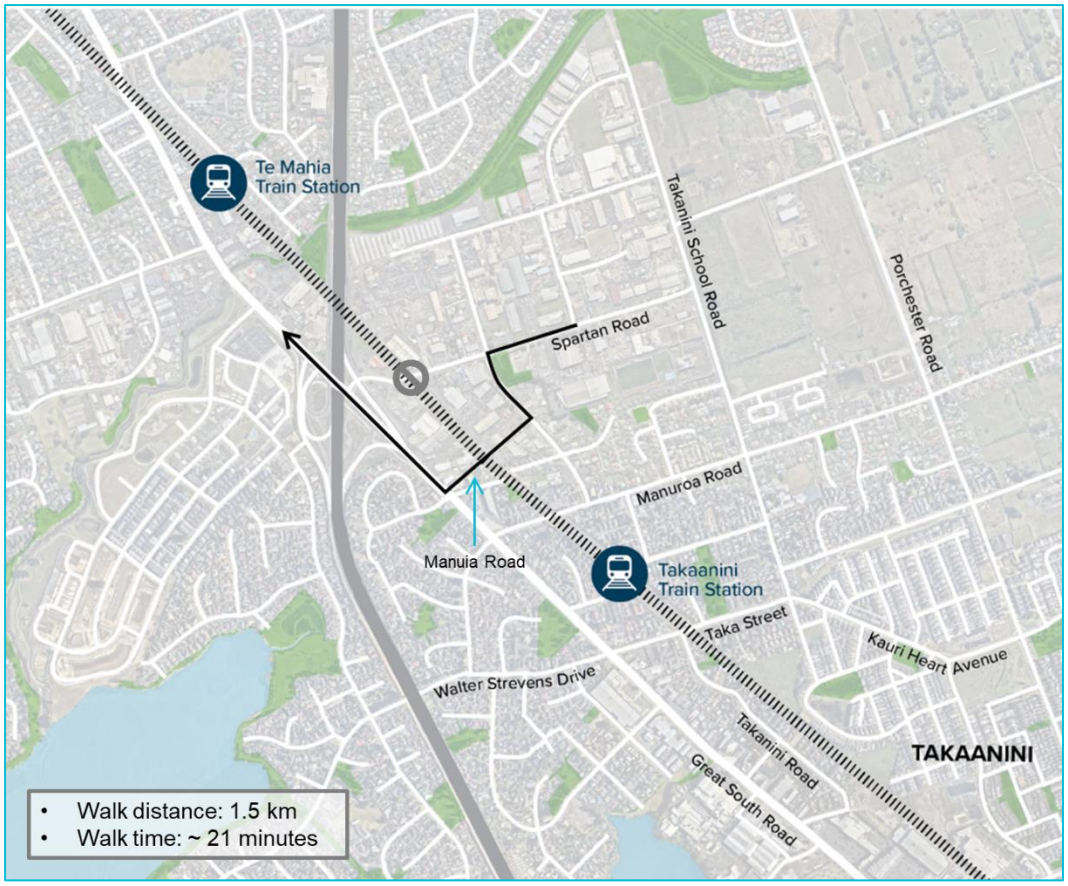


Figure 56: Walk diversion route to a location in the north if no active mode connection is provided at Spartan Road

Key points to note include:

- Diverted routes are approximately 600m longer for those travelling north; and
- This diversion distance approximately equates to an additional nine minutes of walk time.

The above points regarding severance for those travelling north, emphasise the importance of an east-west connection at Spartan Road to access destinations to the north such as Te Mahia Station. Hence, an active mode bridge replacement is preferred at Spartan Road to mitigate this effect of the level crossing closure at this location.

The design consists of switch-back ramps and grades that pedestrians and cyclists will have to travel up and down, leading to a longer distance to walk or cycle compared to crossing at-grade level crossings in the Do Nothing scenario. There is the potential that the active mode design may not be suitable for all pedestrians and cyclists, affecting usage of these connections. Hence, it is recommended at detailed design, that the active mode connection should be designed appropriately and aligned with engineering design standards to ensure the facility accommodates the needs of pedestrians and cyclists.

7.1.4 Summary and Conclusions

Table 44 provides a summary of the operational effects and recommendations for the Spartan Road project area.

Table 44: Summary of Assessment of Effects and Recommendations - Spartan Road

Effect	Assessment	Recommendation
Operational		
Routing for northbound trips onto Great South Road and access to SH1 northbound on-ramp are affected due to Spartan Road level crossing closure.	VTNZ and Hall's Cold Chain Logistics are typically required to travel northbound onto Great South Road to access the SH1 northbound on-ramp for the operation of their businesses. These businesses would normally travel via a U-turn manoeuvre at the Takaanini interchange (0.5km, 2 minutes), or re-route east over the rail line, through Oakleigh Avenue and Manuroa Road (1.8km, 4 minutes). The option to route via Manuroa Road will no longer be possible due to the closure of the Spartan Road level crossing. The alternative route will be via Manuia Road and using the Manuia Road/ Oakleigh Avenue roundabout to perform a U-turn. This route would be 1.7km and take approximately 4 - 5 minutes to reach the NB on-ramp. This routing distance and expected travel time is approximately equivalent to the current routing via Manuroa Road.	Discussions with landowners are currently underway to understand the operation of the business and typical access movements. It is recommended that prior to the start of construction, a design safe system audit is undertaken for the Project. This will determine if any additional mitigation measures are required to address any safety risks in regards to the U-turning of heavy vehicles at the Takaanini Interchange. The U-turn manoeuvre at the Takaanini interchange southern intersection should be assessed to understand if U-turning of heavy vehicles can be accommodated, as Hall's Cold Chain Logistics are expected to generate a high number of heavy vehicle trips. The road safety assessment may consider possible mitigation measures to make the movements around the interchange safer. These may include: • Providing a U-turn pocket by widening the corridor out towards the west within Waka Kotahi land to accommodate a safer U-turn movement for large heavy vehicles. • Banning the U-turning of large vehicles at the interchange and limiting the movement to the alternative route. The alternative route available for vehicles is via Manuia Road / Oakleigh Avenue roundabout. The roundabout should be designed to

Effect	Assessment	Recommendation
		accommodate heavy vehicles U-turning.
There is the potential that the design of the active mode bridge is not suitable for pedestrians and cyclists, resulting in reduced uptake of the active mode connection.	The current design consists of switch-back ramps and grades that pedestrians and cyclists will have to travel up and down, leading to a longer distance to walk or cycle compared to crossing at-grade level crossings in the Do-Nothing scenario. The active mode model considers these design parameters, hence, forecasts a decrease in walk and cycle trips on Spartan Road active mode bridge compared to the Do-Nothing scenario.	At detailed design, the active mode connection should be designed appropriately and aligned with engineering design standards to ensure the facility accommodates the needs of pedestrians and cyclists.

7.2 Manuia Road

This section assesses specific transport matters relating to the Manuia Road corridor.

7.2.1 Overview and description of works

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised. Figure 57 below outlines the area of works for the proposed Manuia Road overpass.

Figure 57: Manuia Road proposed overpass from existing cul-de-sac at level crossing

Manuia Road is located in Takaanini in the south of Auckland. It is residential and commercial in nature, situated adjacent to businesses such as BP Truckstop, Unique Cars (NZ) and Takanini Urgent Pharmacy. Manuia Road is currently a cul-de-sac which is relatively light trafficked with 80 vpd and 5% heavy vehicles, where the majority of heavy vehicles are associated with the industrial businesses.

The proposed design of the existing Manuia Road layout involves an overpass from Great South Road to Oakleigh Avenue with vehicle and active mode provisions.

7.2.2 Assessment of operational effects

7.2.2.1 General Traffic

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

Manuia Road has only one entry and exit point which forms an intersection with Great South Road and Challen Close. This intersection is STOP controlled for Manuia Road and Challen Close with Great South Road having priority. There are no turn restrictions noted at this intersection.

The proposed design of the existing Manuia Road layout involves an overpass from Great South Road to Oakleigh Avenue with vehicle and active mode provisions.

7.2.2.2 Freight

The vertical alignment of the Manuia Road bridge includes grades of:

- 8% maximum; and
- 0.5% minimum.

The maximum grade of the Manuia Road bridge is as per TDM without requiring specific treatment for pedestrian routes. The vertical alignment of the bridge will accommodate the traversing of heavy vehicles. At the detailed design stage, the Manuia Road bridge should be designed to accommodate heavy vehicles and should be aligned with future standards.

7.2.2.3 Local access

Manuia Road currently provides accesses to BP Truckstop, Unique Cars (NZ), Takanini Urgent Pharmacy and approximately 6 residential houses. Based on the proposed design, the overpass requires land designation and will lead to the demolition of all the commercial properties on the north of Manuia Road; however, all mixed housing properties on the south side of Manuia Road are to remain.

Entry and egress trips to/from Manuia Road are anticipated to increase efficiency with access to Oakleigh Avenue streamlined via the overpass. Entry and egress trips into and out of the catchment area can be seen below in Figure 58 and Figure 59. Eastbound movements are the primary movement affected by the overpass which results in an approximate 415m reduction in travel distance to the Spartan Road / Oakleigh Avenue / Westbrook Avenue.

Figure **58:** Manuia Road egress movements east of the level crossing

Figure **59:** Manuia Road entry movements east of the level crossing

To summarise:

- The Manuia Road bridge will result in a reduction of travel distance of approximately 400m for the businesses/ properties located on the local Manuia Road cul-de-sac. This travel distance reduction will result in less travel time for these properties and is hence, a positive effect.

7.2.3 Summary and Conclusions

Table 45 provides a summary of the operational effects and recommendations for the Manuia Road project area.

Table 45: Summary of Assessment of Effects and Recommendations – Manuia Road

Effect	Assessment	Recommendation
Operational		
Gradient of Manuia Road and the effect on freight	The vertical alignment of the Manuia Road bridge includes grades of: • 8% maximum • 0.5% minimum	At the detailed design stage, the Manuia Road bridge should be designed to accommodate heavy vehicles and should be aligned with future standards.

7.3 Manuroa Road

This section assesses specific transport matters relating to the Manuroa Road corridor.

7.3.1 Overview and description of works

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

Manuroa Road is predominantly residential in nature, with a local centre by the Princess Street intersection and some commercial/industrial sites (see Figure 60). Manuroa Road is currently a two-lane corridor carrying approximately 12,900 vpd with 6% heavy vehicles, where the majority of the heavy vehicles are likely to be associated with Takaanini industrial area to the north, being accessed via the Level 3 freight route on Oakleigh Avenue (as per Future Connect). Currently there is a road crossing and two pedestrian crossings over Manuroa Road.

Figure 60: Manuroa Road level crossing

The proposed design of the existing Manuroa Road pedestrian and road level crossings involves the closure of the existing at grade level crossings and replaced with a grade separated active modes bridge.

7.3.2 Assessment features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

Traffic from Great South Road enters Manuroa Road on the west side via a signalised intersection including Beaumaris Way approximately 180m west of the level crossing. Traffic currently queues to the intersection when the half arm barriers of the level crossing have been activated. There is a dedicated left-turn lane which extends 200m to allow queuing capacity. Heading northbound on Great South Road there is a 50m right turning lane which adjoins a central median which is 350m long, which also could be used to stack future traffic volumes without affecting through traffic.

Traffic from Takanini School Road enters Manuroa Road from the east, approximately 580m from the level crossing. It is unlikely that traffic queues from the level crossing extend to this intersection if activated. The Manuroa Road / Takanini School Road intersection is signalised four-way intersection with cycle waiting facilities present on all legs of the intersections.

Takaanini Station is the nearest station, located approximately 250m southeast of the level crossing. The nearest bus stop for southbound services is 240m from the level crossing, located by the Manuroa Road / Great South Road / Beaumaris Way intersection. The nearest bus stop for northbound services is 320m away from the level crossing located to the north of the Manuroa Road / Great South Road / Beaumaris Way intersection, near Challen Close.

Currently there are pedestrian crossings facilities on the north and south sides of Manuroa Road. The existing pedestrian level crossings on Manuroa Road have an estimated LCSS of:

- Pedestrian Up – 42/60 which corresponds to a Medium-High LCSS risk band; and

- Pedestrian Down – 40/60 which corresponds to a Medium-High LCSS risk band

In the likely future receiving environment in 2028, the LCSS for the Manuroa Road pedestrian level crossings are expected to be:

- Pedestrian Up – 33/60 which corresponds to a Medium LCSS risk band; and
- Pedestrian Down – 29/60 which corresponds to a Medium-Low LCSS risk band.

7.3.3 Assessment of operational effects

7.3.3.1 General Traffic

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

The existing level crossing at Manuroa Road will be closed in the future and replaced by a walking and cycling bridge. This means that vehicular traffic that would have used Manuroa Road to travel east or west of the NIMT will be required to reroute to use alternative east-west connections. The new Manuia Road bridge is seen as the replacement vehicular connection for the closure of Manuroa Road.

The existing intersection at Manuroa Road / Great South Road / Beaumaris Way does not have any turn restrictions. Hence vehicular traffic turning right out of Manuroa Road will travel northbound on Great South Road to the new Manuia Road bridge. Businesses and residential properties on the eastern side of the level crossing are able to use Oakleigh Avenue to travel to the Manuia Road east-west connection in order to travel west.

7.3.3.2 Walking and cycling

A walking and cycling east-west connection at Manuroa Road will serve predominately local walking trips within the Takaanini area. It will provide access to key walk/ cycle trip destinations in the vicinity such as the:

- Takaanini School;
- Takaanini Train Station;
- Neighbourhood centre: post shop, dairy, local supermarket, laundromats and other services; and
- Community centre / church.

The neighbourhood centre at the junction of Manuroa Road and Princess Street is located approximately 220m east of the level crossing.

The Manuroa Road level crossing is also a 750m walk from Takaanini School, which is located at 39 Takaanini School Road. Hence, this east-west connection is key in terms of providing access to the school and is important in avoiding severance in school zones. Figure 61 shows the Takaanini School zone which indicates that all students who live within the home zone shown in the map are entitled to enrol at the school.

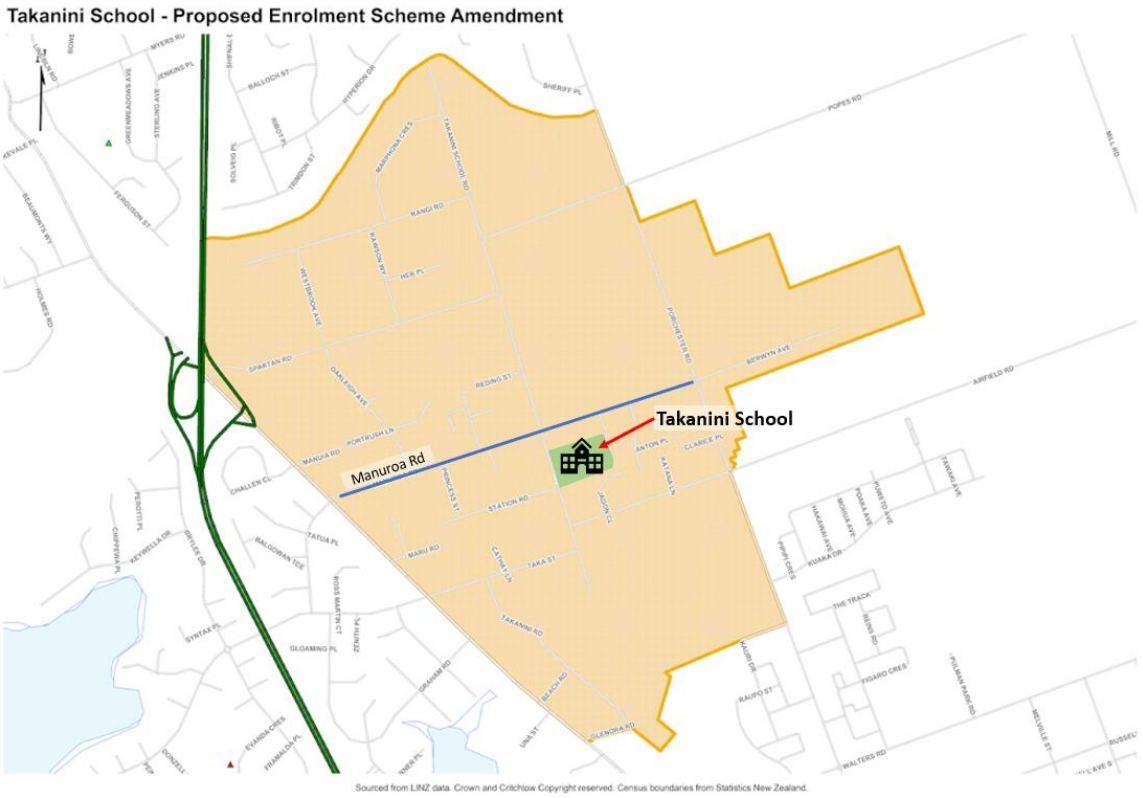


Figure 61: Takaanini School Zone Map[30]

The Manuroa Road level crossing is also within a 400m radius of the Takaanini Station. Hence, this east-west connection is key in terms of providing direct access to the RTN and in increasing active mode permeability. Providing an active modes connection at Manuroa Road will potentially reduce walking and cycling distance to Takaanini station for commuter trips.

There are opportunities to integrate the Manuroa Road active mode connection with the Takaanini Train Station, to improve key access to this station. In the future it is also expected that the existing through movement across the rail line between Maru Road and Station Road, via the Takaanini Train Station, may be prohibited. This results in Maru Road and Station Road only serving rail users as opposed to providing a through movement in the future. As a result, an east-west connection at Manuroa Road will provide for active mode permeability in the network.

Kye points regarding walking and cycling diversion routes are as follows:

- In both cases where east-west through movement via Takaanini Station is and is not permitted in the future, pedestrian and cyclist accessibility for people travelling north will be impacted if Manuroa Road is closed to active modes. If people are travelling north from Manuroa Road, they are expected to travel an additional 300m if there is no active mode connection at Manuroa Road. The diversion route requires pedestrians to walk up Oakleigh Avenue to access the new Manuia Road connection, to get onto Great South Road.
- If no east-west through movement is permitted through Takaanini Station in the future, then pedestrians and cyclists are expected to travel approximately 500m more if they are travelling in the south direction i.e. to St Aidans Reserve. The diversion route traverses from Manuroa Road, down Princess Street, through the Takaanini Reserve, onto Taka St and then turning

[30] Map is taken from Takaanini School Website: https://www.takanini.school.nz/parent-portal/enrolling-your-child.

onto Great South Road. This trip would take approximately 16 minutes to walk which is longer than the desirable walk time of 10 minutes.

- However, if through movement is allowed though the Takaanini Station, then this route distance will be 750m and require a walk time of 9 minutes which is the same outcome as having Manuroa Road open for active modes. Hence, there is no impact on pedestrians and cyclists in the scenario where east-west through movement via Takaanini Station is permitted in the future.

Given, the uncertainty of whether an east-west through movement connection will be provided at Takaanini Station for non-rail users in the future, it is recommended to provide an active modes bridge at Manuroa Road to increase east-west active mode permeability in the network and avoid diversion distances.

Key points to note include:

- The policy context regarding climate change, provides clear indication for the provision of active modes where possible. This east-west connection will accommodate the anticipated uptake of active modes and/or encourage people to shift to active modes;
- In the likely instance where there is no east-west through connection via Takaanini Station, there is expected to be longer diversion routes for pedestrians and cyclists travelling north and south from Manuroa Road if there is no east-west connection provided here. These diversion routes are 300m – 500m longer;
- Current pedestrian and cyclist data show that people are using the existing Manuroa Road east-west connection to cross over the rail line. It is expected that walking and cycling demand will increase in the future, especially given evolving land use decisions on intensification around stations with the NPS-UD and MDRS. Hence this east-west connection plays a critical role for access in the future network; and
- An active mode bridge replacement is needed at this location to mitigate the effects of level crossing closures at this location.

The design consists of switch-back ramps and grades that pedestrians and cyclists will have to travel up and down, leading to a longer distance to walk or cycle compared to crossing at-grade level crossings in the Do-Nothing scenario. There is the potential that the active mode design may not be suitable for all pedestrians and cyclists, affecting usage of these connections. Hence, it is recommended at detailed design, that the active mode connection should be designed appropriately and aligned with engineering design standards to ensure the facility accommodates the needs of pedestrians and cyclists.

7.3.3.3 Local access

The proposed design of the existing Manuroa Road pedestrian and road level crossings involves the closure of the existing at grade level crossings and replaced with a grade separated active modes bridge. The effects to property access along Manuroa Road are detailed below.

West of the level crossing

Manuroa Road, between Great South Road and the level crossing, provides access to businesses such as Osaka Cars and residential properties.

Egress trips out of the catchment area can be seen below in Figure 62Error! Reference source not found.. Northbound, southbound and westbound movements for the catchment area are unaffected by the closure of the level crossing; however, in order to complete eastbound trips based from the Manuroa Road / Great South Road / Beaumaris Way intersection, a 300m detour is needed via the Manuia Road vehicle overpass.

Entry trips to the catchment area can be seen below in Figure 63. All movements are unaffected except for westbound trips which will operate the same as the egress movements, via the Manuia Road vehicle overpass. This results in an 200m detour westbound.

Figure **62:** Manuroa Road egress movements west of the level crossing

Figure **63:** Manuroa Road entry movements west of the level crossing

To summarise:

- Manuia Road is seen as the replacement connection for the closure of Manuroa Road level crossing; and
- The closure of Manuroa Road level crossing will result in an additional detour distance of 200m - 300m for the businesses/ properties located on the west of the rail line on Manuroa Road. This roughly equates to an additional travel time of 1 minute which is not a significant adverse effect.

East of the level crossing

Manuroa Road between the level crossing and Takanini School Road provides access to four side streets, four rights-of-way and a significant number of vehicle accessways.

Egress trips out of the catchment area can be seen below in Figure 64. Eastbound movements for the catchment area are unaffected by the closure of the level crossing; however, in order to complete westbound, northbound and southbound trips, detours are required via the Manuia Road vehicle overpass as shown below.

Entry trips to the catchment area can be seen below in Figure 65. Westbound trips to the catchment area are unaffected by the closure of the Spartan Road level crossing. Southbound, eastbound and northbound trips to the catchment area are rerouted via the Manuia Road vehicle overpass with distances shown below.

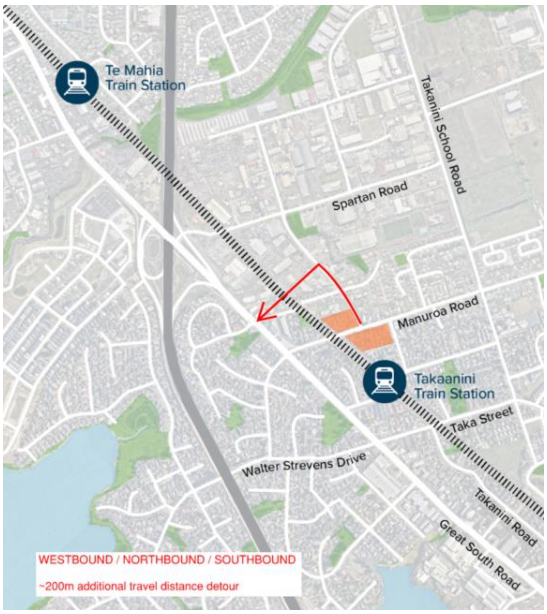


Figure **64:** Manuroa Road egress movements east of the level crossing

Figure **65:** Manuroa Road entry movements east of the level crossing

To summarise:

- Manuia Road is seen as the replacement connection for the closure of Manuroa Road level crossing; and
- The closure of Manuroa Road level crossing will result in an additional detour distance of 200m for the businesses/ properties located on the east of the rail line on Manuroa Road. This roughly equates to an additional travel time of 1 minute which is not a significant adverse effect.

7.3.4 Summary and Conclusions

Table 46 provides a summary of the operational effects and recommendations for the Manuroa Road project area.

Table 46: Summary of Assessment of Effects and Recommendations - Manuroa Road

Effect	Assessment	Recommendation
Operational		
There is the potential that the design of the active mode bridge is not suitable for pedestrians and cyclists, resulting in reduced	The current design consists of switch-back ramps and grades that pedestrians and cyclists will have to travel up and down,	At detailed design, the active mode connection should be designed appropriately and aligned with engineering design

Effect	Assessment	Recommendation
uptake of the active mode connection.	leading to a longer distance to walk or cycle compared to crossing at-grade level crossings in the Do-Nothing scenario. The active mode model considers these design parameters, hence, forecasts a slight decrease in walk and cycle trips on Manuroa Road active mode bridge compared to the Do-Nothing scenario.	standards to ensure the facility accommodates the needs of pedestrians and cyclists.

7.4 Taka Street

7.4.1 Overview and description of works

Figure 66 below displays the proposed bridge location at the existing Taka Street level crossing. Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

Figure 66: Taka Street proposed bridge location

Taka Street is located in Takaanini in the south of Auckland. It is residential and commercial in nature, situated adjacent to businesses such as Takaanini Care Centre and Amber Early Learning Centre. Taka Street is low trafficked with 4,100 vpd with 4% heavy vehicles.

The proposed design of the existing Taka Street layout involves an overpass from Great South Road to the roundabout involving Takanini School Road and Kauri Heart Avenue with vehicle and active mode provisions.

7.4.2 Assessment features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

Traffic from Great South Road enters Taka Street on the west side via a signalised intersection including Walter Stevens Drive approximately 230m west of the level crossing. Traffic from Takanini

School Road and Kauri Heart Avenue enter Taka Street on the east side via a roundabout approximately 300m from the level crossing.

Taka Street enables pedestrian access to Takaanini Station carpark via a footpath east of the level crossing. As Taka Street is relatively low trafficked, it is unlikely that vehicles will form queues to adjacent intersections when the level crossing is activated. From where the half arm barrier limit line is on the west side of the crossing, there is approximately 200m until Great South Road which allow queuing capacity of up to 30 vehicles.

Currently there are pedestrian crossings facilities on the north and south sides of Taka Street. The existing pedestrian level crossings on Taka Street have an estimated LCSS of:

- Pedestrian Up – 40/60 which corresponds to a Medium-High LCSS risk band; and
- Pedestrian Down – 50/60 which corresponds to a High LCSS risk band.

In the likely future receiving environment in 2028, the LCSS for the Taka Street pedestrian level crossings are expected to be:

- Pedestrian Up – 32/60 which corresponds to a Medium LCSS risk band; and
- Pedestrian Down – 33/60 which corresponds to a Medium LCSS risk band.

7.4.3 Assessment of operational effects

7.4.3.1 General traffic

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

The existing level crossing at Taka Street will be closed in the future and replaced by an overpass with vehicle and active modes provisions. There are no proposed changes to the signalised intersection of Taka Street / Great South Road / Walter Stevens Drive to the west and the roundabout of Taka Street / Takanini School Road / Kauri Heart Avenue to the east.

The Taka Street / Takaanini Road intersection is proposed to be closed, with Takaanini Road proposed to be tuned into a cul-de-sac. The Taka Street / Cathay Lane intersection is proposed to be relocated further west, after the bridge. This new intersection will be four-way as part of a looped underpass and GIVE WAY controlled.

7.4.3.2 Local access

The proposed design of the existing Taka Street pedestrian and road level crossings involves the closure of the existing at grade level crossings and replaced with a grade separated vehicle and active modes bridge. The effects to property access along Taka Street are detailed below.

West of the level crossing

Taka Street, between Great South Road and the level crossing, provides access to businesses such as Takaanini Care Centre and Amber Early Learning Centre and residential properties.

Egress trips out of the catchment area will remain as existing. All movements will be unaffected by the closure of the level crossing. It should be noted that access to right-of-ways and properties to the west

of the level crossing will be affected. As part of the proposed design, new connections to these properties are provided based on land designation.

Entry trips to the catchment area will remain as existing. All movements will be unaffected by the closure of the level crossing.

East of the level crossing

Taka Street, between Great South Road and the level crossing, provides access to businesses such as Takaanini Care Centre and Amber Early Learning Centre and residential properties.

Egress trips out of the catchment area will remain as existing. All movements will be unaffected by the closure of the level crossing. The Taka Street / Cathay Lane intersection is proposed to be relocated further west, after the bridge. This new intersection will be four-way as part of a looped underpass and GIVE WAY controlled.

Entry trips to the catchment area will remain as existing. All movements will be unaffected by the closure of the level crossing.

7.4.3.3 Freight

The vertical alignment of the Taka Street bridge includes grades of:

- 7% maximum; and
- 0.5% minimum.

The maximum grade of the Taka Street bridge is as per TDM without requiring specific treatment for pedestrian routes. The vertical alignment of the bridge will accommodate the traversing of heavy vehicles.

7.4.4 Summary and Conclusions

Table 47 provides a summary of the operational effects and recommendations for the Taka Street project area.

Table 47: Summary of Assessment of Effects and Recommendations - Taka Street

Effect	Assessment	Recommendation
Operational		
Gradient of Taka Street bridge and the effect on freight	The vertical alignment of the Taka Street bridge includes grades of: • 7% maximum • 0.5% minimum	At the detailed design stage, the Taka Street bridge should be designed to accommodate heavy vehicles and should be aligned with future standards.

7.5 Walters Road

This section assesses transport matters relating to the Walters Road corridor.

7.5.1 Overview and description of works

Figure 67 below displays the proposed bridge location at the existing Walters Road level crossing. Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

Figure 67: Walters Road proposed bridge location

Walters Road is located in Takaanini in the south of Auckland. It is residential and commercial in nature, situated adjacent to businesses such as Southgate Shopping Centre, Arion Shopping Centre Takanini Fish Mart, Carters and Tony's Tyre Service. Walters Road is a district arterial road with 14,400 vpd with 4% heavy vehicles.

The proposed design of the existing Walters Road layout involves an overpass from Great South Road to the four-legged roundabout with Porchester Road with vehicle and active mode provisions.

7.5.2 Assessment features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

Traffic from Great South Road enters Walters Road on the west side via a five-legged roundabout involving Longford Park Drive and Intel Road, approximately 280m west of the level crossing. The closest intersection to the east of the level crossing is approximately 150m away being a signalised T-intersection with Arion Road. Traffic from Porchester Road enter Walters Road on the east side via a four-legged roundabout approximately 300m from the level crossing.

The nearest bus stop for southbound services is approximately 350m away from the level crossing, located on Great South Road south of the roundabout. The nearest bus stop of northbound services is approximately 400m away located to the north of the roundabout.

Currently there are pedestrian crossings facilities on the north and south sides of Walters Road. The existing pedestrian level crossings on Walters Road have an estimated LCSS of:

- Pedestrian Up – 50/60 which corresponds to a High LCSS risk band; and
- Pedestrian Down – 44/60 which corresponds to a Medium-High LCSS risk band.

In the likely future receiving environment in 2028, the LCSS for the Walters Road pedestrian level crossings are expected to be:

- Pedestrian Up – 33/60 which corresponds to a Medium LCSS risk band; and
- Pedestrian Down – 33/60 which corresponds to a Medium LCSS risk band.

7.5.3 Assessment of operational effects

7.5.3.1 General traffic

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the TLC.

The existing level crossing at Walters Road will be closed in the future and replaced by an overpass with vehicle and active modes provisions. There are no proposed changes to the roundabouts either side of the level crossing.

7.5.3.2 Local access

Walters Road, between Great South Road and the level crossing, provides access to businesses such as Southgate Shopping Centre, Arion Shopping Centre Takanini Fish Mart, Carters and Tony's Tyre Service

Egress trips out of the catchment area will remain as existing. All movements will be unaffected by the closure of the level crossing. It should be noted that access to properties to the west of the level crossing will be affected. As part of the proposed design, new connections to these properties are provided based on land designation.

Entry trips to the catchment area will remain as existing. All movements will be unaffected by the closure of the level crossing.

7.5.3.3 Freight

The vertical alignment of the Walters Road bridge includes grades of:

- 7% maximum; and
- 0.5% minimum.

The maximum grade of the Walters Road bridge is as per TDM without requiring specific treatment for pedestrian routes. The vertical alignment of the bridge will accommodate the traversing of heavy vehicles.

7.5.4 Summary and Conclusions

Table 48 provides a summary of the operational effects and recommendations for the Walters Road project area.

Table 48: Summary of Assessment of Effects and Recommendations - Walters Road

Effect	Assessment	Recommendation
Operational		
Gradient of Walters Road bridge and the effect on freight	The vertical alignment of the Walters Road bridge includes grades of: • 7% maximum • 0.5% minimum	At the detailed design stage, the Walters Road bridge should be designed to accommodate heavy vehicles and should be aligned with future standards.

8 Conclusions

Table 49 summarises the key construction effects and operational transport effects of the Project.

Table 49: Summary of Assessment of Effects and Recommendations

Effect	Assessment	Recommendation
Construction Effects		
Temporary disruption to people movement and vehicle movement in the area for an indicative construction duration of 2.5 – 3 years. Reduced network resilience due to multiple level crossing closures during construction. If one corridor is closed for construction without an alternative, the network will see an increase in congestion and reduction in network resilience.	Testing of various construction sequencing scenarios were undertaken to assess impact on community access in the network and the impact on each transport mode. The network of east-west connections was assessed under three geographic areas based on inter-dependency between connections. Community access, diversion routes for all road users, vehicle-to-capacity ratios, delays to vehicles, freight routing, safety implications, and impacts on bus routes were considered as part of this assessment.	A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of Spartan Road or Manuroa Road level crossings such as constructing **Manuia Road** bridge. A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Taka Street** level crossing during construction. This could mean the following: • Partial closure; and/or • Reroute traffic to an alternative connection such as Manuroa Road A suitable alternative to facilitate traffic, pedestrian and cyclist movement should be provided for the closure of **Walters Road** level crossing during construction. This could mean undertaking offline construction or partial closure. Appropriate timing of closures and community engagement can mitigate impacts.
Traffic generated during construction, including construction vehicle movements to	Construction of the Project will likely involve disruption to the surrounding existing road network and property access. Additional	Able to be managed / mitigated through traffic management such as CTMPs and engagement before construction commencement.

Effect	Assessment	Recommendation
and from the construction areas, partial or full road closure, temporary speed limits restriction around site access, and impacts to vulnerable road users. Points of conflict along the TLC corridors include access points along each corridor.	traffic will be generated from general staff and workforce for the Project as well as construction specific traffic such as traffic movements for material delivery and movement within construction areas. There are a few schools and early childhood centres in or surrounding the Project areas. This may indicate a potential increase of heavy traffic movements near sensitive areas.	Access to compound sites, laydown areas and construction zones for construction vehicles, plant and materials will be via site access points identified as part of future CTMPs. Sufficient space for construction laydown areas is to be provided to allow for construction vehicles to be stored off the corridors and to reduce impact on through movement in the network.
Access to properties along the TLC corridors may be impacted by temporary traffic management controls during the construction works.	Construction works may impact property access for residents and businesses in the Project areas. This will lead to temporary inability to get in and out of driveways and allow for business operations to occur. This construction effect may adversely impact business operations and restrict movement for residents in the area.	Existing driveways that remain during construction will be required to have safe temporary access provision to mitigate this effect. If required Site Specific Traffic Management Plan (SSTMP) can be developed to manage constraints on access to affected properties.
Construction vehicles parking in the surrounding network.	Additional construction traffic is expected to be entering the network and may be parking along the TLC corridors and affecting.	Provide construction parking facilities within the site footprint. Construction site workers should be provided with allocated parking facilities to access the site so that local business parking will not be impacted.
Operational Effects		
Closure of **Takaanini Road** at Taka Street effects community access to the Takaanini Hall	Closure of Takanini Road with Taka Street will affect the environment as vehicle users who would typically traverse through this link will have to divert via Glenora Road or Beach Road to access Great South Road and Taka Street.	Provide wayfinding signage on Taka Street which will help direct the community to the Takaanini Hall which is a community facility. There is also an opportunity at the time of implementation, to provide a connection for pedestrians and cyclists between the northern end of Takanini Road and the Taka Street bridge via stairs/ ramp.
The current **over-dimension freight** route is not suitable in the future network due to closure of Manuroa Road level crossing.	The alternative over-dimension route from Porchester Road to Great South Road, through the industrial area will be via Manuroa Road, Oakleigh Avenue and the Manuia Road connection. This	Alternative over-dimension route will need to be provided via the future Manuia Road connection to Great South Road. The Manuia Road bridge should be designed to accommodate over-dimension vehicles as per relevant engineering standards.

Effect	Assessment	Recommendation
	alternative route has been agreed with AT freight SMEs.	The alternative route should have a clear width and height to accommodate over-dimension vehicles and any overhead powerlines may need to be undergrounded. The roundabout at Manuia Road / Oakleigh Ave intersection should be designed to allow for enough turning space for over-dimension vehicles.
Routing for northbound trips onto Great South Road and access to SH1 northbound on-ramp are affected due to **Spartan Road level crossing closure**.	VTNZ and Hall's Cold Chain Logistics are typically required to travel northbound onto Great South Road to access the SH1 northbound on-ramp for the operation of their businesses. These businesses would normally travel via a U-turn manouvere at the Takaanini interchange (0.5km, 2 minutes), or re-routing through Manuroa Road (1.8km, 4 minutes). The option to route via Manuroa Road will no longer be possible due to the closure of Spartan Road level crossings. The alternative route is via Manuia Road and using the Manuia Road/ Oakleigh Avenue roundabout to perform a U-turn. This route would be 1.7km and take approximately 3.5 minutes to reach the NB on-ramp. This routing distance and expected travel time is less than the current routing via Manuroa Road.	It is recommended that prior to the start of construction, a design safe system audit is undertaken for the Project. This will determine if any mitigation measures are required to address any safety risks in regards to the U-turning of heavy vehicles at the Takaanini Interchange. The U-turn manouvere at the Takaanini interchange southern intersection should be assessed to understand if U-turning off heavy vehicles can be accommodated, as Hall's Cold Chain Logistics are expected to generate a high number of heavy vehicle trips. The road safety assessment may consider possible mitigation measures to make the movements around the interchange safer. These may include: • Providing a U-turn pocket by widening the corridor out towards the west within Waka Kotahi land to accommodate a safer U-turn movement for large heavy vehicles; • Banning the U-turning of large vehicles at the interchange and limiting the movement to the alternative route; and • Alternative route that should be provided for vehicles is via Manuia Road/ Oakleigh Avenue roundabout. The roundabout should be designed to accommodate heavy vehicles U-turning.
Existing **property access may be altered** in the surrounding network with potential land take	The proposed works may cause parcels to be landlocked if existing property access is altered and a safe alternative access is not provided.	Property access impacts and related safety implications are to be validated through site visits prior to the implementation of the Project. Access should be provided to properties; therefore, mitigation is required to ensure legal access is retained.

1 Appendix A – Modelling Assumptions

DBC Package	DBC	Projects / Elements	2038 Do Nothing	2048+ Do Nothing	2048+ Recommended Network	Current Planning Status	Current Funding Status
Takaanini DBC Package	Level Crossings DBC assessed for removal and/or replacement (this DBC)	Spartan Road	Level crossing is open	Level crossing is open	Level crossing is closed, replaced with an active mode bridge	Subject of this application	Unfunded
		Manuia Road	Existing access alignment	Existing access alignment	New alignment to connect GSR and Oakleigh Ave. Grade-separated multi-modal bridge.	Subject of this application	Unfunded
		Manuroa Road	Level crossing is open	Level crossing is open	Level crossing is closed, replaced with an active mode bridge	Subject of this application	Unfunded
		Taka Street	Level crossing is open	Level crossing is open	Level crossing is closed, replaced with a grade-separated multi-modal bridge.	Subject of this application	Unfunded
		Walters Road	Level crossing is open	Level crossing is open	Level crossing is closed, replaced with a grade-separated multi-modal bridge.	Subject of this application	Unfunded

DBC Package	DBC	Projects / Elements	2038 Do Nothing	2048+ Do Nothing	2048+ Recommended Network	Current Planning Status	Current Funding Status
	South Frequent Transit Network (FTN) (being prepared in parallel with this DBC)	Great South Road FTN between Drury Central Station and Manukau Station. This FTN partially exists and serves the bus service – route 33.	Included	Included	Included	Business Case only	Unfunded
		Takaanini FTN between Drury West Station and Manukau Station	Included, section south of Papakura Station is excluded.	Included	Included	Business Case only	Unfunded
		Popes Road and Croskery Road urbanisation	Excluded	Included	Included	Business Case only	Unfunded
Rail DBC Package	Rail DBC	New Drury Central Station	Included	Included	Included	Consented	Funded
		New Drury West Station	Included	Included	Included	Lodged	Funded

DBC Package	DBC	Projects / Elements	2038 Do Nothing	2048+ Do Nothing	2048+ Recommended Network	Current Planning Status	Current Funding Status
		New Paerātā Station	Included	Included	Included	Consented	Funded
		Additional rail capacity (four tracks between Wiri and Pukekohe)[31]	Excluded	Included	Included	Business Case only	Unfunded
South Strategic DBC Package	Mill Road and Drury DBC	Mill Road Corridor upgrades	Mill Road North: 2 lane safety corridor (50km/h) project	4 lane safety corridor (50km/h) project	4 lane safety corridor (50km/h) project	Business Case only	Partially funded
		Upgrades in Drury	Included	Included	Included	Business Case only	Unfunded
	Pukekohe DBC	Alternative route to SH22 between SH1 and Pukekohe	Included	Included	Included	Business Case only	Unfunded
		New arterial connections to the proposed Pukekohe	Included	Included	Included	Business Case only	Unfunded

[31] This project is expected to be packaged in segments for the planning process.

DBC Package	DBC	Projects / Elements	2038 Do Nothing	2048+ Do Nothing	2048+ Recommended Network	Current Planning Status	Current Funding Status
Drury Local	Drury Local Arterials DBC	New Drury arterial network	Included	Included	Included	Consented	Partially funded

Takaanini FUZ Network:

- **Wastney Road:** There is a new N-S collector through the Takaanini FUZ, connecting the existing Wastney Road at Alfriston Road in the north, with Airfield Road in the South. This N-S collector through the Takaanini FUZ is present in both the Do Nothing and recommended 2048+ network.
- **Popes Road urbanisation project:** The Popes Road east-west connection between Takanini School Road (in the west) and Mill Road (in the east), is expected to urbanise to a two lane multi-modal connection with separated walking and cycling facilities. This is consistent across both the Do Nothing and recommended network. Modelling assumes Popes Road will urbanise from 2048 onwards.

South arterial projects:

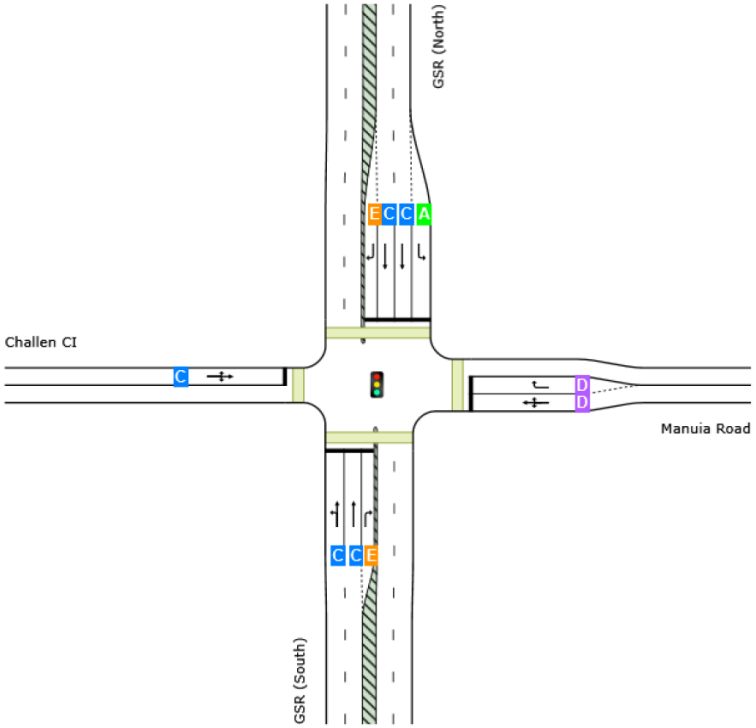
- **Mill Road:** Four-lane, lower speed Mill Road corridor project is included in both the 2048 and 2048+ Do minimum closure and recommended network. The two-lane Mill Road corridor safety project is included in the interim years (2028 and 2038), across both the Do Nothing and recommended network
- **Ōpaheke N-S Arterial:** Ōpaheke N-S arterial is included in both 2048+ Do Nothing and recommended network. The arterial is not included in the interim model years in both the Do Nothing and recommended network.
- **Croskery Road urbanisation project:** Croskery Road (between Hunua Road and Mill Road) is expected to urbanise to a two lane multi-modal connection with separated walking and cycling facilities. This is consistent across both the Do Nothing and recommended network. Modelling assumes Croskery Road will urbanise from 2048 onwards.

2 Appendix B – SIDRA Outputs

Manuia Road / GSR Intersection – SIDRA Outputs

Manuia Road / GSR

AM Peak



LANE SUMMARY

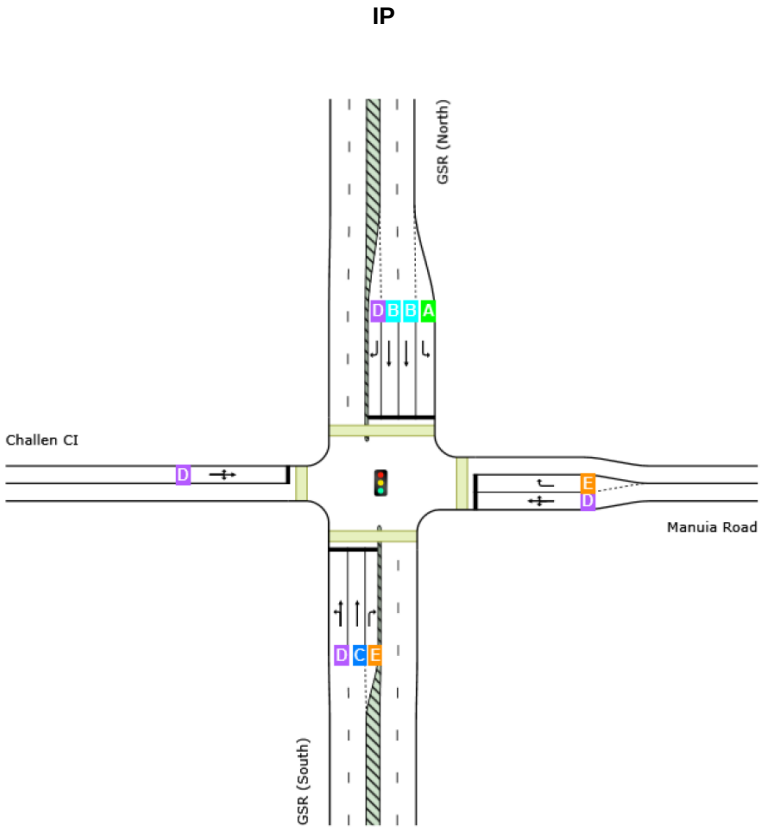
Site: 102 [ManuiaRd/GSR_AM (Site Folder: Manuia Rd/ GSR_75% Ind demand 80% Manuia Road)]

2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 130 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: GSR (South)													
Lane 1	591	18.4	649	0.910	100	32.8	LOS C	32.5	263.7	Full	152	0.0	55.8
Lane 2	552	17.2	607[1]	0.910	100	34.1	LOS C	32.3	259.3	Full	152	0.0	54.2
Lane 3	67	28.1	79	0.848	100	76.5	LOS E	4.7	40.9	Short	100	0.0	NA
Approach	1211	18.3		0.910		35.8	LOS D	32.5	263.7				
East: Manuia Road													
Lane 1	422	21.7	472	0.895	100	46.3	LOS D	26.9	223.4	Full	345	0.0	0.0
Lane 2	420	22.0	469	0.895	100	47.1	LOS D	26.8	223.1	Short	120	0.0	NA
Approach	842	21.9		0.895		46.7	LOS D	26.9	223.4				
North: GSR (North)													
Lane 1	682	30.6	984	0.693	100	5.3	LOS A	1.7	15.3	Short	250	0.0	NA
Lane 2	431	12.3	663	0.649	100	22.2	LOS C	17.4	134.7	Full	260	0.0	0.0
Lane 3	437	10.1	672	0.649	100	22.2	LOS C	17.6	134.1	Full	260	0.0	0.0
Lane 4	8	25.0	81	0.104	100	68.9	LOS E	0.5	4.4	Short	100	0.0	NA
Approach	1558	19.7		0.693		15.1	LOS B	17.6	134.7				
West: Challen CI													
Lane 1	39	10.8	241	0.162	100	30.1	LOS C	1.3	9.7	Full	100	0.0	0.0
Approach	39	10.8		0.162		30.1	LOS C	1.3	9.7				
Intersection	3649	19.7		0.910		29.4	LOS C	32.5	263.7				

Manuia Road / GSR



LANE SUMMARY

Site: 102 [ManuiaRd/GSR_IP (Site Folder: Manuia Rd/ GSR_75% Ind demand 80% Manuia Road)]

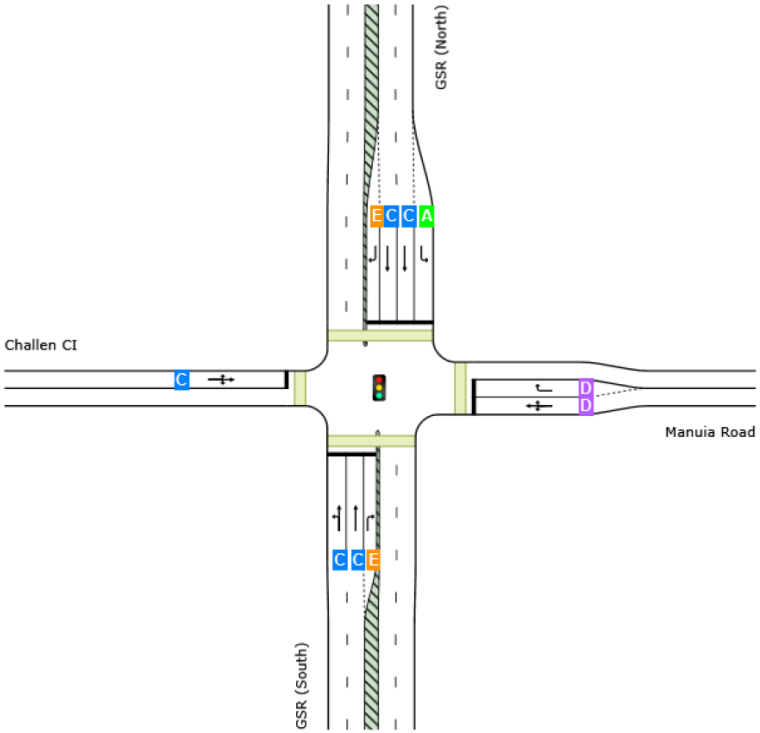
2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 135 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: GSR (South)													
Lane 1	552	10.9	624	0.883	100	40.8	LOS D	33.6	257.5	Full	152	0.0	53.5
Lane 2	548	9.4	621[1]	0.883	100	35.0	LOS C	33.5	253.8	Full	152	0.0	52.1
Lane 3	2	100.0	46	0.046	100	75.1	LOS E	0.1	1.8	Short	100	0.0	NA
Approach	1102	10.3		0.883		37.9	LOS D	33.6	257.5				
East: Manuia Road													
Lane 1	362	26.3	399	0.908	100	54.8	LOS D	25.1	215.0	Full	345	0.0	0.0
Lane 2	352	29.2	387	0.908	100	55.8	LOS E	24.4	213.8	Short	120	0.0	NA
Approach	714	27.7		0.908		55.3	LOS E	25.1	215.0				
North: GSR (North)													
Lane 1	752	60.2	885	0.849	100	8.2	LOS A	5.5	58.0	Short	250	0.0	NA
Lane 2	578	10.0	769	0.752	100	18.0	LOS B	23.7	180.5	Full	260	0.0	0.0
Lane 3	580	8.3	771[1]	0.752	100	18.0	LOS B	23.6	176.9	Full	260	0.0	0.0
Lane 4	11	30.0	130	0.081	100	35.6	LOS D	0.3	3.1	Short	100	0.0	NA
Approach	1920	29.3		0.849		14.3	LOS B	23.7	180.5				
West: Challen CI													
Lane 1	42	7.5	264	0.160	100	40.0	LOS D	1.6	11.9	Full	100	0.0	0.0
Approach	42	7.5		0.160		40.0	LOS D	1.6	11.9				
Intersection	3778	23.2		0.908		29.2	LOS C	33.6	257.5				

Manuia Road / GSR

PM Peak



LANE SUMMARY

Site: 102 [ManuiaRd/GSR_PM (Site Folder: Manuia Rd/ GSR_75% Ind demand 80% Manuia Road)]

2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 105 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

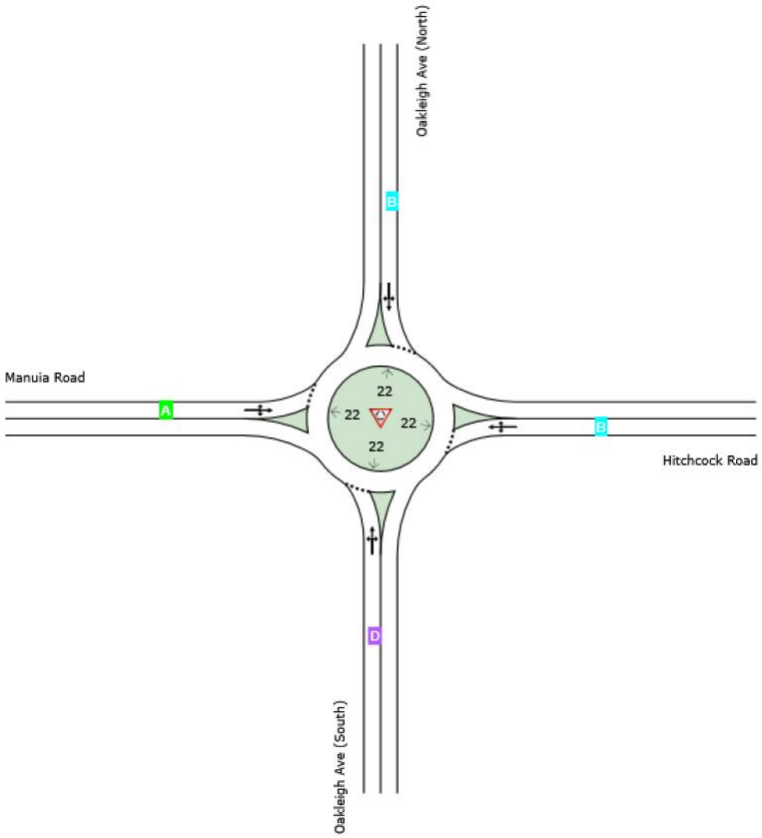
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: GSR (South)													
Lane 1	450	9.2	619	0.727	100	22.1	LOS C	16.7	125.7	Full	152	0.0	0.0
Lane 2	449	7.2	618	0.727	100	22.4	LOS C	17.3	128.7	Full	152	0.0	0.0
Lane 3	2	100.0	59	0.036	100	57.7	LOS E	0.1	1.4	Short	100	0.0	NA
Approach	901	8.4		0.727		22.3	LOS C	17.3	128.7				
East: Manuia Road													
Lane 1	395	15.0	475	0.831	100	35.9	LOS D	18.8	148.6	Full	345	0.0	0.0
Lane 2	380	17.1	457	0.831	100	37.0	LOS D	18.3	146.6	Short	120	0.0	NA
Approach	775	16.0		0.831		36.5	LOS D	18.8	148.6				
North: GSR (North)													
Lane 1	549	55.9	779	0.705	100	5.8	LOS A	1.8	19.0	Short	250	0.0	NA
Lane 2	451	8.9	611	0.738	100	22.7	LOS C	17.7	132.9	Full	260	0.0	0.0
Lane 3	457	6.7	620	0.738	100	22.6	LOS C	17.9	132.3	Full	260	0.0	0.0
Lane 4	7	14.3	92	0.080	100	56.1	LOS E	0.4	2.9	Short	100	0.0	NA
Approach	1465	25.9		0.738		16.5	LOS B	17.9	132.9				
West: Challen CI													
Lane 1	56	7.5	268	0.208	100	27.9	LOS C	1.5	10.9	Full	100	0.0	0.0
Approach	56	7.5		0.208		27.9	LOS C	1.5	10.9				
Intersection	3197	18.2		0.831		23.2	LOS C	18.8	148.6				

Manuia Road / Oakleigh Avenue Intersection – SIDRA Outputs

Manuia Road / Oakleigh Avenue

AM Peak



LANE SUMMARY

Site: 102 [ManuiaRd/OakleighAve/HitchcockRd_AM (Site Folder: Manuia Rd /Oakleigh Ave/Hitchcock Rd_75% Ind demand)]

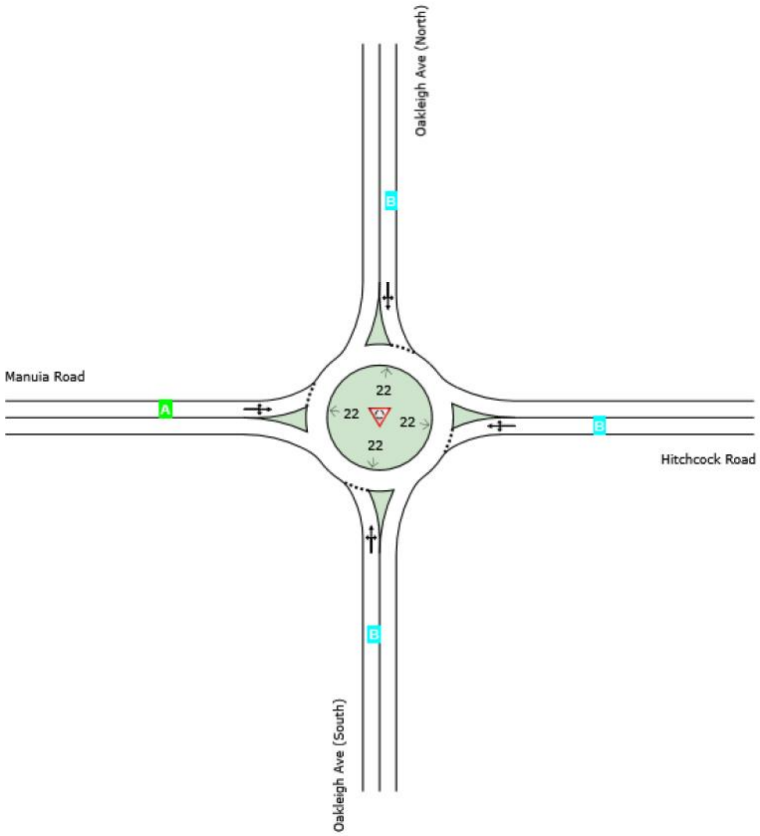
2048+ Ref Case
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Oakleigh Ave (South)													
Lane 1[d]	619	22.8	668	0.927	100	35.9	LOS D	22.7	190.1	Full	227	0.0	0.0
Approach	619	22.8		0.927		35.9	LOS D	22.7	190.1				
East: Hitchcock Road													
Lane 1[d]	32	0.0	585	0.054	100	10.4	LOS B	0.4	2.6	Full	100	0.0	0.0
Approach	32	0.0		0.054		10.4	LOS B	0.4	2.6				
North: Oakleigh Ave (North)													
Lane 1[d]	556	30.9	936	0.594	100	10.6	LOS B	5.7	50.3	Full	173	0.0	0.0
Approach	556	30.9		0.594		10.6	LOS B	5.7	50.3				
West: Manuia Road													
Lane 1[d]	768	29.9	1211	0.635	100	5.2	LOS A	7.8	68.4	Full	345	0.0	0.0
Approach	768	29.9		0.635		5.2	LOS A	7.8	68.4				
Intersection	1975	27.5		0.927		16.5	LOS B	22.7	190.1				

Manuia Road / Oakleigh Avenue

IP



LANE SUMMARY

Site: 102 [ManuiaRd/OakleighAve/HitchcockRd_IP (Site Folder: Manuia Rd /Oakleigh Ave/Hitchcock Rd_75% Ind demand)]

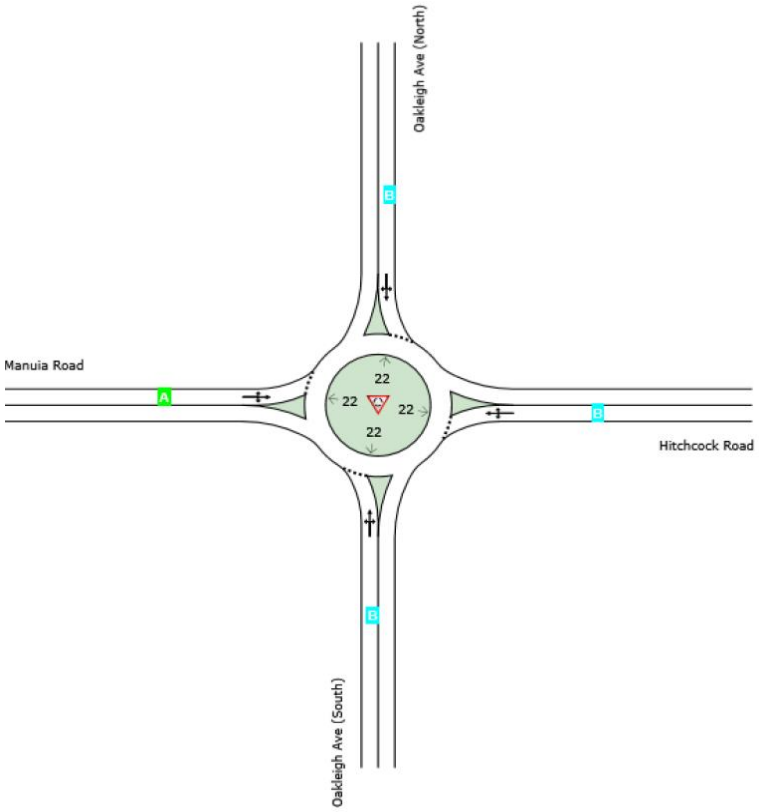
2048+ Ref Case
Site Category: (None)
Roundabout

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Oakleigh Ave (South)													
Lane 1[d]	497	29.9	655	0.758	100	16.8	LOS B	10.2	89.9	Full	227	0.0	0.0
Approach	497	29.9		0.758		16.8	LOS B	10.2	89.9				
East: Hitchcock Road													
Lane 1[d]	32	0.0	542	0.058	100	11.2	LOS B	0.4	2.8	Full	100	0.0	0.0
Approach	32	0.0		0.058		11.2	LOS B	0.4	2.8				
North: Oakleigh Ave (North)													
Lane 1[d]	509	33.9	801	0.636	100	13.5	LOS B	6.8	61.5	Full	173	0.0	0.0
Approach	509	33.9		0.636		13.5	LOS B	6.8	61.5				
West: Manuia Road													
Lane 1[d]	771	59.3	1086	0.710	100	6.2	LOS A	10.0	105.6	Full	345	0.0	0.0
Approach	771	59.3		0.710		6.2	LOS A	10.0	105.6				
Intersection	1808	43.0		0.758		11.2	LOS B	10.2	105.6				

Manuia Road / Oakleigh Avenue

PM Peak



LANE SUMMARY

Site: 102 [ManuiaRd/OakleighAve/HitchcockRd_PM (Site Folder: Manuia Rd /Oakleigh Ave/Hitchcock Rd_75% Ind demand)]

2048+ Ref Case
Site Category: (None)
Roundabout

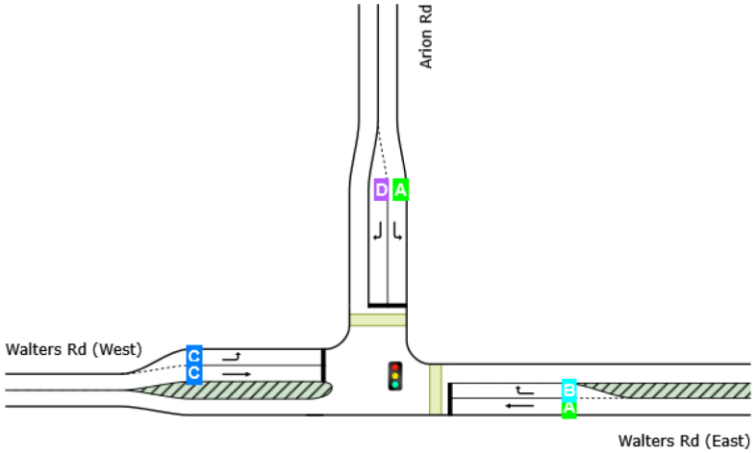
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Oakleigh Ave (South)													
Lane 1[d]	551	21.6	707	0.779	100	17.1	LOS B	11.3	94.0	Full	227	0.0	0.0
Approach	551	21.6		0.779		17.1	LOS B	11.3	94.0				
East: Hitchcock Road													
Lane 1[d]	32	0.0	607	0.052	100	10.1	LOS B	0.3	2.4	Full	100	0.0	0.0
Approach	32	0.0		0.052		10.1	LOS B	0.3	2.4				
North: Oakleigh Ave (North)													
Lane 1[d]	545	22.4	966	0.564	100	10.1	LOS B	5.0	41.7	Full	173	0.0	0.0
Approach	545	22.4		0.564		10.1	LOS B	5.0	41.7				
West: Manuia Road													
Lane 1[d]	566	55.2	1065	0.532	100	5.8	LOS A	5.4	55.7	Full	345	0.0	0.0
Approach	566	55.2		0.532		5.8	LOS A	5.4	55.7				
Intersection	1694	32.7		0.779		10.9	LOS B	11.3	94.0				

Walters Road / Arion Road Intersection – SIDRA Outputs

Walters Road / Arion Road

AM Peak



LANE SUMMARY

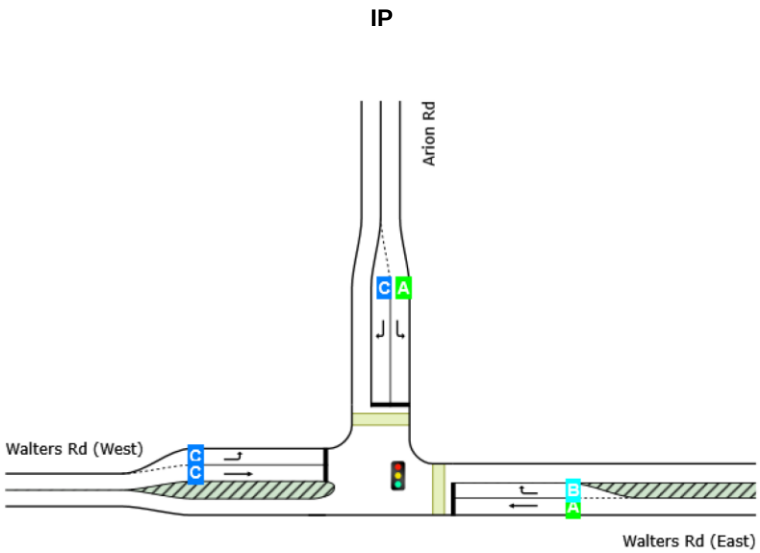
Site: 102 [WaltersRd/ArionRd_ AM (Site Folder: Walters Rd/ Arion Rd_75% Ind demand)]

2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 65 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Walters Rd (East)													
Lane 1	251	2.1	1420	0.176	100	2.4	LOS A	2.2	15.9	Full	130	0.0	0.0
Lane 2	560	4.3	820[1]	0.683	100	13.6	LOS B	11.0	79.6	Short	22	0.0	NA
Approach	811	3.6		0.683		10.1	LOS B	11.0	79.6				
North: Arion Rd													
Lane 1	322	7.5	1329	0.242	100	7.2	LOS A	3.1	22.8	Full	500	0.0	0.0
Lane 2	43	9.8	160	0.269	100	36.6	LOS D	1.4	10.4	Short	50	0.0	NA
Approach	365	7.8		0.269		10.7	LOS B	3.1	22.8				
West: Walters Rd (West)													
Lane 1	224	4.7	458	0.490	100	27.2	LOS C	6.2	45.4	Short	42	0.0	NA
Lane 2	74	2.9	172	0.428	100	32.5	LOS C	2.4	17.1	Full	417	0.0	0.0
Approach	298	4.2		0.490		28.5	LOS C	6.2	45.4				
Intersection	1474	4.8		0.683		14.0	LOS B	11.0	79.6				

Walters Road / Arion Road



LANE SUMMARY

Site: 102 [WaltersRd/ArionRd_IP (Site Folder: Walters Rd/ Arion Rd_75% Ind demand)]

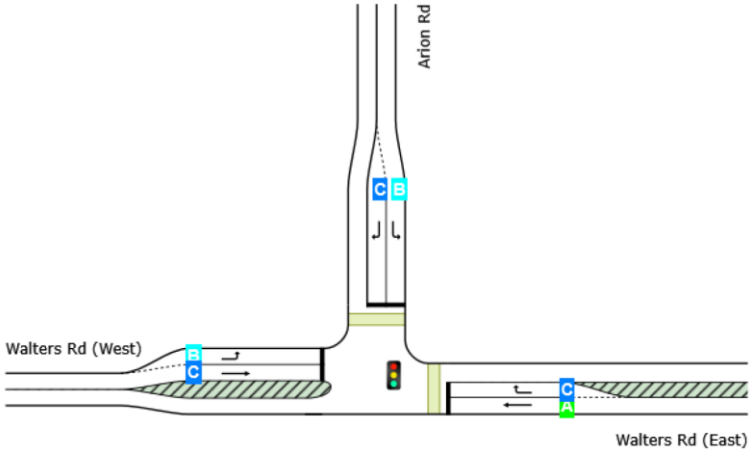
2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Walters Rd (East)													
Lane 1	337	1.6	1323	0.255	100	3.5	LOS A	3.6	25.4	Full	130	0.0	0.0
Lane 2	356	2.4	669[1]	0.532	100	15.5	LOS B	6.8	48.8	Short	22	0.0	NA
Approach	693	2.0		0.532		9.7	LOS A	6.8	48.8				
North: Arion Rd													
Lane 1	462	3.0	1273	0.363	100	8.5	LOS A	5.4	39.0	Full	500	0.0	0.0
Lane 2	106	5.0	239	0.445	100	32.2	LOS C	3.1	22.4	Short	50	0.0	NA
Approach	568	3.3		0.445		12.9	LOS B	5.4	39.0				
West: Walters Rd (West)													
Lane 1	315	4.0	615	0.511	100	21.7	LOS C	7.5	54.2	Short	42	0.0	NA
Lane 2	129	1.6	251	0.517	100	27.8	LOS C	3.8	26.7	Full	417	0.0	0.0
Approach	444	3.3		0.517		23.5	LOS C	7.5	54.2				
Intersection	1705	2.8		0.532		14.4	LOS B	7.5	54.2				

Walters Road / Arion Road

PM Peak



LANE SUMMARY

Site: 102 [WaltersRd/ArionRd_PM (Site Folder: Walters Rd/ Arion Rd_75% Ind demand)]

2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

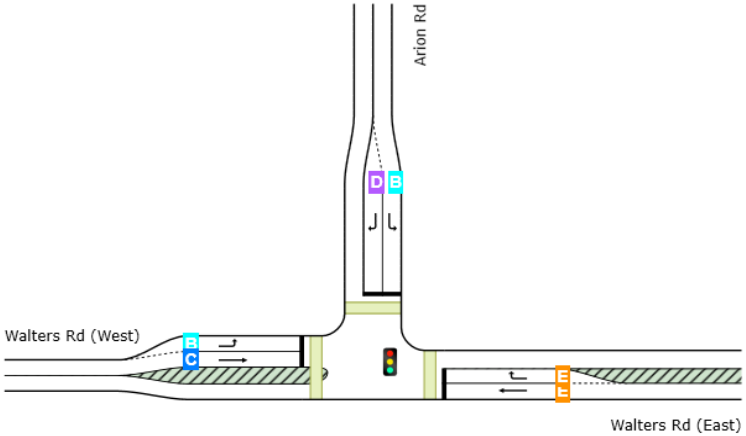
Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Walters Rd (East)													
Lane 1	338	0.9	1044	0.324	100	8.0	LOS A	5.4	38.4	Full	130	0.0	0.0
Lane 2	173	4.9	346	0.499	100	28.8	LOS C	4.7	34.5	Short	22	0.0	NA
Approach	511	2.3		0.499		15.0	LOS B	5.4	38.4				
North: Arion Rd													
Lane 1	329	3.2	1029	0.320	100	12.0	LOS B	5.1	36.9	Full	500	0.0	0.0
Lane 2	255	5.0	508	0.501	100	24.6	LOS C	6.4	47.0	Short	50	0.0	NA
Approach	584	4.0		0.501		17.5	LOS B	6.4	47.0				
West: Walters Rd (West)													
Lane 1	351	4.5	1110	0.316	100	10.0	LOS B	4.7	34.3	Short	42	0.0	NA
Lane 2	247	1.3	502	0.492	100	20.7	LOS C	6.3	44.7	Full	417	0.0	0.0
Approach	598	3.2		0.492		14.4	LOS B	6.3	44.7				
Intersection	1693	3.2		0.501		15.7	LOS B	6.4	47.0				

Walters Road / Arion Road Intersection (added pedestrian movement on western arm) – SIDRA Outputs

Walters Road / Arion Road

AM Peak



LANE SUMMARY

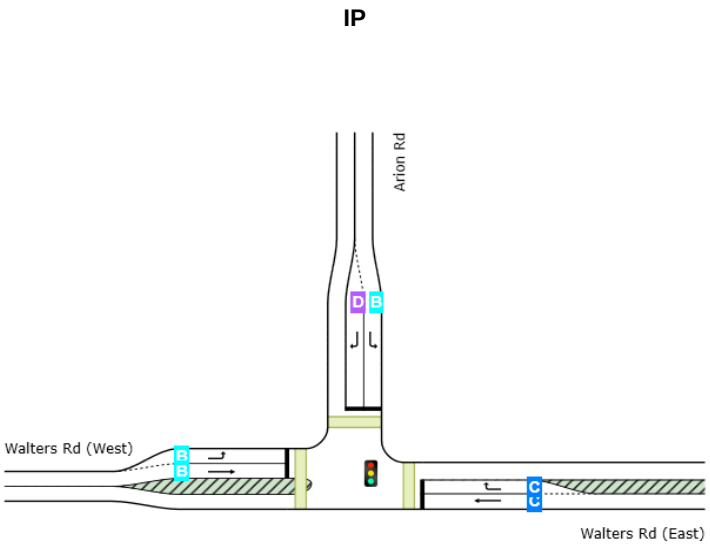
Site: 102 [WaltersRd/ArionRd_ AM (Site Folder: Walters Rd/Arion Rd_75% Ind demand)]

2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 65 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Walters Rd (East)													
Lane 1	251	2.1	256[1]	0.977	100	62.3	LOS E	12.3	87.6	Full	130	0.0	43.9[8]
Lane 2	560	4.3	579[1]	0.968	100	58.8	LOS E	27.4	198.7	Short	22	0.0	NA
Approach	811	3.6		0.977		59.9	LOS E	27.4	198.7				
North: Arion Rd													
Lane 1	322	7.5	1058	0.305	100	11.5	LOS B	5.0	37.3	Full	500	0.0	0.0
Lane 2	43	9.8	160	0.269	100	36.6	LOS D	1.4	10.4	Short	50	0.0	NA
Approach	365	7.8		0.305		14.4	LOS B	5.0	37.3				
West: Walters Rd (West)													
Lane 1	224	4.7	727	0.308	100	18.5	LOS B	4.8	35.2	Short	42	0.0	NA
Lane 2	74	2.9	459	0.161	100	21.2	LOS C	1.9	13.4	Full	417	0.0	0.0
Approach	298	4.2		0.308		19.2	LOS B	4.8	35.2				
Intersection	1474	4.8		0.977		40.4	LOS D	27.4	198.7				

Walters Road / Arion Road



LANE SUMMARY

Site: 102 [WaltersRd/ArionRd_IP (Site Folder: Walters Rd/Arion Rd_75% Ind demand)]

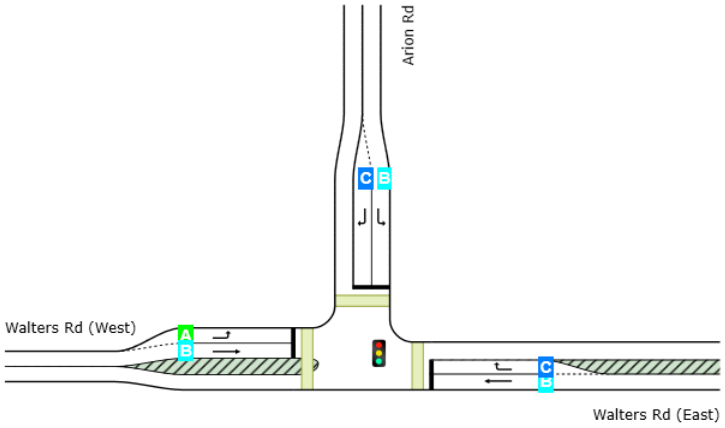
2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Walters Rd (East)													
Lane 1	337	1.6	410[1]	0.822	100	25.6	LOS C	10.1	71.5	Full	130	0.0	0.0
Lane 2	356	2.4	421[1]	0.844	100	31.8	LOS C	11.2	79.7	Short	22	0.0	NA
Approach	693	2.0		0.844		28.8	LOS C	11.2	79.7				
North: Arion Rd													
Lane 1	462	3.0	940	0.492	100	14.8	LOS B	8.9	63.6	Full	500	0.0	0.0
Lane 2	106	5.0	179	0.593	100	35.3	LOS D	3.3	23.9	Short	50	0.0	NA
Approach	568	3.3		0.593		18.6	LOS B	8.9	63.6				
West: Walters Rd (West)													
Lane 1	315	4.0	879	0.358	100	14.5	LOS B	5.7	41.1	Short	42	0.0	NA
Lane 2	129	1.6	595	0.218	100	16.5	LOS B	2.8	20.1	Full	417	0.0	0.0
Approach	444	3.3		0.358		15.1	LOS B	5.7	41.1				
Intersection	1705	2.8		0.844		21.9	LOS C	11.2	79.7				

Walters Road / Arion Road

PM Peak



LANE SUMMARY

Site: 102 [WaltersRd/ArionRd_PM (Site Folder: Walters Rd/Arion Rd_75% Ind demand)]

2048+ Ref Case
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: Walters Rd (East)													
Lane 1	338	0.9	526[1]	0.642	100	17.3	LOS B	8.1	57.2	Full	130	0.0	0.0
Lane 2	173	4.9	288	0.599	100	31.4	LOS C	5.0	36.6	Short	22	0.0	NA
Approach	511	2.3		0.642		22.0	LOS C	8.1	57.2				
North: Arion Rd													
Lane 1	329	3.2	878	0.375	100	15.2	LOS B	6.2	44.3	Full	500	0.0	0.0
Lane 2	255	5.0	419	0.609	100	27.9	LOS C	7.0	51.1	Short	50	0.0	NA
Approach	584	4.0		0.609		20.7	LOS C	7.0	51.1				
West: Walters Rd (West)													
Lane 1	351	4.5	1168	0.300	100	9.1	LOS A	4.3	31.1	Short	42	0.0	NA
Lane 2	247	1.3	659	0.375	100	16.0	LOS B	5.5	39.1	Full	417	0.0	0.0
Approach	598	3.2		0.375		12.0	LOS B	5.5	39.1				
Intersection	1693	3.2		0.642		18.0	LOS B	8.1	57.2				

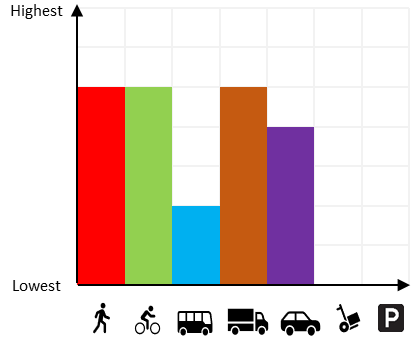
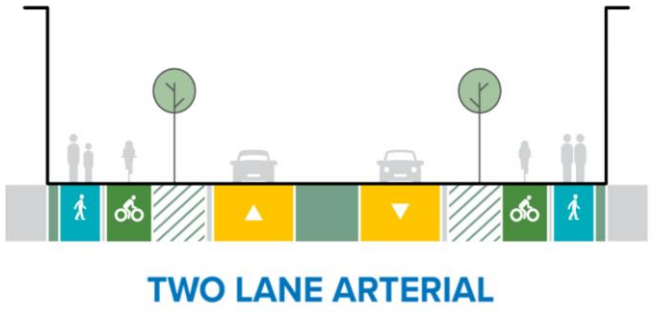
3 Appendix C – Roads and Streets Framework Assessment

The development of the corridor design has included the use of AT's Roads and Streets Framework, which qualitatively assesses the typology (movement and place value) and modal priority. The intent of that framework is to classify the expected movement and place functions from a consistent regional context and identify the likely priority applied to each mode.

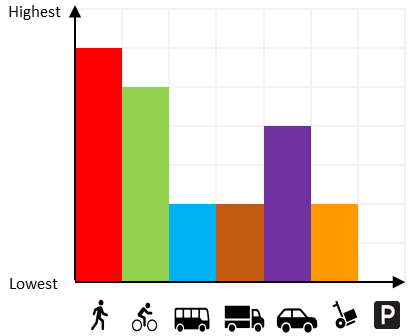
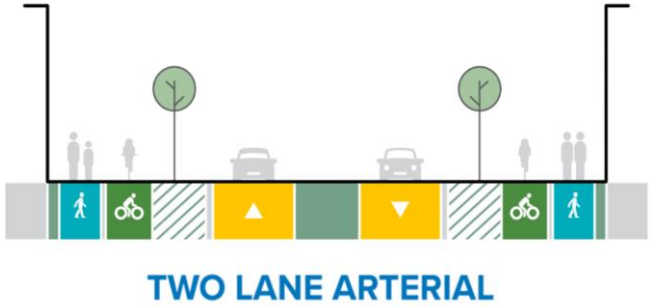
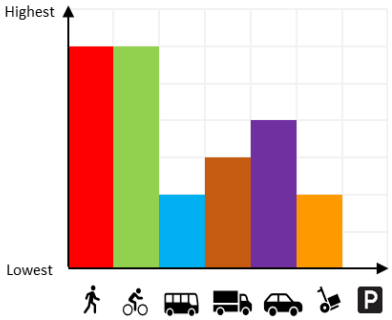
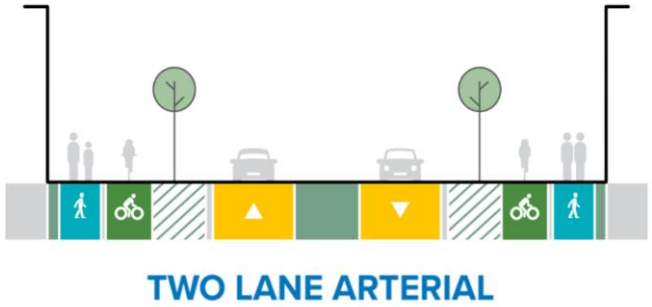
The framework itself does not directly dictate a specific corridor design but provides context and guidance regarding the intended function of the corridor, that will be used to inform future development and operation of the corridor. For integrated land use and transport classification purposes, land use context uses Place Value (ranking from P1 'low' to P3 'high' importance) and for transport context uses Movement Value (ranking from M1 'low' to M3 'high' importance).

The following table provides a summary of the RASF mandates and Corridor Form and Function (**CFAF**) results for the Takaanini Level Crossings corridors. The future typology (movement and place value) and future modal priority for each corridor is summarised below, along with the proposed future cross section from the CFAF process.

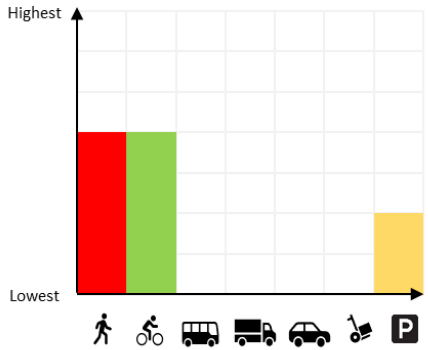
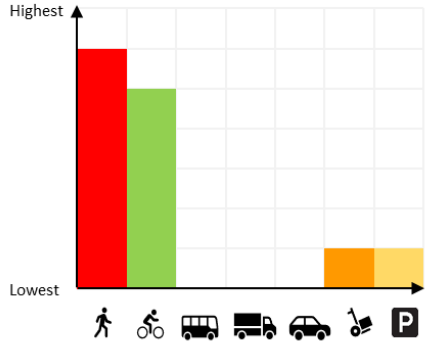
RASF and CFAF Mandates Summary – Takaanini Level Crossings (multi-modal connections)

Manuia Road (GSR – Oakleigh Avenue)	Future Modal Priority	CFAF Cross Section
Future Typology: P2/M2		

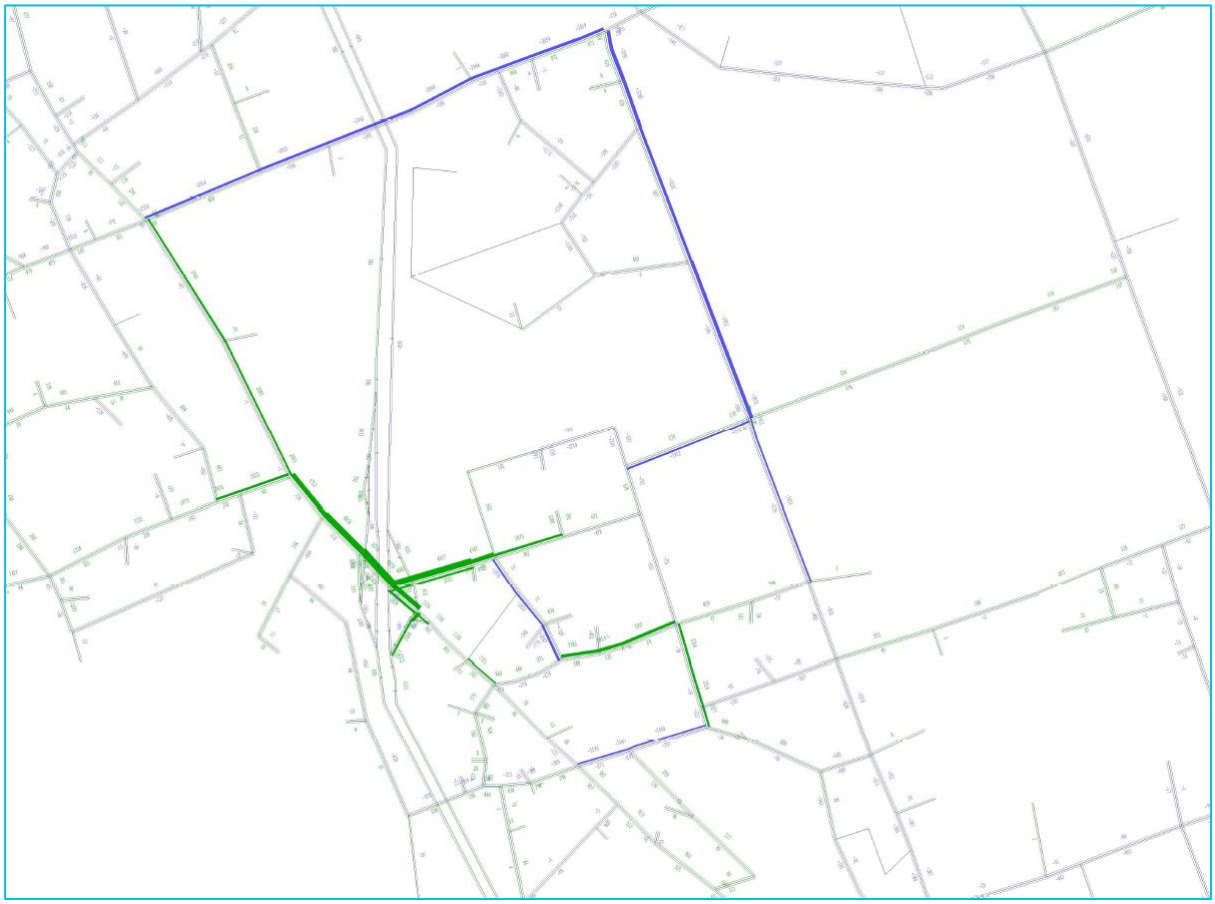
RASF and CFAF Mandates Summary – Takaanini Level Crossings (multi-modal connections)

Taka Street (GSR – Kauri Heart Avenue)	Future Modal Priority	CFAF Cross Section
Future Typology: P2/M2		
Walters Road (GSR – Porchester Road)	**Future Modal Priority**	**CFAF Cross Section**
Future Typology: P2/M2		

RASF and CFAF Mandates Summary – Takaanini Level Crossings (active mode connections)

Spartan Road	Future Modal Priority	CFAF Cross Section
Future Typology: P1/M1		
Manuroa Road	**Future Modal Priority**	**CFAF Cross Section**
Future Typology: P2/M1		

4 Appendix D – Construction Scenarios traffic flow difference plots



Daily flow difference plot (Scenario 1a - Do Nothing scenario)

Scenario 1a:

- **Spartan Road** level crossing closed.
- **Manuia Road** being constructed.
- **Manuroa Road** level crossing open
- **Taka Street** level crossing open
- **Walters Road** level crossing open

When Spartan Road is closed during the construction of Manuia Road bridge, traffic is diverted to Alfriston Road and Porchester Road (thick blue lines). Traffic reduction is shown by the green lines for this plot.

Daily flow difference plot (Scenario 1b – Do Nothing scenario)

Scenario 1b:

- **Spartan Road** level crossing open
- **Manuia Road** being constructed.
- **Manuroa Road** level crossing closed.
- **Taka Street** level crossing open
- **Walters Road** level crossing open

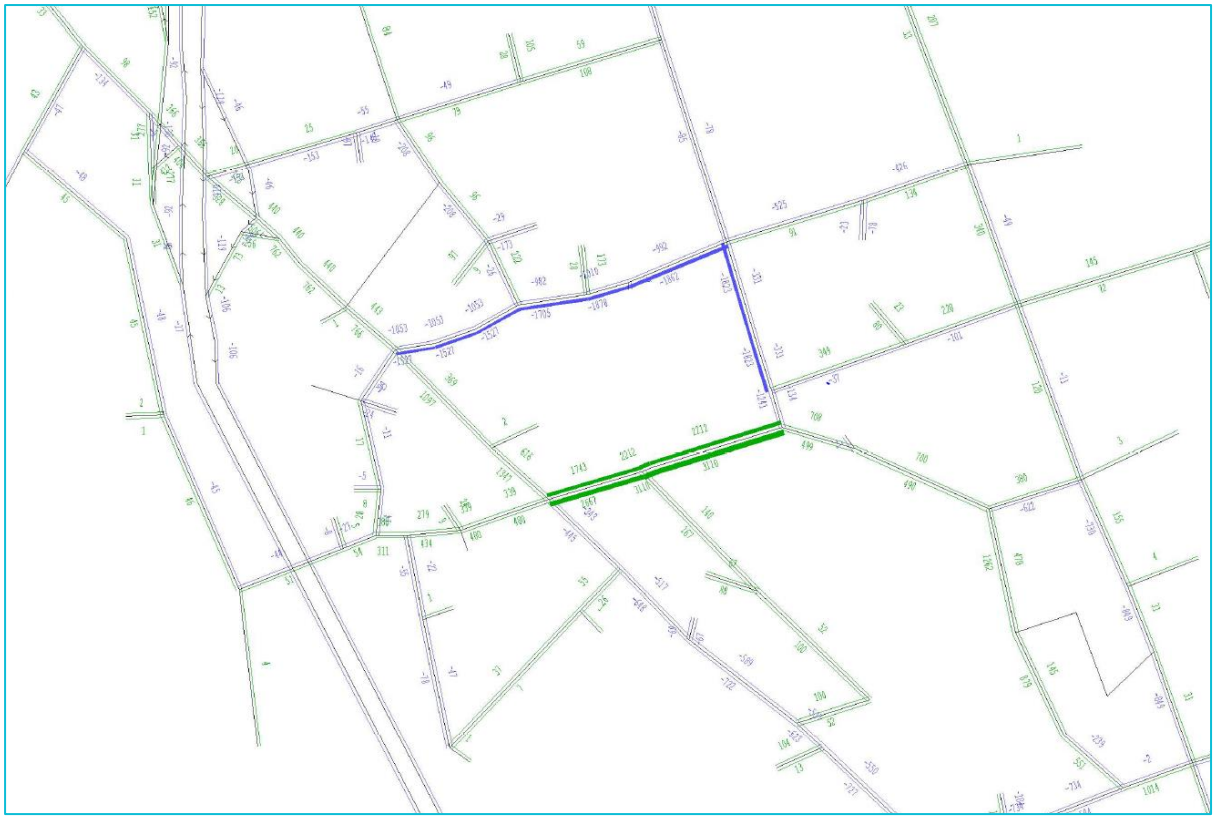
When Manuroa Road is closed during the construction of Manuia Road bridge, traffic is diverted to Taka Street (thick blue line). Traffic reduction is shown by the green lines for this plot.

Daily flow difference plot (Scenario 2a – Do Nothing scenario)

Scenario 2a:

- **Spartan Road** level crossing closed.
- **Manuia Road** bridge open
- **Manuroa Road** level crossing closed.
- **Taka Street** level crossing closed for construction.
- **Walters Road** level crossing open

When Manuia Road bridge has been built, and Spartan Road, Manuroa Road and Taka Street level crossings are closed during the construction of the Taka Street bridge, heavy traffic is diverted to the new Manuia Road bridge (thick blue line). Traffic reduction is shown by the green lines for this plot.



Daily flow difference plot (Scenario 2b – Do Nothing scenario)

Scenario 2b:

- **Spartan Road** level crossing open
- **Manuia Road** bridge not built.
- **Manuroa Road** level crossing open
- **Taka Street** level crossing closed for construction.
- **Walters Road** level crossing open

When Manuia Road bridge has not yet been built, and just Taka Street level crossing is closed during the construction of the Taka Street bridge, traffic is expected to be diverted predominantly to Manuroa Road (blue line). Traffic reduction is shown by the green lines for this plot.

Daily flow difference plot (Scenario 3 – Do Nothing scenario)

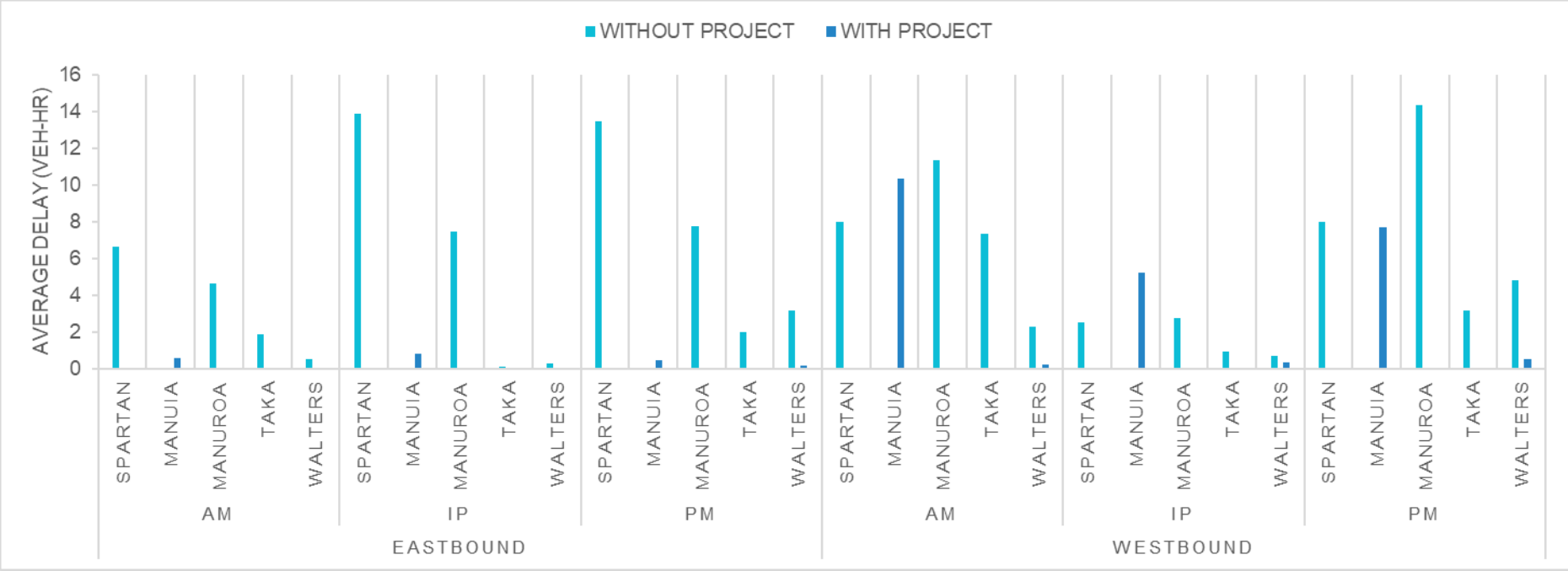
Scenario 3:

- **Spartan Road** level crossing open
- **Manuia Road** bridge not built.
- **Manuroa Road** level crossing open
- **Taka Street** level crossing open
- **Walters Road** level crossing closed for construction.

When Manuia Road bridge has not yet been built, and just Walters Road level crossing is closed during the construction of the Walters Road bridge, traffic is expected to be diverted predominantly to Subway Road and to Taka Street (blue line). Traffic reduction is shown by the green lines for this plot.

5 Appendix E – Average delay

Average total delay across each TLC corridor (veh-hr) with and without the Project in 2048+ is included in the graph below.



Total delay (veh-hr) across each TLC corridor in 2048+