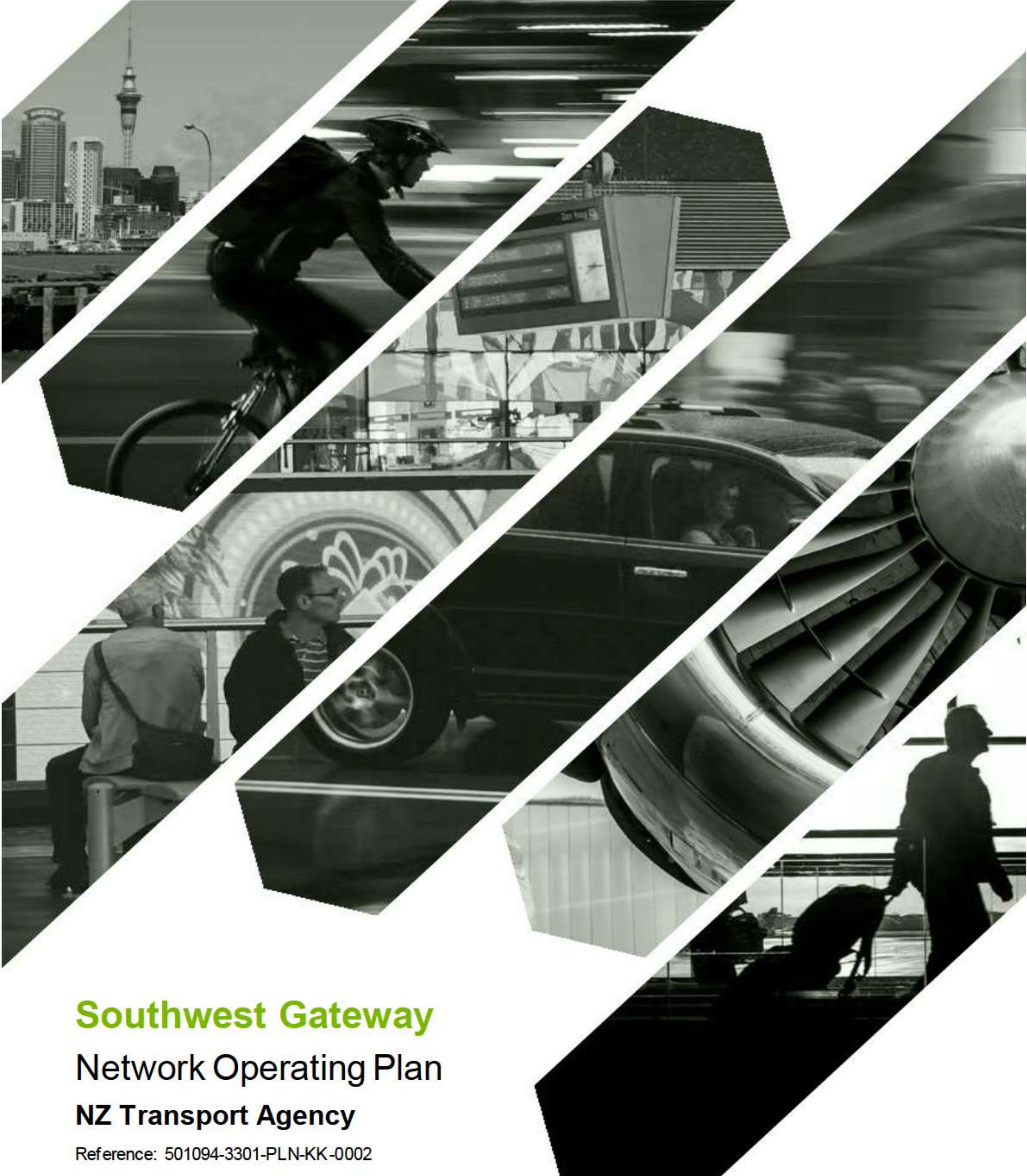
Appendix G

SWGP Network Operating Plan



Southwest Gateway

Network Operating Plan

NZ Transport Agency

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Executive summary

Introduction

The southwest Gateway programme incorporates a range of improvements to the transport network in Southwest Auckland. The most significant of these being 20 Connect (which defines state highway upgrades on SH20, SH20A and SH20B) and Airport to Botany RTN (which defines a significantly enhanced rapid transit corridor between the Airport and Botany, through Manukau).

The Southwest Gateway Network Operating Plan (NOP) is the guiding document to define the desired operational outcomes for the transport network which provides access to Auckland International Airport, and surrounding communities.

The NOP has been prepared for the New Zealand Transport Agency (NZ Transport Agency) with its investment partners Auckland Transport (AT), Auckland International Airport Limited (AIAL) and one of its network operating partners, Auckland Transport Operations Centre (ATOC).

This NOP is forward looking, focusing on outcomes for the year 2048. It provides a common vision and understanding across core operational and planning stakeholders as to how the Southwest Gateway Programme of investments will operate once completed. Its 30-year design horizon has been used to help determine the preferred option under the 20Connect Single-Stage Business Case (SSBC), ensuring that the operation of the network is considered, up front and integrated with both planning and design optioneering workstreams.

Network Operating Principles

Through a series of workshops, the overarching Network Operating Principles have been defined and listed below. These will be used to help test and validate other projects which may come online, currently outside the scope of the Southwest Gateway Programme. This is to confirm the desired operational functionality is achieved under all conditions.

SWG Network Operating Principles

- Improve safety for all users on the transport system.
- Enhance the customer perception of safety.
- Deliver the outcomes as defined by the ANOP and GPS on Land Transport.
- Maintain access along SH20 to ensure the WRR can perform its strategic function as an alternate route to SH1 during unplanned and planned events.
- Provide an agile network that can keep people and goods moving.
- Provide resilient access to and from Auckland Airport to enable it to carry out its function as a lifeline utility.
- To enhance overall network efficiency.
- Efficient and reliable public transport travel times to and from the Northern and Eastern Airport approaches.
- Prioritise public transport on key routes by time of day.
- Provide priority on SH20, SH20A and SH20B for trips to inter-regional markets over local access.
- Prioritise freight movements to / from the north and south industrial areas and airport.
- Prioritise pedestrians within 400-800m of high activity pedestrian areas.
- Support the amenity function around key activity centres by improving walking and cycling access.
- Improve connectivity of walking and cycling network facilities with the wider Auckland network to provide a viable transport mode for local and medium distance trips for users of all ages and abilities, and support access to public transport.
- Improve trip reliability for time sensitive aeronautical traffic (passengers, crew, time sensitive freight) to and from the airport.
- Discourage non-airport related traffic from travelling through the airport precinct.
- Improve local amenity and air quality by reducing 'rat running' commuter traffic and freight on local roads.

Network Priorities

The Network Priorities are shown in Figure 1 below. These Network Priorities were developed from the agreed Operating Principles, the future network diagrams for each mode and through discussions with operating partners. Where conflict points existed between modes, trade-offs were agreed by applying the priorities set out in the Government Policy Statement (GPS) for Land Transport and through discussions with operating partners in Workshop 3.

Along SH20, SH20A and SH20B and some arterials, there are several modes considered to be the highest equal priority. The operating partners decided that consideration should be given to providing facilities for each mode without compromising other modes of equal priority for each major route.

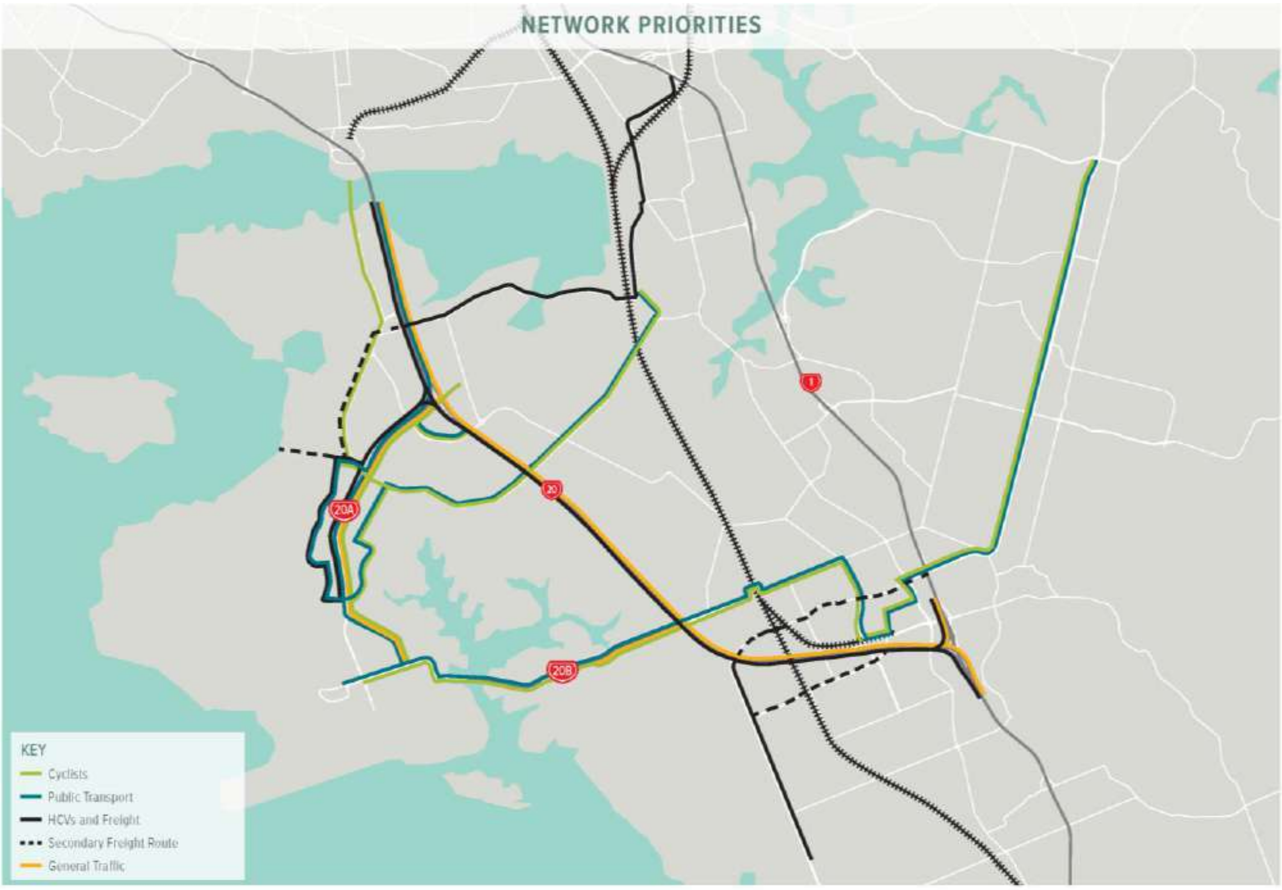

Figure 1 Southwest Gateway Network Priorities

Although not shown on this map pedestrians are also considered a high priority along every corridor with the exception of SH20 where the priority is lower. Notwithstanding this, pedestrians are prioritised around public transport stations (Puhinui, Manukau etc) as well as in town centres such as Mangere, Manukau and on the airport precinct, in particular around the terminal buildings.

On SH20B there is high priority given to both public transport and cycling along the full length of the corridor. High priority is given to general traffic only between SH20 and Prices Road. Freight is considered the lowest priority along this route.

Operational Performance Measures and KPI's

The key aspect of network operations is establishing a methodology for ongoing network evaluation to determine when interventions (i.e. implementation of available management tools and options) are required. The focus of network operations is optimal safety, efficiency and reliability of the transport network, and any ongoing evaluation of the network should be focussed in these areas. To guide this evaluation, KPIs will be used against performance measures that reflect the SWG NOP Operating Principles, using information provided from data sources. This includes AT HOP data, crash and crime databases, ANPR and ATOC reports, which will be used to address performance measures such as average travel times, incident responses, PT boarding numbers, trip times for key freight origins / destinations etc.

Next Steps

The Operating Principles and Network Priorities will also provide a guide for the Next Steps, such as construction phasing and temporary traffic management plans. These Principles and Priorities will also be used for other more specific detailed procedures and plans going forward, such as an Operating Philosophy, as a Concept of Operations is not currently required for the network. An Operating Philosophy will support the long-term option by incorporating high-level operational thinking in the design philosophy. It will discuss how the proposed long-term infrastructure is to be operated to achieve the investment objectives, operating principles and priorities.

As the transport network evolves, this NOP will require regular and on-going review, particularly in response to changes in land use and technology. These may influence forecast in travel demands, modes of travel and therefore the operation of the future network.

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1 Introduction

1.1 Background

The NZ Transport Agency (Transport Agency), alongside investment partners Auckland Transport (AT) and Auckland International Airport Limited (AIAL) are investigating improvements to customer journey experiences and access to and from Auckland International Airport (Auckland Airport) and the surrounding area, the Southwest Gateway Programme (SWG). In particular, the Transport Agency are seeking to address the gaps between the expected and present performance of the State Highway (SH) 20, SH20A and SH20B corridors, across all modes. The 20Connect Single-Stage Business Case (SSBC) identifies the recommended activities to deliver the required outcomes on the state highway network, in response to future changes in land use and travel demand.

1.2 Project objectives

Auckland is one of the fastest growing regions in New Zealand with businesses in Greater Auckland being a key driver of the New Zealand economy. Auckland International Airport is a major point of entry for both people and goods, entering and leaving the country. However, reliable and timely access to and from Auckland Airport and its surrounding business areas is limited by lack of travel choice. This lack of travel choice is leading to poor journey experiences and is currently putting New Zealand economic potential at risk. With rapid growth, the transport network constraints will be exacerbated. Therefore, the following objectives are sought for the transport network in and around the Airport:

- Enhance and align transport system capacity, connections and management across all modes to carry more people and goods efficiently to meet predicted demand
- Provide better transport choices for people and businesses travelling to, from and within the Southwest Gateway study area
- Enhance transport system predictability and accessibility in the Southwest Gateway study area
- Optimise management of the existing and future transport system to balance demand with reliable throughput and movement of people and goods.

This Southwest Gateway Network Operating Plan (the NOP) has been developed in parallel with the 20Connect SSBC, thus allowing the desired operational outcomes of this plan to inform the option design process in the 20Connect SSBC.

1.3 Project area

This NOP study area covers state highways 20 (between Mangere Bridge and SH1), 20A and 20B. Figure 1-1 below shows the location of these corridors in relation to the surrounding area.

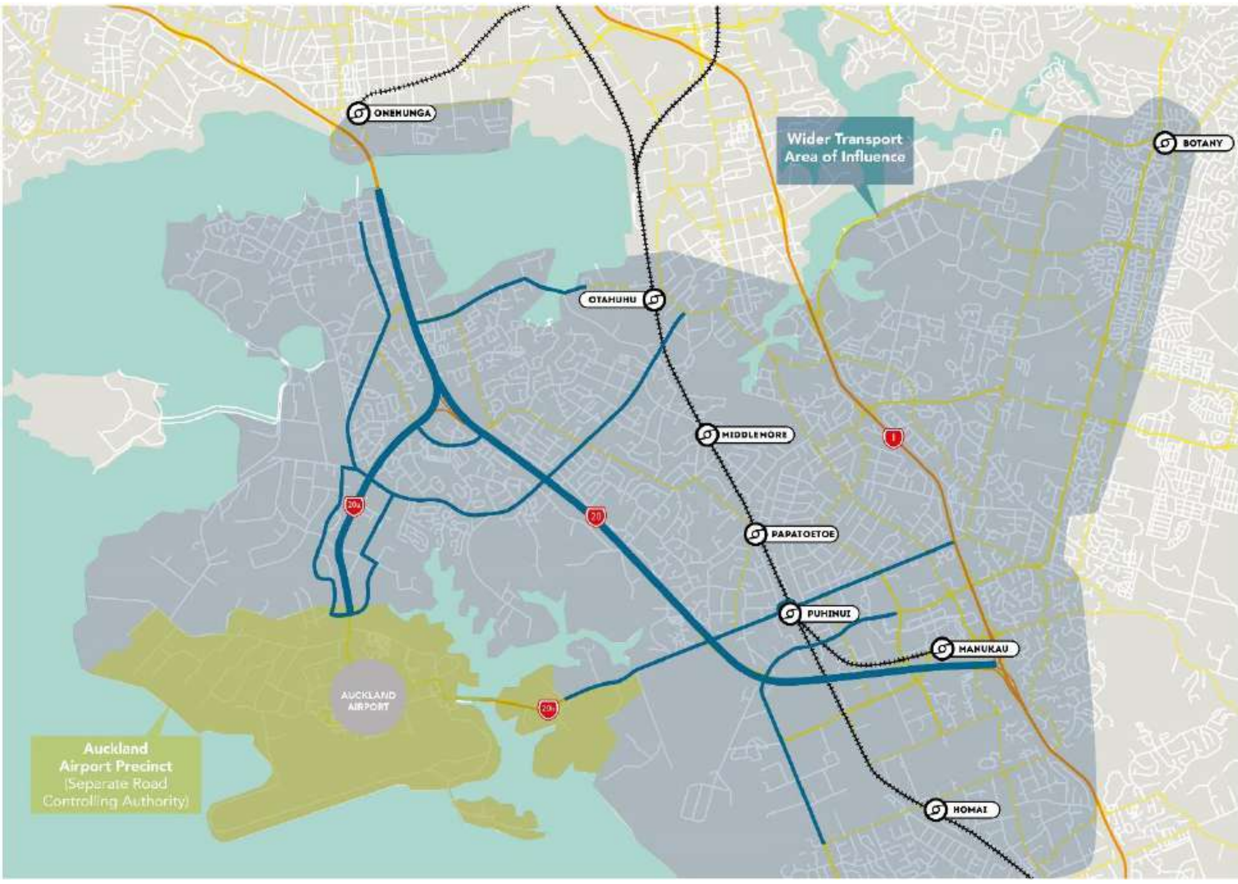

Figure 1-1 Network Operating Plan study area

This NOP also considers arterials and key strategic corridors (highlighted in blue) including Favona Road, Massey Road, Puhinui Road, Bader Drive, Kirkbride Road, Richard Pearse Drive, Airpark Drive, Landing Drive, Westney Road, Verissimo Drive, Roscommon Road and Cavendish Drive.

Note: SH20A has been considered between SH20 and Landing Drive, so far as the Transport Agency's landholdings permit, with the same being the case for SH20B between Orrs Road and SH20. Although the connecting section between SH20A and SH20B is under AIAL's jurisdiction, options that consider this connection are not precluded.

1.4 Area of influence

The area of influence, shown in Figure 1-1 above, covers Auckland International Airport, Airport Oaks, Mangere, Papatoetoe, Puhinui, Manukau, Wiri, East Tamaki and Botany. The area of influence encompasses the main areas in which there are activities which generate, or attract, trips on the transport network and specifically in the study area.

1.5 Infrastructure Projects

Within the area of influence the most significant infrastructure upgrades currently being investigated are:

- City Centre to Mangere Light Rail (Light Rail line between Central Auckland and the Airport)
- 20 Connect State Highway improvements (enhancements to SH20, 20A and 20B)
- Airport to Botany Rapid Transit (A rapid transit connection between Botany and the Airport, through Manukau
- Auckland Airport Road Network Improvements

1.6 Project staging

The NOP has been developed to support options assessment within the above business cases and project delivery under the Southwest Gateway Project by 2048. Table 1-1 outlines the options being assessed as part of the 20Connect SSBC to be implemented and a description of the interventions proposed as part of each option.

Table 1-1 2048 20 Connect and A2B options

Option No.	Description
1a	SH20B offline with grade separated interchanges SH20/SH20B Puhinui south-facing system interchange ramps SH20 widening north of SH20A and south of SH20B Rapid transit corridor (RTC) on SH20B Pukaki Creek Bridge four-lanes RTC from Puhinui Road to Botany
1b	SH20B offline grade separated connections SH20/SH20B Puhinui south-facing system interchange ramp SH20 widening north of SH20A and south of SH20B RTC on SH20 and SH20A Pukaki Creek Bridge four-lanes RTC from Puhinui Road to Botany
2a	SH20B online widening with at-grade connections SH20A/SH20 southbound system interchange ramp SH20 widening from Mangere Bridge to SH20B RTC on SH20B Pukaki Creek Bridge four-lanes RTC from Puhinui Road to Botany
2b	SH20B online widening with at-grade connections SH20A/SH20 southbound system interchange ramp SH20 widening from Mangere Bridge to SH20B RTC on SH20 and SH20A Pukaki Creek Bridge four-lanes RTC from Puhinui Road to Botany
3a	SH20B online widening with at-grade connections SH20A/SH20 southbound system interchange ramp SH20 widening from Mangere Bridge to SH20B RTC on SH20B Pukaki Creek Bridge two-lanes RTC from Puhinui Road to Botany
3b	SH20B online widening with at-grade connections SH20A/SH20 southbound system interchange ramp SH20 widening from Mangere Bridge to SH20B RTC on SH20 and SH20A Pukaki Creek Bridge two-lanes RTC from Puhinui Road to Botany

All options assume that a shared use path (SUP) is provided at the following locations:

- Beside SH20 between Bader Drive and Puhinui Road
- Beside of SH20B between the western abutment of the Pukaki Creek Bridge and Puhinui Road.

Emerging preferred option

At the time of writing, the emerging preferred option consists of the following improvements.

Physical infrastructure improvements include:

- SH20A/SH20 System interchange grade separated ramp connections:
  - New two-lane system interchange ramp: SH20A northbound to SH20 southbound over the existing SH20 carriageway. The outer lane commencing at Kirkbride Road on SH20A and terminating under the Massey Road overpass on SH20 and the inner lane commencing at the Bader Drive eastbound off-ramp on SH20A and terminating between the Puhinui Road southbound off-ramp and the Puhinui Road underpass
  - Bader Drive eastbound off-ramp removed to allow for SH20A/SH20 system interchange.
- Widening of SH20 (north of SH20A):
  - One additional southbound lane between Rimu Road and the SH20A/SH20 system interchange.
  - One additional northbound lane between the SH20A/SH20 interchange and Mangere Bridge.
- Widening of SH20 (between SH20A/SH20 south-facing system interchange ramps and SH20B):
  - One additional lane northbound between the Puhinui Road northbound on-ramp and SH20A/SH20 system interchange.
  - Two additional lanes southbound between the SH20A/SH20 system interchange and the Massey Road interchange.
  - One additional lane southbound between the Massey Road interchange and the Puhinui Road southbound off-ramp.
- Widening of SH20B:
  - Conversion of the proposed short-term bus shoulders to general traffic lanes, resulting in one additional east and westbound lane from Pukaki Creek Bridge to SH20B/SH20 interchange.
  - Minor widening on the southern side of SH20B to accommodate a median and edge shoulders.
  - At-grade signalised intersections at Campana Road and Manukau Memorial Gardens retained from the short-term works.
  - Access onto SH20B restricted to signalised at-grade intersections at Campana Road and Manukau Memorial Gardens.
  - Property access on northern side of SH20B, via new service road. Access on southern side via realigned Price Road from the short-term works.
- Widening of Pukaki Creek Bridge
  - Existing Pukaki Creek Bridge retained for eastbound carriageway
  - New structure required over Pukaki Creek for westbound carriageway, RTC and SUP, located on the south side of the existing structure
  - Two lanes for each direction on SH20B.
- Shared Use Path
  - SUP provided between Bader Drive and Puhinui Interchange on the eastern side of SH20 and from Puhinui Interchange to the western abutment of Pukaki Creek Bridge on the southern side of SH20B.
- Rapid Transit Corridor (RTC) component:
  - RTC on the southern side of SH20B from Airport to Puhinui Interchange

2 Network operating plan development process

2.1 Scope of the SWG Network Operating Plan

The scope of this document is to outline the high level operational principles and desired mobility outcomes for the immediate project area. Its focus will be on SH20, SH20A and SH20B. However, this NOP will influence the intersecting transport network, facilitate the use of alternative modes and will discuss the interaction with the adjoining area of influence.

This plan describes the transport system functionality (what it will do), guidance on achieving optimal performance (how well it will function) and under what conditions it will operate. The NOP will be used to:

- Inform the long-term options
- Influence other initiatives associated with access to Auckland Airport and the south west.

What it does not cover are the specifics, such as operational procedures and processes for the transport network. These will be covered in the Concept of Operations and Standard Operating Procedures that will be developed at later stages in the project.

2.2 Purpose of the SWG Network Operating Plan

This NOP has been developed to create a strategy led approach that provides guidance to investment partners (the Transport Agency, AT and AIAL) so that they can achieve the outcomes envisaged from the investment in the 20Connect SSBC. It outlines the strategic function and intents of the Southwest Gateway network and its relationship with the wider transport network.

It is based on the requirements and needs identified by the relevant transport network operators and stakeholders, bringing together these stakeholders to:

- Develop a common vision for the operations of the project
- Capture the operational needs and aspirations of key stakeholders
- Develop a reference document outlining appropriate management and operating strategies to support delivery of the desired outcomes.

This NOP will also be used to help define the roles of the operational stakeholders and network/transport operators in achieving a common goal whilst also realising their individual operational objectives.

It explains the roles and functions of the respective transport corridors and State Highways in the project area and how they relate to the wider transport network along with the systems and resources required to facilitate delivery of the desired outcomes.

It also considers the role that user behaviour plays in developing an operations strategy and provides a framework for performance measurement and evaluation. It highlights opportunities and potential network performance issues as well as management strategies to target these opportunities and issues.

This NOP has a focus on the future (2048) but is also cognisant of the shorter-term outcomes. It acknowledges the strategy and the methodologies for implementing the strategy will change over time as the network develops, demand patterns change and technology develops.

2.3 Methodology

2.3.1 Process

The key approach in developing this NOP is the ongoing consultation and collaboration with The Transport Agency's investment partners and network operating partners. The NOP development process has been used to define the roles and functions of stakeholders and as a basis to develop an operational vision. It has been prepared based on input from stakeholders and network operators along with data gathering, customer insights, current best practice and the outputs of strategic modelling.

Key steps in the process have been:

- Information gathering and assessment including:
  - Strategic documents and policies, vehicle / pedestrian data, existing network form and function, customer insights
  - One on one meetings with stakeholders and operators to identify current issues, future plans and works, desired operation, priorities, outcomes and objectives
- Workshop 1, Objectives (Appendix A):
  - Agree user groups
  - feedback from one on ones, potential conflicts / inconsistencies
  - common operational objectives
  - high level user / mode priority
- Workshop 2, Priorities (Appendix B):
  - Network extent and Area of influence
  - Network function
  - Operational principles
  - User/mode priority
  - Conflict points, interim and future state
- Workshop 3, Management strategies (Appendix C):
  - Performance measures and targets
  - Performance gaps
  - Align with DBC long list options
- Preparation of draft NOP
  - preferred strategy
  - deployment plan
  - post implementation evaluation framework

2.3.2 Consultation

Consultation was undertaken with the following stakeholders through a series of one on one meetings and workshops:

- Melanie Alexander - AT Network Management and Safety
- [redacted]

- [redacted]
- [redacted]
- Debajeet Baruah - AT, Metro (Facilities)
- Adam Beattie – AT, Walking and Cycling
- [redacted]
- [redacted]
- [redacted]
- Luke Elliot - AT, Metro (Network Development)
- [redacted]
- [redacted]
- [redacted] [redacted]
- Miguel Menezes – AT, Network Operations
- [redacted]
- [redacted]
- [redacted]
- Steve Patton – AT, Walking and Cycling
- Shweta Rattan – AT, Metro (Networks)
- [redacted]
- Renata Smit - AT, Metro
- Irene Tse – AT, Safety
- Danny Xu – AT, Network Management and Safety

2.4 Relationship with other documents and projects

The NOP is an important strategic document linking strategy with operations. This NOP has been developed under the strategic framework of the Auckland Network Operations Plan (ANOP), the Western Ring Route Operating Plan (WRROP) and cognisant of the priorities set out in Government Policy Statement (GPS) on Land Transport, the Transport Agency's Statement of Intent, Auckland Transport's Statement of Intent and the AIAL Transport Strategy.

This NOP informs a suite of documents that set out details in how the operating outcomes are to be achieved. These document relationships are illustrated in Figure 2-1 overleaf.

In reference to projects the NOP covers areas related to Airport to Botany Rapid Transit, 20Connect and the Auckland Airport Precinct Improvements projects. This is illustrated in Figure 2-2 overleaf.

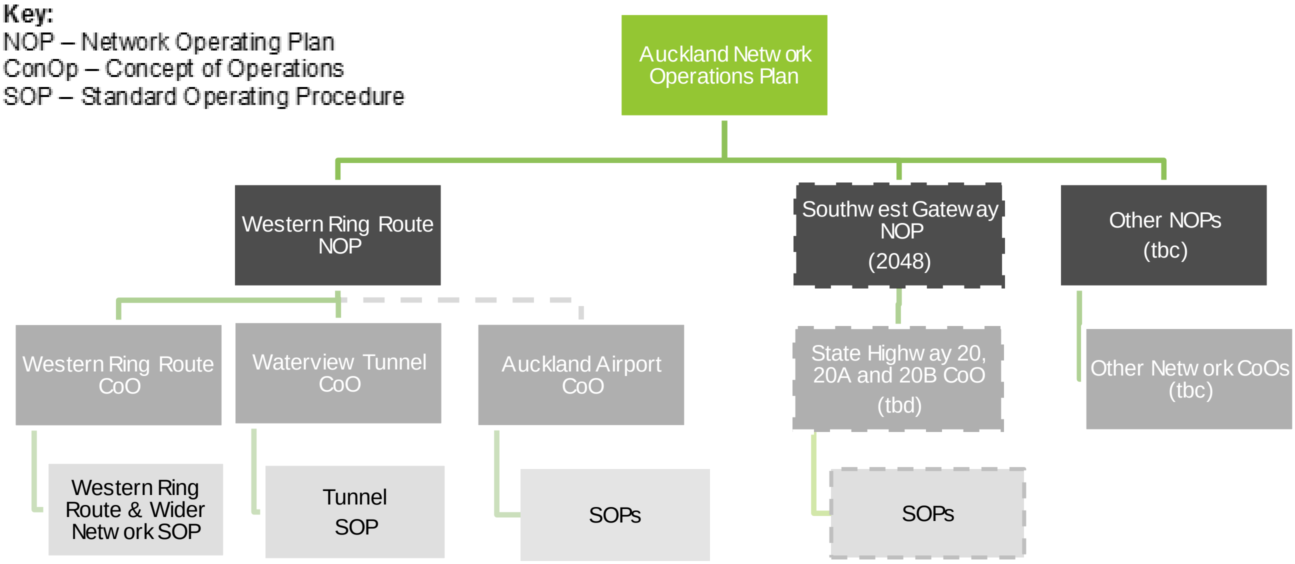

Figure 2-1 Southwest Gateway NOP document relationship structure

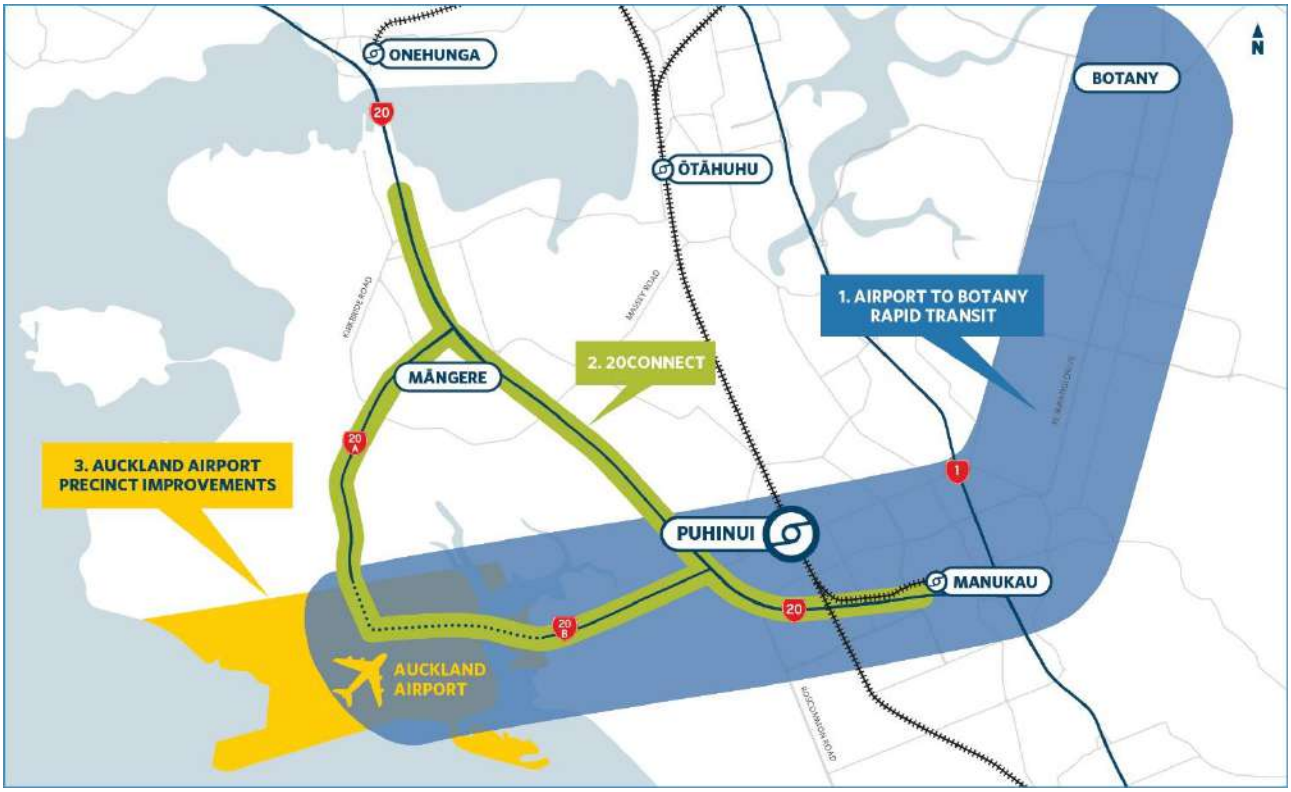

Figure 2-2 Southwest Gateway NOP project relationship structure

2.5 Intended audience

The NOP is aimed at stakeholders impacted or involved in the delivery of access to and from the Auckland Airport. It is also intended for those who are involved in the day-to-day operation, management, maintenance and incident response on the network. It explains the outcomes sought and helps define the various roles and responsibilities.

The key target audiences are the network operators, the investment partners and the emergency services.

The network operators are:

- Auckland Transport Operations Centre (ATOC)
- Auckland Motorway Alliance (AMA) or their successor
- Waterview Tunnel Joint Operations (WTJO)
- AIAL

The roles and responsibilities of these network operators and investment partners are covered in Section 3.10 of this plan. The Southwest Gateway NOP highlights the main focus areas of each operating partner to achieve the agreed strategic outcomes as stated in Section 3.1.

This NOP is written to also inform and influence other stakeholders who have an operational interest in the access to and from Auckland International Airport. These include Auckland Council, vehicle recovery services, heavy haulage association and the Automobile Association (AA), public transport operators, etc.

2.6 Intended use

The NOP has been developed in consultation and collaboration with the Transport Agency, and its investment partners AT and AIAL. It will be used to inform and guide the development of:

- The design of SH20, SH20A and SH20B Long-term Improvements, particularly priority movements and the ITS design
- Long-term State Highway 20, 20A and 20B Concept of Operations
- Auckland Airport Concept of Operations (Live document, completed September 2018)

System operating requirements / other operating documents / technical notes associated with operational responses within the project area.

3 Network overview

3.1 Operational objectives

The key stakeholders / project partners are all aiming to deliver transport and economic benefits to Auckland and New Zealand on behalf of the government. As such, the GPS has been given due cognisance in developing operational outcomes that give effect to the investment objectives. The operational outcomes are:

- A network that is safe.
- A network that is resilient.
- A network that provides access.
- A network that enables transport choice.
- A network that reduces adverse effects on the local environment.
- A network that provides value for money.

3.1.1 Auckland Network Operations Plan

The operating objectives for the Auckland network are outlined in the ANOP. This is a strategy led document setting the framework to achieve the desired outcomes of improving mobility and managing congestion in and around the Auckland region whilst getting the most out the transport asset. The network is prioritised by mode, time of day and corridor / intersection.

To achieve the optimal outcomes from each route, a road user hierarchy has been developed by allocating each mode to routes based on the strategic function and location of the route. Priority weightings for each mode are then allocated to routes and intersections on a time of day basis. In general, the hierarchical order for assessment is:

- Pedestrian
- Cyclist
- Public Transport
- Freight
- General vehicle

Current functions and priorities on routes in the project area of influence are shown in Figure 3-1 below.

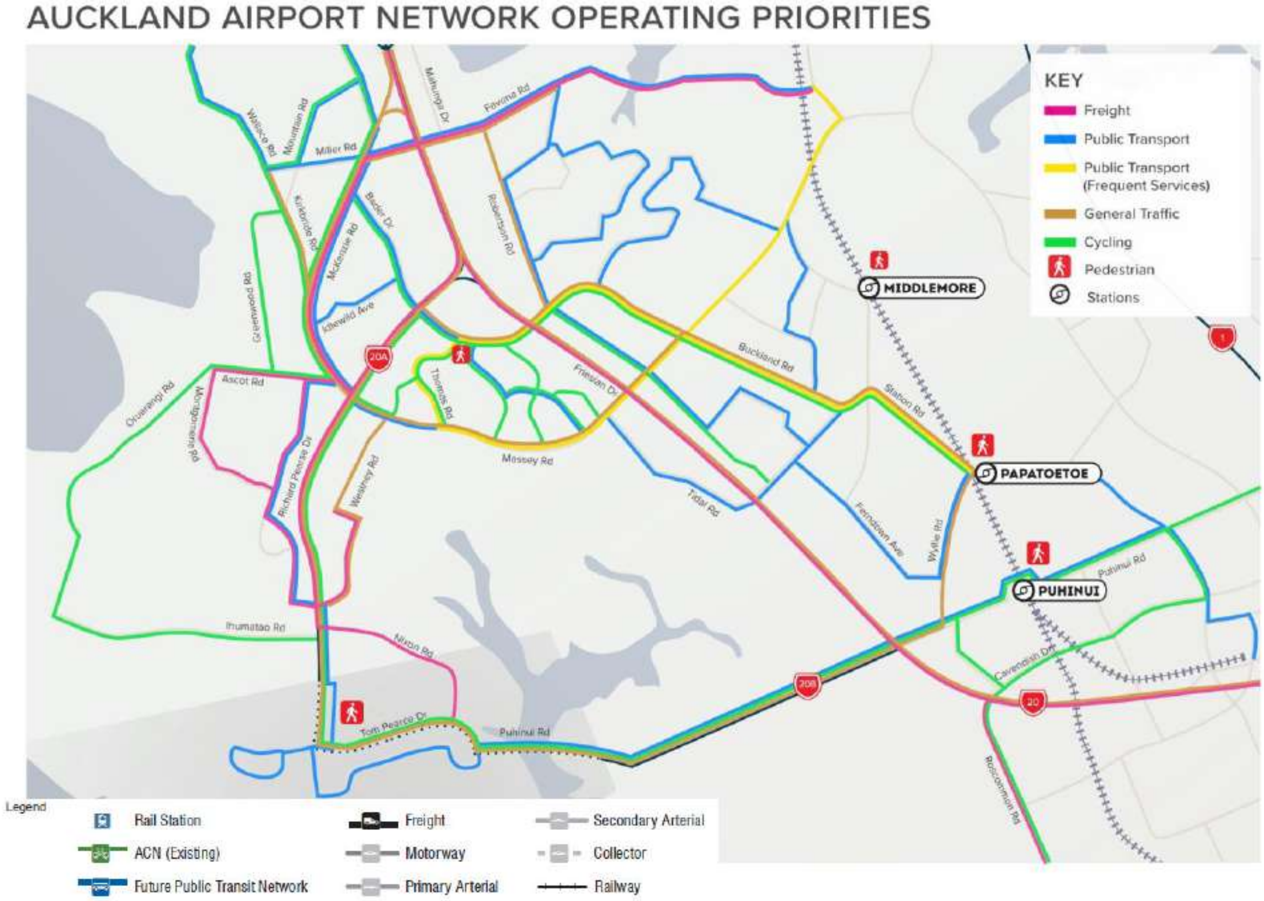

Figure 3-1 ANOP Functions and Priorities

From the figure above, it is evident that the current priorities on SH20 are freight and general traffic, while SH20A priorities include active transport, and public transport within the Airport precinct. For SH20B, current priorities include freight and public transport. It should be noted that priorities do vary by time of the day.

3.1.2 Western Ring Route

SH20 and its connections to SH20A and SH20B form part of the WRR. The main goal of the WRR is to provide a north-south alternative to SH1, and a by-pass route around the Auckland City Centre during normal operations and on exceptional periods such as major events, incidents, major maintenance and emergency closures on SH1. Operating outcomes and principles developed for the Southwest Gateway need to align with, and not conflict with, the WRR operating outcomes and principles as per the WRR Network Operating Plan and WRR Concept of Operations. The WRR operational outcomes that are most relevant for the airport access include:

- SH16 / SH20 is an alternative north-south route to SH1
- Reliable trips / journeys; west to south (SH16 / SH20), north to south (SH18 / SH16 / SH20) and CBD to south and airport (SH16 / SH20 / SH20A)
- The motorway network (as opposed to local network) is to from the primary routes for regional, cross-city, freight and goods movements
- Primary freight routes are SH16 to / from CMJ and Ports of Auckland and SH20 to / from Onehunga Wharf, Auckland Airport and Wiri Freight Hub

The WRR operating principles are shown in Table 3-1.

Table 3-1 WRR Operating Principles

WRR Operating Principles
■ Desired outcome is to operate the tunnels at an average vehicle speed of above 20km/hr over the full length of the tunnel as this is considered best international practice.
■ Dangerous goods vehicles prohibited from the tunnel and a suitable alternate route maintained at all times.
■ Over height Vehicles to be detected efficiently and prevented from entering the tunnel.
■ Prioritise predictable journeys for bus by optimising motorway access and egress.
■ To deliver outcomes as defined by Auckland Network Operating Plan on urban arterials.
■ Aim to ensure that at least 1 detour or alternative strategic route is available during planned and unplanned events.
■ Prioritise trips to and from Auckland Airport
■ Improve interregional access to markets and ports in Auckland
■ Improve the efficiency of intra-regional travel for trade and services during business hours
■ WRR prioritised for regional over local journeys.
■ To deliver outcomes as defined by Strategic Auckland Network Operating Plan including prioritisation of use (General Traffic, Freight, Public Transport and other modes).
■ To ensure that access to employment from West Auckland is not unduly restricted at the expense of other competing priorities
■ Discourage undesirable use of the local network for regional journeys through signage and optimisation of ITS assets
■ To deliver outcomes as defined by Auckland Network Operating Plan including prioritisation of use (General Traffic, Freight, Public Transport and other modes).

3.1.3 Auckland Airport Precinct Concept of Operations

The management and operation of the Auckland Airport internal road network is the responsibility of AIAL as the road controlling authority. The Auckland Airport CoO has been developed in parallel with the Southwest Gateway NOP and seeks to deliver the following two overarching strategic outcomes from the operation of the Auckland Airport road network:

- Enable aeronautical services (such as flight crews and catering services) to reach the terminals on time to avoid impacts to flight schedules
- Keep a balance between traffic entering and traffic leaving the precinct, such that during periods of high demand the Airport road network continues function at an acceptable level of service.

To deliver these outcomes, a set of operational principles were developed. They are to:

- Provide sufficient capacity and/or queuing space for the outbound movements from the Airport prescient to allow the Airport network to continue functioning during periods of high demand (heavy congestion)
- Prioritise trips out of the airport precinct over inbound trips
- Prioritise traffic heading away from the domestic and international terminals over traffic travelling towards the terminals
- Prioritise higher occupancy modes and/or passenger transport services for travel within the Airpo rt precinct
- Discourage public pick-up and drop-off at the terminal forecourts (with a view to a response that provides other opportunities)
- Discourage non-Airport related through traffic on George Bolt Memorial Drive (GBMD) (south of Nixon Road) and Tom Pearce Drive (TPD)
- Maintain access along Cyril Kay Road to Checkpoint Charlie
- Maintain access for pedestrians to and from The Quad (including the Ibis Hotel) and to and from the terminal buildings

Maintain access for cyclists where it is currently available within the Airport precinct.

3.2 "One network" Operating principles

The Southwest Gateway transport network will operate under the collaborative "One Network" principle, which is a partnership approach between the Transport Agency and AT to better address user needs for a more consistent road network. In March 2011 a Partnership Charter was entered between the Transport Agency and AT with the purpose to:

"Operate one transport system that delivers a satisfying experience to customers by providing an integrated approach to moving people, goods and services safely and effectively through the Auckland Region."

The Charter's aim is to enable customers to make smarter and more informed choices about the way they travel, achieving the most from Auckland's transport services and infrastructure and keeping Auckland moving by a single network approach. This will be achieved by:

- One Network – operating one reliable network across all modes throughout the region
- Customers – putting customers first by being responsive and providing accurate and timely information
- Co-Operation – creating a jointly governed, managed and staffed operations centre for the Auckland region
- Safety – ensuring the safety of all
- Technology – optimising the efficiency and effectiveness of the network through innovation and the operation of appropriate technology in real time
- Expertise – providing technical advice for operations, strategic planning, investigations, design and construction
- People – creating and maintaining a healthy enthusiastic organisation
- One Team – proactively and collaboratively use our experience, resources and expertise to work together to deliver enhanced value for money.

Operating arrangements have been implemented to give effect to the "One Network" charter including the following parties:

- Auckland Transport Operations Centre (ATOC) – join charter between the Transport Agency and AT
- Auckland Motorway Alliance (AMA)
- Waterview Tunnel Joint Operations (WTJO).

These network operators work together as one team to proactively and collaboratively utilise their experience, resources and expertise to deliver the one network operating outcomes. The roles and responsibilities of each of the above network operators are defined in Section3.10.

3.3 Customer behaviour

A range of customers access the study area, not only for international and domestic travel but also for work, to send and receive goods and for business travel. The array of major customer groups identified reflects the variety of activities. The different types and proportions of customers who access the Airport and the surrounding area are identified in Figure 3-2.

Figure 3-2 Users of the State Highway network who access Auckland Airport

There are currently more than 900 businesses located near Auckland Airport, employing around 21,000 people, with approximately 12,000 employees based on the Airport's land. In addition to the Airport's core, areas adjacent to the Airport are predicted to experience ongoing population and employment growth. Less than 2% of workers use public transport. Approximately 45% live to the south of the Airport, meaning that SH20B is their main travel route to and from work.

The modes that are currently being used by customers to travel to and from Auckland Airport and the surrounding area include public bus, rail/bus, park and ride, SkyBus, taxi, cycle and private car. However, car use is the most dominant travel mode for Auckland Airport customers, employees and visitors.

Approximately 84% of workers in the Auckland Airport and surrounding area currently use private vehicles to travel to work. Public transport options are currently lacking in priority, with the nearest rail station, Puhinui Station, located several kilometres away. There are currently no dedicated bus facilities on SH20B, leading to unreliable travel times for customers which in turn influences their travel mode choice.

Within the wider customer groups, business travellers have very different expectations of surface transport from non-business travellers, especially those using low-cost airlines. International leisure travellers may be self-sufficient (free independent travellers) or may be in large tour groups. Lower-paid shift workers have different requirements from executives and so on, and those transporting high value/time critical freight also have particular needs.

Travel time reliability for transporting freight to and from the Airport and the surrounding area is a key factor in the cost of doing business. Auckland Airport plays an important role in movement of high-value, lowweight, time-critical cargo. Imports and exports via Auckland Airport include industrial parts and machinery, medical, optical, photographic parts and machinery, audio and video parts and machinery, pharmaceuticals, gems and precious stones. Exports via the Airport that outweigh imports include food and plant products, particularly fish, crustaceans, live animals, flowers and dairy products.

3.4 Land use

The existing land use adjacent to SH20A predominantly comprises light industrial and business park activity. SH20B is predominantly rural/ green-fields in character with very little development. Some land remains undeveloped to the far west of the study area.

In addition to Auckland Airport's core, areas adjacent to the Airport are predicted to experience ongoing population and employment growth.

Since becoming operative in part, the Auckland Unitary Plan (*AUP)* has provided greater certainty on how population and employment growth will occur in the area surrounding Auckland Airport. There is an estimated 400 hectares of land currently available in the study area around the airport available for further industrial and commercial development. Additionally, there are currently three main Future Urban Zones within the Project Area shown in the *AUP* planning maps which will enable further development.

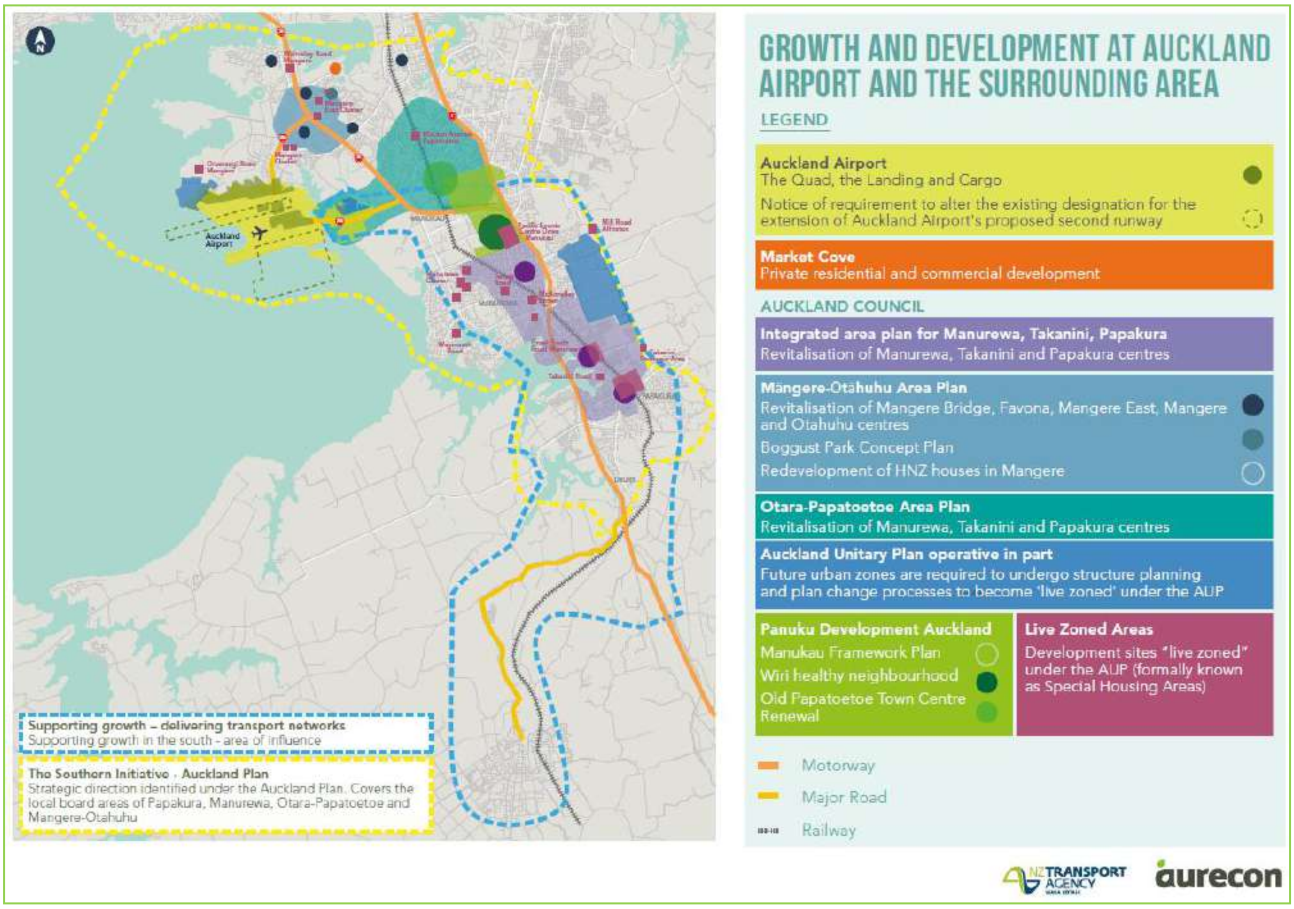

Figure 3-3 Key growth areas and development in the Auckland Airport surrounds (20Connect SSBC)

There are a number of developments, strategies and associated projects already planned in the study area (refer to Figure 3-3), however some strategies branch out wider into the surrounding areas. The relevant developments, strategies and associated projects include:

- The Puhinui Precinct and Māngere Gateway Precinct which will increase the level of development immediately adjacent to SH20B, and in the vicinity of SH20A

- The Future Urban Zone (FUZ) has been modestly extended south to provide further development in areas, including Pukekohe, Drury, Paerata and Takanini[1]
- Residential zoning rules have been relaxed, enabling denser development both in new subdivisions and additional infill and redevelopment in the existing urbanised area. This has been achieved through changes that permit smaller lot sizes and more dwellings per site in residential zones, as well as ‘rezoning’ of some suburbs to allow for apartment buildings and terraced housing. Intensification is concentrated within Māngere, Papatoetoe, Manurewa, Ōtara, Otahuhu, East Tamaki and Flat Bush, with areas rezoned for apartment and terrace housing
- As part of the Auckland Housing Accord, housing developments (formally known as Special Housing Areas[2]) were set up to speed up the supply of housing in Auckland. In the surrounding area, these are mainly located in FUZs, which are planned to deliver set amounts of new dwellings by a certain timeframe which differs depending on the facilities and utilities available. These include:
  - Oruarangi Road, Māngere (33 hectares for 480 homes over an eight-year period)
  - Māngere East Cluster (150 homes over an eight-year period)
  - Manurewa Cluster Extension (additional 125 homes to the 35-40 originally planned homes over a two-year period).

Refer to Figure 3-4 below for the location of these developments and an overview of the proposed growth initiatives and developments.

[1] The FUZ is applied to greenfield land that has been identified as suitable for urbanisation. The FUZ is a transitional zone and will remain in place until a structure plan and concurrent plan change re-zones the land to the appropriate urban zone (e.g. residential or business). Land may be used for a range of general rural activities but cannot be used for urban activities until the site is re-zoned for urban purposes.

[2] Auckland Council (2013). Special Housing Areas. Accessed 27 September 2017, from **http://temp.aucklandcouncil.govt.nz/EN/ratesbuildingproperty/housingsupply/Pages/home.aspx**

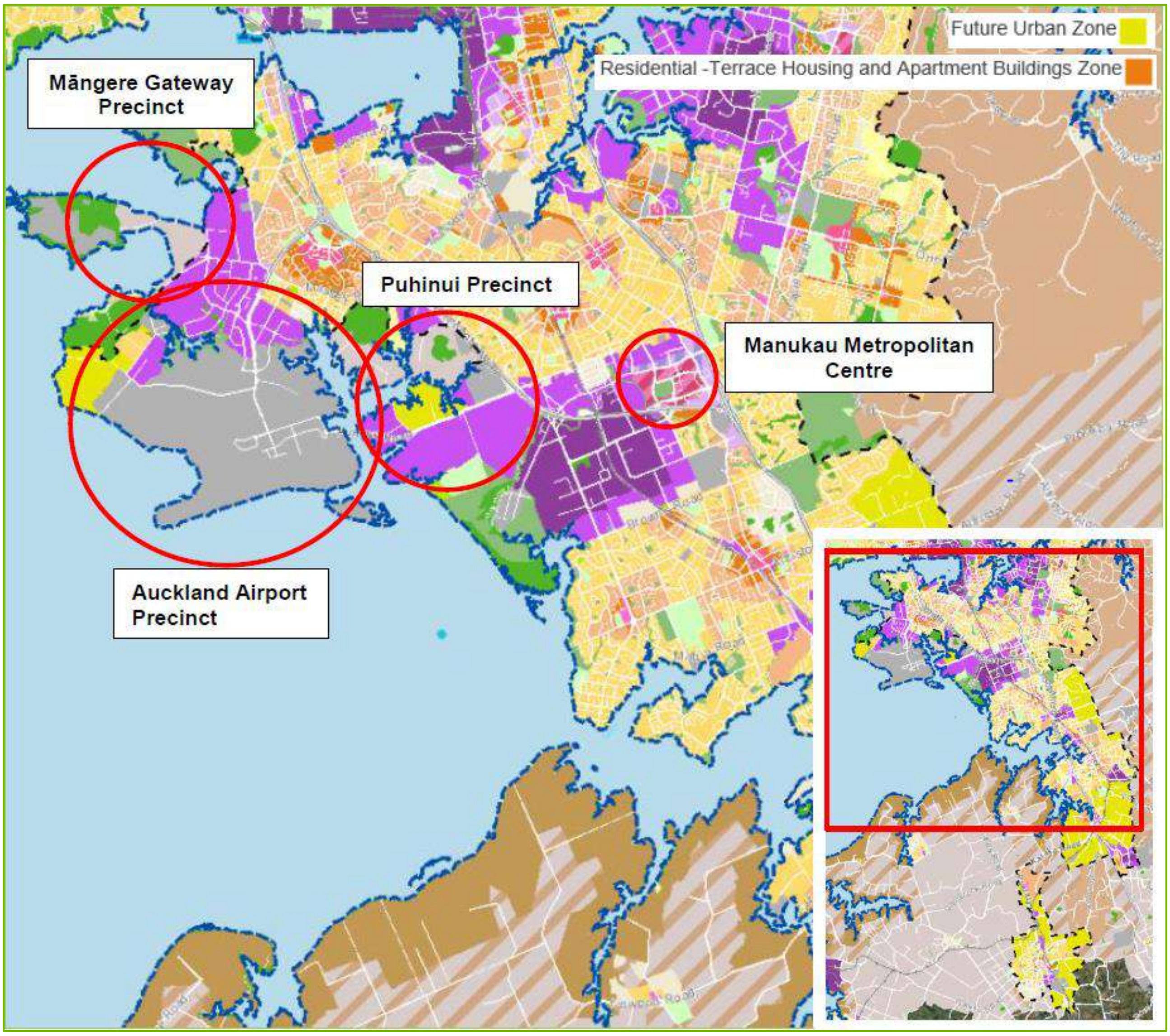

Figure 3-4 Relevant land use changes under the Auckland Unitary Plan

The combined effect of these adjacent developments is likely to add significant pressure on the south-western transport system, where customers travelling on SH20, SH20A and SH20B and local roads will experience significant levels of increasing demand and associated delays, congestion and unreliability in their journeys.

3.5 Road network infrastructure

Auckland Airport and the surrounding area is effectively a peninsula and is constrained in terms of connections to the wider transport network, with very few minor roads providing alternatives for access.

3.5.1 State Highway network hierarchy and infrastructure

There are three state highways SH20, SH20A and SH20B.

SH20A is a four-lane expressway with bus shoulders, which has recently been upgraded to motorway standard as part of the SH20A to Airport project. SH20A primarily provides access to the airport and the airport industrial area from the north. It carried approximately 43,000 vehicles per day in 2016, of which, approximately 7% were heavy vehicles.

SH20B is a two lane, undivided highway with local access from side roads. SH20B provides access to the airport from the east and south. In 2016, it carried approximately 27,000 vehicles per day, of which, approximately 4% were heavy vehicles.

SH20 is a four-lane motorway which operates as an alternative to SH1 for north-south traffic connecting Manukau to the south with Waterview to the north. It carried approximately 74,000 vehicles per day in 2016, between the Puhinui and Massey Road interchanges, of which approximately 6% were heavy vehicles. Recent upgrades along SH20 include the Waterview connection, which completed the Western Ring Road (WRR).

3.5.2 Arterial network

There are local arterial roads that provide alternative access to the state highways. Key arterial routes in the area include Massey Road, Kirkbride Road, Bader Drive, and Walmsley Road. These roads provide additional east-west access to the airport area, as well as facilitating access to the south from the northern parts of the airport industrial district. Puhinui Road is also a key arterial connecting directly to SH20B to the east of SH20 and plays an important role in providing public transport access from Puhinui Rail Station.

Puhinui Road is a two-lane road east of SH20B and is a key route for public transport connections to and from the Airport. Puhinui Road connects directly onto SH20B at the SH20 Puhinui Interchange and is the primary route for buses connecting to the wider Manukau and Botany areas.

Kirkbride Road is a two-lane, undivided road, connecting SH20 to the north via McKenzie Road with SH20A and Massey Road to the south. The SH20A/Kirkbride Road intersection has been grade separated, and the Kirkbride Road/Westney Road intersection signalised as part of the SH20A to Airport project.

Massey Road is a two-lane, undivided road, connecting SH20A at Kirkbride Road to the west with SH20 to the east.

3.5.3 Auckland Airport network

Although outside of the scope of the NOP the existing Auckland International Airport road network is noted below and in Figure 3-5. It will change significantly this is being developed by AIAL. Recent improvements to AIAL's road network include:

- Changes to lane configurations at the Puhinui Road and Tom Pearce Drive intersection to increase traffic flows through the intersection.
- Changes to lane configurations on George Bolt Memorial Drive and Laurence Stevens Drive roundabout to improve traffic flows to the domestic terminal
- Nixon Rod bypass for southbound traffic through to SH20B and signalisation of the Jimmy Ward Crescent roundabout
- Domestic forecourt reconfiguration
- Development of a Concept of Operations document to record and formalise the existing operating procedures of the Airport precinct and adjoining state-highways.

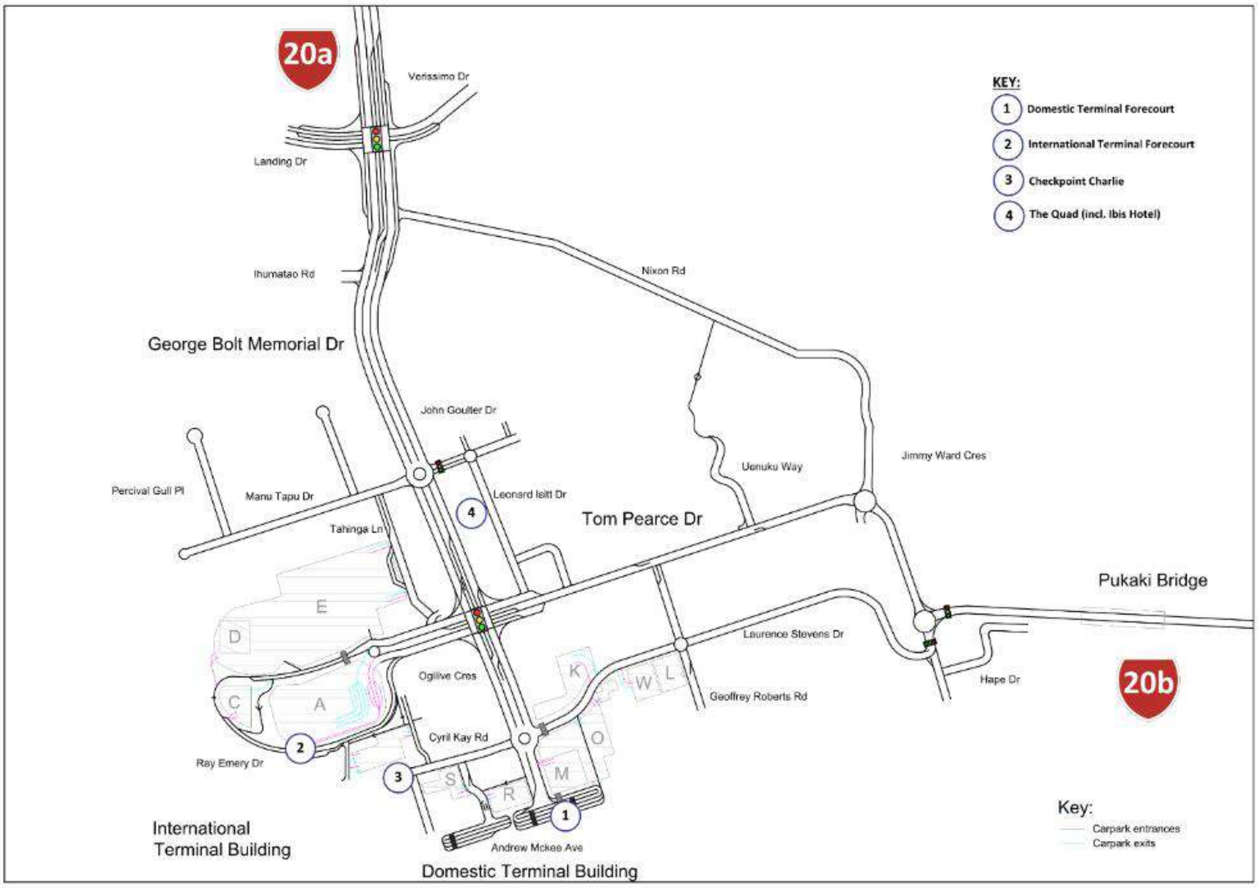

Figure 3-5 Auckland Airport internal road network

3.5.4 Roads and Streets Typologies

The main corridors within the study area have been classified in accordance with Auckland Transport's Roads and Streets Framework (RASF) guidelines by the project team. Consideration was given to both the place and movement function of each corridor, as well alignment with the NZ Transport Agency's "One Network Road Classification" typically focussed on only the 'movement' functions. The relationship between the one network and RASF classification system is shown in Figure 3-6 overleaf.

SH20A and SH20B are important access routes for the airport precinct and surrounding development, facilitating regional accessibility of the Airport. In terms of the NZ Transport Agency's "one network" road functional classification guidelines, both SH20A and SH20B are state (or national) highways, with a primary mobility function. However, within the immediate vicinity of the airport precinct, which has an important place-function, these roads could be classified as "Main Street Collector", in terms of the RASF guidelines.

Since there are limited access options to the airport, it will be necessary to accommodate both the mobility, access and place requirements of the Airport precinct within the same available space and therefore a compromise between mode priorities is necessary.

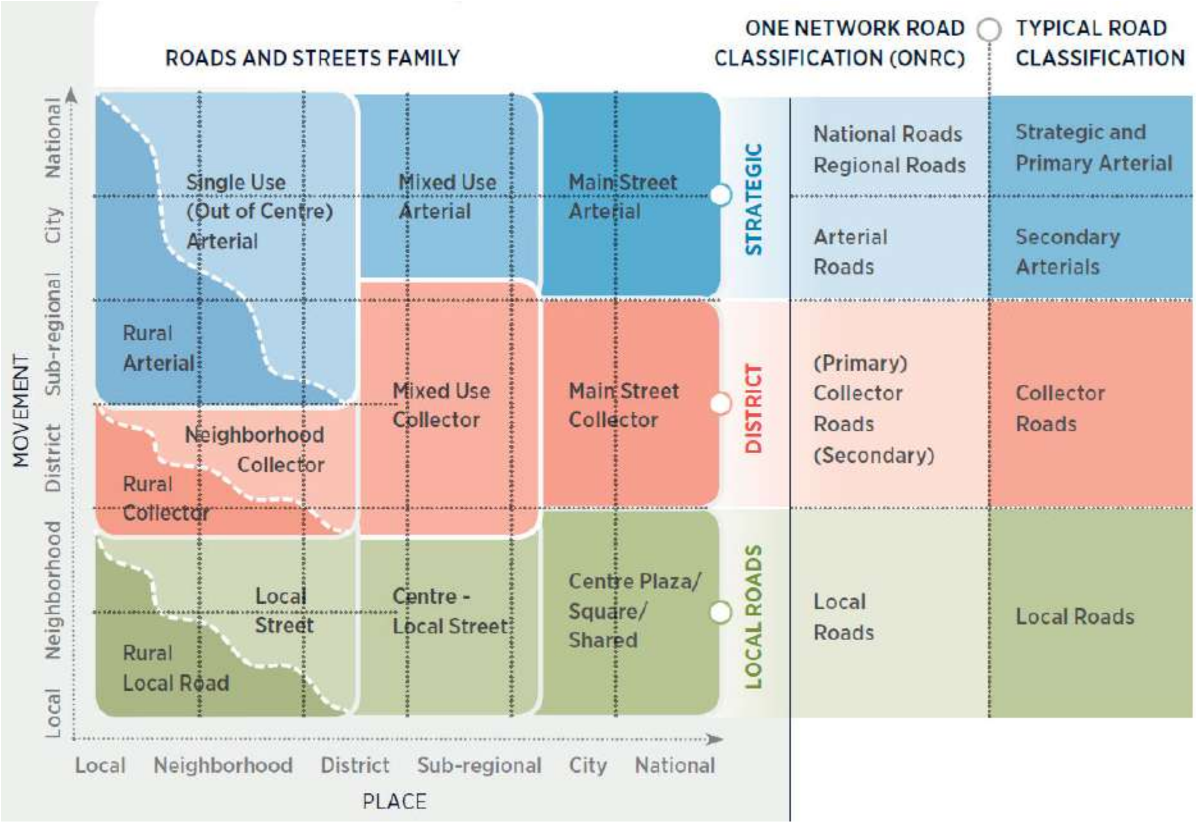

Figure 3-6 Relationship between NZTA's ONRC, typical road classifications and the RASF

For each of the corridors considered in this NOP, their typology has been determined by the project team as shown in Figure 3-7.

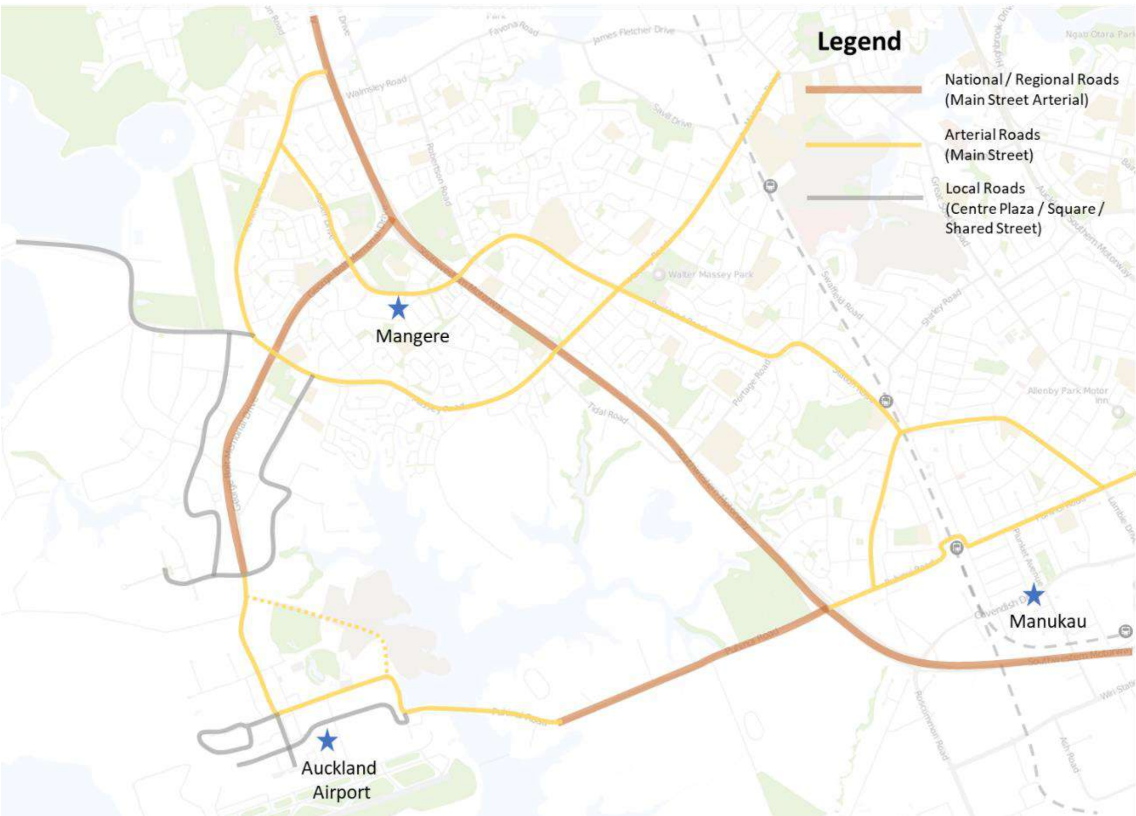

Figure 3-7 Local road network classification

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3.6 Public transport network

There are bus shoulders along part of SH20A and no dedicated bus facilities currently provided on SH20B. This means that bus travel to and from Auckland Airport is often unreliable because of congestion on the road network.

SkyBus uses SH20A between Auckland Airport and Auckland's City centre. It carries approximately 780 inbound passengers and 600 outbound passengers per day and runs every 10 minutes, all day.

The Airporter 380 uses SH20B between Manukau and the Airport. The Airporter 380 runs a service every 15 to 20 minutes during the day, 7 days a week, 365 days of the year, between Manukau and Onehunga which travels via Papatoetoe Station and Onehunga Station. It serves the employment areas in the outer airport precinct area. It takes a non-direct and relatively circuitous route, particularly between the Airport and Onehunga. Prior to the recent frequency changes in December 2017, it carried approximately 520 inbound passengers and 360 outbound passengers per day.

The closest rail public transport services to Auckland Airport are located on the NIMT Line, several kilometres to the east of Auckland Airport at Puhinui Station and the Manukau branch line that currently terminates at the Manukau metropolitan centre.

The proposed bus routes and future mass rapid transit services proposed to be operating by 2028 are shown in Figure 3-8.

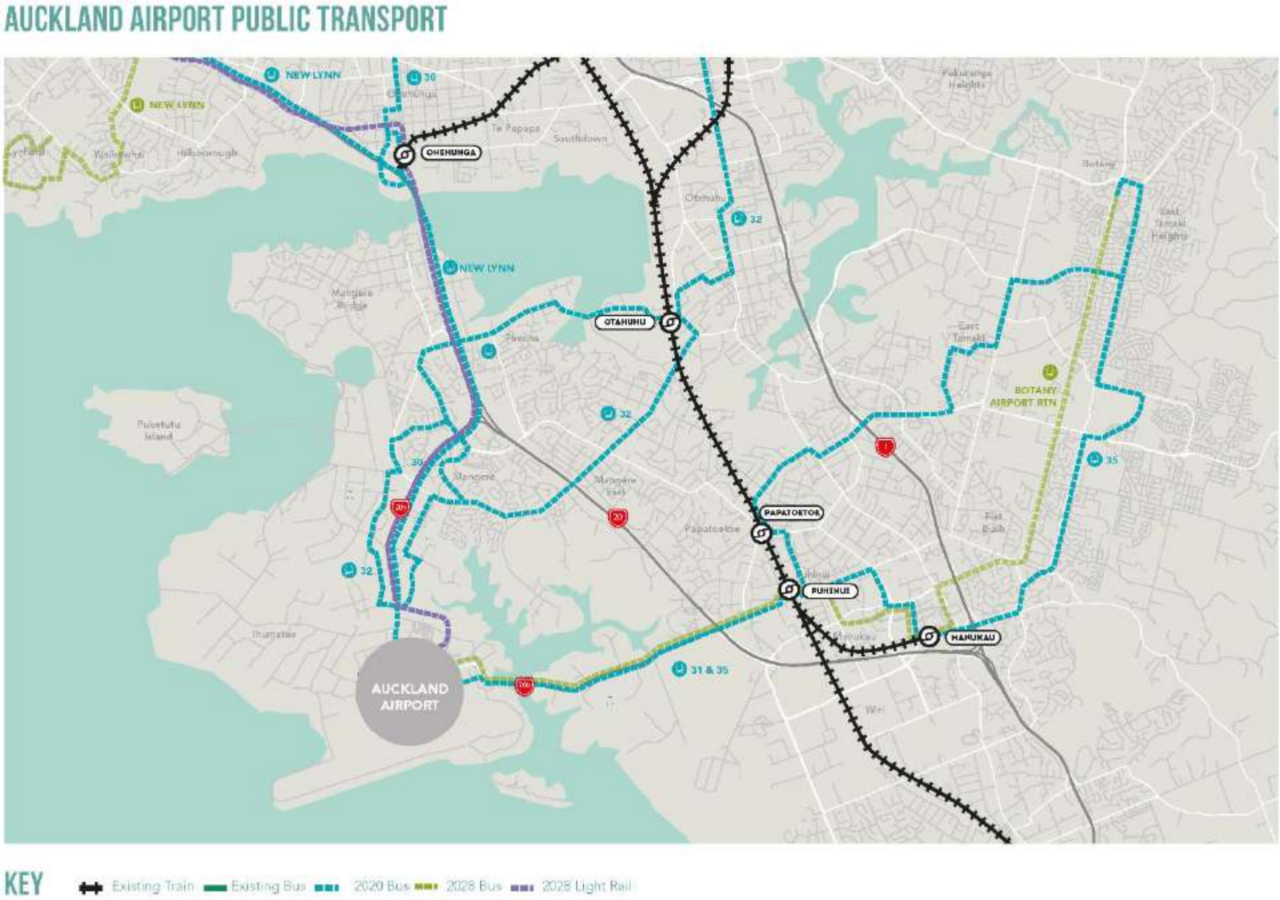

Figure 3-8 Proposed public transport services under investigation, 2020 and 2028

3.6.1 Auckland Airport to City Centre Mass Rapid Transit Corridor

In March 2017 the Transport Agency and AT announced an agreement on a staged integrated transition from bus to light rail transit (LRT) from the Airport to City Centre, based on future demand and capacity, and to commence route protection for this important gateway corridor between two of Auckland's key growing employment areas.

3.6.2 Auckland Airport to Botany Mass Rapid Transit Corridor

AT is commissioning a SSBC for the Airport to Botany MRT and short-term airport access improvements to progress key elements of the Access to Airport Programme. This includes an investigation into an upgrade of the Puhinui station into a bus-train interchange by 2020 and improved bus services to Auckland Airport from the south-east along SH20B. Beyond this, over the decade 2026 to 2036, AT plan to add an eastern busway from Airport to Botany via Manukau.

3.7 Walking and cycling network

There is limited active mode provision in the area adjacent to Auckland Airport. Dedicated cycle lanes are provided on parts of SH20A, Bader Drive, Buckland Road, Cavendish Drive, Lambie Drive and Kirkbride Road. Shared paths are provided on some coastal routes, local roads and in reserves. There are no provisions for pedestrians and cyclists coming from the east of Auckland Airport.

The existing and proposed walking and cycling network identified by both AT and within Auckland Council's area plans is shown in Figure 3-9.

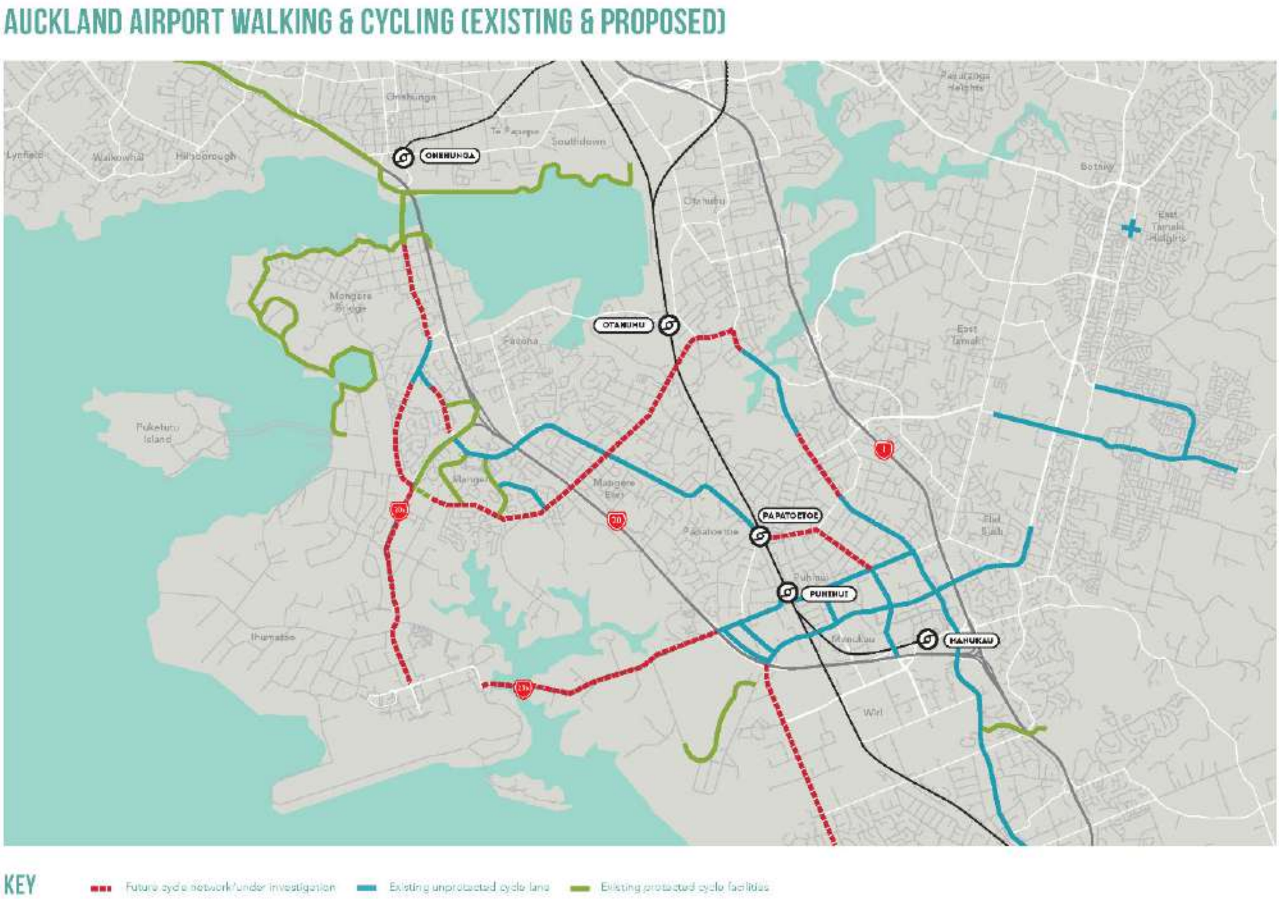

Figure 3-9 Existing and Proposed Auckland Airport Walking and Cycling Network

3.8 Freight network

The demand for the movement of freight is substantial and the road network is the dominant mode for moving goods, as there is no heavy rail access to the Southwest Gateway project area. Auckland International Airport handles time sensitive, high value freight. It is New Zealand's largest air cargo port and handles 16% of imports and exports by value.

SH20A and SH20B, alongside SH20 between Manukau and the SH20A intersection are areas of high heavy commercial vehicle use on or around the strategic freight network. Auckland Airport and Wiri/ Manukau and their surrounds are both international gateways and are major freight generating and attracting areas.

Road-based freight traffic is forecast to grow substantially in the future by almost 75 per cent between 2012 and 2042 putting significant pressure on the freight network.

Figure 3-10 shows the strategic freight network in the study area (based on the *Auckland Regional Land Transport Plan (RLTP) 2015 – 2025*), with routes depicted as follows:

- Level 1A – Motorways serving strategic inter- and intra-regional movements
- Level 1B – Arterial roads serving strategic inter- and intra-regional movements
- Level 2 – Roads serving industrial parks
- Level 3 – Roads with no freight priority but requires active management

The strategic freight network is overlain with the Transport Agency's over-dimension vehicle routes.

The various industrial zoned areas zoned from the *AUP* are also shown on Figure 3-10.

Figure 3-10 Strategic freight network, inland container ports and industrial areas

The Auckland Airport and surrounding area forms Auckland's main industrial, warehousing and distribution area. For this reason, a number of freight-related operations are located in the area due to the many competitive advantages that proximity affords, including shorter transit times to end destinations and improving the overall supply chain efficiency.

The Figures in Appendix D provide a summary of the existing freight (HCVs) movements and routes for the month of March 2018. The figures have been produced from eRUC data produced by EROAD, which represents approximately 45% of the total number of HCV movements. It is a significant enough sized sample, that provides for the relative importance of each origin/destination. The key findings are summarised below.

The typical movements of HCVs for the 24hr period and afternoon peak follows relatively the same travel patterns. The total number of trips generated during afternoon peak is about 18% of the total trips generated in the 24-hour period. Given that the afternoon peak only accounts for 12.5% of the day, there are a high portion of HCV trips during the afternoon, which conflicts with other modes and movements such as the afternoon commuter peak and airside arrivals, congesting the network.

For the HCVs coming into the system on SH20 from Mangere Bridge southbound, most stay on SH20. For the HCVs coming into the system from SH20 from Lambie Drive westbound, most of the vehicles stay SH20 westbound and then northbound. This means that SH20 supports more inter-regional freight journey's rather than journeys to / from the airport area.

For the HCVs coming into the system from SH20A (SH20A/Ihumatao Road) northbound, most of the vehicles travelled north towards Mangere Bridge via SH20A and SH20.

For the HCVs coming into the system northbound, from Roscommon Road, most of the vehicles either travelled eastbound via SH20 or travelled northwest bound via SH20. Only a small portion of the HCVs travelled towards the Airport area via SH20B.

Some HCVs leave the system via local roads and off-ramps where no screen-lines were analysed.

SH20 has the highest volume of HCV movements accounting for 49% of southbound journeys (from Mangere Bridge) and 32% of northbound journeys throughout the day as it's an important link for HCVs that travels from the industrial area in Onehunga/Penrose to Wiri/Manukau or vice versa. It's noted that a significant number of vehicles travelling southbound from Mangere Bridge might be using Walmsley Road, McKenzie Road for the freight route. The strategic freight network plan shows that Walmsley Road is classified as level 3 and for oversized vehicles. Thus, currently, HCVs are travelling through the route which does not have freight priority and a screen-line at Walmsley Road westbound or McKenzie Road southbound is recommended for further tracking of HCV movements. Furthermore, for the trips generated from screen-line D, 37% of the trips were not captured. Thus, a screen-line at Roscommon Road southbound is recommended.

3.9 Network ITS infrastructure

The existing network operating infrastructure provided for the study area consists of a range of equipment and tools that can be utilised for a variety of traffic management applications. Similar to Auckland's wider transport network, this includes but is not limited to: CCTV footage, Variable Message Signs (VMS), Lane Control Signs (LCS), Variable Speed Signs (VSLS), Ramp Metering System (RMS) and Traffic Signals. These can be used to monitor and control traffic, and update travellers on delays and road / lane closures etc.

3.10 Roles and Responsibilities

The stakeholders in relation to this NOP and the operation of the southwest gateway network have roles and responsibilities that may be similar to other networks, however due to the long-term orientation of this NOP these must remain flexible for an unknown future. These stakeholders are: The Transport Agency, Auckland Council and AT, AIAL, the Collaborative Operations Group (COG), Iwi and the network operators ATOC, WTJO, AMA and emergency services.

4 Network operations strategy

Access to the airport precinct is currently facilitated by the State Highway network, with almost no direct local arterial access. The limited road network access therefore has to serve competing uses. With the Auckland Airport being such a significant port of entry, for people and goods, and a major employment hub, all user groups are important, not only for the airport, but for the economy of New Zealand as a whole.

Competing needs therefore need to be catered for, and where they do conflict, some will have higher priority depending on time of day. There is also scope to "motivate" travel behaviour through infrastructure and service provision, as well as mode prioritisation and transport network management.

4.1 Operating Principles

The following Operating Principles were developed by investment partners at the first and second workshops. They are the guiding principles by which any changes to the operational environment should be governed to ensure the desired network outcomes are achieved.

SWG Network Operating Principles

- Improve safety for all users on the transport system.
- Enhance the customer perception of safety.
- Deliver the outcomes as defined by the ANOP and GPS on Land Transport.
- Maintain access along SH20 to ensure the WRR can perform its strategic function as an alternate route to SH1 during unplanned and planned events.
- Provide an agile network that can keep people and goods moving.
- Provide resilient access to and from Auckland Airport to enable it to carry out its function as a lifeline utility.
- To enhance overall network efficiency.
- Efficient and reliable public transport travel times to and from the Northern and Eastern Airport approaches.
- Prioritise public transport on key routes by time of day.
- Provide priority on SH20, SH20A and SH20B for trips to inter-regional markets over local access.
- Prioritise freight movements to / from the north and south industrial areas and airport.
- Prioritise pedestrians within 400-800m of high activity pedestrian areas.
- Support the amenity function around key activity centres by improving walking and cycling access.
- Improve connectivity of walking and cycling network facilities with the wider Auckland network to provide a viable transport mode for local and medium distance trips for users of all ages and abilities, and support access to public transport.
- Improve trip reliability for time sensitive aeronautical traffic (passengers, crew, time sensitive freight) to and from the airport.
- Discourage non-airport related traffic from travelling through the airport precinct.
- Improve local amenity and air quality by reducing 'rat running' commuter traffic and freight on local roads.

It should be noted that all of the principles are applicable and ensuing KPI's could potentially be achieved for the year 2048. These principles will be used to help validate other projects which may come online, currently outside the scope of the Southwest Gateway Programme to ensure the desired operational functionality is achieved at all conditions.

4.2 User Priorities

The following user groups and mode priorities have been defined through workshops with investment partners and discussions with the project team technical specialists.

4.2.1 User Group Definition

To better understand the types of users for each modes of transport, the following user groups were defined with stakeholders at the first workshop.

Figure 4-1 below outlines the user groups defined as part of this NOP to be considered.

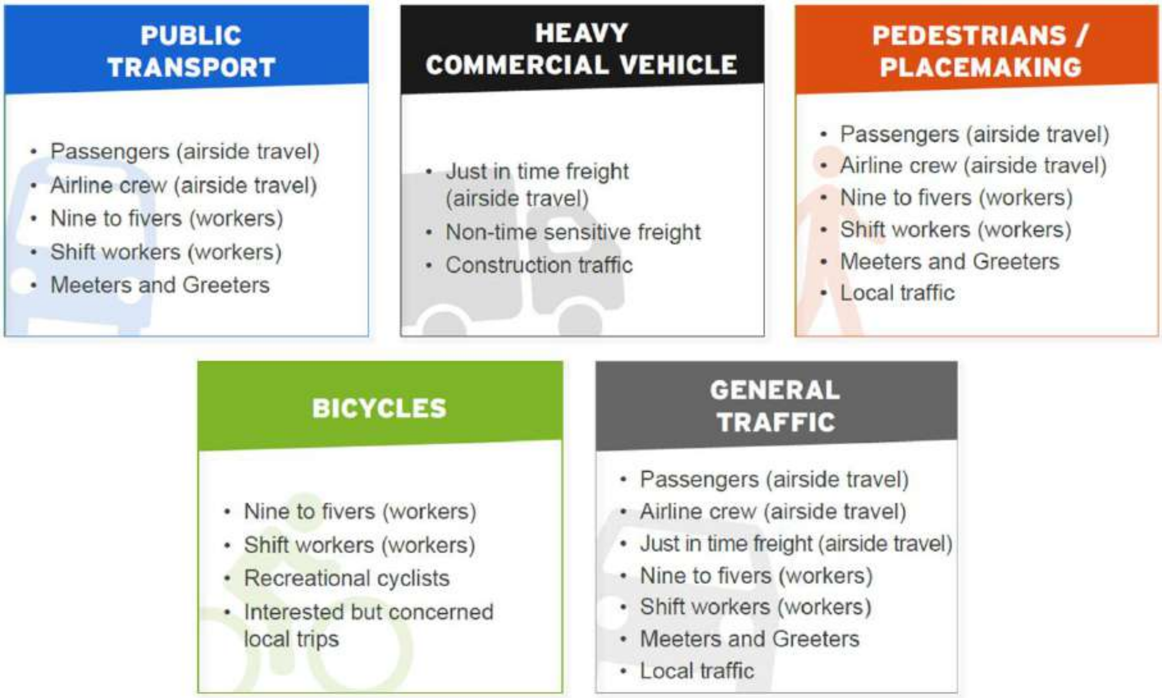

Figure 4-1 Southwest Gateway NOP User Groups

A user hierarchy was developed by allocating each transport mode to routes based on the strategic function of the route, the location and the time of day.

For roads which were not specifically defined, in term of priorities as part of this NOP, the following hierarchy applies to the transport modes to achieve the desired operational outcomes:

1. Pedestrians / placemaking
2. Bicycles
3. Public transport
4. Heavy Commercial Vehicle
5. General Traffic.

4.2.2 Priorities

Since there are limited access options for the airport, it is necessary to accommodate both the mobility and access requirements of the Airport precinct within the same available space and therefore a compromise between mode priorities is required. The following mode priorities for each corridor were determined applying the priorities set out in the GPS, and where conflicts exist, through discussions with network operating partners in Workshop 3.

The main priorities by mode, for the NOP study area are outlined below and illustrated in Figure 4-2.

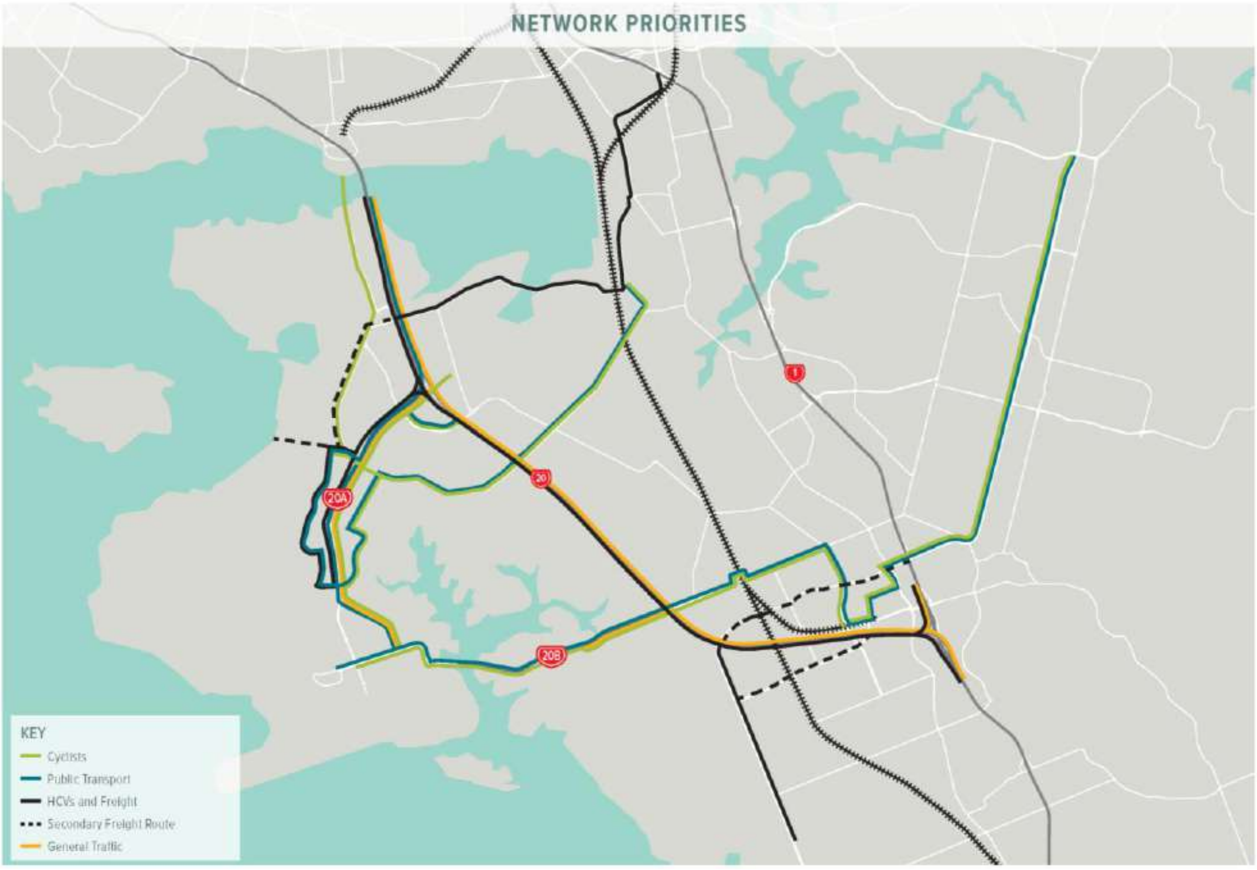

Figure 4-2 Network route priorities

Public Transport

Public transport is shown as a high priority along all proposed frequent bus or rapid transit routes.

Cycling

Active modes are a high priority down both SH20A and SH20B corridors. Typically cycling is provided as a high priority along all corridors on which public transport is a high priority to support last mile trips from public transport stops. Cycling has also been provided as a high priority on McKenzie Road and Coronation Road to connect cyclists travelling north-south with the new Mangere Bridge and SH20 cycleway.

On Massey Road only the active modes and public transport are given priority to better support the place and movement function of this east west connection.

Note: that although SH20 between Mangere Bridge and SH1 does not show cycling as a high priority, it should still be accommodated, and facilities provided for it along the SH20 corridor or a parallel corridor. This is explained further in Section 5.

Pedestrians

Although not shown on this map pedestrians are considered a high priority along every corridor with the exception of SH20 as noted above. Notwithstanding this, pedestrians are prioritised around public transport stations (Puhinui, Manukau etc) as well as in town centres such as Mangere, Manukau and on the airport precinct, in particular around the terminal buildings.

Freight

Freight is a high priority on SH20 to facilitate inter-regional trips and access to the inland ports at Wiri and Onehunga. Freight is a high priority on SH20A and parallel Kirkbride Road, Richard Pearse Drive and Landing Drive to facilitate access to and from Airport Oaks given the large industrial and freight forwarding land use. Freight is a high priority along Favona Road and Walmsley Road to support east-west freight movements, previously provided for on Massey Road.

There is no freight priority provided on SH20B however freight will still be accommodated. Southbound freight from airport Oaks will be encouraged, through mode prioritisation to first head north on SH20A and then south on SH20. At the time of writing this NOP, the SH20A - SH20 southbound connection is missing

Secondary freight routes are shown by the dashed line, which represents an alternative access for freight to the state highway to ensure there is resilience in the system for freight which is typically time sensitive in nature.

General Traffic

General traffic and freight is only prioritised on SH20 and SH20A. General traffic is also given priority on SH20B but only between SH20 and Prices Road/ Campana Road where the Auckland Airport Park and Ride South is proposed as well as access through to future greenfields developments on this peninsula.

Although general traffic is not prioritised on any other corridors, it will still be accommodated. Typically it is a lower priority to the other modes as outlined in the overall hierarchy in previous section.

5 Operational scenarios

The travel demand within the airport district is determined by a number of factors. The peaks are driven by flight schedules and employee shift changes. The two-way traffic is generally at its highest during the PM peak. To establish the basis for time of day prioritisation, the existing flow profiles on SH20A and SH20B were analysed, using SCATS data for the two-week period between 25th February and 10th March 2018, as summarised below.

On SH20A, the average airport-bound (southbound) traffic flows remain above 1,000 vehicles per hour throughout the day, peaking to between 1,500 and 2,000 hourly volumes in the morning and early afternoon. The outbound (northbound) traffic flows are higher during the PM peak period, reaching a maximum flow of 2,300 vehicles per an hour across two traffic lanes.

On SH20B, both the airport-bound (westbound) peaks at just under 1,000 vehicles per hour during the AM peak, and remain constant (at around 500 vehicles per an hour) for the remainder of the day. The outbound (eastbound) traffic is lower during the AM peak and steadily increases throughout the day, reaching a maximum of about 1,500 vehicles per an hour during the PM peak. The PM peak period is significantly longer on SH20B, almost 6 hours as compared to SH20A, 3 hours.

For both SH20A and SH20B, the PM peak period has the highest two-way traffic volumes. This is evidencing a conflict in movement demand overlap of the peak employee movements and peak passenger demand periods.

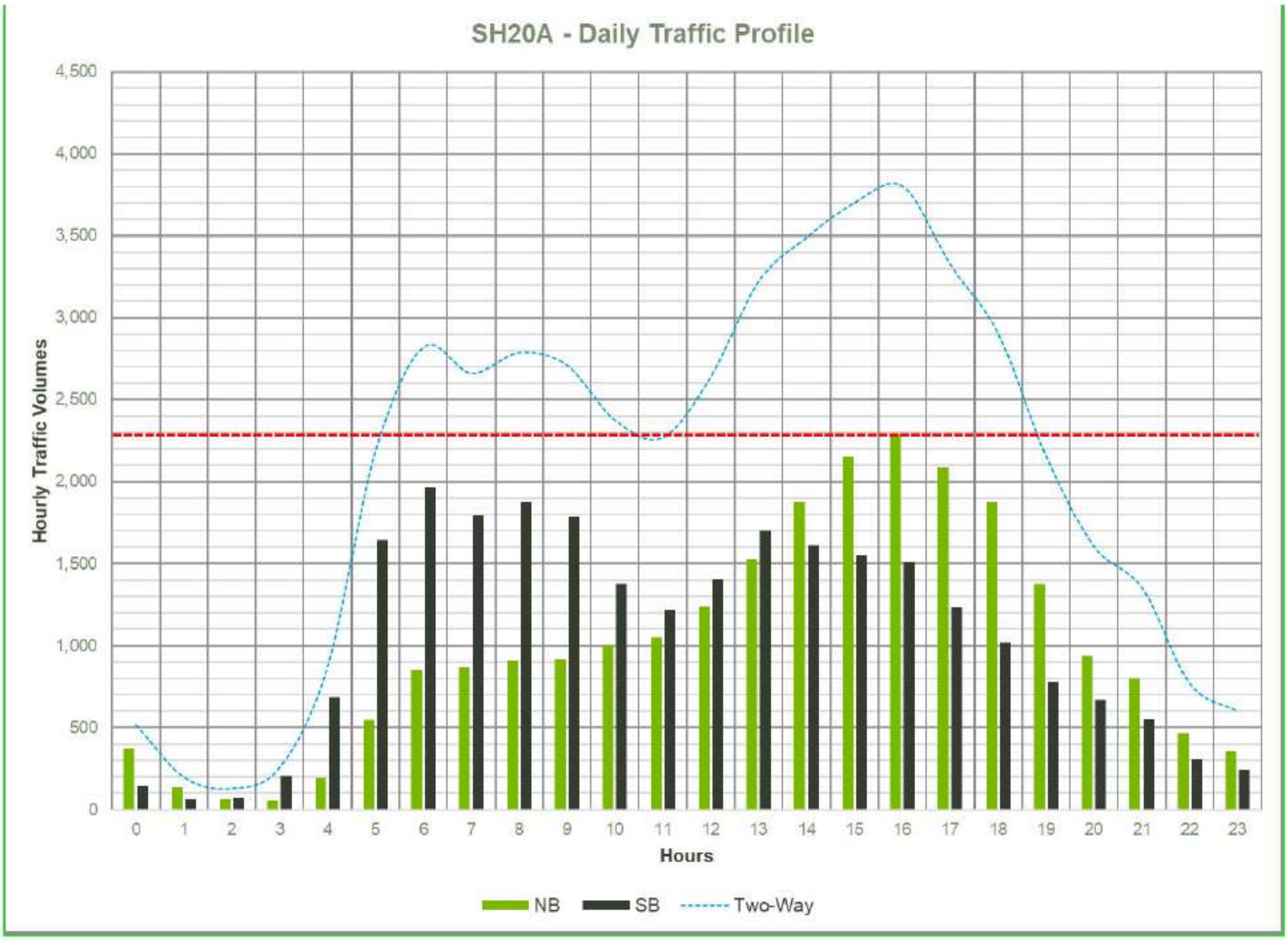

Figure 5-1 Average weekday traffic profile – SH20A (SCATS data)

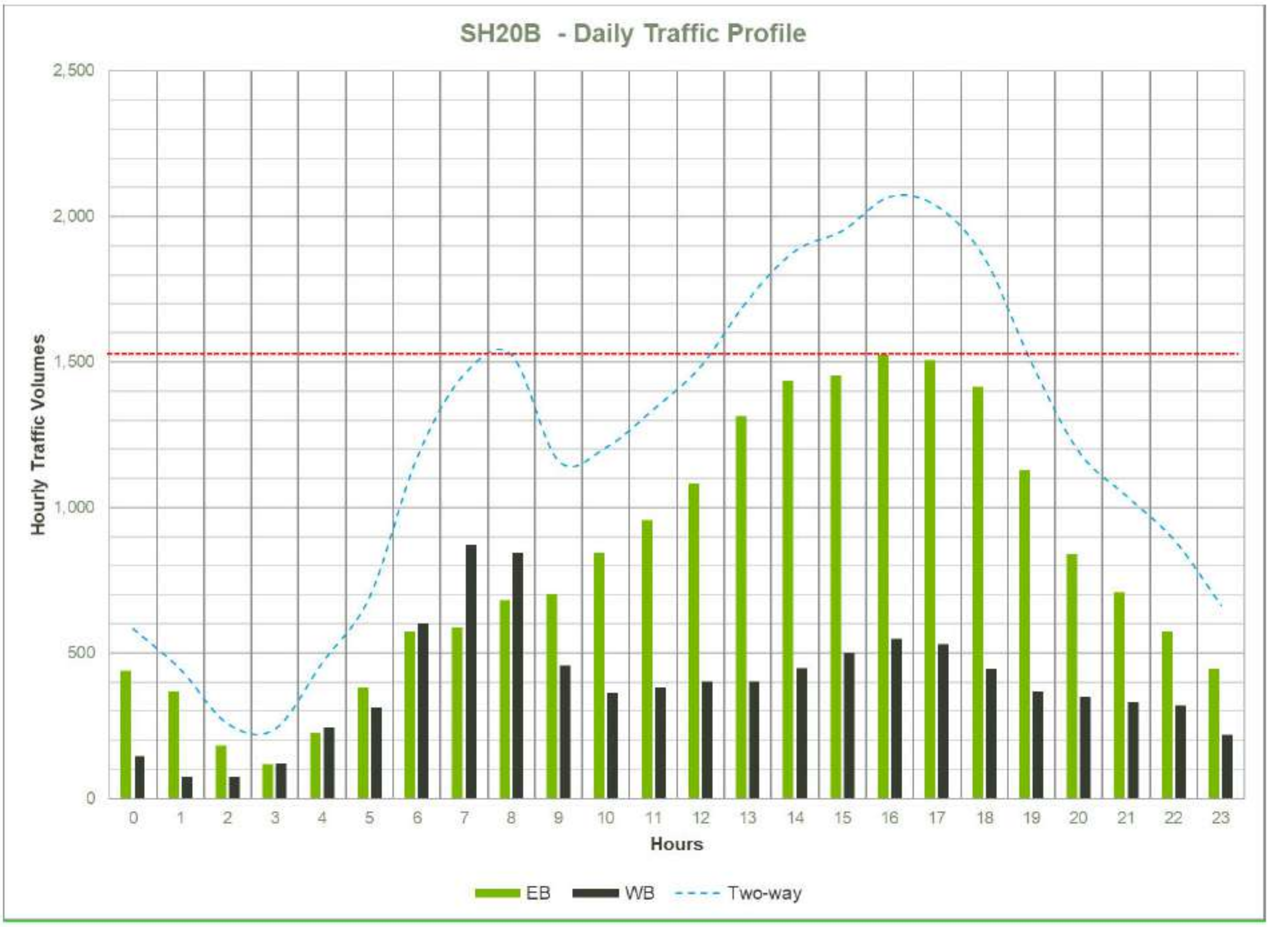

Figure 5-2 Average weekday traffic profile – SH20B (SCATS data)

When demand increases beyond the capacity of the road network, and no (or little) alternative routes exist, the excess demand will generally be distributed to periods outside of the peak periods. As a result, the network becomes congested for more hours of the day as compared to the baseline (i.e peak spreading). The excess demand that is displaced from the ideal time of travel can also be considered latent travel demand. This is traffic demand that would most likely return to the peak period, if the capacity of the network is improved to take advantage of the additional capacity. Under this scenario, managing the network becomes more complex and compromises, between competing modes, are unavoidable. Sustainable strategies therefore require provision of infrastructure and optimised network operation to prioritise active modes and those which move more people.

Operational scenarios that can be expected on the immediate transportation network are discussed further below.

5.1 Normal Operating Conditions

Under normal operating conditions the network operating hierarchy should give active modes the highest priority and general traffic / cars as the lowest priority, summarised in Figure 5-3 below:

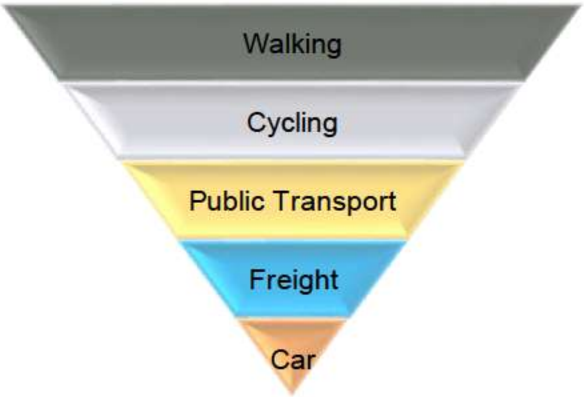

Figure 5-3 Southwest Gateway Network Operating Hierarchy

Active modes should be given priority at major conflict points, followed by public transport (i.e Light rail, bus and taxis), high-occupancy vehicles (HOVs), freight and then private car travellers. Priority consideration should also consider the functional classification of the transport network (e.g. freight has a lower priority than other modes on local roads, and a higher priority on regional freight corridors such as SH20).

The following sections outline differences in mode priority under normal operating conditions along the main corridors by time of day. The tables should be read with the following key.

Key	Description
-	Discouraged
•	Lowest priority
••	Medium priority
•••	Highest priority

5.1.1 AM Peak

During the AM peak, the inbound traffic coincides with the peak airside departures, and employee traffic. To maintain relatively safe and efficient operations within the airport core, it is critical to be able to decongest the airport precinct. Thus, outbound traffic flows are also prioritised. General traffic on SH20B is given a slightly high priority for traffic inbound to Park and Ride South, it is assumed that the priority will drop to the match the eastbound direction west of Prices Road.

Public transport priority is high in both directions, inbound for departing passengers and employees and outbound for arriving passengers. This is so that public transport reliability can remain high and therefore maintain or increase public transport mode share. On SH20 south of SH20A this priority drops back to a low priority given that there are few bus routes that travel along this section.

Freight is actively discouraged from Massey Road to ensure efficient access for public transport and safe access for active modes. The modal priorities during the typical AM peak are summarised in

Figure 5-4 overleaf. Freight is given a high priority on Richard Pearse Drive and SH20, however is a lower priority on SH20A to enable the highest movement priority to be provided for public transport.

Corridor / Direction					
SH20 – NB	●●	●●	●●●*	●●●	●●●
SH20 – SB	●●	●●	●●●*	●●●	●●●
SH20A – SB (to airport)	●●●	●●●	●●●	●●	●●
SH20A – NB (from airport)	●●●	●●●	●●●	●●	●●
SH20B – WB (to airport)	●●●	●●●	●●●	●	●●
SH20B – EB (from airport)	●●●	●●●	●●●	●	●
Richard Pearse Drive	●●●	●●●	●●●	●●●	●
Massey Road	●●●	●●●	●●●	-	●

* *High priority north of SH20A only. South of SH20A there is low priority for PT on SH20.*

Figure 5-4 Southwest Gateway NOP AM-peak modal priorities

5.1.2 Business Peak

During the business peak (or inter-peak) period approximately 10am to 2pm, freight traffic will play a key role owing to the surrounding land use, which is mainly industrial and logistics, and is given high priority on SH20, SH20A and Richard Pearse Drive. It will also be important to incentivise freight traffic to travel during the inter-peak and off-peak periods, rather than during the AM and PM peak periods, where commuter traffic is at its busiest. The network priorities summarised in

Figure 5-5 below reflect the desire to offer travel time savings incentives to freight outside the commuter traffic peaks.

Corridor / Direction					
SH20 – NB	●●	●●	●●●*	●●●	●●
SH20 – SB	●●	●●	●●●*	●●●	●●
SH20A – SB (to airport)	●●●	●●●	●●●	●●●	●●
SH20A – NB (from airport)	●●●	●●●	●●●	●●●	●●
SH20B – WB (to airport)	●●●	●●●	●●●	●	●●
SH20B – EB (from airport)	●●●	●●●	●●●	●	●●
Richard Pearse Drive	●●●	●●●	●●●	●●●	●
Massey Road	●●●	●●●	●●●	-	●

* *High priority north of SH20A only. South of SH20A there is low priority for PT on SH20.*

Figure 5-5 Southwest Gateway NOP Business peak modal priorities

5.1.3 PM Peak

In the afternoon peak, the outbound commuter peak from businesses coincides with peak airside arrivals, increasing the overall outbound demand significantly. To maintain relatively safe and efficient operations within the airport core, it is critical to decongest the airport precinct. Accordingly, outbound traffic will be prioritised on all corridors. High public transport priority for both inbound and outbound directions will also be maintained to ensure reliability can remain high.

Freight will be actively discouraged from using SH20B in the afternoon peak with the priority of general traffic eastbound being elevated to medium priority.

The afternoon peak mode priorities are summarised in Figure 5-6.

Corridor / Direction					
SH20 – NB	●●	●●	●●●*	●●●	●●●
SH20 – SB	●●	●●	●●●*	●●●	●●●
SH20A – SB (to airport)	●●●	●●●	●●●	●	●
SH20A – NB (from airport)	●●●	●●●	●●●	●●	●●
SH20B – WB (to airport)	●●●	●●●	●●●	-**	●
SH20B – EB (from airport)	●●●	●●●	●●●	-**	●●
Richard Pearse Drive	●●●	●●●	●●●	●●	●
Massey Road	●●●	●●●	●●●	-	●

** High priority north of SH20A only. South of SH20A there is low priority for PT on SH20.*

*** Assuming SH20A southbound ramp is implemented, freight needs to be discouraged along SH20B in order to discourage rat-running through the airport terminal precinct*

Figure 5-6 Southwest Gateway NOP PM-peak modal priorities

5.1.4 Off-Peak

Traffic volumes are generally lower off-peak during the night and on the weekends. There are also lower volumes of pedestrians and cyclists on the network in these times making it an ideal time for freight movements within the airport precinct, especially given that there is very limited residential land use.

Public transport priority is retained through these times on the state highways and Massey Road. It is reduced to a medium priority on Richard Pearse Drive as there are few commuter trips at this time and airport bound riders will typically be travelling on direct PT routes which use the SH20A corridor.

Freight is elevated to a high priority along Richard Pearse Drive off-peak. The mode share priorities for the off-peak period are summarised in

Figure 5-7.

Corridor / Direction					
SH20 – NB	●●	●●	●●●*	●●●	●●●
SH20 – SB	●●	●●	●●●*	●●●	●●●
SH20A – SB (to airport)	●●●	●●●	●●●	●●●	●●
SH20A – NB (from airport)	●●●	●●●	●●●	●●●	●●
SH20B – WB (to airport)	●●●	●●●	●●●	●	●●
SH20B – EB (from airport)	●●●	●●●	●●●	●	●●
Richard Pearse Drive	●●●	●●●	●●	●●●	●
Massey Road	●●●	●●●	●●●	-	●

* *High priority north of SH20A only. South of SH20A there is low priority for PT on SH20.*

Figure 5-7 Southwest Gateway NOP Off-peak modal priorities

5.2 Incidents and Unplanned Activities

In the context of network operations / management, an incident is an unplanned event or activity that may lead to disturbances in normal traffic flow conditions, affect public transport reliability or may pose risk to human life and the transport infrastructure. It is an important consideration for this NOP as it is essential for maintaining a safe and efficient network.

Incident detection, response and escalation will be coordinated through ATOC, in consultation with other partners, depending on incident level and defined partner roles and responsibilities. The generic response protocol is summarised in Figure 5-8 below:

Figure 5-8 Incident response strategy protocol

5.3 Maintenance and Planned Activities

During planned events, a safe and efficient network means the road users shall be well informed of the event in advance, and well-planned traffic diversions are in place to minimise the impact on customer journeys.

Temporary traffic management plans (TTMPs) will need to be prepared and approved by relevant authorities, for all planned maintenance. TTMPs should retain the mode and time of day priorities outlined in this NOP.

5.4 Special Events / Demands

Traffic management plans will need to be prepared and approved by relevant authorities for events that may interfere with normal network operations.

With events involving VIPs such as heads of states, the NZ Police generally take command for transporting VIPs, including route selection to be used due to the higher security protocols for some travellers. ATOC-Smales generally support the NZ Police to facilitate efficient transportation of VIPs on such event days through the use of ITS infrastructure and provision of appropriate traveller information where major disruptions are expected. Key events that are likely to require transport priority include:

- Visits by international leaders
- Large funeral processions at Manukau Memorial Gardens
- Sporting team's arrivals

6 Network Gaps

Network gaps exist where the existing network does not meet the operating principles and priorities set out for the network therefore preventing it from achieving the desired operational outcomes. The identified deficiencies, in the existing transport network within the study area are discussed below and have been incorporated into the options proposed within the business case.

6.1 Access

- There are very limited alternative options to access the airport and surrounding area. The Massey Road / Kirkbride Road corridor provides an alternative east-west connection and southbound access to SH20, however Massey Road provides priority for public transport and active modes and therefore is not a viable alternative for freight traffic.
- The SH20A / SH20 interchange does not currently have a southbound ramp to provide the connection needed for southbound freight and general traffic. As a result, rat running occurs on local roads such as Massey Road and Kirkbride Road and SH20B carries higher than desired freight and general traffic volumes, compromising public transport reliability.
- Traffic travels through the airport terminal or local arterial roads to get south from the Airport Oaks area, thus diminishing the amenity and place functions in these areas for pedestrians and workers.

6.2 Public transport

- Public transport provision is currently limited to a few routes and only provided by a combination of premium (Skybus) services linking to the city centre and north shore, and the Airporter 380 routes that connects the airport to Onehunga, Papatoetoe and Manukau rail stations.
- There are currently approximately 15 buses per hour per direction serving the airport (including sky premium services), with combined capacity of just under 800 persons per hour per direction. This is approximately 17% of the current person capacity per hour per direction on the local transport network.
- Lack of bus priority measures means buses compete for space with freight and general traffic, resulting in lower (perceived and actual) travel time reliability. Recently opened bus lanes on SH20A will help improve bus Sky bus service reliability. Public transport is not currently perceived as faster, convenient and more reliable means of accessing the airport, hence the high reliance on private car travel for airport district employees, travellers and visitors.
- Public transport access from the east (Botany/ Pakuranga) and the west (New Lynn/ Henderson), which are popular residential places for employees in the study area, require at least one transfer with either rail or bus service. This makes it a less desirable option as existing frequencies are low, and interchanges between public transport services incur additional waiting and transfer time between services; resulting in an increase of total journey time (i.e. transfer penalty).

6.3 Walking and cycling (active modes)

- With the exception of SH20A, there are currently very limited, if any, walking and cycling facilities provided along the state highway corridors.
- The vehicle speeds and volumes on SH20B are not considered appropriate for safe walking and cycling (although these activities are permitted), given the current lack of protection for vulnerable users on the road (i.e. more than 80kph and 1,300 vehicles per hour per lane per direction during peaks).
- There are few safe, dedicated crossing points for active modes across the network.

6.4 General traffic and freight

- SH20 tends to be congested during the PM peak in both the northbound and southbound directions from effects downstream which has flow on effects to the Southwest Gateway study area and preventing SH20A and SH20B operating effectively.
- There is no SH20A to SH20 southbound link therefore there is limited choice or resilience for southbound routes.
- Without Park and Ride South (yet to be constructed) there is still a high demand for general traffic to travel through the airport precinct to get to a Park and Ride facility. Therefore, until the early improvements are completed, SH20B cannot achieve the desired operational outcomes.

6.5 Technological disruption

Times of change and rapid revolution of technology in the transport sector is affecting the way people travel and the needs people will have from a service and infrastructure perspective. Many emerging technologies such as Mobility as a Service (MaaS), autonomous vehicles etc. are in their infancy now, but their potential impact may change the demand for different modes and is yet to be fully understood.

E-hailing services, such as Uber, Taxify, etc, have disrupted the traditional metered taxi sector across the world. These app-based services have increased choice and flexibility for travellers. Similar disruptions are happening in the logistic sector, where distributors are increasingly using on-demand app-based delivery services, using similar “shared fleet” and “partner-driver” strategies. The impact of this disruption may see a greater demand for small ‘general traffic’ vehicles which make more trips per day than existing heavy freight vehicles.

Electric buses (e-buses) are also being continually developed and trialled in more cities globally. A combination of growth in development of e-bus technology, including increase in travel distance range, efficient charging, and improvement in the autonomous driving capabilities, may result in more efficient and environmentally sustainable bus networks and services.

It may be possible to run park and ride shuttles, or even longer distance bus routes services, using autonomous pods, minibuses and e-buses. These will reduce the operational cost for running the system with less labour cost, higher frequencies and longer operational hours.

Private autonomous vehicles can also offer efficiency and network capacity improvements, through reduction of required headways or traffic gaps to safely navigate the network (i.e vehicles could travel closer to each other without increased risk of collision, thus increasing the lane capacity of the road network). As mentioned earlier, autonomous vehicles may also be requested (whether e-hailing services, rental cars, own vehicles or shared) on demand, from a remote location. They will therefore require fewer parking bays close to the core airport terminals (as bays are used multiple times for drop-off and pick-up).

Although the emerging and future technologies and disruptions in transportation may be considered too far into the future for the project horizon, the signs are there already of the potential impact and speed at which these technologies are launched to consumers, with less flexible legislative framework being the major drawback. These technological improvements will have an impact on how the future transport network is managed and operated.

There is therefore, a need for design flexibility in the provision of infrastructure within the airport district and immediate surroundings. This flexibility will allow re-purposing of spaces and infrastructure to respond to disruptions e.g. convert general traffic lanes to public transport lanes, parking areas to more productive land uses, kiss and ride bays, etc.

7 Network performance evaluation

The key aspect of network operations is establishing a methodology for ongoing network evaluation to determine when interventions (i.e. implementation of available management tools and options) are required. The focus of network operations is optimal safety, efficiency and reliability of the transport network, and any ongoing evaluation of the network should be focussed in these areas. To guide this evaluation, the following KPIs will be used against performance measures that reflect the SWG NOP Operating Principles, using information provided from the given Data Sources.

The assessment criteria required to evaluate the Auckland Airport access is aligned with the GPS and Auckland Transport Statement of Intent.

Table 7-1 Performance Measures, KPIs and relevant ITS Equipment for 20Connect SSBC

20 Connect Investment Objectives	Southwest Gateway NOP Operating Principles	Performance Measure(s)	KPI(s)	Data Source(s)
1. To improve health, safety and security of people.	▪ To improve safety for all users on the transport system. ▪ To enhance the customer perception of safety.	▪ Safer journeys / safe system ▪ Customer experience / Barrier free accessible transport (i.e. feel safe using it)	▪ No. of deaths and serious injuries on the transport system per capita and vehicle kilometres travelled (i.e. all modes). ▪ % users or customers that feel safe / are satisfied with their experience using the transport system – Increase in number of users by mode / age / ability on public transport and active modes in the transport system – Transport officer hours / number of transport officers – No. of criminal activities reported in or around transport system.	▪ Police crash report; ▪ CAS (NZ Transport Agency); ▪ AT HOP data; ▪ Cash Ticket Sales; ▪ Operator Database; ▪ Periodic manual surveys; ▪ Staff list from AT/NZ Transport Agency; ▪ Crime and victimisation database
2. To improve the reliability and resilience of the transport system.	▪ To deliver the outcomes as defined by the ANOP and GPS on Land Transport.	▪ Availability of alternative modes to and from airport	▪ Service availability – No. of unplanned service outages – % time alternative modes available	▪ Telematics data (e.g. Tomtom / Google traffic/NZ Transport Agency)

20 Connect Investment Objectives	Southwest Gateway NOP Operating Principles	Performance Measure(s)	KPI(s)	Data Source(s)
	▪ To maintain access along SH20 to ensure the WRR can perform its strategic function as an alternate route to SH1 during unplanned and planned events. ▪ Provide an agile network that can keep people and goods moving. ▪ To provide resilient access to and from Auckland Airport to enable it to carry out its function as a lifeline utility.	during incident & events – Detour / diversion route plans set up – Network / Service availability ▪ Reliable travel times to / from Airport (by mode and time of day)	– % of time SH20A and SH20B are available / % of time on SH20, SH20A and SH20B where one or more lanes is impacted by unplanned events / incidents – Average road closure time (full closure, partial closure) – No. of detour plans designed / set up for all modes / change in travel time & route length – Service availability (on SH, transport corridors and key arterials e.g. Puhinui Rd, Massey Rd, Kirkbride Rd, McKenzie Rd, Walmsley Rd, Bader Dr) – No. of boardings on alternative modes (non-car) ▪ Incident detection, response, clearance & recovery times ▪ Average travel times / 95%ile travel times on – SH20, 20A, 20B – key arterials (Puhinui Rd, Massey Rd, Kirkbride Rd, McKenzie Rd, Walmsley Rd, Bader Dr) – PT routes ▪ % of trips within x% of average or 95%ile travel time to / from Airport and strategic locations – Auckland City Centre – Puhinui Station – Freight depots	▪ ANPR, etc ▪ Mobile phone tracking (Bluetooth, Wi-Fi scanners, etc) ▪ NZ Transport Agency TREIS Database for road closure durations ▪ Automatic accident detector sensors / system ▪ Emergency phones / mobile network base station (universal coverage) / High-speed internet connectivity (sensor networks and emergency reporting) ▪ Infrared cameras or manual surveys (periodic sample surveys)/AT HOP Data/Cash Ticket Sales ▪ ATOC Reports or incident response times (VIDSYS and TREIS) NZ Transport Agency NTIS information and journey time boards ▪ AT Bus travel data

20 Connect Investment Objectives	Southwest Gateway NOP Operating Principles	Performance Measure(s)	KPI(s)	Data Source(s)
3. To improve economic performance of the airport area, Auckland and New Zealand	▪ To enhance overall network efficiency. ▪ Efficient and reliable public transport travel times to and from the Northern and Eastern Airport approaches. ▪ Prioritise public transport on key routes by time of day. ▪ Provide priority on SH20, SH20A and SH20B for trips to inter-regional markets over local access. ▪ Prioritise freight movements to / from the north, south, industrial areas and airport. ▪ Prioritise pedestrians within 400-800m of high activity pedestrian areas. ▪ Support the amenity function around key activity areas / centres by improving walking and cycling access. ▪ Improve connectivity of walking and cycling network facilities with the wider Auckland network to provide a viable transport mode for local and medium distance trips for users of all ages and abilities, and support access to public transport. ▪ Improve trip reliability for time sensitive aeronautical traffic (passengers, crew, time sensitive freight) to and from the airport. ▪ Discourage non-airport related traffic from travelling through the airport precinct.	▪ Transport system productivity ▪ Travel time to / from the airport (by mode) ▪ Proportion of Auckland population who live within a X minute trip via public transport to Auckland Airport ▪ Trip reliability – Predictability (by mode and time of day) – Travel time difference between modes ▪ Pedestrian LoS C or better as per AT User Experience Table ▪ Facilities provided / barrier free transport ▪ % through trips vs airport related trips	▪ Volume of people or $ value of goods x travel speed ▪ Level of service (by mode and time of day) ▪ No. of boardings on public transport ▪ % of public transport services that arrive within X minutes of scheduled time ▪ Population within 45minute public transport journey / Auckland population ▪ Volume of people and freight by strategic route by time of day ▪ Trip times to / from key freight origins / destinations – Airport – Airport Oaks – MetroPort / Onehunga – Wiri Freight Hub – Otahuhu – Highbrook / East Tamaki ▪ % of trips within x% of average or 95%ile travel time to / from Airport and strategic locations (also in 2.) – Auckland City Centre – Puhinui Station – Freight depots ▪ No. new / upgraded pedestrian & cycle facilities	▪ Infrared cameras or manual surveys (periodic sample surveys); ▪ Telematics data (e.g. Tomtom / Google traffic) ▪ ANPR, etc ▪ Mobile phone tracking (Bluetooth, Wi-Fi scanners, etc); ▪ Automatic counters for freight bus fleet management systems (GPS logs); ▪ Operator database / periodic manual surveys ▪ Government population census ▪ Cycle / pedestrian counters (Radar / Cameras / loops / CCTV virtual loops); ▪ Km of new SUP/cycle facilities/active modes installed

20 Connect Investment Objectives	Southwest Gateway NOP Operating Principles	Performance Measure(s)	KPI(s)	Data Source(s)
			▪ Km of new pedestrian / cycle facilities installed ▪ No. of / km of age / ability appropriate facilities implemented (i.e. facilities for young, elderly, mobility impaired, buggies / pushchairs, inclusive cycles, those with luggage etc)	
4. Reduce the effects of the transport system on the environment and taonga	▪ Improve local amenity and air quality by reducing 'rat running' commuter traffic and freight on local roads.	▪ Route Optimisation – Prioritises local traffic over commuter traffic and vice versa – reduced through traffic on local roads ▪ Carbon emissions, pollution generated in key locations	▪ PPM Carbon Monoxide in key locations and on key routes / section of routes: – Mangere Town Centre – Massey Rd – Auckland Airport shopping centre – PT stations / hubs – SUPs ▪ Tonnes per vehicle volume / tonnes per network km on key routes ▪ HCV / freight volumes on local roads ▪ No. of EVs and vehicles on alternative fuel across all modes on the network	▪ Air Monitoring Stations; Vehicle emission monitoring system; ▪ Weather station ▪ No. of users of SUPs ▪ PT patronage from AT HOP card data at specific stations ▪ Automatic counters for freight volumes and loads Government/EV car registrations
5. A network that provides **value for money**	▪ Flexible infrastructure to allow for changes in operating requirements. ▪ Flexible infrastructure to allow for changes in transport technology.	▪ Future-proofed transport corridor* e.g. ▪ A network that operates on 4G or 5G ▪ Asset & system availability (i.e. reliable)	▪ % of corridors with multi-use lanes; permitted users can change by time of day, day of week ▪ No. of plug in / swap out components / elements installed ▪ Number of ITS equipment that operates on ADSL / VDSL ▪ % availability / up-time / on-line by asset & system	▪ No. of ITS equipment linked to Fibre or Fibrea coverage along SH network ▪ No. of ITS equipment capable of 4G/5G

8 Next Steps

The Operating Principles and Network Priorities will also provide a guide for the Next Steps, such as construction phasing and temporary traffic management plans. These Principles and Priorities will also be used for other more specific detailed procedures and plans going forward, such as an Operating Philosophy, as a Concept of Operations is not currently required for the network. An Operating Philosophy will support the long-term option by incorporating high-level operational thinking in the design philosophy. It will discuss how the proposed long-term infrastructure is to be operated to achieve the investment objectives, operating principles and priorities.

As the transport network evolves, this NOP will require regular and on-going review, particularly in response to changes in land use and technology. These may influence forecast in travel demands, modes of travel and therefore the operation of the future network.

Appendix A
Workshop 1 record

Bringing ideas to life

Airport Access DBC

Network Operating Plan
Operational Objectives

21st February 2018

NZ TRANSPORT AGENCY
WAKA KOTAHI

aurecon

Bringing ideas to life

Agenda

1. Introduction
2. Our user groups
3. Feedback from one-on-ones and existing networks
4. Prioritisation discussion
5. Next steps

aurecon

Bringing ideas to life

Round Table

aurecon

Bringing ideas to life

Purpose of Network Operating Plan (NOP)

- Capture the operational objectives and outcomes sought.
- Achieve consensus on ‘what’ needs to be achieved.
- Capture the operational principles to achieve the agreed objectives.
- Create alignment and build partnerships between the stakeholders.
- Verify/inform improvement options, tested in the DBC

Bringing ideas to life

What success looks like…

Airport Access DBC: Network Operating Plan – Development Framework

AIRPORT ACCESS

STAGE	TASK	CLIENT LIAISON	TECHNICAL TASKS	INTEGRATION WITH BUSINESS CASE	OUTPUT
1	Network Operations Framework		» Review best practices, guidelines, PBC and lessons learnt from previous projects » Setup NOP working group		» NOP purpose and scope » NOP development framework » NOP table of contents
2	Network Operations Objectives	» NOP working group Introductory Workshop	» Identify relevant statements of intent, strategies and policies » Information/data collection and analysis	» Alignment with DBC Objectives	» Network operation objectives » Network operating principles, KPIs and target level of service
3	Network Definition	» NOP working group Strategic Workshop	Review » Existing and future network for different modes » Existing and future network infrastructure » Existing and future transport demands » Existing and future land uses » Journey origin and destinations Present findings to working group	» Align with Part A Strategic Case evidence although anticipated to cover a wider area of influence » Priorities between different modes/user groups will inform DBC option assessment	» Project area and area of influence » User/Mode priorities by time of day/ day of week (high level) » Network hierarchy and function
4	Network Performance		» Review traffic modelling outputs » Identify network deficiencies by mode within the preferred option and identify hot spots	» Review infrastructure options and confirmation of alignment with operating priorities	» Existing and future network performance levels » Performance gaps » Network operation performance measures and targets
5	Management Options	» NOP Working Group Performance Review Workshop	» Identify operational options to mitigate congestion hot spots for each mode » Impact assessment and scenario testing » Preferred operational option development » Costs and benefits identified	» Preferred infrastructure options aligned with preferred operational strategy	» Operational option evaluation » Deployment programme for the preferred management options
6	Operating Plan	» NOP Working Group - Operation Plan Finalisation Workshop	» Compilation of Plan and review by key stakeholders	» Network operation performance measures and targets	» Agreed Network Operationing Plan » Post implementation evaluation framework » NOP ongoing review and update processes

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Bringing ideas to life

What success looks like…

Airport Access DBC: Network Operating Plan – Development Framework

Workshop No.	Title	Key Discussion Topics	Dates
1	Operation Objectives Workshop	Agree user groups Potential conflicts / inconsistencies Common operational objectives High level user/mode priority	Mid February 2018
2	Operation Priorities Workshop	Agree on the area of influence Network function Agree user/mode priority	Mid March 2018
3	Management Strategies Workshop	Performance measures and targets Performance gaps Aligning with DBC long list options	Early April 2018
4	Agreement on First Draft NOP Workshop	Preferred strategy Deployment plan Post implementation evaluation framework	End of April 2018

Plan Finalisation Workshop

targets

» NOP ongoing review and update processes

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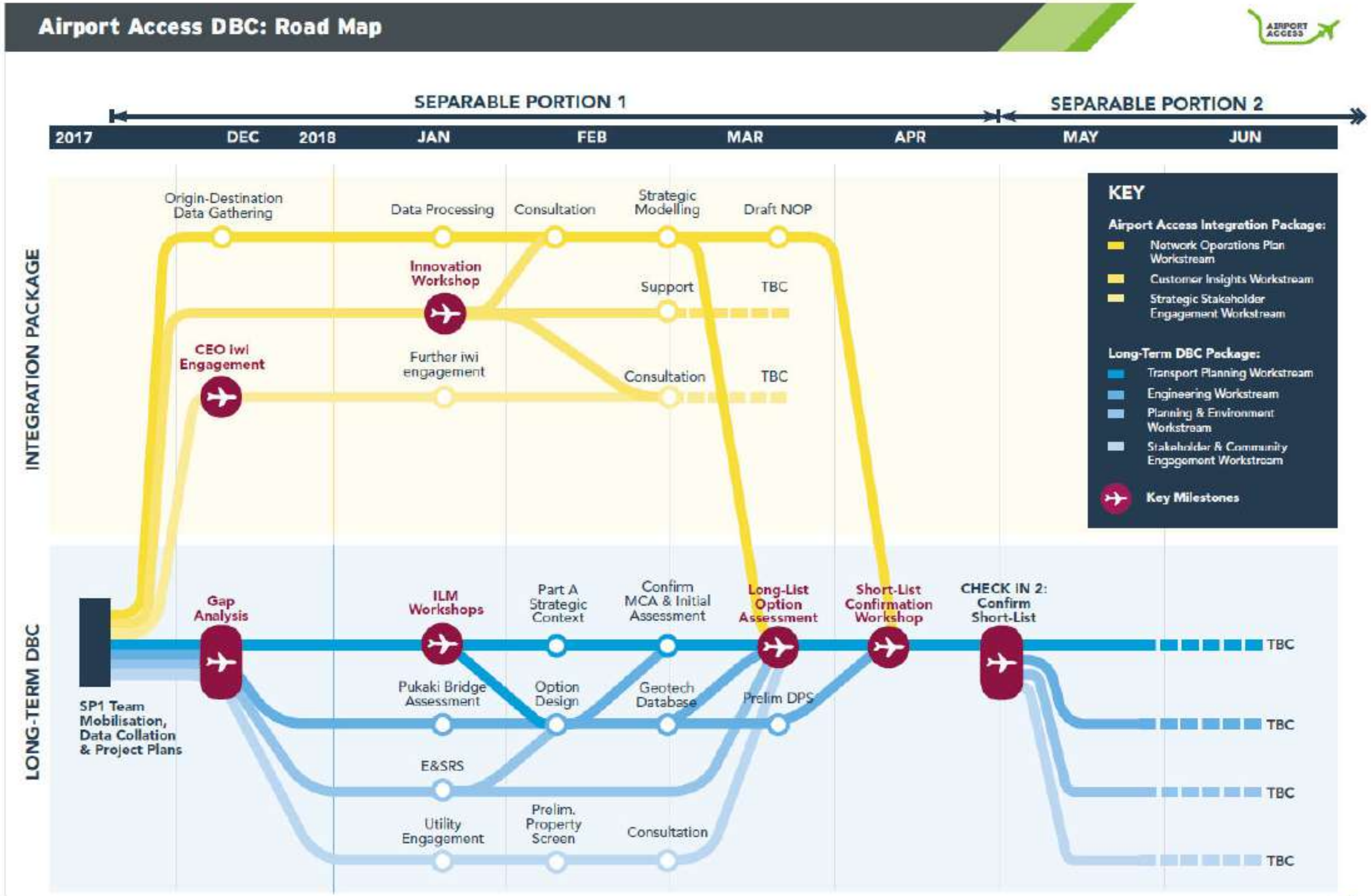
Bringing ideas to life

Network Operating Plan vs Detailed Business Case



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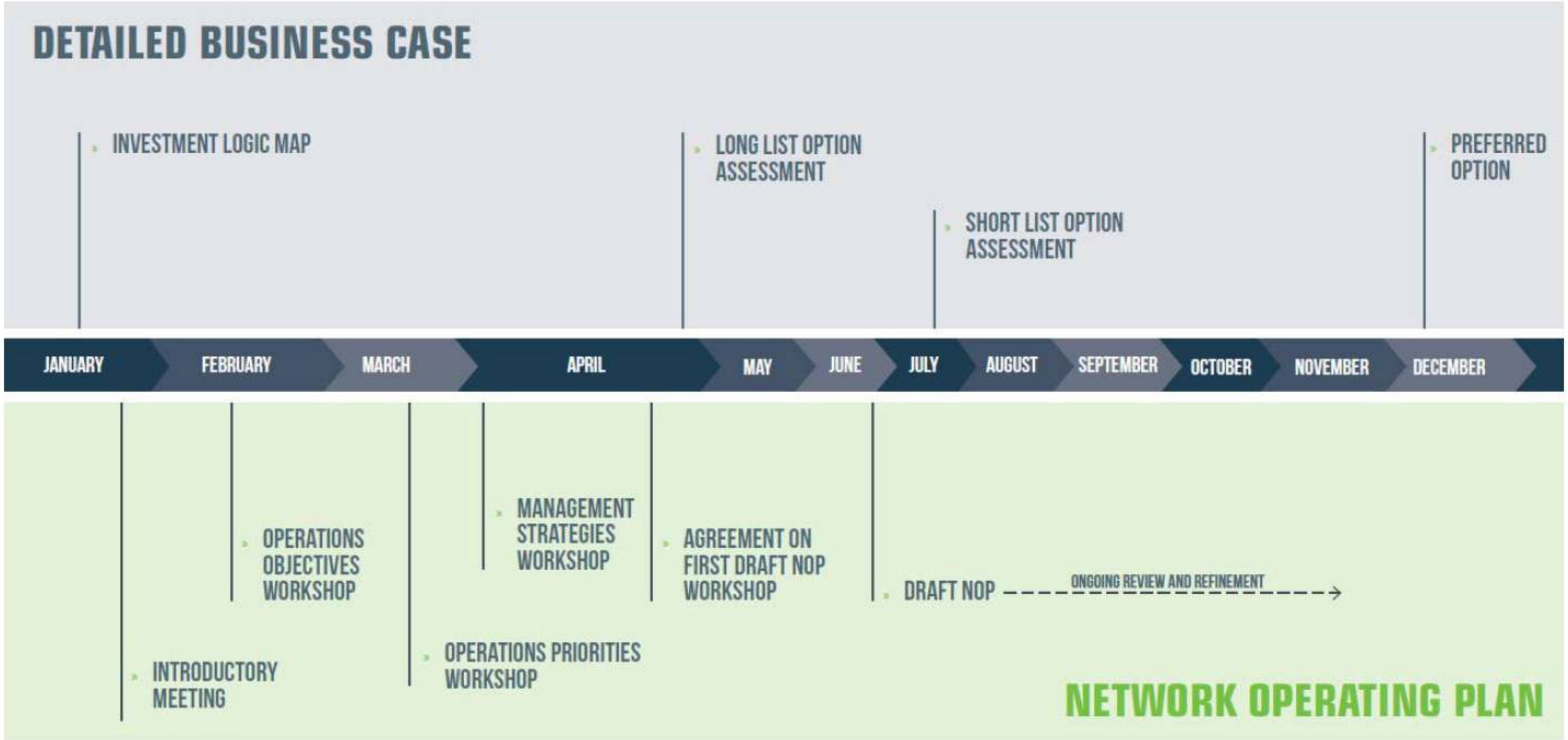
Bringing ideas to life



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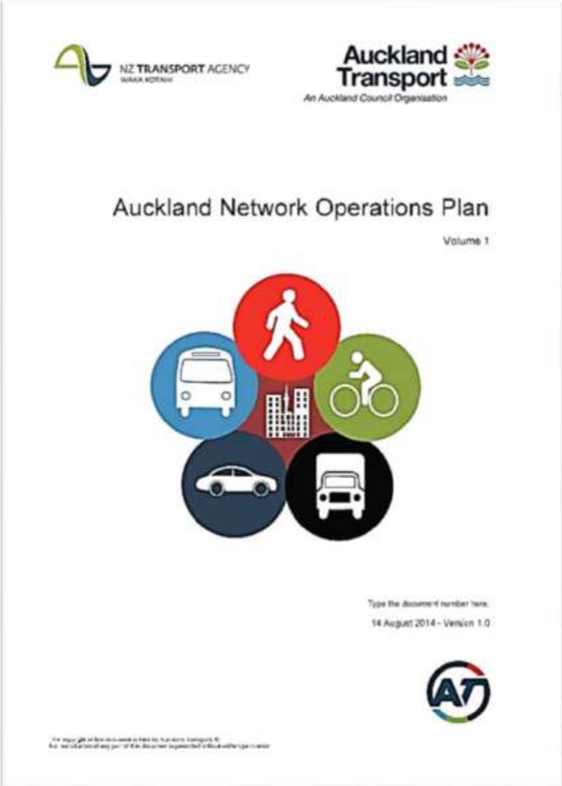
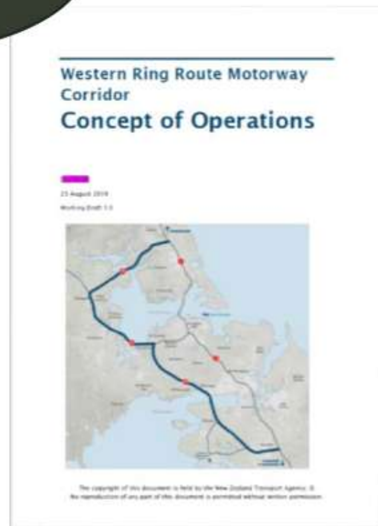
Auckland NOP



Airport Access Concept of Operations

'Provide faster access and greater trip reliability to Auckland International Airport'



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Study area


STUDY AREA OF INFLUENCE
SH20, SH20A & SH20B IMPROVEMENTS
INTERNATIONAL TERMINAL
DOMESTIC TERMINAL
AUCKLAND INTERNATIONAL AIRPORT

Who are our users?

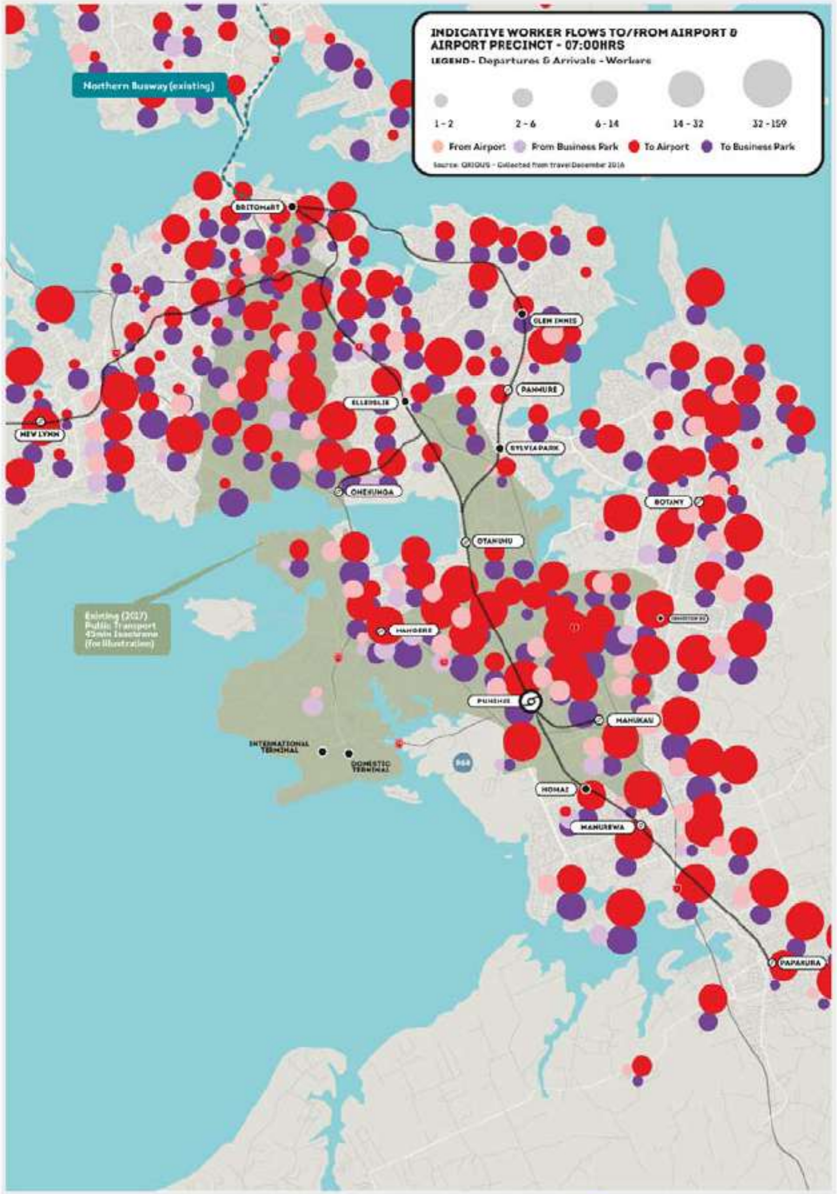
- **28%** Employees
- **20%** Air Traveller International
- **21%** Air Traveller Domestic
- **28%** Meeters & Greeters
- **3%** Freight

Source: From AT customer insights, March 2017

Bringing ideas to life

Employees

- 84% of employees use private vehicles
- Less than 2% use public transport



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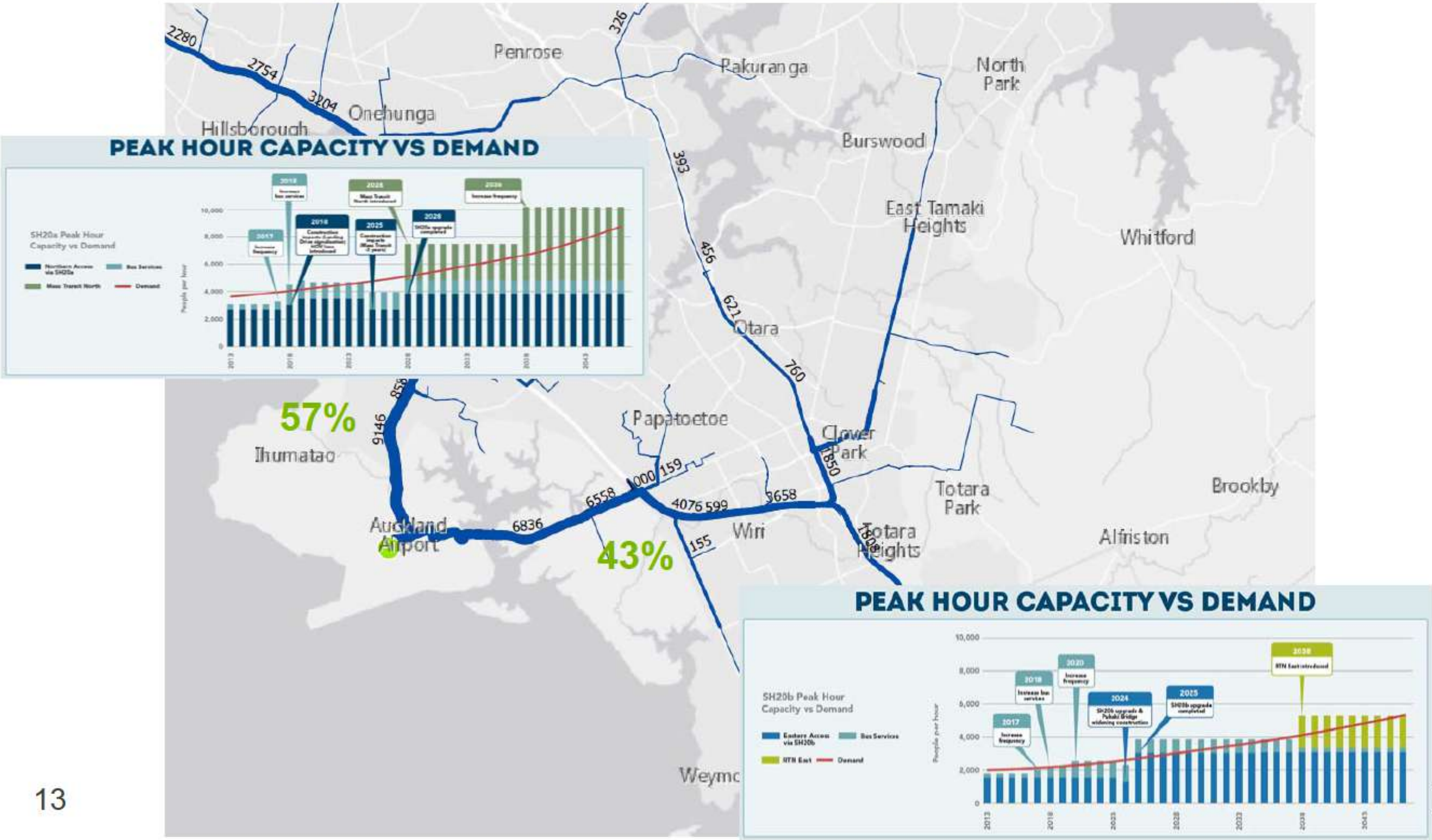
2046 AM peak vehicle journeys to the Airport



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Bringing ideas to life

Our customers

- Workers
  - Nine to Fivers
  - Shift workers
  - Airline crew
- Passengers
  - Leisure travellers
  - Business travellers
- Meeters and Greeters
- Local traffic
- Freight
  - Distribution centre trips to/from south-east
  - Distribution centre trips to/from north
  - Internal commercial vehicles
  - Dolly trains
  - Just in time
  - Construction Traffic
- Others?

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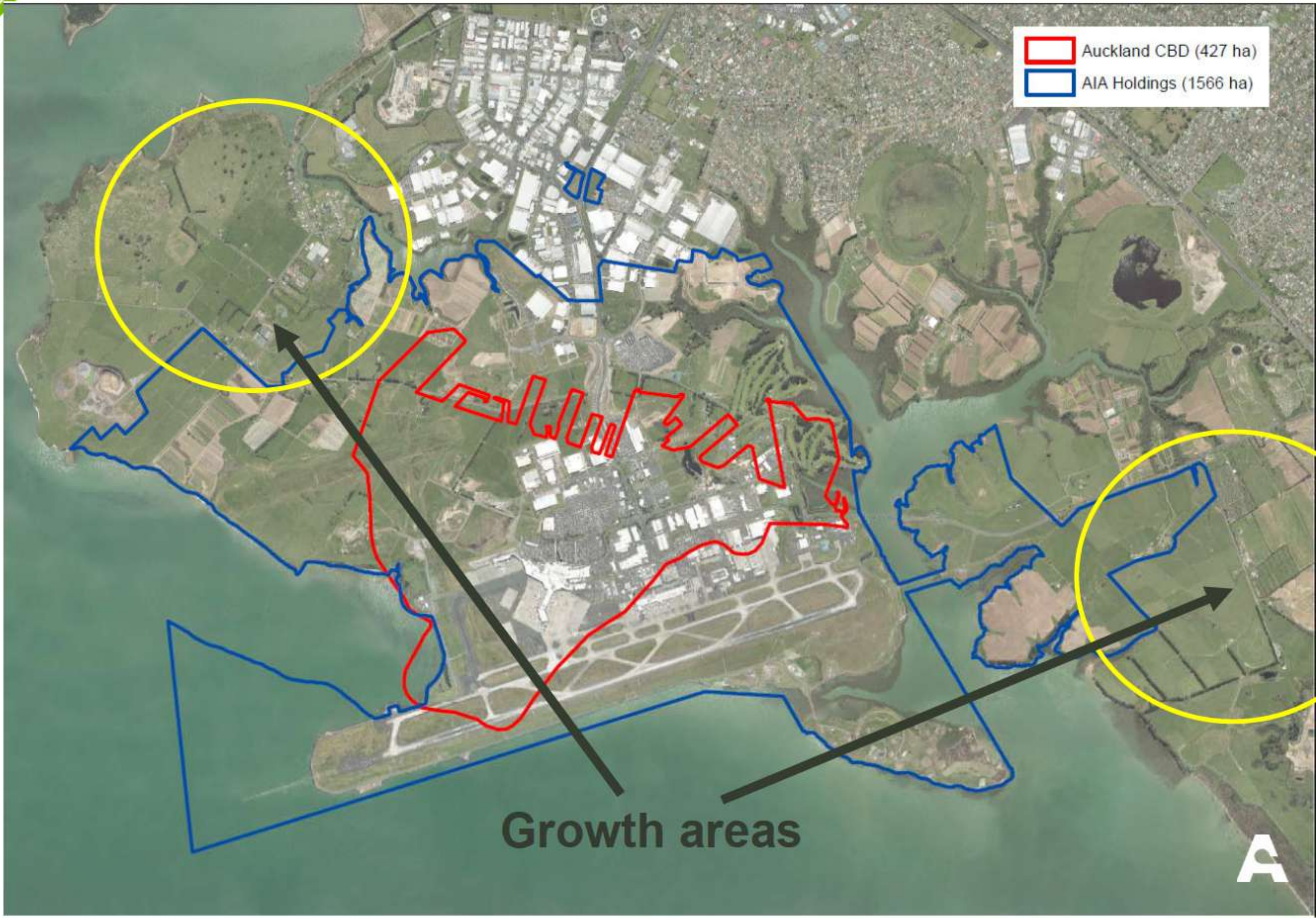

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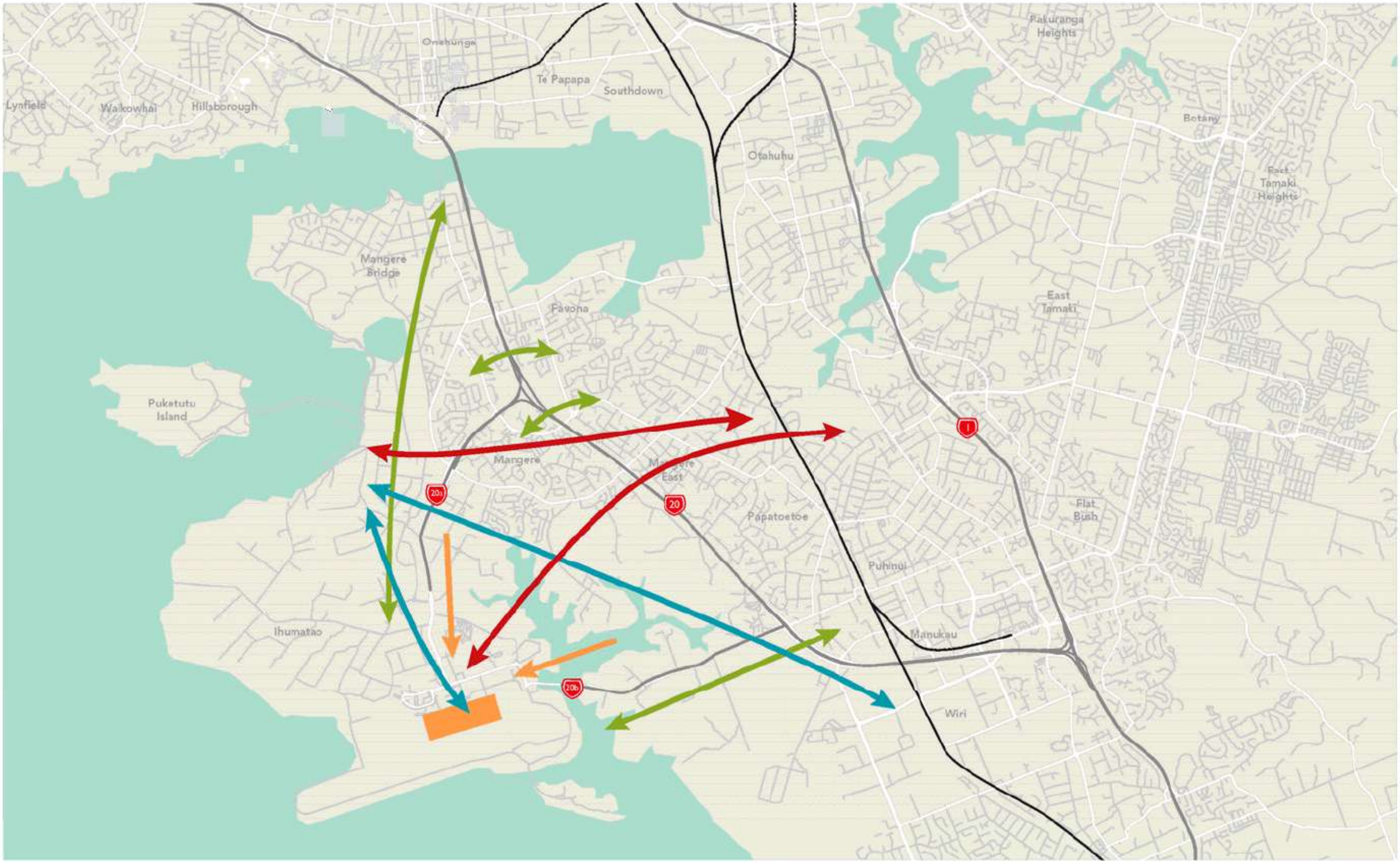
Feedback from one-on-ones

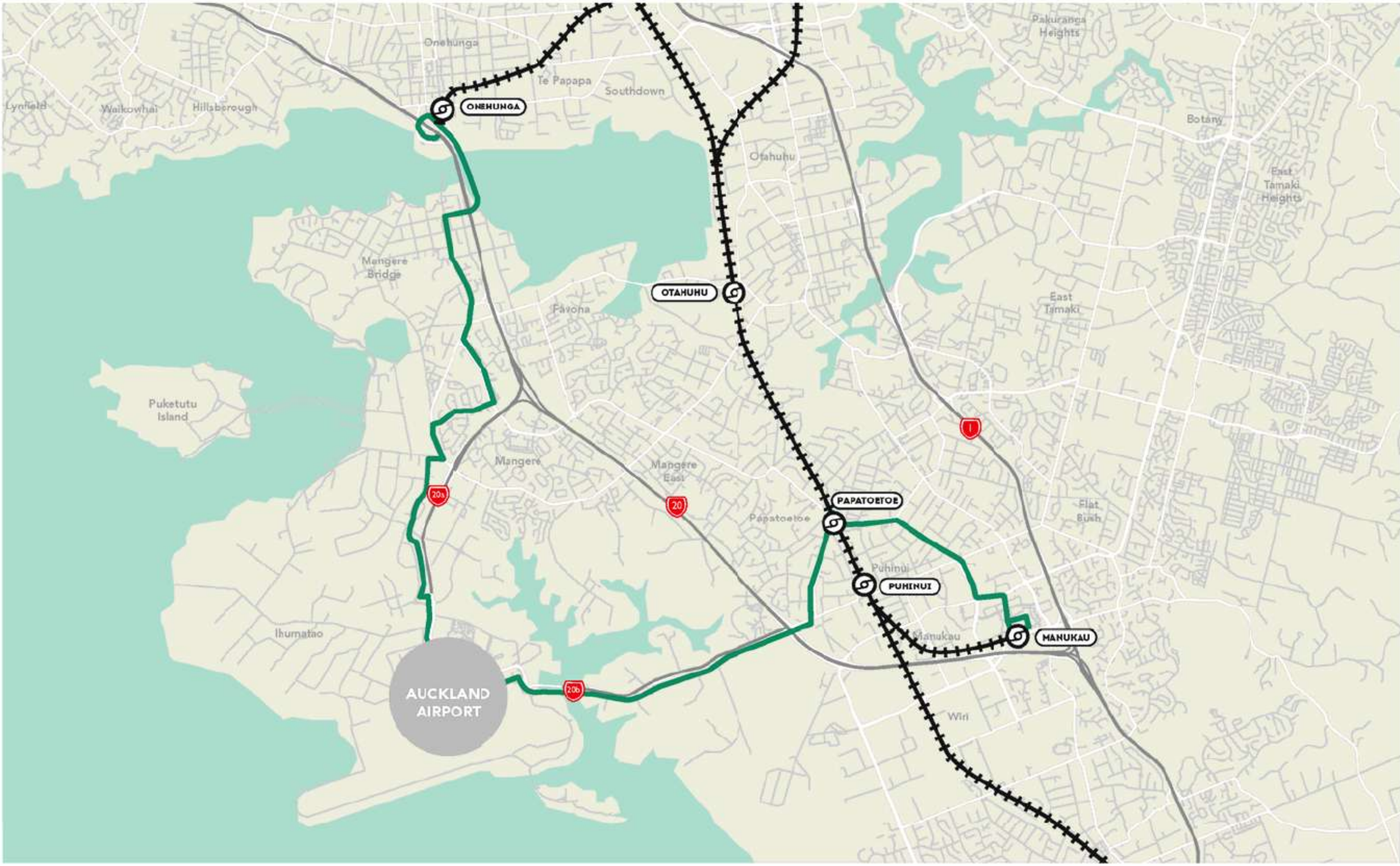
AUCKLAND AIRPORT USER DESIRES



KEY

- PT (Largely workers, desire to grow travellers)
- Freight
- Cycling
- Airport passengers / terminal traffic

AUCKLAND AIRPORT PUBLIC TRANSPORT



KEY Existing Train Existing Bus

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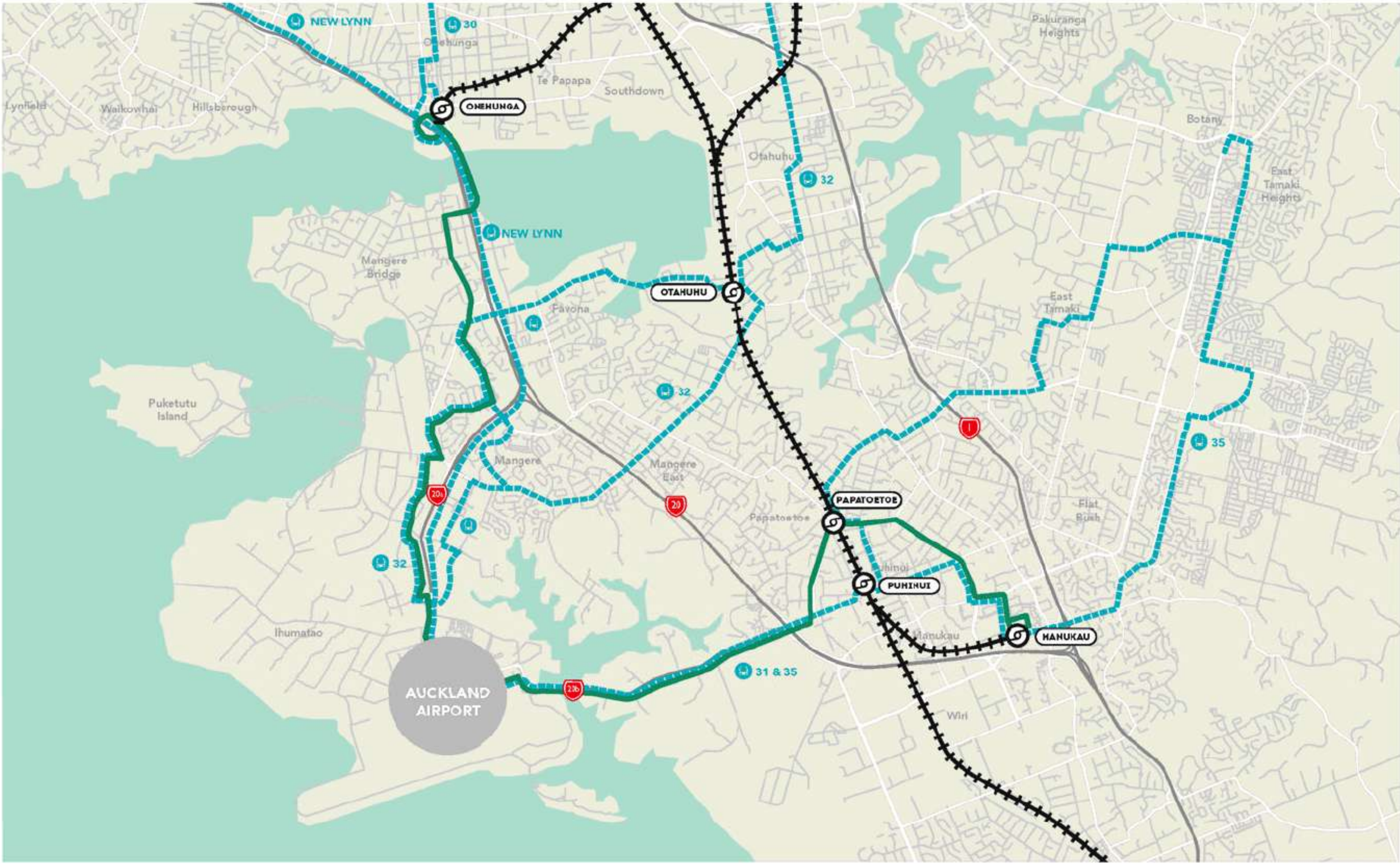
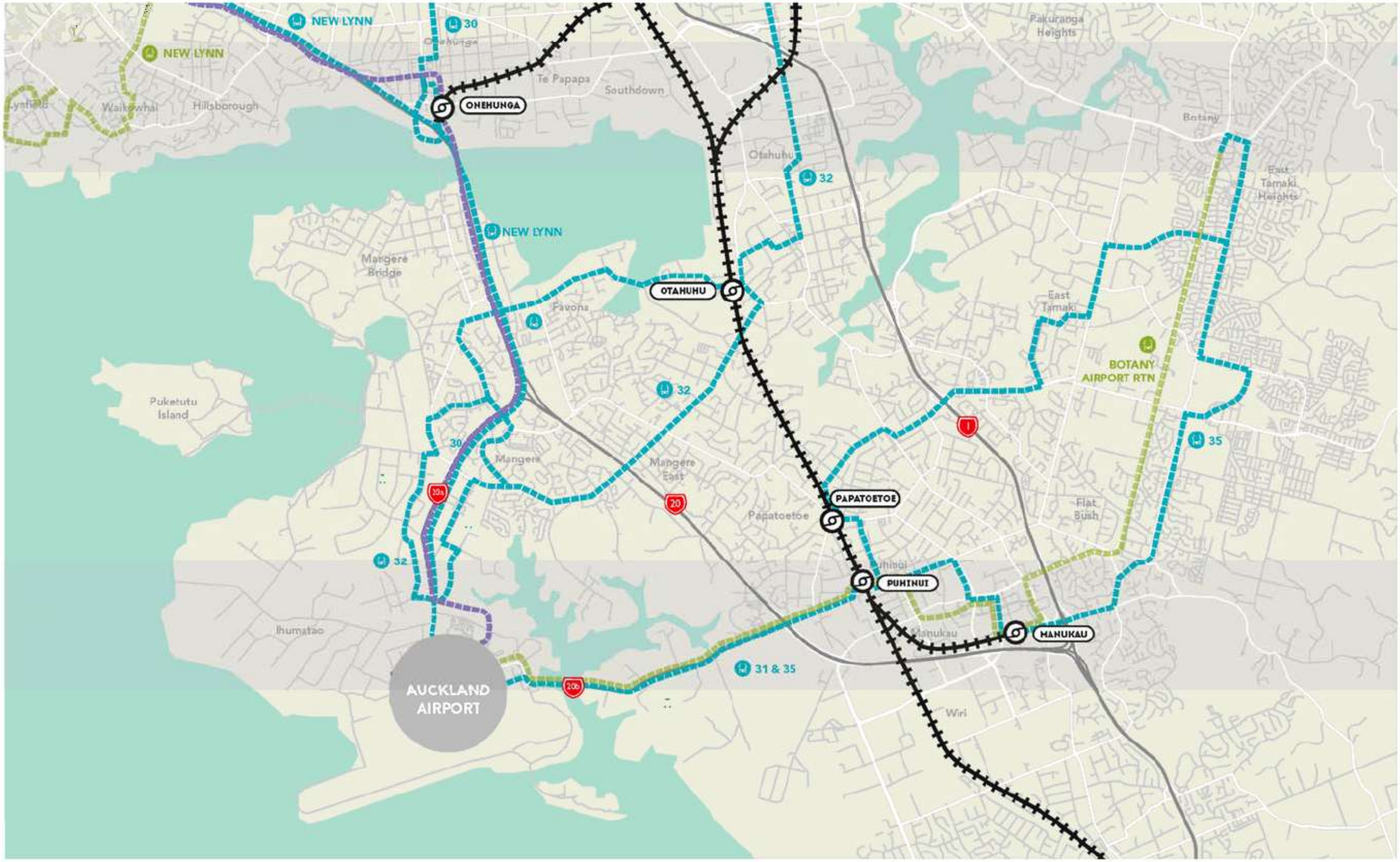
AUCKLAND AIRPORT PUBLIC TRANSPORT



KEY

Existing Train — Existing Bus — 2020 Bus

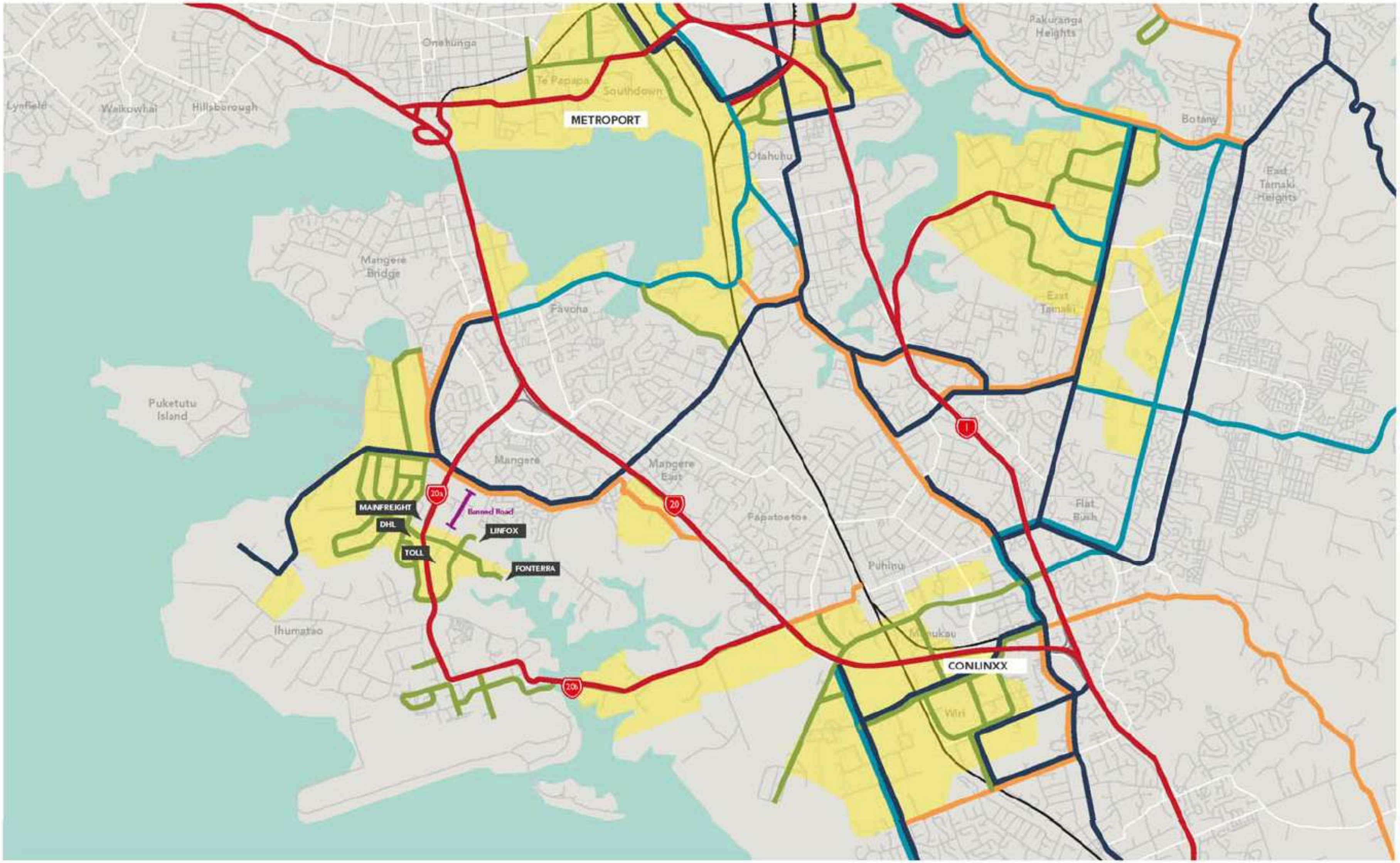
AUCKLAND AIRPORT PUBLIC TRANSPORT



KEY

Existing Train — Existing Bus — 2020 Bus — 2028 Bus — 2028 Light Rail

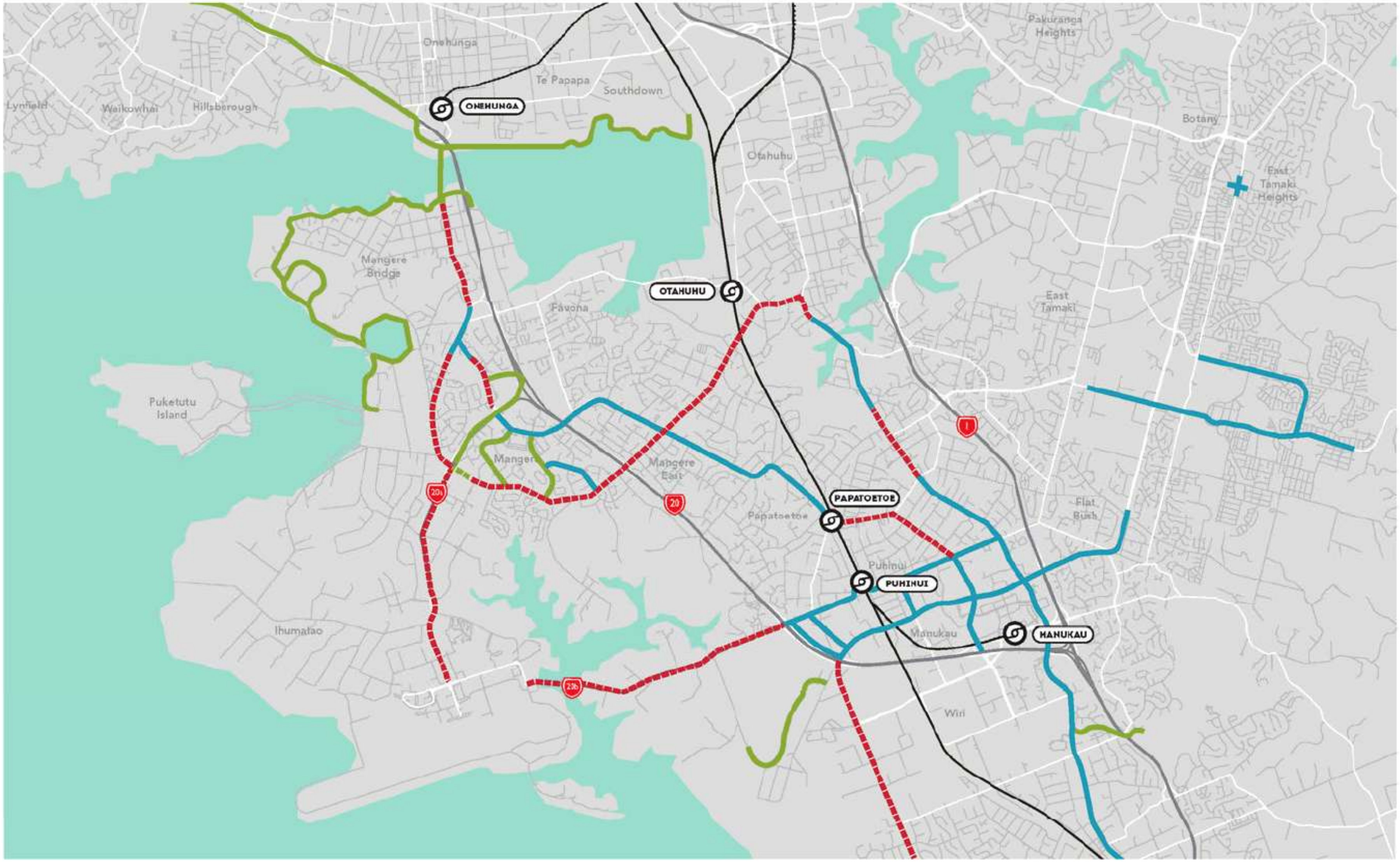
AUCKLAND AIRPORT FREIGHT



KEY

- Level 1A
- Level 1B
- Level 2
- Level 3
- Overdimension
- Industrial Areas

AUCKLAND AIRPORT WALKING & CYCLING (EXISTING & PROPOSED)



KEY

- Future cycle network/under investigation
- Existing unprotected cycle lane
- Existing protected cycle facilities

AUCKLAND AIRPORT GENERAL TRAFFIC FEATURES

KEY
- Parking
- Shopping Centres/ Food Court
- Petrol Stations
- Car Rentals

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Bringing ideas to life

Changing shape of transport at the Airport

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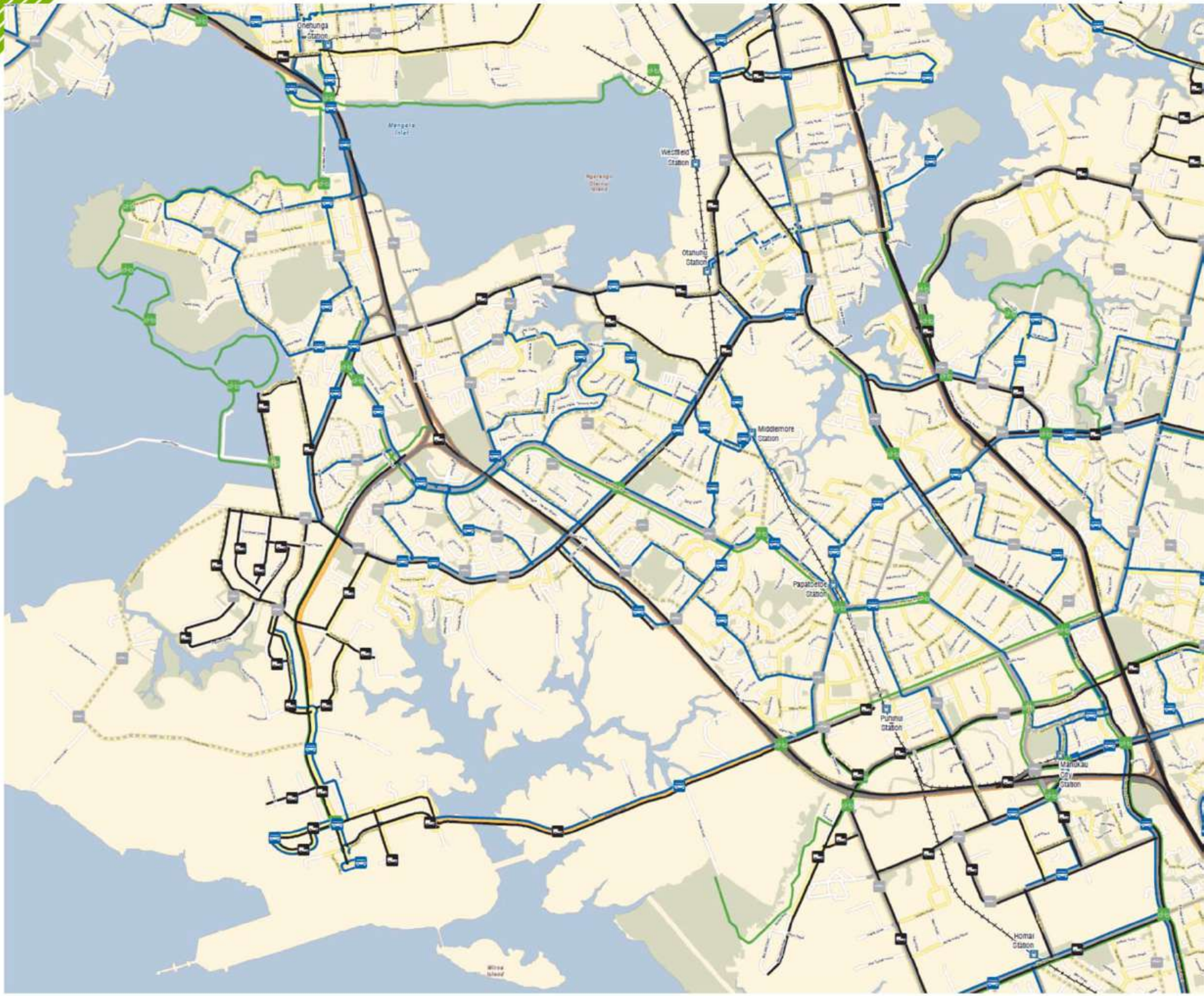
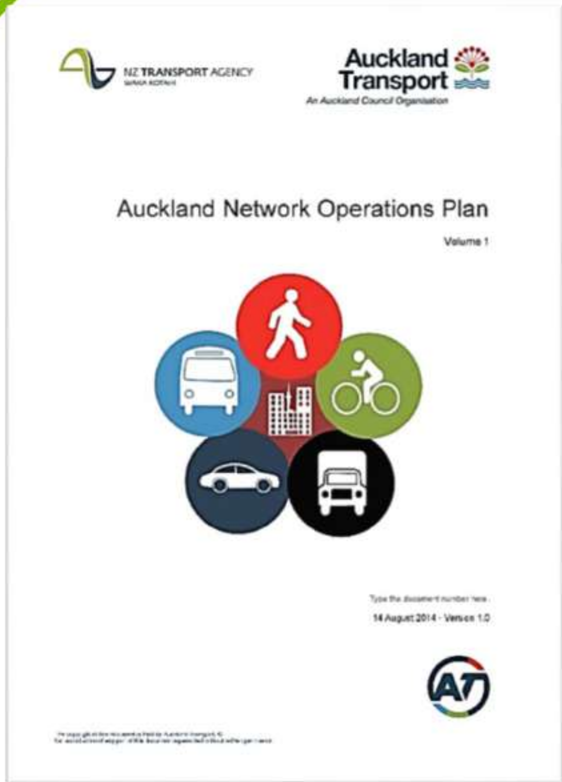

Onehunga Station
Westfield Station
Otahuhu Station
Middlemore Station
Papatoetoe Station
Puhinui Station
Manukau City Station
Homai Station

Bringing ideas to life



ANOP road user hierarchy

1. Pedestrian
2. Cyclist
3. PT
4. Freight
5. General vehicle

?

However, hierarchy based on the strategic function of the route, its location and time of day.

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Testing the ANOP Priorities

Our customers

- Workers
  - Nine to Fivers
  - Shift workers
  - Airline crew
- Passengers
  - Leisure travellers
  - Business travellers
- Meeters and Greeters
- Local traffic
- Freight
  - Distribution centre trips to/from south-east
  - Distribution centre trips to/from north
  - Internal commercial vehicles
  - Dolly trains
  - Just in time
  - Construction Traffic
- Others?

Next Steps

- Refine operational objectives
- Develop prioritisation for customers by route
- Workshop 2 (mid March)

Appendix B
Workshop 2 record

Bringing ideas to life

Airport Access DBC

Network Operating Plan
Operational Priorities

26th March 2018

NZ TRANSPORT AGENCY WAKA KOTAHI

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Auckland Airport

Agenda

1. Since the last workshop…
2. Workshop objectives
3. Agree Operational Principles
4. Discuss priorities (future state)
5. Interim network prioritisation
6. Next steps

Round Table

Since the last workshop

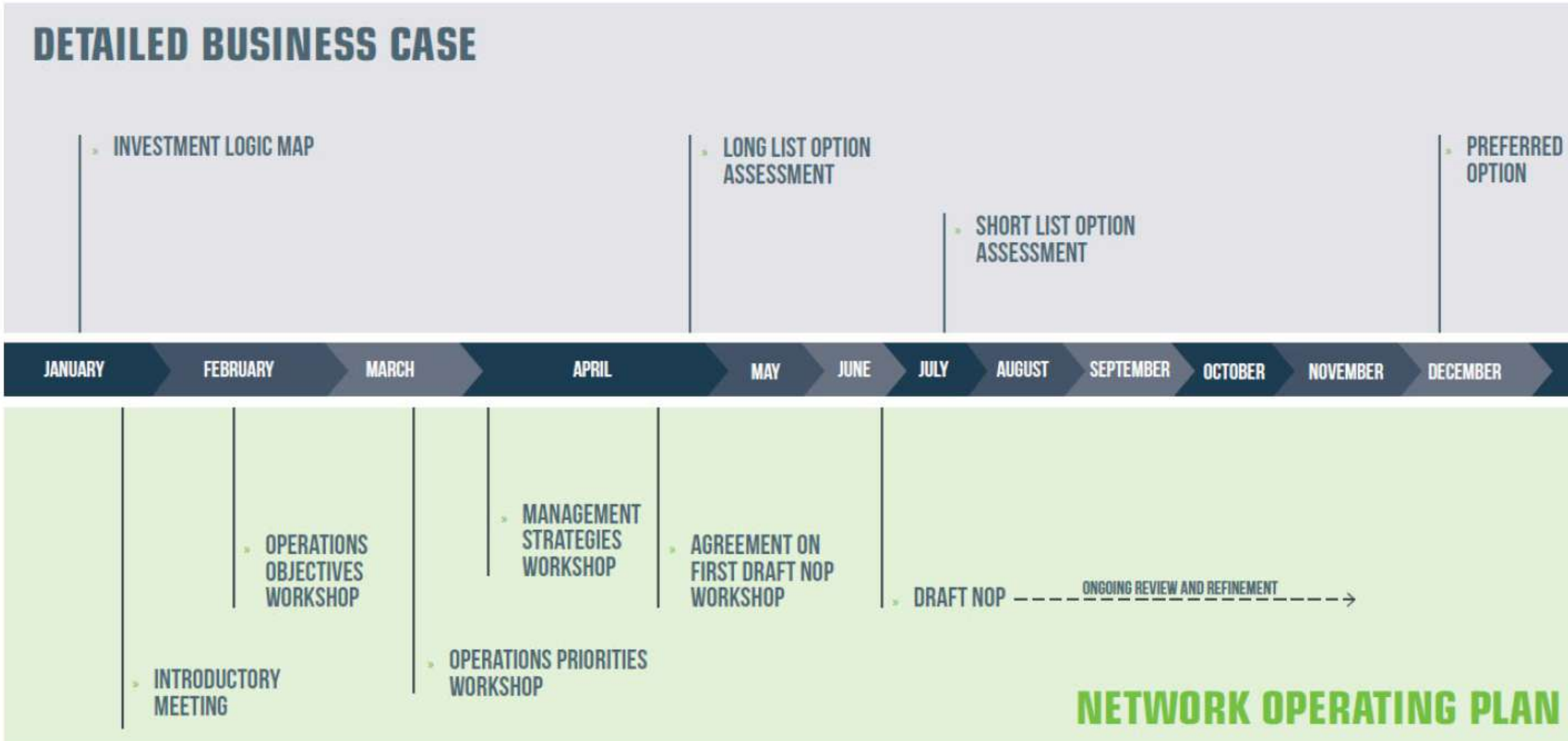
Airport Access DBC: Network Operating Plan – Development Framework

AIRPORT ACCESS

Workshop No.	Title	Key Discussion Topics	Dates
1	Operation Objectives Workshop	Agree user groups Potential conflicts / inconsistencies Common operational objectives High level user/mode priority	Mid February 2018
2	Operation Priorities Workshop	Confirm operational objectives Agree user/mode priority Network function	Mid March 2018
3	Management Strategies Workshop	Performance measures and targets Performance gaps Aligning with DBC long list options	Early April 2018
4	Agreement on First Draft NOP Workshop	Preferred strategy Deployment plan Post implementation evaluation framework	End of April 2018

6 Plan
Plan Finalisation Workshop
key stakeholders
performance measures and targets
framework
NOP ongoing review and update processes

Bringing ideas to life



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Our users

- Airside Travel
  - Passengers
  - Airline crew
  - Time sensitive freight
- Workers
  - Nine to Fivers
  - Shift workers
- Meeters and Greeters
- Local traffic
  - Local trips
- Freight
  - Non-time sensitive freight
  - Construction Traffic
- Cyclists
  - Interested but concerned/ commuters
  - Recreational/ Tourist cyclists
- Placemaking function

Bringing ideas to life

Our modes

PUBLIC TRANSPORT

- Passengers (airside travel)
- Airline crew (airside travel)
- Nine to fivers (workers)
- Shift workers (workers)
- Meeters and Greeters

HEAVY COMMERCIAL VEHICLE

- Just in time freight (airside travel)
- Non-time sensitive freight
- Construction traffic

PEDESTRIANS / PLACEMAKING

- Passengers (airside travel)
- Airline crew (airside travel)
- Nine to fivers (workers)
- Shift workers (workers)
- Meeters and Greeters
- Local traffic

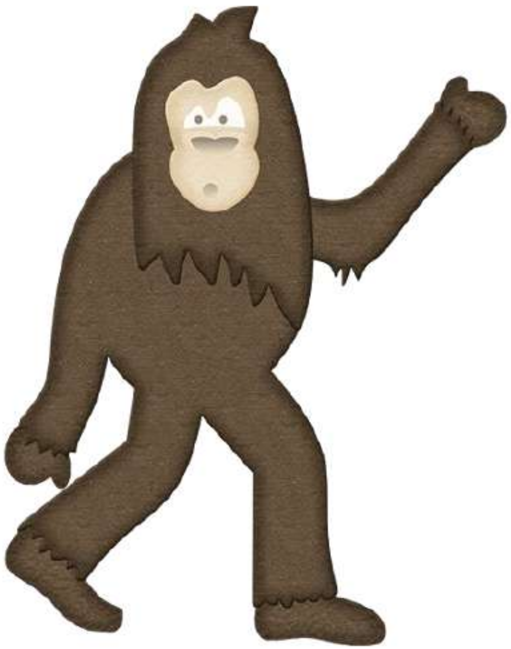
BICYCLES

- Nine to fivers (workers)
- Shift workers (workers)
- Recreational cyclists
- Interested but concerned local trips

GENERAL TRAFFIC

- Passengers (airside travel)
- Airline crew (airside travel)
- Just in time freight (airside travel)
- Nine to fivers (workers)
- Shift workers (workers)
- Meeters and Greeters
- Local traffic

Draft Operating Principles



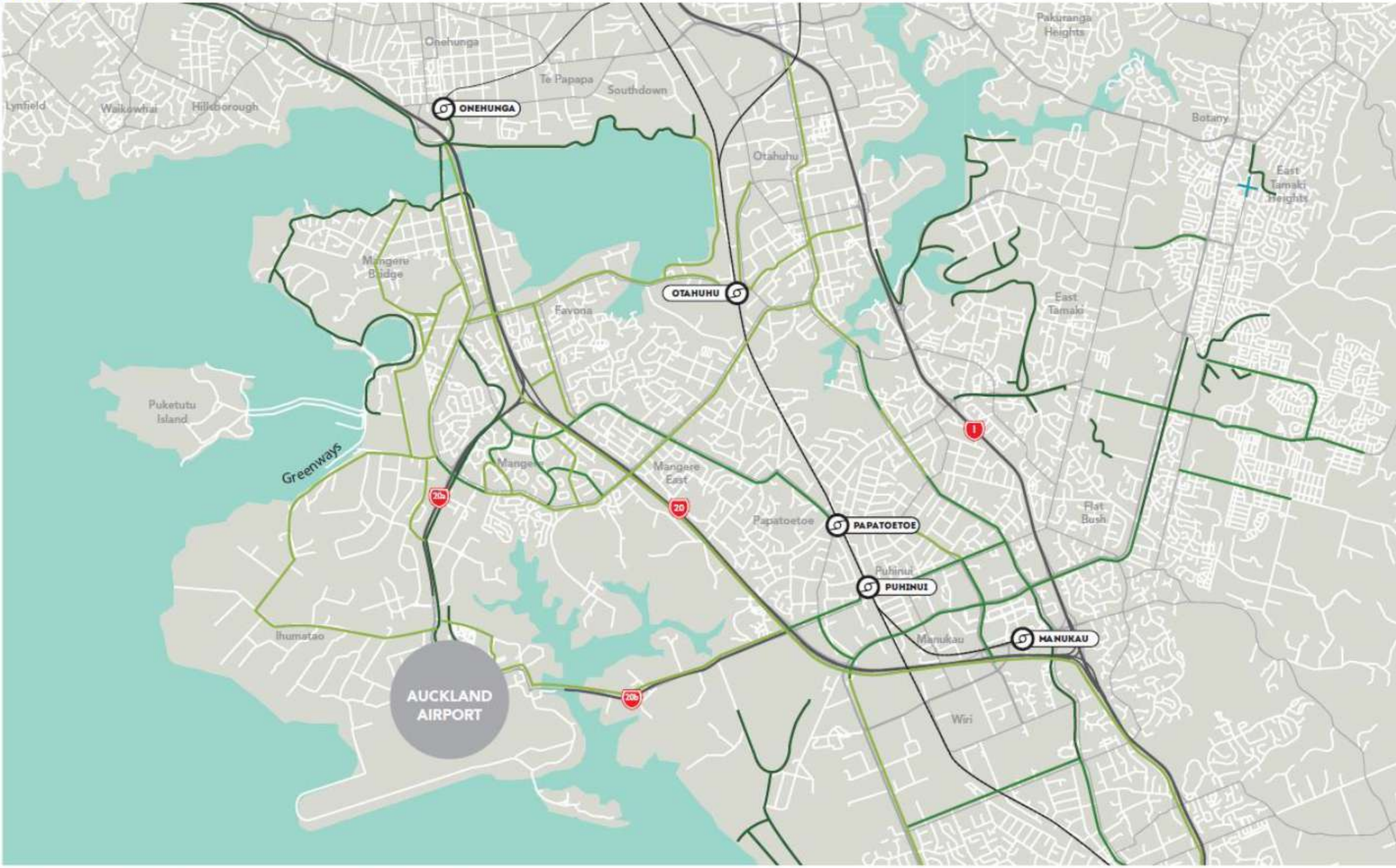
Discussion Time

Network Priorities

Future focus – look toward the 2046 network

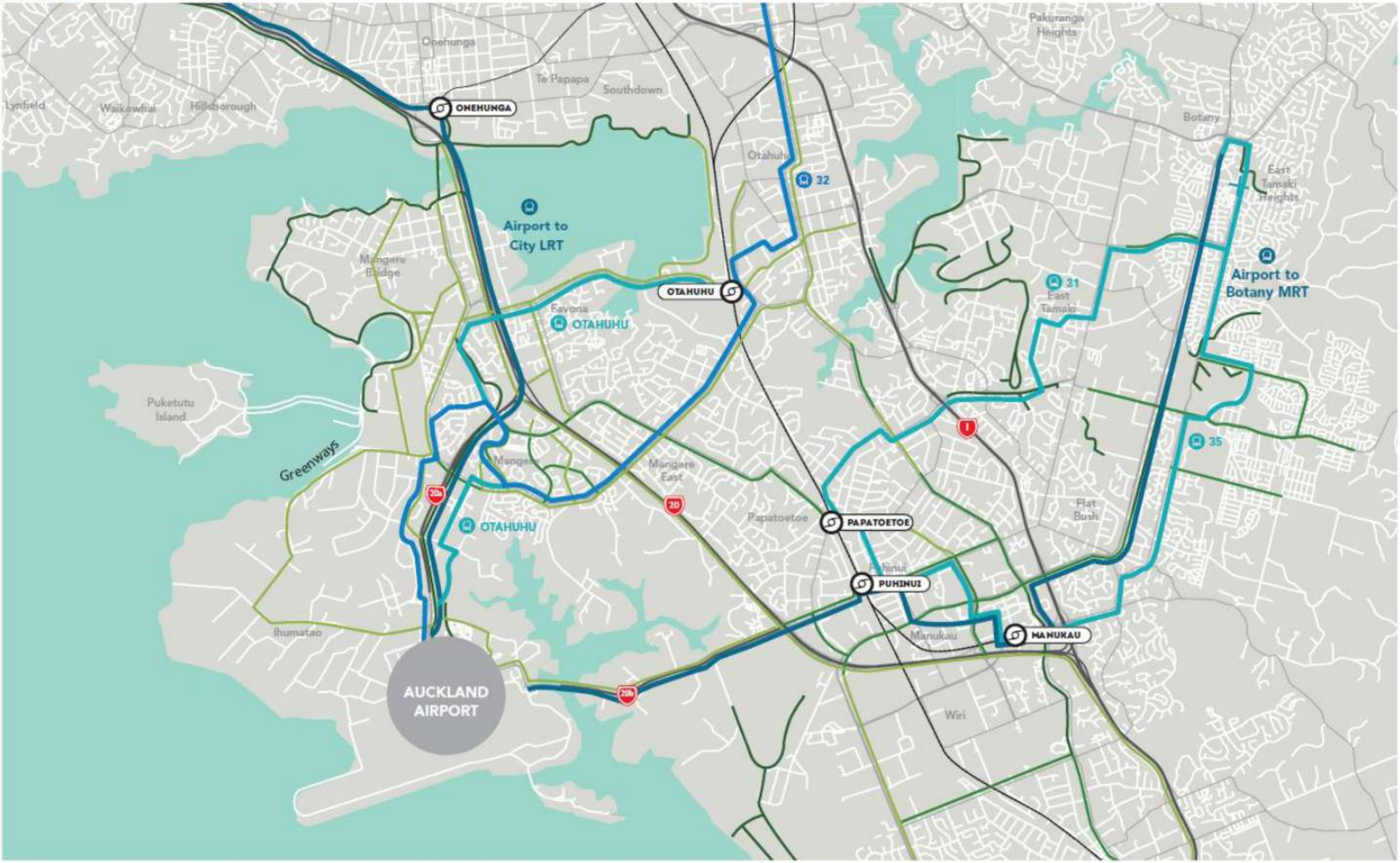
1. Priorities by mode
2. Priorities by time of day

From this we will address potential gaps in operational priority (develop a network management strategy) which will inform the DBC long list.



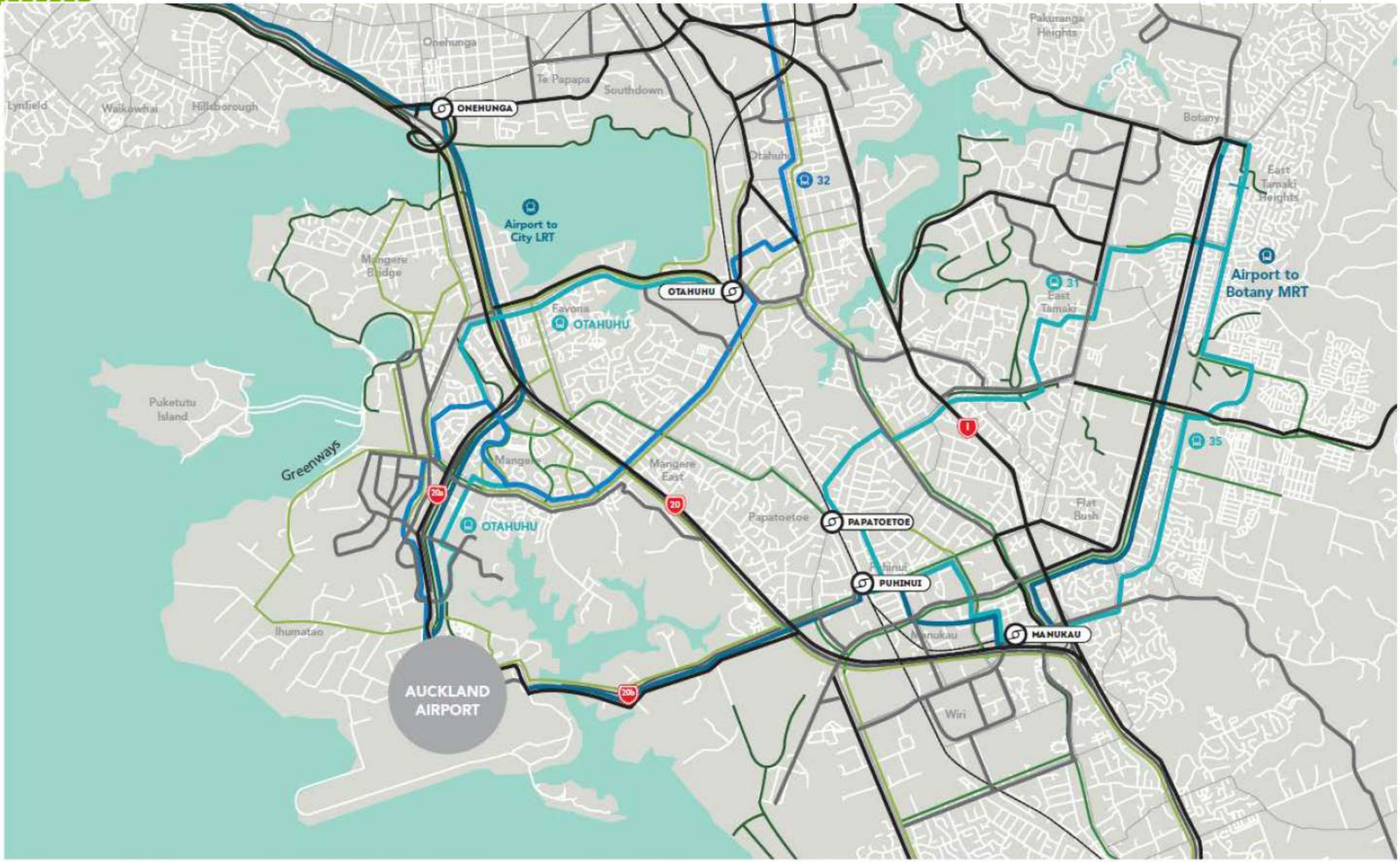
KEY

- Arterial
- Motorway
- Separated Facility or Protected Cycle Lanes
- Unprotected Cycle Lanes
- Future Cycle Network



KEY

- Arterial
- Motorway
- Separated Facility or Protected Cycle Lanes
- Unprotected Cycle Lanes
- Future Cycle Network
- Mass Rapid Transit
- Frequent Bus Service
- Local or Connector Bus Services



KEY

- Arterial
- Motorway
- Separated Facility or Protected Cycle Lanes
- Unprotected Cycle Lanes
- Future Cycle Network
- Mass Rapid Transit
- Frequent Bus Service
- Local or Connector Bus Services
- Freight - Level 1A & 1B
- Freight - Level 2 & 3

Bringing ideas to life

Next Steps

- Update network priorities based on today's discussion
- Feedback on final draft priorities?
- Finalise priorities by mode and by time of day
- Confirm network function
- Draft performance measures and performance targets for discussion.

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Appendix C
Workshop 3 record

Southwest Gateway Programme
Network Operating Plan
Workshop 3 – Network Performance

24th August 2018

NZ TRANSPORT AGENCY WAKA KOTAHI | AT | Auckland Airport | aurecon

Who’s who

Safety share

Workshop Objectives

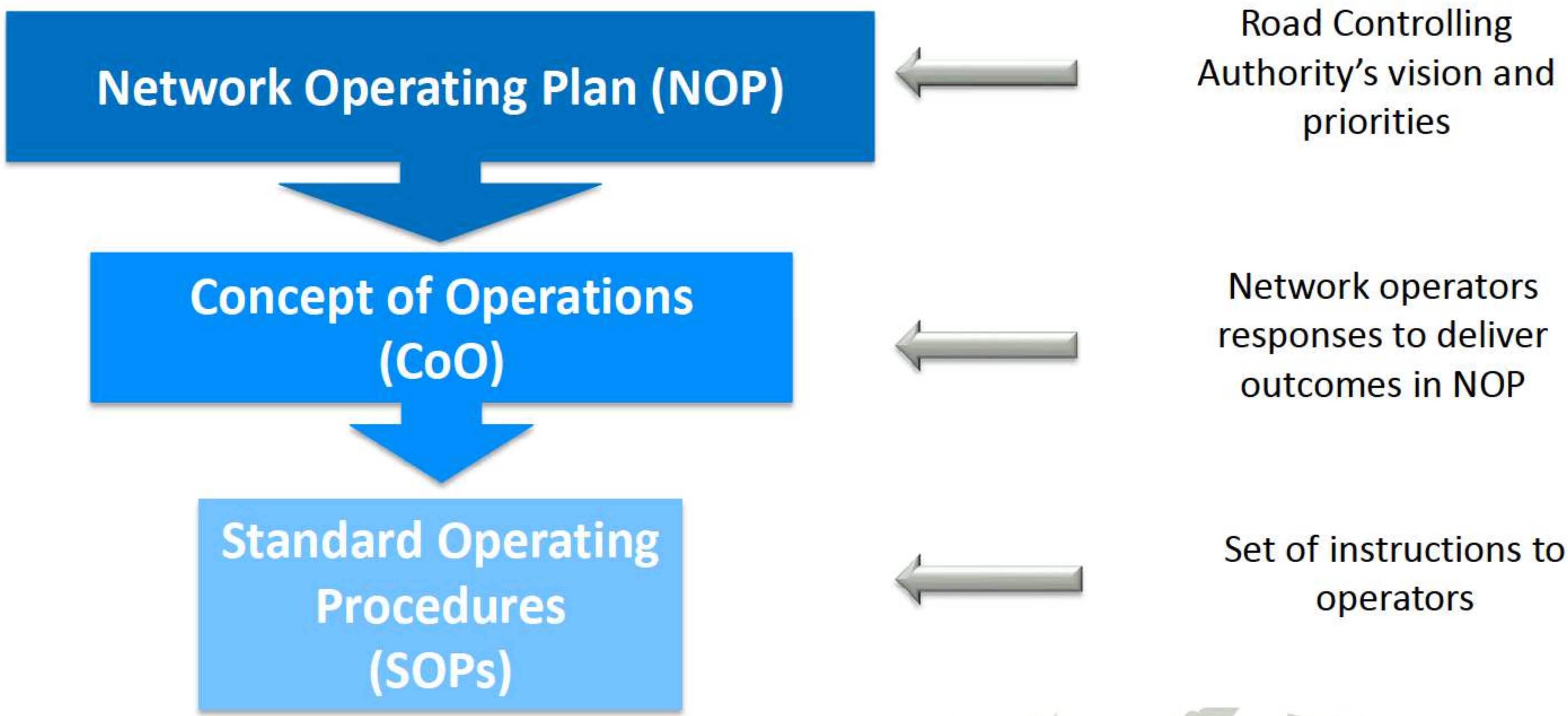
- Determine network performance measures and KPIs
- Agree mode priorities along key routes
- Introduce long list options and Operations input into the multi-criteria analysis
- Share operations inputs into the Long-list MCA assessment
- Discuss the way forward for Network Operations/ Concept of Operations development for 2020

1. Recap

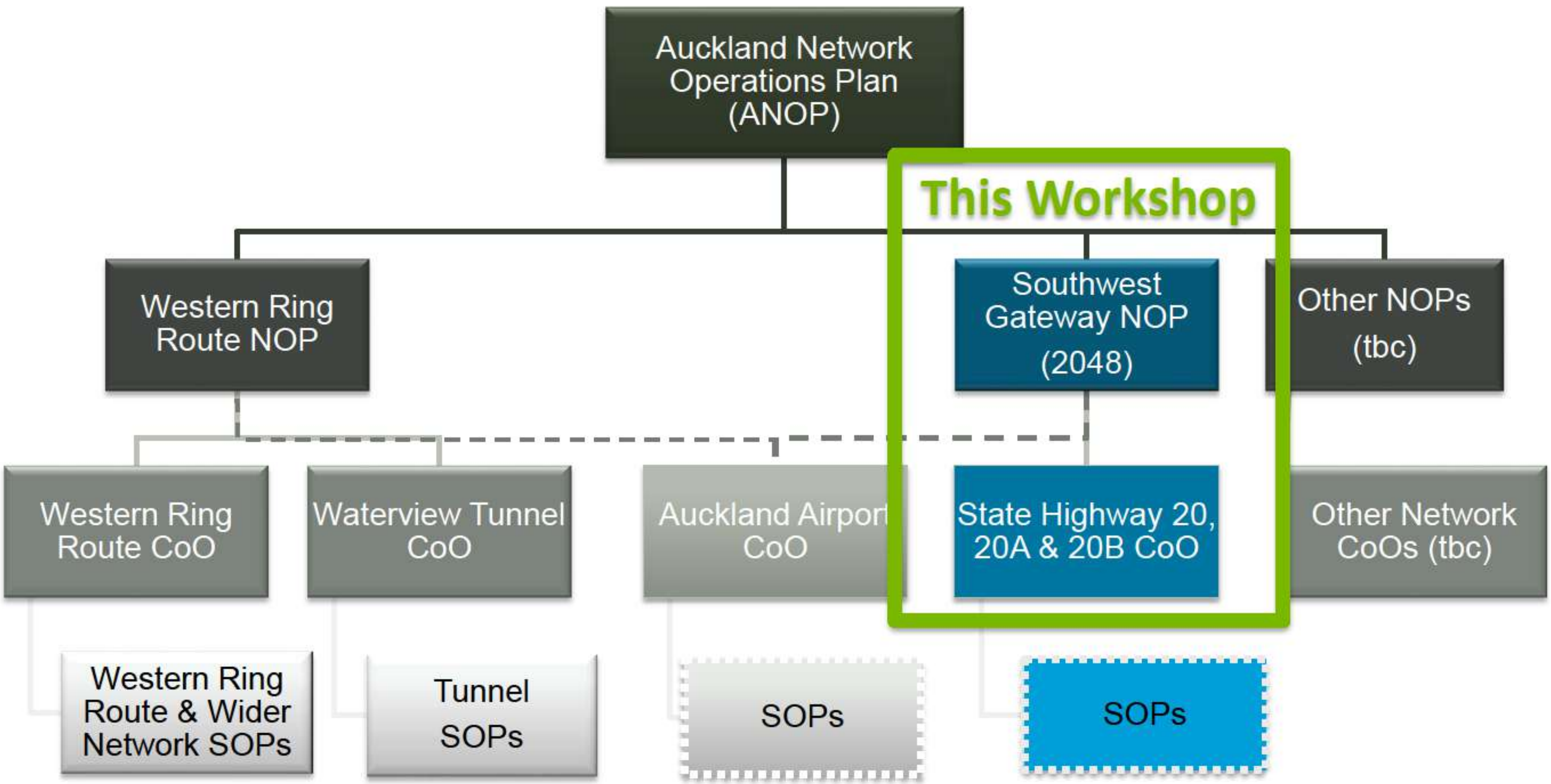
NOP Workshops

Workshop No.	Title	Key Discussion Topics	Dates
1	Operation Objectives Workshop	Agree user groups Potential conflicts / inconsistencies Common operational objectives High level user/mode priority	Mid February 2018
2	Operation Priorities Workshop	Agree on the area of influence Network function Agree user/mode priority	Mid March 2018
3	Network Performance Workshop	Performance measures and targets Aligning with DBC long list options	August 2018
4	Agreement on First Draft NOP Workshop	Preferred management strategies Deployment plan Post implementation evaluation framework	tbc

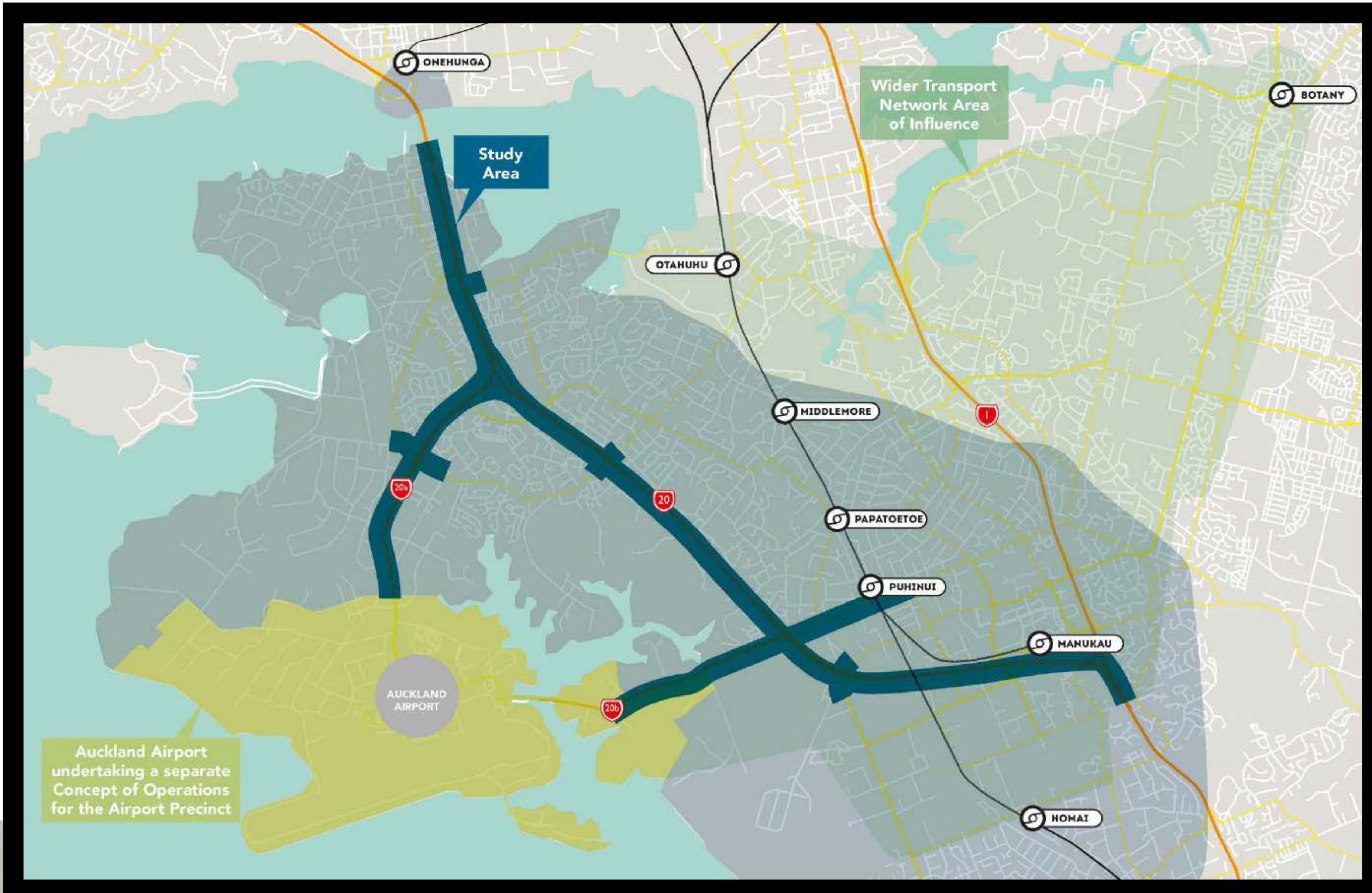
Operations Plan Hierarchy



Southwest Gateway Operations Workstreams



Study Area


ONEHUNGA
BOTANY
Wider Transport Network Area of Influence
Study Area
OTAHUHU
MIDDLEMORE
PAPATOETOE
PUHINUI
MANUKAU
HOMAI
AUCKLAND AIRPORT
20a
20
20b
1
Auckland Airport undertaking a separate Concept of Operations for the Airport Precinct

Our Operating Principles

What's been happening

- Stakeholder engagement
- Identification of long list of options for state highway improvements and public transport corridors
- Developed a list of key performance indicators and measures to assess network performance
- Development of scheme linking Puhinui Station to the Airport for early implementation.

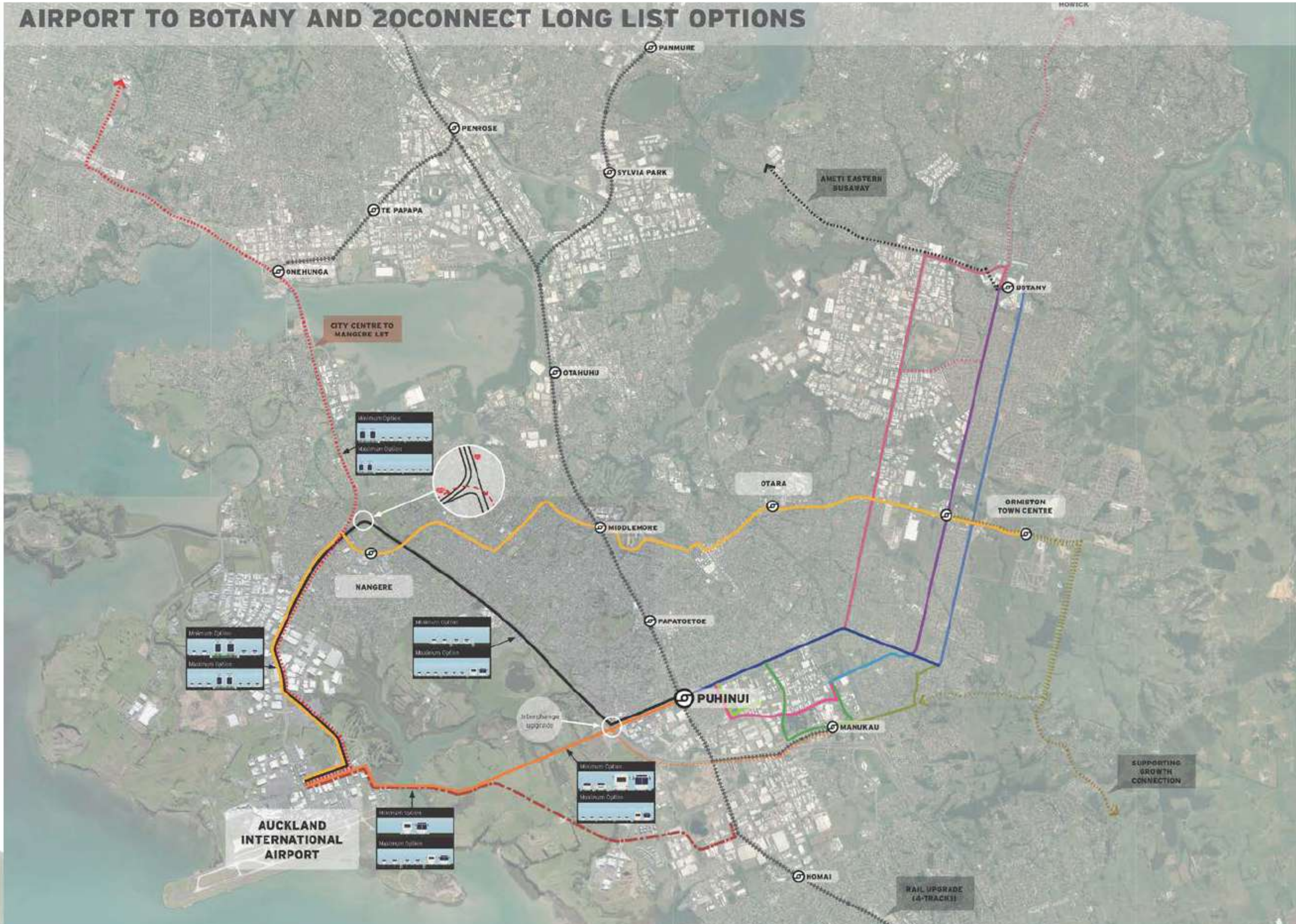
2. Key Performance Indicators and Measures

3. Mode Priorities

4. Longlist Options

Option	Intent	Key Considerations
C1a: **SH20A High Investment Only With/Without MRT / LRT on SH20a**	Reduce reliance on SH20B SH20A becomes main access to airport	• MRT/LRT • Pukaki Bridge • SH20 widening
C1b: **SH20A High Investment - 20B converted to RTN**	Reduce reliance on SH20B	• Pukaki Bridge • TDM – RTC • SH20 widening
C2a: **SH20B High Investment Only - Motorway Puhinui South-Facing Ramps Only**	Improve access to development land from the south	• SH20A corridor • Memorial Gardens • SH20 widening
C2b: **SH20B High Investment Only - Motorway Puhinui All Ramps**	Improve access to development land and airport from the north and south	• Memorial Gardens • TDM • SH20 widening
C3: **SH20A and SH20B High Investment**	Improve access to the airport through SH20A and SH20B corridors	• PT uptake – mode split/TDM • SH20A Corridor • Pukaki Bridge • SH20 widening
C4a: **Balanced Approach - SH20B Expressway**	Provide improved access through SH20B corridor Resilience through 20A to 20 Connection	• SH20B grade-separation • SH20 widening

Longlist Options



s - summary worksheet

Option number						1	2	3	
Option title						Base Case	C1a	C1a1	
Option description						Existing Environment	SH20A High investment Only With MRT C1a/ LRT on SH20s	SH20A High investment Only Without MRT / LRT on SH20s	SH20A 20B co
Investment objectives									
	20Connect Benefits	20Connect Investment Objectives	20Connect KPI	20Connect Measures	Weighting				
ctions and recinct area ty	1. More reliable and resilient transport system	To improve the reliability and resilience of the transport system	KPI 1: Capacity in the system v forecast demand	Degree of saturation of key links and intersections	5.00%	0	2	2	
			KPI 2: Separation of movements and amount of conflict in the system	No. and performance of grade separations and at-grade junctions and intersections	5.00%	0	-1	3	
			KPI 3: Ability for high priority trips to be have reliable journeys	Length of separated rights of way for freights, PT, HOVs and special uses.	5.00%	0	-1	3	
				Volume/capacity of key routes and special purpose lanes	5.00%	0	-1	3	
					8.00%	0	-1	3	
oices limits customers, goods	2. A more prosperous Airport Precinct area, Auckland and New Zealand.	To improve economic performance of the airport area, Auckland and New Zealand	KPI 4: Population accessible to jobs in the airport area	Population within 30 minute trip during peak hours 2046	5.00%	0	-1	3	
			KPI 5: Jobs accessible from Ormiston, Otara, Botany, Manukau and Papakura	Jobs within 30 minutes trip during peak hours 2046. Correlate with deprivation and Do-min levels of access	5.00%	0	-1	3	
			KPI 3: Ability for high priority trips to be have reliable journeys	Length of separated rights of way for freights, PT, HOVs and special uses.	5.00%	0	-1	3	
			KPI 6: Travel time and reliability for key routes.	Travel time for key journeys: - City – Airport - Papakura – Airport	5.00%	0	2	2	
				Assessment of reliability for each	5.00%	0	-1	3	
	ronment is d nd enhanced	Reduce the effects of the transport system on the environment and taonga.	KPI 7: Air quality / emissions from transport system.	Emissions assessment from models	10.00%	0	1	1	
			KPI 8: Water quality effects of transport system	Change in quantity and quality of stormwater due to changes in paved area and stormwater management infrastructure introduced	5.00%	0	-1	3	
			KPI 9: Effects on places of Heritage	Extent of effects on: - sites, buildings and places of heritage value. - sites and places of archaeological value.	5.00%	0	-1		
			KPI 10: Maori communities and wellbeing.	Extent of effects on the relationship of Maori to their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other Taonga (tangible and intangible).		0	-1		
			KPI 11: Te Taiao (Air, Land, water, Taonga):	Eff water and other ources in a Maori.			-1		
			KPI 12: Effects on culture a ditio	ortunities to s ne relation aditions, , water, sit Taonga an ole).					
			/ em rom						

MCA Assessment – operations inputs

5. Horizon 2020

Do these Operating Principles still apply?

Offering Thoughts for short term operating Principles

Construction Traffic

- Prioritise construction traffic access over HCV through trips

Safe Access

- Maintain safe access for pedestrians and cyclists (where it already exists)?

Temporary Traffic Management

- Maintain two way access during peak periods

Rat Running/ Local amenity

Can we deliver on these principles in the short term in the absence of the SH20A to SH20 southbound connection?

6. Next Steps

- Engage with stakeholders
- Longlist assessments
- Identify operational design options to mitigate conflict hotspots

Appendix D
HCV movements for March 2018

eRUC data screen-lines analysed

Figure D-1 Approximate screen line locations

HCV journeys from specified origins

The following images provide a snapshot of the journeys taken by HCVs in the network. They provide a sum total of the trips undertaken in the weekdays of March 2018. i.e. are a sum of 22 days' worth of HCV movements. The following plots are for a 24 hour and a 3 hour PM peak period with trips entering the network at screen-lines A, D, F and M.

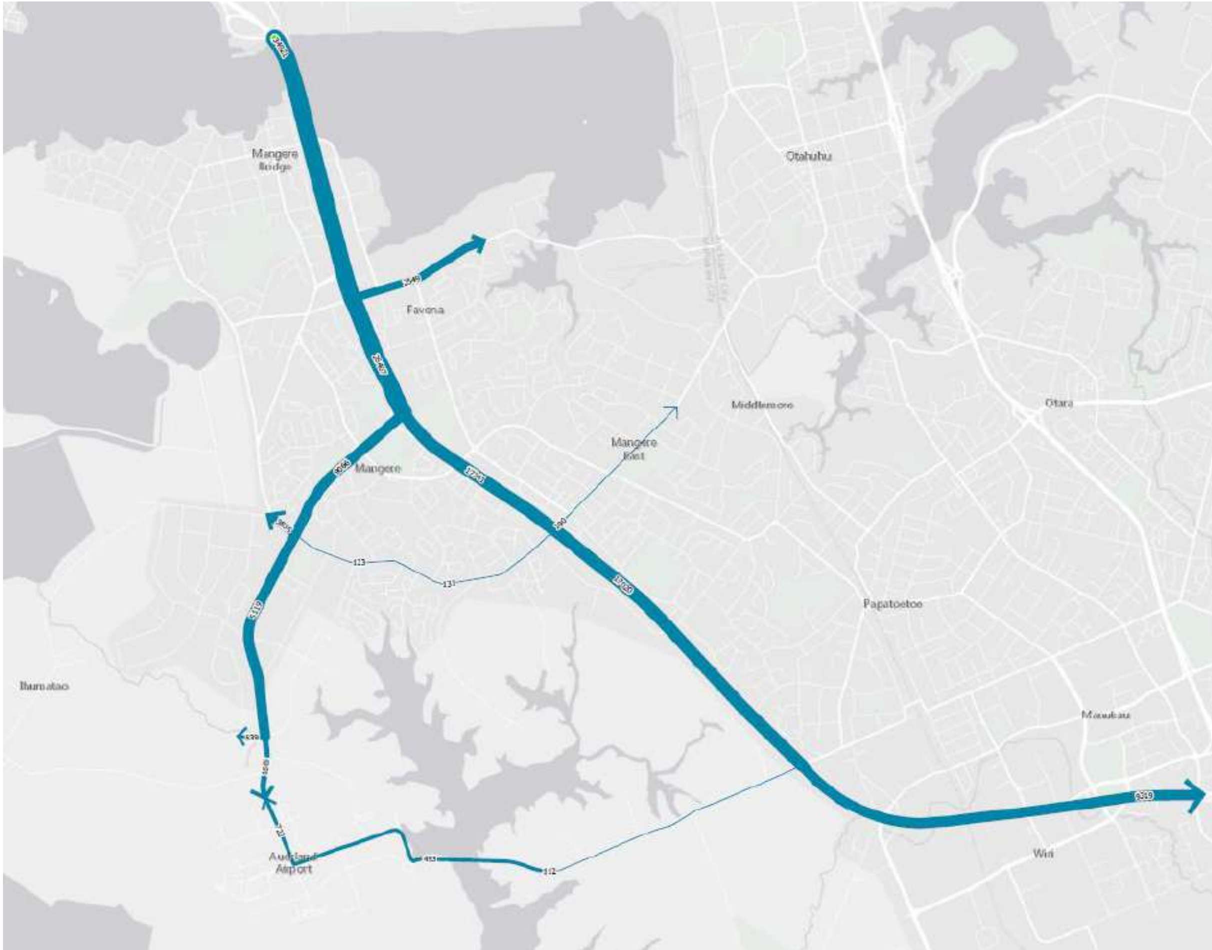


Figure D-2 24hr period HCV eRUC volume, origin A southbound

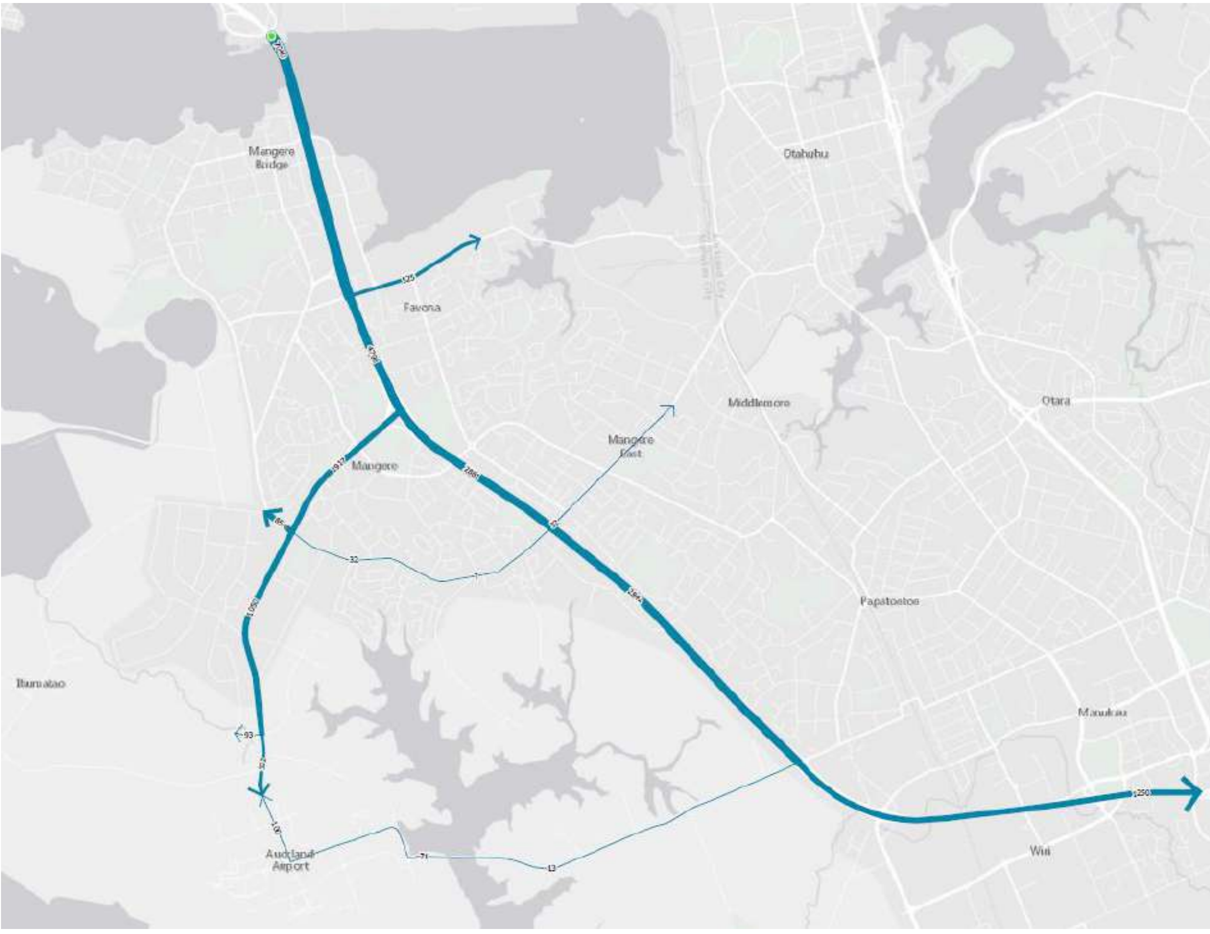


Figure D-3 Afternoon peak HCV eRUC volume, origin A southbound

Figure D-4 24hr period HCV eRUC volume, origin D westbound

Figure D-5 Afternoon peak HCV eRUC volume, origin D westbound

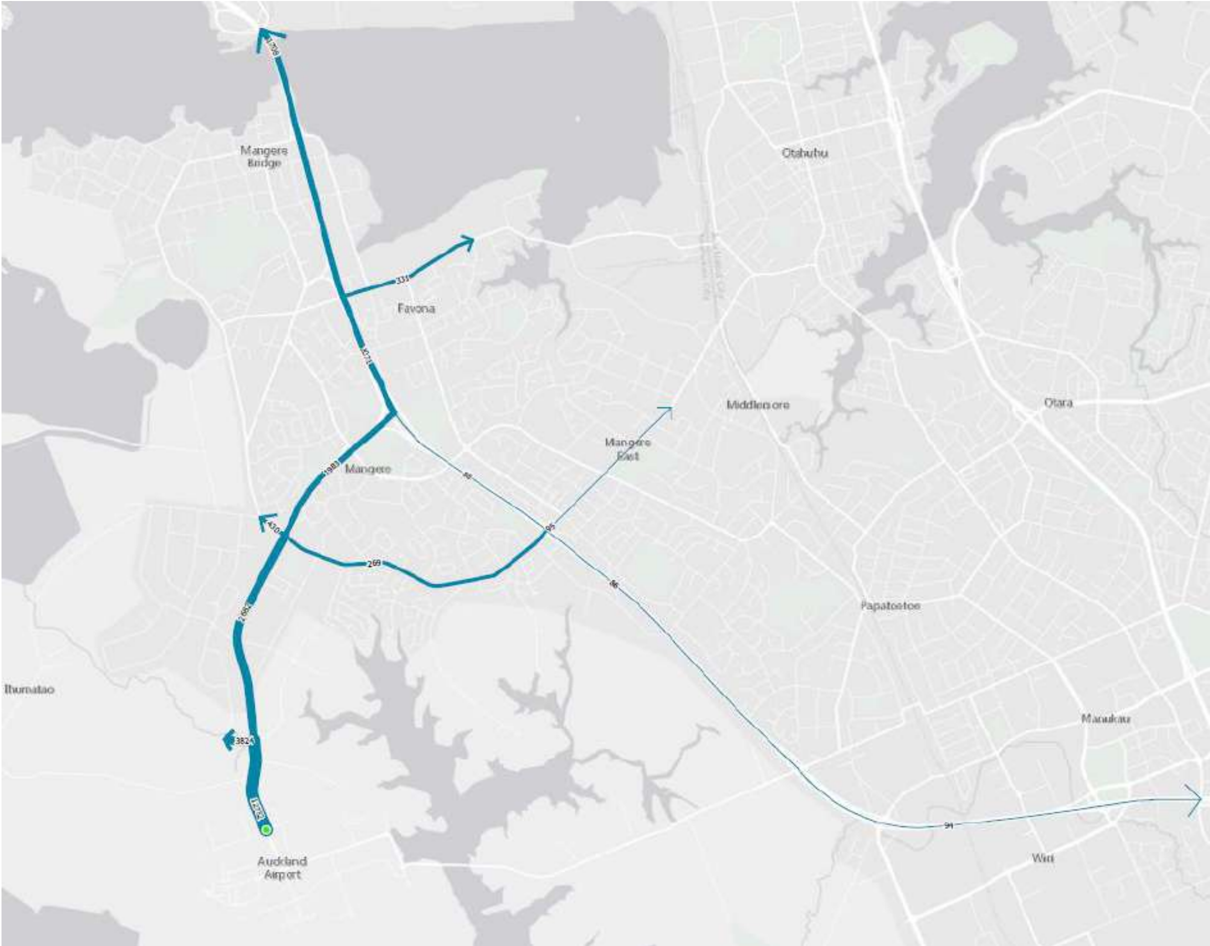


Figure D-6 24hr period HCV eRUC volume, origin F northbound

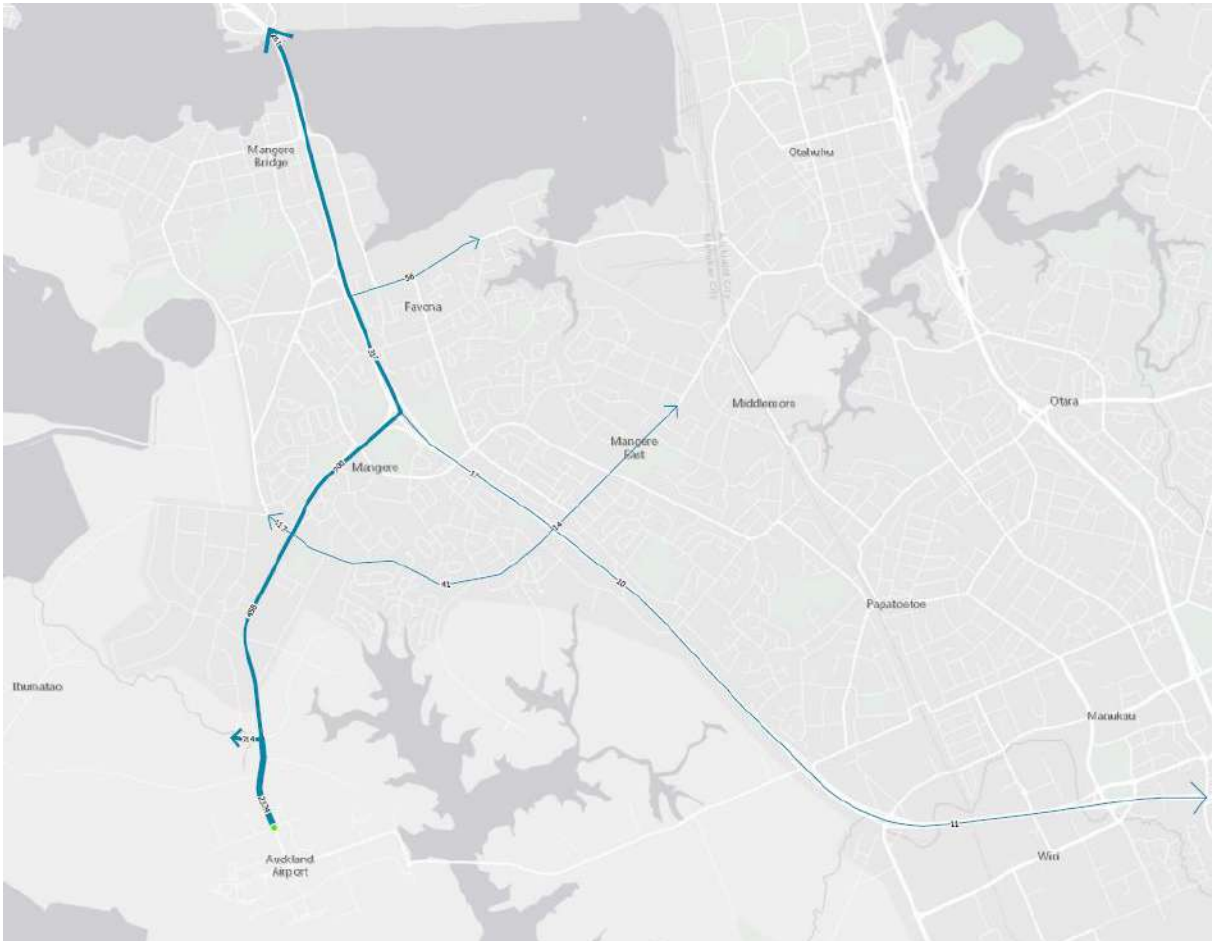


Figure D-7 Afternoon peak period HCV eRUC volume, origin F northbound

Figure D-8 24hr period HCV eRUC volume, origin M northbound

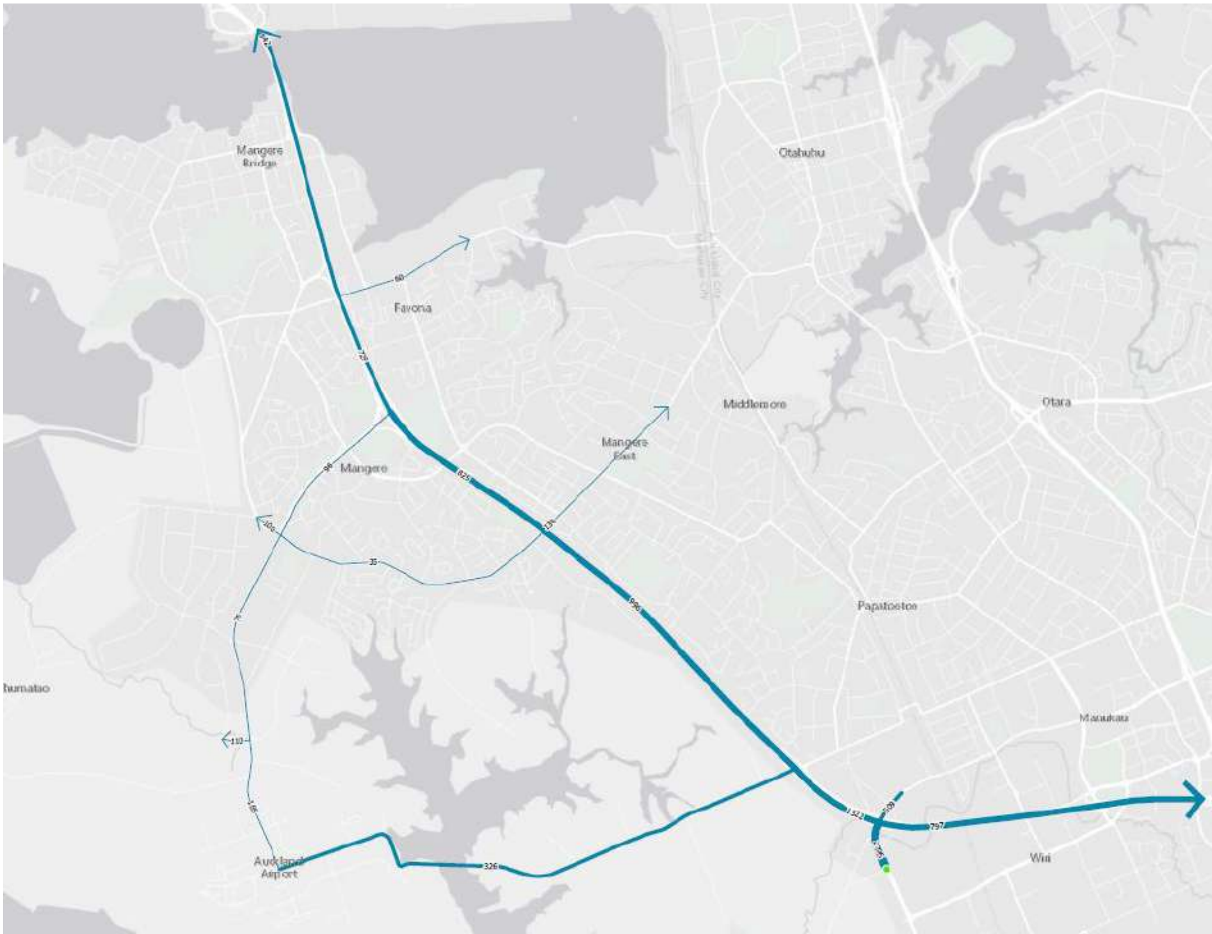
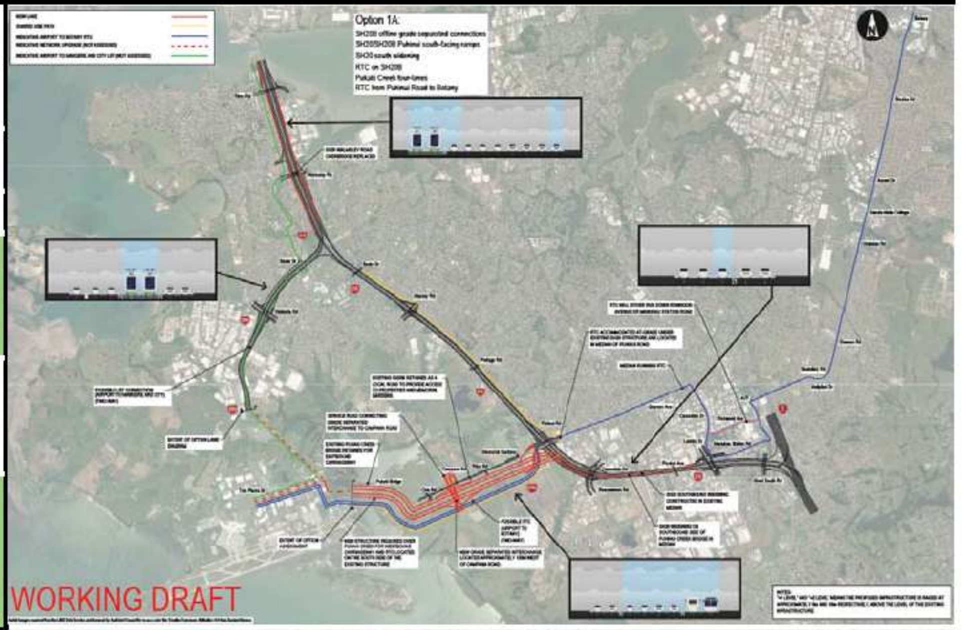
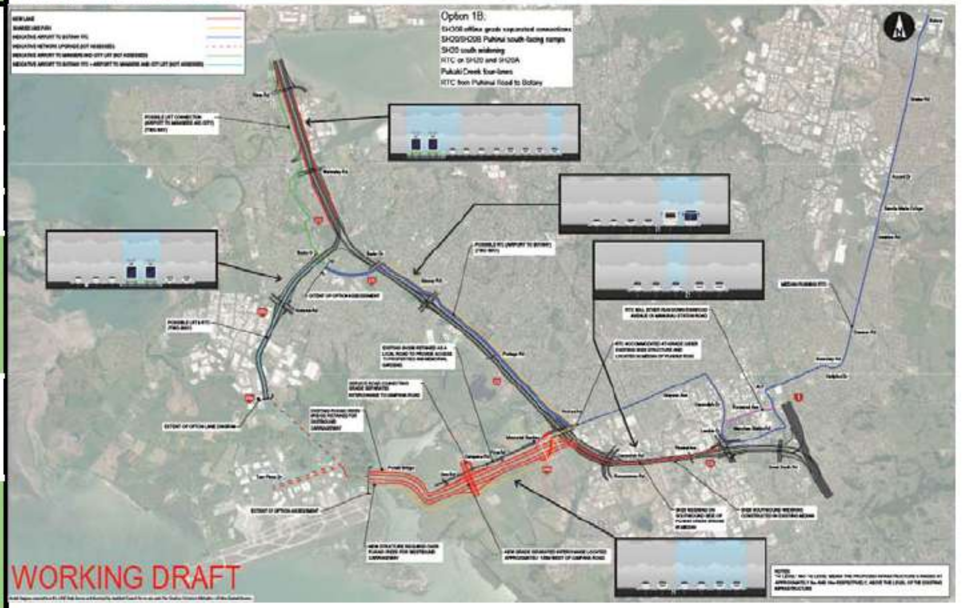
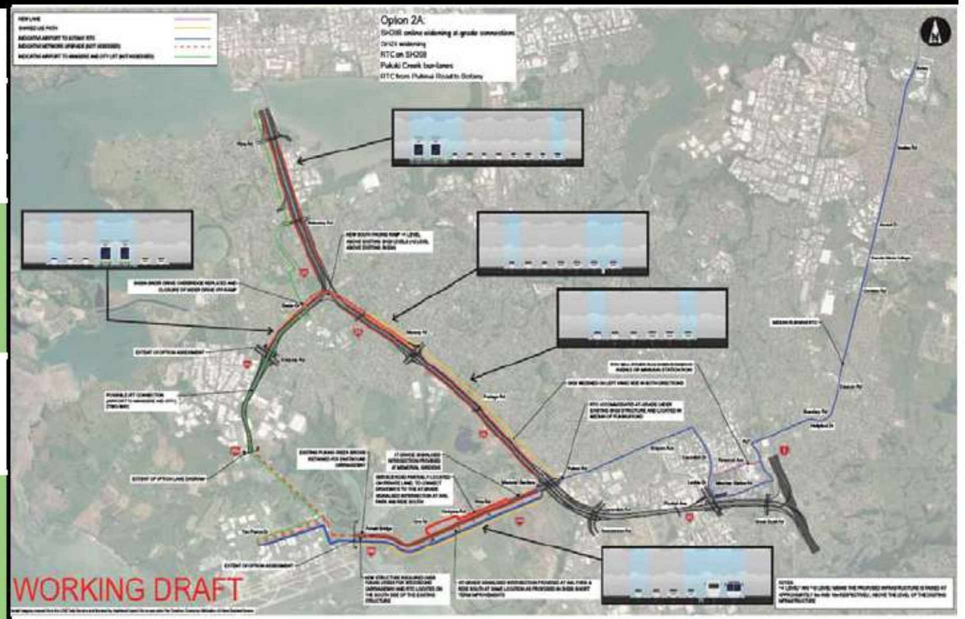
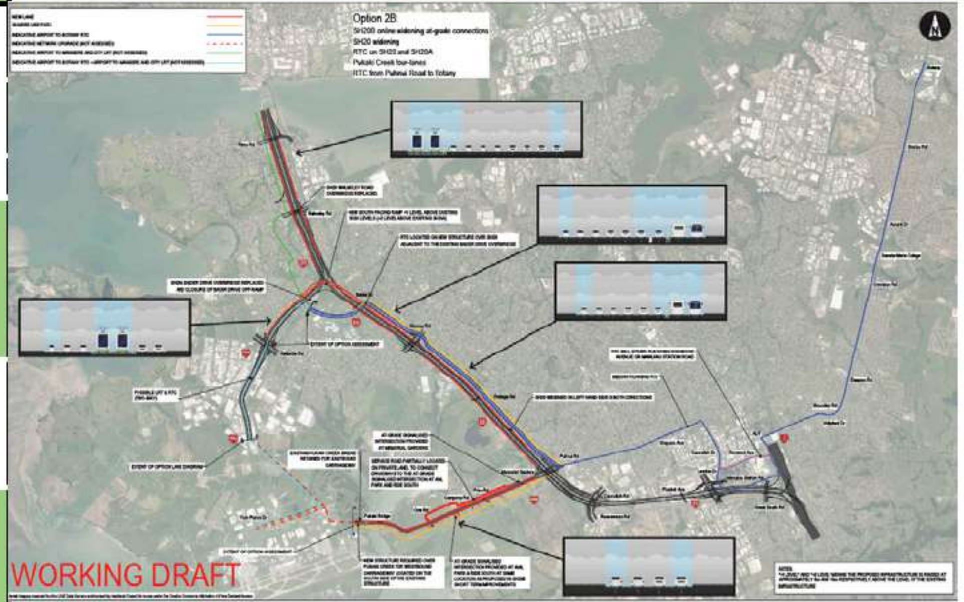
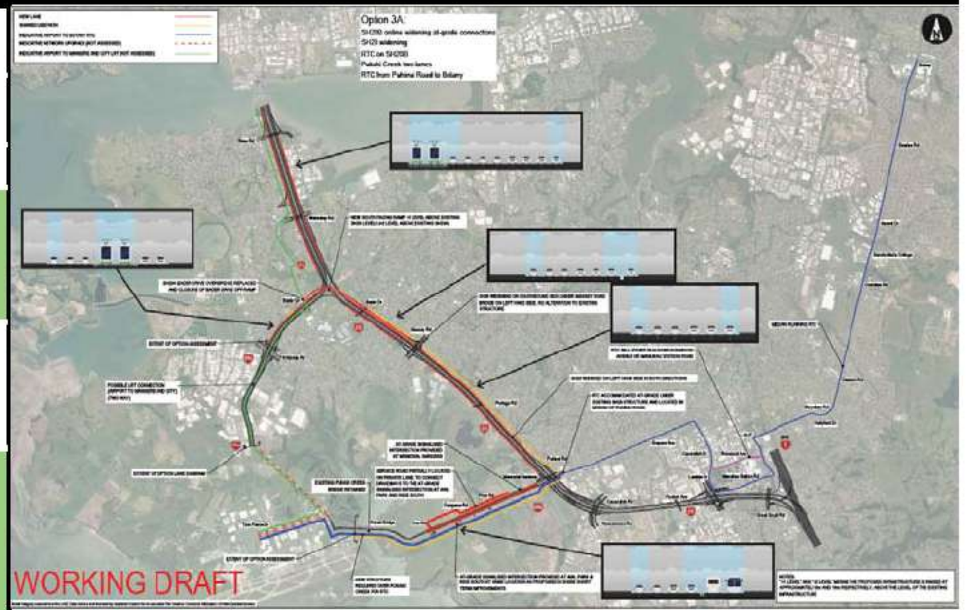
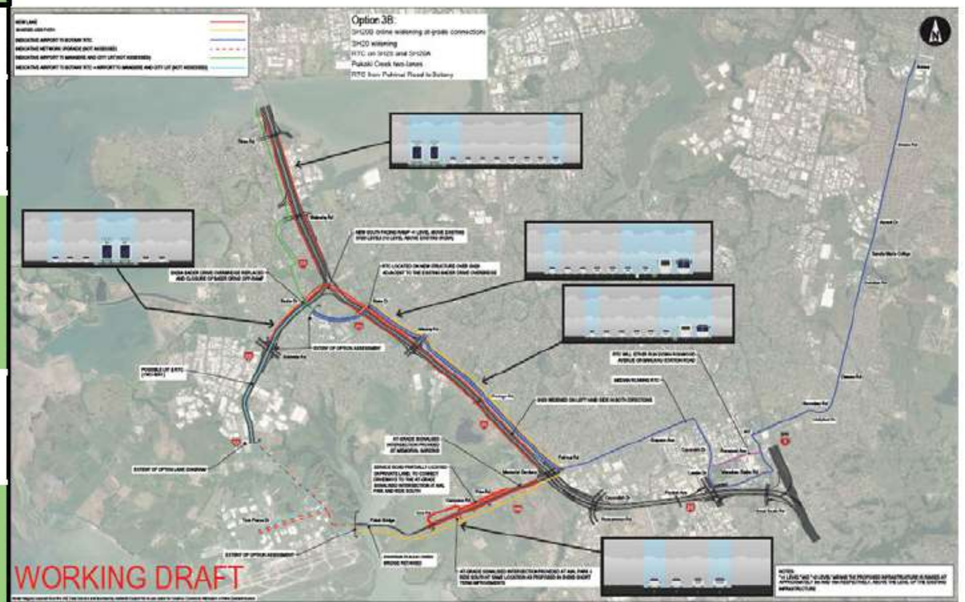


Figure D-9 Afternoon peak HCV eRUC volume, origin M northbound

Appendix E
Operational assessment of long list options

	Option Descriptions	Assessment	Investment Objectives and Associated NOP Operating Principles SCORE: To improve health, safety and security of people	SCORE: To improve the reliability and resilience of the transport system	SCORE: To improve economic performance of the airport area, Auckland and New Zealand	SCORE: Reduce the effects of the transport system on the environment and taonga	SCORE: A network that provides value for money	Map
Option 1A	SH20B offline grade separated connections	Reduction in vehicle conflicts; Improved safety of users; Reduction in travel times; Improved travel time reliability; Minimal impact on amenity function of local town centre and residential area;	2	2	2	0	0	
	SH20/SH20B Puhinui south-facing ramps	Improve travel time reliability to the airport; Increased arrival rates at SH1/ SH20 could increase localised delays and queue build up on SH20.	1	1	1	0	0	
	SH20 widening	Reduction in conflict points; Reduced weaving on through lanes	1	1	1	0	0	
	RTC on SH20B	Improve public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required.	2	3	3	2	2	
	Pukaki Creek four-lanes	Improved airport access; Improved trip reliability for airport traffic; Reduced travel time; Increased trip reliability along SH20B. Additional capacity could encourage rat-runs through the airport.	0	1	1	0	0	
	RTC from Puhinui Road to Botany	Improved public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required; Improve accessibility to local town and business.	2	3	3	2	2	
Option 1B	SH20B offline grade separated connections	Reduction in vehicle conflicts; Improved safety of users; Reduction in travel times; Improved travel time reliability; Minimal impact on amenity function of local town centre and residential area;	2	2	2	0	0	
	SH20/SH20B Puhinui south-facing ramps	Improved travel time reliability to the airport; Increased arrival rates at SH1/ SH20 could increase localised delays and queue build up on SH20.	1	1	1	0	0	
	SH20 widening	Reduction in conflict points; Reduced weaving on through lanes	1	1	1	0	0	
	RTC on SH20 and SH20A	Improve public transport journey experience - but longer journey time from eastern approach than A options Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required;	2	3	2	1	2	
	Pukaki Creek four-lanes	Improved airport access; Improved trip reliability for airport traffic; Reduced travel time; Increased trip reliability along SH20B. Additional capacity could encourage rat-runs through the airport.	0	1	1	0	0	
	RTC from Puhinui Road to Botany	Improve public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required; Improve accessibility to local town and business.	2	3	3	2	2	

	Option Descriptions	Assessment	Investment Objectives and Associated NOP Operating Principles SCORE: To improve health, safety and security of people	SCORE: To improve the reliability and resilience of the transport system	SCORE: To improve economic performance of the airport area, Auckland and New Zealand	SCORE: Reduce the effects of the transport system on the environment and taonga	SCORE: A network that provides value for money	Map
Option 2A	SH20B online widening at-grade connections	Reduced speed differential, through facilitation of local traffic via Service road; Some reliability improvements for time-sensitive airport traffic Fewer diversion/ detour route availability than offline option	1	1	1	0	0	
	SH20A/SH20 southbound interchange ramp	Alternative routes for southbound traffic; Reduction of rat-running freight and general traffic through airport precinct and local roads, improving local amenity	1	2	3	2		
	SH20 widening	Reduce weaving on through lanes; Reduce conflict points;	1	1	1	0	0	
	RTC on SH20B	Improve public transport journey experience - more direct connection than SH20; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required.	2	3	3	2	2	
	Pukaki Creek four-lanes	Improved airport access; Improved trip reliability for airport traffic; Reduced travel time; Increased trip reliability along SH20B. Additional capacity could encourage rat-runs through the airport.	0	1	1	0	0	
	RTC from Puhinui Road to Botany	Improve public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required; Improve accessibility to local town and business.	2	3	3	2	2	
Option 2B	SH20B online widening at-grade connections	Reduced speed differential, through facilitation of local traffic via Service road; Some reliability improvements for time-sensitive airport traffic Fewer diversion/ detour route availability than offline option	1	1	1	0	0	
	SH20A/SH20 southbound interchange ramp	Alternative routes for southbound traffic; Reduction of rat-running freight and general traffic through airport precinct and local roads, improving local amenity	1	2	3	2		
	SH20 widening	Reduce weaving on through lanes; Reduce conflict points;	1	1	1	0	0	
	RTC on SH20 and SH20A	Improve public transport journey experience - but longer journey time from eastern approach than A options Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required; Improve accessibility to local town and business.	2	3	2	1	2	
	Pukaki Creek four-lanes	Improved airport access; Improved trip reliability for airport traffic; Reduced travel time; Increased trip reliability along SH20B. Additional capacity could encourage rat-runs through the airport.	0	1	1	0	0	
	RTC from Puhinui Road to Botany	Improve public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required. Improve accessibility to local town and business.	2	3	3	2	2	

	Option Descriptions	Assessment	Investment Objectives and Associated NOP Operating Principles SCORE: To improve health, safety and security of people	SCORE: To improve the reliability and resilience of the transport system	SCORE: To improve economic performance of the airport area, Auckland and New Zealand	SCORE: Reduce the effects of the transport system on the environment and taonga	SCORE: A network that provides value for money	Map
Option 3A	SH20B online widening at-grade connections	Reduce speed differential (Service road); Improve reliability for time sensitive airport traffic Fewer diversion/ detour route availability than offline option	1	1	1	0	0	
	SH20A/SH20 southbound interchange ramp	Alternative routes for southbound traffic; Reduction of rat-running freight and general traffic through airport precinct and local roads, improving local amenity	1	2	3	2		
	SH20 widening	Reduce weaving on through lanes; Reduce conflict points;	1	1	1	0	0	
	RTC on SH20B	Improve public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required.	2	3	3	2	2	
	Pukaki Creek two-lanes	Increased weaving on either side of the Pukaki Bridge; No significant airport access improvements, west of the P&R; Possible increased in local delays, affecting airport traffic trip reliability. There could be an increase in local traffic demand.	-1	-1	0	0	0	
	RTC from Puhinui Road to Botany	Improve public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required; Improve accessibility to local town and business.	2	3	3	2	2	
Option 3B	SH20B online widening at-grade connections	Reduce speed differential (Service road); Improve reliability for time sensitive airport traffic Fewer diversion/ detour route availability than offline option	1	1	1	0	0	
	SH20A/SH20 southbound interchange ramp	Alternative routes for southbound traffic; Reduction of rat-running freight and general traffic through airport precinct and local roads, improving local amenity	1	2	3	2		
	SH20 widening	Reduce weaving on through lanes; Reduce conflict points;	1	1	1	0	0	
	RTC on SH20 and SH20A	Improve public transport journey experience - but longer journey time from eastern approach than A options Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required; Improve accessibility to local town and business.	2	3	2	1	2	
	Pukaki Creek two-lanes	Increased weaving on either side of the Pukaki Bridge; No significant airport access improvements, west of the P&R; Possible increased in local delays, affecting airport traffic trip reliability. There could be an increase in local traffic demand.	-1	-1	0	0	0	
	RTC from Puhinui Road to Botany	Improve public transport journey experience; Increased people carrying capacity of the network; Dedicated right of way for transit (Bus priority); Reduction in private vehicles travelling along the corridor; Transit lanes can be converted to HOV lane; Transit lanes can facilitate emergency vehicle access if required.	2	3	3	2	2	

Score	Definition
3	Significantly positive
2	Moderately positive
1	Minor positive
0	Neutral (against the do-minimum)
-1	Minor adverse
-2	Moderately adverse
-3	Significantly adverse

20 Connect Investment Objectives	Southwest Gateway NOP Operating Principles
To improve health, safety and security of people	To improve safety for all users on the transport system.
	To enhance the customer perception of safety.
To improve the reliability and resilience of the transport system	To deliver the outcomes as defined by the ANOP and GPS on Land Transport.
	To maintain access along SH20 to ensure the WRR can perform its strategic function as an alternate route to SH1 during unplanned and planned events.
	Provide an agile network that can keep people and goods moving.
	To provide resilient access to and from Auckland Airport to enable it to carry out its function as a lifeline utility.
To improve economic performance of the airport area, Auckland and New Zealand	To enhance overall network efficiency.
	Efficient and reliable public transport travel times to and from the Northern and Eastern Airport approaches.
	Prioritise public transport on key routes by time of day.
	Provide priority on SH20, SH20A and SH20B for trips to inter-regional markets over local access.
	Prioritise freight movements to and from the northern and southern industrial areas and airport.
	Prioritise active modes within 400-800m of high activity pedestrian areas.
	Support the amenity function around key activity centres by improving walking and cycling access.
	Improve connectivity of walking and cycling network facilities into the wider Auckland network. This will provide a viable transport mode for local and medium distance trips for users of all ages and abilities, and support access to public transport.

	Improve trip reliability for time sensitive aeronautical traffic (passengers, crew, time sensitive freight) to and from the airport.
	Discourage non-airport related traffic from travelling through the airport precinct.
Reduce the effects of the transport system on the environment and taonga A network that provides value for money	Improve local amenity and air quality by reducing ‘rat running’ commuter traffic and freight on local roads.
	Provide flexible infrastructure to allow for changes in operating requirements.
	Design flexible infrastructure to allow for changes in transport technology.

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Bringing ideas to life

AIRPORT TO BOTANY

Concept of Operations

Auckland Transport

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Appendices

Appendix A

Glossary of abbreviations

Abbreviation	Term
A2B	Airport to Botany
AC	Auckland Council
AIAL	Auckland International Airport Limited
AMA	Auckland Motorway Alliance
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
ATOC	Auckland Transport Operations Centre
AVID	Automatic Video Incident Detection
AVL	Automatic Vehicle Location
BRT	Bus Rapid Transit
CC2M	City Centre to Māngere
CCTV	Closed Circuit Television
CPTED	Crime Prevention Through Environmental Design
EHP	Emergency Help Point
FPD	Fare Payment Device
INCOSE	International Council on Systems Engineering
ITDP	Institute for Transportation and Development Policy
IPTED	Injury Prevention Through Environmental Design
ITS	Intelligent Transport System
LTMA	Land Transport Management Act 2003
NOP	Network Operating Plan
ONRC	One Network Road Classification
PA	Public Address
PBC	Programme Business Case
PID	Passenger Information Display
PTOM	Public Transport Operating Model
RCA	Road Controlling Authority
RMA	Resource Management Act 1991
RTN	Rapid Transit Network
SCATS	Sydney Coordinated Adaptive Traffic System
SH(#)	State Highway (number)
SSBC	Single-Stage Business Case
SPBC	Supplementary Programme Business Case
SUP	Shared Use Path
TDM	Transport Design Manual
Transport Agency	NZ Transport Agency
TTMP	Temporary Traffic Management Plan
VIP	Very Important Person
VRD	Vending and Reload Device
WRR	Western Ring Route

1 Introduction

1.1 Background

In 2018, the Transport Agency, Auckland Transport (AT) and Auckland International Airport Limited (AIAL) designated the collective suite of projects addressing Airport access to the east and south as "The Southwest Gateway Programme". It is a programme of three key transport projects to create a well-connected transport system that provides choice and reliability for how people and freight travel around southwest and southeast Auckland, including to and from the Airport. The programme aims to:

"Connect communities and support growth by ensuring it's possible to move increasing numbers of people. The efficiency of freight will be improved by providing greater travel choice, improving safety and in turn improving accessibility to jobs, education and social opportunities, reducing congestion and providing health and environmental benefits."

The Auckland Airport Access Programme Business Case (PBC) was endorsed by AIAL, the Transport Agency and AT in June 2017. Its key purpose is to strongly encourage mode shift, as well as better network and demand management to meet the growing demand needs of the Airport and surrounding area. It recognises that it will not be possible to accommodate the level of anticipated demand with road capacity alone.

To achieve this, 20Connect and Airport to Botany Rapid Transit projects are being planned jointly, along with AIAL improvements, to ensure that the staging and sequencing of improvements supports the overarching objectives of the programme. Figure 1-1 maps out the three projects that form the Southwest Gateway programme.

Figure 1-1: Southwest Gateway project map

1.2 Purpose of Document

This document describes the operation of the Airport to Botany Rapid Transit system (and adjacent transport network) as part of the Southwest Gateway programme.

The Concept of Operations forms part of a suite of documents developed to support the development of a rapid transit connection between the Auckland International Airport and Botany. Key documents include:

- **A Single Stage Business Case** which sets out the case for investment and value proposition including options considered, costs and benefits.
- **A Preliminary Design Philosophy Statement** which describes the design assumptions and philosophy
- **A Concept Design** which illustrates the proposed physical outcome, establishes feasibility and allows costs to be developed and impacts assessed
- **A Consenting Strategy** which details the proposed pathway for obtaining environmental approvals
- **This Concept of Operations** which describes the system design and operational concept

Together, these documents outline why the investment should be made, how much it will cost and its benefits, what form it should take operationally and physically, how it should be developed and when it should be developed. There are a number of Technical Notes and papers which support each of these documents. Those that are source documents for this Concept of Operations are detailed in Section 1.4.

Within this context, the primary purpose of the Concept of Operations is to cover the service and operational aspects of the future Airport to Botany service. As the service is expected to operate on corridors controlled by Auckland Transport, the NZ Transport Agency and Auckland International Airport, this Concept of Operations is intended to inform all road controlling authorities.

There are three objectives of developing this Concept of Operations for the proposed transport system:

1. To collate the operational assumptions underpinning the business case and concept design.
2. To identify important system attributes and potential interfaces.
3. To provide a basis for which system requirements can be developed as the design progresses through subsequent stages, in line with the System Engineering process.

1.3 Development note

The International Council on Systems Engineering (INCOSE) describes Systems Engineering as an interdisciplinary team process aimed at creating successful systems. The process starts by defining customer needs and functionality, before going onto create a holistic design. Business and technical needs of all customers are considered, with the goal of providing a quality product that meets the user needs.

Systems Engineering is an internationally accepted approach to complex transportation projects and is often referred to as the v-model (see Figure 1-2), which begins with a 'Concept of Operations' which informs subsequent phases. Figure 1-2 shows where the Airport to Botany RTN concept design, Design Philosophy Statement and Concept of Operations fit in the Systems Engineering process.

The INCOSE states that *"Research shows effective use of Systems Engineering can save 10-20% of the project budget. It is not hard to know when System Engineering fails, because when something important goes wrong it usually makes the news fast. People get hurt, programs are delayed and over-budget, the law becomes involved."*

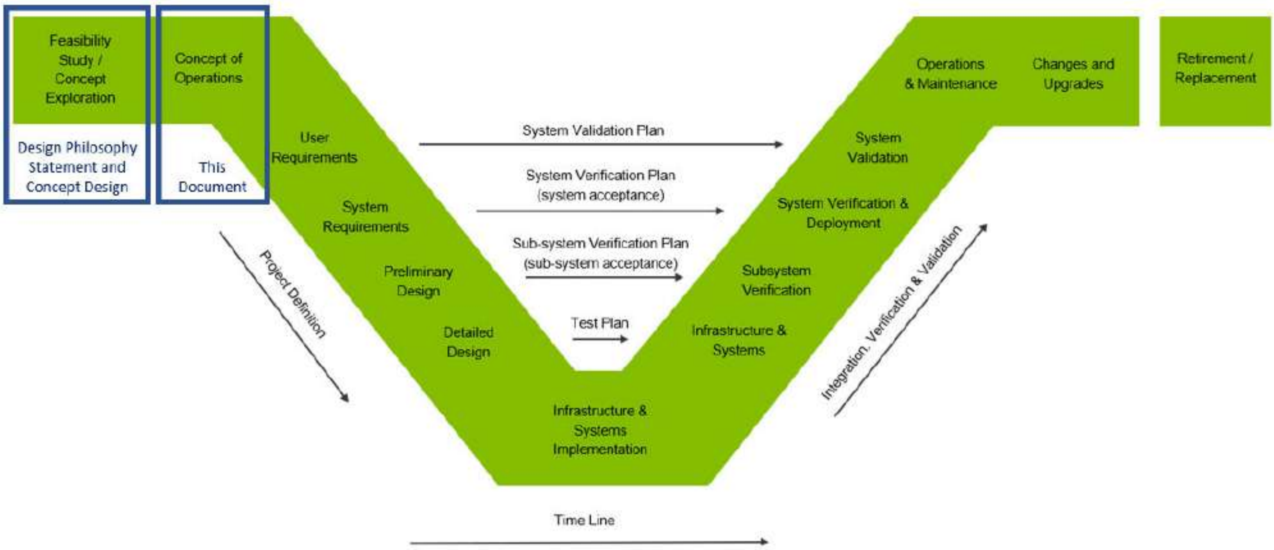


Figure 1-2: Systems engineering V-model showing current status (source: adapted from U.S. Department of Transportation guide for Designing for Transportation Management and Operations)[1]

Benefits of systems engineering include:

- A better product for the customer (for end-users).
- Reduced design changes.
- Reduced through-life costs.
- Better traceability of decision making.
- Management of risk.
- Improved organisational learning.

This document is intended to both commence the systems engineering process at this early stage and also to describe the intended operational concept for the system to inform scoping of future phases and give effect to the value proposition outlined in the business case. The document includes many areas undefined at this stage that should be defined as development progresses.

Note that this Concept of Operations is developed at a very early stage in the project's lifecycle as per Figure 1-2. The Concept of Operations is a *'living'* document and is subject to regular review and revision as the projects progress.

[1] https://ops.fhwa.dot.gov/publications/fhwahop13013/fhwahop13013.pdf

1.4 Relationship with other documents

This document is a collation of elements from a number of technical notes developed to inform the business case and concept design. Not all elements of all documents are relevant to the Concept of Operations. Figure 1-3 shows the documentation that has been used to develop this Concept of Operations. These documents can be referred to for greater detail in each specific area.

SWG Programme documents

- Auckland Airport Access PBC
- Auckland Airport Access SPBC
- Airport transport system improvements (led by AIAL).
- 20Connect SSBC
- Airport to Botany SSBC
- SWG Network Operating Plan (PLN-KK-0002)

Technical documents

- Short List Options Assessment and Preferred Option (502334-6000-TEC-JJ-0003)
- Long List Assessment and Short List recommendation (502334-6000-TEC-JJ-0002)
- Rationale and Design Principles for Active Modes (502334-7000-TEC-KK-0022)
- RTC Placement Assessment (502334-7000-TEC-KK-0030)
- Station Locations (502334-7000-TEC-KK-0004)
- RTN Modes and Demands (502334-7000-TEC-KK-0024)
- Speed Limits Along the Airport to Botany Mass Rapid Transit Corridor (502334-7000-TEC-KK-0040)
- Preliminary Design Philosophy Statement (502334-7000-REP-JJ-0024)
- High Level Station Access Assessment (502334-7000-REP-KK-0028)
- RTN Demands and Mode Tech Note (502334-7000-TEC-KK-0024)
- Vehicle and Fleet Procurement Tech Note (502334-7000-TEC-KK-0026)
- Equity Assessment (502334-7000-TEC-0032)
- Detailed Stations Access Study (502334-7000-REP-KK-0029)

→ **Concept of Operations (this document)**

Figure 1-3 Documentation informing this Concept of Operations

2 The Need for Change

2.1 Current system

2.1.1 Strategic need

The Strategic Case contained within the Airport to Botany and 20 Connect SSBC are the source for the strategic need for the system. This is summarised below.

Strategic issues

The Strategic Case describes the four strategic issues – which can be opportunities - being addressed in the business case. They are:

- A large gap in access to the rapid transit network resulting in a lack of rapid, efficient and reliable public transport serving the desire line between the south-west, south and east of Auckland
- Poor quality access for a large, highly disadvantaged population
- Poor and worsening access to Auckland International Airport
- The need to provide access for more affordable housing and higher quality urban development in South Auckland.

The issues are discussed now to provide the wider context before they are considered in depth in Section 4 looking at the problem statements and supporting evidence.

Problem definition

Problem statements were developed at a standard investment logic map (ILM) workshop. The ILM identifies four problems, that the business case responds to:

1) Costly, unreliable, long and complicated trips severely limit people's ability to meet daily needs for work, learning and socialising, reinforcing ongoing deprivation
2) Poor east-west travel choices in the study area constrain current and future growth, undermining prosperity for Aucklanders
3) The current transport system does not recognise cultural identity and taonga, diminishing the Mauri of the area
4) Perceptions of poor personal safety limit uptake of public transport and active modes.

The evidence to support these problem statements is discussed in the following sections, while the benefits of responding to the problems are discussed in the Strategic Case.

Objectives

The Objectives for the A2B project represent the measure of success of the system. These were designed to support the entire A2B process including route selection. The highlighted sections represent key aspects relevant to the operating strategy for A2B and 20 Connect:

- More **equitable access and travel choices to jobs, learning, cultural and social activities** for south and east Auckland
- **Reliable and resilient** transport system in south and east Auckland that is **easy to use**
- Transport network that enables **efficient movement** of people and goods
- Urban regeneration and **improved built environment**

- Minimal impact of the transport system on the environment and taonga
- **Safe and secure** transport facilities in south and east Auckland

Physical context

The corridor from the airport to Botany passes through various urban and rural areas each of which present their own set of opportunities and challenges when developing the transport network.

At the western end of the corridor the airport is bounded by Manukau Harbour to the west and south, and the large industrial zone of southern Māngere to the north. To the east the airport is partially separated from the Puhinui Peninsula by the Pukaki and Waokauri Creeks. Each of these creeks has Māori reservation status.

SH20B connects the airport to the Manukau central area via Puhinui Road which crosses the Pukaki Creek on the two lane Pukaki Bridge. This section of the corridor then travels onwards through largely open fields before the land becomes densely urban at the intersection with SH20A.

Taking a line along Puhinui Road from SH20A to Manukau city centre the urban environment is roughly divided into two zones with low density residential to the north including the suburb of Papatoetoe, and the industrial zones of Wiri and Manukau to the south. This section of the corridor is bisected by the North Island Main Trunk (NIMT) railway line. Puhinui passenger station is located centrally within this section of the corridor at the north-eastern corner of the Wiri industrial zone. A 2.5 km spur line off the NIMT railway line south of Puhinui station, passes through the commercial zone to Manukau city centre.

Central Manukau marks an approximate halfway point between the airport and Botany. The commercial centre sits on the north western side of the intersection of the Southern and the South-Western Motorways.

From Manukau the corridor heads in a straight line through to Botany. This section of the route has few notable geographical features except several streams and creeks. Taking Te Irirangi Drive as a central reference line, the eastern half of this section of the corridor is predominately residential, a zoning only broken by a small commercial zone at Botany Junction and Sancta Maria College. On the western side the area is dominated by the large industrial zone of East Tāmaki.

2.1.2 Current transport network

State highways

- SH20, SH20A and SH20B are each classified as National, High Volume highways under the One Network Road Classification (ONRC)
- SH20 is a four-lane motorway, connecting Manukau to the south with Māngere, the inner western suburbs and SH16 to the north.
- SH20 forms the southern-most section of the Western Ring Route (WRR)
- SH20A and SH20B connect from SH20 to the airport and the surrounding industrial area
- SH20A is a four-lane expressway, which has recently been upgraded to motorway standard with grade separation, running from SH20 at Māngere to the airport precinct
- SH20B is a two lane, undivided corridor with limited local access providing the southerly access to the airport.

Local roads:

A well-developed local network, including:

- Un-divided, two-lane arterial roads with direct property access such as Puhinui Road
- Divided two-lane roads with direct property access such as Lambie Drive and Ronwood Avenue
- Divided four-lane arterial roads with a mixture of direct and indirect property access such as Te Irirangi Drive

Rail

- The North island Main Trunk railway line runs north to south through the A2B corridor and provides both passenger and freight services
- The Manukau spur connects with the stations to the north only
- Stations in the study area located along the NIMT line include Homai, Puhinui, Papatoetoe, Middlemore, Māngere and Ōtāhuhu. The Manukau Station is located on the Manukau Branch.

Public transport services

AT's New Network for bus services in south Auckland was implemented in October 2016. The New Network is based on a frequent connected service model that aims to enable public transport journeys between a wider range of origins and destinations.

There is currently very limited dedicated bus priority provided on SH20A or SH20B. This means that bus travel to and from the airport is often unreliable because of congestion on the road network. Some bus lanes exist on SH20A and transit lanes are provided in parts of AIAL's network.

AT provides the following public transport routes to the Airport:

- 380 Airporter. This service operates between Onehunga, Māngere Town Centre, and Manukau, via Papatoetoe and Onehunga Train Stations. Services operate every 15 to 20 minutes, seven days a week, 365 days a year, during the day. It takes a relatively circuitous route, particularly between the Airport and Onehunga.
- Train-Bus service to Auckland Airport via Papatoetoe and Onehunga Train Stations (using the 380 Airporter bus). Train services operate run between 5am – 10pm (approximately) with later evening services on Fridays.
- Route 31 Bus. This bus route travels between Botany Town Centre and Māngere Town Centre via the Papatoetoe Train Station – and via Otara Interchange (MIT campus), Hunters Corner and Papatoetoe Train Station (on Shirley Rd). Route 31 operates every 15 minutes from 7am to 7pm, seven days a week. Outside of these hours it runs every 30 minutes. The Route 31 still requires a transfer to the Route 380 to access the airport.

These routes are provided on a simple zoned fare system using cash or AT HOP.

SkyBus offers a commercial service to and from the Airport that has premium fares and runs every 12 minutes during peak times. It carries approximately 780 inbound passengers and 600 outbound passengers per day. SkyBus offers the following public transport options to and from the Airport:

- Auckland City Express – a frequent service via Mt Eden Road which operates 24/7
- North Harbour Express – a frequent service via Akoranga, Smales Farm and Westfield Albany. This service operations 04:00-23:00 to the Airport and 06:00-22:00 from the Airport.

Other bus operators offering public transport to the Airport include: Intercity and SKIP®.

Walking and cycling network

The area surrounding the Airport is relatively flat, however there is very little cycle infrastructure close to and within the airport precinct. The existing network is described below:

AT – local road connections

There are very limited cycling facilities provided on the AT road network around the airport, particularly when approaching from the south and south-east. The facilities provided are intermittent and do not currently provide a continuous cycle route to the Airport precinct from surrounding areas such as Onehunga, Māngere East, Favona, Ōtāhuhu, Papatoetoe and Puhinui.

NZ Transport Agency - state highway connections

No dedicated walking or cycling facilities are located alongside SH20B or SH20 and there are currently no strategic metro-grade cycling facilities to access the airport and its surrounds from the south-east. Vehicle speeds and volumes on SH20B are not considered appropriate for safe walking and cycling (although these activities are permitted), given the current lack of protection for vulnerable users on the road. Recently upgraded sections of SH20A have cycle facilities.

3 Programme Context

3.1 Southwest Gateway – Airport to Botany Rapid Transit and 20Connect

The Transport Agency, AT, and AIAL have agreed on a comprehensive set of actions based on behaviour change, improved network management and capacity interventions, implemented in a staged manner progressively over time. Each stage of the programme targets the specific problems of different customer groups, achieving cumulative benefits that will escalate and over time, meeting the investment objectives of the Southwest Gateway programme. These changes are summarised in Table 3-1 below.

The focus of this Concept of Operations is on the long-term improvements.

Table 3-1: Change programme

Programme stage	Transport system changes
Short-term improvements (2018 to 2020/21)	Within the overall Southwest Gateway strategy, a set of initial proposals were identified by the project partners to be advanced in the short-term period to 2021, to provide more immediate benefits. These improvements make the most of existing infrastructure and services to improve travel choices and journey experiences. The shorter-term measures are seen as having high importance and priority within the overall programme. The following improvements are expected to be completed by the end of 2020/early 2021, subject to consenting and funding: ▪ A new bus/rail interchange at Puhinui station - providing more reliable and timely travel choices as well as connecting people to wider Auckland through southern and eastern line train services. Allowance for the future rapid transit overbridge across the rail line to provide a more direct connection with Puhinui Station Interchange ▪ New direct bus services between the Airport, Puhinui station and Manukau and potential new bus service routes between the Airport and other centres (a new Route 36) – subject to funding ▪ Priority lanes for public transport between the Airport, Puhinui and Manukau via Lambie Drive ▪ Two new intersections on SH20B between Campana and Orrs Roads to accommodate a proposed future Park & Ride, and at Manukau Memorial Gardens to improve access and safety ▪ Localised road widening and resurfacing, drainage and stormwater treatment on SH20B ▪ Improved walking and cycling facilities between Pukaki Creek bridge, Puhinui Station and Manukau ▪ Improved cycling and walking in the Māngere, SH20/SH20A area. These improvements will deliver the following benefits: ▪ Every 10 minutes a bus will travel the 12-15-minute journey between the Airport and Puhinui Station allowing people to make connections via frequent train services and access Manukau. ▪ More reliable and timely travel choices around southwest and southeast Auckland, including to and from the Airport ▪ Improved access to jobs, education and social opportunities

Programme stage	Transport system changes
	▪ Improved safety and environment ▪ Contributes towards long-term outcomes.
Long-term improvements (2021 – 2048)	▪ Staged delivery of rapid transit between the Airport and Botany – Airport to Puhinui Rapid Transit system via SH20B – Puhinui through Manukau RTN via Manukau Centre along Ronwood Ave – Manukau to Botany RTN via Te Irirangi Drive ▪ State highway widening to support rapid transit – Widening of SH20B to a 4-lane expressway arterial road (including over Pukaki Bridge) – online at-grade – total of two lanes in each direction – New SH20B/SH20 southbound ramp ▪ Increased access to the state highways to free up local roads – New SH20A/SH20 southbound ramp – Additional lanes on SH20 between Manukau Harbour Crossing and SH20B interchange ▪ Walking and cycling facilities along SH20B ▪ Walking and cycling facilities along SH20 between Manukau Harbour Crossing and SH20B interchange.

3.2 Interfacing projects

There are a number of transport investments planned across Auckland. The Southwest Gateway programme will work with other initiatives including the City Centre to Māngere Light Rail and Eastern Busway projects to achieve a connected transport system that supports accessibility and growth in Auckland. It will also enable better use of existing investment in heavy rail with both the southern and eastern lines connecting to the upgraded Puhinui Station and onto the rapid transport corridor between the Airport and Botany.

Figure 3-1 Interfacing projects

3.2.1 Southwest Gateway – Auckland Airport Precinct Improvements

The Auckland Airport Precinct Improvements led by AIAL involves a programme of investment which enhances not only the transport network within the Airport precinct, but also integrates with the Transport Agency and AT's projects. In 2014, AIAL announced its latest master plan, which recommends a number of transformational infrastructure investments over the next 30 years, including a combined international and domestic terminal, new airfield infrastructure, second runway and upgraded departures and arrivals areas as well as upgrades to public transport, roading and walking infrastructure within the airport precinct.

3.2.2 Eastern Busway (Auckland - Manukau Eastern Transport Initiative)

The Eastern Busway is a project led by AT that will create a dedicated, congestion-free busway between Panmure, Pakuranga, and Botany town centres. Once the busway is completed, customers will be able to travel by bus and train between Botany and Britomart in less than 40 minutes. The busway will be supported by three new stations at Panmure, Pakuranga, and Botany, new cycling and walking connections, urban design enhancements, and improvements for general traffic such as advanced signalling at important intersections. Construction of the Pakuranga to Botany busway section and cycling and walking paths will be completed by 2025. The final stage between Panmure and Botany is due for completion in 2026. Botany Station will provide an interchange for the Eastern Busway and Airport to Botany Rapid Transit system.

3.2.3 City Centre to Māngere (CC2M) Light Rail

This light rail line between the airport and city centre will provide a reliable service along the route and connect communities along the corridor including employment hubs (i.e. city centre, Onehunga, Auckland Airport).

3.2.4 Supporting Growth – South Auckland

The Supporting Growth programme will support an additional 50,000 dwelling units and 30,000 job opportunities in the south Auckland communities of Takanini, Drury, Paerata and Pukekohe. This growth activity will generate increased transport demands that will directly affect the operation of the transport network. The aim of this initiative is to develop transport networks to support Auckland's new housing and business areas over the next 30 years. Projects currently being considered include:

- Road safety improvements
- Rail and bus infrastructure and service upgrades
- New walking and cycling facilities
- Strategic road network capacity upgrades.

4 Proposed System Overview

4.1 Route

The proposed alignment for the Airport to Botany Rapid Transit is illustrated in Figure 4-1

Figure 4-1: Proposed route and station locations

This route has been selected through the Airport to Botany SSBC process[2]. The route connects several major generators of demand and land use development, including the following:

Major employment areas:

- Auckland International Airport and its surrounding employment areas
- Manukau Central and Wiri
- East Tamaki
- Botany

Metropolitan Centres as defined in the Unitary Plan (major town centres with significant growth and mixed-use potential):

- Botany Town Centre
- Manukau Centre

Major mode interchanges with existing or proposed rapid transit lines and public transport services:

- Future light rail at Auckland Airport
- North Island Main Trunk (southern line services) at Puhinui

[2] Airport to Botany Single Stage Business Case, Part B

- Manukau Rail Line (eastern line services) at Manukau
- Bus services at Manukau Interchange
- Bus services and Eastern Busway at Botany

The route is 18km long and is expected to have 12 stations. The likely mode is bus rapid transit (BRT) although geometry will be such that light rail is possible in the future should conditions be appropriate. The system design is generally to have running ways separated from traffic, other public transport, pedestrians and cyclists although intersections with be at-grade with signal prioritisation for the RTN services. A separated cycle and pedestrian way are proposed along the length of the route.

4.2 Project stakeholders

Mana Whenua in the Auckland region are a partner and will retain a partnership role in the ongoing development of the system.

The key stakeholders in the ongoing system design include:

- Auckland Transport internal stakeholders
- New Zealand Transport Agency
- Auckland International Airport Limited
- Auckland Council
- KiwiRail
- Rail operators
- Bus operators
- Local Boards
- Panuku
- Kaianga Ora and other relevant Government agencies
- Heritage New Zealand Pouhere Taonga
- Freight and road user groups
- Union
- Advocacy and interest groups
- Community stakeholders
- Business associations
- Network utility operators
- Emergency services
- Directly affected property owners, lessees and tenants

5 Customers and User Needs

5.1 Travel patterns

5.1.1 Demands and occupancy

Figure 5-2 and Figure 5-3 indicate that the predicted demand profile is relatively flat and bi-directional. Unlike most radial transit routes that are strongly peaked in one direction, this corridor is generally predicted to have counter-peak flows that are approximately one-third to one half of the peak direction.

Furthermore, the flatness of the demand profile along the route suggests a high level of patronage turnover or 'churn'. This is where passengers board and alight at a range of points along the route in both directions, rather than travelling to a single anchor destination at one end of the route (as is usually the case with routes serving a city centre). This is not unexpected as the A2B route has what amounts to four anchor stations: one at either end by the commercial/employment centres of the airport and Botany Town Centre respectively, and in the middle at Puhinui rail interchange, and the Manukau Metropolitan Centre. Figure 5-1 shows this pattern. Annual estimates for major stations would see Botany with 6.4 million, the airport terminal with 4.0 million, Puhinui with 5.0 million and Manukau with 3.4 million boardings per year in 2040. Refer refer to Appendix A for further patronage data.

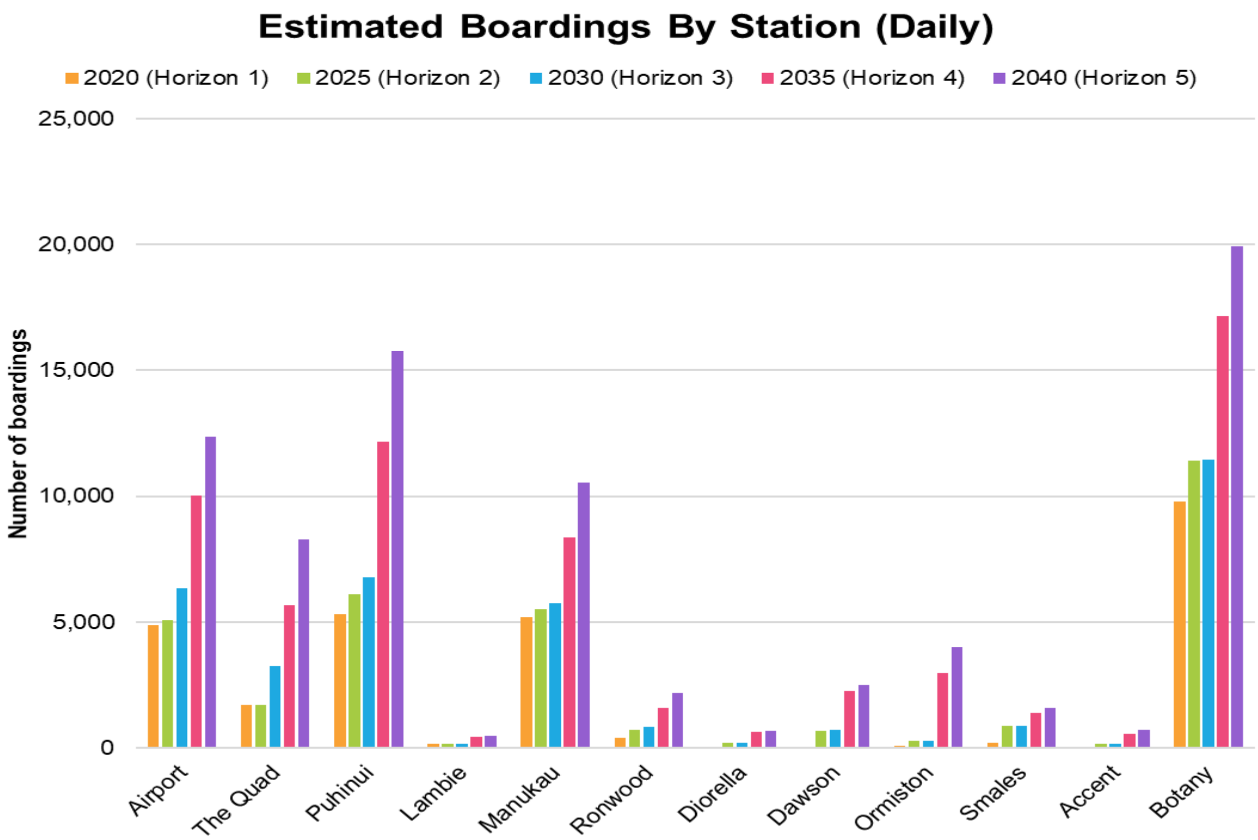


Figure 5-1: Forecast station patronage (source: MSM)

This combination of bidirectionality and high passenger turnover creates good conditions for efficient operations, translating into high boarding's (and fare revenue) per service-hour with high utilisation of fleet resources. Each 'seat' of capacity operated can be utilised multiple times in both directions by different passengers, unlike strongly radial unidirectional routes which achieve only one boarding per seat per return run.

This general trend notwithstanding, there is still a clearly observable peak flow originating in the generally suburban areas of Botany and Ormiston at one end of the route, and at the employment areas of Manukau and the Airport at the other. This manifests as generally higher occupancies on the Manukau to Airport section, with the highest occupancies observed on the section between Puhinui and the Airport. Furthermore, a small but distinct step change in occupancy is visible at Puhinui in each peak, indicating significant volumes of passengers using the Airport to Botany corridor to shuttle between Puhinui train station and the Airport in one direction, and between Puhinui and Manukau and the eastern suburbs in the other.

Overall, occupancies in 2048[3] can be broadly described as being in the range of 500 to 900 passengers per hour both ways during the interpeak and in the counter peak direction, increasing to peak loads of 1,500 to 1,900 passengers in the peak direction at peak times. This suggests the line could be served by a relatively simple service pattern that provides base capacity for 900 passengers per hour in both directions at all times, supplemented by additional capacity up to a total of 1,900 passengers per hour in the peak direction, at peak times.

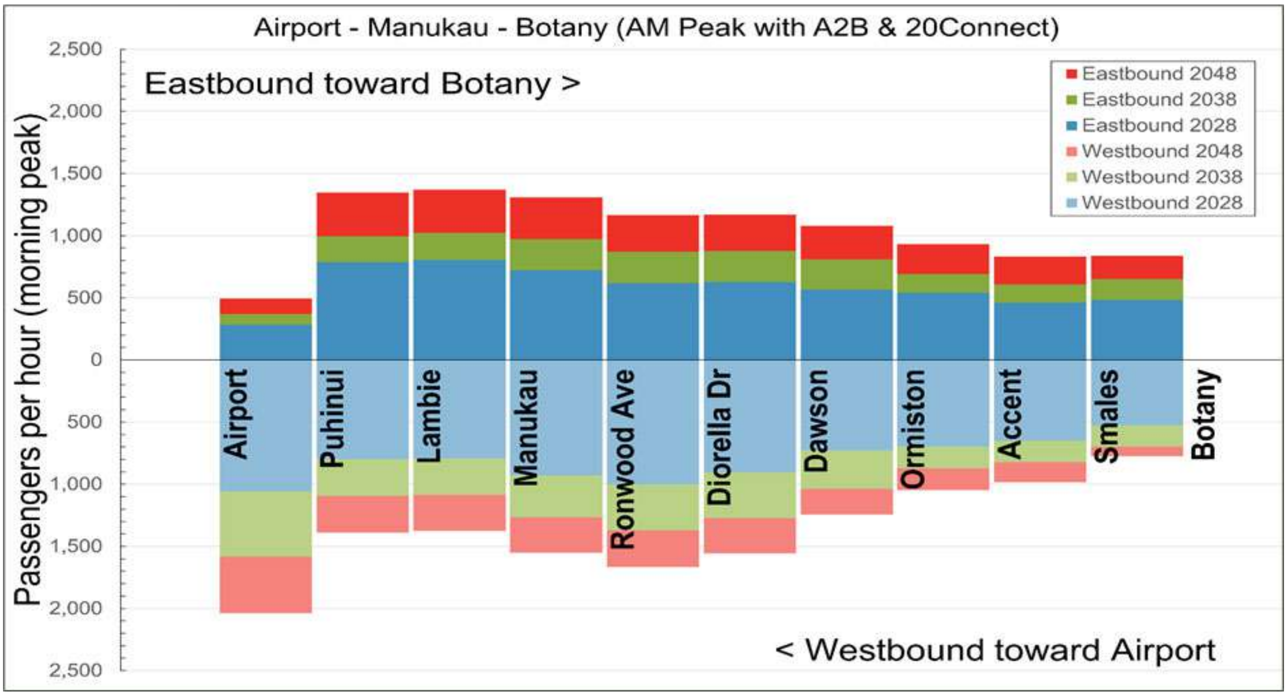


Figure 5-2: AM Peak occupancy by section and direction, by decade

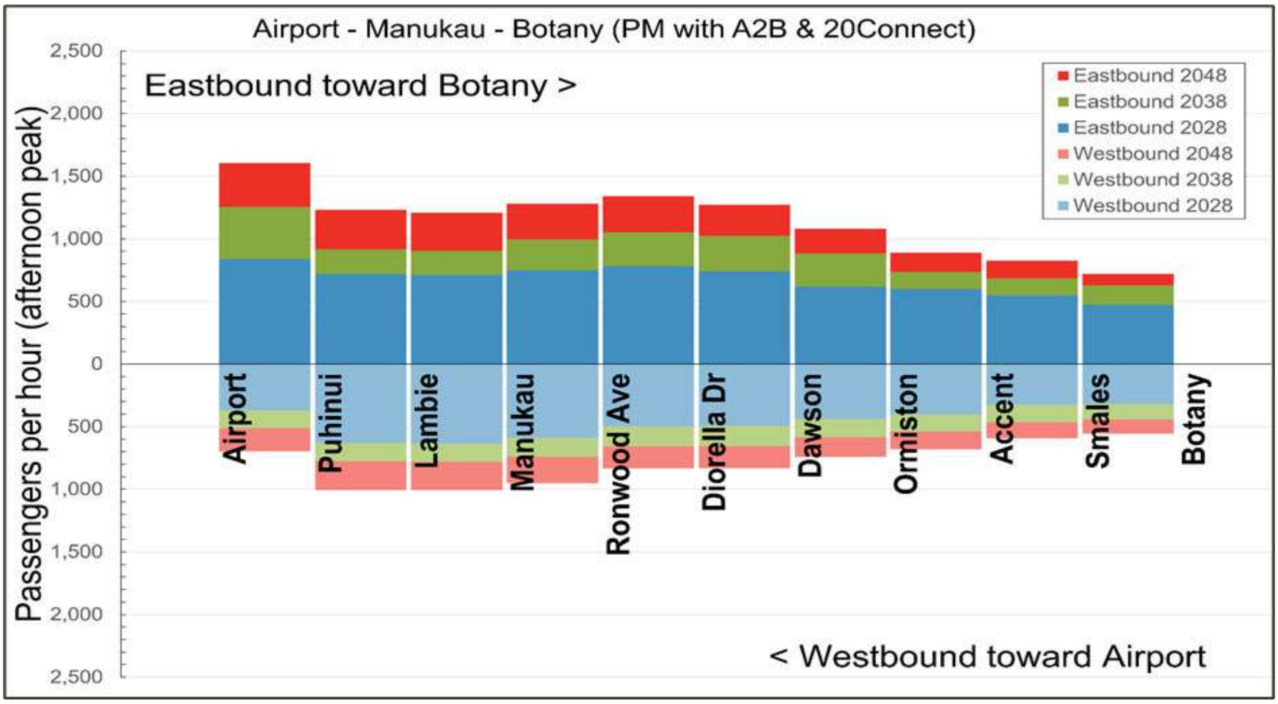


Figure 5-3: PM Peak occupancy by section and direction, by decade

[3] MSM forecasts i11 land use

5.1.2 System integration – origins and destinations of trips

At this early stage in development, patronage forecasts rely on a strategic model (MSM) which has limitations at a detailed level. It is possible however, to draw some conclusions as to the likely usage patterns and means/locations of access to the system in order to understand the system integration needs for the system.

Taking a forecast screenline on Te Irirangi Drive around the State Highway 1 crossing entering Manukau in 2048 (Figure 5-4) shows that:

- Just over half of all passengers crossing the screenline at Manukau have transferred from buses making operational and physical connections with local bus services crossing Te Irirangi Drive and at Botany important.
- Botany interchange is the largest source of transfers, but collectively the local bus interchanges at Smales, Ormiston and Dawson Roads are almost equal to Botany
- Approx. 42% of people crossing the screenline at Manukau have walked or cycled to stations, making pedestrian quality around stations important.
- Approx. 42% of people who are on the RTN as it enters Manukau are still on the system as it enters the airport, showing that the airport and its employment areas (including its specific customer groups and their needs) are significant considerations in the system design.

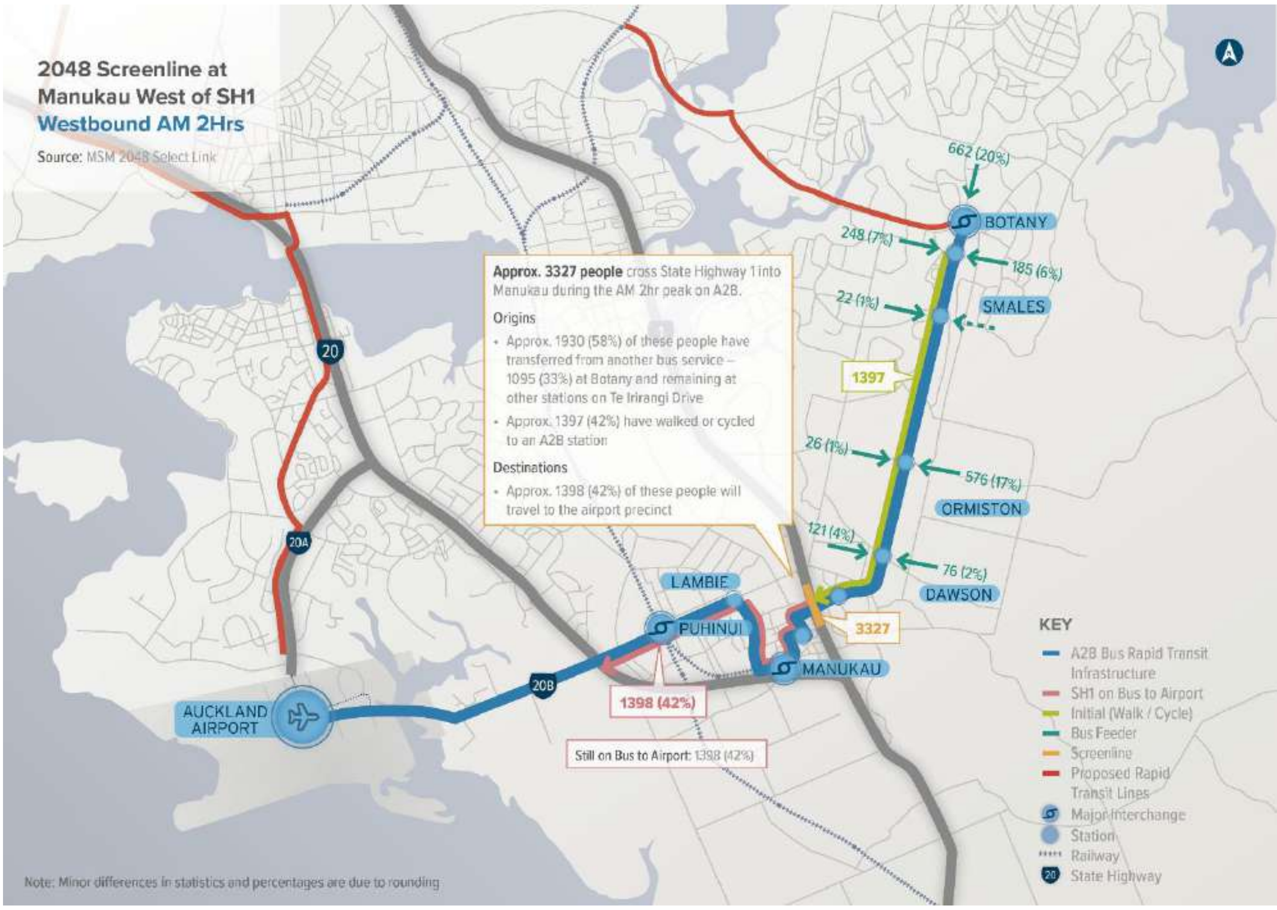


Figure 5-4: Demand origins and destinations. Screenline on Te Irirangi Dr, west of SH1 (source MSM i11.5 2048)

Taking a screenline on State Highway 20B as it enters the airport area in 2048 (Figure 5-5) shows that:

- There is a strong link with rail services at Puhinui Station. Almost half (45%) of the patronage entering the airport has come from trains (11% from the north and 34% from the south). This reinforces the importance of Puhinui Interchange and the importance of maintaining and enhancing a seamless transfer.
- There is a strong link with the southern growth areas of Auckland. Approx. a quarter of all people on the RTN as it enters the airport have come from Papakura or further south. This illustrates the alignment with Supporting Growth South and the need to consider wider network integration.

- People are making relatively long trips on the Airport to Botany system. Over half (52%) of the people accessing the airport on the service have come from the Airport to Botany route from east of Puhinui. This demonstrates a need for a fast service as a high proportion of customers are travelling relatively long distances.

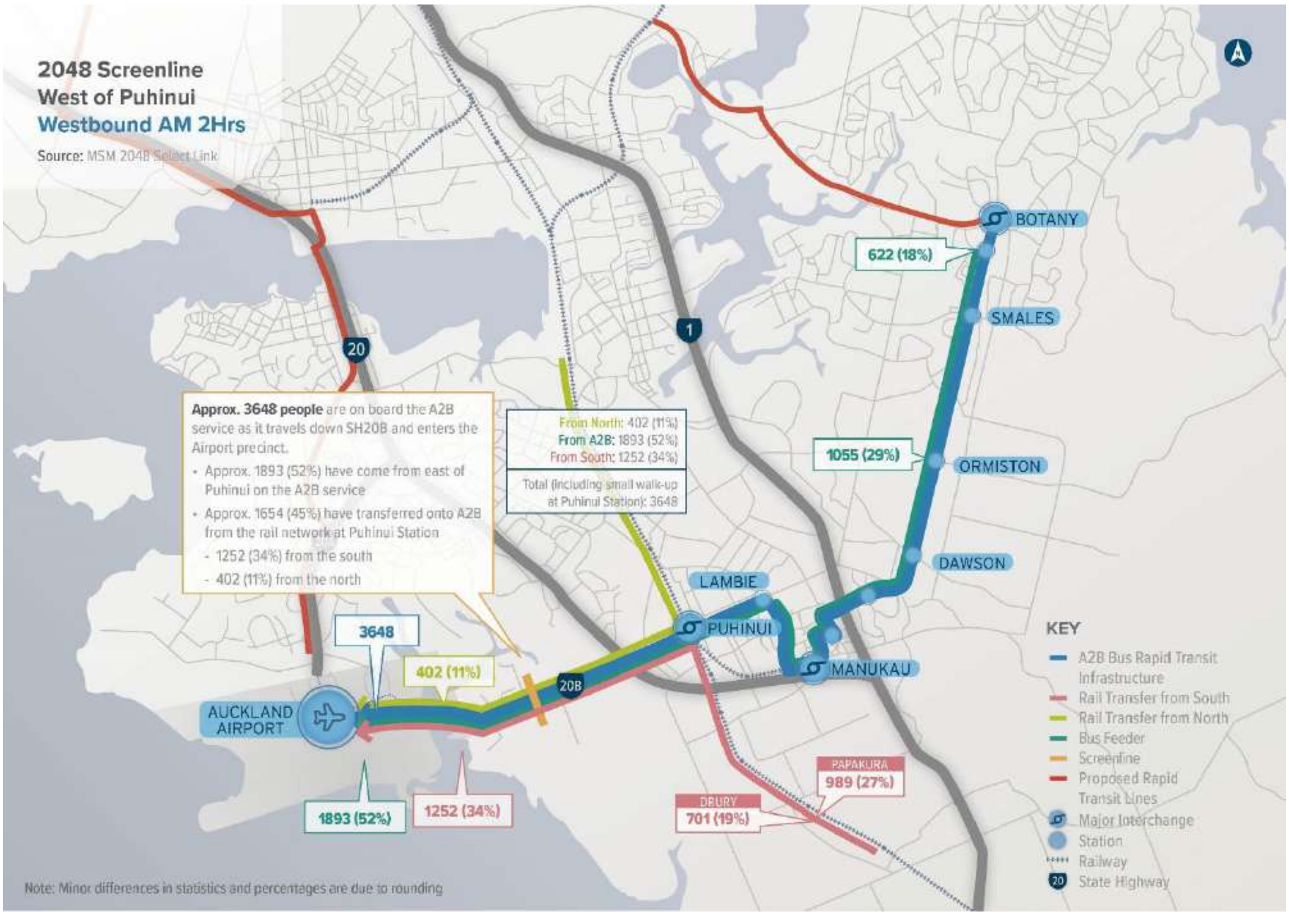


Figure 5-5: Demand origins and destinations. Screenline on SH20B (source: MSM i11.5 2048)

Taking a screenline on Puhinui Road as it enters Manukau in 2048 (Figure 5-6) shows that:

- There is a strong link with rail services at Puhinui Station. Two-thirds of the patronage entering the Manukau from the west has come from trains (8% from the north and 59% from the south)
- There is a strong link with the southern growth areas of Auckland. Approx. half of all people on the RTN as it enters the Manukau from the west have come from Papakura or further south.

Figure 5-6: Demand origins and destinations. Screenline on Puhinui Road (source MSM i11.5 2048)

5.1.3 System design implications

This data illustrates the need for an integrated design of the Airport to Botany system with the operation and design of the wider public transport network. The Airport to Botany line is a cross-connection linking:

- Two Metropolitan Centres in Botany and Manukau, each of which are major hubs for local bus services
- Four rapid transit lines, assuming Eastern Busway and City Centre to Mangere lines are built
- A number of arterial routes with frequent bus services accessing catchments east and west of the RTN route.

Customers will access the system via the following modes of transport:

- Walking
- Bicycle (including e-versions)
- Scooters and skateboards (including e-versions of these modes)
- Motorbikes
- Cars, vans and mini-buses e.g. private vehicle, taxi, on-demand taxi, rental car
- Buses e.g. local buses and Airport to Botany Rapid Transit line
- Trains.

Station function and arrival mode priorities are established in the High-Level Station Access Assessment[4] and discussed in detail in Section 6.3.1. A focus on access by a range of modes, including vehicular modes is a

[4] 502334-7000-REP-KK-0028

part of a response to a relatively low land use density, but significant catchments outside of the main centres the route serves.

5.2 Customer research

The SWG Programme has taken a customer-focused approach to planning and testing ideas, stemming from the early work in support of the Programme Business Case[5].

Customers will use this transport system for a variety of reasons, including:

- Commute to and from work (nine-to-five and a high proportion of shift-work movements). Key areas of employment include Auckland Airport, Airport precinct businesses, Manukau Metropolitan Centre, Botany own Centre, distribution centres in Wiri and East Tamaki, and Middlemore hospital
- Travel to education opportunities, particularly at Manukau (AUT and MIT campuses) and also numerous schools
- International and domestic air travel
- Travel to amenities e.g. shops, community venues and services, and Manukau Memorial Gardens
- Travel to local venues and leisure activities
- Picking up or dropping off friends and relatives at hubs.

5.2.1 Demographics

The Airport to Botany corridor has some of the most diverse populations in Auckland from an ethnicity, age and income perspective. Most of the users of the system are expected to live in the corridor or close by. Designing a transport system response to the needs of its community is important to ensure it is effective.

Socio-economic

Some areas surrounding the Airport to Botany route are scored as some of the more deprived areas according to the NZ Index of Deprivation in Auckland and indeed New Zealand. This index considers employment, income, crime rates, housing, health, education and access to services, such as medical, education and shopping. Areas to the north-east of the route have lower levels of deprivation index scores compared to the south-west. This is also reflected in the median incomes of the populations in these areas.

The study area is located within the Māngere-Ōtāhuhu, Ōtara-Papatoetoe, Manurewa, and Howick local board areas of Auckland Council. The information below provides a comparison between the local boards and the region as a whole of three of the basic measures of deprivation.

The information in Table 5-1 comes from the 2013 census[6] and data held by Auckland Council[7].

Table 5-1: Socio-economic data (Census 2013, Auckland Council)

Local Board	Population	Median Household Income ($)	Unemployment (%)	No formal qualifications (%)
Māngere-Ōtāhuhu	81,590	59,900	15.5	31
Ōtara-Papatoetoe	89,610	60,800	14	29
Manurewa	96,200	67,800	13.3	28.2

[5] Airport Access Supplementary Programme Business Case, 2017
[6] Latest data available has been used. a
[7] Demographic and economic statistics from https://ecoprofile.infometrics.co.nz/Auckland

Local Board	Population	Median Household Income ($)	Unemployment (%)	No formal qualifications (%)
Howick	150,200	84,500	6	14
Auckland avg.	**NA**	**76,500**	**6**	**17**

The Table 5-1 shows that wealth and opportunity are not shared equally throughout the local boards within the study corridor. When compared against the Auckland average, the three local boards closest to the airport, Māngere-Ōtāhuhu, Ōtara-Papatoetoe, and Manurewa all compared unfavourably across all of the three measures. Māngere-Ōtāhuhu, in particular, had high rates of unemployment, low levels of educational attainment, and the lowest median household income (MHI) in the study area.

Census 2013 information indicates high rates of renting from government organisations, such as Kāinga Ora, compared with the New Zealand average.

This is likely to present issues with affordability of travel and access to the system.

Age

The average age of people living near the proposed route is relatively young compared to the Auckland region. Most areas around the preferred route have a median age between 15 and 40. There are relatively few areas around the route where the median age is greater than 40. Several areas along the route have more than a quarter of the population under 15.

This attribute creates the need to enable access to education, access for people who cannot drive, and also present issues with affordability using the system.

Ethnicity

The catchment area is ethnically diverse, when compared with the rest of Auckland. Pasifika and Asian populations make up the largest population groups along the preferred route.

In some areas, particularly near Ōtara and East Tamaki, Pasifika populations make up more than 80% of the population. This is significantly higher than most of Auckland.

To the east of the route and in the area around Manukau, more than 40% of the population identifies as Asian. The areas surrounding the route have some of the lowest rates of population identifying as European in Auckland.

In areas to the south of the route, more than 20% of the population identifies as Māori. This means the area has a higher proportion of the population identifying as Māori than most of Auckland, except for some areas further south.

International and airport users

Directly servicing Auckland International Airport, the system is likely to have a greater than usual proportion of users who have limited or no English and have limited or no knowledge of Auckland's place names, geography and travel options.

This is likely to generate issues with legibility and language in using the service and require a simple, intuitive design of stations, the service pattern and signage, service labelling and timetables. This will also create the need for a simple suite of fare products that are easily accessible.

The airport is also likely to generate a higher than average proportion of one-off or infrequent users which will have implications for ease of use, legibility and access to fare products.

System response to demographic data

There are interventions, both in the development of the design and operation of the system that can greatly increase the access offered by the service to its likely specific users. These are detailed in Table 5-2 and are divided into interventions/design/operation already included in the system, and those which should be considered in further designs of both service and facilities as the service and infrastructure are further developed.

These interventions would enable people who are transport disadvantaged with more transport choice and are based on the 'seven principles of universal design' adapted for bus rapid transit by Bitterman and Hess (2008). These are:

- Equitable use
- Flexibility in use
- Simple and intuitive
- Perceptible information
- Tolerance of error
- Low physical effort
- Size and space for approach and use

Table 5-2: Design and operational responses to demographic and equity needs

Community sector	Sub group	Potential issues / travel behaviour	Design response	Operational response
Socio-economic deprivation	N/A	Limited access to smart phone data Less likely to have access to a car and high dependency on public transport Higher likelihood of working shift hours or early morning/late night stops and starts and lateness penalties	Welcoming and comfortable station design, including places to sit, Realtime information Sufficiently detailed information about the public transport network and available connections Toilets	Wi-fi access at stations for real time information / journey planning Timetabling of services to facilitate the movement of shift workers i.e. long service span, frequency, and onward connections. Availability of frequent and reliable onward connections Fare structure based on trip patterns of lower socio-economic groups Reliable service Frequent service
Age	Older people (65+ years)	Feeling of safety Space for carers Stress Lack of mobility leading to social exclusion	Places to sit Clear wayfinding Beauty Reduce the walking distance between shops, stops and benches to sit on Non-slip surfaces Shelter and shade	Enough time to connect between train and bus services Clear transfer information Longer pedestrian phases around stations Friendly, well-trained drivers Culture of offering seats to those in need Longer pedestrian phases around stations

Community sector	Sub group	Potential issues / travel behaviour	Design response	Operational response
	Younger people (5-20 years)	Travel in larger groups Physical safety, especially night time Potentially not able to drive High reliance on public transport More likely to work and socialise outside of peak hours May be taking part in study Limited income	Space to meet / linger Active transport connections in and around the A2B corridor	Fare concessions Frequent off-peak operating hours Tracking of youth ridership rates
	Children (0-5 years)	Space for carers Reliance on caregivers for transport	Family space Safe spaces for kids Wide paths without obstructions Safe, obvious, step-free access routes Toilet facilities at/near stations	
Gender	Pregnant women	Slower movement Stress Bathroom Easily exhausted	Places to sit out of traffic/busy areas Reduce the walking distance between shops, stops and benches to sit on Safe, obvious, step-free access routes Toilet facilities at stations	Enough time to connect between train and bus services Clear transfer information
	Women	Feeling of safety and actual safety Bathroom Sexual harassment More likely to be in a caring role for children or elderly Carry a lot of gear Multi-leg journeys	More toilets for women Safe night time waiting spaces 'Eyes on the street' Diverse land use, including public spaces such as parks and playgrounds which activate the community Storage or carrying capacity for different size and style of bikes Seating and resting places along walking routes Human scale lighting	Unscheduled stops at night to let women off the service closer to home
	Childcare	Slower movement More gear Changing facilities Limited time Prams and other children – safety Complex trip chaining	Unisex changing facilities Breastfeeding space A place to temporarily store gear / prams while working out logistics All door boarding Safe, obvious, step-free access routes	Trollies to transport gear Kneeling buses Frequent service, regular connection points for a range of journeys. Fare structure that does not deter multi-leg journeys / affordable weekly passes.
	Trans and non-binary people	Feeling of safety Physical abuse Sexual harassment Verbal harassment	Unisex toilets 'Eyes on the street'	Staff training including awareness of Trans and non-binary needs

Community sector	Sub group	Potential issues / travel behaviour	Design response	Operational response
Disabilities	Sensory impairment	Low or no vision Low or no hearing	Tactile wayfinding Cues and hazard identification	Audible and visual real-time wayfinding information Station/ operational staff available to answer queries
	Cognitive impairment	Orientation Stress	Space away from congestion to read wayfinding Obvious accessible routes	Clear line of sight Wayfinding
	Mobility impairment	Mobility aids – wheelchair, modified bicycle Uneven surfaces causing stress and uncertainty	Safe, obvious, step-free access routes Level boarding	Print, digital and on-street wayfinding information Station/ operational staff available to answer queries
	Mental health	Stress Anxiety Depression	Speed of lifts Beautification of station, such as street trees and green streets People watching areas Lighting Service standards reducing crowding	Frequent service Station/ operational staff available to answer queries Service crowding measurement and response strategies
Multicultural needs	Māori Pasifika Asian European	Family travel – potential for large groups Using the station as a meeting point Languages other than English	Place to meet and greet – large space needed Wayfinding with a range of languages Images and iconography in wayfinding Timetables available in more than one language	Allowing enough time for large family groups to board services Employ staff who speak more than one language

5.2.2 Customer profiles

To understand the customers and their purpose for travelling the Airport Access Programme Business Case 2017 categorised customers and used observed data from a range of sources to determine the proportions of the total customer base, as shown Figure 5-7. This was broken down broadly as employees (28%), air traveller international (20%), air traveller domestic (21%), meeters & greeters (28%), and freight (3%).

Figure 5-7 AT Customer Insights breakdown of customer segments by purpose of journey to airport

In the development of the Programme Case, investment partners and key stakeholders participated in a workshop in February 2017 to identify customer groups and understand their specific problems. These user groups align with the AT Customer Insights data and are grouped along with their key problem/s in Figure 5-8. “Needs” expressed as personal statements were developed by AT using actual customer feedback.

Air traveller - Business

"Getting to the airport by car or taxi means I don't have to work around schedules, can maximise time working rather than travelling, make calls on my way, and just get home after my trip. I need a better option so I know how long it will take and doesn't get me stuck in more and more traffic"

Air traveller - Non-business (from Auckland)

"I am focussed on our trip, not on getting to the airport. We have to build in a lot of extra time so we aren't late. If family can't take us, the park and ride is OK and our car will be waiting for an easy trip home. Taxis are expensive, and there is no train that we could easily get a family with luggage on without long transfers"

Air traveller - Non-business (from outside of Auckland)

"Auckland is a big enough city to have a good train and bus system, but when I arrive I don't see easy to use, affordable options. It's easier to take a taxi or shuttle, or a rental car especially if I am just passing through Auckland"

Nine to Five employee

"I am frustrated that it takes me longer and longer to drive in. I haven't really considered other options, because from where I live it would take a long time and multiple connections. I have a good car and like the flexibility, and have parking provided at work"

Shift employee

"I start and finish at odd times, I can't afford to be late, and cost is an issue for me. Buses don't start early enough, take a long time, and I don't feel safe walking after dark at either end. I would rather not drive, which takes ages when my shifts are at busy times, but it is the cheapest way to make sure I am on time"

Freight & passenger transport driver

"Getting in and out of the airport area is unreliable as we get caught in all the other traffic. It costs us time, limiting the number of jobs we can deliver and increasing costs through wages and vehicle running. There are very limited options for contingency planning as our clients' needs and schedules are fixed"

Figure 5-8: Customer problem statements (AT customer insights)

While being focused on airport access, this research indicates a broad range of users with specific needs unique to airport access and need to be considered in system design. Considerations such as the following are relevant to the operating concept:

- Reliability of journey times
- Easy to use to compete with simple options like taxis and car driving/parking
- Reducing connections or improving quality of connections (frequency, quality of facilities)
- A service span (duration and level of service) to allow access to airport shift patterns and flight times
- Comfort and quality to allow travel time to be spent productively
- Personal safety and security

5.2.3 Auckland Transport’s Kantar TNS research

Auckland Transport engaged research agency Kantar TNS to understand the current transport patterns, along with barriers to transport modes, transport needs, and opportunities to influence travel behaviour and mode choice. Their approach involved a qualitative phase made up of focus groups and intercept interviews at the airport, and an online survey of 1,000+ people for the quantitative phase. The groups the study targeted were office/ regular hour workers, shift workers, Auckland resident business customers, Auckland resident leisure travellers, domestic visitors to Auckland, and international visitors to Auckland.

The study found that cars were the most common travel mode to the airport, and recent infrastructure upgrades such as the Waterview Tunnel and services such as Park & Ride are seen as positives for those travelling by car. Cars are frequently preferred because of ease of travel and length of the journey, as well as free parking for workers and free pick up zones for visitors. The study identified that “pain points” for car travel are unreliable journey times and traffic congestion and found that the majority of those working in the airport area were dissatisfied with car travel.

Only 5% of non-public transport users between Botany and the airport would consider it in its current form and 63% of study participants “reject” public transport as an option. The study found the following barriers to using public transport:

- Changing buses to make a journey
- Unpredictable services
- Inconsistent service frequency
- Low service frequency
- Poor comfort and convenience
- Perception of poor experience

Addressing these barriers in the operating concept will be key to creating mode shift and achieving the objectives of the project.

When shown a design for a high-quality rapid transit system including extended routes and new stops and interchanges, 42% - 47% of non-public transport users said they would use it. This substantial improvement from 5% suggests that high quality system can effectively negate the above barriers to create an opportunity to shift people from cars to public transport.

The required response in the system design to these issues is:

- Quality, intuitive interchanges to allow mode changes to be easy and safe
- A dedicated right of way and signal priority to allow fast, reliable journey times
- A high frequency and long span of this frequency to allow journeys at the times people need to travel to access jobs and travel opportunities on this route
- Stations, waiting and arrival mode facilities of quality
- Information on approaches to stations, at stations and in vehicles of a form and quality to enable simple navigation and customer assurance

6 Description of Proposed Airport to Botany Rapid Transit System

6.1 Airport to Botany Rapid Transit and 20Connect

6.1.1 Southwest Gateway Programme

The Airport to Botany corridor runs from Auckland International Airport to Botany Town Centre, via major interchanges at Puhinui rail station and Manukau Town Centre and other intermediate stations. The corridor primarily runs within State Highway 20B, Puhinui Road and Te Irirangi Drive. This corridor alignment minimises the system's footprint and integrates the system within the existing urban/suburban fabric. SH20B will be widened to enable the rapid transit corridor to the Airport.

The rapid transit system will be a "managed system" that operates high-capacity BRT vehicles on a fully dedicated rapid transit corridor, with street level platform-style stops, offboard ticketing and all-door level boarding to deliver 'turn up and go' service levels. A managed system means that access to the system is limited to vehicles and services that meet certain standards so that the reliability and customer experience is not degraded through congestion and variable levels of service.

To achieve this 'turn up and go' experience, the system will operate all day and most of the evening, seven days a week. Minimum service will provide 10-minute headways (6 vehicles per hour) at all times of day, and 3 to 4 minute headways (20 vehicles per hour) at peak, where required for capacity.

As illustrated in Figure 6-1, as well as the Airport to Botany dedicated route and stations, 20Connect will make additional infrastructure changes to local highways to improve journey time reliability, network resilience and safety. These changes are:

- New SH20A/SH20 and SH20B/SH20 southbound ramps
- Widening of SH20 between Manukau Harbour Crossing and SH20A (online at grade)
- Widening of SH20 between SH20A and SH20B (online at grade)
- Widening of SH20B to four lanes (including over Pukaki Bridge) – online at-grade
- Walking and cycling facilities along SH20 and SH20B.

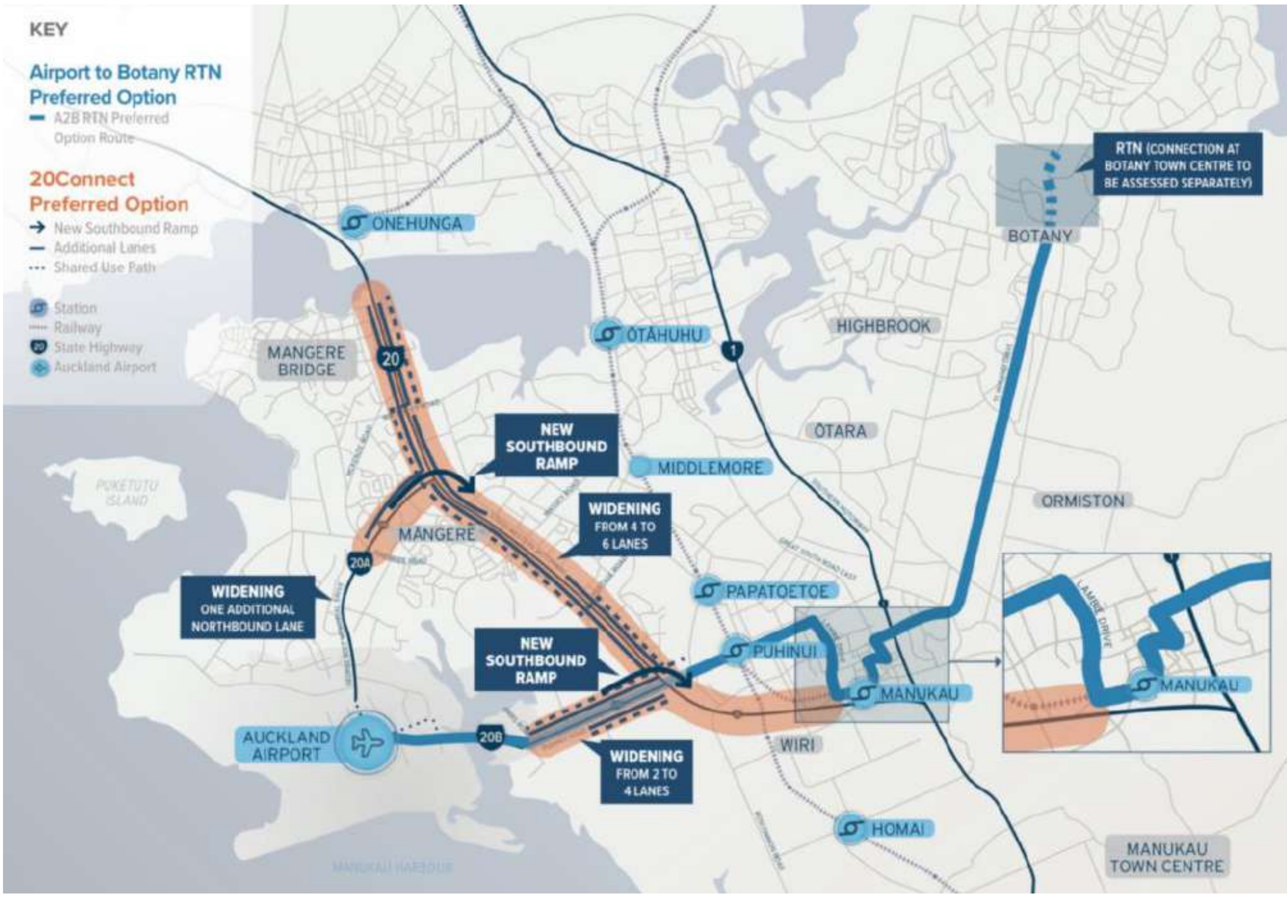


Figure 6-1 Airport to Botany and 20Connect recommended option infrastructure elements[8]

6.1.2 Network Operating Plan

The main priorities by mode, for the Network Operating Plan (NOP) study area are outlined below and illustrated in Figure 6-2.

Public Transport

Public transport is shown as a high priority along all proposed frequent bus or rapid transit routes. These include all the key corridors to and from the Airport. The Airport to Botany rapid transit route can be seen along SH20B - Puhinui Road - Manukau - Te Irirangi Drive.

Cycling

Active modes are a high priority on both SH20A and SH20B corridors. Typically cycling is provided as a high priority along all corridors on which public transport is a high priority to support last mile trips from public transport stops. Cycling has also been provided as a high priority on McKenzie Road and Coronation Road to connect cyclists travelling north-south with the new Mangere Bridge and SH20 cycleway.

Cycling is a high priority along the full length of the Airport to Botany rapid transit route, as well as along the two key arterials that run parallel to Te Irirangi Drive, supporting the east west connection.

On Massey Road and Ti Rakau Drive, only the active modes and public transport are given priority to better support the place and movement function of these east west connections.

Pedestrians

Although not shown on this map pedestrians are considered a high priority along every corridor except for SH20. Notwithstanding this, pedestrians are prioritised around public transport stations as well as in town

[8] The location of the shared use path is not fully depicted in the layout.

centres such as Mangere, Manukau, Botany, Ormiston and on the airport precinct, in particular around the terminal buildings.

Freight

Freight is a high priority on SH20 to facilitate inter-regional trips and access to the inland ports at Wiri and Onehunga. Freight is a high priority on SH20A and parallel Kirkbride Road, Richard Pearse Drive and Landing Drive to facilitate access to and from Airport Oaks given the large industrial and freight forwarding land use. Freight is a high priority along Favona Road and Walmsley Road to support east-west freight movements, previously provided for on Massey Road. There is no freight priority provided on SH20B however freight will still be accommodated. Southbound freight from airport Oaks will be encouraged, through mode prioritisation to first head north on SH20A and then south on SH20.

Secondary freight routes are shown by the dashed line, which represents an alternative access for freight to the state highway to ensure there is resilience in the system for freight which is typically time sensitive in nature.

General Traffic

General traffic and freight are only prioritised on SH20 and SH20A. General traffic is also given priority on SH20B but only between SH20 and Prices Road/ Campana Road where the Auckland Airport Park and Ride South is proposed as well as access through to future greenfield developments on this peninsula. Although general traffic is not prioritised on any other corridors, it is still accommodated to minimise delays where possible.

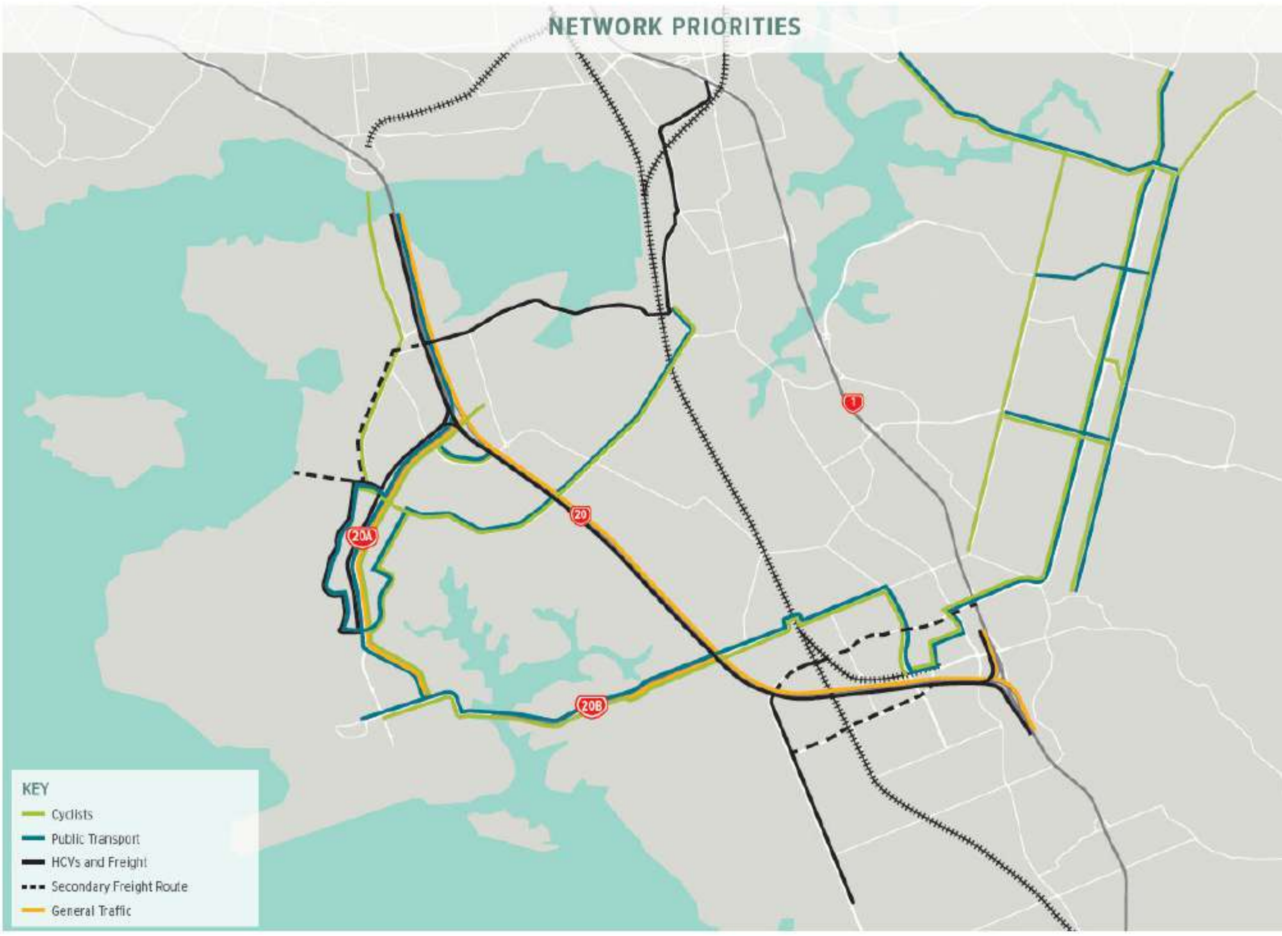


Figure 6-2: Network Operating Plan mode priorities

6.2 General system definition

6.2.1 A managed system

The preferred operating concept is for a fully dedicated rapid transit corridor that runs at-grade within the road corridor to avoid high land-acquisition costs and minimise impacts on existing transport and land uses. Therefore, the A2B system requires a road-capable mode with a relatively compact footprint that can be well-integrated with the existing urban/suburban fabric.

From a customer experience perspective, the intent behind the project is to generate changes in travel behaviour which, in turn will require delivering a product to people that is attractive and easy to use. To achieve this, the system design approach is to adopt as many of the positive characteristics as light rail transit which is generally seen as an attractive and easy to use mode.

For these reasons, a **managed-system** operating model is preferred. A 'closed system' is typical of light rail and BRT lines internationally. A managed system is proposed for A2B which is essentially the same but recognises that there may be locations where some sharing of the facility may be required and, in this case, recognises the early stage in design and definition and that there is the possibility of change in future stages. The managed system will operate as a single coordinated system of purpose-designed infrastructure and stations integrated with specifically-procured, high-capacity vehicles and information systems. The line will be designed to operate similar to a light rail or metro line, with one service pattern operating all-stops (further discussed in Section 6.5.2), and a high frequency service to station-style stops along a dedicated trunk route.

This is paired with inline stations with street level platform-style stops, offboard ticketing and all-door level boarding, to ensure consistent short dwell times and reliable operating of an inline system at high frequencies. Service frequency must be high enough to deliver 'turn up and go' service levels, but not so high it creates operational difficulties or congestion.

High system capacity will be provided by a relatively small number of long, high capacity articulated buses running at regular and even intervals. The buses will operate as a serial in-line system at 'turn up and go' frequencies all day, seven days a week. Buses will not pass each other, skip stops or overtake.

Vehicles will be specific to the line, designed to align the floor level with platforms at stops to allow level boarding and offboard ticketing. All-door boarding and alighting, through multiple doors simultaneously, allows rapid turnover of passengers and more convenient access from any point of the vehicle or platform. Access to and from the system will be via passenger connections at stations, all of which will be interchange stations. This integrates the line into the wider network of local bus routes and other rapid transit lines, without the vehicles leaving the dedicated corridor.

Under the recommended service pattern only RTN vehicles will use the running way, although flexibility for alternative service patterns will be retained where practical. This is to avoid potential delays and conflicts with other vehicles and enable fast, legible and highly reliable operation. This will also maintain a consistently high customer experience. See Section 6.5.2 for further justification on the recommended service pattern.

6.2.2 Flexibility

The proposed system design has flexibility in its ability to adapt to higher and slower rates of growth. Discussed further in 6.5.1 and specifically outlined in Figure 6-8 the proposed system has capacity for around 20% higher growth than forecast in 2048. Even higher growth can be accommodated in the route's physical design of accommodate light rail. The staged implementation also allows for slower or lower than expected growth.

Operational flexibility in degraded scenarios can be accommodated in the station design. For example, where bunching of buses occurs, additional platform length will be provided to allow for a second vehicle to pull up behind the bus at the active platform. This arrangement also allows services to operate around a broken-down vehicle. An additional passing lane is also provided at many stations allowing vehicles to pass one another.

While a managed system operating model is recommended for the corridor, the design provides flexibility for different operating patterns that may be required in future. In addition to the extended station lengths and passing lanes mentioned above there are opportunities to enable buses to enter and exit the busway along the corridor, including through the provision of mid-block merge and exit points.

6.2.3 Key characteristics

The following are the main characteristics of the system. Many of these characteristics are outlined in more detail in following sections:

- **Service frequencies:** Headways of three to five minutes at peak times, and a minimum of 10-minute frequencies at all times, will deliver high customer service standards with minimal wait times, to allow for timetable-free use of the line and facilitate seamless connections to local buses and other rapid transit lines on the network. The high passenger capacity of the rapid transit buses enables these service labels to be maintained without congestion at stops, intersections and terminals, and a minimised chance of bunching or other delays. A higher frequency using standard buses would not offer this benefit.
- **Number of routes:** A single service pattern is recommended for this route. This provides a clear and legible service offering for customers, supports efficient and reliable operations, and prevents any need for buses to pass one another. However, the design has been future-proofed to allow additional service patterns to use the system if there is a strong justification for this in future.
- **Types of buses:** The system is restricted to buses that meet the design parameters for high capacity, level-boarding and access, short dwell times and fast passenger turnover.
- **Stop layout:** Fewer services and moderately high service frequency on the busway mean operations will be more reliable than regular bus routes, so inline stops can be used. This further reduces delays or disruption by avoiding the need for buses to pull in and out of each stop.
- **Station size:** The system requires smaller stations than an open busway like the Northern Busway, because fewer services will use the route, therefore requiring fewer and shorter platforms. Buses will stop inline, so no passing lanes are required (unless specific locations require). This allows for narrower stations within the road corridor. Smaller stations require less land acquisition and construction costs, as well as improved urban integration by being easier to fit in the most ideal locations.
- **Dwell time at stations:** Faster boarding is afforded because the vehicle and platform are level, and off-board ticketing and all-door boarding procedures can be provided. Buses will not be delayed upon exit because stops are in-line and buses do not need to pull out. Dwell times should be in the 20-30 second range.
- **Speed and reliability:** With a fully dedicated pair of busway lanes along the entire route, just one or two services using the busway for large distances, and inline stops, services will be very reliable. Combined with signal priority at intersections and off-bus ticketing and validation, the rapid transit buses should be able to complete most runs from end to end without stopping for any reason other than letting passengers on and off at stations.
- **Signal priority:** Fewer services, operating more evenly with inline stops and regular dwell times, make it easier to provide signal priority at intersections for the rapid transit services. Three to five-minute headways require modifying only every second or third signal cycle to prioritise the transit phase, allowing plenty of time for the signal system to catch up the other phases in between. This provides the means to provide a green wave for transit on the corridor without unduly disrupting connecting buses or private vehicles on cross streets.
- **Actively managed:** To retain reliability and regularity of service, active management of headways through manipulation of traffic signals and communication with drivers and passengers.
- **Fleet size and operating costs:** A relatively lower number of higher capacity vehicles means operations are more efficient and reliable, so a smaller fleet can deliver an equivalent service level and capacity to other operating conditions. This reduces the vehicle and driver costs and allows the operating budget to be focussed on a broad span of frequent service across the day and week.

- **Boarding experience:** Because the vehicles and stations are designed together and stations are inline, buses will be able to pull into the station consistently and quickly align to the platform, and passengers can step directly onto the platform with no level change.
- **All-door boarding:** To reduce dwell times and produce more consistent dwell times and improve customer experience, all-door boarding is proposed. This will allow a "train-like" boarding operation. This will also provide improved utilisation of space within the longer vehicles as there is no need for people to board at the front and move down the vehicle. This is considered important for travellers to the airport with baggage.
- **Off-vehicle ticketing and validation:** To improve customer experience through not having to "tag on" at the door potentially resulting in delays and causing anxiety, all-door boarding will allow people to purchase and validate tickets on the platform as is typical with trains or light rail. This will reduce dwell-times and improve reliability as well as make the system easier to use.
- **Customer perception:** Customer perception should be very high because stations and vehicles are designed to give a similar 'feel' to train and light rail, and bus arrivals are frequent, regular and predictable.

6.3 Infrastructure and access

6.3.1 Stations

The role of the rapid transit network (RTN) in Auckland is to provide regional connectivity, supported by multiple bus routes and feeder services that, in turn, provide a local access coverage service role. Airport to Botany, as part of the proposed RTN, provides services focused on patronage and therefore, in line with the policy of the Auckland Regional Public Transport Plan, focuses on speed and directness above local access. Consequently, Airport to Botany, as a rapid transit line with a patronage service focus, targets station locations at major destinations and interchanges, rather than regularly spaced stop locations, which would be prioritised if the focus was on coverage.

The RTN platforms will be 34m long with additional length provided at some stations to be approximately 50m long to accommodate a second vehicle behind one at the active platform and allow them to move around one another.

The location of stations is a critical component for the accessibility and usefulness of a rapid transit line. For safe and efficient operations, passengers may only get on and off a rapid transit line at designated stations. This is especially so for 'closed' transit corridors operated by a single service pattern, like Airport to Botany, where local services do not move on or off the rapid transit running way, and network connections are based around passengers transferring at stations.

Locations

Station locations have been confirmed through the Station Locations Tech Note (502334-7000-TEC-KK-004) and are illustrated in Figure 6-3. This shows the relationship between the station locations and land use planning. Zones in purple are employment zones, striped purple/pink are high density town centres and yellow/orange residential.

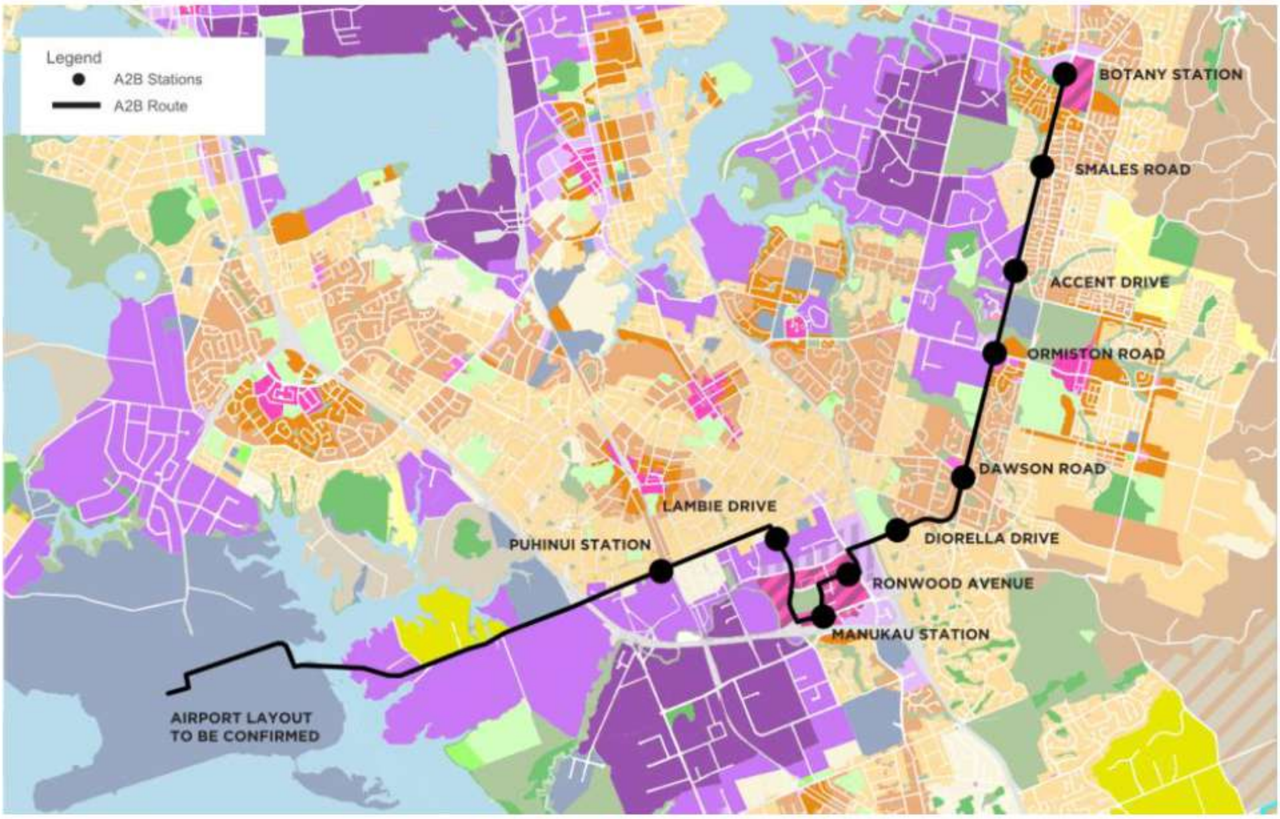


Figure 6-3: Proposed station locations and land uses

Table 6-1 provides the full list of the Airport to Botany Rapid Transit stations and their indicative classification.

Table 6-1: Station classifications

Stop number	Section	Location	Major interchange	Minor interchange
1	Airport	Airport Passenger Terminal	X	
2	Airport	The Quad Business Park (Eastern Airport Precinct)		X
3	Puhinui	Puhinui Rail Station	X	
4	Puhinui	Puhinui Road/ Lambie Drive		X
5	Manukau	Manukau Station	X	
6	Manukau	Ronwood Avenue (Manukau Metropolitan Centre)		X
7	Te Irirangi	Diorella Drive (AUT/Sportsbowl)		X
8	Te Irirangi	Dawson Road		X
9	Te Irirangi	Ormiston Road – Botany Junction Shopping Centre		X
10	Te Irirangi	Accent Drive		X
11	Te Irirangi	Smales Road		X
12	Botany	Botany Metropolitan Centre	X	

These stations are a mixture of intermediate and interchange stations, where customers can connect with other public transport services. Design features of the intermediate and interchange stations are outlined in the following sections. As outlined in Section 5.1.2 many stations provide a key role in access to the system through facilitating interchange with local bus services.

Major interchange stations

The arrangement of each major interchange station will provide short accessible paths with clear sightlines to connecting public transport services. Table 6-2 provides a summary of the requirements for each of the major interchange stations.

Table 6-2 Major interchange station design requirements

Interchange Stations	Design requirements
International and Domestic Airport Passenger Terminal at Airport business park	▪ As a minimum, the assets provided will be equal to intermediate stations. In addition to these, the following apply: ▪ Platforms will be a minimum of 5m wide at this station ▪ Platforms will be a minimum of 34m long at all stations to accommodate light rail vehicles ▪ Staffed Customer Service Centre, ticket machines and validation ▪ Simple, comfortable (in all conditions), short and efficient customer connections between Airport to Botany Rapid Transit services and domestic and international terminals ▪ Rapid transit vehicle charging facilities ▪ Staff welfare facilities that are accessible from the layover location ▪ Accessible toilets if adjacent airport facilities are not available.
Puhinui Station	▪ As a minimum, the assets provided will be equal to intermediate stations. In addition to these, the following apply: ▪ The Puhinui Interchange stop is to tie-into the balcony designed in the Puhinui Interchange project, above the railway line ▪ Platforms will be a minimum of 5m wide at this station ▪ As Puhinui interchange station will be on an elevated bridge deck, the platform lengths will be designed to 67m lengths to allow for potential future coupling of LRT vehicles and avoid rebuilding the bridge deck ▪ Staffed Customer Service Centre, ticket machines and validation ▪ Simple and efficient customer connections between Airport to Botany Rapid Transit services and train services.
Manukau Station	▪ As a minimum, the assets provided will be equal to intermediate stations. In addition to these, the following apply: ▪ Staffed Customer Service Centre (existing) ▪ Simple and efficient customer connections between Airport to Botany Rapid Transit services, train services, and local bus services. This will include a pedestrian priority space within the intersection between the three public transport modes.

Interchange Stations	Design requirements
Botany Metropolitan Centre	▪ As a minimum, the assets provided will be equal to intermediate stations. In addition to these, the following apply: ▪ Platforms will be a minimum of 5m wide at this station ▪ Platforms will be a minimum of 34m long at all stations to accommodate light rail vehicles ▪ Staffed Customer Service Centre (existing), ticket machines and validation ▪ Convenient customer access to and from the Metropolitan Centre ▪ Simple and efficient customer connections between Airport to Botany Rapid Transit services, Eastern Busway services, and local bus services.

Minor interchange stations

The arrangement of each minor interchange station will provide short accessible paths with clear sightlines to connecting public transport services. Table 6-3 summarises the assets provided at each minor interchange station. In addition to these assets, the North of Botany Terminus will require charging facilities for the rapid transit vehicles, and staff welfare facilities that are accessible from the layover location.

Table 6-3 Minor interchange station design requirements

Asset	Design requirements
Platforms	▪ Platforms will be a minimum of 3m wide at all stations ▪ Platforms at Davies Ave and Ronwood Ave stops will be wider than 3m – the exact dimension is dependent on property constraints ▪ Platforms will be a minimum of 34m long at all stations to accommodate a range of single bus rapid transit and light rail vehicles. Only spatial future proofing for coupled light rail vehicles will be provided ▪ Platform markings to indicate safe areas etc.
Lighting	▪ To satisfy CPTED and IPTED principles
Shelter	▪ High standard of protection against wind, rain and sun ▪ To satisfy CPTED principles
Seating	▪ As per current best practice and AT codes
Vending and Reload Devices (VRDs)	▪ As per current best practice and AT codes
Fare Payment Devices (FPDs)	▪ As per current best practice and AT codes – no gate lines
Emergency Help Points (EHPs)	▪ As per current best practice and AT codes
Passenger Information Displays (PIDs)	▪ Dynamic real-time service information, including audible messages ▪ As per current best practice and AT codes
Public Address (PA) speakers	▪ As per current best practice and AT codes
Static information boards	▪ Route and service information posters ▪ As per current best practice and AT codes

Asset	Design requirements
Wayfinding signage (including maps)	▪ Simple and legible signage, in accordance with existing AT standards ▪ Illuminated station marker totem ▪ Platform signage that identifies the Rapid Transit direction of travel
CCTV	▪ As per current best practice and AT codes
Wi-Fi	▪ As per current best practice and AT codes
Rubbish bins	▪ As per current best practice and AT codes
Bicycle parking for privately owned bicycles (to provide first and last mile connections)	▪ As per current best practice and AT codes
Bicycle & scooter parking for shared mobility devices (to provide first and last mile connections)	▪ As per current best practice and AT codes
On-demand transport options (to provide first and last mile connections)	▪ Parking for taxis, Uber/ride-share vehicles, e-scooters etc. shall be accessible from the station e.g. within a 50m radius.

Station access hierarchy

Detailed in the High-Level Stations Access Study (502334-7000-REP-KK-0028) there is a proposed hierarchy for station mode access and approach to first and last mile transport. Figure 6-4 illustrates that pedestrians have the greatest priority at stations, followed by cyclists and feeder buses. Vehicular arrives are lower priorities in a spatial sense although as outlined below, these are still an important part of the A2B system design. Park and ride are not expected to play a significant role.

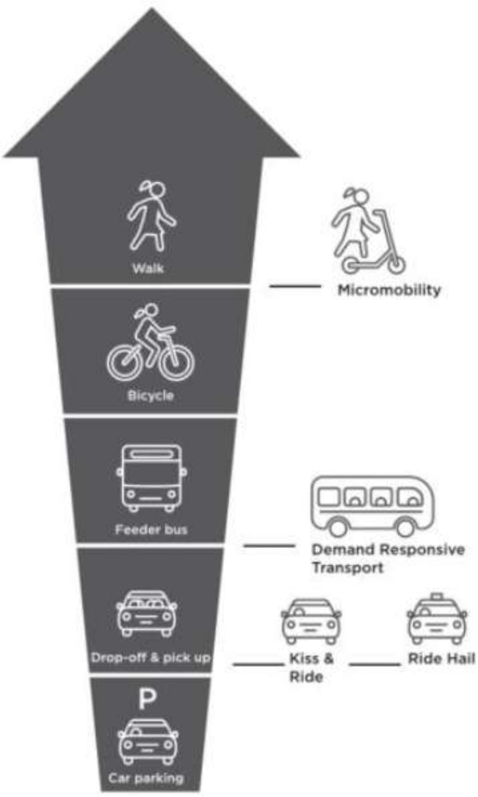


Figure 6-4: Mode access hierarchy

Walking

Walking is the top priority for station access and should be prioritised. The High-Level Stations Access Study (502334-7000-REP-KK-0028) and Detailed Stations Access Study (502334-7000-REP-KK-0029) provide a detailed strategy for including quality walk-up experience for A2B customers. A 1km waling catchment is assumed and is consistent with best practice for RTNs and supported by Walkable catchment analysis at Auckland train stations (2012 Auckland Council technical report, TR2012/023).

Other arrival modes

Given the relatively low land use densities in much of the route, careful attention will be required to arrival modes that can extend the catchment of the service and enable the system to fully give effect to the project objectives. Figure 6-5 illustrates the 1km and 3km catchments of proposed stations. The 1km catchment can be considered a reasonable catchment for walk-up passengers. A 3km catchment can be applied to a range of modes including cycling, micromobility, taxi, ride share or drop off and pick up. The 3km catchment extends to cover a significant proportion of the urban area in the corridor.

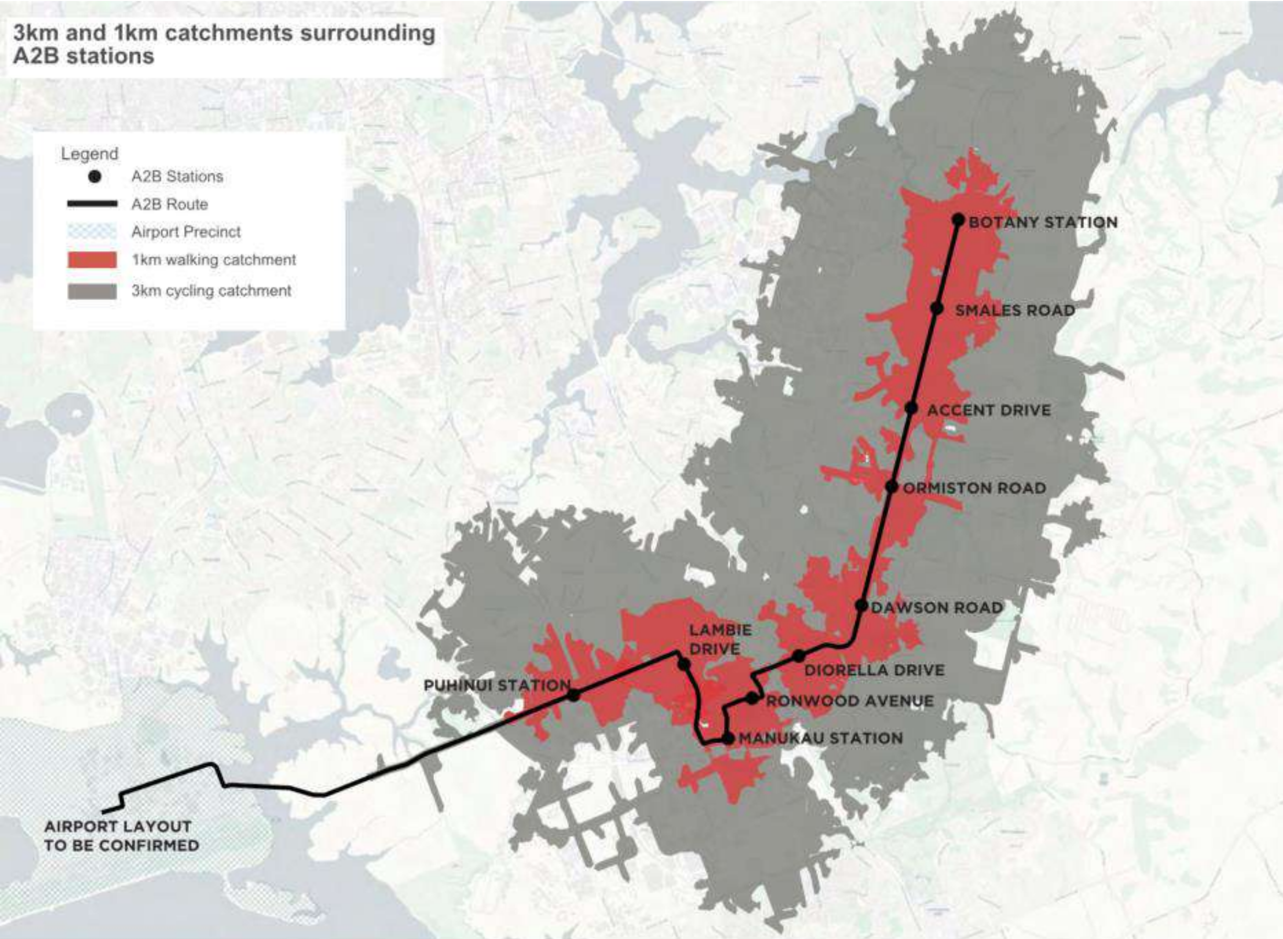


Figure 6-5: 1km and 3km station catchments

To enable this wider catchment to be accessed effectively and provide people with genuine travel choices, consideration of network integration and specific design for the following arrival modes will be required.

Cycling (including electric bikes)

Cycling is evolving and with the uptake of powered e-bikes cycling is becoming a real alternative for longer distances and wider sections of the community. This will require:

- Secure bike storage
- Safe access routes

- Integration with wider cycling networks
- Potentially bike share schemes

Other micromobility

This is a mode or range of modes that is rapidly changing and may have evolved further when A2B is designed in detail. Consideration of access for, safety of and storage of scooters and other forms of mobility will be required.

Buses

The Potential Changes to the Local Bus Network in Response to A2B tech note (502334-7000-TEC-KK-0027) outlines a range of network changes. Figure 6-6 illustrates the stations that connect with either RTN services or Frequent Services. These locations will require specific facilities for local bus routes and customers and quality pedestrian connections to Airport to Botany line stations.

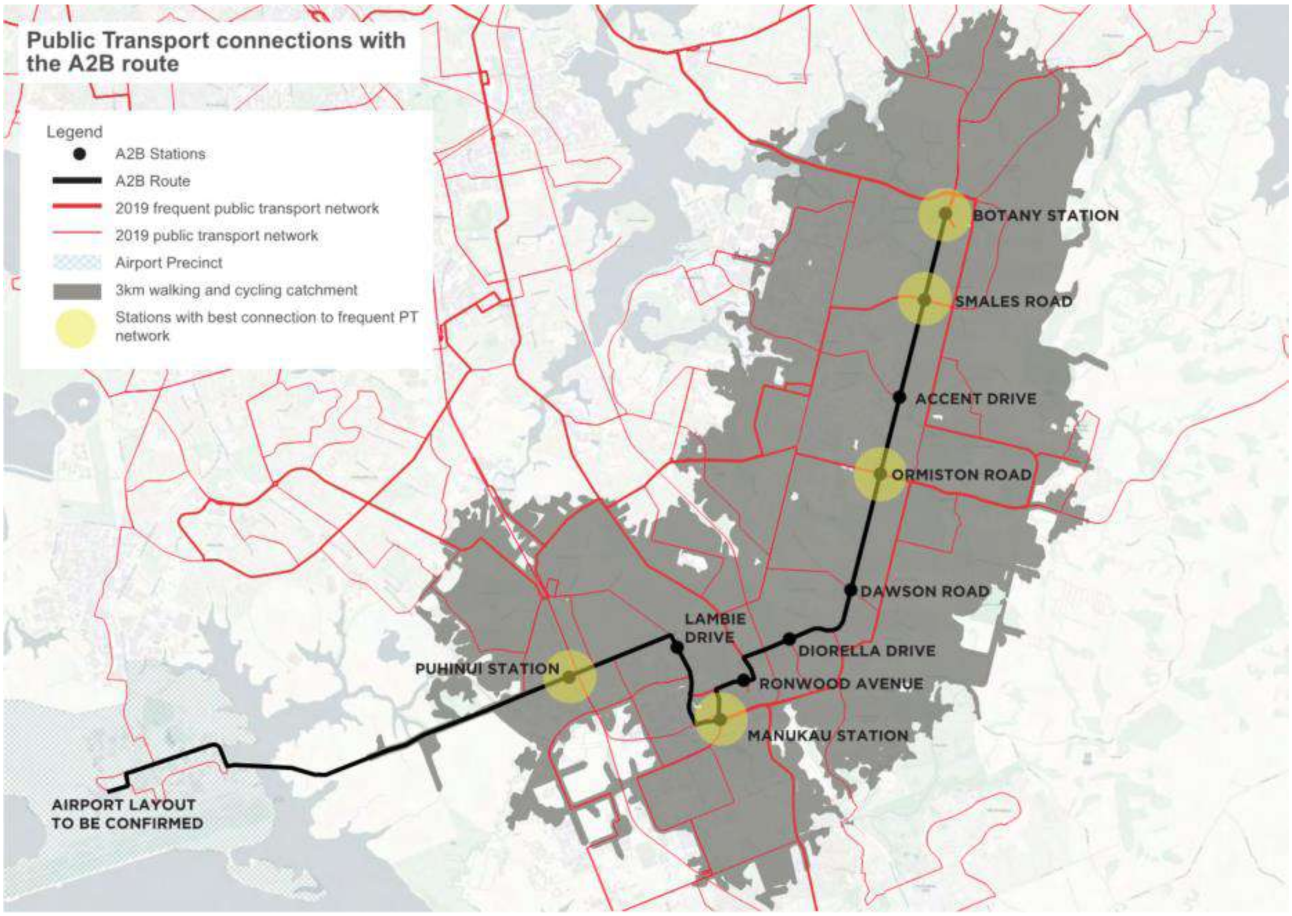


Figure 6-6: Public transport connections with A2B

Demand responsive transport

While at this time there are no proposals to operate demand responsive transport in the Airport to Botany area, it has the potential to support access to the system and should be provide for if proposed.

Taxi and ride share

Taxis and ride share, including Uber for example are likely to be a mode of access to stations, particularly with the airport as a key destination. Space should be provided on local streets near stations with lighting and quality access to stations.

Private vehicle pick-up and drop-off

While private vehicle arrivals are not high in the access hierarchy, drop off and pick up may be an attractive mode of access given the number of cross-arterial roads that access motorways and major employments zones, meaning that ride-sharing and drop off could be a practical access mode.

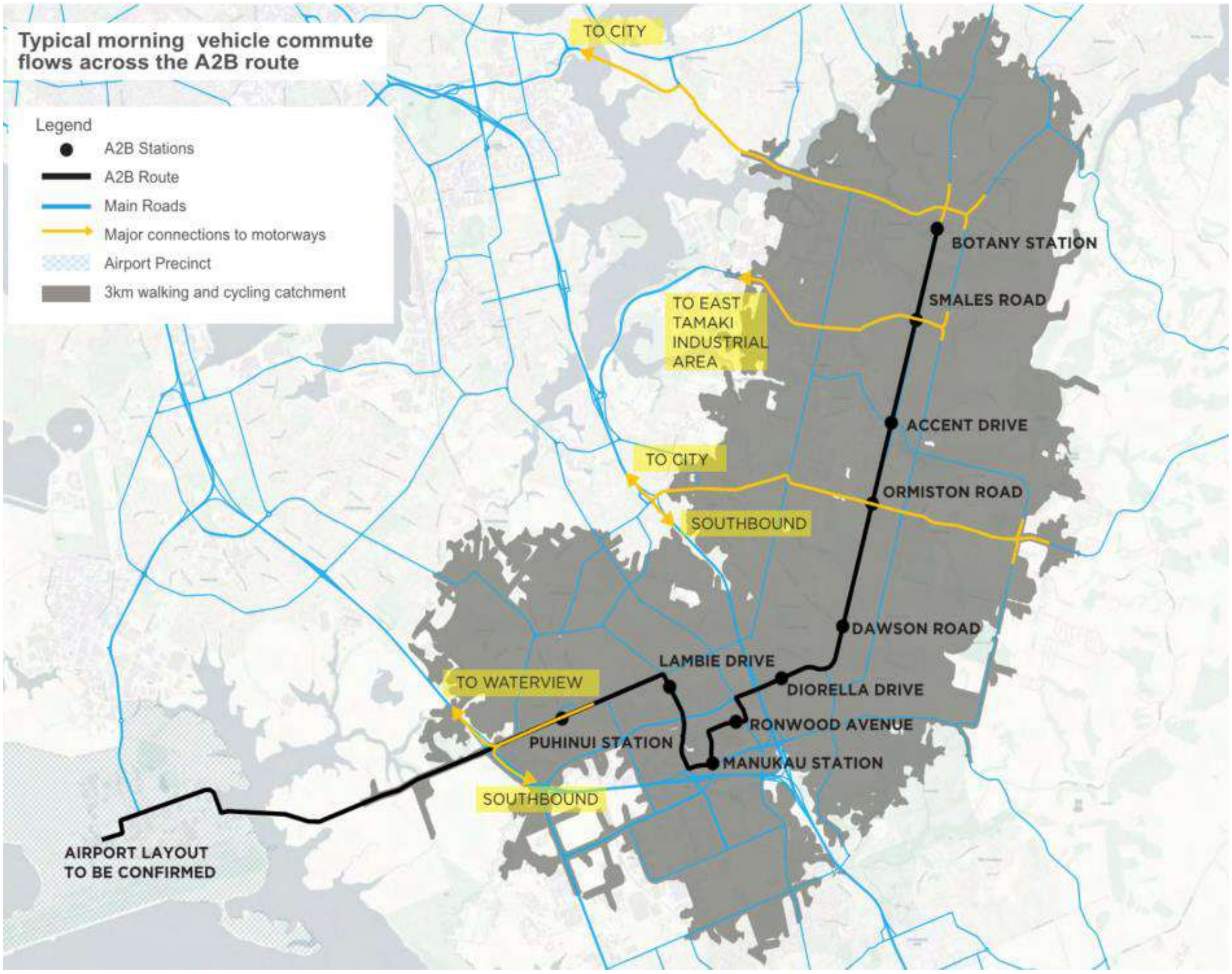


Figure 6-7: Potential drop off and pick up routes and locations

Figure 6-7 illustrates these key commuter routes and the likely locations for this activity. Short term parking that is safe and well connected to stations should be provided at these locations.

Park and ride

Provision of park and ride has not been proposed as part of the A2B project.

6.3.2 Rapid transit corridor in the public carriageway

The Airport to Botany Rapid Transit route will run from the proposed Auckland International Airport terminal to Botany Town Centre, via major interchanges at Puhinui and Manukau and other intermediate stations. The corridor primarily runs within State Highway 20B, Puhinui Road, Lambie Drive, Manukau Station Road, Davies Avenue, Ronwood Avenue, Great South Road and Te Irirangi Drive, along a dedicated rapid transit lane in each direction. As a dedicated rapid transit corridor, no other vehicles are permitted to operate within these lanes apart from emergency vehicles responding to an incident.

General traffic lanes and protected walking and cycling facilities will be provided alongside the rapid transit corridor. The rapid transit stops will be provided in-line with the corridor at street level, with no facility for passing. While general traffic lanes are generally retained in the concept design in each direction the extent of retention of this space for general traffic should be rigorously tested before being included in the final design.

The Preliminary Design Philosophy Statement (502334-7000-REP-JJ-0024) outlines the design considerations adhered to in the concept design.

Features of the rapid transit corridor and public carriageway include:

- On street segments (including at intersections) where more than one vehicle lane per direction currently exist, the conditions and vehicle demands will be tested to determine if the number of vehicle lanes can be reduced. Where possible, the number of vehicle lanes will be reduced, with reallocation of space to enhance the public realm with high quality walking and cycling facilities and/or landscaped berms. This will also mitigate the negative stormwater and amenity impacts of removing the existing landscaped median space.
- Replacement of the short-term bus priority lanes along Puhinui Road and Lambie Drive with the rapid transit corridor. This will include a bridge over the railway line at Puhinui Station
- Davies Avenue will be closed to general vehicle access between Putney Way and Manukau Station Road:
- Only rapid transit vehicles will be able to travel in both directions along Davies Avenue between Putney Way and Manukau Station Road.
- General vehicle access will be maintained on Davies Avenue between Ronwood Avenue and Putney Way. General vehicle traffic running down Davies Avenue will be diverted along Putney Way, and vice versa.
- At Manukau Bus Station, buses will enter the station at Osterley Way and exit southbound at the Davies Avenue/Manukau Station Road intersection.
- A bi-directional cycle path will run continuously along Davies Avenue (including in front of the rail station) and connect into the bi-directional cycle path on Manukau Station Road and the uni-directional cycle paths on Ronwood Avenue.
- Provision of a shared space on Davies Avenue outside the interchange at Manukau Station, subject to final design and operational requirements of the rapid transit corridor.
- Replacement of existing parking adjacent to Hayman Park with parallel parking along the eastern edge of Davies Avenue. The space required for this will not restrict the amount of space provided to active modes moving along or across Davies Avenue.

Speeds

Table 6-4 shows the proposed operating and designs speeds for each road along the rapid transit corridor. Any changes to road speeds are subject to a Waka Kotahi review process and consultation.

The Speed Limits Along the Airport to Botany Mass Rapid Transit Corridor tech note (502334-7000-TEC-KK-0040) outlines how these proposed speed changes can meet the investment objectives and align with wider strategic and policy context. This is reflected in the Preliminary Design Philosophy Statement.

Table 6-4 Proposed road operating and design speeds

Road	AT Roads and Streets Framework Typology		Posted Speed Limit		Proposed Design Speed
	Current	Proposed	Current	Proposed	
SH20B	NA	NA	50 km/h to 80 km/h	50 km/h to 80 km/h (no change)	50 km/h to 80 km/h (no change)
Puhinui Road	Single Use (Out of Centre) Arterial	Mixed Use Arterial	60 km/h	50 km/h	50 km/h
Lambie Drive (North of Cavendish Dr)	Mixed Use Arterial	Mixed Use Arterial	60 km/h	50 km/h	50 km/h
Lambie Drive (South of Cavendish Dr)	Mixed Use Arterial	Mixed Use Arterial	60 km/h	50 km/h	50 km/h
Manukau Station Road	Mixed Use Arterial	Mixed Use Arterial	60 km/h	50 km/h	50 km/h
Davies Avenue	Mixed Use Collector	Mixed Use Collector	60 km/h	30 km/h	30 km/h
Ronwood Avenue	Mixed Use Arterial	Mixed Use Collector	50 km/h	30 km/h	30 km/h
Great South Road	Mixed Use Arterial	Mixed Use Arterial	60 km/h	50 km/h	50 km/h
Te Irirangi Drive (South of Whetstone Road)	Mixed Use Arterial	Mixed Use Arterial	60 km/h	50 km/h	50 km/h
Te Irirangi Drive (North of Whetstone Road)	Single Use (Out of Centre) Arterial	Mixed Use Arterial	80 km/h	50 km/h	50 km/h

Intersections

The following operating principles apply to the intersections along the rapid transit corridor:

- Pre-emption or priority for the rapid transit service at intersections.
- All existing signalised intersections are maintained in the concept design and operational assumptions. As the operational concept is progressed, trade-offs between rapid transit journey time and reliability may be required and may require consideration of reducing conflicting turns across the rapid transit corridor.
- The level of service for general vehicles at most intersections is likely to drop below the current level. This is necessary to enable to the rapid transit to run efficiently and ensure its customers accessing stations can do so safely and comfortably.
- Intersections should align with the intersection principles of the latest Transport Design Manual (TDM). These principles will include making intersections safe for all users and considering vision zero.
- Slip lanes will be removed and replaced with left turn lanes that will be phased. Wherever possible left turns will be combined with a through lane to reduce the overall intersection size.
- Where there are currently two right turn vehicle lanes, one will be removed to make way for the rapid transit corridor. The only exception to this is at the Great South Road/Te Irirangi Drive intersection due to the demand for the motorway ramps.

- The existing Ronwood Avenue/Davies Avenue roundabout will be converted into a signalised intersection.
- The existing Ronwood Avenue/Osterley Way/Sharkey Street roundabout will be upgraded to a signalised intersection.
- All vehicle approach and exit lanes at signalised intersections (including the rapid transit corridor) will be aligned.
- Protected walking and cycling facilities should be physically separated from each other approaching and through crossing points (this includes at mid-block crossings, signalised and unsignalised intersections). Where these occur at stations, these will be staggered on either side of the platform.
- All existing unsignalised intersections that allow right turn movements will be converted into left-in, left-out junctions.
- At intersections where rapid transit stops are located, platforms will be staggered on either side of the intersection and pedestrian and cycle crossings will be staggered on either side of the platforms.

Legal status and enforcement

The Airport to Botany route will be required to be legally recognised as a special vehicle lane under the Local Government Act (1974) and the Land Transport Act (1998). At the appropriate time in the project's development, mechanisms will be required to provide this status.

Enforcement measures will need to be developed to ensure the safe and efficient operation of the BRT corridor. This is likely to be a joint responsibility of the NZ Police and AT.

6.3.3 Walking and cycling

The following principles apply to walking and cycling **along** the Rapid Transit corridor:

- Walking and cycleway design will be in accordance with the TDM. Cycling facilities along the corridor (mid-block segments) and at intersections (intersection segments) should aim to achieve Quality of Service 1 as stated in the Bike Quality of Service Guide from AT. Facility qualities should not be lower than Quality of Service 2.
- Provision of protected, separated, and continuous cycling facilities along the rapid transit corridor and Cavendish Drive. Protected cycle paths are a cycle path which is both vertically and horizontally separate from the carriageway used by motor vehicles. Guidance for the form of separation is as follows:
- Horizontal protection could take the form of planted berm, street trees with canopies lifted to provide 2m clearance, planter boxes or concrete/ pavers/ asphalt strip.
- Vertical protection typically takes the form of full height kerb or another form of continuous vertical feature. Depending on the context this could be a low wall if no pedestrian cross movement is needed.
- Guidance around horizontal width and vertical heights are noted in the TDM, widths and heights relate to traffic speed and volume with greater protection (width and height) needed for higher volume faster roads.
- Separation between the walking and cycling paths must be identifiable for a vision impaired user and safely traversed by a mobility impaired user.
- Protected walking and cycling facilities should be physically separated from each other approaching and through crossing points (this includes at mid-block crossings, signalised and unsignalized intersections). Where these occur at stations, these will be staggered on either side of the platform.
- Comfortable waiting spaces will be provided.

- Where there are existing parallel side roads adjacent Te Irirangi Drive, these streets will transform into bicycle streets (streets where bicycles are prioritised, and cars are visitors). Elements of these future bicycle streets include:
    - Reduced speeds,
    - Retaining existing vegetated buffer,
    - Closing/restricting or redesigning private vehicle entry and exit points from Te Irirangi Drive (to reduce conflict opportunities),
    - Guiding bicycles to travel in the middle of the road with local traffic, and
    - Guiding pedestrians to use existing footpaths.

All new walking and cycling facilities will be designed to have priority across side roads.

6.4 Intelligent transport systems

ITS will be used across the Southwest Gateway programme and will be fundamental to delivering the 'one network' operating model. The applications and services to be used on the project are outlined below.

6.4.1 Customer experience

Timely travel choice and journey information for customers meets the objectives of the project, international standards, and the desirable characteristics of the project. Potential ITS applications for the customer experienced are outlined in the Table 6-5 below.

Table 6-5 Potential ITS applications for customer experience

Pre-departure	▪ Mobile app to inform on real travel times, suggested routes, modes, park and ride availability and connections ▪ Integrated airport and public transport travel information ▪ Simple ticketing through AT HOP and airport ticket solutions
During journey	▪ Mobile app to inform on real travel times, suggested routes, modes, park and ride availability and connections and their services ▪ On-vehicle real-time passenger information e.g. journey times, flight departures, major connecting services etc. ▪ Station PA announcements, hearing loops, and dynamic real-time PIDs. Including integrated airport and public transport travel information, including major connecting services ▪ Variable Message Signs for journey information at key decision points on SH20, SH20A, and SH20B.

6.4.2 Network performance

The following ITS applications can be deployed to optimise network performance.

- SCATS to optimise signal phasing and traffic signal priority
- Variable speed and lane management
- Traffic data collection
- Incident detection using Automatic Video Incident Detection (AVID)
- Automatic Incident Response Plans

- CCTV throughout the rapid transit corridor, stations, and state highways
- Automatic Vehicle Location (AVL).

6.4.3 Safety

Detection and management of safety and security risks across the network to meet safety objectives could include the following.

- CCTV throughout the rapid transit corridor, stations, and state highways
- EHPs at stations.

6.4.4 Signal priority

With an at-grade BRT in which buses are expected to negotiate traffic signals, it is desirable to provide a form of signal pre-emption or priority to reduce journey times and improve reliability. While detailed assessment can be carried out on the corridor, international experience is that typically a frequency greater than twenty buses per hour will limit this potential. At frequencies of less than twenty buses per hour, signal priority tends to minimize the irregularity with which vehicle services operate, enabling priority to be inserted into intersection cycle times without excessive disruption to cross-movements of traffic, cyclists, pedestrians and local buses. This provides a limitation to the number and frequency of routes that can be accommodated in a managed at-grade system.

Traffic signal priority operations

Using the traffic signal management system, signals will be set up and operated to prioritise the A2B rapid transit services and to further support movements for pedestrians and bicycles; this shift in prioritisation may discourage some general traffic to use the A2B corridor. Conversely, the signals will be set up to encourage general traffic to use alternative routes such as parallel corridors.

The traffic signal management system will be used to enable more efficient detour routes when there are temporary closures, incidents or planned events occurring on key corridors, the rapid transit corridor or major routes nearby (e.g. SH20 and SH20A).

The following operating principles apply to traffic signals along the rapid transit corridor:

- Traffic signals will form part of the intersection signals and be managed and operated via the wider network traffic signal management system.
- Priority will be given to the rapid transit corridor to provide efficient operation with minimum delays whilst balancing this with the needs of other users moving along or across the corridor such as pedestrians and people on bicycles, i.e. maintaining acceptable levels of service for all modes.
- Using the traffic signal management system, stop line and advanced detection on the rapid transit corridor, priority will be given to the rapid transit services by facilitating green extensions, early cut-offs for conflicting movements, head starts or repeat phases
- Detection loops will be provided at each station to detect vehicle departure
- To reduce wait times and increase the time allowed to cross for both passengers and other intersection priority users, the signal cycle times will be minimised; this can be done through reducing the number of phases that may require consideration of prohibiting or removing some vehicle movements. Time to cross intersections will be sufficient to allow all users to cross safely e.g. vision impaired and mobility impaired users.
- Signals will display a crossing countdown for pedestrians.
- Co-ordination of the signals along the corridor will further promote priority for the rapid transit services along the route.

Future versions of this document will include the prioritisation of modes and movements at the signalised interchanges along SH20, SH20A and other key intersections that link to the state highway network and rapid transit system.

Rapid Transit traffic signal aspects

The traffic signals used for the Airport to Botany Rapid Transit system should be consistent with those used for the Eastern Busway.

6.5 Fleet and service

6.5.1 Demand and capacity

In 2048, the projected passenger loading along the Airport to Botany corridor is estimated to be 1,200 to 1,900 passengers per hour in the peak direction, during the morning peak hour at the peak load point, and 500 to 900 per hour in the counter-peak direction and during the interpeak period.

Overall, this indicates the need for a public transport mode that can efficiently deliver a base demand of 900 passengers per hour while still maintaining good service frequencies, and which can accommodate peak occupancies of around 2,000 passenger per hour without requiring frequencies so high they negatively impact operations.

Model analysis indicates a relatively even and bi-directional demand profile along the route, albeit with a noticeable peak flow from the suburban areas at the Botany-Ormiston end of the corridor to the employment areas at the Manukau-Airport end of the route. Modelling also indicates the corridor will support a significant shuttle function between the Puhinui rail interchange station and both the airport and Manukau.

Figure 6-8 presents each of the modes and their capacities at the service levels considered, compared to the modelled peak demands of the A2B service in 2028, 2038 and 2048. The key features of this chart are:

- Yellow horizontal bars: low service levels to meet demand (5 to 15-minute headways)
- Green horizontal bars: ideal service levels to meet demand (3 to 5-minute headways)
- Blue horizontal bars: 'stretch' service levels to meet demand (2 to 3-minute headways), reaching the limit of service that can be provided
- Red vertical bars: A2B forecast demands by decade – peak direction/location.

If the red demand bar intersects with the green part of the bar for a given mode, that mode should provide sufficient capacity for the A2B service in the given year, operating at ideal service levels with 3- to 5-minute headways. Where the red line intersects with the blue zone, the service would need to operate at headways that will make managing signal priority and a reliability difficult. The yellow area requires a low level of service to meet demand, meaning either a lower level of frequency to meet demand or if a higher frequency is operated, a low vehicle utilisation. The modes that would be over- or under-utilised if they were selected for the service have been greyed out.

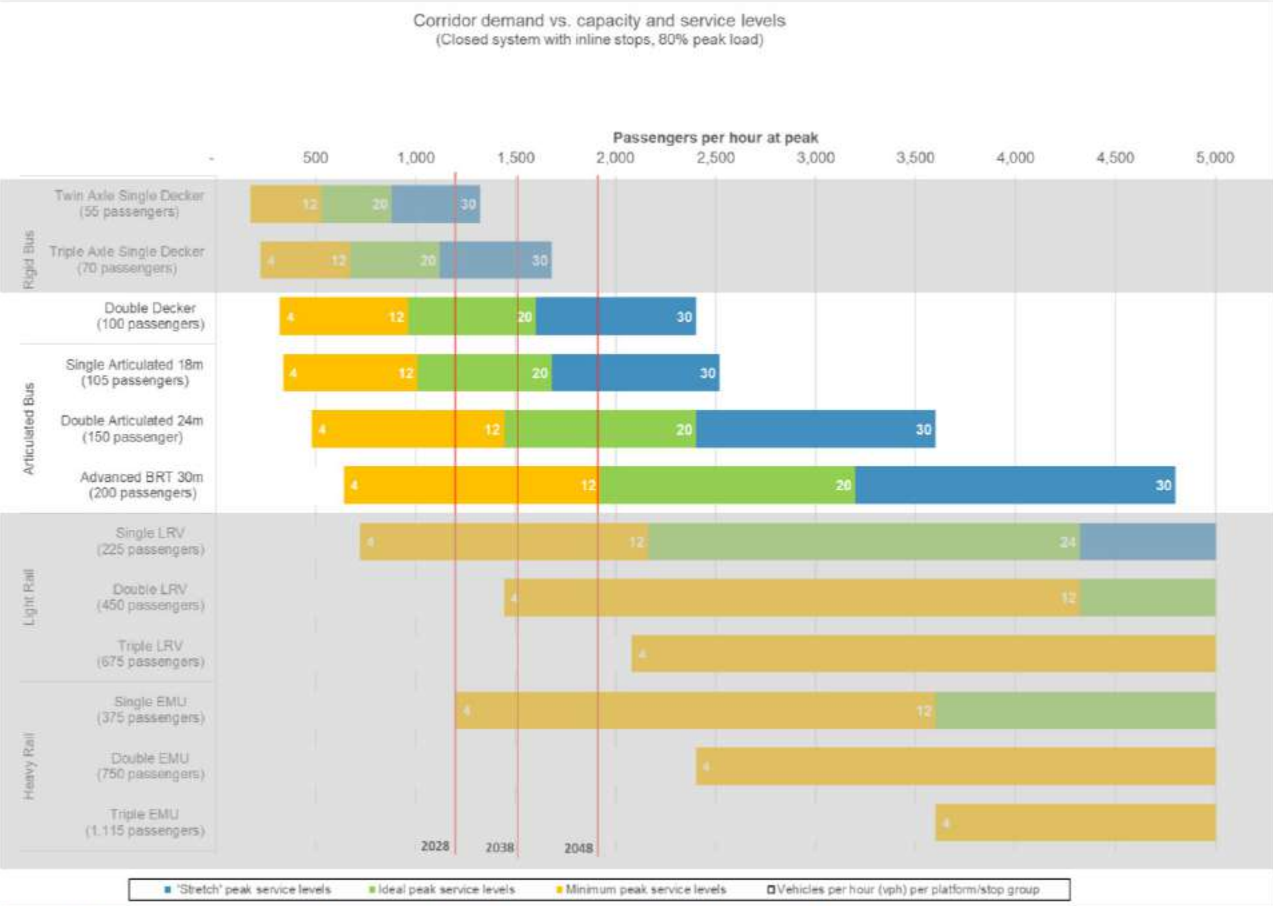


Figure 6-8: A2B peak demand by decade vs. mode capacity and service levels

The results of this assessment indicate that the lower capacity bus modes (standard buses, double decker buses, single-articulated buses) could accommodate projected interpeak demands and peak demands in 2028 and 2038 but would have insufficient capacity to accommodate peak demands at acceptable headways in 2048. A double decker or single-articulated bus could accommodate the projected peak demands in 2028 and 2038, so could be used as an interim vehicle before a higher capacity vehicle is required for later years. Conversely, the results also indicate that the higher-capacity modes (light rail and heavy rail) would be a significant over-provision of capacity at the targeted service levels, even at peak times in 2048.

Based on this assessment, a 24m double-articulated bus, with capacity for 150 people, would best accommodate the predicted demands at the preferred service levels for the A2B service. This mode option could service the predicted demands in 2048 with headways of just under 5-minutes. With acceptable headways of as low 3-minutes, this option provides for further demand growth beyond 2048 and/or higher-than-predicted demands before 2048.

In summary, this assessment indicates the ideal mode for the Airport to Botany corridor is BRT using high capacity double-articulated buses. However, where practical, it will be prudent not to preclude either specialised bus-based urban transit vehicles or light rail if higher demands eventuate.

6.5.2 Service design

It is proposed that the corridor is served by a single service pattern with all-stops services only. The long space between stops means that skip-stop services are unlikely to be required. The "managed system" concept does allow for more than one service pattern should future planning identify the need for an additional service, however the intent is that service patterns are limited to two or three at most.

A single service pattern is preferred over multiple service patterns, as it:

- Can operate like a 'trunk' rail / light rail line
- Will be faster and more reliable (multiple services may suffer due to bunching)

- Will be highly legible and provide customers with certainty
- Will allow consistent headways, meaning signal priority can be used more effectively and easily, and bunching will be less likely to occur
- Can be more easily designed for off-board ticketing and all-door boarding
- Can deliver highest capacity by operating exclusively high-capacity vehicles at high frequencies.

Multiple service patterns have the potential to make the network confusing and will also be likely to involve lower capacity vehicles with single-door boarding, resulting in longer dwell times. Unless priority is provided for the entirety of all routes, multiple services will also be less reliable.

The service pattern is proposed to exist in the context of a local bus network (refer tech note 502334-7000-TEC-KK-0027). The local bus network can be altered to 'branch' off the main single service.

There may be limited parts of the corridor that shared running is required for operational reasons, for example in the vicinity of Manukau Central and the airport.

6.5.3 Service levels

Auckland's rapid transit system is intended be a 'turn up and go' service when it is fully functional. The service levels will increase with demand as the infrastructure is constructed, Table 6-6 presents the estimated future service levels. Services will operate with dwell times of approximately 20-30 seconds to achieve the desired 'turn up and go' level of service.

Table 6-6 Service levels

Time of day	Headways
Peak services (between 07:00 – 08:59 and 16:00 - 18:59)	Up to 5-minutes (12 vehicles per hour) between 2028 and 2038 Up to 3-minutes (20 vehicles per hour) after 2038
Off-peak services (between 06:00-06:59, 09:00-15:59 and 19:00-23:59)	Minimum of 10-minutes (6 vehicles per hour)
Early-morning and late-night services (between 04:30 - 06:59 and 00:00 - 01:29)	15-minutes (4 vehicles per hour)

6.5.4 Journey times

Fast and reliable journey times is a core part of the value proposition for the service and key to generating mode shift. The journey time from the Airport Terminal to Botany is estimated to be 36 - 41 minutes based on analysis at the time of writing this part of Concept of Operations. Estimated timings between stations are outlined in Table 6-7 and Table 6-8.

Table 6-7: Approximate journey times between A2B stations

From	To	Journey time
Airport	**Botany**	**36-41 minutes**
Airport	Puhinui	10-12 minutes
Puhinui	Lambie	~2 minutes
Lambie	Manukau	4-5 minutes
Manukau	Ronwood	~2 minutes
Ronwood	Diorella	2-4 minutes
Diorella	Dawson	~2 minutes

From	To	Journey time
Dawson	Ormiston	~3 minutes
Ormiston	Accent	~2 minutes
Accent	Smales	~2 minutes
Smales	Botany	~3 minutes

Table 6-8: Travel times between key stations

From	To	Journey time
Airport	**Botany**	**36-41 minutes**
Airport	Puhinui	10-12 minutes
Puhinui	Manukau	5-7 minutes
Manukau	Ormiston	9-11 minutes
Ormiston	Botany	7-8 minutes

These journey times will be refined as design and corridor operation is developed in greater detail.

6.5.5 Operating hours

The operating hours of the Airport to Botany line are proposed to be consistent with the existing 380 Airporter bus – 04:30am - 01:30am (next day), seven days a week. The three-hour non-service period will be used for maintenance works.

6.5.6 Fleet requirements - general

In the Demands and Mode for the Airport to Botany RTN Corridor tech note (502334-7000-TEC-KK-0024), demand forecasting supports an advanced BRT mode as the most appropriate for the Airport to Botany corridor. This would meet 2048 forecast peak demands with high, but manageable frequencies.

A 24m-long double-articulated electric bus has been selected as the ultimate design vehicle for the Airport to Botany corridor.

- The 2048 required passenger capacity and service levels can be most readily delivered with a double-articulated bus of approximately 24m length, configured for urban BRT operations with multiple doors and level boarding.
- Lesser demands in earlier decades could be served by standard single-decker buses (e.g. 13.5m) and/or single-articulated buses (e.g. 18m), however these should also have door and interior configurations designed for high frequency operation and short dwell times.
- Double decker buses are not preferred at any time for the A2B closed-system operating model due to the inefficient boarding/alighting capabilities and the provision of platforms for longer buses in the future anyway.
- A 24m double-articulated vehicle based on conventional bus technology is available from a range of suppliers, at relatively low cost. However, these would need changes to meet relevant standards such as Vehicle Dimensions and Mass Rules, and the Requirements for Urban Buses.
- Battery electric buses, with overnight charging at the depot, potentially with midday top-up charging are assumed for the design vehicle.

- Zero-emission electric buses will be required for the Airport to Botany corridor if procured from 2025, as per Auckland Transport policy. This policy excludes diesel or hybrid buses.
- Systems that require intermittent charging infrastructure at stations or along the route in-service are not preferred, due to the requirement for additional infrastructure and the potential to delay vehicles in-service but should be considered.

The rapid transit vehicles will be approximately 24m long to accommodate 150 passengers i.e. 50 seated and 100 standing (4pax/m2). These vehicles will be a single level specialised articulated bus, with conventional right-hand drive, single ended, and driver operated Figure 6-9.

Figure 6-9: Van Hool Exquicity 24m

The rapid transit corridor will be future proofed for advanced rapid transit vehicles that are 32m long, see example in Figure 6-10, recognising that technology in this area is evolving and the “ultimate” fleet will not be procured for a number of years.

Figure 6-10: "Trackless Tram" CRRC 31m

The Vehicle Specification and Fleet Procurement for RTN Corridor Tech Note (502334-7000-TEC-KK-0026) discusses a staged approach to the fleet evolution. The requirements outlined in this Concept of Operations relate primarily to the ultimate service design to align with the intent of the concept design and business case. It is noted that detailed planning for fleet and procurement is a task for subsequent stages.

Staging

An initial service-only stage and three subsequent fleet stages are proposed in combination with the ongoing development of the corridor's infrastructure.

- Early 2020s (existing fleet, service only on-street): Begin service as an on-street route using conventional buses from the existing fleet.
- Mid 2020s: (First generation custom vehicles, mixed on-street and transit corridor running to operate on partially completed infrastructure). Procure bespoke vehicle based on a conventional single decker rigid bus, but with electric motive power and urban transit style configuration.
- Mid 2030s: (Second generation vehicles, operating primarily off-street on continuous infrastructure). Supplement and replace first generation fleet with 24m double-articulated electric BRT buses.
- 2040s: Increase fleet size with additional tranches of 24m double-articulated electric BRT buses or replacing with equivalent advanced bus or 'trackless tram' vehicle if demands require larger vehicles.

Procurement model

The status quo PTOM procurement model (where private operators own, maintain and supply buses under contract, and account for fleet and depot ownership in their service contract rates), has been selected as the most appropriate method for the Airport to Botany business case.

Depot and stabling

At this early stage, it is assumed that stabling, maintenance and servicing can take place at an existing facility such as the existing depot on Ti Rakau Drive. This is particularly the case for early stages. More detailed definition of vehicle types, procurement models, operating models and design will need to define in more detail the servicing, stabling and operational requirements of the fleet.

Specific, off-street layover capacity is expected to be designed into the terminal stations at the airport and at Botany.

6.5.7 Fleet size

The Airport to Botany line is likely to require each vehicle to operate around 600 km per day in service. This would require buses with large, heavy, batteries to operate under charge-at-depot system, with vehicles charging overnight, as well as returning to the depot during the day for a top-up charge.

The service plan indicates a broad span of up to 21 operational hours per day. The first generation of vehicles is expected to have a peak vehicle requirement of 11-12 buses, and 6 buses in operation in the early/late hours (i.e. from 04:30-06:00 and 23:59-01:30). The peak bus requirement would run from 7am to 9am, and from 4pm to 7pm. The requirement for spares will also need to be assessed.

6.5.8 Features of the recommended A2B vehicle

The Vehicle Specification and Fleet Procurement for RTN Corridor Tech Note (502334-7000-TEC-KK-0026) outlines the proposed vehicle and fleet requirements and evolution.

High passenger capacity, single deck, long articulated buses

- A passenger capacity of approximately 150 passengers per vehicle appears optimal for the proposed system design and demands for the third decade of operation
- A single deck cabin configuration is required to allow fast boarding and alighting through multiple doors, to maximise the use of floor space, and to provide sufficient headroom in the passenger cabin to allow for a significant ratio of standing passengers.

A 'rapid transit' appearance and design

- A distinctive exterior design and livery that identifies the vehicle as "Rapid Transit" and indicates the rail-like service offering of the proposed system.
- A high-quality interior design, distinct from conventional bus design and promoting a premium user experience.

A mass transit style cabin configuration,

- An 'urban transit' interior layout designed for high passenger turnover, with a relatively high standing to seating ratio (for example, 2:1), broad interior aisles, and wide vestibule areas with clear circulation space.
- Seating can be delivered as a combination of transverse and longitudinal rows.
- Space for luggage, shopping and parcels. This could be delivered either as dedicated luggage racks, and/or areas of clear floor space near seating.
- Space for wheelchair and mobility scooters to be parked without any special process or assistance.
- Allowance to bring bikes, scooters and other personal mobility devices on board, including appropriate storage space within the cabin. This is to replicate the existing arrangement on Auckland's rapid transit rail lines, i.e. to extend the catchment and utility of the line for the maximum number of customers.

Door designs that allow all-door boarding and alighting from multiple doors for fast dwell times and high passenger turnover:

- Multiple doors are required, i.e. at least three sets of doors spaced along the length of the vehicle.
- All doors to be double width, to allow two streams of people to board or alight in parallel at each door, and to allow any door to accommodate a person using a wheelchair, pram or luggage without additional delay.
- All doors should be level boarding from the platform, with no step-up or stairs.
- The door to platform threshold should afford a minimal platform gap that allows wheelchair and luggage users to cross from platform to vehicle without requiring assistance, and without additional delay.

Offboard ticketing to facilitate high turnover with short dwell times:

- The vehicle configuration should operate under the 'rail-style' offboard ticketing regime.
- HOP card tag posts and ticket machines should be located on the platform, with all ticketing and validation to occur before or after boarding to avoid any source of delay or disruption to dwell times.
- The vehicle should be designed as a fare paid area. No ticket sales and validation should occur on the vehicle. Accordingly, no HOP readers or ticket vending machines should be installed in the vehicle.
- The driver shall not be required to sell, validate or inspect any tickets or HOP cards, or engage in any routine customer interaction that would interrupt their primary driving task. Accordingly, the driver may be located in a separate compartment that is not accessible from the passenger saloon.

Other requirements

In addition, the rapid transit vehicles will:

- Provide step-free boarding and alighting at three (or more) sets of double doors on the left-hand side.
- Provide onboard space for the safe and efficient movement of wheelchairs, luggage, prams and bicycles.
- Provide space onboard for personal wheeled mobility devices, including scooters and bicycles.
- Be electric to satisfy AT's zero local emissions policy.

6.6 Airport section

6.6.1 General

The section of the route beyond the boundary of AIAL's land is subject to AIAL's design processes and must integrate with the transport network being developed by AIAL. The two stations proposed in the airport area are expected to contribute significantly to the ridership of the system and strategically the connection with the airport is a core factor in the need for the system making these stations and the effectiveness of the section within the airport area key to the success of the entire route.

While from a design perspective the part of the route that sits within AIAL's boundary is outside the scope of the Airport to Botany SSBC, the section is a core part of the future operation and the expectation is that the system performance characteristics described in this Concept of Operations will be applied to the system as it operates within the airport area.

At the time of writing this Concept of Operations, it is understood that there are two key differences likely to apply to the system operation that will need to be managed, discussed below.

6.6.2 Shared running way

While the form and function of future light rail between the city centre and the airport is not confirmed, modelling and designs to date have assumed a shared alignment with Airport to Botany services on Tom Pearce Drive within the airport area.

There is an expectation that the performance characteristics outlined in this Concept of Operations and supporting material will be applied in the design of the shared facility.

6.6.3 Shared stations

This potential shared alignment will create the need for shared stations so that both the proposed light rail and Airport to Botany services can access the key activity centres within the airport area.

Tom Pearce Drive

The station serving the airport's office park is proposed to be served by both light rail and Airport to Botany lines. This will create a number of design and operational integration issues which will require resolution. Platform height and length will be key issues as these interfaces with vehicle design when combined with the desire to achieve level boarding on both systems. Dwell time will affect the reliability and journey time for both routes. These issues may have implications for the entire Airport to Botany route.

Airport Terminal

It is understood that design of the airport terminal station will accommodate both Airport to Botany and light rail services. This will require consideration of all aspects referred to in this Concept of Operations, including but not limited to:

- Platform layout and allocation
- Legibility, facilities, comfort and information for customers
- End of trip facilities for drivers and recovery space for buses
- Repositioning for buses
- Scheduling and reliability of timetable for each route on departure (noting shared proposed shared carriageway)
- Safety and conflicts

The design and location of the airport terminal station will also require consideration of customer access to terminals and ensuring that the terminals is highly placed in the access hierarchy for the terminal itself with associated quality, legible, comfortable and direct access between terminal and the platforms.

7 System management

While at an early stage of design, this section outlines what a typical management system could include and how it could work. This is an aspect of the system that will be developed in later phases, but in principle is considered important to deliver the customer experience, reliability and speed attributes required to deliver the benefits of the Airport to Botany service and assumed in the SSBC.

7.1 Control centre

It is anticipated that to provide for the intended reliability, performance and customer experience that a system of active, real-time management will be required. Early intervention to resolve issues and maintain system performance will be key to delivering the quality of product sought in the business case for Airport to Botany. The systems involved in the control and management of BRT (Figure 7-1) would include:

- Operation Aid and Planning System to get real-time vehicle location and operations planning
- Radio Communication System(s) for communication between drivers and Control Centre staff and transmission of data (e.g. vehicle location, passenger information panels)
- Traffic Signal Priority System for signal timing and ability to influence intersection priority
- Real-time Passenger Information System at stations and in vehicles
- Public Address at stations and in vehicles
- Telephony/Intercom systems for communication between passengers and the Control Centre staff
- CCTV and security monitoring in stations and in vehicles
- Monitoring of ticketing equipment
- Operation and monitoring of charging power supply equipment (if BRT vehicles are electric)
- Interface with the wider network management systems and teams in Auckland Transport and Waka Kotahi.

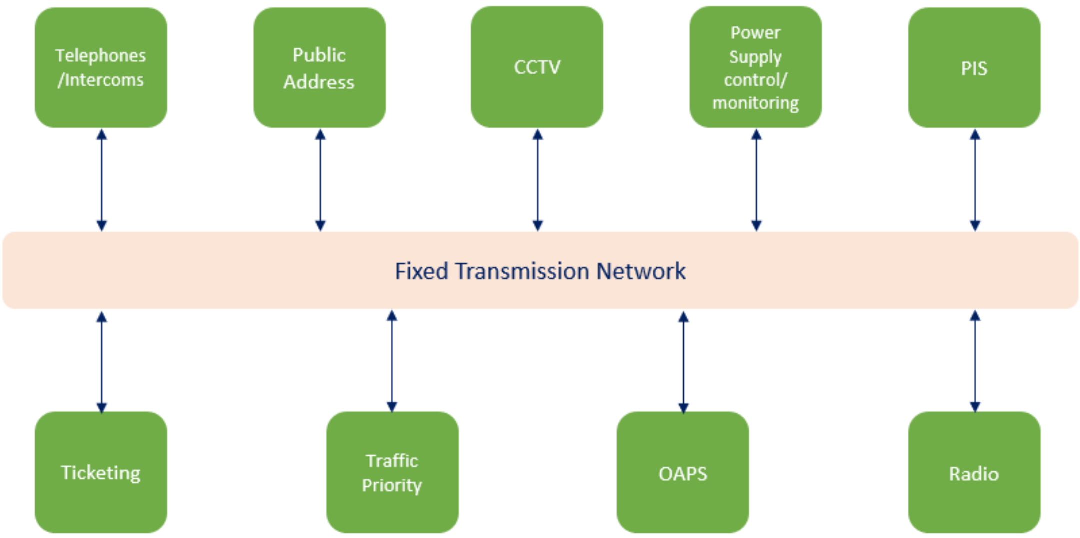


Figure 7-1: Systems involved in the control and management of BRT operations

A control centre could be specific to the route or an additional function of Auckland Transport's existing control centre arrangements. In any case, it will be necessary to install video panels, which show the entire BRT route, so that an operator can monitor for example the location of buses, status of traffic signals at junctions, charging points, cameras, ticketing machines, alarms, etc and be able to inform of any incidents to the necessary staff or agency.

The same operator could also answer passenger calls from help points depending on the roles and manning of the Control Centre.

The following sections outline some of the typical functions of a control centre in operating a BRT.

7.1.1 Operation Aid and Planning System (OAPS)

This system could be functionally divided into two parts, the Real Time OAPS and the Deferred Time OAPS.

The first one is responsible for the management in real time of the operation and is composed of two agents, a central module, installed on a server in the control centre and an on-board module, installed in the vehicles.

To allow consistent operation of both systems, central and on-board, it is necessary that all on-board units are synchronized with the central server and that this, in turn, is synchronized with the central clock of the control centre, which is usually based on GPS as time source.

The Deferred OAPS is responsible for carrying out the work before and after the operation, that is, it allows the planning of the different services in the first instance, as well as the planning of the personnel and mobile units associated with them. Additionally, once the day is over, the application will allow the generation of different reports and statistics for analysis of the operation.

Figure 7-2 is an outline of a typical architecture of the OAPS system, as well as its interaction with third parties.

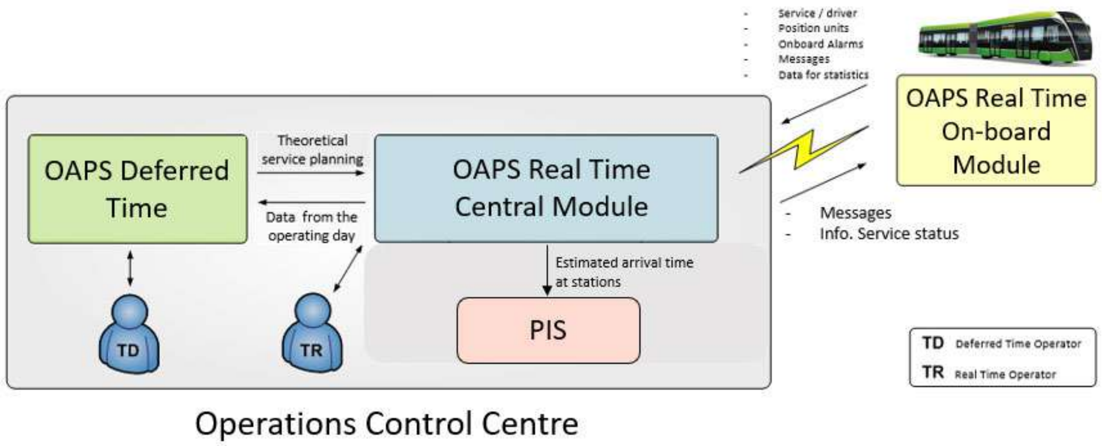


Figure 7-2: OAPS system architecture

7.1.2 Radio Communication System

Two systems can be distinguished with two different purposes:

- Voice communication: This system will be used for the transmission of voice and light data in real time along the entire route between bus drivers and the control centre staff, as well as for communication with maintenance or security personnel. Private Radio Networks are used, standards such as TETRA or more future-proof technologies based on 4G or 5G
- Data transmission: This system will be used for the transmission of heavy data to and from mobile units e.g. through WIFI. The premises of workshops and garages will provide coverage so that, outside operating hours, data can be transferred from the vehicles to central systems (OAPS).

7.1.3 Traffic Signal Priority System

This system, shown in Figure 7-3, is used on junctions with other road vehicles to give priority to buses, which is a key aspect in the implementation of a BRT. There are different systems depending on the way buses are given priority and detected (which are called “active signal priority” systems), for example:

- Bus detection based on elements installed on the road
- Bus detection based on vehicle-road detectors (e.g. loop detectors)
- Remote Control: priority is requested by the driver through a push-button

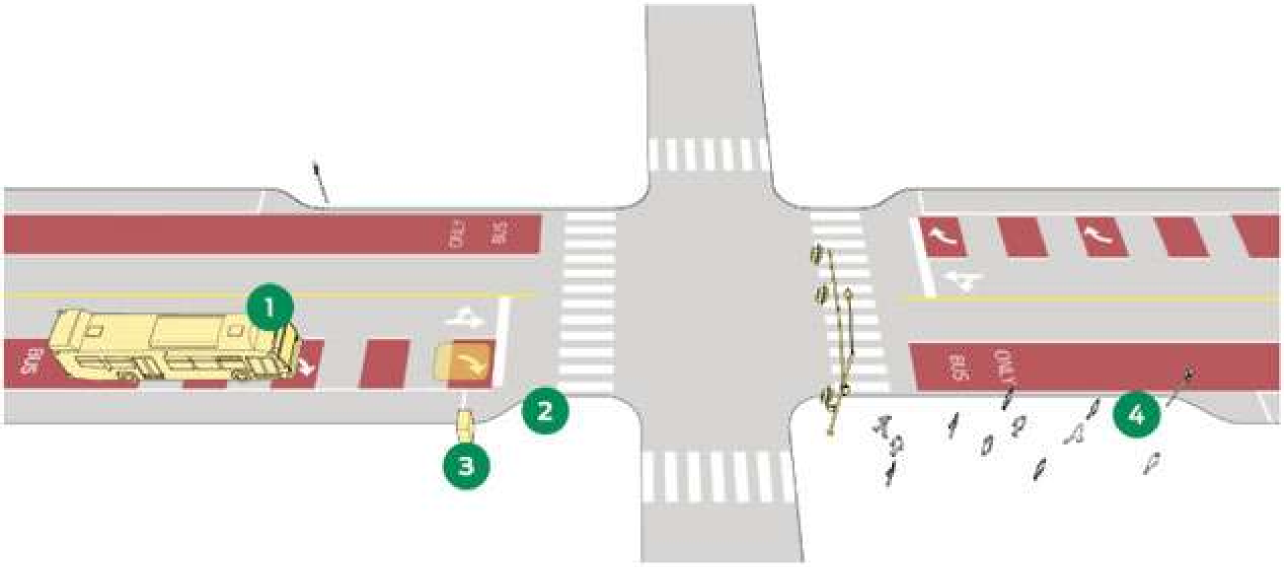


Figure 7-3: Traffic Signal Priority is key in the implementation of a BRT system

- Active signal priority uses a combination of on-board and wayside technology that determines what type of signal priority can be implemented. Conditional priority usually requires on-board automatic vehicle location, GPS, optical or laser communication, or other link between the transit vehicle and the signal system (1)
- Active transit signal priority can be provided on transitways using in-ground loop detectors to identify arriving transit vehicles, since only authorized vehicles are present (2)
- Intersection signal controllers and centralized traffic signal management systems are usually the longest-lifecycle elements of the system, and should be chosen with flexibility in mind and in direct coordination with transit agencies and technical specialists (3)
- A simple detection system that detects vehicle presence only, such as an in-ground loop detector, can be used to provide unconditional priority to transit vehicles operating on a transitway without the need for special equipment, as long as the intersection already has detection capability for other vehicles (4)

7.1.4 Real-time Passenger Information Displays (PIDs)

Auckland Transport has a system in place, and it is expected the Airport to Botany system would form part of this.

This system aims to disseminate information of interest to passengers, such as next bus arrivals. It consists of graphic terminals at bus stations and in vehicles as wells as centralised components located in the control centre. The PIDs gets the information from the OAPS.

The type of information which the PIDs may present includes service information such as vehicles location, estimated time of arrival, occupancy and destination.

7.1.5 Public Address (PA)

This system is used to make announcements to passengers at bus stations. Messages can be pre-recorded or transmitted live from an operator's microphone.

The following main components are distinguished within the Public Address system at a station:

- Speakers distributed and integrated within the scope of the station
- Power stages sized to power all speakers distributed in the station with redundant configuration

For the management and supervision of all the equipment mentioned above, specific equipment is required in the control centre:

- A microphone desks
- PA server including management software

The management software will allow direct supervision of all system elements so that any incident will be reported to the corresponding operator.

7.1.6 Telephony/Intercom System

This system will allow the following:

- Communication between passengers through intercoms at bus stations and the control centre staff
- Communication between operations staff and the control centre e.g. through telephones at ticketing offices, technical rooms, garage.
- Communication between control centre staff to external numbers through the public operator network

In general, this kind of systems consist of the following main components, which are shown in the figure below:

- Telephones in offices at bus stations, charging points, garage, etc
- Telephony server (PABX) in the control centre
- Help-point intercoms in stations

  Audio recorder (can be combined with the audio recorder for the Radio System for Voice communication)

7.1.7 CCTV

The video surveillance system, also called CCTV, has the function of capturing images in strategic locations to allow the following:

- Supervision of the movement of buses
- Provide security for example in the following areas:
  - Passengers area: e.g. at help points
  - Equipment in bus stations or technical rooms: the system can be integrated with the Access Control system in case an alarm is raised (intrusion detected)
  - Traffic signals
  - Access to buildings: workshops, garage, control centre

Auckland Transport has a suite of CCTV cameras and monitoring systems for train stations, busway stations and other facilities. It is expected that Airport to Botany will require an expansion of this service.

7.1.8 Operation and Monitoring of Charging Power Supply Equipment

When using electric buses, it is essential to be able to control and monitor the power supply equipment in electrical substations, which are responsible for delivering the necessary power to the bus charging points. This is done by having a “Command and Control” system.

The following parameters can be monitored in the charging points:

- Power transformer temperature
- Currents and power consumption cells (e.g. disconnectors, and breakers state. Currents and power consumption. Voltage, Temperature monitoring).
- UPS (e.g. state of the batteries and breakers)
- Monitoring of alarms

The Command and Control system also involves HW and SW in the Control Centre such as central server(s) and the corresponding operator workstation, so that remote control of power equipment is possible.

7.2 Revenue protection

The proposed off-vehicle ticketing model involving validation on platforms and all-door boarding is likely to require ongoing revenue protection staffing requirements to reduce fare evasion. This is an existing activity within Auckland Transport for the rail system which operates many stations the same way. This service is likely to require expansion with the proposed operating model.

7.3 Staff and training

The core intent of the system is an easy to use, turn-up-and-go model in order to attract new users and achieve behaviour change. The system proposed significant investment in stations, vehicles and running ways to be design with the potential to achieve these outcomes.

Staffing levels have not been specifically defined at this time, however staff at major stations is likely and, in some cases, already provided (Manukau) and proposed (Puhinui). Vehicles are likely to have a driver-only operation.

In daily operation, the optimal implementation of the potential for this system will be the responsibility of staff. As this is a form of bus for example, alignment at platforms and in-vehicle ride quality is the responsibility of drivers. This can be mitigated through technology such as limitations of acceleration and deceleration and autonomous operation, however staff will always have an influence on customer experience. It is suggested that training and protocols be put in place to specify key aspects that cannot be mitigated through technology. This includes energy consumption though guidelines and monitoring of driver performance.

7.4 Modes of operation

The proposed transport system will operate under the following operational modes:

- Normal operations
- Degraded operations
- Incidents and emergency operations
- Planned maintenance
- Special events.

The following sections provide a high-level description of each of these modes. Future development of the operational concept and system design will include greater definition of the modes and their management responses to align with AT's wider network. This will include the return to normal service.

7.4.1 Normal operations

During normal operating conditions, a safe and efficient network means traffic is flowing freely at or near the posted speed, and the likelihood of congestion is low, or the duration and intensity of congestion is minimised. A reliable network means users are informed about traffic conditions in an appropriate and timely manner, enabling each journey to be predictable with expected travel times, resulting in no surprises to the road or public transport user.

Normal operations include the following defined periods of the day:

- **Peak –** between 07:00 - 08:59 and 16:00 -18:59
  This is the period with the highest volume of traffic during a day. Across the network, several proactive traffic management practices using a range of ITS tools and services will be used to provide customers with a reliable, safe and efficient journey during peak periods. The minimum frequency of peak services will be five minutes.

- **Off-Peak –** between 06:00 - 06:59, 09:00 - 15:59 and 19:00 - 23:59
  This is the remainder of the time that is not 'peak'. Off-peak periods may include weekends and will be associated with relatively low traffic flows and generally free flow conditions with speeds at or near the posted speed limit. The minimum frequency of off-peak services will be 10 minutes.

- **Early-morning and late-night –** between 04:30-06:59 and 00:00-01:29
  This period has a lower demand but is essential for some workers to get to and from work. The minimum frequency of early-morning/late-night services will be 15 minutes.

Normal operations is considered as *Business as Usual*, where the system operates and performs as planned within defined limits and constraints. This includes typical scenarios that are not considered as degraded or emergency, e.g. the bunching of buses. In this scenario, where stations are located adjacent to signals, the second bus can pull up behind the active platform and wait (see Figure 7-4). Short dwell times mean delay would be minimal. Other scenarios will be explored as the operational concept is developed.

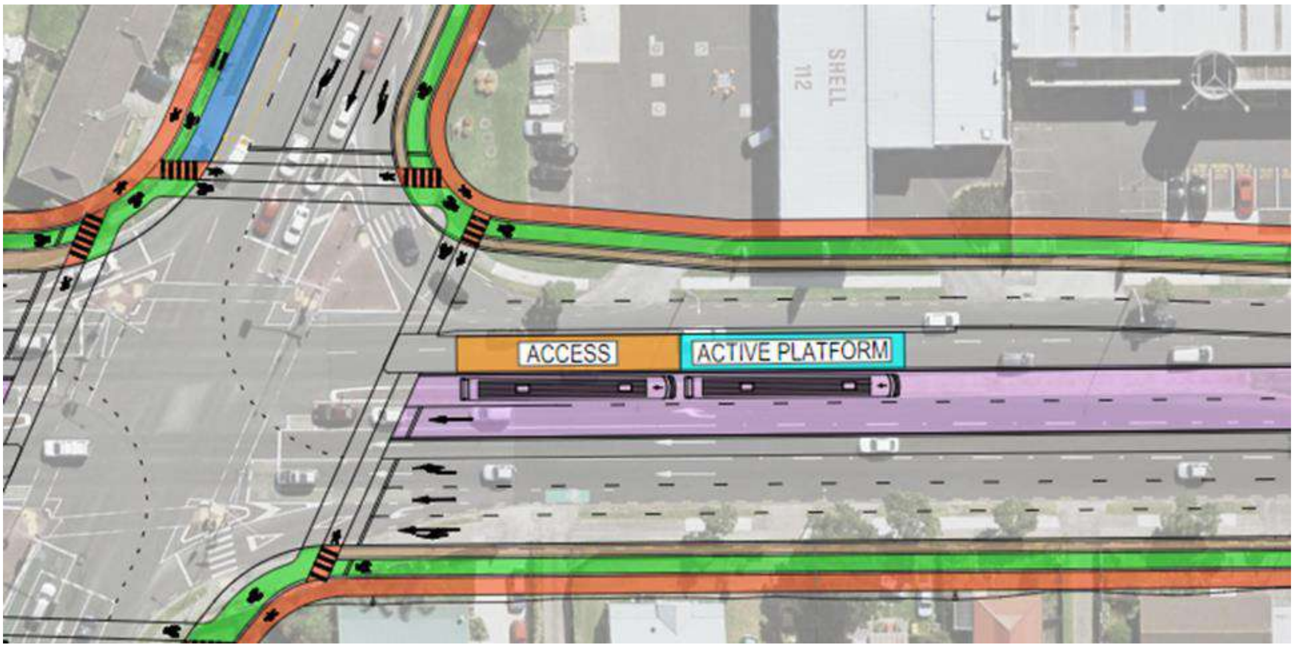


Figure 7-4: Management of bunching at stations

7.4.2 Degraded operations

Degraded operations are defined as the restricted conditions under which systems and subsystems may be operated in the event of a technical failure that requires intervention. Such events are not planned, and customers cannot be informed at least 24 hours in advance about deviations to the standard levels of service. Degraded operation is likely to affect service delivery on the system, with capacity affected by irregular headways and/or slower journey times.

Degraded scenarios and their contingency plans will be determined as the operational concept is developed. These scenarios may include:

- Stranded bus (between stations or at a station)
- Traffic signals failure
- Bus failure at start of service.

7.4.3 Incidents and emergency operations

Incident and emergency operations are defined as situations where systemwide operational capability, including functional and performance capability, is severely degraded, or completely lost due to a catastrophic system event, or major system or security event. In the context of the A2B system, an incident or emergency is an unplanned event or activity that may lead to:

- disturbances in normal traffic flow conditions,
- public transport unreliability, or
- risk to human life and the transport infrastructure.

Incidents require a safe and efficient response that reduces the risk of secondary incidents and restores the network to normal conditions as soon as possible. These events can occur at any time of the day and during any traffic or weather conditions. Incident detection, response and escalation will be coordinated through ATOC, in consultation with other partners, depending on incident level and defined partner roles and responsibilities.

The strategy for managing incidents and emergencies will be determined as the operational concept is developed. These scenarios may include:

- Fire
- Bomb threat
- Explosion
- Public disorder, armed intrusion or criminal acts
- Chemical, biological or radiological event
- Medical event
- Collision of bus
- Extreme weather event
- Earthquake, tsunami or volcanic eruption
- Evacuation or loss of ATOC
- Unplanned major service disruption (crowding)
- Traffic signals or communication system outage.

7.4.4 Planned maintenance

During planned events, a safe and efficient network means that customers are well informed of the event in advance, and well-planned traffic diversions and replacement services in place to minimise the impact on customer journeys. For the road network, Temporary Traffic Management Plans (TTMPs) will need to be prepared and approved by relevant authorities for all planned maintenance.

7.4.5 Special events

Special events may require direct use of corridors or indirectly influence traffic flows. Traffic management plans be prepared and approved by relevant authorities for events that may interfere with normal network operations.

Appendix A

Notes:

These ables (w th the exception of the Puhinui Rail boardings/al ghtings) should reflect the data contained in F g. 5-1 of the Concept of Operat ons.
Any assumpt ons shou d be stated (e.g. what is the AM peak, PM peak, Interpeak; are these f gures for A2B services only or for all services using the stat on in question etc.)

Airport to Botany Rapid ransit Forecast Boardings by Station

Station	Type	Variable	Location	Do min / Horizon 1 (2021) Model year: 2028 Boardings AM Peak	PM Peak	Interpeak	Daily	Annual	Horizon 2 (2025) Model year: 2028 Boardings AM Peak	PM Peak	Interpeak	Da ly	Annual
All stations	Total												
	Walk-up												
	Transfers from other PT												
Airport erminal	Total	num_boardings	Airport	559	706	697	,858	1,55 ,520	610	732	735	5,081	1,625,796
	Walk-up	num_journey_starts	Airport	79	671	653	,555	1, 57,631	82	676	658	,589	1, 68, 50
	Transfers from other PT		Airport	80	35	5	303	96,889	128	56	78	92	157,3 6
he Quad	Total	num_boardings	The Quad Business Park	110	190	639	1,719	5 9,951	110	188	633	1,702	5 ,595
	Walk-up	num_journey_starts	The Quad Business Park	110	190	639	1,719	5 9,951	110	188	633	1,702	5 ,596
	Transfers from other PT		The Quad Business Park	0	0	0	0	0	0	0	0	0	0
Puhinui	Total	num_boardings	Puhinui Bus	10 2	227	188	2,386	763,571	1286	278	239	2,9 2	9 1,567
	Walk-up	num_journey_starts	Puhinui Bus	71	2	15	207	66,2 8	112	36	26	320	102,355
	Transfers from other PT		Puhinui Bus	971	203	172	2,179	697,322	1,17	2 2	213	2,623	839,212
Lambie	Total	num_boardings	Lamb e	30	15	1	1 8	7,509	28	17	31	1 5	6,329
	Walk-up	num_journey_starts	Lamb e	30	15	1	1 8	7,509	28	17	31	1 5	6,329
	Transfers from other PT		Lamb e	0	0	0	0	0	0	0	0	0	0
Manukau Station	Total	num_boardings	Manukau (Davies Avenue)	1031	580	1217	5,206	1,665,809	1052	619	1309	5,520	1,786,288
	Walk-up	num_journey_starts	Manukau (Davies Avenue)	1 1	272	670	2,200	703,856	153	296	7 2	2, 02	766,737
	Transfers from other PT		Manukau (Davies Avenue)	890	308	5 7	3,006	961,95	900	32	567	3,117	997,551
Ronwood	Total	num_boardings	Ronwood (incl. AUT)	35	8	126	08	130,60	57	81	235	706	225,831
	Walk-up	num_journey_starts	Ronwood (incl. AUT)	35	8	126	08	130,60	57	81	235	706	225,831
	Transfers from other PT		Ronwood (incl. AUT)	0	0	0	0	0	0	0	0	0	0
Diorella	Total	num_boardings	D orel a	0	0	0	0	0	65	22	16	195	62,253
	Walk-up	num_journey_starts	Diorel a	0	0	0	0	0	65	22	16	195	62,253
	Transfers from other PT		Diorel a	0	0	0	0	0	0	0	0	0	0
Dawson	Total	num_boardings	Dawson	0	0	0	0	0	1 3	83	116	68	218,927
	Walk-up	num_journey_starts	Dawson	0	0	0	0	0	1 3	83	115	683	218,582
	Transfers from other PT		Dawson	0	0	0	0	0	0	0	0	1	335
Ormiston	Total	num_boardings	Ormiston	7		17	83	26, 5	6	27	60	260	83,208
	Walk-up	num_journey_starts	Ormiston	33		12	6	20,582	57	26	58	2 6	78,620
	Transfers from other PT		Ormiston	1	0	5	18	5,872	7	1	2	1	,588
Smales	Total	num_boardings	Smales	50	30	1	217	69, 26	251	10	97	878	280,9 9
	Walk-up	num_journey_starts	Smales	50	30	1	217	69, 26	251	10	97	877	280,685
	Transfers from other PT		Smales	0	0	0	0	0	0	0	0	1	26
Accent	Total	num_boardings	Accent	2	0		6	1 ,709	5	12	56	165	52,823
	Walk-up	num_journey_starts	Accent	39	0		3	13,706	2	12	50	155	9,552
	Transfers from other PT		Accent	3	0	0	3	1,003	3	0	6	10	3,271
Botany	Total	num_boardings	Botany	1886	1282	1357	9,779	3,129,3 7	2272	1 65	1675	11, 17	3,653,551
	Walk-up	num_journey_starts	Botany	566	370	9	2,9 6	9 2,816	96	356	77	2,790	892,767
	Transfers from other PT		Botany	1,320	912	863	6,833	2,186,531	1,777	1,108	1,198	8,627	2,760,78
Puhinui Station Rail Patronage	Total	num_boardings	Puhinui Ra l	62	289	979	2,917	933,562	9	316	1061	3,169	1,01 ,12
	Walk-up	num_journey_starts	Puhinui Ra l	381	1 9	195	1,338	28,1 7	362	1	190	1,288	12,2
	Transfers from other PT		Puhinui Ra l	81	1 0	783	1,579	505, 16	133	172	871	1,881	601,881

Station	Type	Hor zon 3 (2030) Model year: 2028 Boardings AM Peak	PM Peak	Interpeak	Daily	Annual	Horizon 4 (2035) Model year: 2038 Boardings AM Peak	PM Peak	Interpeak	Daily	Annual	Horizon 5 (2040) Model year: 20 8 Boardings AM Peak	PM Peak	Interpeak	Daily	Annual
All stations	Total	NO FILLED OU O AVOID M SIN ERPRE A ION OF RESUL S SEE ASSUMP IONS SHEE FOR DE AILS ON ASSUMP IONS														
	Walk-up															
	Transfers from other PT															
Airport erminal	Total	1002	8 6	1017	6,335	2,027,3 2	1755	1296	1662	10,027	3,208,778	2133	1608	2020	12,353	3,952,831
	Walk-up	91	688	669	,668	1, 93,76	629	886	861	6,009	1,923,025	781	1103	1073	7, 78	2,392,908
	Transfers from other PT	512	158	3 8	1,667	533,578	1,127	10	800	,018	1 285,753	1,352	505	9 8	,875	1,559,923
he Quad	Total	17	333	1383	3,256	1,0 2,039	300	590	2370	5,679	1,817,398	30	862	3 6	8,271	2,6 6,67
	Walk-up	17	333	1383	3,256	1,0 2,039	300	590	2370	5,679	1,817,398	30	862	3 6	8,271	2,6 6,67
	Transfers from other PT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Puhinui	Total	1 16	305	280	3,252	1,0 0,5 9	2 7	567	677	6,1 6	1,966,629	3311	73	1029	8,085	2,587,119
	Walk-up	123	1	31	363	116,299	157	63	5	521	166,765	175	80	53	63	202,7 2
	Transfers from other PT	1,29	26	2 9	2,888	92 ,250	2,317	525	633	5,625	1,799,86	3,136	655	977	7, 51	2,38 ,377
Lambie	Total	29	16	31	1 2	5, 37	106	50	77	39	1 0,365	119	51	99	80	153,75
	Walk-up	29	16	31	1 2	5, 37	102		65	391	125,135	11	3	78	10	131,290
	Transfers from other PT	0	0	0	0	0		6	12	8	15,230	5	9	21	70	22, 6
Manukau Station	Total	1096	6 0	1370	5,727	1,832,763	1 61	1000	1808	8,357	2,67 ,255	1898	1260	2227	10,553	3,377,081
	Walk-up	156	303	756	2, 57	786,1 2	262	5	1003	3,53	1,131,008	35	523	1139	,161	1,331, 25
	Transfers from other PT	9 0	337	61	3,271	1,0 6,621	1,189	555	806	,823	1,5 3,2 6	1,5	737	1,088	6,393	2,0 5,656
Ronwood	Total	6	96	262	817	261,5	128	18	508	1,57	503,731	191	258	680	2,187	699,682
	Walk-up	6	96	262	817	261,5	128	18	508	1,57	503,731	191	258	680	2,187	699,682
	Transfers from other PT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diorella	Total	69	23	17	205	65,625	215	71	6	622	199,032	233	75	52	668	213,851
	Walk-up	69	23	17	205	65,625	215	71	6	622	199,032	233	75	52	668	213,851
	Transfers from other PT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dawson	Total	1 9	87	119	710	227,208	567	277	280	2,2 1	716,99	685	296	303	2, 96	798,626
	Walk-up	1 9	87	118	708	226,680	82	2 5	232	1,963	628,070	598	25	262	2,15	689,153
	Transfers from other PT	0	0	1	2	527	85	32	28	278	88,925	87	2	0	3 2	109, 73
Ormiston	Total	6	28	62	267	85,28	710	313	66	2,972	951,0 6	913	0	832	3,991	1,277,135
	Walk-up	57	26	59	251	80,230	7	1	118	373	119,209	5	7	138	30	137, 66
	Transfers from other PT	8	1	2	16	5,05	66	273	5 5	2,599	831,838	859	39	69	3,561	1,139,669
Smales	Total	253	105	99	886	283, 8	17	156	17	1,388	,10	75	17	209	1,570	502,308
	Walk-up	253	10	98	882	282,185	390	1 6	153	1,286	11,	0	162	18	1, 53	6 ,800
	Transfers from other PT	0	1	1		1,262	27	11	21	102	32,660	35	11	25	117	37,508
Accent	Total	6	1	56	173	55,325	112	58	133	5 1	173,192	151	76	160	699	223,631
	Walk-up	2	1	51	16	52,502	89	6	116	38	1 0,15	115	59	137	556	177,879
	Transfers from other PT	3	0		9	2,823	23	12	17	103	33,038	35	17	22	1 3	5,752
Botany	Total	2279	1 70	1673	11, 51	3,66 ,358	3563	2077	3011	17,165	5, 92,682	176	2 20	3 15	19,933	6,378,68
	Walk-up	96	357	77	2,792	893, 56	751	563	78	, 05	1, 09,739	9 5	716	975	5,573	1,783,3 1
	Transfers from other PT	1,783	1,11	1,196	8,659	2,770,901	2,812	1,51	2,227	12,759	,082,9 3	3,231	1,70	2, 0	1 ,360	,595,3
Puhinui Station Rail Patronage	Total	627	372	1110	3,532	1,130,365	1056	616	1818	6,015	1,92 ,7 6	1 95	7 7	2389	7,693	2, 61,789
	Walk-up	356	1 1	18	1,257	02,208	339	130	159	1,162	371,865	512	173	231	1,628	520,815
	Transfers from other PT	172	231	926	2,275	728,156	717	86	1,659	,853	1,552,881	983	573	2,157	6,066	1,9 0,97

A rport to Botany Rapid ransit Forecast Alightings by Station

Station	Type	Variable	Location	Do min / Horizon 1 (2021) Model year: 2028 A ightings AM Peak	PM Peak	Interpeak	Daily	Annual	Horizon 2 (2025) Model year: 2028 Alightings AM Peak	PM Peak	Interpeak	Da ly	Annual
All stations	Total												
	Walk-off												
	Transfers												
Airport erminal	Total	num_al ghtings	Airport	6	7 3	713	5,1 6	1,6 6,737	696	770	751	5,371	1,718,781
	Walk-off	num_journey_ends	Airport	56	708	668	,8 3	1,5 9,8 7	568	71	673	,879	1,561, 3
	Transfers		Airport	80	35	5	303	96,889	128	56	78	92	157,3 6
he Quad	Total	num_al ghtings	The Quad Business Park	679	22	232	2,055	657, 95	675	220	229	2,027	6 8,532
	Walk-off	num_journey_ends	The Quad Business Park	679	22	232	2,055	657, 95	675	220	229	2,027	6 8,532
	Transfers		The Quad Business Park	0	0	0	0	0	0	0	0	0	0
Puhinui	Total	num_al ghtings	Puhinui Bus	65	135	757	1,508	82,712	129	181	880	1,93	618,8
	Walk-off	num_journey_ends	Puhinui Bus	5	8	30	79	25,280	12	15	39	127	0,627
	Transfers		Puhinui Bus	60	126	727	1, 29	57, 32	117	166	8 1	1,807	578,217
Lambie	Total	num_al ghtings	Lamb e	89	33	0	297	95,180	1	21	37	186	59,596
	Walk-off	num_journey_ends	Lamb e	89	33	0	297	95,180	1	21	37	186	59,596
	Transfers		Lamb e	0	0	0	0	0	0	0	0	0	0
Manukau Station	Total	num_al ghtings	Manukau (Davies Avenue)	1 75	503	780	,801	1,536,36	1573	573	81	5,309	1,698,782
	Walk-off	num_journey_ends	Manukau (Davies Avenue)	622	26	220	2,191	701,236	708	312	2 8	2,5 9	815,731
	Transfers		Manukau (Davies Avenue)	852	239	5 0	2,610	835,128	865	260	566	2,760	883,051
Ronwood	Total	num_al ghtings	Ronwood (incl. AUT)	211	96	76	777	2 8,603	392	151	110	1,27	07,7 7
	Walk-off	num_journey_ends	Ronwood (incl. AUT)	211	96	76	777	2 8,603	392	151	110	1,27	07,7 7
	Transfers		Ronwood (incl. AUT)	0	0	0	0	0	0	0	0	0	0
Diorella	Total	num_al ghtings	D orel a	0	1	0	6	1,766	2	11	0	120	38,358
	Walk-off	num_journey_ends	D orel a	0	1	0	6	1,766	2	11	0	120	38,358
	Transfers		D orel a	0	0	0	0	0	0	0	0	0	0
Dawson	Total	num_al ghtings	Dawson	0	0	0	0	0	121	8	81	8	1 3,221
	Walk-off	num_journey_ends	Dawson	0	0	0	0	0	121	8	81	7	1 2,886
	Transfers		Dawson	0	0	0	0	0	0	0	0	1	335
Ormiston	Total	num_al ghtings	Ormiston	19	3	26	58	18,702	67	23	7	232	7 ,3 1
	Walk-off	num_journey_ends	Ormiston	1	3	20	8	15,205	65	22	6	225	71,999
	Transfers		Ormiston		0	6	11	3, 97	2	1	0	7	2,3 1
Smales	Total	num_al ghtings	Smales	22	33	9	239	76, 17	76	62	162	556	177,982
	Walk-off	num_journey_ends	Smales	22	33	9	239	76, 17	76	62	161	555	177,719
	Transfers		Smales	0	0	0	0	0	0	0	0	1	26
Accent	Total	num_al ghtings	Accent		0	1	20	6,319	9	15	35	161	51,508
	Walk-off	num_journey_ends	Accent		0	1	20	6,319	6	15	29	151	6,236
	Transfers		Accent	0	0	0	0	0	3	0	6	10	3,271
Botany	Total	num_al ghtings	Botany	1691	12 5	1228	9,269	2,966,0 0	2189	1 68	1616	11,293	3,613,8 1
	Walk-off	num_journey_ends	Botany	379	337	36	2, 63	788,122	20	36	17	2,693	861,653
	Transfers		Botany	1,312	908	86	6,806	2,177,918	1,768	1,105	1,199	8,601	2,752,188
Puhinui Station Rail Patronage	Total	num_al ghtings	Puhinui Ra l	1078	269	18	2,866	917,233	1272	297	28	3,217	1,029,305
	Walk-up	num_journey_ends	Puhinui Ra l	85	52	189	537	171,927	82	9	186	520	166, 30
	Transfers		Puhinui Ra l	992	217	229	2,329	7 5,306	1,190	2 8	2 2	2,696	862,875

Station	Type	Hor zon 3 (2030) Model year: 2028 Alightings AM Peak	PM Peak	Interpeak	Daily	Annual	Horizon 4 (2035) Model year: 2038 Al ghtings AM Peak	PM Peak	In erpeak	Daily	Annual	Horizon 5 (2040) Model year: 20 8 A ightings AM Peak	PM Peak	Interpeak	Daily	Annual
All stations	Total	NO FILLED OU O AVOID M SIN ERPRE A ION OF RESUL S SEE ASSUMP IONS SHEE FOR DE AILS ON ASSUMP IONS														
	Walk-off															
	Transfers															
Airport erminal	Total	1089	88	1032	6,631	2,122,070	1861	13 9	1683	10, 23	3,335,2	2262	1675	20 8	12,851	,112,389
	Walk-off	577	726	685	,96	1,588, 92	73	939	883	6, 05	2,0 9, 91	911	1170	1100	7,976	2,552, 67
	Transfers	512	158	3 8	1,667	533,578	1,127	10	800	,018	1,285,753	1,352	505	9 8	,875	1,559,923
he Quad	Total	1583	56	22	,328	1,385,105	27 3	820	735	7,659	2, 50,9 1	035	1202	106	11,226	3,592, 75
	Walk-off	1583	56	22	,328	1,385,105	27 3	820	735	7,659	2, 50,9 1	035	1202	106	11,226	3,592, 7
	Transfers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Puhinui	Total	157	210	932	2,160	691,177	621	502	1699	,881	1,561,891	808	601	2172	6,0 5	1,93 ,371
	Walk-off	13	16	0	133	2,519	27	31	68	255	81,673	29	0	76	307	98,318
	Transfers	1 5	19	893	2,027	6 8,658	595	71	1,631	,626	1, 80,218	780	561	2,097	5,738	1,836,053
Lambie	Total	5	22	0	195	62,301	77	0	82	361	115,659	83	8	97	25	135,95
	Walk-off	5	22	0	195	62,301	73	3	69	31	100, 30	79	39	77	355	113, 90
	Transfers	0	0	0	0	0		6	12	8	15,230	5	9	21	70	22, 6
Manukau Station	Total	1630	591	865	5,507	1,762,085	201	1161	131	9 2 6	2,958,8 5	2336	1391	1695	11,123	3,559,226
	Walk-off	723	320	253	2,610	835,099	1086	621	25	678	1, 97,088	1185	688	89	5,182	1,658,172
	Transfers	907	270	612	2,897	926,987	928	539	889	,568	1, 61,757	1,151	703	1,206	5,9 1	1,901,05
Ronwood	Total	06	157	115	1,321	22,8 9	6 3	289	215	2,333	7 6,716	865	398	300	3,195	1,022,277
	Walk-off	06	157	115	1,321	22,8 9	6 3	289	215	2,333	7 6,716	865	398	300	3,195	1,022,277
	Transfers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diorella	Total	26	11	2	126	0, 00	0	2	88	252	80,61	8	27	160	3	109,973
	Walk-off	26	11	2	126	0, 01	0	2	88	252	80,61	8	27	160	3	109,973
	Transfers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dawson	Total	123	51	83	68	1 9,762	285	152	378	1, 37	59,960	318	16	72	1,62	519,77
	Walk-off	123	51	82	66	1 9,235	277	138	3 7	1,328	2 ,965	308	155	38	1,536	91,5
	Transfers	0	0	1	2	527	7	1	31	109	3 ,996	11	9	3	88	28,230
Ormiston	Total	68	2	8	2 0	76,882	787	321	597	3,020	968, 76	1005	6	756	,036	1,291,588
	Walk-off	66	23	8	232	7 ,182	12	8	52	21	13 ,638	1 6	52	61	75	151,919
	Transfers	2	1	1	8	2,710	66	273	5 5	2,599	831,838	859	39	69	3,561	1,139,669
Smales	Total	77	63	163	56	180,3 9	156	110	285	1,005	321,5 8	133	127	35	1,137	383,716
	Walk-off	77	63	162	560	179,087	129	100	26	903	288,889	98	116	329	1,019	326,208
	Transfers	0	1	1		1,262	27	11	21	102	32,660	35	11	25	117	37,508
Accent	Total	51	17	35	173	55,239	1	58	101	539	172, 98	172	69	128	652	208,596
	Walk-off	8	17	30	16	52, 16	121	5	8	36	139, 60	137	52	105	509	162,8 3
	Transfers	3	0		9	2,823	23	12	17	103	33,038	35	17	22	1 3	5,752
Botany	Total	2197	1 75	161	11,331	3,625,862	3 67	207	2852	16 898	5, 07,303	087	2 18	3232	19,651	6,288,355
	Walk-off	22	365	16	2,699	863,558	669	567	626	,189	1,3 0,561	87	731	805	5, 06	1,729, 3
	Transfers	1,775	1,110	1,198	8,632	2,762,30	2,798	1,507	2,226	12,709	,066,7 2	3,213	1,688	2, 27	1 ,2 7	,558,911
Puhinui Station Rail Patronage	Total	1 03	350	65	3,653	1,168,869	252	586	8 0	6 353	2,032,801	3 52	719	1287	8, 06	2,689, 6
	Walk-up	82	9	183	516	165,121	93	50	185	535	171,05	119	57	256	663	212,127
	Transfers	1,321	301	282	3,137	1,003,7 8	2, 31	536	655	5,818	1,861,7 7	3,333	662	1,032	7,7 2	2, 77,319

Assumptions

From AFC

Daily boardings are estimated as: AM + 5.1* P + PM

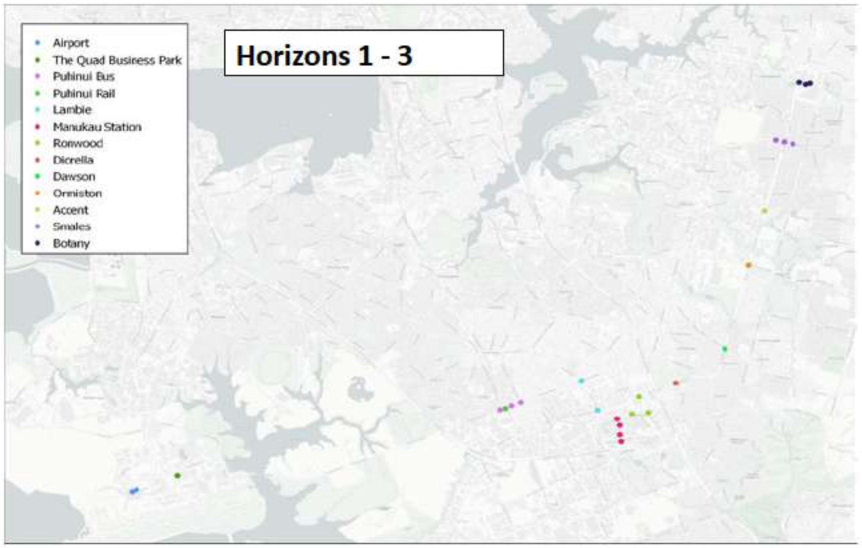
Peak periods all represent 2 hours as per AFC assumptions

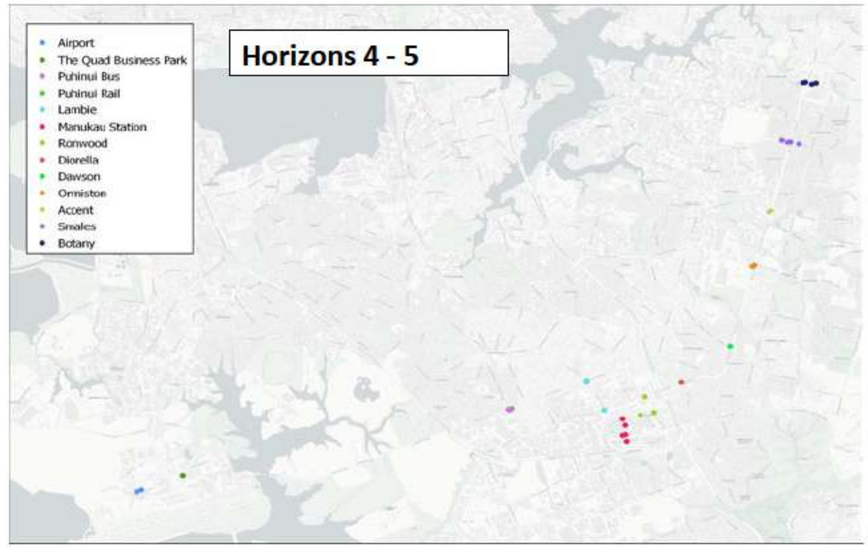
General

Annualisation factor is 320 for PT (see economics)

Boardings and alightings are for all routes at a station (NOT FOR A2B ONLY)

Nodes for analysis are included below





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