Transport Outcomes Report

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Appendix D - Pukekohe Transport Outcomes Report

Document Status

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand .Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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1 Introduction

1.1 Purpose and Scope of the Report

This Transport Outcomes report has been prepared by Te Tupu Ngātahi (the Supporting Growth Alliance) for the Pukekohe Detailed Business Case (Pukekohe DBC). Te Tupu Ngātahi is a collaboration between Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) to carry out the planning phase of the Te Tupu Ngātahi Programme (the Programme) (formerly known as the Transport for Future Urban Growth (TfUG) Programme).

Like the rest of the DBC, this report is targeted at informing a decision to proceed to Route Protection. This means it has a greater focus on flexibility and concepts rather than the more detailed analysis that could be expected for a project being prepared for imminent implementation.

This Transport Outcomes report:

- Provides an overview of the recommended network including the corridor form and function and intersection form and function.
- Details the transport outcomes including Key Performance Indicators (KPIs) of the recommended network for Pukekohe.
- Provides an overview of the key transport assessments undertaken to support the optioneering process for the Pukekohe recommended network including:
    - Land use assumptions
    - Transport network assumptions; and
    - Transport network analysis.

As identified, the focus of this report is the transportation outcomes of the recommended package, with a more detailed description of the option development and assessment process provided within **Appendix C** of the Pukekohe DBC in the Options Assessment Report.

1.2 Report Structure

The report has been split into several sections, covering the following:

Section 2 summarises the recommended network for the Pukekohe corridors.

Section 3 summarises the investment objectives identified for the Pukekohe corridors and the associated Key Performance Indicators (KPIs) set for each of these objectives. These KPIs subsequently measure how well the recommended network performs against the investment objectives.

Section 4 summarises the transport assessment undertaken to reach the recommended network.

2 Recommended Network

The following section outlines the recommended network for the Pukekohe DBC. The recommended transport network for the Pukekohe DBC consists of a system of interventions including local corridors and strategic network components. These components include upgrades to existing rural corridors and new urban corridors.

These interventions are in response to the planned growth within Pukekohe, Paerata and South Drury, where more than 55,000 people are expected to be living, along with 21,000 new homes and 9,000 new jobs. Further detail on the specific features of these interventions are provided in the following section.

Overall, it is considered that the Pukekohe recommended network provides a safe, reliable transport system that supports growth, offers sustainable travel choice and access to employment and social amenities.

2.1 South Wide Recommended Network

A series of Business Cases and public engagement (including corridors in Drury Package) have been undertaken over the past four 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 (TfUG) (2016)
- South Indicative Business Case (IBC) (2018)
- Integrated Transport Assessment Report (2019)

The previous work identified these transport corridors for more detail analysis, which then lead to this assessment process and transportation evidence to reach the recommended network suitable for route protection.

The Pukekohe Package was developed as part of a wider programme of transport initiatives needed to support the growth in the southern part of Auckland. Those other projects have been designed to be complementary to the Pukekohe Package and operate as an integrated network as shown in Figure 2-1 below.

Figure 2-1 - South Auckland Indicative Strategic Transport Network

SOUTH INDICATIVE STRATEGIC TRANSPORT NETWORK

JULY 2019

Projects described in these maps have been identified by indicative business cases and will require further technical investigation, engagement with communities and landowners and statutory approvals before their final detail, location or land requirement is confirmed. They are also yet to be prioritised for funding for delivery over the next 10-30 years.

RAIL CORRIDOR UPGRADE

1. Rail upgrade from Papakura to Pukekohe
2. Closure of Manuroa Road and Spartan Road rail crossings to vehicles
3. New grade separated rail crossings at Taka Street and Walters Road
4. New train station – Drury Central
5. New train station – Drury West
6. New train station – Paerata

NEW OR IMPROVED PUBLIC TRANSPORT CORRIDOR

7. Frequent Transit Networks (FTNs) routes using SH1 and arterial roads to connect to town centres, and the major centres of Papakura, Drury and Manukau

NEW WALKING AND CYCLING CORRIDOR

8. Strategic walking and cycling corridor to connect to SH1 Strategic Cycleway

NEW OR IMPROVED TRANSPORT CORRIDOR

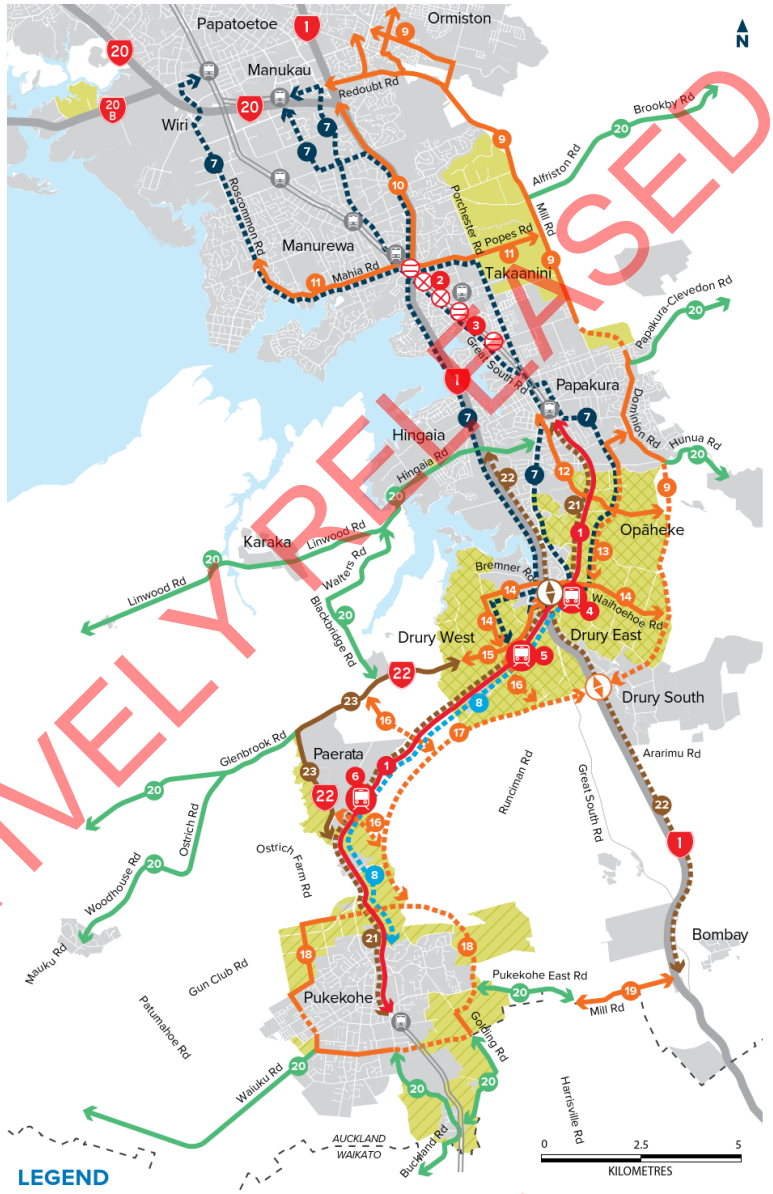
9. Mill Road Corridor including northern connections
10. Additional long term upgrades to SH1 between Manukau and Takaanini
11. Upgrade Mahia Road and Popes Road (including a new grade separated rail and SH1 crossing)
12. Upgrade Opāheke Road and Ponga Road
13. New arterial between Papakura industrial area, to Waihoehoe Road
14. Upgrade Jesmond Road, Bremner Road and Waihoehoe Road
15. Upgrade Drury West section of SH22
16. Connections from SH22 to the Pukekohe Expressway
17. New Pukekohe Expressway connecting Pukekohe to SH1
18. Pukekohe Ring Road
19. Upgrade Mill Road between Harrisville Road intersection and the Bombay interchange

SAFETY IMPROVEMENTS

20. Safety improvements to Alfriston Road, Brookby Road, Papakura-Clevedon Road, Hingaia Road, Hunua Road, Linwood Road, Walters Road, Blackbridge Road, Glenbrook Road, Kingseat Road, McKenzie Road, Ostrich/Woodhouse Road, Pukekohe East Road, Logan Road, Waiuku Road and Buckland Road.

OTHER PRIORITY PROJECTS

21. Rail electrification from Papakura to Pukekohe
22. SH1 Papakura to Bombay Project
23. Safe Networks Programme: SH22 Safety Improvements



LEGEND

- New growth area (Future Urban Zone)
- Drury – Opāheke structure plan area
- Pukekohe – Paerata structure plan area
- Existing urban area
- State Highway (SH)
- Auckland – Waikato Boundary
- New or upgraded interchange
- Existing rail corridor
- Existing train station
- Improved rail corridor
- Closure of rail level crossing
- Grade separation of rail level crossing
- New train station
- New public transport corridor
- Improved public transport corridor
- New walking and cycling corridor
- New transport corridor
- Improved transport corridor
- Safety improvements
- Other priority projects

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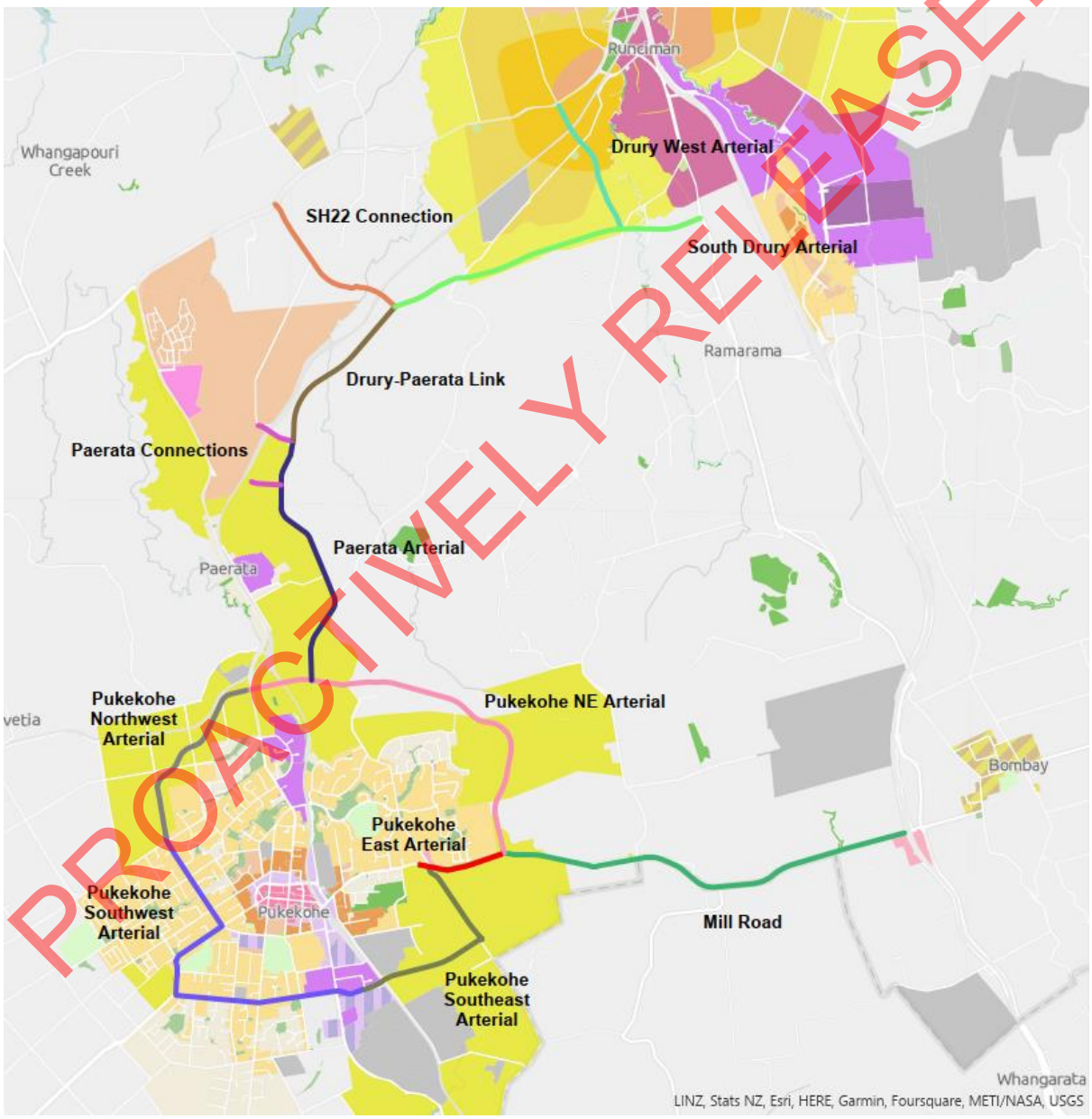
New Zealand Government

2.2 Pukekohe Transport Corridors

The recommended network was derived as an outcome of this network planning process and provides a safe, reliable network that supports growth, offers sustainable travel choice and access to employment and social amenities. The network and corridor planning have been based on the Objectives and desired outcomes, rather than a modelling-driven 'deficiency' analysis. With the focus on long-term route protection, the analysis has assumed and/or sought some flexibility tin the exact final form of the implemented project.

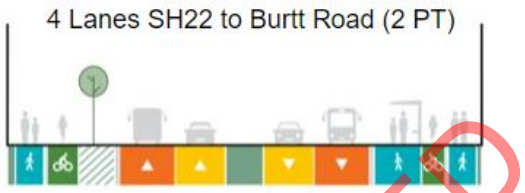
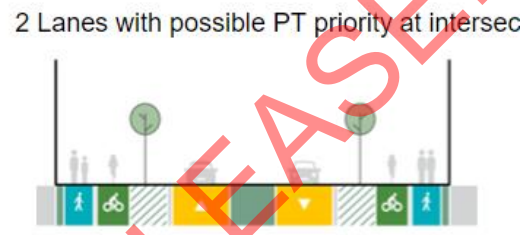
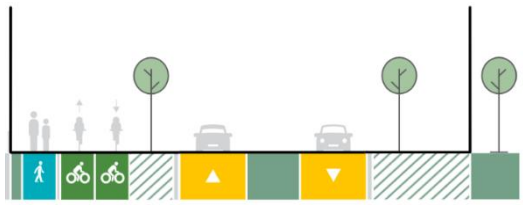
The corridors considered in the Pukekohe DBC are shown below in Figure 2-2.

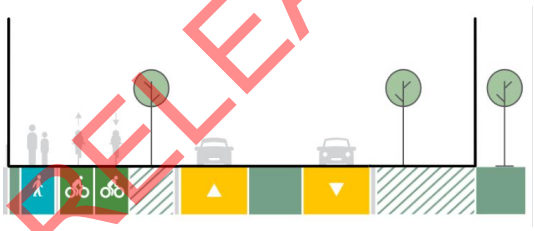
Figure 2-2 - Pukekohe DBC Corridors

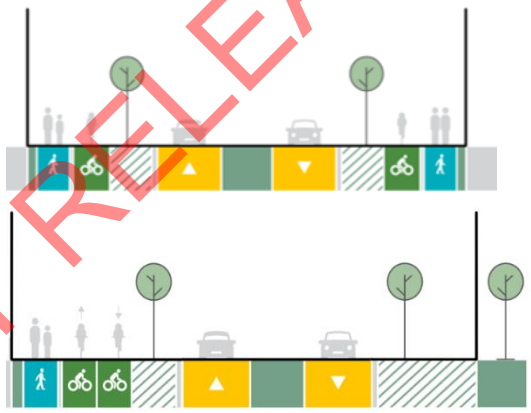


The detailed network elements for the recommended corridors including the corridor form and function are summarised as shown in Table 1 below, with a summary map illustrating this in Figure 2-3.

Table 1 – Network Features

Road Section	Network Features	
Drury West Arterial	• Drury West Arterial provides an arterial connection from SH22/Jesmond Road to the edge of FUZ, connecting to Drury West Town Centre, Drury West Rail Station and provide access to the strategic corridors (SH1, SH22) • **Section 1:** SH22 – Burtt Rd: 30m cross section, 2 lane general traffic, two lane PT, walking and cycling facilities on both sides • **Section 2:** South of Burtt Rd: 24m cross section, 2 lane general traffic, walking and cycling facilities on both sides • 50kph speed limit • 27 buses per hour (Jesmond Rd to rail line) and 9-11 buses per hour (from rail line to Runciman Road)	  **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
South Drury Arterial	• South Drury Arterial provides an arterial connection in Drury West. It is an east-west connection on the edge of the FUZ providing a strategic connection to Drury South Interchange and connecting Drury West with Paerata. • 24m cross section, 2 lane general traffic, walking and cycling on one side • 60 kph speed limit • 8-12 buses per hour (east of Drury West arterial), no buses planned west of Runciman Road • Level 2 freight route, connects to the regional freight corridor on SH1	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P1 -** Predominantly local function with a small catchment of users.
SH22 Connection	• SH22 Connection is a new north-south corridor connecting the future South Drury Arterial and Drury-Paerata Link. It crosses the rail line and provides a key connection between Drury West and Paerata. This connection also provides better travel options, with access to the	

Road Section	Network Features	
	strategic active mode corridor, improved local access between Drury West and Paerata and diverts strategic traffic away from SH22 and provides direct connectivity to Drury South Interchange and SH1. • 24m cross section, 2 lane general traffic, walking and cycling on one side with integration with SH22 • No buses planned on this corridor • 80 kph speed limit • Level 2 freight route	**Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P1 -** Predominantly local function with a small catchment of users.
Drury-Paerata Link	• Drury-Paerata Link is a new east-west corridor connecting the future South Drury Arterial, SH22 Connection and Paerata Arterials. • It improves the wider network connectivity, safety and resilience between Drury West and Pukekohe with a primary general traffic and freight function. • 24m cross section, 2 lane general traffic, walking and cycling on one side • 60-80 kph speed limit • Level 3 freight route	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P1 -** Predominantly local function with a small catchment of users.
Paerata Connection	• The Paerata Connections provides key connection to SH22, Sim Rd, Paerata station, Paerata Rise Development and Centres. It is also the primary east-west connection for all modes and crosses over the railway (NIMT). • 24m cross section, 2 lane general traffic, walking and cycling. • 50 kph speed limit • 8-12 buses per hour (priority at intersections)	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Paerata Arterial	• Paerata Arterial is the primary north-south corridor in Paerata. It connects Paerata Connections, Drury-Paerata Link, Pukekohe Northeast Arterial. It also provides a connection to SH22	

Road Section	Network Features	
	and the proposed new Paerata train station. • 24m cross section, 2 lane general traffic, walking and cycling. • 10-12 buses per hour, no priority at intersections • 50 kph speed limit • Level 3 freight route	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Pukekohe Northeast Arterial	• The Pukekohe Northeast Arterial is a ring road and arterial corridor from Pukekohe East Road to SH22. Its primary function is for general traffic, freight, an active mode links between neighbourhoods and alleviating traffic on Cape Hill and Valley Rd. • 24m cross section, 2 lane general traffic, walking and cycling. • No PT • 50-70 kph speed limit in urban areas (close to SH22), higher speed in rural sections • Level 3 freight route	 **Future Typology (North):** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area. **Future Typology (South):** • **M2 -** Medium strategic network significance with increasing volume of users. • **P1 -** Predominantly local function with a small catchment of users.
Pukekohe East Arterial	• Pukekohe East Arterial is an existing corridor from the north-eastern ring road to Belgium Road. It has a high east-west function for general traffic and freight but also needs to accommodate buses and active modes in future. • 24m cross section, 2 lane general traffic, walking and cycling on both sides • 10 buses per hour	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.

Road Section	Network Features	
	• 50 kph speed limit • Level 1B, strategic freight route	
Pukekohe Southeast Arterial	• Pukekohe Southeast Arterial is a and new and upgraded corridor connecting Pukekohe East Road to Nelson Street. It is also the primary east-west connection for all modes and crosses over the railway (NIMT). It has a moderate to high function for general traffic and freight but also needs to accommodate buses and active modes • 24m cross section, 2 lane general traffic, walking and cycling. • 10 buses per hour • 50 kph speed limit • Level 1B, strategic freight route connecting Pukekohe east Road to SW industrial areas. Level 2 freight route through the industrial areas.	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Pukekohe Southwest Arterial	• Pukekohe Southwest Arterial is a primary east-west and north-south road which helps in detracting general traffic and freight away from the town centre. Its primary function is for general traffic, freight, active modes and with buses in some sections. • Reduced 20m cross section, 2 lane general traffic, walking and cycling on both sides • 8-10 buses per hour on some sections • 50 kph speed limit • Level 3 freight route	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Pukekohe Northwest Arterial	• Pukekohe Northwest Arterial links SH22 and wider Pukekohe Northeast Arterial to the Pukekohe Southwest Arterial. It is also the primary northwest route for all modes in Pukekohe West. • 24m cross section, 2 lane general traffic, walking and cycling on both sides • 10-12 buses per hour • 50 kph speed limit • Level 3 freight route through FUZ areas. Level 2 freight route through the NW industrial areas.	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.

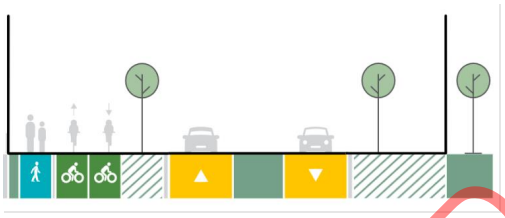
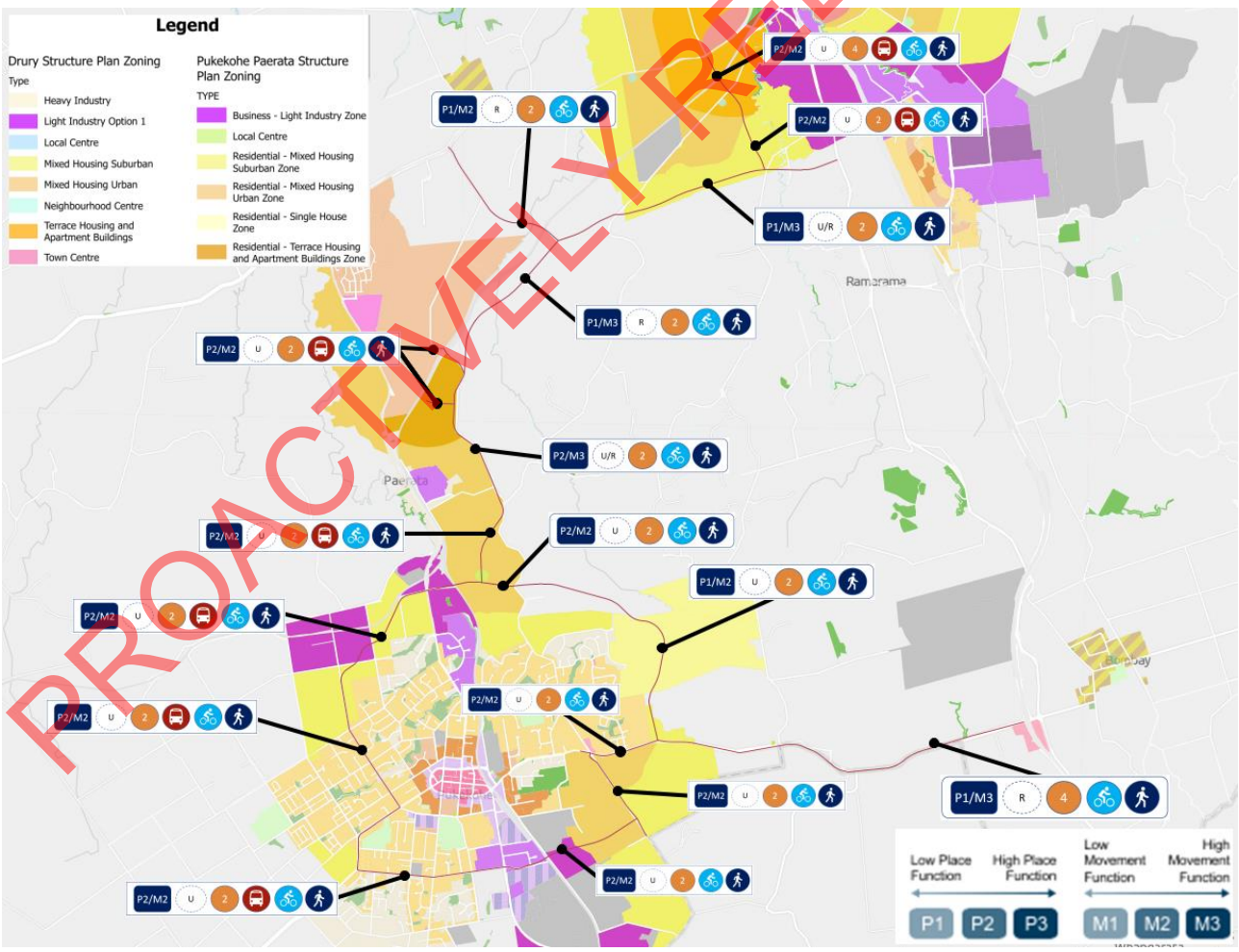
Road Section	Network Features	
Mill Road	• Mill Road (Pukekohe) forms a primary east-west connection from SH1 to Pukekohe future urban areas. This corridor is a strategic connection for traffic and freight, with an active mode connection. • 30m cross section, 4 General Traffic, walking and cycling on one side • 80 kph speed limit • Level 1B, strategic freight route connecting Pukekohe east Road to SH1 regional freight corridor.	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P1 -** Predominantly local function with a small catchment of users.

Figure 2-3 RASF



2.3 Transport Intersections

The intersections on the proposed corridors are proposed to be upgraded to provide adequate capacity to accommodate the expected growth in transport demand and provide safe crossing facilities for all users. The proposed intersections are illustrated in Figure 2-4 below, along with the form and function and intersection performance summarised in

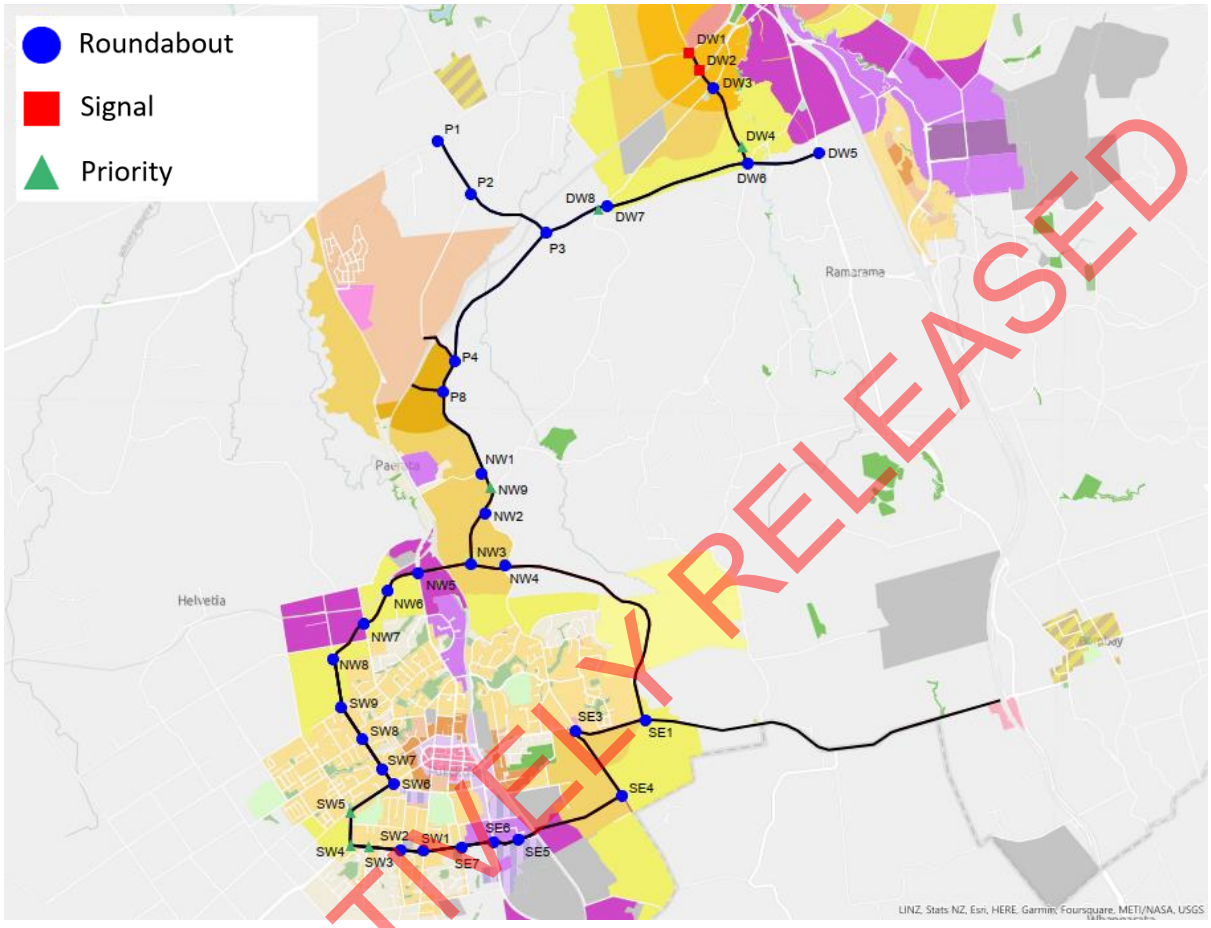


Table 2.

Figure 2-4 Pukekohe Package Intersections

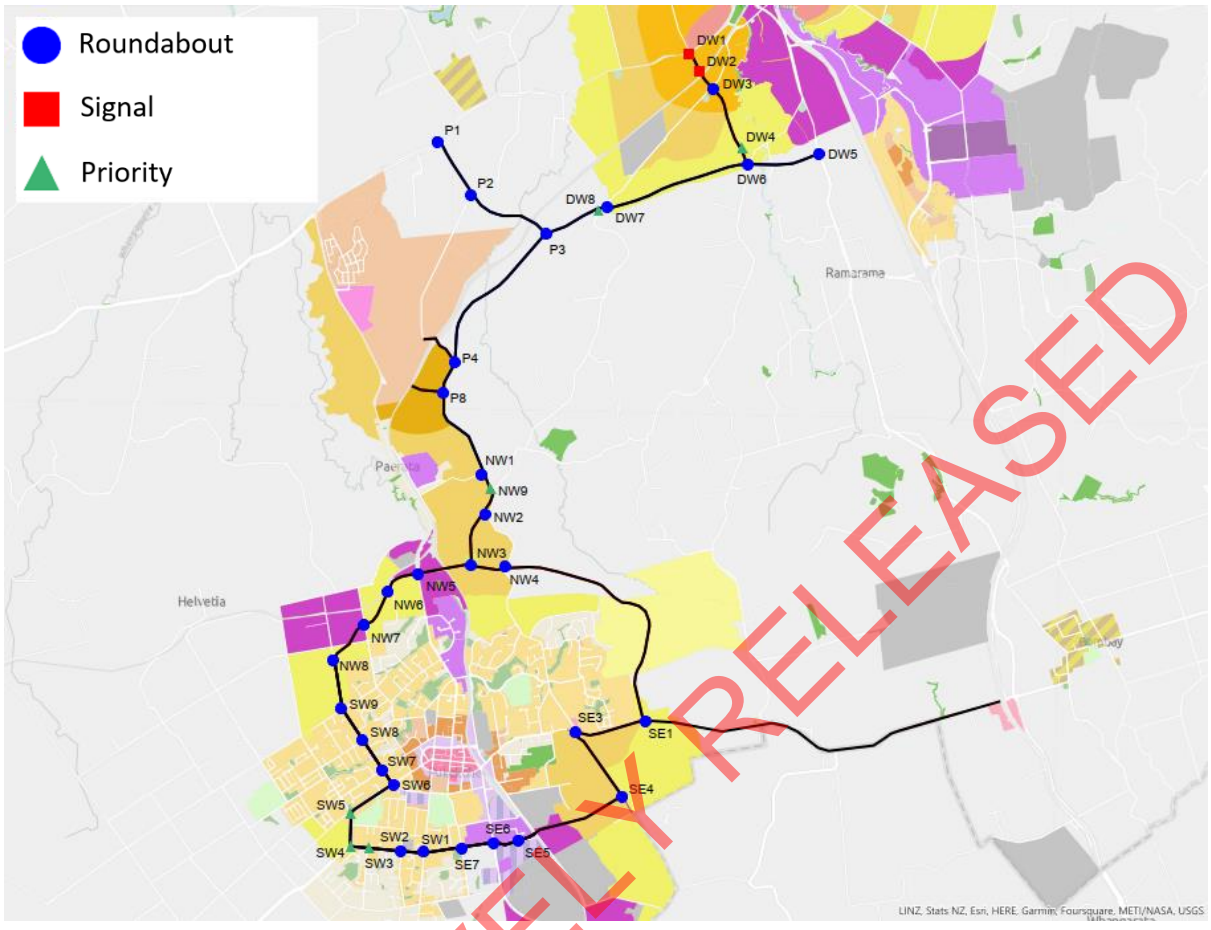


Table 2 - Intersection Forms

Intersection	ID	Current Form	Proposed Form	AM Peak Sidra Performance	PM Peak Sidra Performance
Southwest Pukekohe					
Queen St / Ward St / Nelson St	SW1	Roundabout	Roundabout	A	B
Wellington St / Ward St	SW2	Roundabout	Roundabout	A	A
Ward St / Green Lane	SW3	Priority	Priority	A	A
Puni Rd / Ward St	SW4	Priority	Priority	B	B
Pun Rd / West St / Jutland Rd / McNally Rd	SW5	Roundabout	Priority	B	B
West St / Helvetia Rd / Harris St	SW6	Roundabout	Roundabout	A	A
Helvetia Rd / Victoria St	SW7	Roundabout	Roundabout	A	A
Helvetia Rd / Princes St	SW8	Priority	Roundabout	A	A

Intersection	ID	Current Form	Proposed Form	AM Peak Sidra Performance	PM Peak Sidra Performance
Helvetia Rd / Birdwood Rd / Kauri Rd	SW9	Priority	Roundabout	A	A
Southeast Pukekohe					
Pukekohe East Rd / NE Arterial	SE1	N/A	Roundabout	A	A
Pukekohe East Rd / East St / Golding Rd / Belgium Rd	SE3	Roundabout	Roundabout	C	C
Golding Rd / Railway Link Rd	SE4	N/A	Roundabout	A	A
Manakau Rd / Nelson St / Svendsen Rd	SE5	Roundabout	Roundabout	B	B
Nelson St / John St	SE6	Roundabout	Roundabout	A	A
Pukekohe East Rd / Mill Road / Harrisville Rd	SE7	Priority	Roundabout	B	A
Northwest Pukekohe					
Tuhimata Rd / Burtt Rd / Sim Rd	NW1	Priority	Roundabout	B	A
Cape Hill Rd / Paerata Arterial	NW2	N/A	Roundabout	A	A
NE Arterial / Paerata Arterial	NW3	N/A	Roundabout	A	A
NE Arterial / Cape Hill Road	NW4	N/A	Roundabout	A	A
NE Arterial / Paerata Arterial / Paerata Rd	NW5	Priority	Roundabout	A	B
Paerata Arterial / Butcher Rd	NW6	N/A	Roundabout	A	A
Pukekohe Arterial / Beatty Rd	NW7	N/A	Roundabout	A	A
Pukekohe Arterial / Helvetia Rd / Gun Club Rd	NW8	N/A	Roundabout	A	A
Paerata					
Karaka Rd / Sim Rd	P1	Priority	Roundabout	B	A
SH22 Connection / Sim Road	P2	N/A	Roundabout	A	A
Drury Paerata Link / SH22 Connection	P3	N/A	Roundabout	B	A
Drury Paerata Link / Sim Road	P4	N/A	Roundabout	A	A

Intersection	ID	Current Form	Proposed Form	AM Peak Sidra Performance	PM Peak Sidra Performance
Paerata Station Accesses	P8	N/A	Roundabout	A	A
Drury West					
Karaka Rd / Jesmond Rd / Drury West Arterial	DW1	Priority	Traffic Signal	D	C
Drury West Arterial / Drury Station Access	DW2	N/A	Traffic Signal	B	B
Drury West Arterial / Burtt Rd	DW3	N/A	Roundabout	A	A
Drury West Arterial / Runciman Rd	DW4	N/A	Roundabout	A	A
South Drury Arterial / Great South Rd	DW5	N/A	Roundabout	A	A
South Drury Arterial / Drury West Arterial	DW6	N/A	Roundabout	A	A
South Drury Arterial / Burtt Road (North)	DW7	N/A	Roundabout	A	A

3 Investment Objectives and KPI's

The following section provides a breakdown of the performance of the Pukekohe Recommended Network against the Investment Objectives and subsequent KPIs.

The KPI measures compare a 'Do-minimum' transport network against the proposed Te Tupu Ngātahi projects in the recommended Pukekohe DBC network, using a full build out 2048+ scenario. The DBC has followed the principles of the Te Tupu Ngātahi programme wide approach for the definition of the Do Minimum. The Do Minimum is defined as the least effort to maintain the existing system, including maintenance and operation of the existing system. The 2048+ land use scenario was agreed with Auckland Council to be the most appropriate scenario for route protection purposes. This is not a specified date but reflects the full build-out (post 2048) of the currently planned development, which then informs the long-term infrastructure needs.

The proposed Pukekohe DBC projects and improvements have been identified in order to support growth in Pukekohe and unlock the future land use. In addition to these projects, there are several key strategic projects that integrate with this network including:

- SH1 upgrades from Drury to Bombay
- All Drury Arterial Packages
- Drury South interchange connection up to Great South Road
- Drury West station and access connection
- Paerata station and access connection

It should be noted that these projects have been including in both the 'Do Minimum' and '2048+'

modelling scenarios. The inclusion of the key inter-dependent strategic projects in the Do-minimum network is to account for the fact that those projects are being developed by Waka Kotahi, so are not included as part of the Te Tupu Ngātahi improvements package.

It is the combination of these projects and the proposed Te Tupu Ngātahi projects that will enable the key transport and land use integration outcomes for the Pukekohe community.

The following changes between the Do-minimum (Do-min) and recommended transport network (Recommended Option) are noted below:

- **Road Network**: The Do-minimum network includes the existing arterial and local road connections within and surrounding Pukekohe.
- **Active Mode Connections**: The connections present in the Do-minimum network include all existing / planned facilities.

3.1 Overall Pukekohe Outcomes

As detailed above, the Pukekohe Recommended Network has been developed within the context of a wider network, the following table reports on the overall outcomes of the entire system. The measures reported on are based on the complete network, with the complete build out of projected growth in Pukekohe.

The key investment objectives for the Pukekohe DBC have been identified as the following:

- Safety – provide a transport network that is safe for all users within and between Pukekohe, Paerata and Drury
- Access – enable access to economic and social opportunities by providing multi-modal corridors
- Integration - provide a transport network that appropriate balance between movement and place, and contributes toward well-functioning future urban environments
- Resilience – enable resilient freight and people movement to, from and within Pukekohe, Paerata and Drury
- Travel Choice and Climate Change – enable travel choice in Pukekohe, Paerata and Drury West by enhancing access to the existing rail network and providing a safe and attractive walking / cycling network

Table 3 below details the overall Pukekohe outcomes.

Table 3 - KPIs

KPI	Measure	Outcome	Commentary
Investment Objective 1: Safety			
User safety	DSI's	65 DSIs were recorded in the last 5-year period (2018-2022). However, with the expected growth in the area, the number of vehicles travelling on the road network will increase which may result in an increase in DSIs. To accommodate for this increased safety risk, the pressure on the network will be alleviated by additional connections and improved facilities to keep congestion on the corridors within and surrounding Pukekohe to a minimum. The crash benefits of the Pukekohe Package are **$23m** over 40-year analysis period, compared to the Do Minimum.	Considering the study area covers all of Pukekohe town centre and the supporting network west of SH1, 65 DSIs in a 5-year, It is anticipated that these occurrences could increase significantly because of population growth if adequate mitigation is not put in place. This risk can be significantly reduced by implementing the Pukekohe Package, which significantly improve safety for all users.
Active mode user safety	Active mode DSI's	14 Active mode DSIs in the last 5-year period (2019-2023). However, with the expected growth in the area exposure to risks for active mode users is expected to increase. To accommodate for this increased safety risk, safe and connected walking and cycling facilities will be provided on the majority of corridors in Pukekohe. 5 Active mode DSIs estimated to be saved per year, based on 50% reduction of crashes after implementation of the Pukekohe package.	While the number of previous active mode DSIs are notable, the conflict risk for these users will increase significantly in the future as there are more vehicles and active mode users on the network. This risk can be significantly reduced by providing dedicated facilities separated from traffic.
Perceived safety	KMs of new and improved cycle network achieving required QoS (from AT Statement of Intent 2018-21)	**30.6km** of new cycle network. This is 100% of the arterial network proposed by the Alliance.	Additionally, this KPI was measured on a per corridor basis (one-way along the corridor) • Drury West Arterial: 1.6km • South Drury Arterial: 3.7km • Drury-Paerata Link: 2.2km • SH22: 1.9km • Paerata Arterial: 3.5km • North East Arterial: 4.5km • Mill Road: 2.2km • Pukekohe East Arterial: 3.6km • Pukekohe Southeast

<table>
<tr><th>KPI</th><th>Measure</th><th>Outcome</th><th>Commentary</th></tr>
<tr><td></td><td></td><td></td><td>Arterial: 2.5km
• Pukekohe Southwest Arterial: 4.4km
• Pukekohe Northwest Arterial: 2.1km</td></tr>
<tr><td colspan="4">Investment Objective 2: Access</td></tr>
<tr><td>Access to jobs</td><td>Proportion of population living within travel threshold (15 and 30 mins) of jobs by active modes</td><td>The journey time via active modes within Pukekohe would typically range between 15 and 30 minutes. Accordingly, there journey times have been used for this measure.

In the recommended option, the number of jobs that can be accessed within 15 mins by active modes are 77,000 jobs (compared to 74,000 in the do-min option).

In the recommended option, the number of jobs that can be accessible within 30 mins by active modes are 151,000 jobs (compared to 137,000 in the do-min option).</td><td>The proportion of employment accessible by active modes increases in each of the time intervals assessed.

Within 15 mins the proportion of employment increases by 4% and in 30 mins there is an 10% increase in the recommended option compared to the do-min.</td></tr>
<tr><td>Network Performance</td><td>Vehicle kilometres travelled in peak congestion (>90% v/c) in AM peak</td><td><table><tr><th></th><th>Do Min</th><th>Recomm.</th></tr><tr><td>AM</td><td>101,554 vkt (14%)</td><td>81,811 vkt (11%)</td></tr><tr><td>IP</td><td>58,742 vkt (9%)</td><td>52,076 vkt (8%)</td></tr><tr><td>PM</td><td>115,019 vkt (14%)</td><td>90,475 vkt (11%)</td></tr></table></td><td>There is a 19% reduction of vehicle kilometres travelled in peak congestion (>90% v/c) in the AM peak in the Recommended Option.

There is an 11% reduction of vehicle kilometres travelled in peak congestion (>90% v/c) in the INTER peak in the Recommended Option.

There is an 21% reduction of vehicle kilometres travelled in peak congestion (>90% v/c) in the PM peak in the Recommended Option.</td></tr>
<tr><td>Network performance</td><td>Average freight journey time to SH1 Drury South interchange from the Industrial areas in North-West Pukekohe during the AM peak</td><td>Do-min Option
- 21.7 mins (southbound)
- 29.9 mins (northbound)
Recommended Option
- 14.2 mins (southbound)
- 16.9 mins (northbound)</td><td>The average travel time to SH1 Drury South interchange from the Industrial areas in North-West Pukekohe reduces by 35% for southbound traffic and 43% for northbound traffic in the recommended option.

This improvement allows for efficient and effective means of freight vehicles accessing Pukekohe industrial areas.</td></tr>
<tr><td>Network performance</td><td>Average freight journey time to SH1 Bombay interchange from the Industrial areas in South-East</td><td>Do-min Option
- 10.3 mins (westbound)
- 12.5 mins (eastbound)
Recommended Option
- 8.8 mins (westbound)</td><td>The average travel time to SH1 Bombay interchange from the Industrial areas in South-East Pukekohe reduces by 15% for westbound traffic and 30% for</td></tr>
</table>

KPI	Measure	Outcome	Commentary
	Pukekohe during the AM peak	- 8.8 mins (eastbound)	eastbound traffic in the recommended option. This improvement allows for efficient and effective means of freight vehicles accessing Pukekohe industrial areas.
Investment Objective 3: Integration			
Proximity to active mode network	% of HH with access to high-quality walking and cycling facilities (within 400m of a dedicated, separated active mode facility)	**Do-min Option** **16%** of households within the Pukekohe area are located within 400m of a dedicated, separated active mode facility. **Recommended Option** **31%** of households within the Pukekohe area are located within 400m of a dedicated, separated active mode facility.	Proximity to high-quality active mode facility increases by 15% with implementation of Pukekohe package. This is a notable improvement from the do-min option which only provides for an active mode corridor along the railway line.
Amenity of the street	KMs of new and improved transport network with enough space for street furniture/lighting and tree planting appropriate to the known place function and built form	**26.2km** of new urban street scape space, which is 86% of the Pukekohe arterial network proposed by the Alliance.	Additionally, this KPI was measured on a per corridor basis (one-way along the corridor): • Drury West Arterial: 1.6km • South Drury Arterial: 3.7km • Drury-Paerata Link: 2.2km • SH22: 1.9km • Paerata Arterial: 3.5km • North East Arterial: 4.5km • Mill Road: 2.2km • Pukekohe East Arterial: 3.6km • Pukekohe Southeast Arterial: 2.5km • Pukekohe Northwest Arterial: 2.1km
Investment Objective 4: Resilience			
Susceptibility to inundation	Kilometres of infrastructure susceptible to Q100 flooding	**26.2km** of the road network within Pukekohe achieves Q100 Flood level immunity. This helps support the overall sustainability and resilience goals of the Pukekohe transport network.	Additionally, this KPI was measured on a per corridor basis: • Drury West Arterial: 1.6km • South Drury Arterial: 3.7km • Drury-Paerata Link: 2.2km • SH22: 1.9km • Paerata Arterial: 3.5km • North East Arterial: 4.5km • Mill Road: 2.2km • Pukekohe East Arterial:

<table>
<tr><th>KPI</th><th>Measure</th><th>Outcome</th><th>Commentary</th></tr>
<tr><td></td><td></td><td></td><td>3.6km
• Pukekohe Southeast Arterial: 2.5km
• Pukekohe Northwest Arterial: 2.1km</td></tr>
<tr><td colspan="4">Investment Objective 5: Travel Choice</td></tr>
<tr><td>Mode share</td><td>% active mode share am peak</td><td>14% (5,336 trips) - Recommended Option
12% (4,780 trips) - Do-min Option</td><td>There is a 2% point increase from 12% to 14% in active mode trips in the Recommended option compared to the Do-min option.</td></tr>
<tr><td>Mode share</td><td>% car mode share am peak</td><td>64% (25,524 trips) - Recommended Option
65% (25,059 trips) - Do-min Option</td><td>There is a 0-1% point decrease from 65% to 64% in private vehicle trips in the Recommended option compared to the Do-min option.</td></tr>
<tr><td colspan="4">Investment Objective 6: Climate Change</td></tr>
<tr><td>Emissions</td><td>Absolute and per capita and per household transport emissions as a result of the project as measured by the VEPM model</td><td><table><tr><th>Emission</th><th>CO_2 -eq/t</th></tr><tr><td>Do-min (yearly-2048+)</td><td>380,726</td></tr><tr><td>Recommended (yearly-2048+)</td><td>377,954</td></tr></table></td><td>According to the VEPM model, there is a 2,772-tonne yearly reduction in CO_2 -eq/t emissions for the Pukekohe Recommended transport network in 2048+.</td></tr>
<tr><td>Total vehicle usage</td><td>Vehicle Kilometres Travelled (VKT)</td><td>The Recommended Option records 3,707,937,922 VKT yearly, compared to Do Minimum which records 3,723,384,163 – a yearly reduction of 15,446,241 VKT.</td><td>This VKT reduction is due to the improved connectivity for general vehicles and freight both within and surrounding Pukekohe for traffic that would otherwise be diverted to longer routes.</td></tr>
</table>

3.2 Aotearoa's New Zealand's First Emissions Reduction Plan

In addition to the above metrics, one of the key priorities of the current government is to reduce emissions over the next 15 years. This will help achieve the initial commitment of getting to net-zero emissions by 2050. This is outlined in New Zealand's very first emissions reduction plan.

Transport is one of the largest sources of greenhouse gas emissions, the sector is responsible for approximately 17% of gross domestic emissions and 39% of total domestic carbon dioxide emissions. The emissions reduction plan suggests three focus areas for reducing transport emissions, these include:

- Reducing reliance on cars and supporting people to walk, cycle and use public transport
- Rapidly adopt low-emission vehicles
- Beginning work to decarbonise heavy transport and freight

The outcomes sought by the Te Tupu Ngātahi and the Pukekohe recommended network directly impact the first focus area. This is achieved by improving urban form, travel choice and accessibility to improve transport options which all play a role in reducing VKT emissions. Within this focus area there are two key action areas outlined in the emissions reduction plan. These include:

- **Action 10.1.1 –** Integrate land-use planning, urban development and transport planning and investments to reduce transport emissions.
- **Action 10.1.2 –** Support people to walk, cycle and use public transport.

Further details of how these outcomes directly impact the first focus area are detailed in Table 4 below.

Table 4 - Outcomes of Recommended Network that Achieve Focus Areas

Emissions Reduction Plan Focus Area	Achievement
Action 10.1.1	• 30.6km of new and improved cycling facilities • 24% of households in Pukekohe will be within 400m of a high-quality, dedicated active mode facility in the 2048+ option. This will include upgrading existing corridors on the network with high-quality walking and cycling facilities and the development of new corridors on the network enabling the provision of active mode facilities within new growth areas.
Action 10.1.2	• 30.6km of new and improved cycling facilities • Within 15 mins, the proportion of employment accessible by active modes increases by 4% and within 30 mins there is an 10% increase between the 2048+ and Do-min Option. These increases can be attributed to the improvements outlined in Action 10.1.1 for active modes as part of the recommended transport network. Accordingly, the use of active modes becomes a viable option for residents commuting to local jobs in the 2048+ option. • The provision of dedicated active mode facilities on both new and existing corridors results in a 2% increase in active modes trips in the 2048+ option compared to the Do-min option.

4 Transport Analysis

The following transport analysis sets out the transport network planning undertaken to determine the recommended corridors and intersections.

4.1 Land Use Scenarios

This summary provides an overview of the land use scenarios and assumptions used to assess the transport network.

4.1.1 Land Use Assumptions

Land use data was the main input used to inform the expected growth in transport demand, which then informed the network planning. For network planning purposes, a 2048+ (full build-out of planned development) land use scenario was used to develop the recommended network, which reflects the needs for long-term transport infrastructure.

It is acknowledged that land use forecasts have inherent uncertainty, particularly in terms of the specific rate of new growth in specific 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 (NPS-UD) and Auckland Council's Plan Change 78.

A key intent of those policies is to enable higher density development, especially around high-quality public transport systems. The specific planning response to those policies is currently being progressed by Auckland Council, and revised land use forecasts reflecting any expected changes were not available at the time of preparing this assessment. Generally, it is considered that this Project is not inconsistent with such policy direction, regarding supporting higher density urban development via more sustainable travel modes. Given this context, the use of a full build out scenario forecasts is considered acceptable for this assessment.

Land Use Scenarios

- Unitary Plan Zoning
- Precinct Plans
- Council Plan Changes
- Council Structure Plans, such as the Paerata-Pukekohe Structure Plan
- Outcomes identified in the Auckland Plan, including for Homes and Places; Transport and Access; and Opportunity and Prosperity
- Strategic Framework used in Transport for Urban Growth (TfUG) (only applicable for areas with no Structure Plan)
- Master Planning by landowners through Private Plan Changes

Assessment Years

The development of the land use scenarios includes different analytical years to inform staging, economic assessments and the development of the recommended network. The different assessment years and their intended use are summarised below in Table 5.

Table 5 - Assessment Years

Assessment Year	Network Planning and Staging	Economic Assessments	Recommended Network
2016, 2028	✓	✓	✓
2038, 2048 (interim years)	✓✓✓	✓✓✓	✓
2048+ (full build out)	✓✓✓	✓✓✓	✓✓✓

relative significance low (√), relative significance high (√√√) and base year reference (*)

The different analytical years and their intended use can be summarised as follows:

- The 2016 land-use scenarios were used as a baseline to represent the base year transport context
- The interim land-use scenarios (2028, 2038 & 2048) were mainly used for network planning, staging and economic assessments.
- The 2048+ land-use scenario was agreed with Auckland Council to be the most appropriate scenario to be used for route protection purposes. This is not a specified date but reflects the full build-out (post 2048) of planned development, which then informs the long-term infrastructure needs.

The I-11 land use forecast series was agreed by Waka Kotahi (NZTA), AT and AC as the most appropriate land use scenarios to use. This also includes the interpretation of the Future Urban Land Supply Strategy (FULSS). The inputs include Stats NZ Medium growth population forecasts and detailed demographic trends, via 64 person-categories, 8 household categories, 6 employment types and 3 educational role categories.

Based on the I-11 land use forecast series, the Auckland Forecasting Centre (AFC) created each forecast scenario used by SGA for the interim and full build-out scenarios.

AFC created the forecasts for the IBC and DBC. These include the 2046+ (used in the IBC) and 2048+ (used in the DBC) datasets that include the full build-out in growth areas.

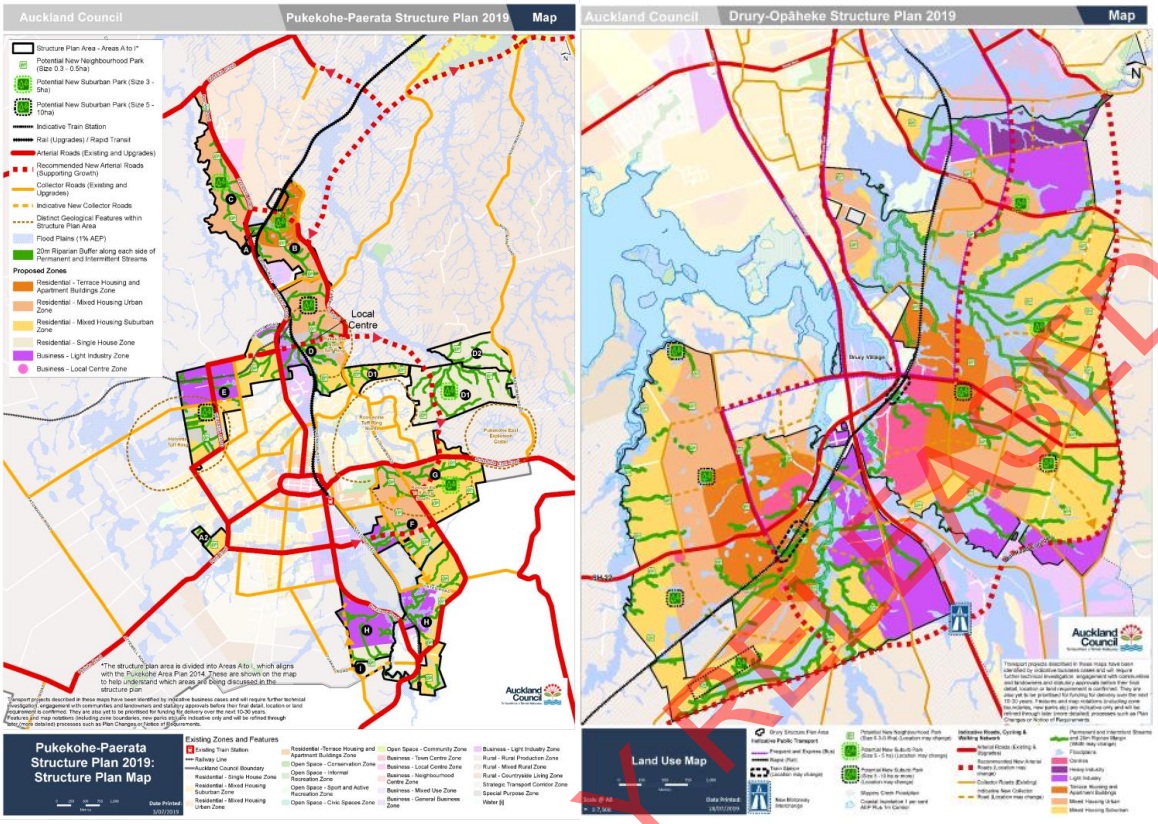
4.1.2 Transport Network Assumptions

The transport network assumptions detail the network planning inputs used to undertake the transport assessment. This includes a range of committed and planned transport projects expected to be built by 2048+ to reflect the cumulative effect of growth and wider transport infrastructure investment.

The Drury, Opaheke and Paerata areas in the south of Auckland have been signalled to undergo significant urban growth in the Auckland Unitary Plan (AUP) and Auckland Council have recently completed structure planning for this area, which includes planned transport projects.

The Pukekohe-Paerata Structure Plan and the Drury-Opaheke Structure Plan developed by Auckland Council in 2019 are shown in Figure 4-1, indicating both the expected pattern of urban development and the future transport projects (subject to planning and funding approvals) in the Pukekohe and Paerata area. Furthermore, there is also a range of regional projects either under construction or expect to be built by 2048+.

Figure 4-1 - Future Transport and Land Use in Pukekohe-Paerata and Drury Area



The future transport projects in southern growth areas are summarised in Table 6 below.

Table 6 Future Transport Projects within Southern Growth Areas

Package	Project
Rail DBC Package	Additional rail capacity between Pukekohe and Papakura (and associated grade separations at road/rail crossings)
	New rail stations at Drury Central, Drury West and Paerata
	Regional north-south cycle route between Drury and Pukekohe, with grade-separated active mode crossings of SH1 and NIMT
South Strategic DBC	Mill Road Corridor – a new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South
	FTN on Porchester / Mahia / Roscommon Roads and Great South Road from Drury to Manukau
SH1 Papakura-to-Bombay	Stage 1 of the P2B project includes an upgrade to the existing Drury interchange, which connects to and is interdependent with the SH22 upgrade project. The Interchange upgrade will also need to provide for proposed rail upgrades. There is also a direct inter-relationship with the Bremner Upgrade/FTN project, as P2B will necessitate an upgrade/replacement of the existing Bremner Road crossing of SH1.
SH22 Drury-to-Paerata (Safe Network Programme)	The Safe Network Programme is in the funding application process for short-term safety improvements in the SH22 area. Parts of this programme are being prioritised including a roundabout at the intersection of SH22 and Glenbrook

Package	Project
	Road, and the recently completed right-turn bay into Jesmond Road.
	Longer term upgrades on SH22 between SH1 and Oira Road are being looked at by SGA as part of this Drury Local package. These upgrades are proposed to improve safety, amenity and capacity along the route to enable urbanisation of the area and are envisaged to ultimately be supplemented by a new route in the long term (the proposed Pukekohe Arterials).
Drury Strategic Transport Network	State Highway 22 Arterial Upgrade (NoR D1)
	Jesmond to Waihoehoe East FTN Arterial upgrade (NoR D2)
	Waihoehoe Road East Arterial Upgrade (NoR D3)
	Opāheke North-South FTN Arterial (NoR D4)
	Ponga Road / Opāheke Road Arterial Upgrade (NoR D5)
Mill Road	Mill Road Corridor – a new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South (4 lanes with lower speeds)
Takaanini DBC Package	New FTN on GSR and other Takanini area road upgrades. This includes the grade-separation and/or closure of level crossing, urbanisation of Takanini Industrial areas, Takanini interchange upgrades.
Pukekohe General	Indicative New Collector Roads
	Crown Road closure
	Speed limit changes in Auckland

4.1.3 Transport Network Analysis

The following section describes the transport analysis undertaken to reach the recommended network for the Pukekohe DBC. This includes the network, corridor and intersection assessments undertaken, including:

- AT's Roads and Streets Framework (RASF)
- The Corridor Form Assessment Framework (CFAF)
- Cross-Section Design
- Intersection Form and Function.
- Intersection Design

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 then inform decisions about planning transport network, corridors, and intersections.

The modelling methodology undertaken for the Pukekohe DBC options follows a typical hierarchical modelling structure and utilises a range of models as detailed below.

Strategic multi-modal model

- MSM is a regional multi-modal model for Auckland, which translates land use (such as population and employment) to travel patterns (which creates estimates of car, truck and public

transport movements) at a strategic and region-wide level.

SATURN model

- The SATURN model is a mesoscopic traffic model, which loads the forecasted vehicle trip patterns from MSM onto the road network to investigate the traffic effects at a more detailed level.

Active Modes model

- The AFC Strategic Active Modes Model (SAMM) provides strategic-level estimates of walking and cycling demands.
- Te Tupu Ngātahi active modes station access model, this tool is only used to provide estimates of walking and cycling to major stations.

Intersection modelling

- SIDRA modelling has been undertaken to assess the operational performance of key intersections along the project corridors. The demand was informed by the SATURN models.

Roads and Streets Framework (RASF)

The development of the corridor design has included the use of AT's Roads and Streets Framework (RASF), 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.

Each corridor within the Pukekohe DBC was assessed based on the following:

- **Place function** – for existing and long term 2048+
- **Movement function** – for existing and long term 2048+
- **Modal priority** – that reflects a 2048+ environment.

The framework itself does not directly dictate a specific corridor design but provides context and guidance regarding the intended function of the corridor. This in turn will be used to inform future development and operation of the corridor. A 'mandate' for each road corridor has been developed by Te Tupu Ngātahi and approved by the RASF Steering Group, comprising senior officers from Auckland Transport and Auckland Council.

RASF mandates were completed for corridors that fall under the jurisdiction of Auckland Transport.

Corridor Form Assessment Framework (CFAF)

The Corridor Form Assessment Framework (CFAF) has been designed by Te Tupu Ngātahi to provide a consistent methodology to define the desired corridor form and function requirements and ensure all modes are considered. The CFAF assessments were completed for all multi-modal corridors within the Pukekohe recommended network.

The CFAF output recommends traffic capacity, bus priority measures, walking and cycling facilities and other corridor elements which influence the corridor footprint. All modes are considered in the development of the cross-section, however facilities for all modes may not necessarily be provided. The resulting cross-section forms the basis for route protection for the corridor.

The form and function of a corridor is determined using a combination of 'place' and 'movement'

significance on the individual setting:

- **Place factors** consider the existing land use, future land use plans and trip generators present in the catchment area. It also includes an assessment of the future density of residential, industrial or mixed land use and local/regional trip attraction areas e.g. stations, schools, hospitals.
- **Movement factors** consider the hierarchy of the corridor in the regional road network (PT network, strategic freight network), modal priorities for the corridor and existing and future traffic volumes to determine the future typology and recommendations for a corridor function. Movement is considered at both local and network levels to ensure that duplication of facilities is avoided and the corridors have targeted modal functions.

Table 7 provides a summary of the inputs and outputs of the CFAF tool used during the assessment.

Table 7 - CFAF Inputs and Outputs

Inputs	Modelling Inputs Required	Parameters	Outputs	Impact on Modelling
Place and corridor function	No	Qualitative assessment based on the Roads and Streets Framework (RASF)	Determines the purpose of the route and feeds into wider modal priority assessment	N/A
Public transport	No	AT Remix File	Public transport priority	No
Walking and cycling	No	Te Tupu Ngātahi primary and secondary walking and cycling network used, based on urban design framework	Helps with geometric design, determining suitable paths and which sides to include the facility	Chosen facility type for different corridors coded into SAMM
General traffic	Yes	ADT volumes used, extracted from SATURN.	If PT priority needed, helps determine whether corridor is route protected for 2 or 4 lanes.	Number of lanes included in MSM, used for SATURN outputs
Freight	Yes	User Class 3 (heavy vehicles) divided by total of all user classes (all vehicles) to determine the percentage of freight. Data extracted from SATURN.	Informs role within wider freight network and whether specific freight measures are needed along corridor.	Yes
Speed Environment	No	Assumption based on RASF and future land use. Parameters for high and low speed based on the IBC design philosophy	High level assessment concludes a low speed of 50/60km/h or a high speed of 80km/h. These are the base assumptions for the speed, subject to vary through the DBC Optioneering process	Speed along each network included in MSM, used for SATURN outputs

Intersection Form and Function

In addition to the corridor form and function, an intersection form and function assessment has been undertaken to determine a suitable footprint required for route protection.

As part of network planning, decision-making for selecting the safest intersection controls is carefully

considered for each corridor on the Supporting Growth network.

The assessment of intersection form adopts a Safe System approach by recommending roundabouts as the first choice for intersections due to the safety benefits for road users resulting from slowing down through traffic and reducing the number of conflict points. Intersections are assessed against a range of site-specific factors and considers changes/ design features to meet the needs of different users safely and effectively.

The intersection form and function assessment undertaken was based on 2048+ network and land use assumptions to determine the following:

- Intersection type (roundabout or signalised) using SGA guidance to determine whether this would be a roundabout or a signal would be more appropriate route protection strategy
- Intersection size (determined by SiDRA modelling)
- Intersection design for route protection

For each intersection typology chosen, design features are also considered to ensure that the intersection meets the needs of different users safely and effectively and responds to the site-specific factors.