Appendix Q

Medium Term Strategy

AIRPORT TO BOTANY

Medium-Term Strategy Report

Auckland Transport

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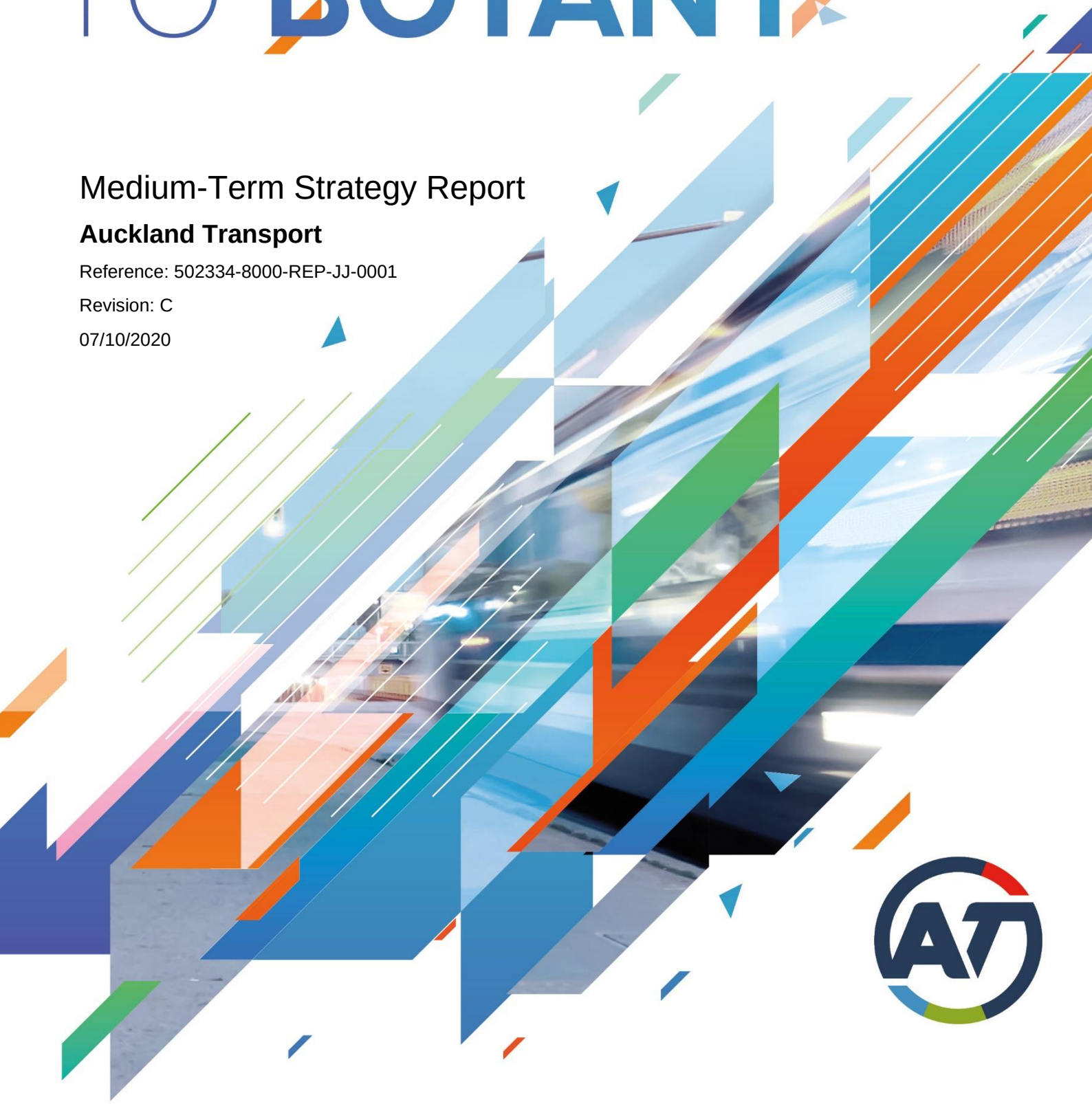

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1 Introduction

This report outlines the assessment undertaken to develop a medium-term strategy to support the delivery of the Rapid Transit Network (RTN) on the Airport to Botany (A2B) corridor.

1.1 Background

The A2B Medium Term is a stage of the A2B project which is the full upgrade of the public transport route from Auckland Airport to Botany, planned as part of the South West Gateway Programme (SWGP). The overall A2B Project is proposed to be an important element of the Auckland's Rapid Transit Network (RTN) – defined in Auckland Regional Public Transport Plan (RPTP) as the highest level of provision. An RTN service "Botany to Auckland Airport" was flagged for investigation in the RPTP and subsequently included in the various Auckland Transport Alignment Project (ATAP) iterations. The full A2B project is expected to be delivered by 2048.

The earlier Auckland Airport Access Supplementary Programme Business Case (SPBC) identified a programme of investment across the Auckland region that included influencing behaviour change, improved network management and increased capacity provision, including the use of technology, improvements to state highway infrastructure and public transport services and infrastructure. The Airport to Botany RTN is included as an important component to serve customers between airport, Manukau and the north-eastern corridor to Botany. It also serves customers from the south and north who would use the heavy rail services to Puhinui and subsequently change to the new east west RTN. The RTN services from airport to Manukau and Botany will deliver higher quality public transport in these corridors, providing necessary alternatives to car travel given that the scale of future demand is likely to be well in excess of realistic road provision[1].

The A2B RTN is proposed to be a segregated 18km BRT corridor operating between the airport and Botany, via Manukau (Figure 1-1). It is expected to provide high levels of reliability and capacity through the following key characteristics:

- Separated running ways, mainly median running
- Long, low floor BRT vehicles
- Signal pre-emption at intersections
- New stations and multi-modal access provision
- High frequencies and a long service span

The long-term outcome and its staged delivery is described in detail in the SSBC.[2] The Medium-Term strategy represents a stage of the delivery of the long term outcome.

[1] Supplementary Programme Business Case, Page 21
[2] Airport to Botany Single Stage Business Case 502334-7000-REP-JJ-0002

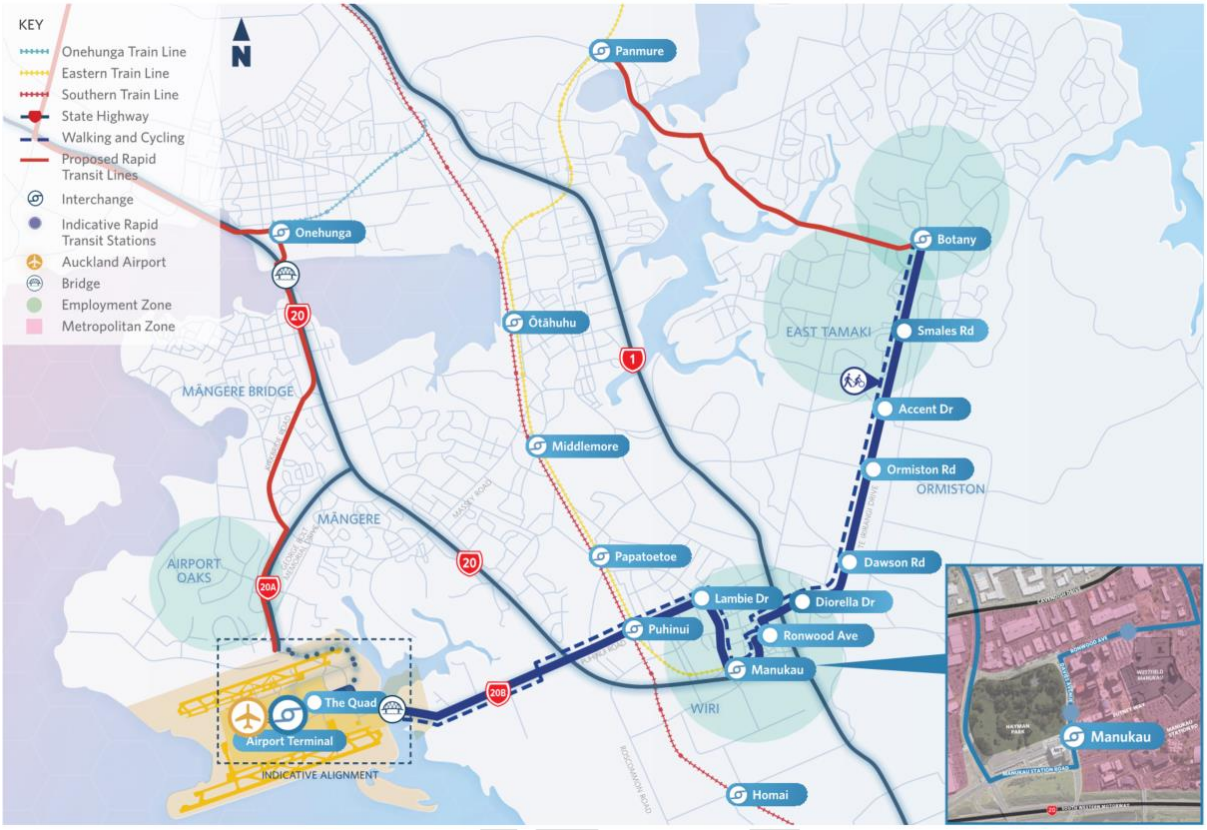


Figure 1-1: A2B long term route and stations

1.2 Problems defined

Problem statements for the long-term Airport to Botany project were developed at an 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 and the benefits of responding to the problems are discussed in the SSBC's Strategic Case[3].

In simple terms, the Airport to Botany programme has set out to improve access to jobs, education and other opportunities by:

- Reducing the cost of travel to households, primarily by providing a realistic alternative to the private car
- Improving the reliability of public transport
- Making public transport simple and easier to use
- Providing more direct connections to where people in the study area work and study, including Manukau, East Tamaki, Botany and the airport and its surrounds
- Providing an opportunity to improve recognition of cultural values

[3] Airport to Botany Single Stage Business Case: Strategic Case

The first phase of the SWGP, the Short Term Airport Access Improvements (STAAI) is already in implementation phase and includes new bus lanes on State Highway 20B and Puhinui Road, a new frequent bus service using these bus lanes between Manukau and the airport and a new bus-train interchange at Puhinui Station to allow access to the wider Auckland region via the rail network.

The drivers behind the A2B SSBC are wider than access to the airport. ATAP has recognised the need for improved public transport connections in the southern Auckland area. The ATAP promotes an RTN service through the A2B corridor that "*links together southern and eastern Auckland and will provide an important connection to the rail network at Puhinui"*[4].

The recent ATAP publication, Better Travel Choices[5], also specifically identifies Manukau and Māngere as *"priority locations for mode shift"* due to these locations having "*important growth locations and the need to improve socio-economic outcomes"*[6]. The document has a strong focus on changing the modal choice away from private vehicles.

The A2B project has its origins in analysis that showed a deficit in public transport provision serving multiple desire lines in south and east Auckland, with multiple centres and interchanges along the potential route[7].

1.3 Customer insights

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

[4] ATAP, op cit
[5] ATAP, Better Travel Choices, NZ Government and Auckland Council, December 2019
[6] Better Travel Choices, p.16
[7] Rapid Transit Network Review Study Report August 2014 and 2015 Update Final June 2015, Jacobs for AT

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 long term 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

The Medium-Term programme will be required to identify which of these key attributes can be realistically delivered and to what extent in the next 3-4 years and within current RLTP limits.

1.4 Staged delivery of A2B

The A2B staging approach facilitates less capital-intensive shorter-term interventions to address existing problems to generate a mode shift towards public transport and build public transport demand leading up to the aspirational full A2B rapid transit services as demands and the need for operational performance increase.

Five staging horizons were developed as follows (Figure 1-2 to Figure 1-5**:**):

Horizon 1 – Short Term Improvements & 'AirportLink' Service. This stage is already in implementation stage.

Horizon 2 – Medium Term solution. This is the Medium-Term Strategy and subject of this paper.

Horizon 3 – Targeted infrastructure upgrades

Horizon 4 – Full Airport to Botany Rapid Transit service and infrastructure

Refer to the A2B Staging Strategy Tech Note (502334-7000-TEC-JJ0006) for details.

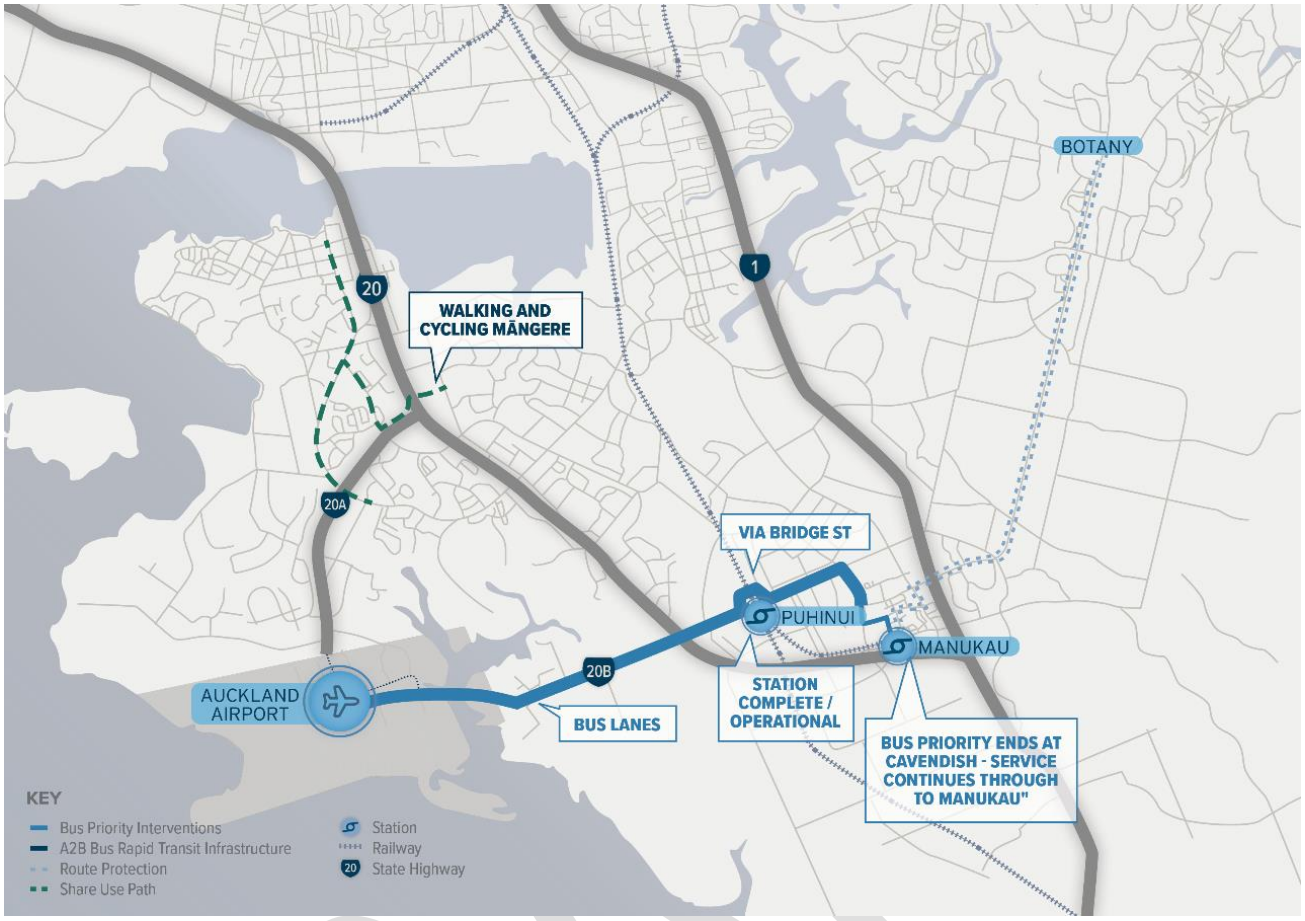


Figure 1-2: Horizon 1

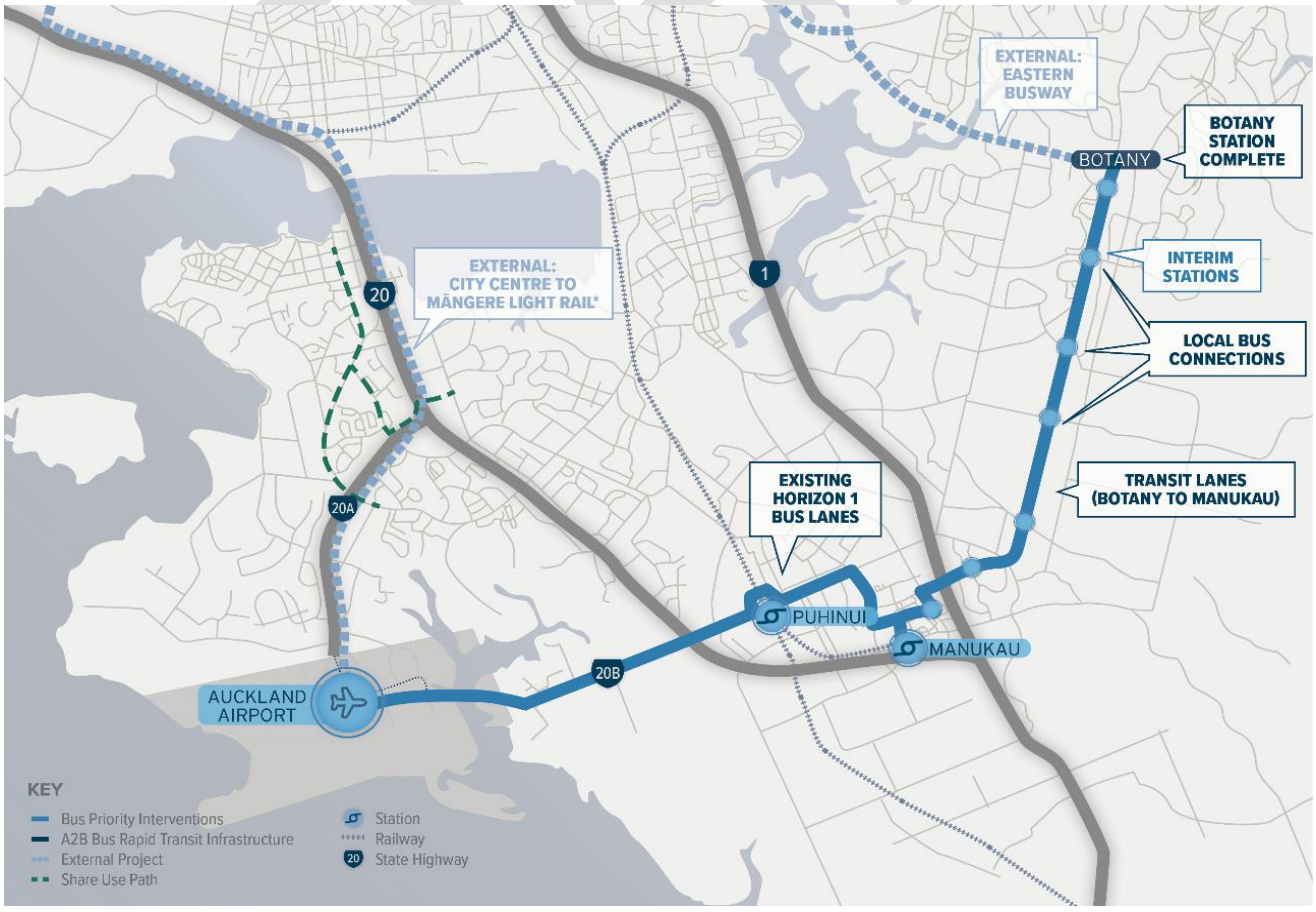


Figure 1-3: Horizon 2

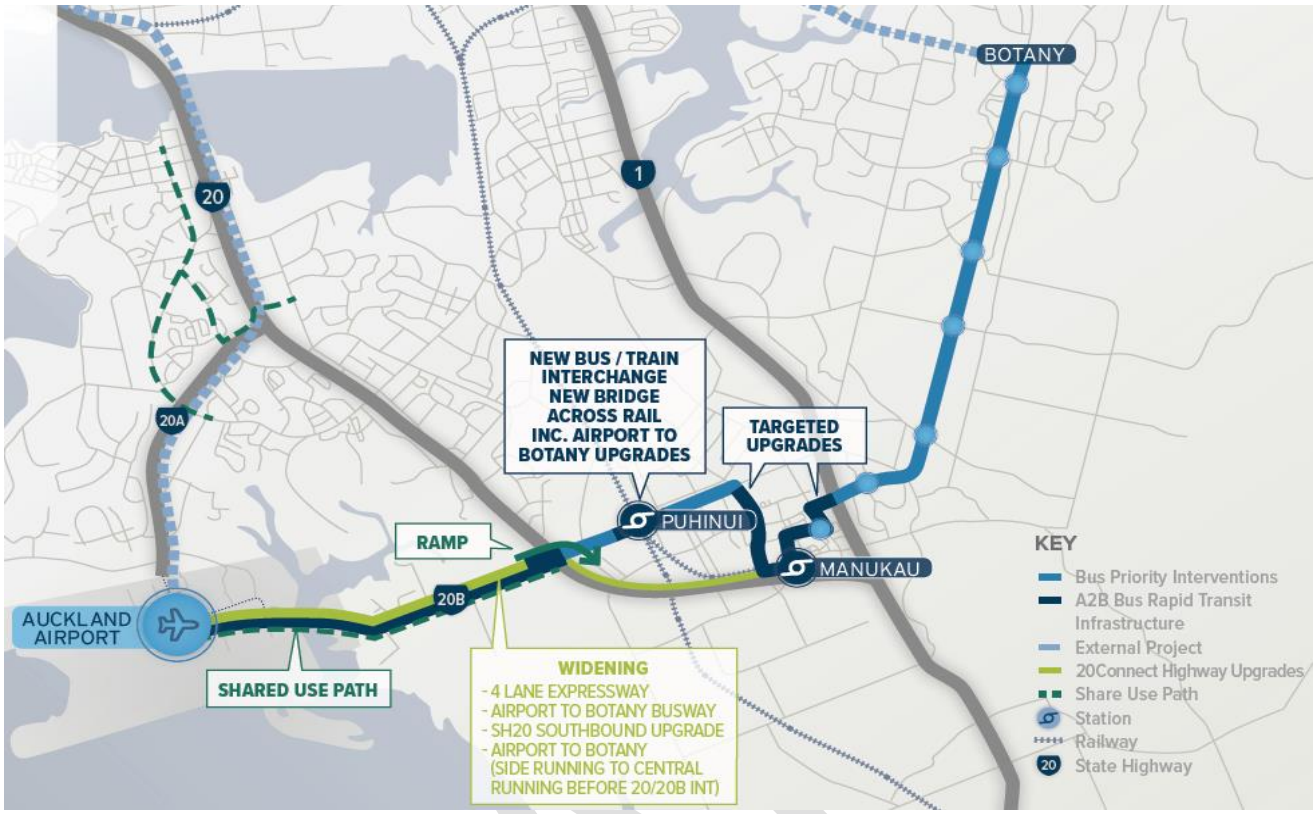


Figure 1-4: Horizon 3

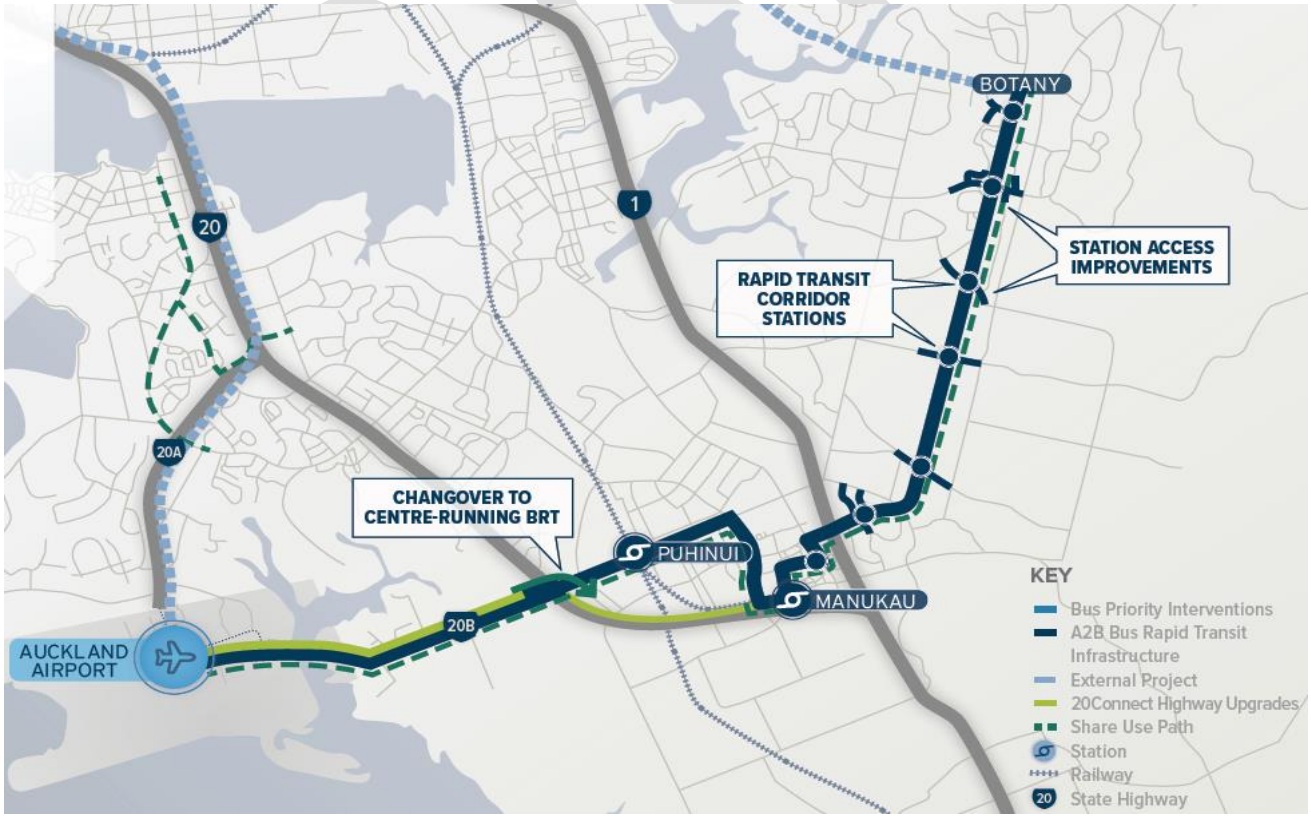


Figure 1-5: Horizon 4

1.4.1 Medium Term Strategy (Horizon 2)

The Medium-Term programme is identified as Horizon 2, with implementation proposed by 2025 to respond to the problems identified in the SSBC in access and travel choices that exist now and have done for some time. The SWGP Staging Strategy recognises both practical constraints on delivery and also the responding to and building demand, requiring more significant investment over time.

The Medium-Term Solution aims to implement a “service-led” public transport improvement to enable delivery of A2B objectives. The strategy is to deliver a service to Botany consistent with identified A2B long term outcomes, including interim stations, access to stations and potentially some initial upgrades in Manukau. The agreed strategy is to implement a service-led outcome, providing a service connection from Manukau (where the STAAI service ends) to Botany with the following characteristics:

- Provides a less-capital intensive approach (than the long term proposed bus rapid transit) to generate mode shift to public transport while fitting within a reasonable financial envelope.
- Establishes the RTN travel patterns and access opportunities, including route, stopping pattern, local bus networks and first/last mile transport.
- Delivery of infrastructure that can support a high-quality service and have adequate capacity for the duration between Horizon 2 and Horizon 4 (approximately 10 years).
- Implement solutions that minimise “regret” costs and reconstruction/removal of infrastructure
- Delivery by 2025. This means requiring no additional land, significant resource consents or approvals.
- At a regional network level - connects the Eastern Busway (under construction) to the proposed A2B service, which creates another direct link across Auckland’s proposed future Rapid Transit Network (as well as efficiencies in linking with services from Southern Auckland) and provides access to rapid transport for a wide cross section of Auckland’s population.

2 A service-led approach

The strategy underpinning the Medium Term is one of generating mode shift and delivering the access and travel choice benefits of the A2B programme. Key to this is providing opportunities and incentives for people to change travel behaviours. The Medium Term is also underpinned by a 2025 delivery timeframe and desire to identify a relatively low scale capital programme.

These factors contribute to the desire and need to prioritise interventions that directly address current barriers to customers using public transport. As a result, the definition of the Medium-Term programme has been developed through a service-led methodology.

The research carried out in support of the Airport Access SPBC and the A2B SSBC through customer insights as well as problem definition evidence and international best practice benchmarking suggests that there are many barriers to mode shift to public transport that can be reduced or removed within the abovementioned constraints. These elements are detailed in various reports, in particular the Concept of Operations (502334-7000-REP-JJ-0020).

This strategy is delivered through the lens of the customer and focuses on providing a service that responds specifically to the expressed needs of customers in this corridor, supported by infrastructure to the extent required to fit within required constraints and timeframes. Customer insights that indicate that many of the barriers to mode shift can be addressed through service design and small-scale physical elements that impact directly on the user experience in the short to medium term until forecast demand reaches a point where greater investment is required.

Given that the Medium-Term programme is a phase in the evolution of the A2B RTN, the approach is transparently connected to the problems, benefits, objectives and service characteristics of the A2B programme.

To this end, the Medium-Term programme is developed in the following sections in the manner outlined in Figure 2-1.

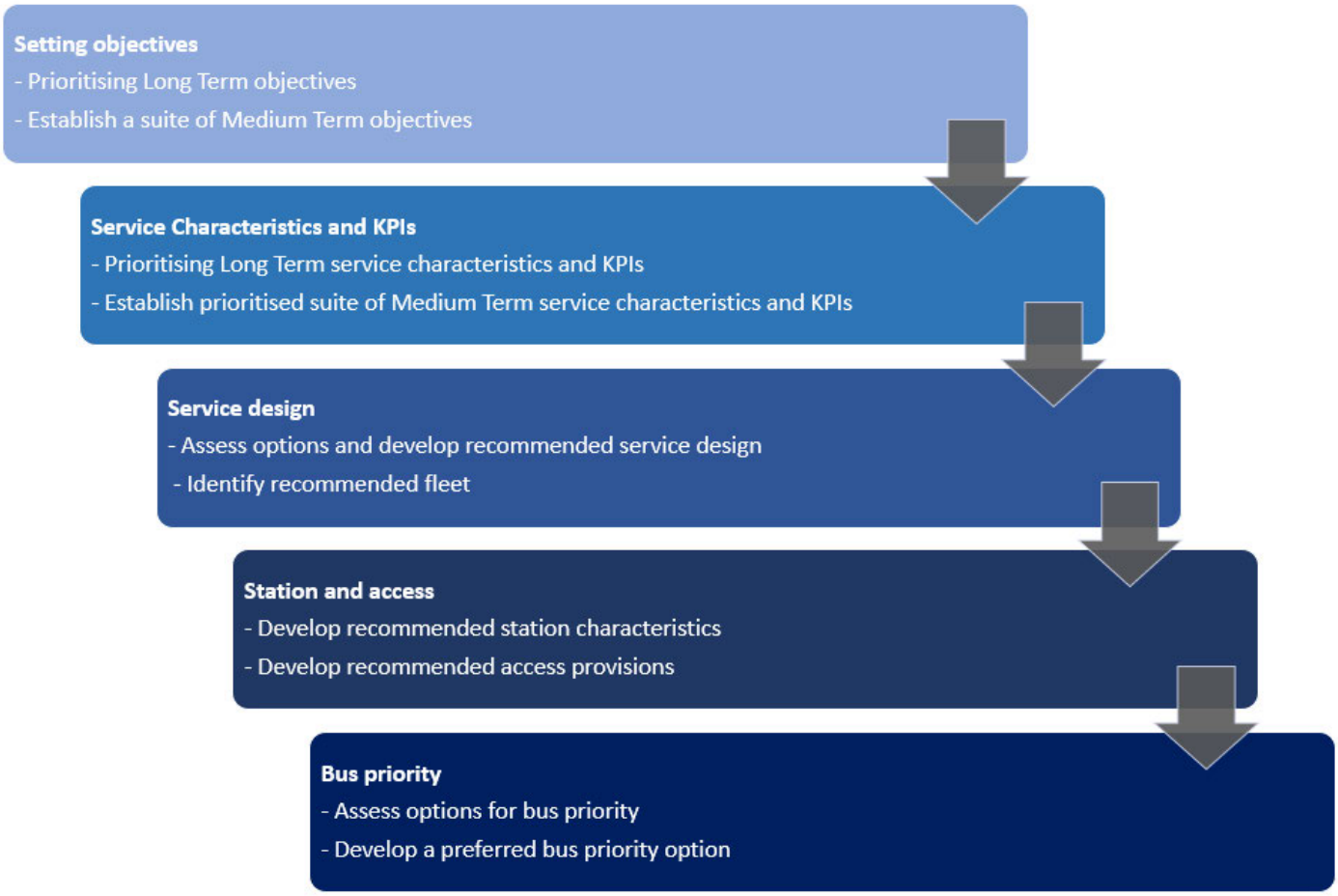


Figure 2-1: Medium Term service-led methodology

3 What success looks like

3.1 Objectives

3.1.1 Airport to Botany Long Term 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:

- 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

3.1.2 Medium Term Desirable Outcomes

The Medium Term is a stage in the overall development of the Airport to Botany project and has been developed as an early response to the access problems identified in the SSBC for the Long Term project. An early stage of the future RTN is unable to fully meet all of the objectives set for a large RTN scheme. As a result, a suite of specific objectives that support the long-term project have been developed[8].

Achieving the A2B Project Objectives by implementing Horizon 2 of the A2B Staging Plan by 2025 through:

- Implementing an RTN-like service plan
- Implementing the RTN stopping pattern and new stations
- Providing for a range of access modes
- Introducing new vehicles
- Providing information and reassurance for customers
- Improving equity of access for people
- Providing a level of speed and reliability that delivers a significant improvement on the current situation
- Managing the effects on traffic to acceptable levels
- Retaining the existing level of cycling on the corridor

For transparency, Table 3-1 maps the objectives identified for the Medium-Term strategy to the objectives in the SSBC for the A2B project.

[8] Task Plan – A2B MRT SSBC Ref 502334-8000-TSK-OO-0013

Table 3-1: Mapping Medium Term objectives to Long Term objectives

Long Term Objective	Medium Term Objective
More equitable access and travel choices to jobs, learning, cultural and social activities in the south and east of Auckland	Providing for a range of access modes.
	Improving equity of access for people. Providing a level of speed and reliability that delivers a significant improvement on the current situation. plan.
Reliable and resilient transport system in south and east Auckland that is easy to use.	Introducing new vehicles. Providing information and reassurance for customers. Implementing a RTN-like service
Urban regeneration and improved built environment	Implementing the RTN stopping pattern and new stations.
Transport network that enables the efficient movement of goods and people	Managing the effects on traffic to acceptable levels.
	Retaining the existing level of cycling on the corridor.
Safe and secure transport facilities in south and east Auckland	Providing information and reassurance for customers.
Minimal impact of the transport system on the environment and Taonga	Minimal impact of the transport system on the environment and Taonga.

Where possible, the assessment of options for elements of the Medium-Term strategy have been assessed using the objectives outlined above. To aid the assessment of some elements a simplified suite of KPIs were identified prior to the commission being commenced[9] and are defined below along with the proposed measure for each. These are used, where it is logical in the assessment of options.

- Efficiency and reliability
  - Ability of buses to avoid congestion. Extent of ability of buses to avoid queues and degree of exclusivity. *Qualitative: Risk of buses missing the initial green phase.*
    Note: Initial assessment to determine preferred option is qualitative, followed by a quantitative assessment via traffic modelling for a refined preferred option.
- Ease of use and affordability
  - Quality of station environments and access provisions. *Qualitative assessment of station environments*.

[9] Task Plan – A2B MRT SSBC Ref 502334-8000-TSK-OO-0013

- Improved access to jobs and other opportunities
  - Journey time and reliability (Airport-Manukau, Manukau-Botany). *Qualitative: Quality of bus priority*
    Note: Initial assessment to determine preferred option is qualitative, followed by a quantitative assessment via traffic modelling for a refined preferred option.
- Improved health and safety
  - Conflicts for vulnerable users accessing stations. *Quantitative: Conflict points on arrival.*
  - Quality of stations. *Qualitative assessment of station environments*.
- Minimising impact on the environment
  - Additional impervious area. *Quantitative: Impervious area*
  - Impact on trees. *Quantitative: Trees removed.*

3.1.3 Demands and capacity

While success of the service will be measured as noted above, the service will need to be sized to meet the forecast demand. It will need to have some scope to grow demand, having some "headroom" for higher than expected growth, while also not over-providing capacity.

Forecast demands in the AM peak in 2028 are shown in Table 3-2. This shows the forecast demands with a full BRT (Long Term A2B solution) in 2028 in red and a "service only" scenario involving direct Airport to Botany bus service with no priority or infrastructure east of Manukau, but including the STAAI outcomes, in blue. These two forecasts provide a low-end patronage range in the AM peak of around 700/hour and a high end of around 1,000/hour in 2028. It is likely the Medium-Term patronage (approximated by 2028 forecast, three years after proposed opening) would be between these two figures based on implementing a single service.

Table 3-2: Medium Term patronage forecast (MSM 2028 AM Peak)

Section	Do Min Patronage 2028	Medium Term 2028
Botany - Manukau	**0 –** A2B route **540** (Route 35)	**500 - 900/hr –** A2B route (Service Only – Full A2B) + **420** (Route 35)
Manukau - Airport	**520** (AirportLink service)	**700 - 1,000/hr** (Service Only – Full A2B)

The 2038 model forecast with the Horizon 3 of the A2B programme (refer Section 1.4) in place requires a capacity of 1,000/hour and full A2B service indicates a required capacity of around 1,500/hour.

For the purpose of defining the system, a required peak capacity of around 1,000 per hour has been assumed for the service. This is at the upper end of the forecast range in 2028 and the lower range of the 2038 forecasts. The implications of this demand on the fleet and operating headways is discussed in Section 6.2.

This level of demand would require a high capacity bus (100 capacity – double deck or articulated) every five minutes or a rigid "extra-large" bus (60 capacity) every three minutes which results in a very high frequency service.

The demand profile is relatively flat and bi-directional across the route, peaking at the key demand drivers at Manukau and the airport.

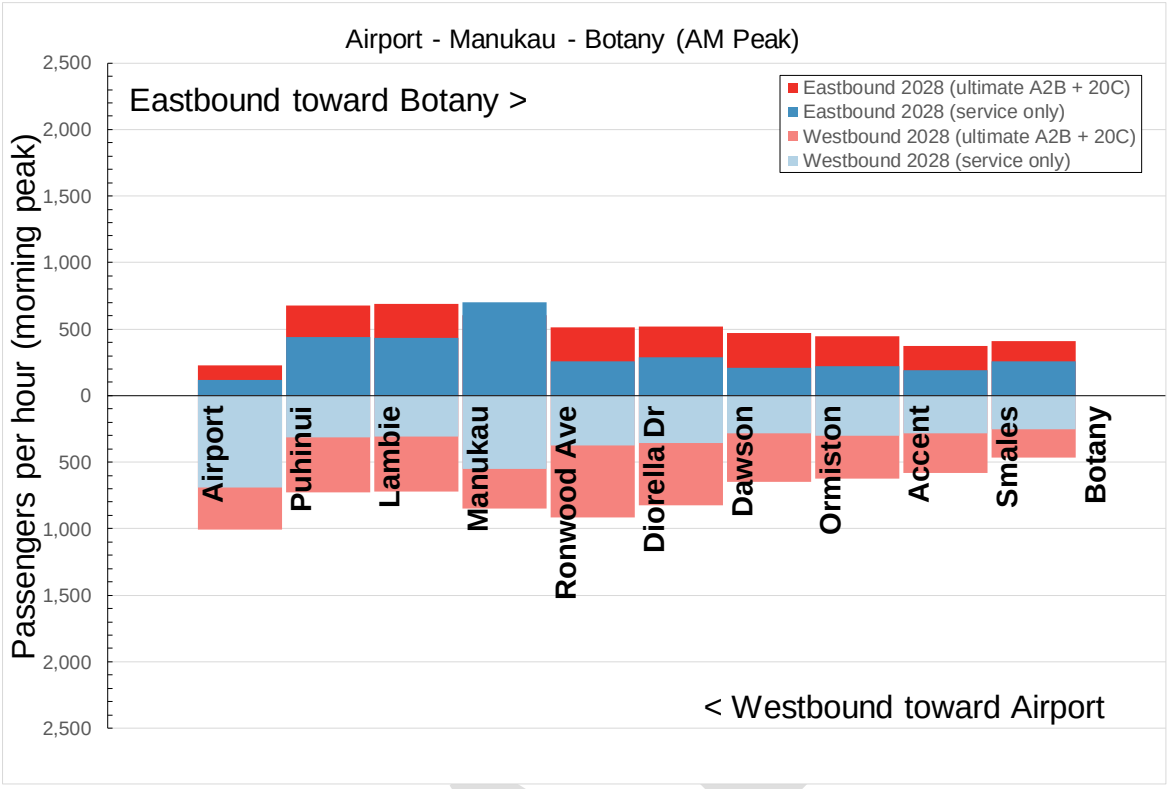


Figure 3-1: Forecast demand profile 2028 (source: MSM)

3.2 Proposed service characteristics

3.2.1 Long Term characteristics

The following are the main characteristics of the proposed long-term system[10]:

- **Service frequencies:** Headways of four minutes at peak times delivers 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.
- **Number of routes:** Fewer service patterns (one or two) will be used. 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.
- **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, allowing 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 inline 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

[10] A2B Concept of Operations: 502334-7000-REP-JJ-0020

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.

3.2.2 Prioritised service characteristics

The table below takes the characteristics of the long term system outlined above and indicates which elements are considered a priority and/or are achievable in the medium term in a service-led approach.

Table 3-3: System Characteristic

System Characteristic	Priority for Medium Term	Explanation
Adopt A2B route and stopping pattern	**High**	▪ Key to access, reliable/fast, efficient and easy to use objectives. ▪ Key to being part of staging plan of long term A2B and establishing travel patterns that will support the future RTN ▪ Creates shorter journey times to key destinations
Stop layout: Fewer stops, inline stops due to fewer services and moderately high service frequency	**High**	▪ Key to access, easy to use and fast/reliable objectives ▪ Improves reliability and journey times ▪ Key to part of staging plan objective ▪ Achievable in timeframe
Number of routes: One or two service patterns for a simplicity, legibility	**High**	▪ Key to easy to use, equity and reliable objectives ▪ Achievable in timeframe
Boarding experience: Quality stations, access mode provision, level boarding through good bus/platform alignment.	**High**	▪ Important to equity and easy to use objectives. Also access objective. ▪ This is a broad suite of initiatives, and some provision of most aspects is likely to be possible in the timeframes and budget.
Branding: Identifiable as a premium service.	**High**	▪ Legibility is a key element to attract new users and mode share and is achievable. ▪ Important for visitors (domestic and international) and infrequent users.

Network integration: Accessible from local buses and other arrival modes eg cycle, drop off, taxi.	**High**	▪ RTN-style stop spacing means network integration is key to access to the service
Service frequencies – 3-5 mins at peak	**Med**	▪ Frequencies required 5 mins at for forecast demand in peaks, 10 mis off-peak for level of service ▪ Key to easy to use, access reliable/fast objectives ▪ Achievable in timeframe
Types of buses: Restricted to buses that meet key design parameters	**Med**	▪ Moderately important to easy to use objectives ▪ Standard buses but well specified and electric. ▪ Full BRT buses as per Long Term not required and unlikely to be achievable in timeframe.
Speed and reliability: With a fully dedicated pair of busway lanes along the entire route	**Med**	▪ Moderately required to reliable/fast objectives and access objectives. ▪ A direct route, limited stops and high frequency will generate significant speed and reliability benefits without separate running ways. ▪ Fully separated bus lanes not a essential, but some priority is considered necessary. ▪ Full bus lanes achievable in timeframes or likely budget
Signal priority: providing signal priority at intersections for the rapid transit services	**Med**	▪ Moderately important for reliable/speed and access objectives. ▪ Some potential exists in the timeframes
Customer perception: Customer perception should be very high because stations and vehicles are designed to give a similar 'feel' to train and light rail	**Med**	▪ Needs to be a "step-up" in customer experience, but is not an RTN.
Actively managed: To retain reliability and regularity of service,	Low	▪ Important for fully reliable RTN service delivery, but the Medium Term is not an RTN. ▪ Without supporting infrastructure there is less value in this investment
Low dwell time at stations: vehicle and platform are level, and off-board ticketing and all-door boarding	Low	▪ Not considered critical for Medium Term ▪ Given possible vehicle and infrastructure outcomes, an improved boarding experience is possible lowering dwell times but full level boarding and other measures are unlikely.
Fleet size and operating costs: A relatively lower number of higher	Low	▪ Demand does not require the balancing of large numbers of lower capacity vehicles with a smaller number of high capacity vehicles.

capacity vehicles means operations are more efficient and reliable		
All-door boarding: To reduce dwell times and produce more consistent dwell times and improve customer experience, all-door boarding is proposed	Low	▪ Not necessary in the medium term ▪ Unlikely in timeframes and budget
Off-vehicle ticketing and validation: To improve customer experience through not having to “tag on” at the door	Low	▪ Difficult to achieve in timeframe ▪ Demands and service frequency will not require

4 The do-minimum

This section describes the do-minimum that has been used as a reference case in the assessment of options for the Medium Term.

The STAAI improvements, which include a direct, branded bus service between the airport and Manukau (the western half of the A2B route), supported by bus lanes are committed and as a result are assumed in the do-minimum for the Medium-Term programme. This service is proposed to terminate at the Manukau Bus Station.

The connection from Manukau to Botany is currently serviced by the Route 35 service which operates every 15 minutes between Manukau and Botany (Figure 4-1) and is timetabled to take between 30 and 55 minutes to complete the journey depending on the time of day. Actual variations in journey time on this route are also high. This means that airport to Botany journey times in the do-minimum situation could be as high as 80 minutes with significant variability.

The 35 service takes an indirect route via Stancombe Road, Murphys Road and Ormiston Road and stops some 24 times between Manukau and Botany (Figure 4-1).

Figure 4-1: 35 Bus route - shown in green (do-minimum)

Note that the 35 service is planned to become a more direct route in the future when a new link road from Ormiston Town Centre to Stancombe Road is provided as shown in Figure 4-2 below.

Figure 4-2: Future link road providing a more direct route for the 35 service at Ormiston Town Centre

5 A2B service pattern assessment

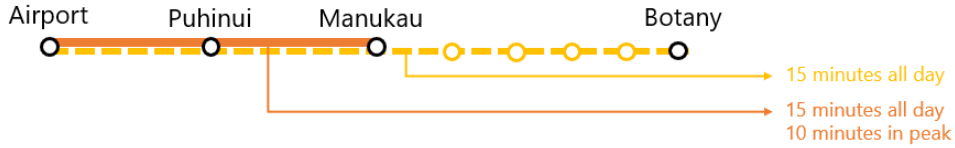
5.1 Options

Three options were assessed for the service pattern of the A2B route in the medium-term. Each provides for complete journeys between the airport and Botany but deliver this in different ways. In general, shorter routes are more reliable as there is less opportunity to incur delays on a given run and more opportunity to recover time at terminals. A longer route is more legible and easier for people to use as it minimises the need to interchange.

Option 1: Full Airport to Botany service, as is proposed in the ultimate A2B business case

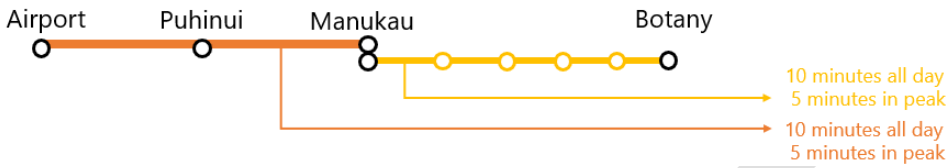
Option 1 essentially replicates the proposed Long Term service design with a single service pattern operating at high frequencies on the entire route between the airport and botany.

Option 2: Airport Link plus Botany overlay



Option 2 retains the STAAI service between the airport and Manukau which will be augmented by a lower frequency service between the airport and Botany.

Option 3: Split service (Airport Link as one service, and Manukau to Botany as a second service)



Option 3 breaks the route into two shorter, high frequency routes, both terminating at Manukau. One route is the STAAI service between the airport and Botany and another, direct service between Manukau and Botany following the A2B pattern.

5.2 Assessment

5.2.1 Service delivery

As Option 1 is the planned long-term service for the A2B route, establishing this service in the medium term would set the precedent for the A2B corridor as a rapid transit service and could begin to generate demand for the future service improvements.

The KPIs for the medium-term project have been reflected in the assessment by considering the following factors to reflect the aspects relevant from the KPIs in Section 3.1.2:

- Service frequency
- Transfers required
- Legibility

While all three options have the same span of service across the day and the same operating hours for each station on the corridor, the legibility of the service and service frequencies at particular stations varies between the options. Table 5-1 describes how each option meets key customer experience requirements: these are the features that support Option 1 being preferred over other options.

Table 5-1: Assessment of service design options

Customer experience	Option 1	Option 2	Option 3
Service frequency	For all stations: 7.5-minutes in peak, 10-minutes at all other times.	Between Manukau and the airport: average 6-minutes in peak[11], 7.5-minutes at all other times. Between Botany and Manukau: 15-minutes at all times.	For all stations: 5-minutes in peak, 10-minutes at all other times.
Transfers required	None required between Botany and the airport.	None required between Botany and the airport.	Transfer required at Manukau for customers boarding east of Manukau or west of Manukau.
Legibility	Good: single, consistent service pattern.	Poor: two service patterns at stations between the airport and Manukau, creating potential for people to catch the wrong service.	Moderate: all stations (except Manukau) are served by a single, consistent, high-frequency service. However, forced transfer in main direction of travel may be confusing. There is no “airport” service from east of Manukau.

Overall, Option 1 provides the best service levels, legibility and ease of use for customers as it:

- Does not require transfers to complete journeys on the route
- Has good, consistent frequencies
- Has a single service which is easily understood

Option 1 does have a long route which makes it susceptible to cumulative delays and unreliability. For Option 1 to be viable, the following criteria need to be met:

- Reliability: travel times from Botany to Manukau need to be sufficiently reliable in order to support the reliability of the Manukau to Airport segment of the route

[11] Actual time between services could be up to 10-minutes in the peak, depending on timing of overlapping services.

- Demand profile: the demand on both parts of the route should be similar enough to support the same vehicle type and frequencies
- Demand patterns: there should be a reasonable demand for travelling from one side of Manukau to the other (eg Ormiston to the airport, or Puhinui to Botany) to justify having a single, direct service
- Operating cost: the operating cost for Option 1 should be comparable to Options 2 and 3

5.2.2 Journey time and reliability

The re-adjustment of the route from the 35 route to use Te Irirangi Drive, being some 4km shorter and the reduction in stops from 24 to 6 between Botany and Manukau in itself provides a significant improvement in journey time and reliability above the do-minimum.

The reliability of the Manukau to airport section is important, particularly given the expectations set by the short-term (STAAI) AirportLink service, and the future reliability expected from the A2B rapid transit corridor. The reliability of the Botany to Manukau journey influences the reliability of the Manukau to the airport part of the journey under an Option 1 service pattern.

To gain a general perspective, the average travel time between Manukau and Botany in the PM peak direction for the do-minimum (35 service), do-minimum (new Medium-Term bus service only) and Long Term are compared. As shown in Table 5-2, travel times between Manukau and Botany is likely to vary by up to 7 minutes (+30% of average travel time) with the proposed Medium-Term bus service only, compared to no more than 3 minutes with the ultimate A2B infrastructure and 15 minutes using the Route 35[12].

Table 5-2: Estimated travel time between Manukau and Botany in PM peak direction (source: AT real time data for 35 and AIMSUN model)

Travel time	Do-Minimum (35 service)	Do-Minimum (Medium-Term bus service only) (modelled)	Long-Term (Ultimate A2B Infrastructure) (expected)
Average travel time (minutes)	45	23	18
Upper travel time (minutes, 85th percentile)	60	30	21
Variability (minutes, 85th percentile)	15	7	3

One reason for developing Options 2 and 3 was to mitigate operational reliability concerns by minimising the exposure of buses to delays along the full length of the route and providing a greater number of layover points on the schedule. In this context, Option 3 would have the most reliable service.

In comparison to Option 3, Option 1 does not require a transfer at Manukau for passengers making a trip through Manukau, which is expected to be approximately 50% of all users[13]. In respect of Option 3, some variation in journey time will exist and if the arrival of one bus misses the departure of the next, from the user's perspective, this will create a significant variation in journey time, particularly interpeak with a 10-minute headway.

Option 2 has a direct service between Botany and the Airport, removing the need for a transfer at Manukau, but the frequencies are low at 15 mins. With the wider station spacing and greater reliance on local bus access, late-running local buses with little or no priority could mean long wait times in the transfer to A2B services. This adds to actual and perceived unreliability to journeys.

[12] AT real-time data, March 2018
[13] Based on MSM forecasts

As a result, all options are rated similarly for unreliability, albeit for different reasons.

Nonetheless, the estimated travel time variability of Option 1 is not high, and therefore, the need to mitigate unreliability, comparatively is not especially great. The reliability benefits of Option 2 and 3 should be considered in comparison to service delivery factors including demand, service frequencies and legibility.

5.2.3 Demand loading profile

Expected demands of an A2B service are relevant for the service pattern decision, to understand the efficiency of servicing both parts of the route with the same service. If one side of the route has significantly lower demands than the other, it may be more efficient to service that side with smaller vehicles and/or lower frequency routes.

Using 2028 AM peak MSM forecasts, the passenger loading charts for A2B show that demand east of Manukau is slightly less than, but similar to, demand west of Manukau (Figure 5-1). This indicates that service requirements for the airport to Manukau and for Manukau to Botany are similar. It would therefore be an efficient use of vehicles to operate a single service to provide for both segments in the medium term. This supports Option 1 and to a lesser extent Option 2.

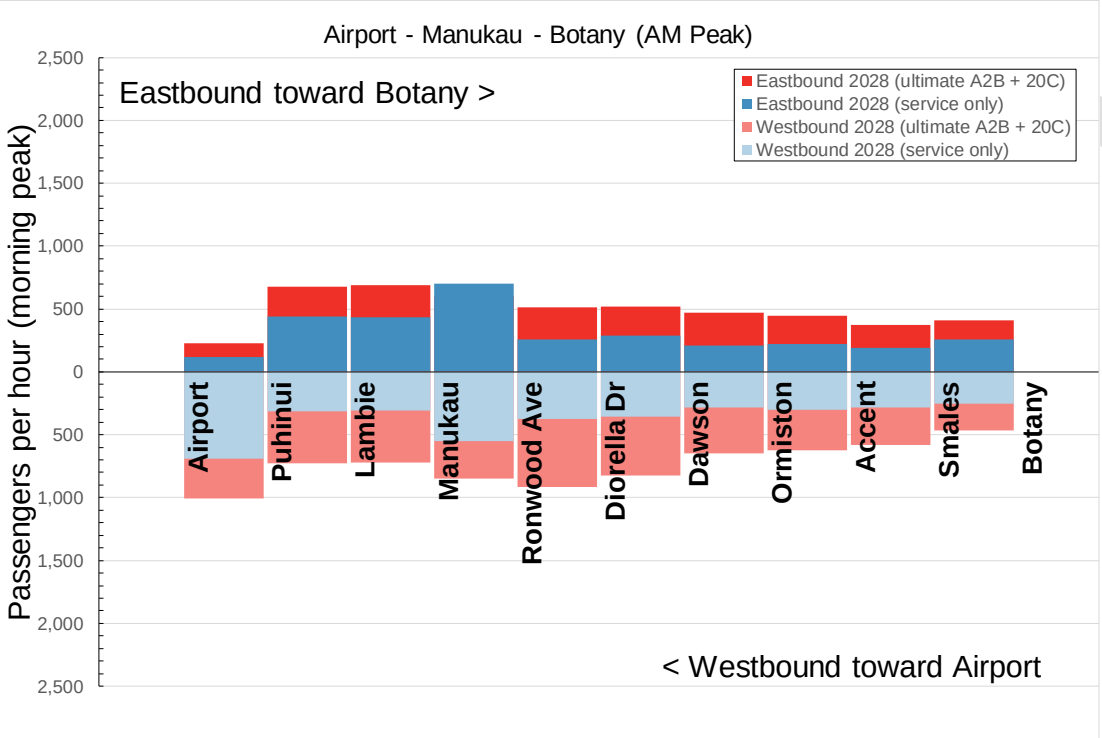


Figure 5-1: Passenger demands[14] along the route, in both directions (2028, AM peak)

5.2.4 Demand patterns

It is also important to understand patterns of demand relating to origins and destinations of journeys likely to use the A2B service. If few journeys cross between the two sides of the route (i.e. travel through Manukau) then a decision to split the service at that breakpoint is less significant than if many journeys are expected to want to travel from one side of Manukau to the other.

The following observations have been made from the MSM modelled demands in the morning peak, from the 2028 model:

[14] Expected passenger demands for the recommended medium-term strategy would lie somewhere between the blue and the red bars in this chart.

For passengers on the A2B service between Diorella Drive and Ronwood Avenue stations (just east of Manukau):

- 37% of passengers on A2B as it approaches Manukau from the east take the service the whole way to the Airport.
- 69% of passengers on A2B as it departs Manukau towards Botany boarded the bus before the Lambie Drive Station, west of Manukau.

For passengers on the A2B service between Puhinui Station and the Lambie Drive station:

- 23% of passengers who boarded between the airport and Puhinui travelled further east on A2B than Ormiston Road
- 34% of passengers on A2B as it approaches Puhinui Station boarded further east of Ormiston Road
- 19% of passengers on A2B as it approaches Puhinui Station caught another bus to Botany to access A2B (either from Eastern Busway, Botany Road or Chapel Road)

These demand patterns indicate that there is a significant “through” demand at Manukau. The data supports a single service from the airport to Botany in the medium-term and support Option 1.

Option 2 wold result in a large proportion of customers having access to a lower frequency service east of Manukau. Option 3 would require a significant proportion of customers to transfer at Manukau.

5.2.5 Operating cost

5.3 Recommended service pattern

Taking all of the above factors into account, Option 1 is the recommended service pattern. Of the three options, Option 1 provides the best overall quality of service and legibility, best fits the predicted demand loading, and best serves the expected user trip patterns.

Option 1 has the lowest operating cost of the three options while providing a higher quality of service. However, Option 1 would be less able to directly mitigate unreliability compared to the other two options, though the service is not expected to have poor reliability overall given the direct route with limited stops. In addition, the Medium Term is driven by a service-led approach aiming to provide high quality customer service. From a customer's perspective, this option does not require transfers and provides a consistent and easy to understand service that is easy to use and legible. However, the success of this recommended service pattern relies heavily on appropriate bus priority infrastructure to mitigate operational risks. Therefore, it is important to address any travel time and reliability issues, that a single service is susceptible to, via targeted and effective bus priority interventions.

Table 5-3: Service pattern assessment summary

Criteria	Best performing option
Reliability	1,2 or3
Demand loading profile	1
Service levels and legibility	1
Demand patterns	1
Operating cost	2
Recommendation	**1**

6 Vehicle and fleet requirements

The fleet requirements for the A2B route in the Medium Term are determined by a combination of the predicted passenger demands, customer needs and experience outcomes, vehicle capacity, and service levels, together with consideration of procurement model, vehicle policies and PTOM operating contracts.

6.1 Vehicle type and configuration

The proposed vehicle type is a bus with the following desirable characteristics:

- A specialised configuration and appearance, based on conventional bus engineering and design that is generally consistent with New Zealand design rules and existing fleet operations.
- Straightforward to procure from a range of potential suppliers.
- Cognisant of the A2B service's specific customers and their needs.
- Distinctive exterior design and livery that identifies the vehicle as "Rapid Transit" and indicates the rail-like service offering of the proposed system.
- High-quality interior design that is distinct from conventional bus design and promotes a premium user experience.
- An 'urban transit' interior layout including:
- High standing to seating ratio
- Broad interior aisles
- 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 delivered either as dedicated luggage racks, and/or areas of clear floor space near seating.
- Space for wheelchairs, mobility scooters and other personal mobility devices to be parked without any special process or assistance.

A standard bus has several attributes that do not meet the customer needs of the A2B route well, including:

- Narrow aisles making it difficult for people in groups of with luggage to move or ride
- While luggage racks can be provided, seating is usually separate from the location of luggage
- Limited/tight space for wheelchairs and mobility scooters
- Higher capacity double deckers have stairs which are difficult to use if a customer has luggage or is travelling in a group

The vehicle should recognise the expected higher than normal proportion of user that fall into the following categories:

- New or infrequent users
- People travelling in groups – for example families
- Users who are unfamiliar with Auckland and its geography
- Users who may be travelling on a stressful journey from a timing perspective
- Users traveling at night from shift work of travel who may not easily be able to orientate themselves

These factors support the need for in-vehicle, live information on upcoming stops, transfer opportunities and time to stops and destinations to provide user confidence and

A bus capable of operating on street with high passenger capacity is required for the Medium Term. Auckland currently operates double decker buses as its principal high-capacity bus solution, on street and on the high volume, open-system Northern Busway. However, double decker buses are not recommended for this the A2B Long Term managed-system corridor due capacity, to longer dwell times, issues with safety and delay using stairs to the upper deck, the limited headroom on both decks restricting the standing capacity, and the difficulty providing sufficient lower deck space for luggage, prams, wheelchairs and bicycles without affecting passenger capacity.

Therefore, a single deck cabin configuration is preferred which allow fully-level boarding and internal movement, facilitates short dwell times, supports the use of all-door boarding, maximise the use of floor space, and provides sufficient headroom in the passenger cabin to allow for a significant ratio of standing passengers. With a single-deck specification, high passenger capacity could be delivered with specially configured rigid buses, or with articulated buses, depending on the required vehicle capacity and service levels. This is discussed in the following section.

In the Medium Term this ideal configuration needs to be considered alongside the practicality and potential costs associated with using existing infrastructure.

6.2 Vehicle capacity and service levels

To determine the appropriate specification for the vehicle passenger capacity, the three main factors of demand, service levels, and crowding standards are taken into account:

- Demand modelling indicates a potential peak demand of 1,000 passengers per hour in the peak direction for the medium-term horizon (circa 2028), with counter-peak loadings of approximately 700 people per hour at the same time.
- A 5-minute headway is proposed at peak times for service quality reasons, which results in a minimum of 12 vehicles per hour per direction at peak. At the same time, headways closer than 3 minutes (20 vehicles per hour) are undesirable on a single bus route operating on street due to the risk of bunching and delays at traffic signals. Note that the ultimate service frequency to be defined by AT Metro and can be increased as per demand.
- Auckland Transport targets an 85% average occupancy across the peak period to account for varied demand and avoid excessive dwell times and passenger discomfort due to overcrowding.

Calculating these three factors together indicates a minimum capacity requirement ranging from a nominal 98 passengers per vehicle which based on forecast demand could operate at five-minute headways, to 59 passengers per vehicle which would need to operate at three-minute headways. This results in the following potential vehicle-service level specifications for operation in the mid to late 2020s:

- At five-minute peak headways: an 18m single-deck single-articulated “bendy” bus with a rated capacity for approximately 100 passengers or a 13.5 double deck bus which has the same rated capacity
- At three-minute peak headways: a 13.5m single-deck rigid body “extra large” bus with a rated capacity for approximately 60 passengers.

The full long-term configuration of the A2B corridor is based on an integrated service and infrastructure system designed to operate at up to three-minute headways at peak times. Exceeding this headway would affect the reliability and efficiency of the bus route, as well as impact on pedestrian and traffic phasing at intersections.

Therefore, while using standard length single-deck buses at a 3-minute peak headway can accommodate the projected demand for the medium-term stage, it does represent the system operating close to maximum capacity with little headroom to accommodate unexpected patronage growth or strong peak demand events.

Furthermore, given the lifespan of a bus is typically in excess of 12 years in revenue service, any vehicle procured in the mid 2020s will likely still be in operation in the 2030s or later. This suggests that the medium-term vehicle configuration should have higher passenger capacity to allow for increased headway and higher

passenger growth over time, indicating that the 18m articulated bus with capacity for over 100 passengers per vehicle should be procured as a minimum for the medium term.

6.3 Procurement model

A conventional bus procurement model is proposed, where Auckland Transport tenders a route for full-service delivery by commercial operators. Under this model, the operators buy and own the vehicles, supply the depot and maintenance facilities, and train and employ the drivers according to Auckland Transport standards. Operators recover the cost of purchasing vehicles and owning depots as a component of their contractual payments, effectively amortizing the capital cost of the fleet across the lifetime of the contract.

In one unconventional procurement model considered, Auckland Transport owns the fleet and/or the depot and supplies these to the operator to use and maintain as part of the service contract. These options would reduce barriers to entry for potential operators and would likely result in greater competition at the tendering stage and result in lower service delivery contract fees. However, this would come at the expense of Auckland Transport requiring significant up-front capital investment for fleet and depots, and the associated risks of procuring and owning these assets. For the A2B medium-term horizon, this does not appear to present any significant advantage over the conventional procurement model.

6.4 Operating contracts (PTOM)

In Auckland, bus routes are delivered by private operators contracted to deliver services for Auckland Transport under the provisions of the Public Transport Operating Model (PTOM). Operators bid to deliver PTOM units, which consist of a route or group of routes to be run in an exclusive area for the length of the contract. The length of the contract tends to be aligned with the lifespan of a bus. While PTOM contracts have some provisions for limited changes to service levels or routes without penalty rates or contract extensions, major network changes require new or renegotiated contracts to avoid excessive marginal costs.

All current PTOM contracts to operate buses in and around the A2B corridor started at the same time for the rollout of the South Auckland New Network, and all such contracts will be due for retendering or renewal in 2025/2026.

The short-term A2B service is being procured as a variation of the existing PTOM unit of the route 380 Airporter bus, which it will replace. This variation retains the same expiration date at the original contract, and therefore also rolls over in the 2025/2026 period.

This indicates that network changes and service increases for the medium-term A2B network should be targeted for rollout in 2025 or 2026, or shortly after.

6.5 Fleet staging and transition

The simplest transition is to plan the start of the medium-term service to begin upon expiry of the current contract in 2025/2026, with the new specialised fleet procured under the new contract. This also has the advantage of opening the A2B medium term PTOM unit to competitive tendering from a range of potential operators. However, there may be a desire to implement the medium-term stage earlier than this date under an accelerated programme.

For earlier delivery, the preferred option would be to run a mixed fleet, with a first tranche of specialised articulated buses ordered early, to supplement the existing airport bus fleet on the extended route. This provides a good outcome for passengers by bringing forward some of the bespoke articulated vehicles, and only operating ‘airport’ configured buses on the A2B medium term line (albeit two different kinds). However, this may lead to complicated contracting issues to implement a new route with a mix of new bespoke articulated buses and existing specialised buses.

A second option is to run an interim fleet, extend the size of the existing short-term fleet with sufficient additional buses to run the longer medium-term route until the contract rolls over in 2025/26. This approach would be

straightforward, but could be expensive as it would amount to a contract to supply extra buses for a short term at variation rates, presumably also taking into account the cost/risk of transitioning the airport configured buses to a standard routes after a few years.

6.6 Zero emission vehicle policy and electric vehicles

Auckland Transport has a policy to require all new buses procured under its service delivery contracts to be zero emission vehicles from 2025. The intention is to phase out all internal combustion buses as their service contracts expire, to achieve a 100% emission-free bus fleet by the year 2040. The implication of this policy is that the buses procured for the A2B medium-term service (circa 2025) must be zero emission vehicles.

Three main classes of zero emission buses are currently being considered by Auckland Transport:

- Battery-electric with overnight 'plug in' charging at the depot. These buses have large on-board batteries intended to store enough electricity for a full day of operations. They are charged at the depot after service hours, a process that takes several hours per bus and which requires depots to be fitted with industrial capacity power supply and sufficient chargers to recharge multiple buses simultaneously. This method has the advantage of using relatively simple battery systems and not requiring any special infrastructure on the route itself. Bus battery technology is advancing rapidly, with some current models able to operate in excess of 500 service-kilometres per charge. However, as A2B is a long-distance route with a long span of service and the daily service-kilometres operated by each bus is likely to be at the upper end of what current technology can achieve. This issue could also be compounded by the small window of time for charging between the end of service (around 1:00am) and the start of the next day of service (4:30am). One mitigation for insufficient range or charge time is to have a greater number of buses than is needed for the schedule, to allow them to be cycled in and out of service across the day.
- Battery-electric with flash charging at stops and terminals. These buses have a smaller onboard electricity storage capacity that is constantly topped up by flash charging for a few seconds at each stop through an automatic fast charging system. This system overcomes the range and weight issues of plug in charging of large batteries but comes at the cost of requiring specialist charging equipment on each bus and at each bus stop, plus the significant cost of installing high current electricity supply to each bus stop location.
- Hydrogen fuel cell electric. This option stores compressed hydrogen in a fuel tank on the bus and combines it with oxygen from the atmosphere in a fuel cell to generate electricity for drive motors[15]. This allows electric buses to be operated in a manner very similar to conventional diesel buses: the tanks are filled with fuel at the depot and allow a full day of operation. The current limitations of this technology are the lack of a commercial-scale hydrogen fuel distribution network and the corresponding cost and risk of buying and storing compressed hydrogen.

Current zero-emission bus procurement in Auckland is for plug-in battery electric systems, which presents the most practical starting point for the specification for the A2B medium term vehicle. Nonetheless, zero emission bus technology is a rapidly changing sector and it is likely that significant developments will occur before the A2B medium-term service is procured in the mid-2020s. The final configuration will be determined by future specifications and market availability through negotiation between Auckland Transport and the operators tendering to run the service.

[15] This process results in only plain water as a byproduct, so it is free of local emissions. Currently most commercially available hydrogen gas is refined from fossil fuel hydrocarbons, resulting in emissions at the source, however it can also be produced as an emission-free product by the electrolysis of water.

6.7 Recommended vehicle and fleet requirements

The capacity requirements for this route to operate effectively (Section 6.2) mean that two options exist:

- Double deck buses
- Articulated buses (18m)

As outlined in this section the customer needs and alignment with the long-term programme suggest that a single floor vehicle with a relatively open cabin would be most appropriate for this route.

The proposed vehicle type is a single-decker, articulated bus of approximately 18m length, with capacity for 100 passengers (seated and standing) without overcrowding (Figure 6-1). This vehicle should include distinctive exterior design and livery that identifies the vehicle as “Rapid Transit” and indicates the enhanced service offering of the proposed system, while providing the opportunity for level boarding and multiple doors. Similarly, it should include high-quality interior design optimised for high passenger turnover and users with luggage.

Figure 6-1: An example of an 18m articulated, low floor vehicle

The buses procured for the A2B medium-term service (circa 2025) must be zero emission vehicles to comply with Auckland Transport policy. Plug-in battery electric buses appear to be the most appropriate configuration at this point in time, however zero emissions bus technology is a rapidly changing field and alternative systems may be superior in the mid-2020s, when the buses are procured/required.

All current PTOM contracts in and around the A2B corridor are up for retendering or renewal in 2025/2026. This presents the most ideal time to transition to a new medium-term fleet and services replacing the existing fleet, with no overlap with the contracting of the short-term airport access route. However, if earlier implementation is desired, an interim period with a mixed fleet may be required.

As discussed in Section 0 there may be some limitations or trade-offs to be considered in selecting an articulated vehicle in respect of using existing or committed infrastructure. In the development of the Medium-Term strategy, AT will need to consider the desired characteristics and capacity requirements outlined here against the costs and issues associated with infrastructure.

Implementing double deck buses will provide the required capacity but would require an assessment of the route for clearance.

7 Local bus network improvements

The A2B service is designed as a system, including the first and last mile, and beyond. To this end, the long term system includes a re-design of the local network to support the direct, limited stop A2B service (refer Changes to the Local Bus Network Tech Note 502334-7000-TEC-KK-0005). The same has occurred in the STAAI programme west of Manukau. With less stops and a relatively low-density land use pattern, it is important that people in a wide catchment are afforded the opportunity to access the A2B service and gain the benefits of the fast, direct route it offers.

Recommendations are provided below for the delivery of these changes over the medium term.

7.1 Planned network improvements

The planned long-term network improvements fall into three groups:

One, improvements to routing and service levels on Ormiston Road to offer frequent connections to the A2B service from Ormiston and Flat Bush:

- Reroute Route 31 to Ormiston East via Ormiston Road and reroute Route 314 to Botany, so that the Frequent Service runs from Otara to Ormiston, and the Connector Service runs from Otara to Botany.

Two, changes to alignment and service levels on local bus routes operating via Botany Station, to support the proposed interchange station and better connect local bus routes to A2B and the Eastern Busway at Botany:

- Extend the Route 35 from Botany to a new terminus at Howick, to run the full length of Chapel Road and replace part of the 72.
- The remaining 72C and 72M routes consolidated as route 72, terminating at Botany.
- Two pairs of local routes to be through routed at Botany, rather than terminate there:
- Routes 355 and 735 joins to become 356 (Manukau to Half Moon Bay via Flat Bush, Botany and Howick).
- Routes 734 and (realigned) Route 314 join to become the 354 (Middlemore to Half Moon Bay via Otara, Botany and Highland Park).
- Shorten Route 739 (Beachlands-Maraetai) and realign to terminate at Ormiston A2B station, rather than Botany Town Centre.

Three, business-as-usual service changes and extensions planned to support intensification and greenfield expansion in the southeast over time. These improvements would be undertaken regardless of the timing and delivery of the A2B route, in response to residential growth.

7.2 Recommendations for the medium term

All of the bus network changes listed above should be implemented before or during the Medium-Term timeframes, in conjunction with the rollout of the main Medium Term A2B service.

The main reason for this is the fact that the PTOM service-delivery contracts for all of the affected routes expire in 2025/2026, such that they will need to be retendered around the time that the medium-term service should be implemented. In addition, the Botany Interchange and the Eastern Busway are expected to be completed by 2025. This presents an opportune time to efficiently and cost-effectively reorganise the bus network across the southeast.

If the service changes are not made at the time the contracts roll over, the new contracts would either need to include special provision for subsequent changes, or Auckland Transport would run the risk of renegotiating services during their validity at unfavourable rates. Either of these presents a considerable cost risk and/or impediment to network improvements.

The first group of changes listed above (upgrading frequency on the Ormiston Road) are closely related to the performance of A2B. Ormiston Road corridor presents the primary “new” feeder route to A2B, as it is the only main network element that is not already served through at Manukau or Botany interchange stations. This is therefore the most important change to the local bus network to support the medium-term A2B service, and it should be prioritised if there is a need to stage the delivery of local bus improvements.

The second group of changes are most closely aligned with the opening of the proposed Botany Station. While these changes support connectivity to A2B, they will also act as improved feeders to the Eastern Busway at Botany Station, as well as provide better local access to Botany Town Centre itself. While these routes should be operational on the A2B medium term timeframe, the route changes should be preferentially delivered in conjunction with the opening of the Botany Station. This station may be delivered as a standalone stage of the Eastern Busway programme before A2B, so it may be appropriate to implement this group of changes in advance of the A2B medium term.

8 Stations

In a service-led strategy which is built on improving customer experience and enabling greater access to public transport, stations are a key element of infrastructure as they provide the “front door” to the service and are locations where people undertake the most undesirable and potentially stressful part of the journey: waiting. Stations and accessing stations are also places where people have the greatest sense of risk to personal security.

The location and frequency of stations also influences the service performance. More closely spaced stations will allow greater walk-up catchments but result in longer journey times and impose greater unreliability on journeys.

This section addresses the location of stations, characteristics and the means of accessing stations. The section essentially represents the first and last element of the A2B service, from a customer’s perspective.

8.1 Station locations

The design development of the A2B corridor identified the optimal long-term station locations based on an assessment of demand, network connectivity and coverage benefits (see Tech Note 502334-7000-TEC-KK-0004 for details). The station locations for the A2B route were selected using a prioritisation process which was connected to the objectives for the project. The factors, in order of priority were:

1. Major demand destinations
2. Interchange points and transfer nodes
3. Additional residential and local coverage

The medium-term strategy is to deliver, as far as is practical, the same long-term stations in the same key locations, with as much of the full station design as is possible within this timeframe. Relevant objectives of the Medium-Term strategy (refer section 3.1.2) are specific in their intent and include:

- Implementing an RTN-like service plan
- Implementing the RTN stopping pattern and new stations

As a result of the abovementioned objectives, for the section primarily on Te Irirangi Drive between Manukau and Botany, the ideal medium-term station locations are the same as the long-term locations as this directly supports the objectives.

As there are currently no bus services or stops on the Te Irirangi corridor, these new stations can be delivered without impacting on the travel patterns of existing public transport users or modifying existing stop locations and coverage to the adjacent neighbourhoods.

However, for the section between the airport and Manukau, the Medium Term A2B service will be a replacement for (or extension of) the AirportLink airport-Puhinui-Manukau bus service. The AirportLink service plan retains six sets of bus stops between the airport and Manukau: Milan Road, Puhinui Station, Plunket Avenue, Norman Spencer Drive, Lambie Drive at Puhinui Road, and Lambie Drive at Cavendish Road. The long term plan includes stations at the Puhinui interchange and a second station near the intersection of Puhinui Road and Lambie Drive as well as two stations in the airport precinct. There is the potential for an additional station on State Highway 20B, just east of the airport, although this does not form part of the proposal in the SSBC.

This raises the question as to whether:

- All six Short Term bus stops between Manukau and Puhinui should be retained in the Medium Term
- Only the two Long Term plan locations should be retained, or
- Some intermediate between the two is preferable.

At this point, it is not certain how the AirportLink service pattern will perform and how well used each of the six bus stops between the airport and Manukau will be. However, this will become apparent after the service is implemented, as the AirportLink pattern will operate for several years before the Medium Term service is rolled out.

The proposed strategy for the Medium Term is therefore to assume that all the AirportLink bus stop locations along Puhinui Road and Lambie Drive are retained in the Medium Term, with no additional or replacement stops implemented. This should be subject to monitoring the actual performance of these stops once the AirportLink service is operational. If any bus stop on this section is performing poorly for patronage and/or contributing to poor travel times or reliability, consideration should be given to consolidating stops and implementing the long-term station locations on Puhinui Road.

Within the airport precinct, the Medium-Term service pattern assumes two sets of stops: one serving the eastern office park development area, and the second serving the combined passenger terminal. This is consistent with the long term pattern and assumes an integrated airport terminal by 2025. These stops are indicative, and subject to change according to the ongoing development and delivery of the airport development masterplan. However, in the event an integrated terminal is not in place by 2025, domestic and international stops will be required. Rationalising the AirportLink stops and potentially having a combined airport terminal stop may reduce travel time and improve reliability for the Medium-Term service.

Table 8-1 outline the proposed stations and their function. This is based on the station functions from the A2B SSBC and the STAAI stop descriptions.

Table 8-1: Station locations in the medium-term (bus stops from the short term should be monitored to determine if they can be removed).

Corridor section	Station location	Timing	Role
Te Irirangi Drive	Botany Town Centre	Long term station	Demand centre, interchange, local coverage
	Smales Road	Medium term station	Interchange, local coverage
	Accent Drive	Medium term station	Interchange, local coverage
	Ormiston Road	Medium term station	Interchange, local coverage
	Dawson Road	Medium term station	Interchange, local coverage
	Diorella Drive	Medium term station	Interchange, local coverage
	Ronwood Avenue	Long term station	Demand centre, local coverage

Corridor section	Station location	Timing	Role
Manukau Town Centre	Manukau Station	Long term station	Demand centre, interchange, local coverage
	Lambie Drive (at Cavendish Drive)	*Short term bus stop*	*local coverage*
Puhinui Road	Lambie Drive (at Puhinui Road)	Long term station	Interchange, local coverage
	Norman Spencer Drive	*Short term bus stop*	*local coverage*
	Plunket Avenue	*Short term bus stop*	*local coverage*
	Puhinui Station	Long term station	Interchange, local coverage
	Milan Road	*Short term bus stop*	*local coverage*
Airport – SH20B	The Quad (airport business park	Long term station (TBC)	Demand centre, interchange
	Airport terminal)	Long term station (TBC)	Demand centre

8.2 Key station assumptions and options

8.2.1 Station capacity requirements

With the proposed service design outlined in Section 5, the Medium-Term service will require a 18m bus stop at each location. This will allow for the longest of the design vehicle options.

Terminal stations at Botany and the airport will require:

- Two 18m bus stops
- Two layover spaces
- Driver facilities for breaks

8.2.2 Assumptions about the airport stops

Two stations are proposed in the airport precinct for the Medium-Term service that are the same as those proposed in the Long Term. These are:

- The Quad – the airport's business precinct
- The airport terminal

Based on Auckland International Airport Ltd's Master Plan, by 2025 there will be a single international and domestic terminal. As a result, while current 380 service has stops at the domestic and international terminals, the proposed pattern for the Medium-Term service assumes that the integrated terminal is in place.

Note that as a result of Covid-19, the integrated terminal may not be complete by 2025.

8.2.3 Puhinui Station

Puhinui Station is being re-built as part of the STAAI programme, including a new ground-level bus interchange area. In the Long Term, the ground-level bus interchange area is proposed to be replaced with a new bridge providing a level connection between buses and the station concourse. The Medium-Term service proposal is to use the STAAI ground level bus interchange area.

The Design Vehicle adopted by AT for Puhinui Station is a 13.5m rigid bus. Should the Medium-Term proposal adopt articulated vehicles for the service, changes may be required to the stop arrangement and circulation at Puhinui Station.

8.2.4 Station options at Manukau Station

There are three potential options for the design and location of the stop at Manukau Station:

- A pair of bus stops (location A Figure 8-1) on Davies Avenue, at the intersection of Putney Way (one existing southbound stop and a potential new northbound stop).
- A bus stop (location B Figure 8-1) is available within the Manukau Bus Station, located on the southern edge adjacent to the operational area.
- The Manukau Bus Station has capacity for the service (location C in Figure 8-1).

Figure 8-1: Manukau Station stop options

All of these locations work with the proposed route for the service outlined in Section 9.6.2.

Table 8-2: Stop A, B, C Stop Assessment

Stop A assessment:

Advantages	Disadvantages
▪ On an active street – safe, visible, accessible ▪ Accessible and visible to train and bus stations ▪ Can be used by any vehicle type ▪ Can accommodate the recommended service pattern	▪ Not part of the main bus station meaning amenity is not as good as internal stops and transfers not as easy ▪ Requires the cost of a shelter and ancillary infrastructure

Stop B assessment:

Advantages	Disadvantages
▪ Can be used by any vehicle type ▪ There is an existing shelter	▪ Not part of the main bus station meaning amenity is not as good as internal stops and transfers not as easy ▪ Access from train and bus stations not as easy, intuitive or safe with the need to cross the main bus egress and its location in the operational part of the interchange. ▪ Off the active street with potential safety issues ▪ Requires the cost of ancillary infrastructure ▪ Operating a through service as per the recommended service pattern will be confusing for passengers with services in both directions at the same stop

Stop C assessment:

Advantages	Disadvantages
▪ Part of the main bus station meaning a high quality, internal waiting environment and easy transfers ▪ Most legible – operating from the same building as all bus services ▪ No additional cost	▪ Can only be accessed by rigid vehicles ▪ Operating a through service as per the recommended service pattern will be confusing for passengers with services in both directions at the same stop

The recommended approach to the Manukau Station stop is:

- Stop C (in the main bus station) is preferred, provided rigid vehicles are adopted.
- Stop A is preferred if, or when articulated vehicles are adopted.

8.2.5 Station and terminal Options at Botany

The Medium-Term service is proposed to terminate at Botany Interchange which is expected to be delivered by the Eastern Busway project by 2025. At this time, there is uncertainty as to the scope, cost and timing of the Botany Interchange. Depending on the resolution of timing and scope of the Botany Interchange, options exist for the Medium-Term service for its termination and end-of-route operational requirements. The options are not exclusive and depending on funding and timing of the Botany Interchange, a temporary operational solution may be required for a period of time before the interchange is complete. Options include:

- Termination and layover in a new Botany Interchange. This option may have a capital cost implication which is not yet fully understood and will be resolved through the design of the Botany Interchange.
- A new kerbside commencement stops north of Town Centre Drive, paired with a new final stop north of Te Koha Place using the same specification as the other Medium-Term stations. This would be accompanied by an out of service route to Aviemore Drive and return with layover on street north of the Botany Road/Ti Rakau Drive intersection. This option adds approximately 10% to the service length of the route and would have a commensurate effect on operational costs discussed in Section 5.2.5.

- A temporary, low cost turn around facility at Botany.
- A pair of stops at the Botany Superclinic as part of the Aviemore out of service route.

8.3 Station features

8.3.1 General

Objectives for the Medium-Term service include:

- Implementing the RTN stopping pattern and new stations
- Providing for a range of access modes
- Providing information and reassurance for customers
- Improving equity of access for people

The following are considered “high” priority service characteristics for the Medium Term (Section 3.2.2):

- Boarding experience: Quality stations, access mode provision, level boarding through good bus/platform alignment. Note that level boarding can be achieved to an extent via kassel kerbs at the roadside platforms.
- Branding: Identifiable as a premium service.
- Network integration: Accessible from local buses and other arrival modes e.g. cycle, drop off, taxi.

The following service characteristic is considered “medium” priority for the Medium-Term service:

- Customer perception: Customer perception should be very high because stations and vehicles are designed to give a similar ‘feel’ to train and light rail

As a result, it is proposed that stations will be constructed to an interim level to provide essential station facilities in the medium term and will later be upgraded to provide long term station and interchange facilities. The station features and their staging are shown in Table 8-3.

Each station has been put into one of three groups, based on whether it is a minor or major station and whether it requires an interim station in the medium-term. The groups for the stations are listed below and shown in Table 8-2.

- Major: All three Major stations (Botany, Manukau and Puhinui) are either already in existence (Manukau), committed (Puhinui) or assumed to be delivered by another project (Botany).
- Minor, interim: all other minor stations will not be fully constructed in the Medium Term and will instead have interim stations that will be delivered to a high quality. Some station features that take up too much space or are difficult or costly to relocate may not be provided for these interim stations.

Table 8-3: Role and level of completion of stations in the medium-term

Station	Type of station	Medium-term	Long-term
Botany	Major	Final	Final
Smales Road	Minor	Interim	Final
Accent Drive	Minor	Interim	Final
Ormiston Road	Minor	Interim	Final
Dawson Road	Minor	Interim	Final
Diorella Drive	Minor	Interim	Final
Ronwood Avenue	Minor	Interim	Final
Manukau	Major	Interim	Final
Lambie Road (at Puhinui Road)	Minor	Interim	Final
Puhinui	Major	Interim	Final

8.3.2 Description

The intention is to create a customer experience as close as possible to an RTN for arrival and boarding of the service. By introducing elements of an RTN-style station (light rail or BRT) and connecting the stations to the local network and arrival modes, there is potential to elevate the customer experience above a “normal” bus route and encourage mode-shift in a lower cost manner.

Fundamental is the creation of station “zones”, similar to neighbourhood interchanges where there is a clear, consistent treatment of an area extending from the mainline stop as far as local stops and drop-off zones. This can be reflected in integrated branding, signage, paving and landscaping materials. Figure 8-2 and Figure 8-3 show an example from Sydney of bus stops on a limited stop, branded bus service that utilises kerbside stops associated with kerbside bus and transit lanes. The service is a branded, limited stop service operating at high frequencies on-street with a mix of kerbside priority measures, including mixed traffic running and has many parallels with the proposed Medium-Term outcome.

Attention in the service design was given to the customer experience, including arrival, waiting, boarding and a quality in-vehicle experience. Features of stops include:

- Integrated branding and information for legibility
- Generous and good quality spaces and paving for quality of experience
- Arrival modes provided for (connections to local stops and bike hoops at all stops, bike cages at some stops, on-demand services and park and ride)
- Lighting, CCTV, help points, seating and live information for safety and reassurance. Note in this example, live information screens include vehicle occupancy indicators
- Edge markers and tactile pavers for equity in access and safety

Figure 8-2: Example of integrated branding and quality finishes and materials at a station with kerbside bus/transit lanes (B-Line, Sydney)

Figure 8-3: Example of station environment with shelter, seating, information, generous paving and cycle storage with kerbside bus/transit lanes (B-Line, Sydney)

Each station "zone" in the Medium-Term service is proposed to include three main areas as described below and shown in an example minor station in Figure 8-4:

1. **General station area:**

The "station area" should extend to include the local stops on side roads and the stops on the mainline. This potential area is shown indicatively in Figure 8-4. This area should be defined by a consistent suite of materials and features that could include the following:

- Paving and landscaping
- Lighting to a level acceptable for an interchange
- Branded wayfinding and symbols
- CCTV coverage

2. **A2B platform area:** the A2B passenger platforms are where passengers using only the A2B line will board, disembark from that service. The intent is to align the customer experience more with a "station" than

a “bus stop” and provide a sense of an elevated level of importance of the facility. These zones should include the features in Table 8-4, and have the following attributes:

- A “high quality” shelter of scale for amenity and legibility
- A look and feel that is elevated from a local bus stop
- Branding integrated to align with the service for legibility and confidence
- A generous area around the shelter providing space for waiting and safe sight lines
- Consideration of the needs of mobility impaired and large groups for equity of access and providing the specific needs of the service’s likely customers
- Consistent materials with the remainder of the route for legibility

3. **Local platform area:** the local bus platforms are, where passengers using local bus routes will board and disembark from those services. These stops should reflect their function as a supporting facility in scale and appointments, however through materials, branding and information, should be connected to the A2B product, but also recognise the role of these stops as stops on the local network, serving other destinations in local area. These zones should include the features in Table 8-4, and have the following attributes:

- A standard AT shelters
- Potentially branding integrated to align with the service
- Consistent materials with the remainder station area

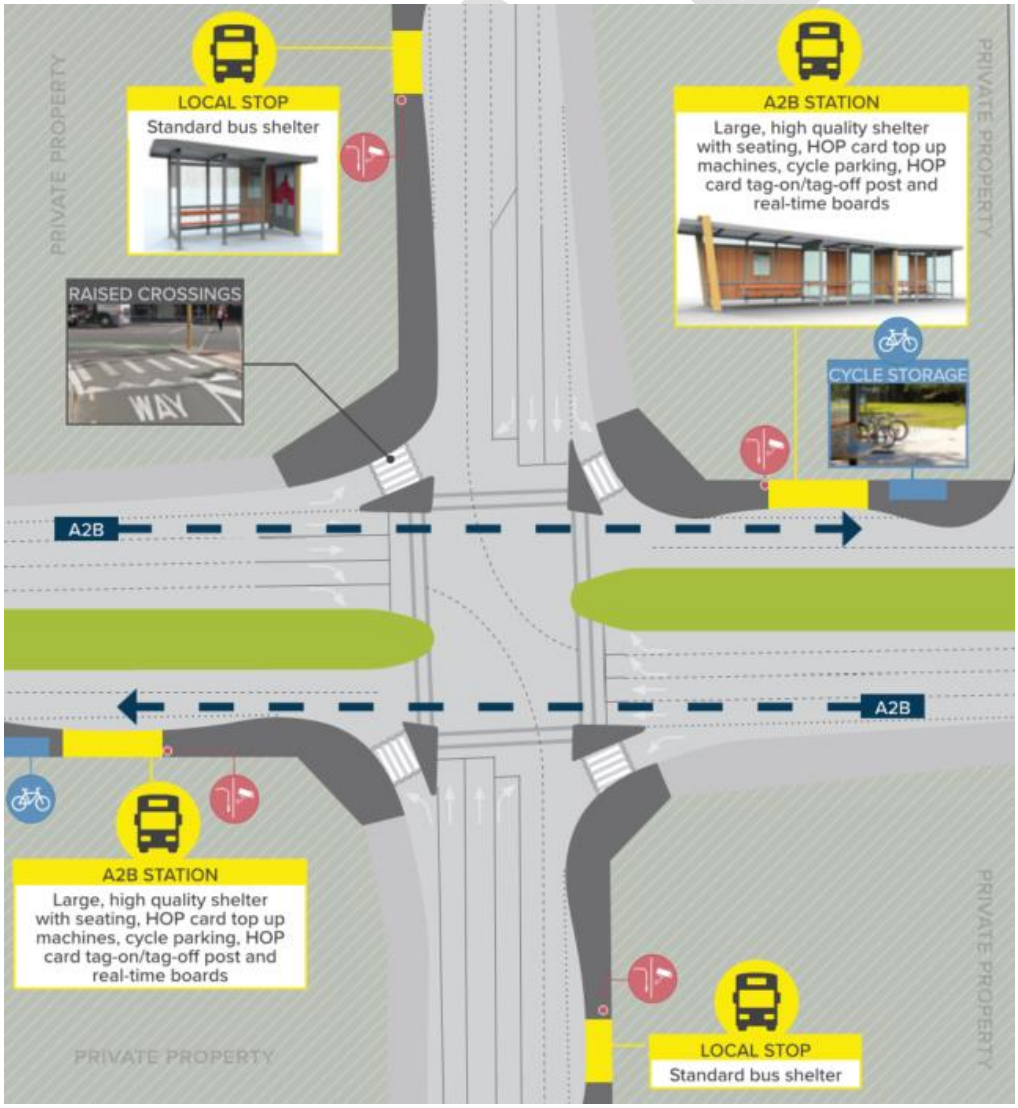


Figure 8-4: Example a station area showing key elements

While a bespoke design for shelters is possible as shown in the B-Line example from Sydney (Figure 8-2, Figure 8-3), a standard Auckland Transport design could be adopted or modified (Figure 8-5).

Figure 8-5: Auckland Transport examples: Potential local stop "standard shelter" (left) and potential mainline stop "high quality shelter" (right)

The station features to be included in each of the station areas, for each type of station in the medium-term are shown in Table 8-4. Some features are only expected to be included (to all stations) in the long term: these are also identified in Table 8-4.

Table 8-4: Station features for interim and final station designs

	Feature	Details	Minor	Major
Passenger support	Vending and reload devices (VRDs)	HOP card top-up and ticket purchase machines		✓
	Passenger Information Displays (PIDs)	Real-time boards	✓	✓
	Audio induction loop	'Hearing loop' for people with hearing aids		✓
	Static information boards	E.g. network maps (including in multiple languages)	✓	✓
	Wayfinding	Tactile and signs (with icons and in multiple languages)	✓	✓
Access	Step-free access routes	Safe, obvious, step-free access routes to the station and between platforms and stops	✓	✓
	Bicycle parking	Parking for personal bikes	✓	✓
	Shared bicycle parking	Parking for shared mobility devices, with wheel stoppers.	✓	✓
	Vehicle pick-up/ drop-off locations	Where possible to provide without impacting on access by other modes	✓	✓
Amenities	Rapid transit branding	Totem (similar to Eastern Busway design)		
	Integrated service branding	Colours, signage, symbols	✓	✓
	Lighting	Distinctive white lights	✓	✓
	Shelters with seating	Standard, with space for prams and wheelchairs	✓	
	Shelters with seating	Bespoke design, perhaps similar to Eastern Busway shelters		✓
	CCTV	Cameras covering station area and under canopies	✓	✓

8.4 Station access

Station access is about providing for the first and last leg of public transport journeys; how people get to/from the public transport stops or stations.

A2B provides an opportunity to improve the attractiveness of and equitability of access to public transport as a mode choice. Taking advantage of this opportunity requires an RTN-style consideration of station access with accessibility measures to be implemented in the medium-term. This is because, to influence travel choices and start to set desirable behaviours for the long-term there is a need not just to ensure that people can practically get to the service to maximised catchments in the medium-term, but also to proactively foster active mode attractiveness so that active modes will start to be seen as the preferred mode, and ultimately become the preferred mode for people working, attending education or living in neighbourhoods near the stations in the long-term.

"Core" access in the immediate station zone is outlined in Section 8.3 and provided for in the cost estimates for the Medium-Term project. This section presents a wider range of access improvements that should be considered by AT in this or other investment programmes.

This section presents a suite of measures to ensure active modes for the first and last leg are as safe as practicable and sufficiently attractive to encourage their uptake within the stations' surrounding neighbourhoods, based on the work carried out for the long term project, considering the less capital-intensive approach of the medium term strategy.

8.4.1 Station access objectives in the medium-term

Providing improvements to station access is key to achieving the following objectives of the Medium Term strategy:

- Implementing a RTN-like service plan (a fast, direct route will require people to use a range of modes to access the service)
- Implementing the RTN stopping pattern and new stations (limited stops will mean a greater distance to stations and use of a wider range of modes than a local service)
- Providing for a range of access modes (Providing choice to people in their travel needs is fundamental to the A2B project)
- Providing information and reassurance for customers (upon arrival, information will provide confidence in finding the right stop, knowing when the service will arrive and where it goes)
- Improving equity of access for people (paying attention to the needs of all users in access routes to stations as well as at the station and in the vehicle so all people can complete their journey safely and comfortably)

This also contributes to the following "high" and "medium" priority desired service characteristics (Section 3.2.2):

- Network integration: Accessible from local buses and other arrival modes e.g. cycle, drop off, taxi.
- Customer perception: Customer perception should be very high because stations and vehicles are designed to give a similar 'feel' to train and light rail

The station access workstream for this strategy makes the following assumptions:

- Property acquisition is not within scope.
- All intersections where stations are located will be upgraded, including the provision of safe and accessible crossings to support walking and cycling access to the stations.
- In assigning priority to different modes accessing stations, the highest priority is given to walking, cycling and other active modes[10].

8.4.2 Methodology for station access recommendations

The methodology for recommending station access interventions in the medium-term is described below and is based on the catchments shown in Figure 8-6. This is significant as with the RTN-style station spacing, essential for fast, reliable journeys, there is a consequential reduction in walk-up catchments (shown in red). By considering additional arrival modes including the following, the catchment area for the service can be extended to 3km (shown in grey) which includes most of the urban area in the corridor:

- Pedestrians (more direct, safer links extending the walkable catchment)
- Local buses (Section 7)
- Cycling, including e-bikes
- Micromobility (scooters etc)
- Drop off/pick up (kiss and ride)

The process also drew on previous station access assessment work (502334-7000-REP-KK-0028). More detail on each step of the methodology is included in Appendix A.

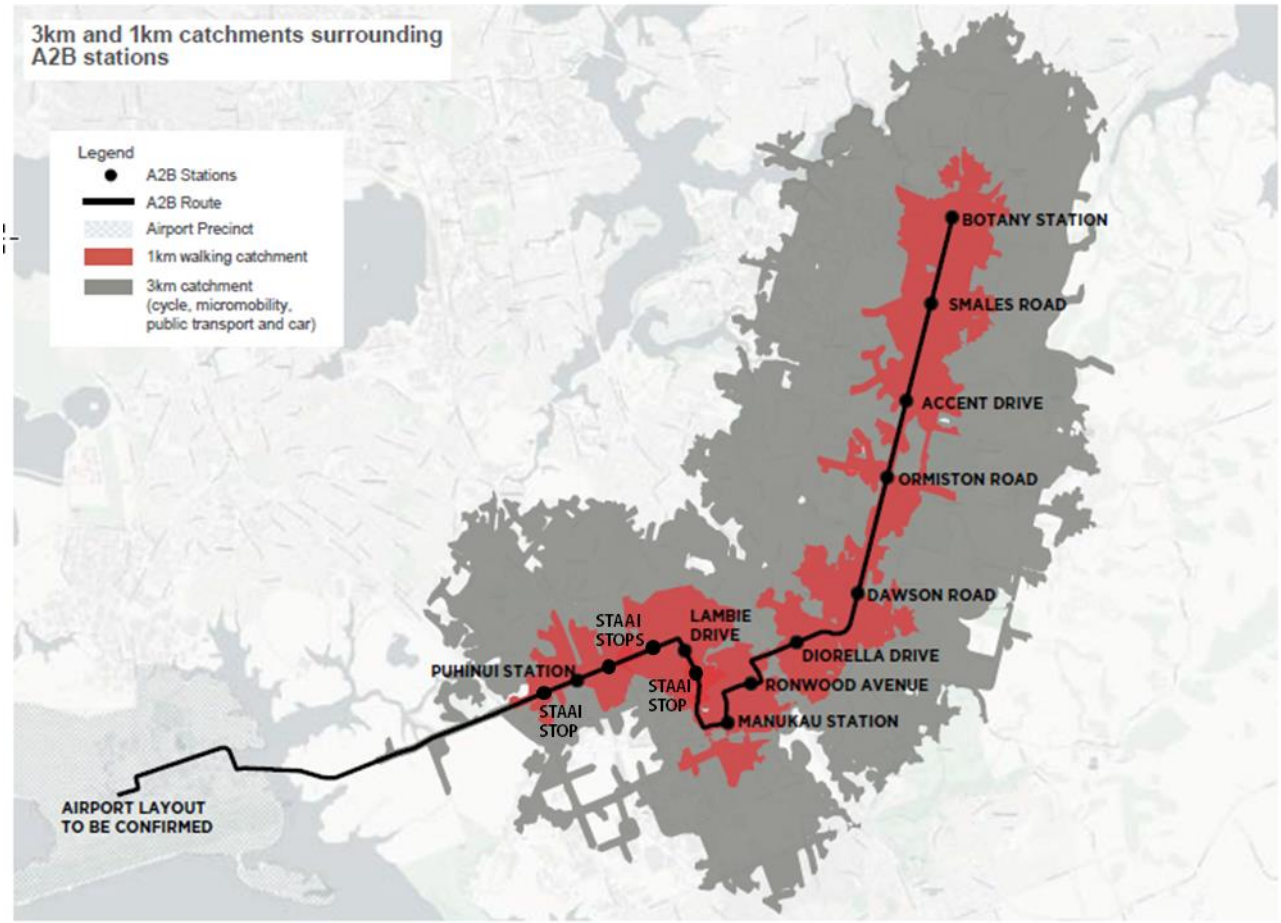


Figure 8-6: A2B Station Catchments - 1 km & 3 km

The first two steps involve identifying generic interventions that can be applied to all relevant areas identified, whilst the third step relates to identifying which specific interventions are most appropriate to include in the medium-term timeframes, to improve the attractiveness of active modes for the first and last leg, and to accord with the less capital-intensive approach of the medium term strategy.

Step 1: Identify intervention locations

Note that the recommended interventions and intervention locations are shown as schematics on maps in Appendix A.

a. **Identifying appropriate areas for speed limit reductions:**

Based on the premise appropriate speeds are important for ensuring active mode accessibility and are not capital intensive to implement. An appropriately lowspeed limit is recommended for areas within 1km of each station. 'Low Traffic Neighbourhoods'[11] should be created, involving physical infrastructure changes like modal filters and gateway treatments to better achieve slower speeds[12].

b. **Identify existing pedestrian links to be upgraded:**

Based on the premise that all pedestrian links within 1km of each station should be upgraded, including installing comprehensive human-scale lighting, repaving uneven paths, bollard removal or replacement with accessible bollards, and wayfinding.

c. Identify other specific interventions

Drawing on the long-term recommendations from the high-level and detailed station access assessments (502334-7000-REP-KK-0028), identify barriers / missing infrastructure links and safety concerns, including potential to manage vehicle movements to improve active mode safety and amenity.

Step 2: Detail interventions at each location

For each intervention location identified above, the specific details of the interventions were then considered. The details of interventions for each location are described and an approximate cost for the set of interventions has been estimated and included in Appendix A under the heading of 'Desirable Station Access Option'.

Step 3: Enhanced medium-term interventions

The step is included to be consistent with the 'less-capital intensive approach' strategy and identifies where costs can be deferred where the full range of benefits derived from interventions would not be achieved in the short to medium term. Therefore, Step 3 refines the full suite of recommended interventions to limit them from those recommended in the earlier work (502334-7000-REP-KK-0028) to those identified as 'essential for enhanced access'. This cut down set of interventions is termed the 'Enhanced Station Access Option'. Consequently, a full suite of recommended improvements, titled 'Desirable Station Access Option' is included in Appendix A, along with the cut-down suite of improvements, titled 'Enhanced Station Access Option'.

8.4.3 Intervention options and costs

The cost estimates for two access improvement scenarios have been summarised and compared in Table 8-5 below.

Note that the 'core" scenario reflects general intersection upgrades that will occur as part of the Medium Term stations (Section 8.3). The Enhanced and Desirable Station Access options apply wider interventions to local catchments of each of the stations, and a 'comprehensive' station access option would align with the recommendations made for the long-term project.

Table 8-5: Comparison of initial and revised recommendations for Station Access work in the medium-term

Station Name	Enhanced Station Access	Desirable Station Access
Puhinui Station		
Lambie Station		
Manukau/ Ronwood Station (combined)		
Diorella Station		
Dawson Station		
Ormiston Station		
Accent Station		
Smales Station		
Botany Station		
Total		

8.4.4 Intervention recommendations

See Appendix A 'Enhanced Station Access Option' for detailed recommended interventions that will complement the Medium-Term Strategy.

Note that the desirable station access options are able to be implemented in the Medium Term if a reassessment of the objectives and goals of the Medium Term suggests that bringing the intervention forward would result in a better outcome than deferring the work.

9 Bus Priority Infrastructure

This section outlines the assessment undertaken to develop a preferred option for bus priority along the medium-term route (Botany to Manukau Town Centre). While the improvements developed in Sections 5 to 8 address many of the objectives and desired characteristics of the Medium-Term strategy, there is a remaining need to investigate priority for buses in order to achieve the following objectives:

- Implementing a RTN-like service plan (this means a long service route, requiring improved reliability)
- Providing a level of speed and reliability that delivers a significant improvement on the current situation (the ability to avoid delays caused by traffic congestion)
- Managing the effects on traffic to acceptable levels (ensuring that prioritising buses does not affect other users beyond the extent necessary)
- Retaining the existing level of service for cyclists on the corridor (ensuring that cycle provision is not adversely affected)

The following KPIs have been used in this assessment as per Section 3.1.2:

- Efficiency and reliability
  - Ability of buses to avoid congestion. Extent of ability of buses to avoid queues and degree of exclusivity. *Qualitative: Risk of buses missing the initial green phase.*
    Note: Initial assessment to determine preferred option is qualitative, followed by a quantitative assessment via traffic modelling for a refined preferred option.
- Ease of use and affordability
  - Quality of station environments and access provisions. *Qualitative assessment of station environments*.
- Improved access to jobs and other opportunities
  - Journey time and reliability (Airport-Manukau, Manukau-Botany). *Qualitative: Quality of bus priority*
    Note: Initial assessment to determine preferred option is qualitative, followed by a quantitative assessment via traffic modelling for a refined preferred option.
- Improved health and safety
  - Conflicts for vulnerable users accessing stations. *Quantitative: Conflict points on arrival.*
  - Quality of stations. *Qualitative assessment of station environments*.
- Minimising impact on the environment
  - Additional impervious area. *Quantitative: Impervious area*
  - Impact on trees. *Quantitative: Trees removed.*

9.1 Methodology

A streamlined options identification[16], assessment and refinement process has been undertaken in the following stages:

1. Establishing base reliability and specific areas of delay and unreliability.
2. Establishing long list of potential bus priority options to schematic/themed level.
3. Setting performance requirements and criteria against which to measure the effectiveness of the options.
4. Testing the themed options against the performance requirements and criteria.
5. Assessment workshop with stakeholders to determine preferred themed option.
6. Themed option refinement based on traffic modelling

The analysis undertaken at each of the stages are described in the sections below.

9.2 Establishing base reliability

Travel time along the proposed medium-term route was sourced from the validated Snitch GPS data set that was used to develop the 2019 AIMSUN base model for the A2B Long Term project (refer to tech note 502334-7000-REP-0021). In order to confirm any changes between 2019 and current conditions, comparisons have been undertaken between the 2019 validated data set and multiple floating car surveys of the route in February 2020. The travel time data obtained from the drive-throughs achieved similarities higher than 90% across all peak hours with either very small increases or decreases in travel time. As such, the travel time figures that are shown in the following sections are based on travel and delays currently observed throughout the corridor.

9.2.1.1 Existing and do-minimum

Currently, the most comparable public transport services provided between the airport, Manukau and Botany are bus services 380 and 35. The 380 is a frequent bus service that operates between Manukau Station and Onehunga Town Centre via Papatoetoe and the Airport. The 380-bus route and average travel time between Manukau Station and the Airport is shown in Figure 9-1. In particular, the route between the Airport and Manukau Station involves 19 bus stops.

The 35 bus service is also a frequent bus service that operates between Manukau Station and Botany Town Centre via Chapel Road and Murphys Road. This bus route involves 26 bus stops. The 35 bus route average travel time is also shown in Figure 9-1 below. Note that travel times shown are an average over their respective peak periods of 7-9am and 4-6pm.

[16] Described in Task Plan 502334-8000-TSK-0013

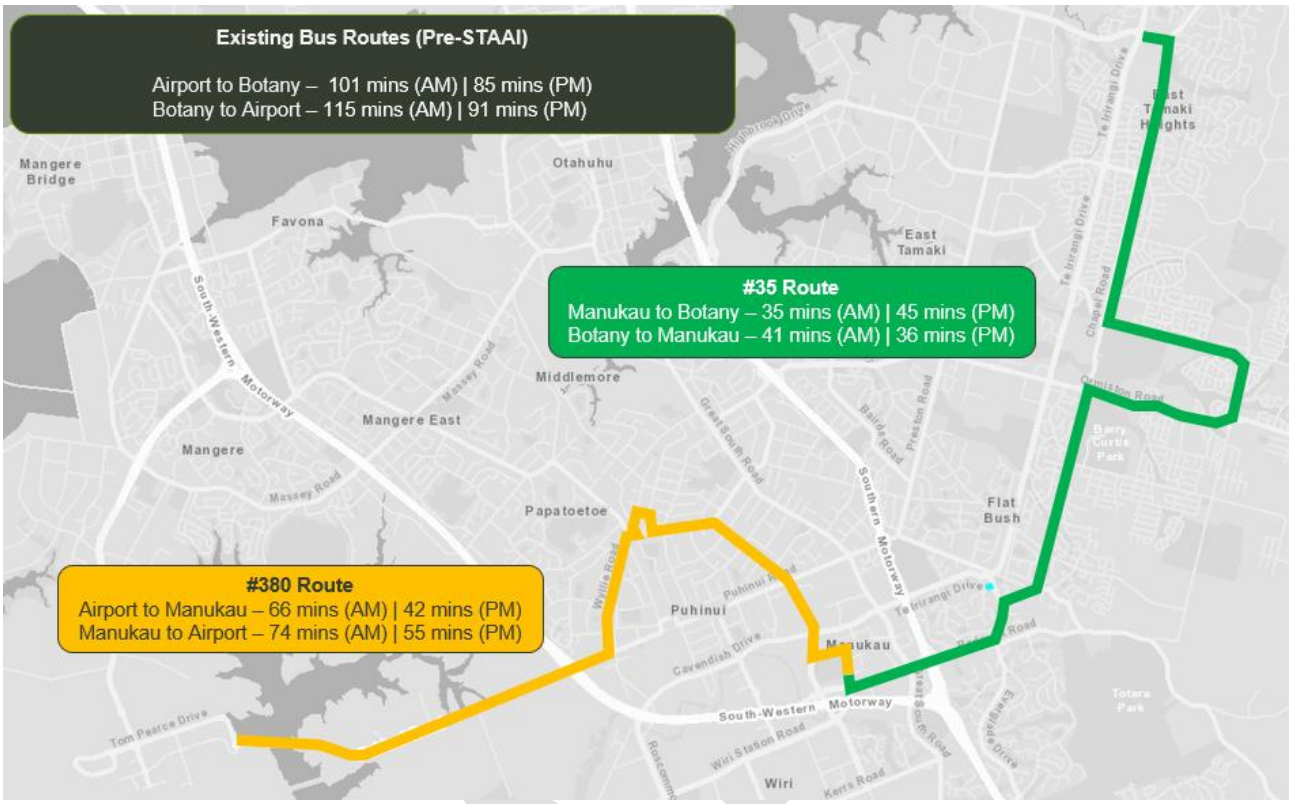


Figure 9-1: Existing bus routes and average travel times over each peak period pre-STAAI (source: AT real time data)

As part of the Short-Term Airport Access Improvements (STAAI), a more targeted bus service as well as bus priority infrastructure was proposed between Manukau Station and the Airport. The new bus route will operate between the airport and Manukau via Puhinui Road and Lambie Drive, which is more direct and involves only 10 bus stops. From this, the travel time between the airport and Manukau is significantly reduced compared to the 380 bus route. The proposed STAAI interventions provide significant travel time savings and these are shown in Figure 9-2 and Table 9-1 below. The expected completion of STAAI interventions is in early 2021. As noted in Section 4, this STAAI service and the 35 route (Figure 9-2) is the do-minimum for this assessment.

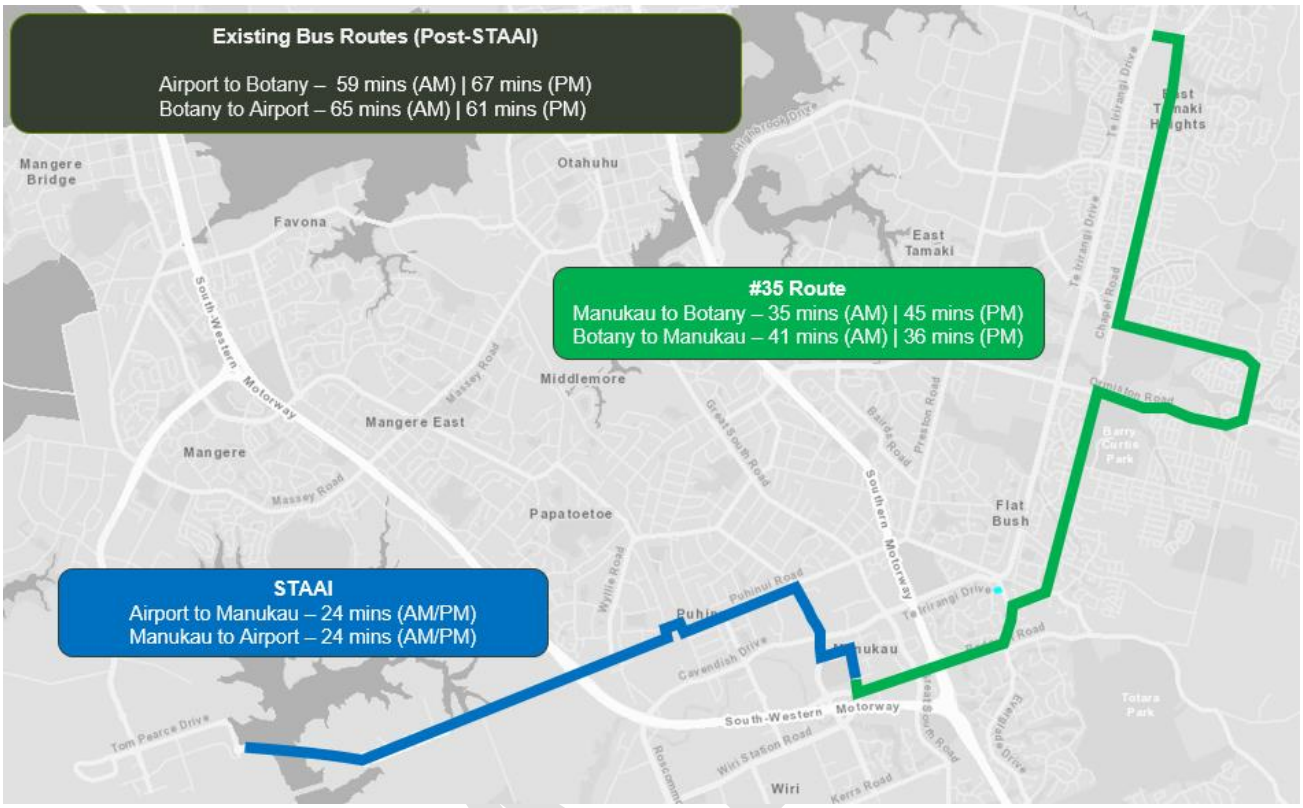


Figure 9-2: Existing bus routes and average travel times over peak periods post-STAAI – the Do-Minimum (sources: STAAI SSBC and AT real time data)

The service design assessment (Section 5) has concluded that the route for this Medium Term service should be the same as that for the Long Term RTN, provided sufficient reliability can be retained across the whole route. In comparison with the existing 35 service, the proposed bus service via Te Irirangi Drive is more direct with less bus stops with 6 stops compared to 26 stops on the do-minimum 35 bus service.

Simply by adopting the proposed medium-term RTN route and stations without any bus priority measures significant travel time savings are expected between Botany and Manukau compared to the 35 bus service. Note that traffic modelling is to be undertaken after the preferred themed option is determined based on assessment against KPIs and subsequent multi-criteria assessment.

Table 9-1 below provides a summary comparing the maximum average peak period bus travel times before and after completion of STAAI in early 2021 using the existing 35 bus route (do-minimum) and the proposed medium-term route.

It should be noted that with the existing bus route and the do-minimum for this assessment, passengers are required to transfer at Manukau Station as there is no single service between the Airport and Botany Station. As such, travel time is likely to be higher than shown.

Table 9-1: Bus route travel time comparison (sources: AT real time data and STAAI SSBC)

	Existing bus route (Pre-STAAI)		Do-minimum bus route (Post STAAI + 35)	
	AM	PM	AM	PM
Airport to Manukau	66mins	42mins	24mins	24mins
Manukau to Airport	74mins	55mins	24mins	24mins
Manukau to Botany	35mins	45mins	35mins	45mins
Botany to Manukau	41mins	36mins	41mins	36mins
Airport to Botany	101mins*	85mins*	66mins*	77mins*
Botany to Airport	108mins*	101mins*	72mins*	70mins*

Note: Travel times shown as an average over the peak periods 7-9am and 4-6pm

Completion of STAAI in early 2021 will already help to improve travel time between the airport and Manukau, saving between 32-40 minutes in the morning peak and 18-31 minutes in the evening peak.

Even without any bus priority interventions, introducing the proposed A2B service via Te Irirangi Drive is expected to provide additional travel time improvements simply by eliminating transfers, reduced stops and a shorter and more direct route. The exact travel time improvements to be determined via AIMSUN modelling as part of the option refinement stage after the themed option has been determined.

It is also expected that bus priority interventions can further reduce the bus travel time and improve reliability for the proposed A2B service. This is explored in later sections of the report.

9.2.1.2 Observed congestion

As part of the process of identifying bus priority measures for the Medium-Term, locations of traffic delay and vehicle queue lengths were investigated along the medium-term route between Manukau Station and Botany Town Centre. Figure 9-3 shows the number of vehicles that queue at each intersection approach during the worst peak in both directions. Queue length provides a physical measure which helps in developing options that are feasible on the corridor for example, determining the length of transit lanes or effectiveness of bus-priority pocket treatments.. Figure 9-4 shows an indicative visual representation of maximum queues observed between both peaks along the medium-term route.

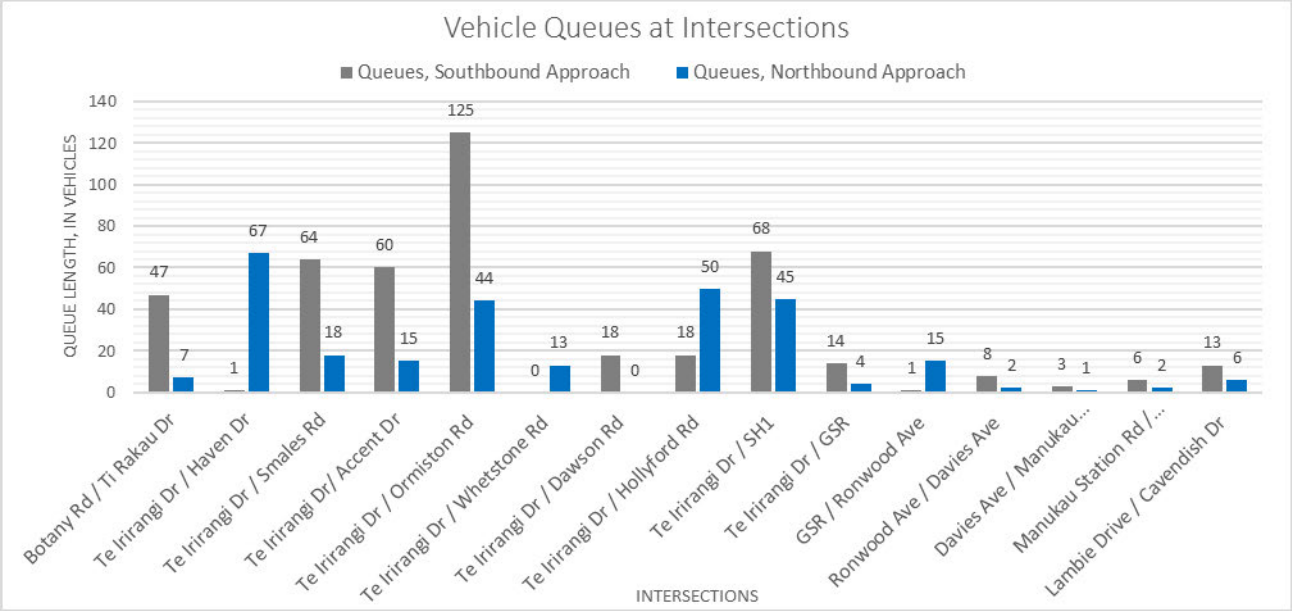


Figure 9-3: Vehicle queues at intersections

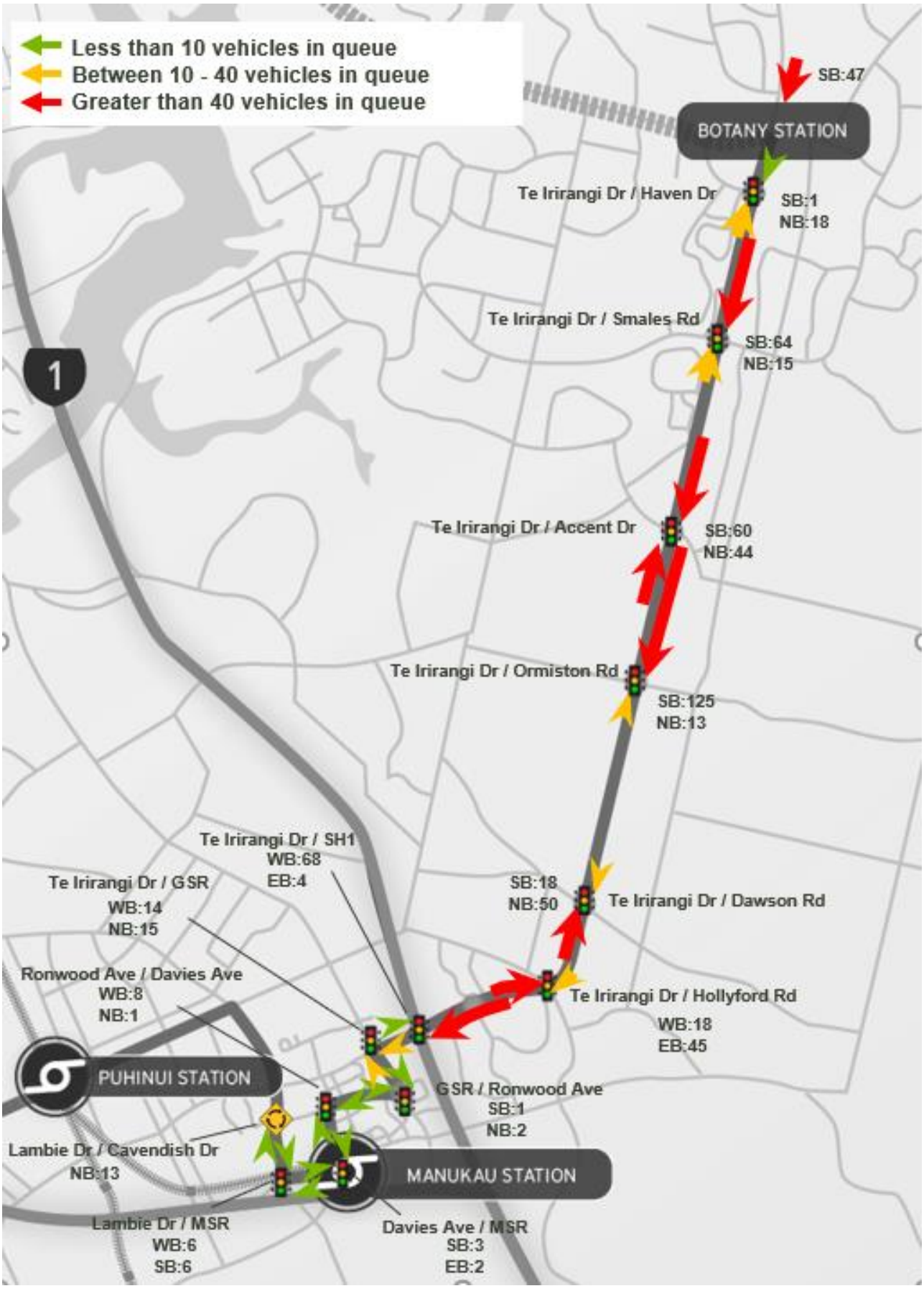


Figure 9-4: Vehicle Queues on Medium-Term Route

Figure 9-5 shows the corresponding maximum traffic delays (in seconds) at each of the intersections during the worst peak in both directions. Based on average cycle times at intersections on the medium-term route, the traffic delay data can portray the number of cycles that is required for queues to clear at an intersection.

The traffic delays observed at most intersections indicate that vehicles can go through the intersection within the first phase i.e. queues are cleared within the first intersection cycle. This is important because if the queue clears on a single phase, the intersection will not provide a significant risk to reliability of the bus service.

There are four intersections on Te Irirangi Drive where queues are not cleared within the first cycle, these intersections are listed in Table 9-2 below. This helps to identify key congestion points where buses will experience the most delay if they are to service the medium-term route and prioritising interventions.

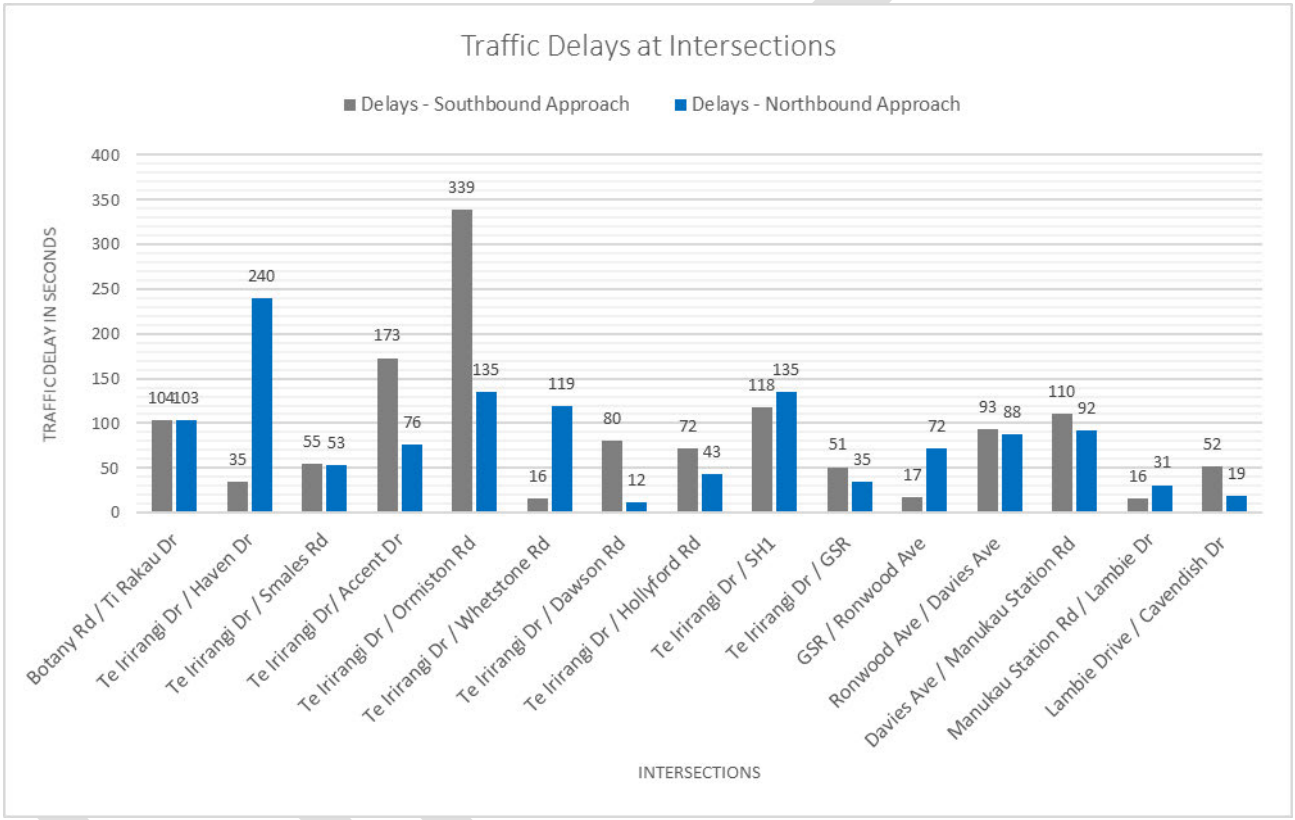


Figure 9-5: Traffic delays at intersections

Table 9-2: Vehicle Dissipation at Intersections

Intersections	Number of intersection cycles required to clear queues
Te Irirangi Drive / Ormiston Road (southbound)	Up to 3 cycles
Te Irirangi Drive / Haven Drive (northbound), Te Irirangi Drive / Accent Drive (southbound); Te Irirangi Drive / Ormiston Road (northbound); Te Irirangi Drive / SH1 (northbound)	Up to 2 cycles
All other intersections on medium term route	1 cycle

9.3 Long List of Options

As part of the project strategy inception meeting, a list of schematic potential bus priority options that could be applied in the medium term were identified. The long list consists of 8 bus-priority options which are summarised in Table 9-3 below.

Table 9-3: Long List Options

Option	Description
1	Do Minimum – buses running in general traffic
2	Convert existing on-street parking space to transit lane
3	Introduce 'Clearway' on existing on-street parking space for additional general traffic lane
4	Convert existing general traffic lane to transit lane
5	Introduce bus priority pocket at intersection
6a	Widen central median for dedicated central bus lanes at intersection approaches.
6b	Dedicated bus lanes on kerbside. Widen central median for general traffic lane at intersection approaches.
7	Full A2B long term design.

Not all options are feasible for each section of route due to constraints associated with the particular characteristics of the road. Each option and their constraints are described in further detail below.

Note that with the except of Option 7, all bus stops are proposed to be indented where possible. However, they are not possible at the following stations:

- Ronwood Avenue;
- Diorella Drive;
- Dawson Road; and
- Ormiston Road.

9.3.1 Option 1: Do Minimum

This option consists solely of indented bus stops where possible to service the medium-term bus route.

This option does not involve any changes to improve bus priority and station access/elements along the medium-term route.

In terms of station elements, this option consists of indented bus stops and can include high quality station amenities such as bespoke bus shelters, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station. Pedestrian safety improvements are also proposed as part of this option such as raised zebra crossings (across slip lanes) to improve pedestrian safety/accessibility to the stations.

This option does not impact existing cycling facilities on the medium-term route.

This option is applicable on all sections of the Medium-Term route.

9.3.2 Option 2: Convert existing on-street parking space into transit lane

This option involves conversion of existing on-street parking spaces to a transit lane which introduces an additional lane during peak traffic hours.

In terms of station elements, this option consists of indented bus stops with high quality station amenities such as bespoke bus shelters, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station. Pedestrian safety improvements are also proposed as part of this option such as raised zebra crossings (across slip lanes) to improve pedestrian safety/accessibility to the stations.

This option does not impact existing cycling facilities on the medium-term route.

This option is only applicable to Ronwood Avenue.

9.3.3 Option 3: Introduce 'Clearway' at existing on-street parking for additional general traffic lane

This option involves re-allocating existing on-street parking spaces to a 'Clearway' to introduce an additional lane during peak traffic hours.

In terms of station elements, this option consists of indented bus stops with high quality station amenities such as bespoke bus shelters, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station. Pedestrian safety improvements are also proposed as part of this option such as raised zebra crossings (across slip lanes) to improve pedestrian safety/accessibility to the stations.

This option does not impact existing cycling facilities on the medium-term route.

This option is only applicable to Ronwood Avenue.

9.3.4 Option 4: Convert existing general traffic lane to transit lane

This option involves converting an existing traffic lane to a transit lane. The use of the transit lane (T2, T3, HCVs) has not been defined as part of this assessment.

This option is feasible when there is sufficient road to re-distribute general traffic to fewer lanes. However, if delays to bus services in the medium term are severe and alternative options are not feasible, this option may be considered despite the negative impact it will have on general traffic. Left turn slips-lanes are retained to reduce impact on general traffic, however raised zebra crossings are proposed (across the slip-lanes) to improve pedestrian safety/accessibility to the stations.

In terms of station elements, this option consists of indented bus stops with high quality station amenities such as bespoke bus shelters, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station.

This option does not impact existing cycling facilities on the medium-term route.

This option is only feasible on Te Irirangi Drive, Great South Road and Lambie Drive.

9.3.5 Option 5: Introduce bus priority pocket at intersection approaches

This option involves introducing a bus priority pocket on approach to intersections. A 50m length of bus lane on approach to an intersection (typically in between the left-turn lane and through lane) is proposed for buses to pass the first 50 m of general vehicle queuing. There is opportunity for buses to travel through the signalised intersection first via a “B” signal phase if required. Kerb adjustments are required and left turn slip lanes will be removed on approach to intersections for this option.

In terms of station elements, this option consists of indented bus stops with high quality station amenities such as bespoke bus shelters, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station.

Cycle lanes can be provided in this design.

This option is feasible at all signalised intersection on Te Irirangi Drive.

9.3.6 Option 6a: Widen central median for dedicated central bus lanes at intersection approaches.

This option involves a median busway-type station within the existing central median, both sides of an intersection. Buses would be expected to travel in the right-most traffic lane of the road before diverging into the central median busway as the bus approaches an intersection. Bus platforms are proposed on the departure side of intersections for passengers to board/alight. The busway would terminate after the bus platform where buses will merge into the right-most traffic lane. The length of the busway is subject to the vehicle queues observed on the section of road. The layout of general traffic lanes will be largely unaffected. Widening of the road corridor is required and all left turn slip-lanes will be removed. An example of Option 6a at an intersection is shown below in Figure 9-7.

In terms of station elements, this option consists of inline bus stops with high quality station amenities such as bespoke bus shelters, barriers, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station.

This option will impact existing on-road cycling facilities due to the large design footprint. In order to maintain the cycling facilities, additional road widening is required (not shown in Figure 9-7)

9.3.7 Option 6b: Dedicated bus lanes on kerbside. Widen central median for general traffic lane at intersection approaches.

This option entails converting the kerbside lane into a bus lane on approach to intersections. The central median will be used for general vehicle lanes for the length of the kerbside bus lane. Bus lanes would either terminate 50 m ahead of an intersection or continue through the intersection, based on available cross-sectional width. Bus stops are proposed on the departure side of intersections for passengers to board/alight. The bus lane would terminate after the bus stop where buses merge back into the kerbside lane. Widening of the road corridor is required and all left turn slip-lanes will be removed. An example of Option 6b at an intersection is shown below in Figure 9-8.

In terms of station elements, this option consists of indented bus stops with high quality station amenities such as bespoke bus shelters, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station.

This option will impact existing on-road cycling facilities due to the large design footprint. In order to maintain the cycling facilities, additional road widening is required (not shown in Figure 9-8).

This option is only feasible on Te Irirangi Drive.

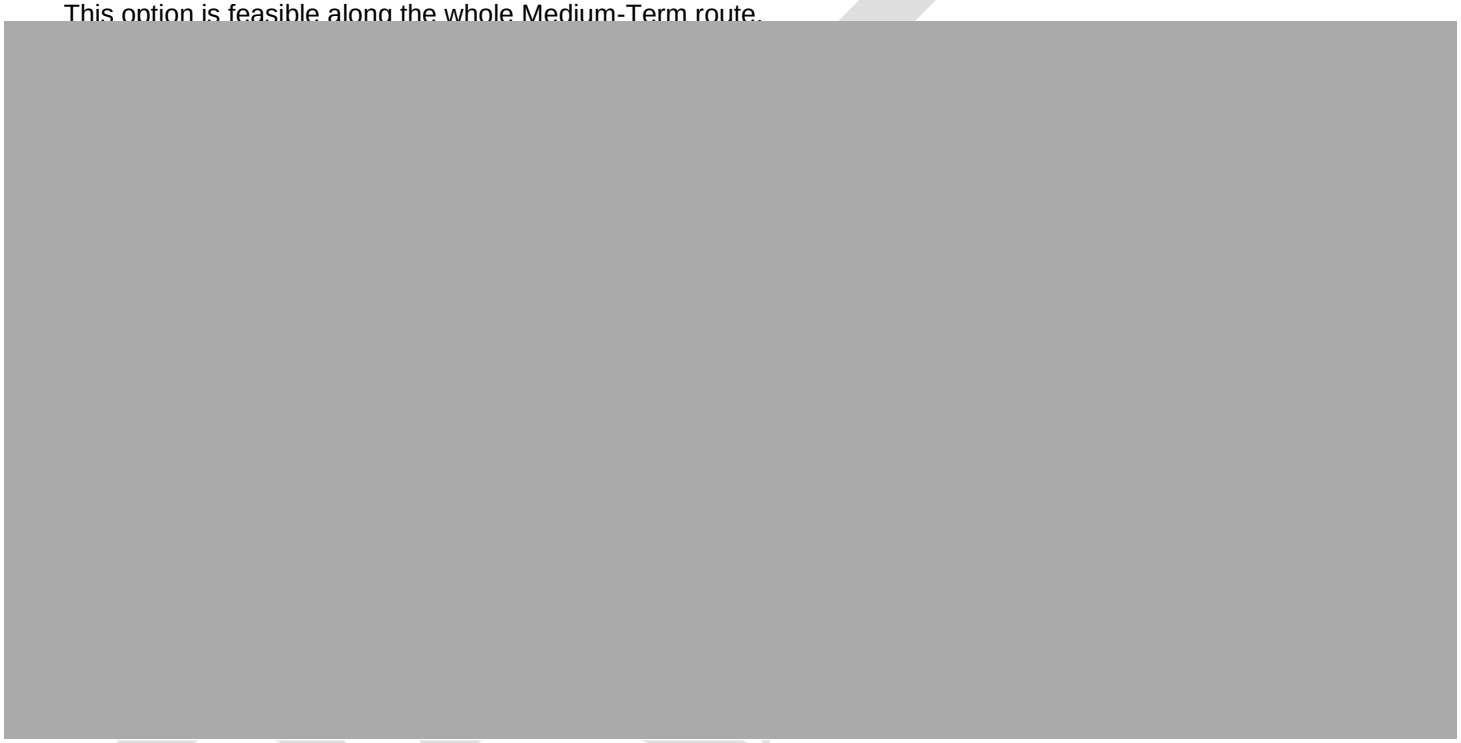
9.3.8 Option 7: Full A2B long term design.

This option entails implementing the design of the Long-Term A2B project. This involves a central busway and separated pedestrians/cyclist facilities at intersections and along the route. Widening of the road corridor is required and all left turn slip-lanes will be removed An example of Option 7 at a typical intersection and connecting roads is shown below in Figure 9-9.

In terms of station elements, this option consists of inline bus stops with high quality station amenities such as bespoke bus shelters, barriers, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into the station.

An off-road, separated cycle facility is provided for this option. As such, all existing on-road cycle facilities on the medium-term route are to be replaced with off-road, separated cycle facilities.

This option is feasible along the whole Medium-Term route.



9.4 Analysis Summary

9.4.1 Assessment Framework

Options 1 to 7 were evaluated against criteria relating to the objectives for the project (Section 3.1). KPIs were identified prior to the commission commenced and are defined below along with the proposed measure for each (Section 3.1.2). Not all of these KPIs and measures are relevant to this aspect of the decision some are greyed out below. Those that are relevant are described in further detail in Sections 9.4.2 and 9.4.3 along with some other relevant considerations.

- Efficiency and reliability
  - Ability of buses to avoid congestion. Extent of ability of buses to avoid queues and degree of exclusivity. *Qualitative: Risk of buses missing the initial green phase.*
    Note: Initial assessment to determine preferred option is qualitative, followed by a quantitative assessment via traffic modelling for a refined preferred option.
- Ease of use and affordability
  - Quality of station environments and access provisions. *Qualitative assessment of station environments*.
- Improved access to jobs and other opportunities
  - Journey time and reliability (Airport-Manukau, Manukau-Botany). *Qualitative: Quality of bus priority*
    Note: Initial assessment to determine preferred option is qualitative, followed by a quantitative assessment via traffic modelling for a refined preferred option.
- Improved health and safety
  - Conflicts for vulnerable users accessing stations. *Quantitative: Conflict points on arrival.*
  - Quality of stations. *Qualitative assessment of station environments*.
- Minimising impact on the environment
  - Additional impervious area. *Quantitative: Impervious area*
  - Impact on trees. *Quantitative: Trees removed.*

Appendix B includes the full technical analysis undertaken to assess all options against the above KPIs.

9.4.2 Assessment against benefit KPIs

The following sections describes the KPIs assessed and the associated criteria for each option. The assessment reflects the scoring for the options in the MCA evaluation which is described further in Section 9.6.1 and 9.6.2.

9.4.2.1 Efficiency and Reliability

Ability of buses to avoid congestion:

Congestion along the medium-term route during peak hours has an impact on the efficiency and reliability of bus services. In particular queues at intersection approaches are at most risk of cause delays, especially where length of queues results in being delayed by multiple phasing cycles.

Therefore, efficiency and reliability of proposed options are measured based on the impact of existing queues at intersections and the expected phasing cycles required to pass an intersection.

- Generally, options that introduce bus priority at intersections (Options 2, 4, 5, 6A, 6B and 7) will provide the greatest benefits by allowing buses to skip traffic queues and minimise the risk of delay by multiple phasing cycles.
- In another option (Option 3), additional capacity is provided to the road network via parking removal, which provides benefits for all road users, but the scale of benefit for buses would be less.

9.4.2.2 Ease of use and affordability

Station environments:

Options that presented the ability to provide high quality infrastructure for customers performed positively. With all options, even where no bus priority is provided, bespoke facilities such as shelters, information boards, good lighting and passenger facilities are proposed at all stops along the medium-term route. As such, all options scored positively in relation to quality of infrastructure. In addition:

- Options that removed left turn slip-lanes such as Options 5 to 7 scored highly as they remove uncontrolled pedestrian crossing points and conflict with vehicles.
- Off-street solutions such as Option 6a and Option 7 scored highest as these options allow dedicated waiting areas for passengers which provides separation from other pedestrian movements.
- Option 4 retains but treats slip lanes with raised tables and pedestrian crossings, so is rated moderately well.

9.4.2.3 Improved access to jobs and other opportunities

Journey time:

All options with a bus servicing medium term route itself helps satisfy the above criteria and will further generate demand for the future service improvements.

At a regional network level, this route connects the Eastern Busway (under construction) to the proposed medium-term service, which creates another direct link across Auckland's proposed future Rapid Transit Network (as well as efficiencies in linking with services from Southern Auckland) and provides access to rapid transport for a wide cross section of Auckland's population.

While more priority will improve journey times, journey time improvements generated by priority measures are assessed under "reliability" to avoid repetition as the results are essentially the same.

Option 4 (transit lanes) has the advantage in that it offers improved journey times to heavy commercial vehicles (HCVs) and high occupancy vehicles (HOVs) and in doing so, will assist the generation of travel behaviour change and productivity. However, this option will also have an adverse impact to general traffic travel times. Note that traffic modelling assessment to determine impacts to HOVs, HCVs and general traffic is to be undertaken for the preferred option after it has been determined.

Reliability:

A key differentiator between options for this KPI is the reliability of the service through travel times between Botany and Manukau. Reliability is improved most significantly with options that achieve full bus priority. Options such as 6a, 6b and 7 that provide full bus segregation scored highest in terms of reliability as separation is achieved from general vehicle queues and delays. Options such as 2, 3 and 4 scored positively as it achieves some bus priority through transit lanes. In summary, reliability of each of the options in terms of reduced bus travel time is summarised below:

- Option 1 – Assumes same travel time and reliability as general vehicles on the route with the addition of delays from bus stops. An improvement compared to the do-minimum 35 bus route.

- Option 2 and 4 – Travel time savings are achieved for buses by travelling in a transit lane. Assumes 75% reduction[17] in volume on the general vehicle lane that is to be converted to a transit lane.
- Option 3 – Assumes equal redistribution of traffic into all available lanes including the clearway lane. Bus travel time savings achieved through overall reduction in delays/queues due to additional clearway lane.
- Option 5 – Travel time savings achieved through priority pocket allowing buses to skip 50 m of vehicle queuing at the head of the intersection. This intervention is however only beneficial when buses can access the bus priority pocket. If queues extend over 50 m, buses cannot access the bus priority pocket. As seen in Section 9.2.1.2 above, the majority of queues extend beyond 50 m at major intersections, reducing the effectiveness of this option. On the other hand, if queues were less than 50 m, the travel time benefit is reduced as buses will generally clear the first signal phase. As such, maximum travel time savings for buses for this option is the travel time saved passing 50 m of general vehicle queuing
- Option 6a – Assumes that the length of dedicated busway is the length of queues experienced at the intersection. Travel time saving for buses achieved is the travel time saved by passing the length of general vehicle queues on approach to the intersection.
- Option 6b – Assumes that the length of kerbside bus lane is the length of queues experienced at the intersection. Travel time saving for buses achieved is the travel time saved by passing the length of the general vehicle queues on approach to the intersection.
- Option 7 – Assumes bus priority with fully segregated bus lanes along entire section. Travel time for buses are assumed to be close to free-flow travel time.

9.4.2.4 Improved health and safety

The health and safety aspect of each option is measured against the number of conflict points for pedestrians to access bus platforms, as well as the station environment.

Conflicts on arrival:

Options that minimise the risk of pedestrian-vehicle conflicts would perform positively in terms of health and safety. In particular, options where access to bus platforms involve fewer pedestrian crossing points and thereby reducing the risk of pedestrian injury or death would perform greater. This can be seen in options, such as Option 4, 5, 6A, 6B and 7, where existing left-turn slip lanes are either proposed for removal or safety improvements. In addition, options with safe station environments that align with CPTED principals would also perform positively.

Quality of station environments:

Options such as Option 2, 3, 4, 5 and 6B, without full RTN stations, but with high quality station elements performed well, while Option 6A and 7 which involved both full RTN stations and high quality station elements performed best.

Option 1 which involves only a basic bus stop performed poorly.

9.4.2.5 Minimising impact on the environment

Impervious area and tree removal:

All options have some level of impact on the surrounding environment through increased impervious areas or removal of trees.

Options that propose bus stops on the kerbsides will include pedestrian improvements such as wider footpaths and landscaped areas for bus stops which all contribute to minor increases impervious areas.

Other options such as 6A, 6B and 7 scored lower as the options include widening carriageways (adding additional lanes for buses and general traffic) which require moderate to significant increases in impervious

[17] Redistribution value to be confirmed and updated by AT based on vehicle occupancy data

areas. These options also require tree removal in some locations making these options score lowest against the KPI.

9.4.3 Assessment against feasibility KPIs

9.4.3.1 Deliverability

As per the Airport to Botany RTN implementation programme, delivery of the medium-term strategy is expected in 2025. As such, the proposed options must be deliverable within 3-4 years. Simple options with fast design and construction timeframes are considered low risk and would be highest performing. In contrast, complex options with slow design and construction timeframes are considered high risk and would perform poorly.

Options 1-5 are simple interventions that can be easily designed and constructed within the 3-4 year timeframe and hence considered low risk. In contrast, Options 6A, 6B and 7 involve complex designs and construction staging that are at risk of a longer delivery timeframe. Given the scope and extent of Options 6A and 6B are relatively small, it is considered a moderate risk, while Option 7 is considered a high risk.

More importantly, each option is also assessed on whether they are physically practicable. Options that are not practically possible are considered high risk regardless of complexity or delivery timeframe. The practicality of the following options was taken into consideration:

- Options 2 and 3 on Te Irirangi Drive, Great South Road, Davies Avenue, Manukau Station Road and Lambie Drive are not practicable due to the absence of existing on-street parking.
- Option 2 and 3 on Ronwood Avenue require minor kerb cutbacks at existing raised zebra crossings to be practicable. This is considered practical.
- Option 5 is only practicable where buses undertake a through movement at a signalised intersection. Therefore, this option is not practicable for majority of the Manukau Town Centre area.
- Option 6A and 6B are only practicable where a bus station is located at a signalised intersection. Therefore, these options are not considered practicable for the midblock bus station on Ronwood Avenue.
- Option 4 is considered physically practical on Te Irirangi Drive, but will require operational analysis to determine risks and effectiveness.
- Option 1 (except the assumed bus stop infrastructure) is feasible in all cases and given level of congestion on Ronwood Avenue and Davies Avenue, may be considered operationally feasible in these locations.

9.4.3.2 Consentability

As per the Airport to Botany RTN implementation programme, delivery of the medium-term strategy is expected in 2025. As such, the proposed options must be deliverable within 3-4 years. Given the likelihood of lengthy timeframes for complex consent approvals, it is important to identify the risk of consent approvals on the 3-4 year delivery timeframe.

Options involving property acquisition are not considered part of the scope for the Medium-Term project[18].

Options involving tree removals would likely involve a consent approval process. Further assessment on the number and types of trees to be removed for Options 6A, 6B and 7 are required to measure the level of consenting risks associated with the tree removals. Nevertheless, options that do not require tree removal performed better in this criteria.

For Option 7, property acquisitions render the option unachievable within scope[18] and tree removals are required along the entire medium-term route and hence it is considered high risk.

For Option 6A and 6B, property acquisitions and tree removals are only required in the southern portion of the medium-term route (from Manukau Station to Te Irirangi Drive / Whetstone Road intersection) render the option

[18] Section 1.1 of Task Plan 502334-8000-TSK-0013

unachievable within scope[18]. For the rest of the medium-term route (north of Whetstone Road), tree removals are required, but no land acquisition. Taking this into consideration, these options are considered high risk.

All other options do not require tree removal or land acquisition and are hence considered low risk.

9.4.3.3 Costs: CAPEX

Options that involve property acquisition have been eliminated due to uncertainties related to increased costs and also the risk involved with timely implementation of securing property/consenting (as outlined in Section 7.5.3.2) above. All options that remained within the existing road corridor scored highly given the ease of implementation and avoidance of increased costs related to property acquisition.

Estimated construction costs vary significantly among the options. Options that require minor kerb-work or changes to the road layout scored positively given the low construction costs associated with the physical works. The majority of costs for Option 1 – 4 are associated with the kerbside bus stop and improvements to pedestrian amenities and adjacent intersections that are proposed likewise for each option. The cost associated with these options are deemed minor,

Options that required major kerb work or changes to the existing road layout scored lower due to the high cost of construction. Option 6A and 6B scored low given the significant extent of carriageway widening and intersection upgrades required to operate the option. Option 7 scored lowest for having the greatest design footprint (requiring significant changes to the road layout) and encroaching into property boundary requiring property acquisition.

High level construction costs for each of the options were estimated as follows:

- Option 1: Approx. $6 mil for entire route.
- Option 2 – 4: Approx. $20 mil for entire route.
- Option 5: Approx. $30 mil for entire route.
- Option 6A: Approx. $175 mil ($25 mil per station on route) excluding potential property acquisition costs
- Option 6B: Approx. $140 mil ($20 mil per station on route) excluding potential property acquisition costs
- Option 7: Approx. $1.025 bil for entire route.

Note: Costs above are estimated based on various high-level assumptions. A refined cost estimate is to be undertaken for the preferred option.

9.4.3.4 Costs: OPEX

The operational expenditure of the proposed bus route involves bus station maintenance and operation costs, bus operation costs and busway maintenance costs (if dedicated busway is provided). Of these different costs, the differentiating factors between all options are bus operation costs and busway maintenance costs, with busway maintenance costs being the major factor. The longer the busway, higher the cost.

Given Options 6A, 6B and 7 have dedicated busways, these options would not perform as well as others. Particularly, Option 7 (a full-length busway) would perform the worst.

The operational cost of the service design is addressed in Section 5.2.5. While not changing the comparative assessment of operating models, other than the susceptibility of models to congestion which is dealt with in Section 5.2.5, less efficient bus operations due to congestion could lead to higher OPEX due to less efficient operations and a requirement for more redundancy in the operation. Therefore, options such Option 1, 3 and 5, where buses are likely to be delayed by general traffic queues at intersection approaches, would perform moderately. In contrast, Option 2 and 4 reduces the risk of buses being delayed by general traffic queues and hence, performs best.

9.4.3.5 'Regret' Spending

All options except Option 7 have costs for infrastructure that is not re-usable as a result of transitioning from medium-term interventions to the full A2B RTN in the future. The Staging Strategy for A2B indicates that this transition would be in the mid-2030s[19]. Options that adopted designs that align with the full A2B RTB alignment scored positively against this KPI, however, all these options require land acquisitions and were unachievable within the scope.

Infrastructure associated with options 1 -5 are unlikely to be re-used in the full rapid transit scheme as the design does not take into consideration the full A2B RTN design. The full A2B RTN proposed central busways along the route with kerb lines that extend further than the existing kerb line. As such, these options scored low on the basis that there is no future-proof capability as they eventually require removal in the future to implement the full A2B RTN design. Some costs can be recovered such as re-using bus stop infrastructure such as bus shelters, passenger information boards, if applicable. However, the overall cost of non-reusable infrastructure associated with these options are low compared to the costs of Option 6A and 6B and would have a useful life of around ten years, assuming current staging expectations are retained.

Option 6A and 6B involve upgrading the intersections to be aligned with the full A2B design. Both options propose kerb lines to match the full A2B design and widens into the central median on Te Irirangi Drive where the central RTN busways will be constructed in the future. The central busway and stations in Option 6A align with the full A2B RTN design and can be used in the future, lowering sunk costs compared to constructing kerbside busways in Option 6B. There are still risks of unforeseen costs in, for example service relocations associated with both options without the design of the full A2B RTN being completed at this stage and risks of the design changing in the future.

[19] A2B Staging Tech Note 502334-7000-TEC-JJ-0006

9.5 Multi-Criteria Assessment

The MCA assessment was divided into two areas as shown in Figure 9-10:

- Te Irirangi Drive between Ti Rakau Drive and Great South Road.
- Manukau Town Centre which includes Great South Road, Ronwood Avenue, Davies Avenue, Manukau Station Road and Lambie Drive.

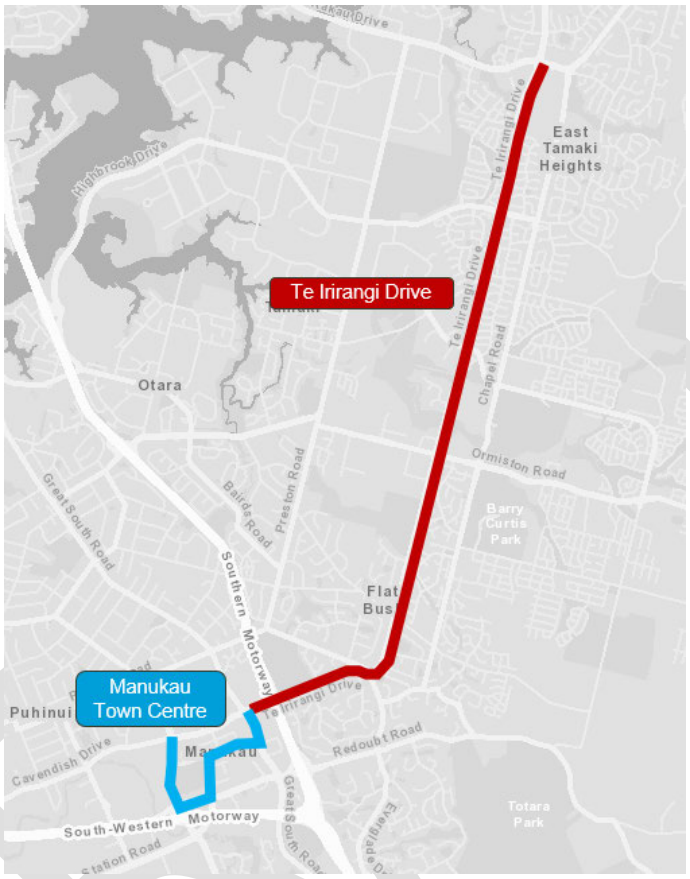


Figure 9-10: Split of Route for MCA Assessment

For the MCA, each of the long list options were assessed against the relevant KPIs along with other relevant considerations. These KPIs and their associated measures were split into benefit KPIs and feasibility KPIs as shown in Table 9-4 and Table 9-6 below. The score scales for these two types of KPIs are also listed in Table 9-5 and Table 9-7.

Table 9-4: Benefit KPIs and Measures

Benefit KPI	Measure
Efficiency and reliability	Avoidance of queues Risk of buses missing initial phase
Ease of use and affordability	Assessment of station environs
Improved access to jobs and other opportunities	Journey times (Airport – Manukau; Manukau – Botany; Airport-Botany)
Improved health and safety	Conflict points for pedestrian routes to platforms Assessment of station environs
Minimising impact on the environment	Additional impervious area/lanes-width Tree removal

A five-point scoring scale was used in the MCA assessment for the benefit KPIs of each option as follows:

Table 9-5: Scoring Scale for Benefit KPIs

Description	Grade
Significant improvement on do-min	2
Improvement on do-min	1
No change from Do-min	0
Worse than do-min	-1
Significantly worse than do-min	-2

Table 9-6: Feasibility KPIs and Measures

Feasibility KPI	Measure
Deliverability	Deliverable within 3-4 years Physically practicable
Consentability	Level of complexity of gaining approvals – e.g. property acquisitions, tree removals
CAPEX	Estimated construction costs
OPEX	Operational expenditure for facility management
“Regret” spend	Costs that are not re-usable as a result of transitioning from medium-term interventions to the full A2B RTN in the future

A three-point scoring scale was used in the MCA assessment for the feasibility KPIs of each option as follows:

Table 9-7: Scoring Scale for Feasibility KPIs

Description	Grade
Easy, low risk	3
Moderately easy, moderate risk	2
Difficult and high risk	1
Requires property	**Fail**

Based on the assessments in Sections 9.4.2 and 9.4.3 and the technical analysis in , a summary of each option’s performance against KPIs is shown in Table 9-8 and Table 9-9.

9.5.1 Te Irirangi Drive

Table 9-8: Te Irirangi Drive MCA

KPI	Measure	Option 1 (Do Min)	Option 2	Option 3	Option 4	Option 5	Option 6A	Option 6B	Option 7
Efficiency and reliability	Avoidance of queues (maps) Risk of buses missing initial phase	0	1	1	1	1	2	2	2
Ease of use and affordability	Assessment of station environs	0	1	1	1	1	2	2	2
Improved access to jobs and other opportunities	Journey times (Airport – Manukau; Manukau – Botany; Airport-Botany)	0	1	1	1	1	2	2	2
Improved health and safety	Conflict points for pedestrian routes to platforms Assessment of station environs	0	1	1	1	1	1	1	1
Minimising impact on the environment	Additional impervious area/lanes-width Tree removal	0	-1	-1	-1	-1	-2	-2	-2
Deliverability	Deliverable within 3-4 years Physically practicable	3	NA	NA	3	3	1	1	1
Consentability	Level of complexity of gaining approvals – e.g. property acquisitions, tree removals	3	3	3	3	3	**Fail**	**Fail**	**Fail**
CAPEX	Estimated construction costs	$5mil	$18mil	$18mil	$18mil	$23mil	$150mil	$120mil	$785mil
OPEX	Operational expenditure for facility management	2	3	2	3	2	1	1	1
“Regret” spend	Costs that are not re-usable as a result of transitioning from medium-term interventions to the full A2B RTN in the future	3	3	3	3	3	2	1	3

9.5.2 Manukau Town Centre

Table 9-9: Manukau Town Centre MCA

KPI	Measure	Option 1 (Do Min)	Option 2	Option 3	Option 4	Option 5	Option 6A	Option 6B	Option 7
Efficiency and reliability	Avoidance of queues (maps) Risk of buses missing initial phase	0	1	1	1	1	2	2	2
Ease of use and affordability	Assessment of station environs	0	1	1	1	1	2	2	2
Improved access to jobs and other opportunities	Journey times (Airport – Manukau; Manukau – Botany; Airport-Botany)	0	1	1	1	1	2	2	2
Improved health and safety	Conflict points for pedestrian routes to platforms Assessment of station environs	0	0	0	0	0	0	0	0
Minimising impact on the environment	Additional impervious area/lanes-width Tree removal	0	-1	-1	-1	-1	-2	-2	-2
Deliverability	Deliverable within 3-4 years Physically practicable	3	2	2	2	1	1	1	1
Consentability	Level of complexity of gaining approvals – e.g. property acquisitions, tree removals	3	3	3	3	3	**Fail**	**Fail**	**Fail**
CAPEX	Estimated construction costs	$0.5mil	$2mil	$2mil	$2mil	$6.5mil	$25mil	$20mil	$240mil
OPEX	Operational expenditure for facility management	2	3	2	3	2	1	1	1
“Regret” spend	Costs that are not re-usable as a result of transitioning from medium-term interventions to the full A2B RTN in the future	3	3	3	3	3	2	1	3

9.6 Summary of MCA

9.6.1 Te Irirangi Drive

As shown above in the MCA assessment (Table 9-8), a range of themed options performed highly overall. There are options that can be eliminated immediately based on deliverability and consentability.

Options 6A, 6B and 7 can be eliminated as they required property acquisition. Options involving property acquisition are not considered part of the scope for the Medium-Term Project.

Nevertheless, options 2, 3, 6A, 6B, and 7 did not perform well against the KPIs due to:

- Option 7 requires property acquisition along the majority of Te Irirangi Drive to implement. The level of effort required to gain consenting approvals to acquire property and remove trees, and construct is very unlikely in the next 3-4 years. Option 7 also has the highest CAPEX construction cost of approximately $785mil which is unlikely to be funded in the current RLTP. As such, this option was not carried forward to the short list of options.
- Option 6A and 6B require property acquisition along the southern section of Te-Irirangi Drive to implement. The level of effort required to gain consenting approvals to acquire property and remove trees, and construct is unlikely in the next 3-4 years. Only north of Whetstone Road is construction of Option 6A and 6B possible within the road reserve but will still require the removal of a significant number of existing trees in the central median on Te Irirangi Drive to widen the carriageway. Consideration has been taken to implement either Option 6A or 6B for just the northern section of Te Irirangi Drive however was rejected as it does not provide continuity in bus infrastructure along the route. As such, Option 6A and 6B was not carried forward to the short list of options
- Option 2 and 3 are not physically practicable as there are no existing on-street parking spaces on Te Irirangi Drive. Conversion from existing on-street parking to transit lanes are not feasible on Te Irirangi Drive. As such, Option 2 and 3 was not carried forward to the short list of options. These were rated “NA” in the MCA table.

Based on this, the remaining options that are applicable on Te Irirangi Drive are Options 1, 4 and 5. All three options are deliverable within the next three years, have low ‘regret spend’ and very low consentability risks. The options can be compared in terms of how they scored against other KPIs:

- In terms of reliability and journey times, Option 4 is expected to performance the best. Option 1 does not provide any travel time or reliability benefits and the effectiveness of Option 5 is limited to the small length of the bus priority pocket. Option 4, although shares the priority with HOV and HCVs, has continuous priority from intersection to intersection. This also means Option 4 involves less operational expenditure in comparison with Option 1 and 5 as bus operations are less susceptible to congestion.
- Option 1 has the lowest estimated construction cost of approximately $5mil. This is followed by Option 4 at approximately $18mil and $23mil for Option 5. It is noted that Option 4 and 5 provide the same level of station improvements for passengers but costs more due to physical works of removing left-turn slip lanes for the option to be feasible. It is also noted that Option 4 provides better journey times for buses at a lower construction cost compared to Option 5.
- Option 4 and 5 have slight increases in impervious areas as wider footpath and pedestrian amenities leading towards the bus station are proposed, compared to the do-min approach of Option 1. This factor however is not expected to be a determining factor for the preferred option.

9.6.2 Manukau Town Centre

As shown in the MCA assessment (Table 9-9), a range of themed options performed highly overall. There are options that can be eliminated immediately based on deliverability and consentability.

Options 5, 6A, 6B and 7 did not perform well against the KPIs due to:

- Option 7 requires property acquisition for majority of the proposed route in the Manukau Town Centre area to implement. I tis considered that this requirement could be mitigated through more detailed design, however the level of effort required, and potential risk is higher than other options. Option 7 also has the highest capital cost construction cost of approximately $240mil which is unlikely to be funded in the current RLTP. As such, this option was not carried forward to the shortlist of options.
- Options 6A and 6B are not physically practicable as it is only applicable where there is a station at a signalised intersection. However, within the Manukau Town Centre, the only new station proposed in the medium-term is a midblock station on Ronwood Avenue. In addition, property acquisitions are required for majority of the proposed route in the Manukau Town Centre area to implement Option 6A or 6B. The level of effort required to acquire property, gain consenting approvals and construct is very unlikely in the next 3-4 years, particularly where there are high-rise buildings in the business district. These two options also scored poorly for impact on environment due to the significant increase in impervious area and tree removals required on Ronwood Avenue, Davies Avenue and Lambie Drive. Therefore, Options 6A and 6B have been eliminated as a preferred option.
- Option 5 although is generally easily implementable within 3-4 years, is not physically practicable within the Manukau Town Centre area due to the lack of space at existing intersections for readjustments/widening for an additional bus pocket. Therefore, Option 5 was having been eliminated as a preferred option.

During the Airport to Botany Staging Programme development, the bus route connection between Puhinui Road and Manukau Station in the short and medium-term was initially agreed to be via Ronwood Avenue and Davies Avenue as shown in Figure 9-11. However, prior to the medium-term strategy assessment, an opportunity to implement the final busway via Manukau Station Road, as shown in Figure 9-12, was identified. As such, Manukau Station Road was taken into consideration.

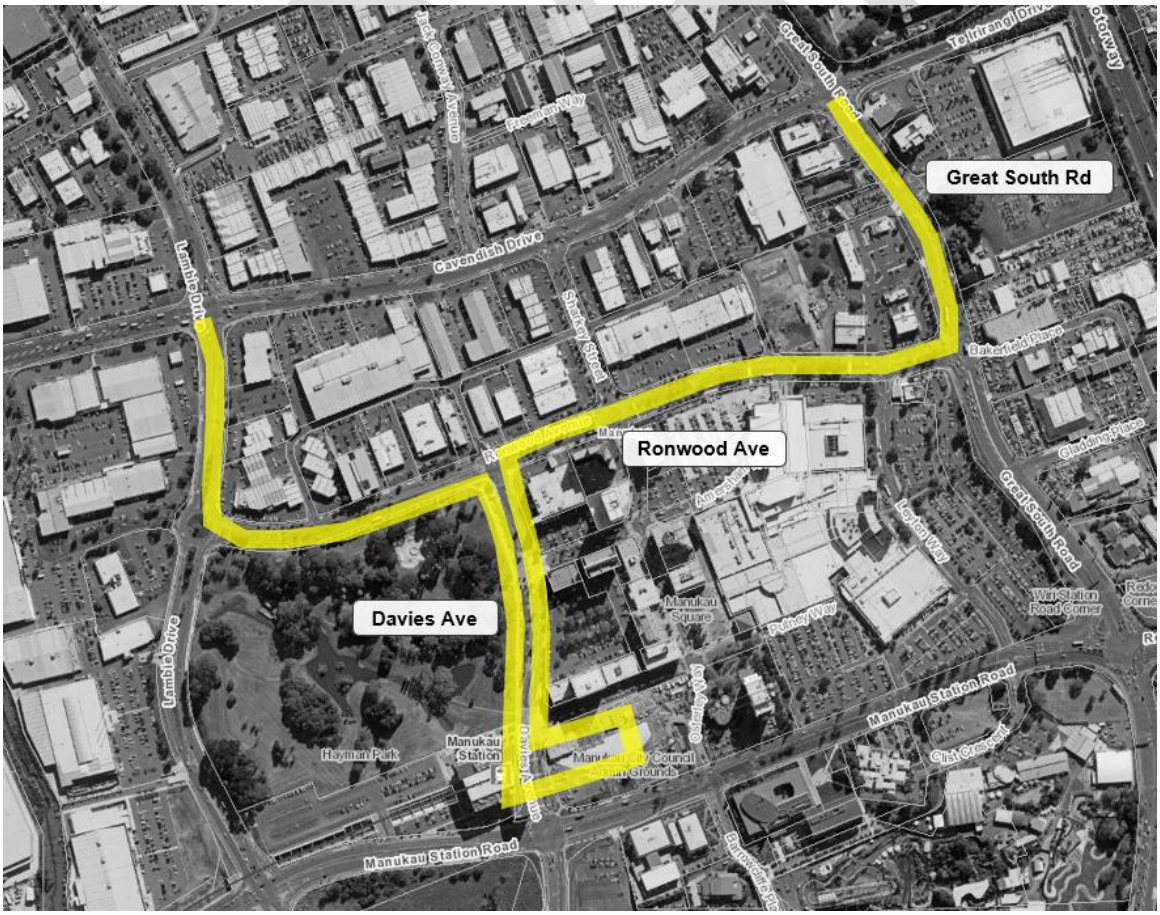


Figure 9-11: Initial short and medium-term bus route through Manukau

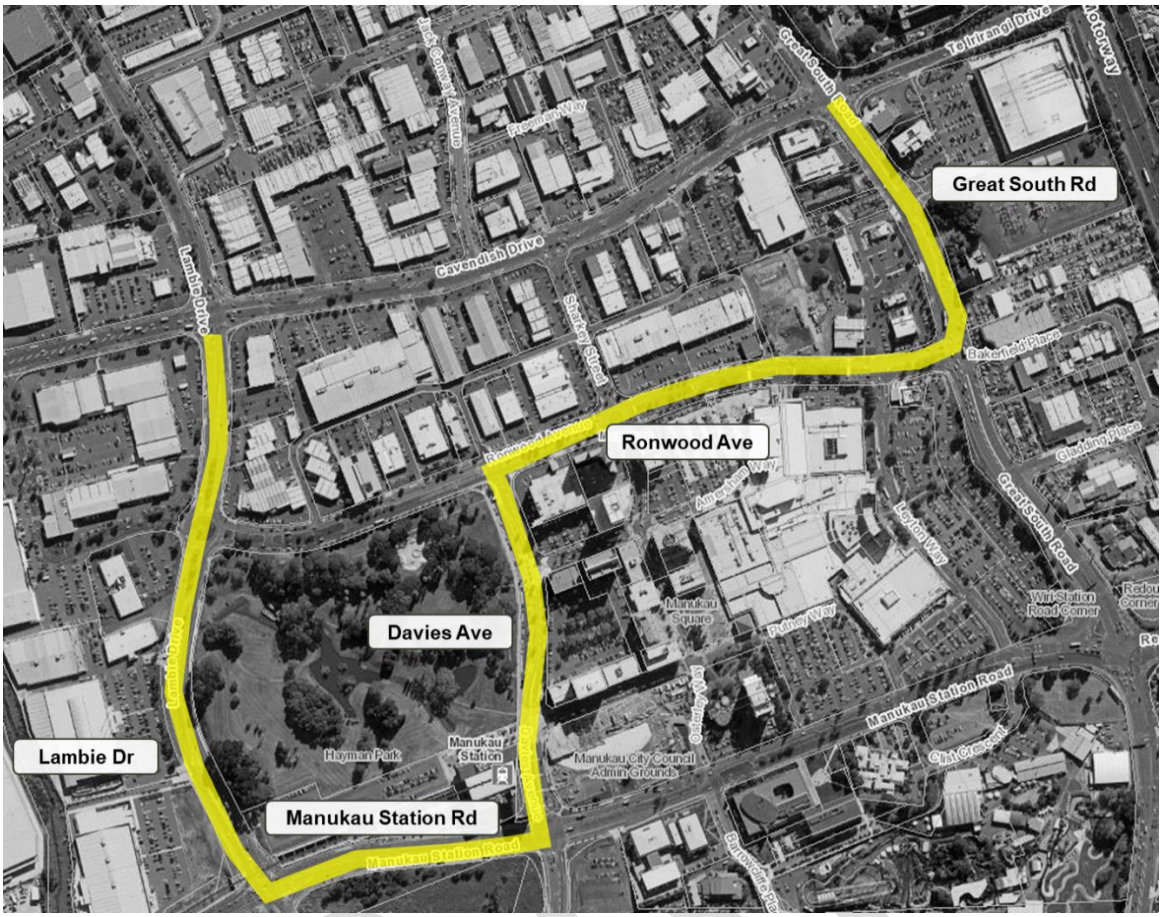


Figure 9-12: Full Airport to Botany busway route through Manukau

Subsequently, the MCA results determined that median busway options were not practicable. Given that the route via Manukau Station Road involves the SH20 interchange, buses are at more risk of congestion and unreliable travel times. Therefore, the initial short and medium-term route via Ronwood Avenue and Davies Avenue (Figure 9-11) is considered more appropriate.

Based this route, it should be noted that Options 2 and 3 are applicable only to Ronwood Avenue and Option 4 is applicable only to Lambie Drive. In addition, the only option applicable to Great South Road and Davies Avenue is Option 1. In particular, Great South Road is a small portion of the A2B corridor that is constrained by properties on both sides of the road. It also involves buses undertaking alternating turning movements (left turn in, right turn out) which limits the possibilities for bus priority measures without significant road widening or severe traffic impacts. Therefore, combinations of options in the Manukau Town Centre area are considered as shown in the following table:

Table 9-10: Combination of Options in Manukau Town Centre

	Great South Road	Ronwood Avenue	Davies Avenue	Lambie Drive
Combination 1	Option 1	Option 1	Option 1	Option 1
Combination 2	Option 1	Option 2	Option 1	Option 4
Combination 3	Option 1	Option 3	Option 1	Option 4

All these option combinations are deliverable within the next three years, have low 'regret spend' and very low consentability risks. These combinations can be compared in terms of how they scored against other KPIs:

- In terms of reliability and journey times, Combination 2 has the shortest travel time through the Manukau Town Centre (from Lambie Drive to Great South Road). The table below shows the travel time comparisons between each of the three option combinations. Combination 2 has slightly faster travel times compared with other combinations; however, difference is minimal due to short route length and relatively low

congestion. Operational expenditure slightly increases with Combinations 1 and 3 due to slightly longer bus travel times i.e. less efficient bus operations due to congestion.

Table 9-11: Travel Time of Combinations 1, 2 and 3 (source: snitch data, Lambie Drive – Great South Road)

	Approx. Travel time – Southbound		Approx. Travel time - Northbound	
	AM	PM	AM	PM
Combination 1	12 mins	14 mins	13 mins	14 mins
Combination 2	11 mins	12 mins	11 mins	12 mins
Combination 3	11 mins	13 mins	12 mins	13 mins

Note: Travel time savings for Option 2 on Ronwood Avenue is assuming free flow traffic for buses. Option 3 assumes traffic delay is halved due to doubled capacity. Option 4 applies traffic redistribution based on AT occupancy data for proportionate reduction in delays.

- Combination 1 has the lowest estimated construction cost of approximately $1.5mil. This is followed by Combinations 2 and 3 at approximately $2mil each.
- Combination 1 provides minimal improvements to station environment for passengers whereas Combinations 2 and 3 will provide a high-quality bus station with secure facilities and improved pedestrian accessibility and safety.
- Combinations 2 and 3 have slight increases in impervious areas as wider footpath and pedestrian amenities leading towards the bus station are proposed, compared to the do-min approach in Combination 1. This factor is not expected to be a determining factor when shortlisting the options.

9.7 Considerations from related projects

9.7.1 Connected Communities

Auckland Transport is currently progressing with investigations to improve reliability on a number of bus routes as part of the Connected Communities Programme. This includes the provision or extension of bus-priority for the full length of key FTN routes, improving average speed and reliability and reducing operating costs.

Manukau City Centre is a priority focus are of the Great South Road Corridor as is scheduled for delivery in the next two to three years. The development and assessment of options for this area are currently underway, and includes a range of bus priority, pedestrian and cycling improvements in Manukau City Centre. Potential draft recommended options include:

- The provision of bus priority for southbound right turning movements into Ronwood Avenue from Great South Road.
- The removal of on-street parking in Ronwood Avenue to provide bus priority lanes
- New pedestrian crossings on Ronwood Avenue
- No immediate changes to Davies Avenue
- Bi-directional cycling facilities on Manukau Station Road.

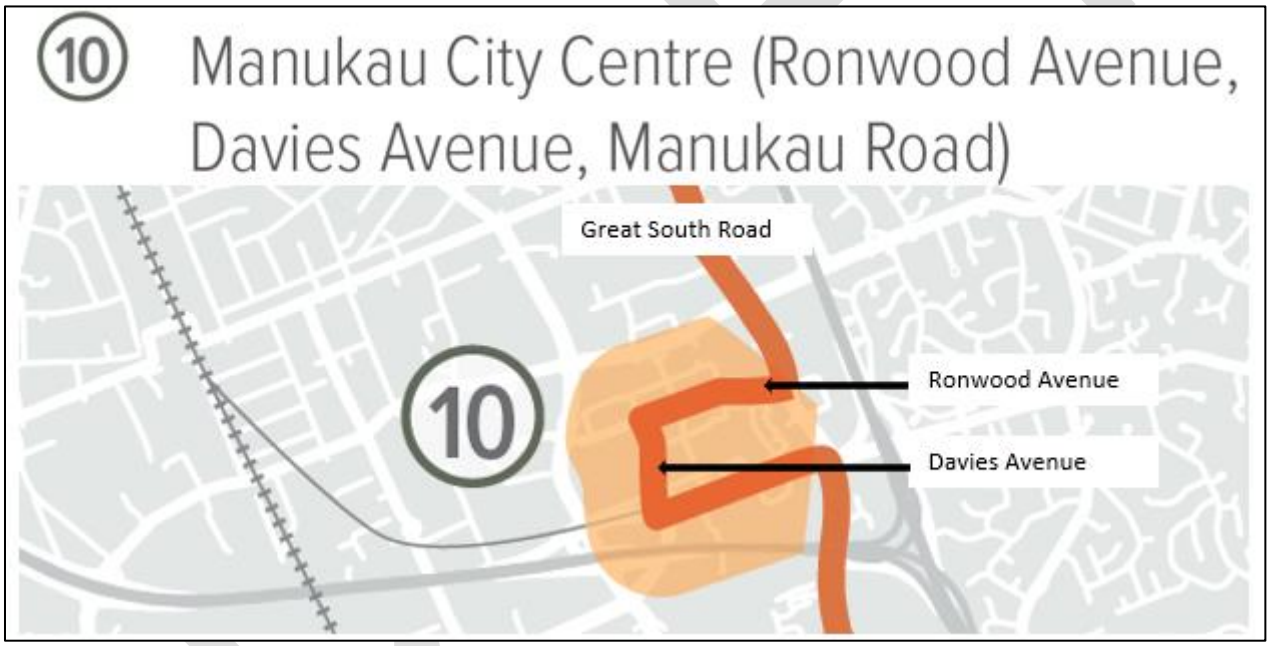


Figure 9-13: Connected Communities - Manukau City Centre Focus Area

Due to the timeframes associated with both projects, and the nature of the improvements planned by the Connected Communities Programme, it is expected that a co-ordinated planning and delivery process will be developed by AT.

The A2B medium-term strategy will provide for the cost of the shelters and customer facilities for the Ronwood Avenue and Davies Avenue stops, to ensure consistency of service deliver in line with desired outcomes.

9.7.2 Manukau Regeneration

An opportunity may exist to implement the long-term infrastructure in the Manukau Central area on Ronwood Avenue and Davies Avenue to support the urban regeneration proposed at that location. The logic in early delivery of the long-term infrastructure would be:

- Assisting urban regeneration through improved access for the centre

- Providing improved public realm and urban quality
- A “dig once” opportunity to minimise disruption

This implementation has been assumed in the Horizon 3 assumptions in the SSBC. This Medium-Term paper does not include the long-term delivery in Manukau as from a reliability and journey time perspective, the Manukau area does not contain significant issues with bus reliability.

9.8 Recommended bus priority themed option

Based on the MCA assessment undertaken above, the preferred themed options for each section are outlined in below.

Table 9-12: Preferred Option

Section	Preferred Option
Te Irirangi Drive	**Option 4 (Convert existing traffic lane into transit lane)** where possible
	Option 1 (Service only) – if required in areas where Option 4 is not possible
Manukau Town Centre	**Option 2 (Convert existing on-street parking into transit lane)** To be undertaken as part of Connected Communities Project – Ronwood Avenue (east of Davies Avenue).
	Option 2 (Convert existing on-street parking into transit lane) – Ronwood Avenue (west of Davies Avenue) where feasible
	Option 1 (Service only) – Great South Road and Davies Avenue
	Option 4 (Convert existing traffic lane into transit lane) – Lambie Drive – noting that the short length of the Lambie Drive section may mean that only Option 1 is feasible.

9.8.1 Te Irirangi Drive

In summary,

- **Option 4** on Te Irirangi Drive is the preferred option for the medium-term project as it most aligns with the project KPIs.
- **Option 1** may be required in few sections where Option 4 is not feasible on Te Irirangi Drive and potentially on Lambie Drive.

Figure 9-14 shows the typical existing cross section on Te Irirangi Drive where there is an existing on-road cycleway. Figure 9-15 shows the typical cross section on Te Irirangi Drive where there is an existing on-road cycleway with Option 4 is implemented. It should be noted that Option 4 does not impact any existing cycle facilities provided on Te Irirangi Drive.

Figure 9-14: Typical existing cross section on Te Irirangi Drive with cycle facilities

Figure 9-15: Typical cross section on Te Irirangi Drive with Option 4 with cycle facilities

9.8.2 Manukau Town Centre

In summary, Connected Communities are to undertake bus priority improvements on Great South Road, Ronwood Avenue (east of Davies Avenue) and Davies Avenue. Planning and delivery should be co-ordinated. The preferred options from the long list assessment are aimed to support bus priority measures on the remaining medium-term route.

- **Option 2** on Ronwood Avenue (west of Davies Avenue)
- **Option 2** on Ronwood Avenue (east of Davies Avenue), Davies Avenue and Great South Road in co-ordination with proposed Connected Communities proposals.
- **Option 4** on Lambie Drive is the preferred options for the medium-term project.
- Full RTC implementation to be considered in conjunction with urban regeneration projects.

Figure 9-16 shows the typical existing cross section on Lambie Drive where there is an existing on-road cycleway. Figure 9-17 shows the typical cross section on Lambie Drive where there is an existing on-road cycleway with Option 4 is implemented. It should be noted that the proposed Option 4 on Lambie Drive will not impact existing cycling facilities

Figure 9-16: Typical existing cross section on Lambie Drive with cycle facilities

Figure 9-17: Typical cross section on Lambie Drive with Option 4

This section of Lambie Drive interfaces with the bus priority infrastructure being implemented as part of the STAAI project which proposes kerbside bus lanes on Lambie Drive between Puhinui Road and Cavendish

Drive. Option 4 being a kerbside transit lane provides good continuation between STAAI and medium-term interventions.

Refinement of the recommended option in design phase found that the length of Lambie Drive in consideration was too short to implement an effective transit lane. As a result, for the short section of Lambie Drive between Ronwood Avenue and Cavendish Drive, **Option 1 is proposed**, while retaining the existing bus pocket at the intersection with Cavendish Drive (Figure 9-18). Bus lanes provided as part of the STAAI programme will be

10 Option Refinement

Following the assessment of themed options, the recommended bus priority options in the Medium-Term route was modelled on AIMSUN to test the journey time and reliability of the new A2B service as well as the impacts to general traffic and the wider network. The initial traffic model based on continuous transit lanes on Te Irirangi Drive between Great South Road and Haven Drive in both directions showed severe traffic impacts in the A2B corridor and the wider network. This issue had a flow-on effect on the performance of the A2B service and negated the benefits provided for majority of the route. Therefore, an option refinement process was undertaken to determine the optimal layout of the transit lanes on Te Irirangi Drive, such that bus travel time and reliability benefits are achieved whilst limiting the impact to general traffic and the wider network.

10.1 The Refined Option

Through AIMSUN modelling, the main operational issues for the recommended bus priority option (continuous transit lanes between Great South Road and Haven Drive) can be summarised as follows:

- General traffic experienced significant congestion and delays due to reduced capacity on Te Irirangi Drive
- Road corridors in the wider network surrounding Te Irirangi Drive experienced significant congestion and delays
- Te Irirangi Drive between SH1 and Hollyford Drive is a heavily trafficked route and the reduced capacity causes heavy congestion. This heavy congestion has significant negative impacts to bus travel time and reliability, and negates much of the benefits provided by the bus priority for the remainder of the route
- Overall congestion at major intersections on Te Irirangi Drive due to continuous transit lanes occupying an approach lane

Given the core operational issues of the recommended option lies within the Te Irirangi Drive corridor, the option refinement process considered the following alternatives:

A. No transit lanes – implementing the A2B service without transit lanes on Te Irirangi Drive
B. Midblock transit lanes – reducing the extents of transit lanes on Te Irirangi Drive to provide additional general traffic capacity at intersections
C. Continuous transit lanes with intersection widening – introduce an additional traffic lane via intersection widening, such that general traffic capacity at intersections is increased and continuous transit lanes can be maintained

AIMSUN modelling was undertaken for all three alternatives, with both B and C providing greater travel time and reliability benefits. The performance of both B and C are largely similar, with C providing slightly better results. However, C involves substantial physical works and higher costs compared to B. Therefore, the preferred refined option is B – midblock transit lanes. Note that C provided travel time improvements for all users on Te Irirangi Drive and hence, it could be considered in the future if there is greater appetite to invest.

To summarise, the refined option consists of the following:

- Midblock transit lanes in both directions of Te Irirangi Drive – minimum 50m gap at signalised intersection approaches and departures to provide general vehicles additional capacity at intersections and ease congestion
- Southbound transit lanes to commence at Haven Drive and terminate at Hollyford Drive
- Northbound transit lanes to commence at Ormiston Road and terminate at Te Koha Road

The concept drawings for the refined option is attached in Appendix C.

10.2 Performance of Refined Option

This section, and the testing undertaken in the AIMSUN model was to test the effectiveness and impacts of the refined option. Note that the modelling results shown in this section are based on the average over five separate AIMSUN model runs to reduce risks of outliers affecting the results. The analysis in this section assumes the following:

- STAAI upgrades are complete and operational
- Transit lanes on Te Irirangi Drive cater for T2 and heavy commercial vehicles
- Based on AT's observation on other transit lane implementation projects, a 10% reduction in traffic was applied to the refined option model to account for mode shift, trip retiming, peak spreading. This reduction is consistent with AT's experience on other similar projects.

10.2.1 Bus Journeys

The AIMSUN model for the refined option indicates that bus journeys on the A2B corridor are faster and more reliable in comparison to the base (post-STAAI and existing 35 service) and service only (A2B service without bus priority between Manukau Station and Botany Station) options. Over time, the refined option supports moving to a fully separated RTN.

10.2.1.1 Travel Time Results

Travel time comparisons between the Airport and Botany are shown as graphs in figures below.

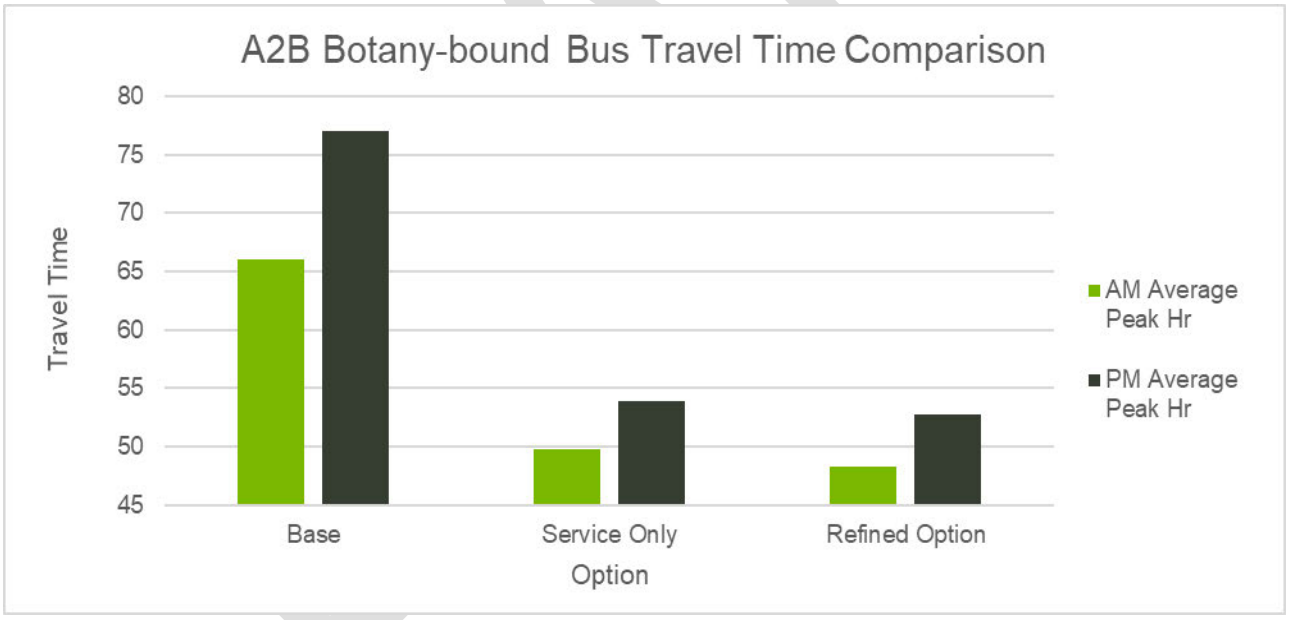


Figure 10-1: A2B Botany-bound bus travel time comparisons in AM and PM average peak hour

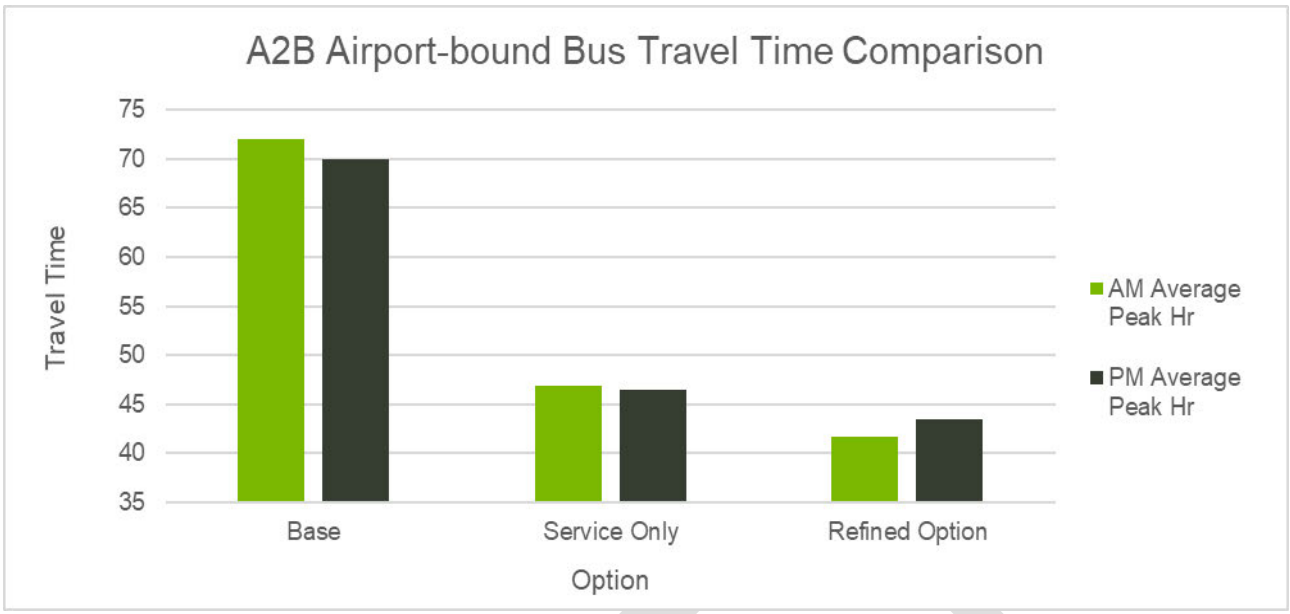


Figure 10-2: A2B Airport-bound bus travel time comparisons in AM and PM average peak hour

In addition to the travel time comparison graphs above, Table 10-1 below also summarises the travel time improvements as a percentage of the base. This highlights the effectiveness of the service only and refined option in various peaks and direction of travel.

Table 10-1: Option Travel Time Improvement on Base

Travel Time Improvement on Base (%)			
		Service Only	Refined Option
AM	Airport to Botany	25%	27%
	Botany to Airport	35%	42%
PM	Airport to Botany	30%	31%
	Botany to Airport	34%	38%

10.2.1.2 Reliability Results

The reliability of the A2B bus journey is measured based on the variability between the 85th percentile travel time and the average travel time. Note that due to the STAAI upgrades, majority of the variability observed in the base originates from the existing 35 service. Reliability comparisons between the Airport and Botany are shown as graphs in the figures below.

It should be noted that the variability for Botany-bound buses in the AM peak is already relatively low at 7 minutes and hence, the reliability improvement for service only and the refined option remains similar. Similar results are also observed for the Airport-bound services in PM peak.

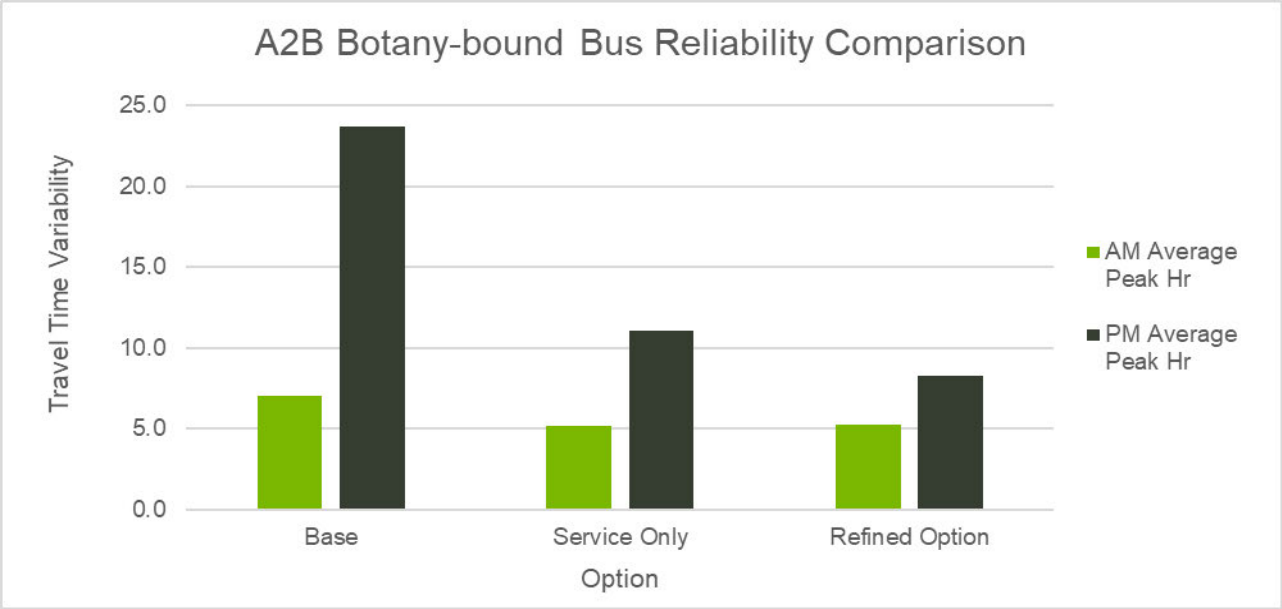


Figure 10-3: A2B Botany-bound bus reliability comparisons in AM and PM peak hour

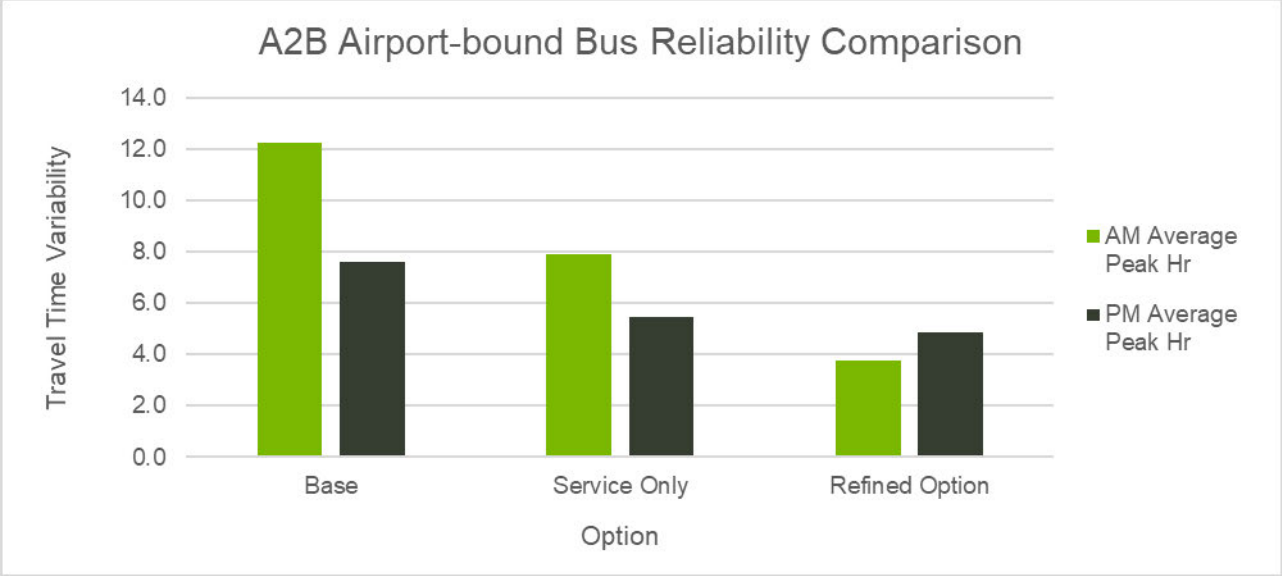


Figure 10-4: A2B Airport-bound bus reliability comparisons in AM and PM peak hour

In addition to the reliability comparison graphs above, Table 10-2 below also summarises the reliability improvements as a percentage of the base. This highlights the effectiveness of the service only and refined option in various peaks and direction of travel.

Table 10-2: Option Reliability Improvement on Base

Reliability Improvement on Base (%)			
		Service Only	Refined Option
AM	Airport to Botany	26%	26%
	Botany to Airport	36%	69%
PM	Airport to Botany	53%	65%
	Botany to Airport	28%	36%

10.2.1.3 Summary

Based on the bus travel time and reliability results, the following are particularly of note:

- The base travel time and reliability shown in the figures above do not account for a service transfer required at Manukau Station between the STAAI service and the 35 service. This means the travel time and reliability for passengers in the base will likely be worse than shown.
- It is evident that the AM peak direction is Airport-bound, and PM peak direction is Botany-bound.
- Travel time
    - As expected, the service only option provides significant travel time benefits in both peaks and directions compared to the base, with travel time improvements ranging from 25% to 35%.
    - The refined option provides further travel time benefits in both peaks and directions compared to the base, with travel time improvements ranging from 27% to 42%.
- Reliability
    - The service only option provides significant reliability benefits in both peaks and directions compared to the base, with reliability improvements ranging from 26% to 53%.
    - The refined option provides further reliability benefits in both peaks and directions compared to the base, with reliability improvements ranging from 26% to 69%.

10.2.2 Other Transit Lane Users

In addition to buses, other transit lane users include T2 and heavy commercial vehicles (HCVs). The AIMSUN model indicates that there are travel time benefits for T2 and HCVs on Te Irirangi Drive. T2 and HCV travel time comparisons between the existing and Medium-Term are shown as graphs in the following figures.

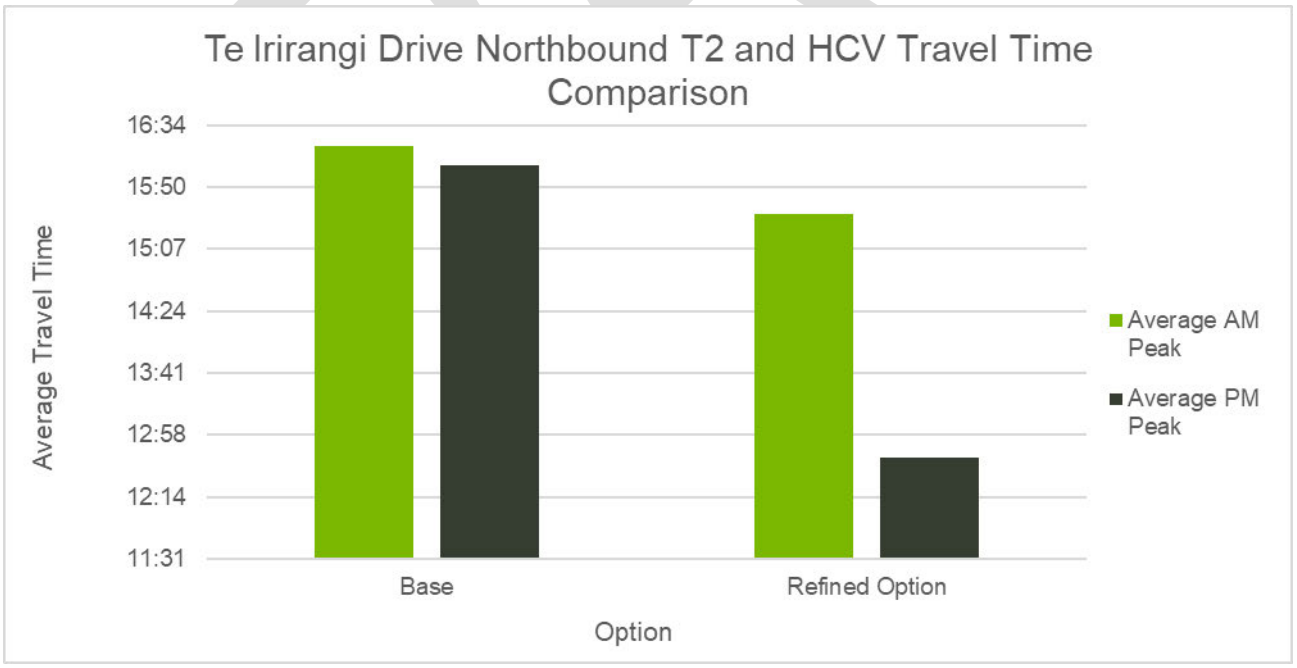


Figure 10-5: T2 and HCV travel time comparison on Te Irirangi Drive northbound

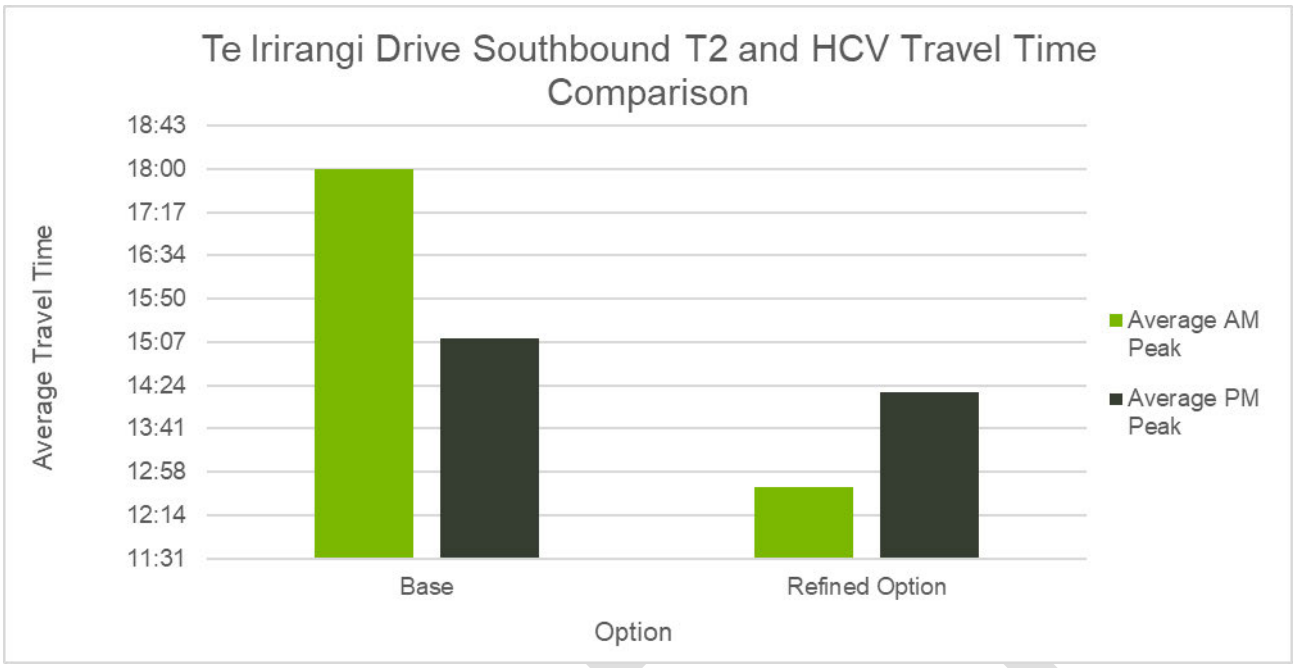


Figure 10-6: T2 and HCV travel time comparison on Te Irirangi Drive southbound

As shown above, there are significant travel time benefits for T2 and HCVs, particularly in the peak directions – northbound in PM and southbound in AM. Therefore, the proposed transit lanes on Te Irirangi Drive not only provides benefits for buses, but also provides benefits for other modes.

10.2.3 Single Occupant Vehicles

As expected, the introduction of transit lanes on Te Irirangi Drive has detrimental effects on single occupant vehicles (SOVs). However, through the option refinement process, the negative impacts were minimised by adjusting the extent of transit lanes to derive an optimal solution that balances public transport benefits and general traffic impacts. As a result, the refined option impact on SOVs is minimal, with similar travel times between base (existing) and the refined option. Travel time comparisons between the base and refined option are shown as graphs in the following figures.

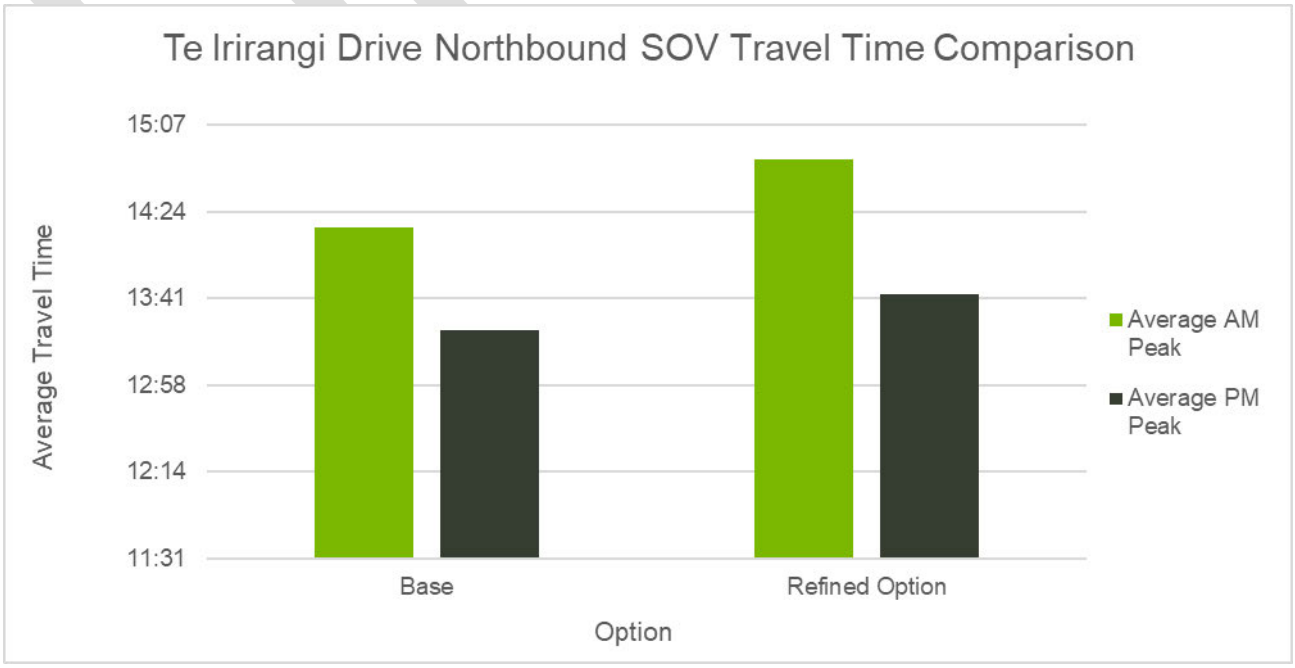


Figure 10-7: SOV travel time comparison on Te Irirangi Drive northbound

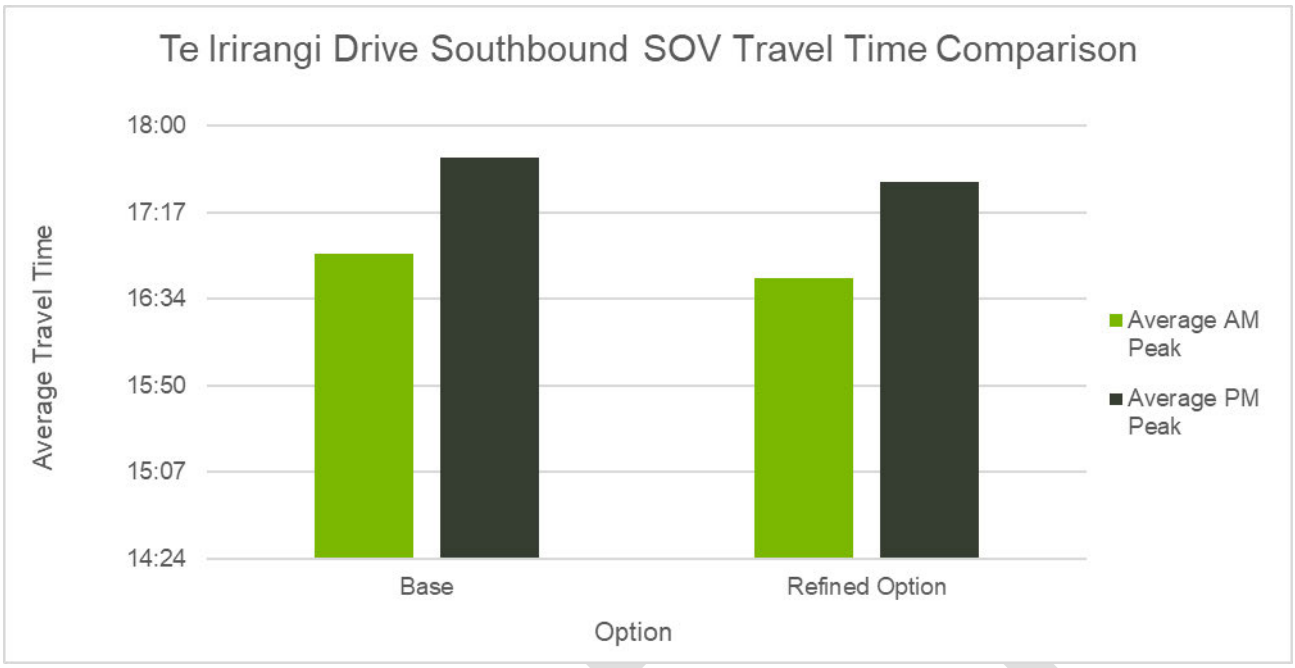


Figure 10-8: SOV travel time comparison on Te Irirangi Drive southbound

10.2.4 The Wider Network

For a general perspective on the wider traffic network impacts of the refined option, analysis on traffic delays was undertaken for several road corridors in the vicinity of Te Irirangi Drive. Note that traffic delay is defined as the difference between peak hour average travel time and free flow travel time. For a general overview, existing traffic delay and new traffic delay (as a result of the refined option) for all modes were extracted from the AIMSUN model. Comparisons were then made for AM and PM peak hour to determine the degree of impact to the wider network. Refer to Table 10-3 below. Note that increase in traffic delays are shown as positive values and decrease in traffic delays as negative values. The traffic delay impact is shown as increase or decrease in minutes and as a percentage change compared to existing delays.

Table 10-3: Refined Option Traffic Delay Impacts on Wider Network

		Traffic Delay Impacts as a Result of Refined Option			
		AM Increase / Decrease in Delays		PM Increase / Decrease in Delays	
		Travel Delay Impact (mins)	Traffic Delay Impact (%)	Traffic Delay Impact (mins)	Traffic Delay Impact (%)
Preston Rd/Springs Rd - Great South Rd to Allens Rd	Eastbound	02:16	39%	00:17	5%
	Westbound	00:49	10%	-01:19	-21%
Harris Rd - Allens Rd to Ti Rakau Dr	Eastbound	-00:23	-18%	00:01	2%
	Westbound	01:26	58%	00:41	51%
Great South Rd - Puhinui Rd to Manukau Stn Rd	Northbound	00:23	14%	00:07	4%
	Southbound	00:28	14%	00:06	3%
Chapel Rd - Ti Rakau Dr to Aspiring Ave	Northbound	03:17	41%	-00:15	-3%
	Southbound	-02:28	-13%	01:29	30%
Ti Rakau Dr - Harris Rd to Chapel Rd	Eastbound	01:01	54%	00:20	16%
	Westbound	-01:20	-29%	00:01	0%
Smales Rd - Harris Rd to Chapel Rd	Eastbound	00:54	47%	00:56	46%
	Westbound	-01:12	-27%	00:20	15%

		Traffic Delay Impacts as a Result of Refined Option			
		AM Increase / Decrease in Delays		PM Increase / Decrease in Delays	
		Travel Delay Impact (mins)	Traffic Delay Impact (%)	Traffic Delay Impact (mins)	Traffic Delay Impact (%)
Accent Dr - Harris Rd to Chapel Rd	Eastbound	00:31	15%	01:10	31%
	Westbound	00:18	10%	-00:23	-13%
Ormiston Rd - Harris Rd to Chapel Rd	Eastbound	00:22	8%	00:30	13%
	Westbound	-03:02	-51%	-00:14	-9%

The AIMSUN model results showed a mixture of increases and decreases in delays at varying magnitudes. Of particular note, Harris Road westbound, Chapel Road northbound, Ti Rakau Drive eastbound and Smales Road eastbound are expected to be impacted the most with impacts ranging from 41% to 58%. Overall, the traffic impacts of the refined option on the surrounding road corridors is considered acceptable.

10.2.5 Summary

As discussed in Section 5.3, the success of the recommended single service pattern relies heavily on appropriate bus priority infrastructure that enables a fast and reliable service. The AIMSUN modelling has shown that the refined option is able to support a fast and reliable single service in the Medium-Term. Concurrently, the refined option also provides a solution that avoids severe traffic impacts in the A2B corridor and the wider network. In addition, travel time savings are also observed in the model for other transit lane users which is an added benefit for T2 and HCVs. This is particularly effective given Te Irirangi Drive is a main freight route and provides access to many commercial and industrial areas. It also encourages carpooling and mode shift, which aligns with the project objectives.

11 Cycle Infrastructure

11.1 Existing cycle facilities on the corridor

As per the Medium-Term Strategy Project scope, existing cycle facilities were identified along the medium-term route.

Within the medium-term route, there are no existing off-road or separated cycle facilities. However, on-road cycle facilities exist in various sections along the route as shown in Figure 11-1. These are located as follows:

- Te Irirangi Drive, between Great South Road and Dawson Road
- Great South Road, between Te Irirangi Drive and Ronwood Avenue
- Lambie Drive, between Ronwood Avenue and Cavendish Drive

On-road cycle facilities cross the corridor at:

- Smales Road
- Ormiston Road
- Cavendish Drive (across Great South Road)
- Cavendish Drive (across Lambie Drive)

There is no impact on the existing on-road cycle lanes as a result of the recommended option. The existing on-road cycle lanes on Te Irirangi Drive and Lambie Drive are unaffected and will remain unchanged. The on-road cycle lanes that cross the medium-term corridor at Smales, Road, Ormiston Road and Cavendish Drive are also unaffected and will remain unchanged.

Due to the timeline and nature of the improvements planned by the Connected Communities Programme (as outlined in Section 9.7.1), no improvements along Great South Road are recommended for the medium-term strategy. As such, there are no improvements proposed or impacts on the existing cycle lanes on Great South Road as part of this medium-term strategy.

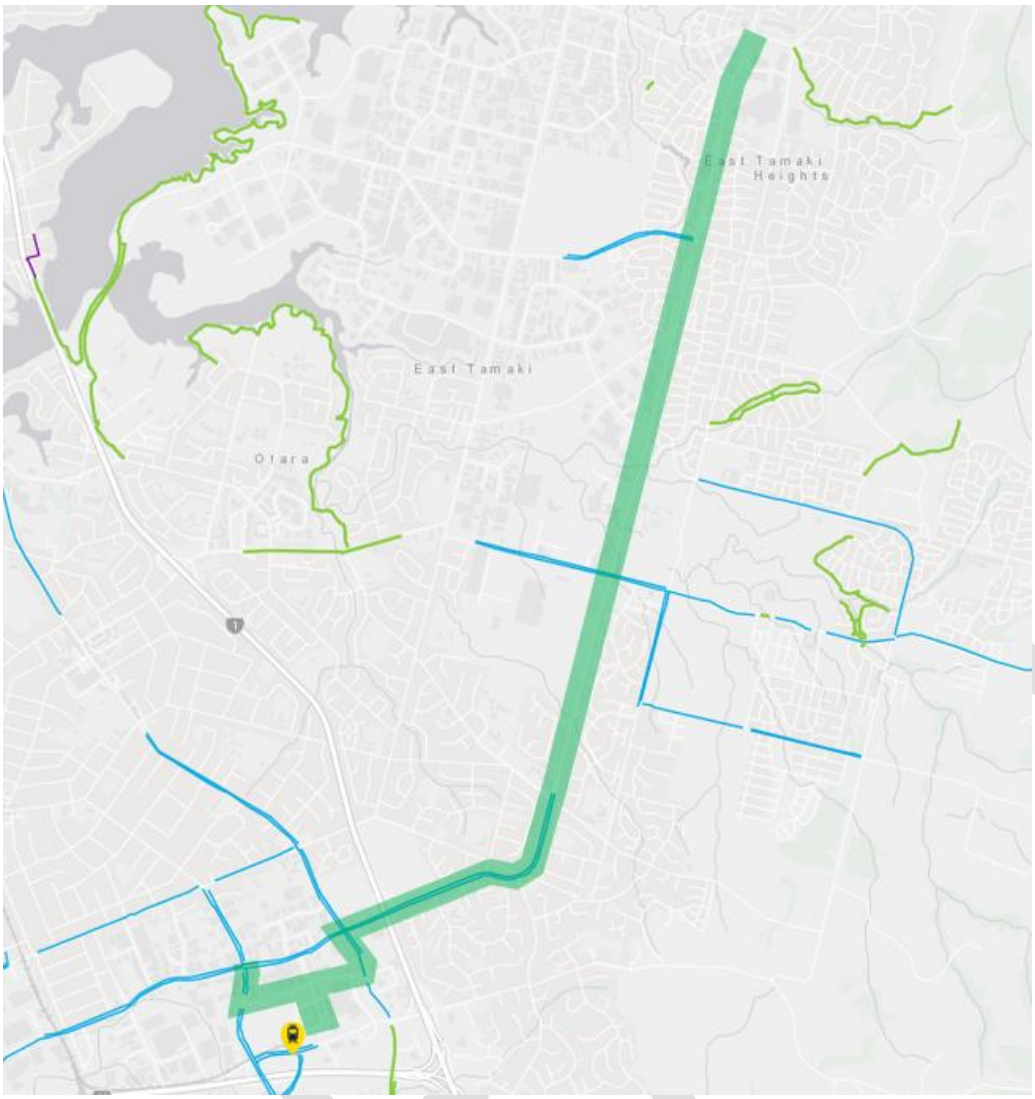


Figure 11-1: Existing cycle facilities in blue with A2B Medium Term route shown in green (Source at.govt.nz)

11.2 Effects of recommended option on cycling

The recommended option does not impact or change the existing cycle lanes on the medium-term route or those crossing the route. The route retains the existing level of cycling on the corridor ensuring that cycle provision is not adversely affected. The recommended option does however improve network integration between different modes such as cycling by providing cycle storage facilities at the A2B bus stops. Accessibility to buses are improved this way as it provides opportunities to cycle as an arrival mode to the bus stations.

12 A2B Medium Term Recommended Option

12.1 Description summary

12.1.1 Service design

The recommended option adopts the long-term A2B service design with a single service pattern operating at high frequencies between Botany and the Airport. Establishing this service in the medium term would set precedence for the A2B corridor as a rapid transit service and could begin to generate demand for the future service improvements. The recommended option also has a more direct connection between Manukau and Botany with fewer stops compared to the current 35 bus service improving journey time and reliability.

12.1.2 Vehicles and fleet

The recommended vehicle type is a single deck, articulated BRT bus of approximately 18m in length, with capacity for 100 passengers (seated and standing). The vehicle should have a distinctive exterior with opportunities for level boarding and multiple doors and also configured to optimise high passenger turnover and users with luggage. All buses procured for the medium-term service must be zero emission vehicles to comply with Auckland Transport policy.

Figure 12-1: Example of single deck articulated bus

It is noted that there are some potential issues with implementing articulated vehicles in respect of existing or committed infrastructure. Further assessment by AT Metro bus services team is required prior to confirming the vehicle type.

12.1.3 Local bus network

Changes to local bus routes and service levels are recommended to support enhancing opportunities for people to gain access to service from wider catchments. These changes are consistent with the recommended local bus pattern adopted for the Long-Term programme. Improvements are proposed to route and service levels for local bus services 31 and 314 onto Ormiston Road to offer frequent connections to the medium-term service from Ormiston and Flatbush. Other changes to local bus routes and service levels operating via Botany Station are proposed to support the proposed interchange station, improving connections for local buses to

the medium-term service (and subsequent long-term A2B service) and the Eastern Busway. All current PTOM service-delivery contracts for all affected routes are up for retendering/renewal in 2025/2026 presenting an ideal time to implement local bus route and service changes, around the time the medium-term service is implemented.

12.1.4 Stations

The medium-term station locations for the section between Manukau and Botany are the same as the long-term locations. This is to deliver as far as practical, the same long-term stations in the same key locations for an RTN-like service plan and RTN stopping pattern. It is proposed that the stations will be constructed to an interim level to provide essential station facilities in the medium term and will be later upgraded to provide long term station and interchange facilities. This does not apply to the three major station (Botany, Manukau and Puhinui) which are either already in existence, committed with no modifications, or assumed to be delivered by another project. Two bus station are assumed in the airport precinct for the medium-term service that are the same as those proposed in the long-term.

For the section between the airport and Manukau, the Medium Term A2B service will be a replacement for (or extension of) the Short-Term airport-Puhinui-Manukau bus service. The Short-Term service plan retains six sets of bus stops between the airport and Manukau: Milan Road, Puhinui Station, Plunket Avenue, Norman Spencer Drive, Lambie Drive at Puhinui Road, and Lambie Drive at Cavendish Road. The Long-Term plan includes stations at the Puhinui interchange and a second station near the intersection of Puhinui Road and Lambie Drive as well as two stations in the airport precinct. The proposed strategy for the Medium Term is to assume that all the Short-Term bus stop locations along Puhinui Road and Lambie Drive are retained in the Medium Term, with no additional or replacement stops implemented. This should be subject to monitoring the actual performance of these stops once the Short-Term service is operational.

Table 12-1: A2B Stations

Corridor section	Station location	Timing	Role
Te Irirangi	Botany Town Centre	Long term station	Demand centre, interchange, local coverage
	Smales Road	Long term station	Interchange, local coverage
	Accent Drive	Long term station	Interchange, local coverage
	Ormiston Road	Long term station	Interchange, local coverage
	Dawson Road	Long term station	Interchange, local coverage
	Diorella Drive	Long term station	Interchange, local coverage
Manukau	Ronwood Avenue	Long term station	Demand centre, local coverage
	Manukau Station	Long term station	Demand centre, interchange, local coverage
	Lambie Drive (at Cavendish Drive)	*Short term bus stop*	*local coverage*
Puhinui Road	Lambie Drive (at Puhinui Road)	Long term station	Interchange, local coverage
	Norman Spencer Drive	*Short term bus stop*	*local coverage*
	Plunket Avenue	*Short term bus stop*	*local coverage*
	Puhinui Station	Long term station	Interchange, local coverage
	Milan Road	*Short term bus stop*	*local coverage*

Corridor section	Station location	Timing	Role
Airport – SH20B	The Quad (airport business park	Long term station (TBC)	Demand centre, interchange
	Airport terminal)	Long term station (TBC)	Demand centre

The interim stations will be similar to neighbourhood interchanges where there is a clear, consistent treatment of an area extending from the mainline stop as far as local stops. The stations will be delivered to high quality with attention given shelters, safety, branding, accessibility, legibility and to the customer experience including arrival, waiting, boarding and a quality on-vehicle experience. Figure 12-2 is a graphic showing the station elements proposed at a typical station.

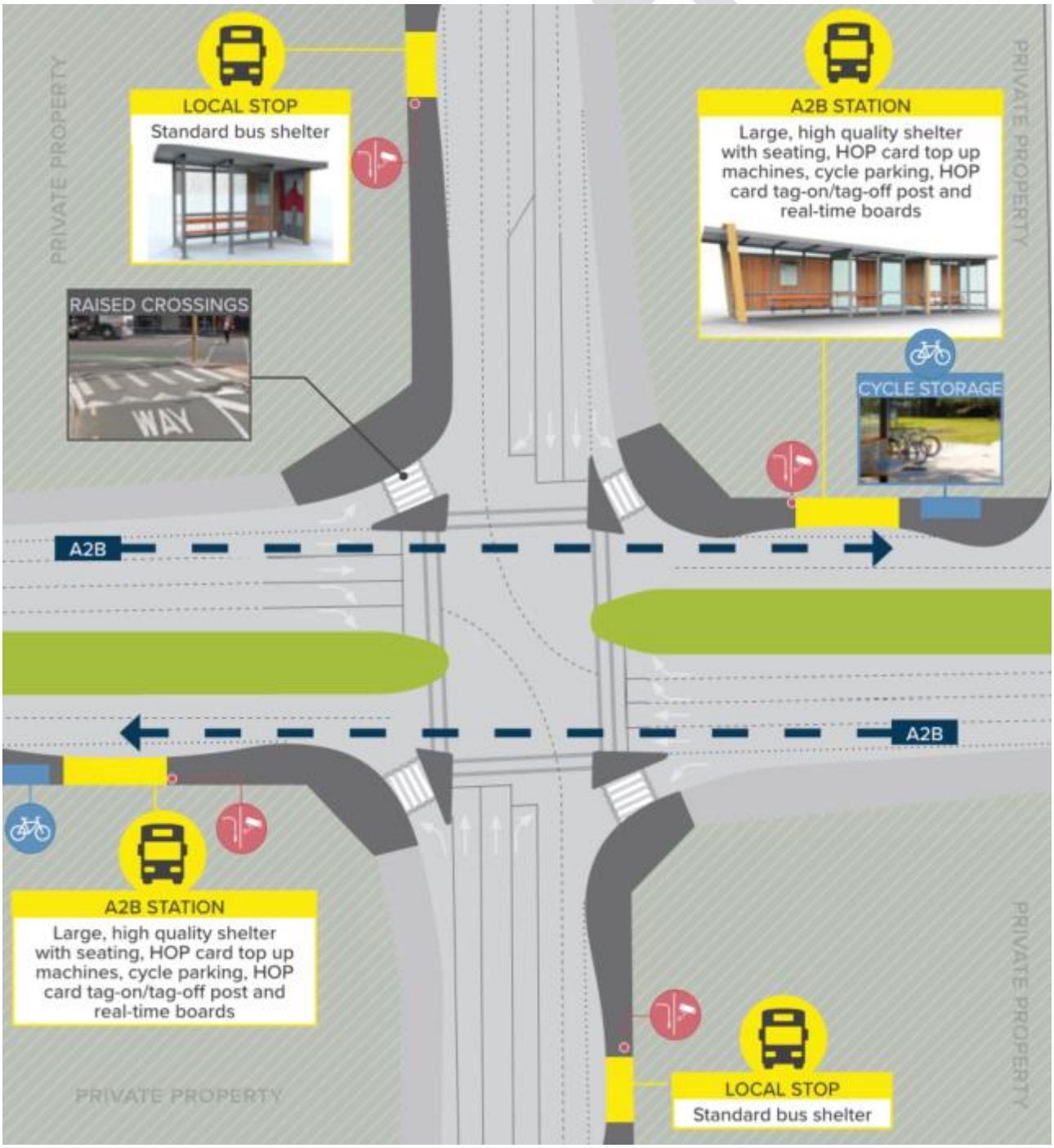


Figure 12-2: Proposed station zone

12.1.5 Station access improvements

Measures have been proposed to ensure that users from all modes can safely and comfortably access stations from a wide catchment. These measures have been identified at three levels:

- Core
- Enhanced
- Desirable

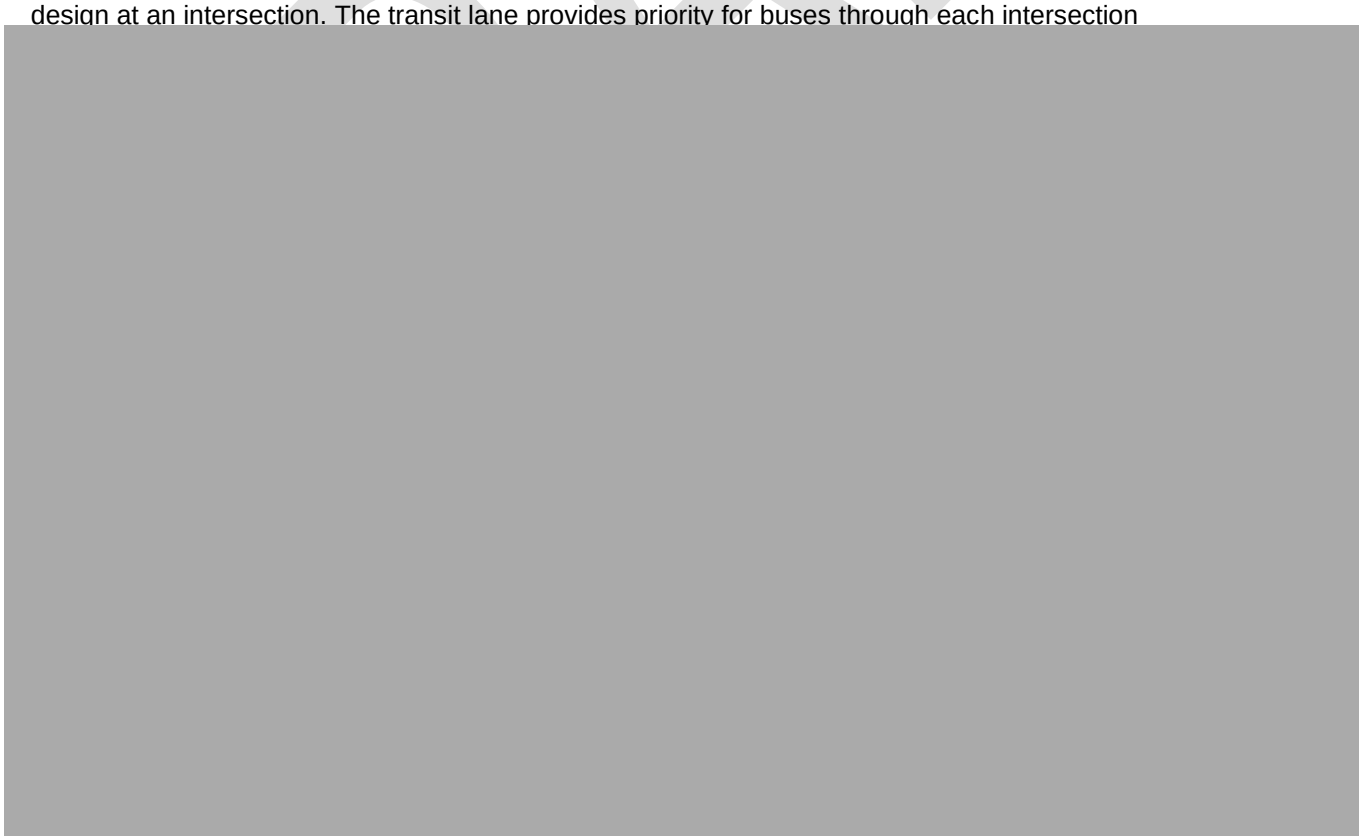
Core station access interventions in the medium-term are those indicated in Figure 12-2 and Figure 12-3 and include:

- Treatment of slips lanes at all intersections where stations are located through the installation of raised zebra crossings to provide priority to crossing pedestrians/cyclists and to slow approaching vehicle speeds.
- Cycle access and storage
- Local bus stops connected with consistent paving, landscaping and wayfinding
- Generous paving to access and waiting areas within the station zone

Enhanced and Desirable interventions include barriers to comfortable and safe access extending further from the stations themselves and are detailed in Appendix A which provides a detailed breakdown of the elements included in the Enhanced and Desirable station access programmes.

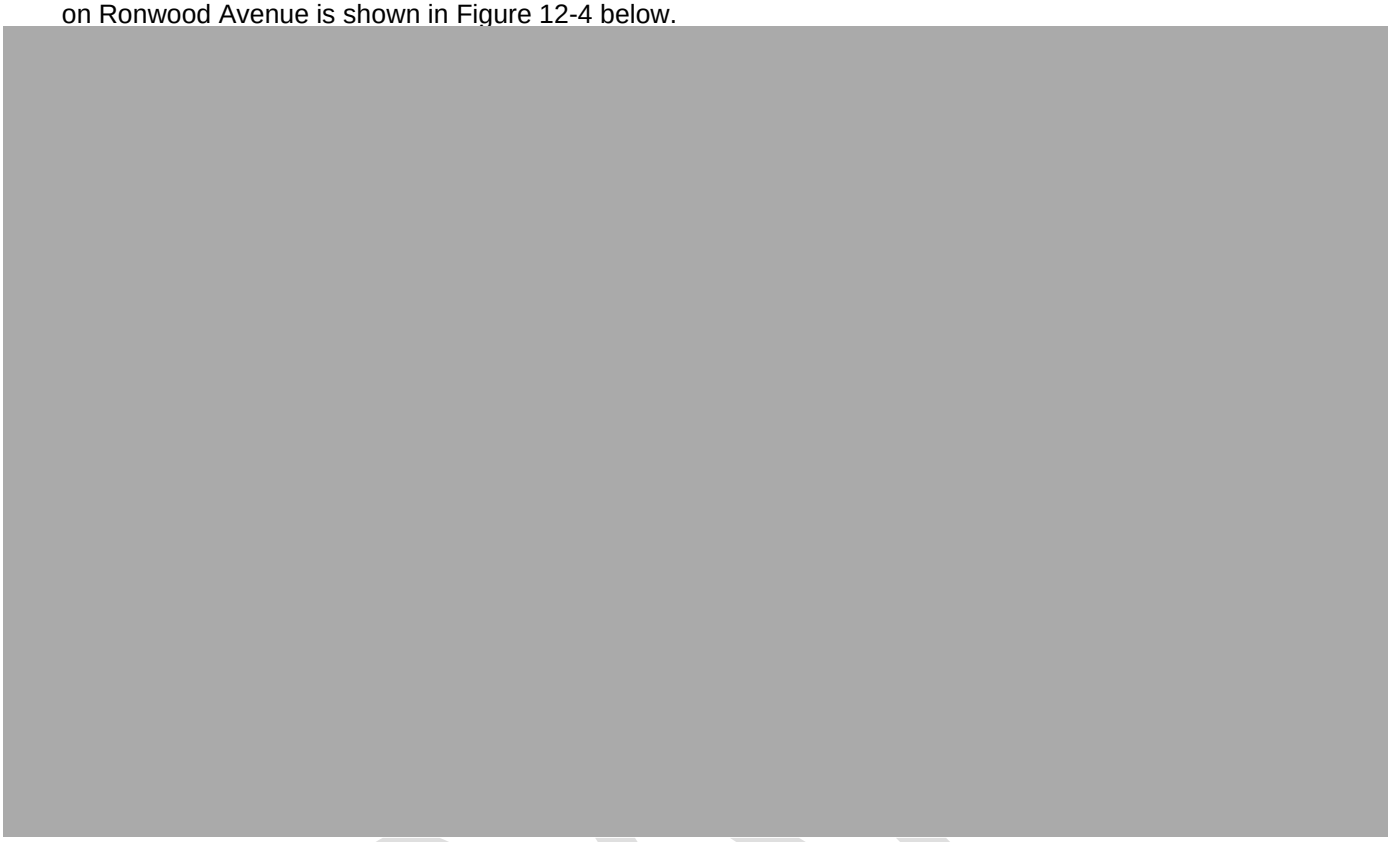
12.1.6 Bus priority

Transit lanes allowing for T2 and heavy vehicles on Te Irirangi Drive between Botany Station and Great South Road is the recommended bus priority measure as it most aligns with the project KPIs. This involves converting an existing general traffic lane to a transit lane. Refer to Figure 12-3 for a typical example of the transit lane design at an intersection. The transit lane provides priority for buses through each intersection



Bus priority lanes are proposed on Great South Road, Ronwood Avenue (east of Davies Avenue), and Davies Avenue. These are included indicatively in the Medium-Term proposal and the Connected Communities programme is concurrently proposing bus lanes in these sections.

For the remaining medium-term route, a westbound bus lane is proposed on Ronwood Avenue (west of Davies Avenue) providing additional bus priority leading up to the STAAI bus priority upgrades. The bus lane design on Ronwood Avenue is shown in Figure 12-4 below.



12.2 Performance of Recommended Option

12.2.1 Patronage

Demand modelling indicates a peak demand of 1,000 passengers per hour in the peak direction for the medium-term horizon (circa 2028) with counter-peak loadings of approximately 700 people per hour at the same time. A 5-minute headway is proposed at peak times for service quality reason, which results in a minimum of 12 buses per hour per direction at peak. However, given patronage demand is grown over time, a 10-minute headway can be considered initially to reduce OPEX. For five-minute peak headways, a 18m single-deck articulated bus with a rated capacity for 100 passengers (seated and standing without overcrowding) is sufficient to cater for the medium-term patronage demand. Higher patronage growth or events resulting in strong peak demands can be managed by increased headway over time.

In forecasting to date, the Medium-Term scheme has not been modelled specifically, however schemes have been modelled that provide a reasonable understanding of the likely outcomes.

Forecast demands in the AM peak in 2028 are shown in Figure 12-5. This shows the forecast demands with a full BRT (Long Term A2B solution) in 2028 in red and a “service only” but direct Airport to Botany bus service with no priority or infrastructure east of Manukau but including the STAAI outcomes west of Manukau in blue. This provides a low-end patronage range in the am peak of around 700/hour and a high end of around 1,000/hour in 2028.

It is likely the Medium Term patronage would be between these two figures as the additional priority and new stations provided east of Manukau would add to the “Service Only” forecast, but would be unlikely to generate the demands that the full Long Term A2B operation would.

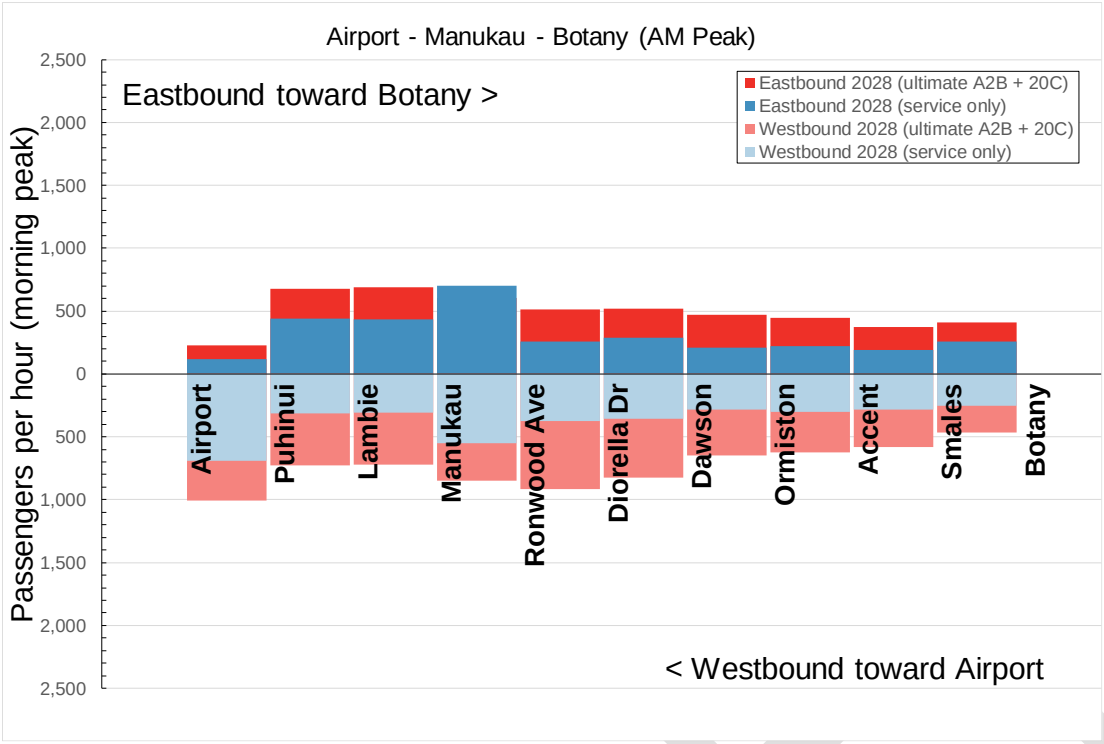


Figure 12-5: Forecast demands (MSM 2028 AM peak)

Compared with the do-minimum, the comparison of potential patronage outcomes is shown in Table 12-2. This tables illustrate that the Medium Term can be expected to generate a significant increase in public transport ridership.

While east of Manukau the Route 35 is expected to see a small reduction in patronage, this is outweighed significantly by the increase in ridership generated by the A2B service resulting is a significant overall increase in ridership in the corridor.

At the western end of the route near the airport, patronage can be expected to increase significantly above the do-minimum.

Table 12-2 Medium Term patronage forecast (MSM 2028 AM Peak)

Section	Do Min Patronage 2028	Medium Term 2028
Botany - Manukau	**0 –** A2B route **540** (Route 35)	**500 - 900/hr –** A2B route (Service Only – Full A2B) + **420** (Route 35)
Manukau - Airport	**520** (AirportLink service)	**700 - 1,000/hr** (Service Only – Full A2B)

12.2.2 Travel Time and Reliability

Improvements to the travel time and reliability of journeys between the do-minimum (Figure 12-6) and the recommended Medium Term option (Figure 12-7) are achieved in the following ways:

- A shorter, more direct route
- Less stops
- Prioritising buses
- Eliminating transfers

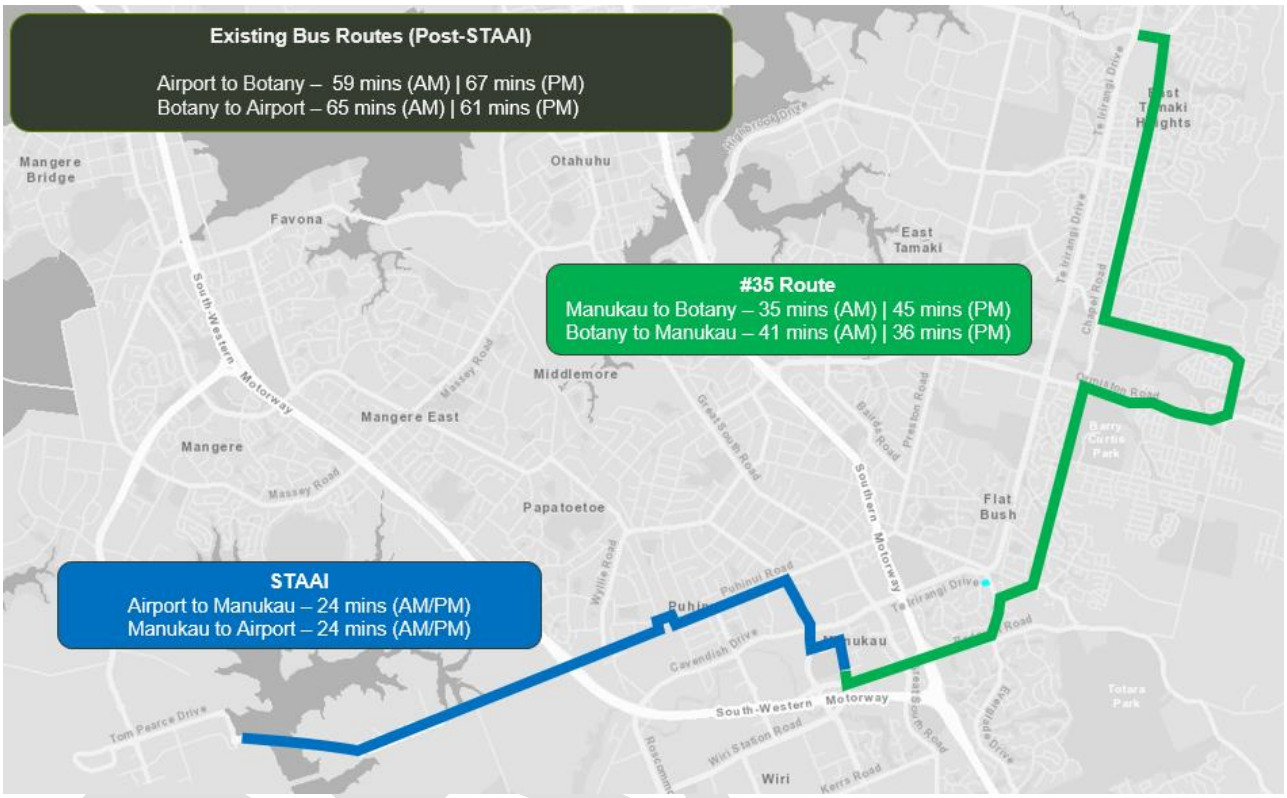


Figure 12-6: Do minimum routes and journey times

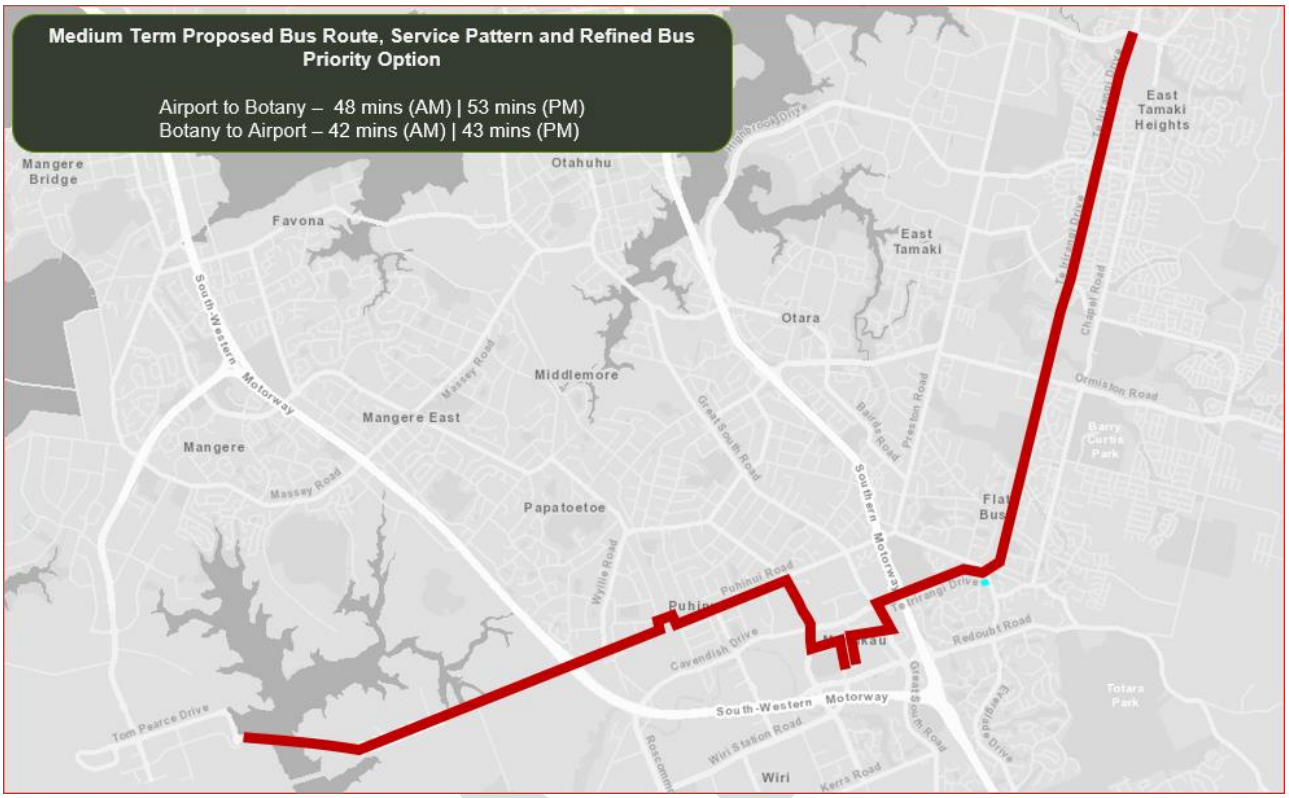


Figure 12-7: Recommended option route and journey times

Table 12-3 outlines the base (post STAAI and 35 service), A2B service only and recommended option (A2B service with refined bus priority option) journey times and variability as assessed in the model. The data shown in the table is for Botany-bound A2B service in both peaks (the Botany-bound service is found to be the critical direction in both peaks). The reliability of the proposed service is expected to be significantly better than the do-minimum. This is because of two key factors:

- Less stops are included – stops are a key source of travel time variation due to boarding, alighting and re-entering traffic streams.
- In all cases, the proposed bus priority interventions are expected to reduce bus exposure to congestion and enable buses to pass though signalised junctions on the first available green phase. Incurring multiple signal cycles at intersections are a key source of travel time variation.

The base has a variability of some 24 minutes between the Airport and Botany in the PM peak. The Medium-Term project reduces this to 8 minutes.

Table 12-3: Estimated travel time between Airport and Botany in both peaks (source: AT real time data for 35, STAAI SSBC and AIMSUN Model)

Peak	Travel time	Base (Post STAAI and 35 service)	A2B Service Only	Recommended Option (A2B service with refined option)
AM	Average travel time (minutes)	66	50	48
	Upper travel time (minutes, 85th percentile)	73	55	53
	Variability (minutes)	7	5	5
PM	Average travel time (minutes)	77	54	53
	Upper travel time (minutes, 85th percentile)	101	65	61
	Variability (minutes)	24	11	8

Figure 12-8 and Figure 12-9 below are graphs displaying the comparison made between the base, A2B service only and the recommended option. These graphs emphasize the magnitude of the journey time and reliability benefits provided by the recommended Medium-Term Strategy.

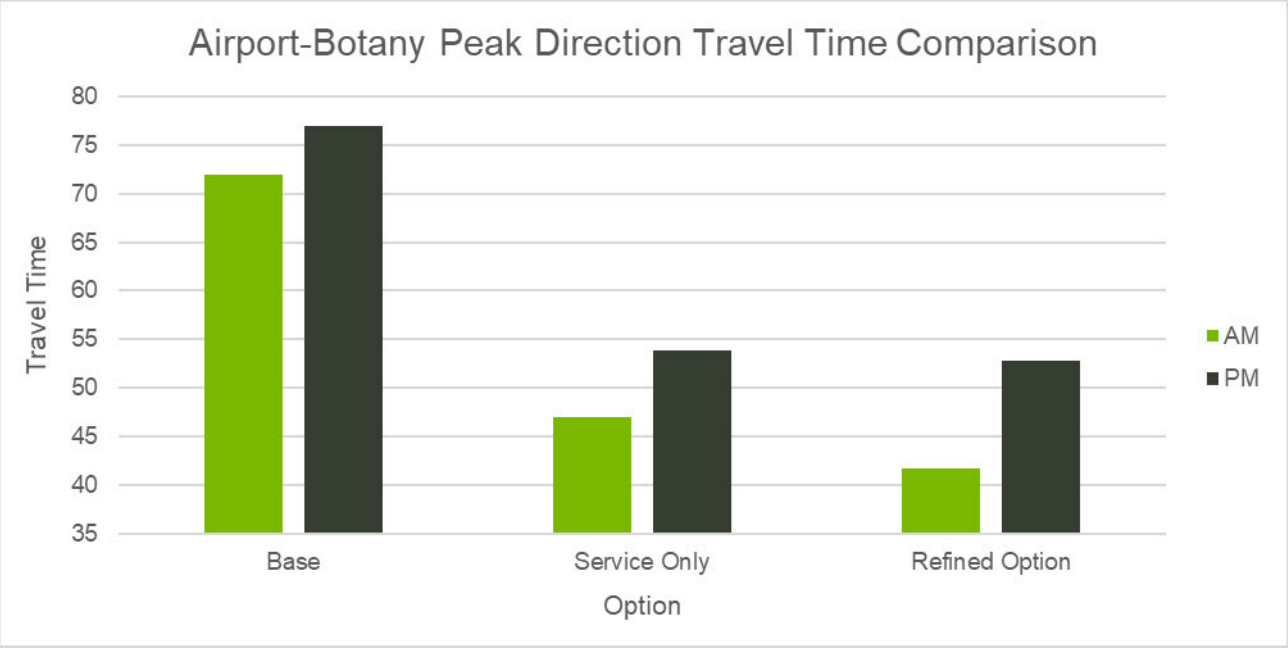


Figure 12-8: Option travel time (speed) comparison (Manukau-Botany)

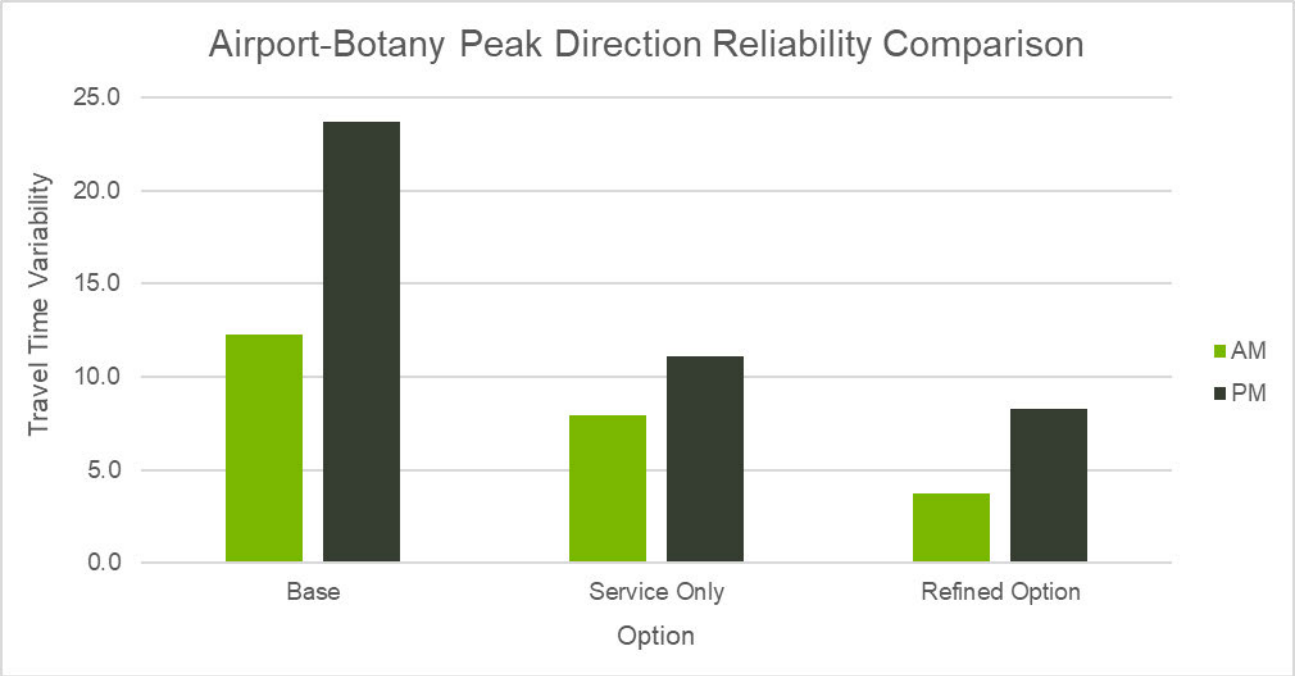


Figure 12-9: Option travel time variability (reliability) comparison (Maukau-Botany)

12.2.3 Customer experience

The customer experience in the recommended option for the Medium Term provides significant improvement over the public transport services currently provided as well as in the Do-Minimum scenario. The high-quality station environments and facilities, improved pedestrian access, unique BRT buses and premium service branding all contribute to a premium customer experience. In addition, the improved public transport journey times and reliability creates a foundation where public transport demand can be grown to support the long term plans of a premium RTN service between Airport, Manukau and Botany.

The high-quality station environments and features proposed are as per below:

- Real time information
- Network maps
- Wayfinding tactiles and signage
- Step-free access to stations, platforms and stops
- Cycle parking
- Integrated service branding
- Distinctive white lighting
- Standard shelters with seating
- CCTV coverage

Particularly from customer's journey perspective, the customer able to identify the A2B service easily via the unique and integrated branding. The wayfinding, network maps and real time board facilities allow the customer to know exactly where they are, where they are going and how to get there. The local service stops are located in close proximity to the A2B service stops which allows quick and painless transfers for customer access from the wider network. The cycle parking proposed also provides an additional access mode for customers. The lighting and CCTV proposed provides customers with a sense of security when using the services. All these station features contribute to high-quality customer experience.

12.2.4 Summary Against Desirable Outcomes

The effectiveness of the recommended option and its expected outcomes against the medium-term objectives is below in Table 12-5. A five-point scoring scale was used as follows.

Table 12-4: Scoring Scale for Assessment

Description	Grade
Significant improvement on do-min	2
Improvement on do-min	1
No change from Do-min	0
Worse than do-min	-1
Significantly worse than do-min	-2

Table 12-5: Summary Assessment Against Objectives

Long Term Objective	Medium Term Objective	Provision	Rating
More equitable access and travel choices to jobs, learning, cultural and social activities in the south and east of Auckland	Providing for a range of access modes.	Pedestrian improvements – raised tables and wide footpaths Local bus stops and access to mainline stops Cycle storage and access Provision is basic in design standards and retains slip lanes for traffic	**1**
	Improving equity of access for people.	Low floor vehicles and kassel kerbs Generous waiting spaces CCTV and good sight lines Legible, forgiving service design Tactiles and edge marking Audible and visual information in vehicles and at stops	**2**
	Providing a level of speed and reliability that delivers a significant improvement on the current situation.	Airport to Botany PM Peak of 24 minutes down from 50 minutes. Significant improvement on do-min but not as effective as major RTN-type interventions.	**1**

Reliable and resilient transport system in south and east Auckland that is easy to use.	Introducing new vehicles.	Proposes new, low floor, electric fleet, branded for the service.	**2**
	Providing information and reassurance for customers.	Audible and visual information in vehicles and at stops Simple, legible service design Co-branded stations, vehicles and information.	**2**
	Implementing a RTN-like service	Limited stops and direct route Quality stations Not full RTN-standard levels of infrastructure facilities	**1**
Urban regeneration and improved built environment	Implementing the RTN stopping pattern and new stations.	Adopts the final A2B stopping pattern east of Manukau. New stations are proposed, not to full RTN standard.	**1**
Transport network that enables the efficient movement of goods and people	Managing the effects on traffic to acceptable levels.	Some additional congestion for general traffic. Offset by better journey for HOVs, HCVs.	**-1**
	Retaining the existing level of service for cycling on the corridor.	Retains all current cycle facilities to the same standard.	**2**
Safe and secure transport facilities in south and east Auckland	Providing information and reassurance for customers.	Audible and visual information in vehicles and at stops Simple, legible service design Help points Co-branded stations, vehicles and information. Stations not designed for full RTN standards	**1**
Minimal impact of the transport system on the environment and Taonga	Minimal impact of the transport system on the environment and Taonga.	Minimal additional paved area with some wider footpaths. No other impacts	**2**

13 Costs

13.1 Capital Costs

Based on the design developed for the recommended option, cost estimates were undertaken to determine the capital expenditure (CAPEX) required for the Medium Term. The estimate is included as Appendix E and summarised below in Table 13-1.

13.2 Service Operating Cost

13.3 Maintenance Cost

The recommended Medium-Term Strategy involves minimal additional infrastructure on top of the existing. Majority of the physical works involved is pavement markings. However, given the proposed Medium-Term introduces a new frequent bus route on Te Irirangi Drive, which may have implications to the pavement life cycle.

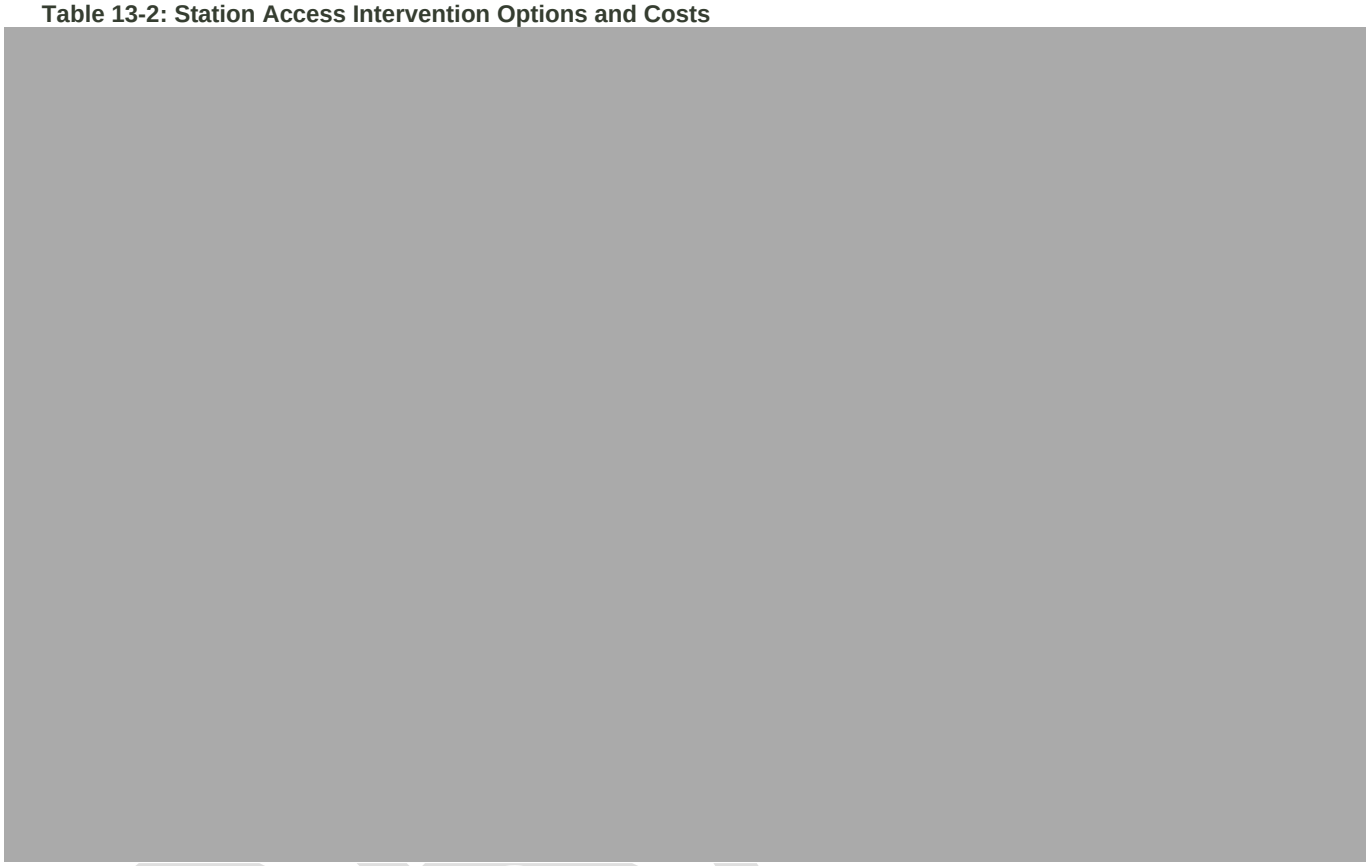
Assuming the new A2B service pattern is a 5-minute headway in the peak periods and 10-minute headway at other times, bus volumes are roughly 168 buses per direction per weekday on Te Irirangi Drive. In comparison to existing HCV volumes, the new A2B service introduces approximately an additional 11% of HCVs. However, given Te Irirangi Drive is a regional route with heavy traffic volumes, it is unlikely the additional bus volumes will have a significant impact to the pavement life cycle. Further pavement investigation can be undertaken to confirm the strength and durability of existing pavement.

The remainder of the A2B route (Great South Road, Ronwood Avenue and Davies Avenue) currently has a high volume of buses operating on it already and the pavement is likely to be affected by the new A2B bus volumes. Further pavement investigation can be undertaken to confirm the strength and durability of existing pavement.

13.4 Station Access

As per the station access study in Section 8.4.3, two possible access intervention options were developed, and their associated costs are shown in Table 13-2 below. Details of both station access options can be found in Appendix A. It should be noted that the costs shown below are not part of the Medium-Term Project, however, they are potential options that could be implemented to compliment the Medium Term interventions and provide greater benefits to the wider community.

Table 13-2: Station Access Intervention Options and Costs



14 Planning and Consenting

A planning and consenting assessment based on the recommended medium-term option has been undertaken. A full report including analysis is attached as Appendix F and summarised in this section.

Given that the recommended option is confined to the road corridor, the resource consent requirements are likely to be restricted to stormwater (quality and management) only.

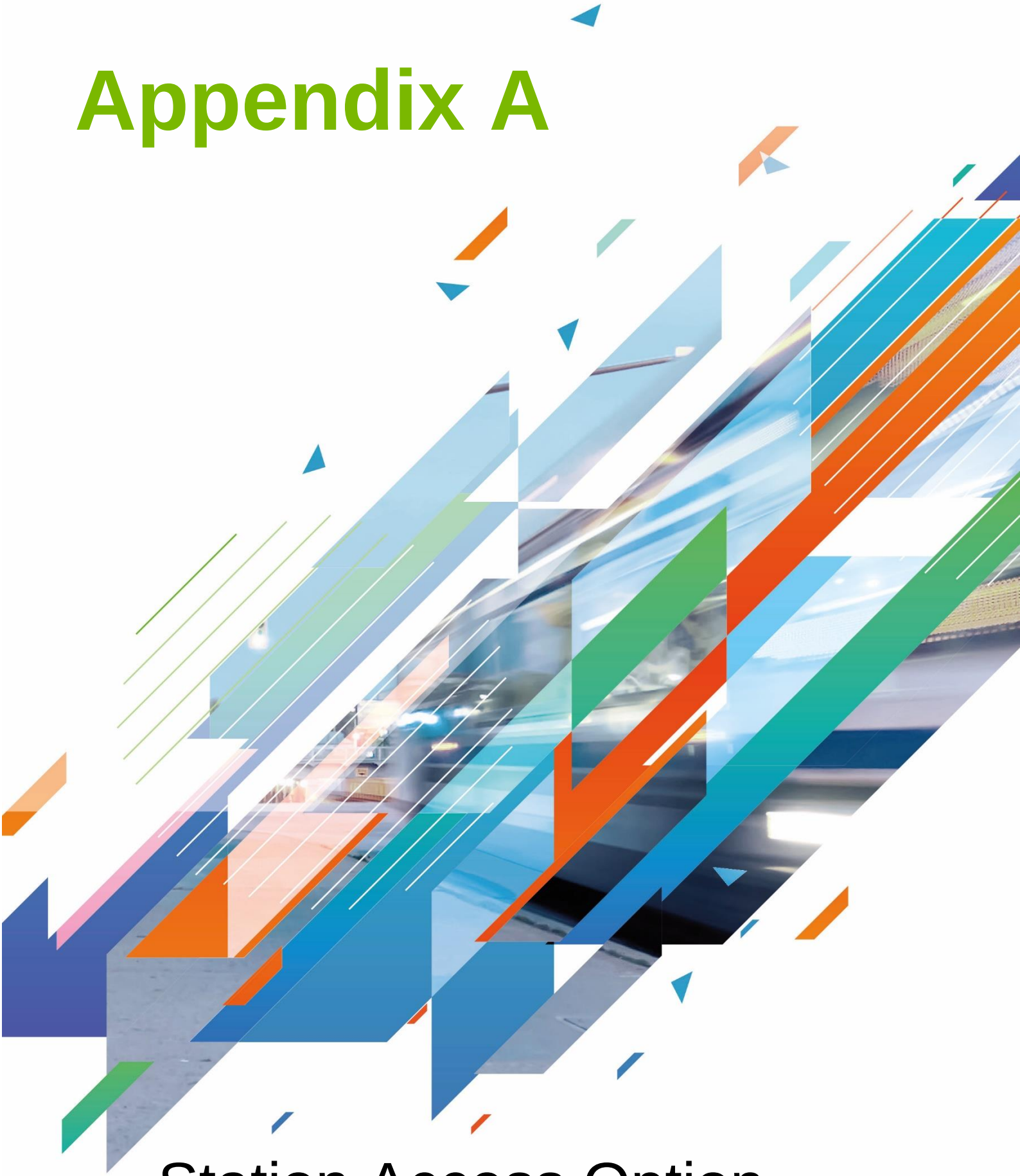
An archaeological authority may be required for the project given known archaeological sites are within the project area. This will need to be confirmed during the pre-implementation phase.

It is unlikely a National Environmental Standard (NES) soil consent would be required for the works as it is confined to within the road corridor, however this should also be reviewed along with the need to complete further investigations during the pre-implementation phase. Impacts on street trees as the design advances may result in additional triggers for resource consent.

It is unlikely the works would hinder or prevent other over-lapping designations within the road corridor, however consultation with the applicable requiring authorities is recommended to confirm this.

Subject to these effects being appropriately managed and mitigated, the resource consent application (based on the limited information at this stage and on prior experience) would likely be determined by the Consent Authority (Auckland Council) on a non-notified basis.

Appendix A



Station Access Option Identification Detail

Station access for different modes

The modal hierarchy for station access is shown in Figure 14-1 below. Most of the recommended interventions are focused on providing for and improving access for walking, cycling and other active modes. More details of these interventions are included throughout the rest of this section.

Access by feeder buses is incorporated in the medium-term strategy for A2B by locating the local bus stops immediately adjacent to the intersections with A2B stations (as per the ultimate designs) and upgrading those intersections. This will minimise transfer distances between services and ensure safe and comfortable crossing facilities at intersections. Demand responsive transit options are not considered here.[18]

Potential locations for private drop-off and pick-up were identified in the High Level Station Access Assessment (502334-7000-REP-KK-0028). These potential locations are shown on the following schematics, but further assessment of suitability and potential impacts on station access for higher priority modes must also be considered before these locations are formalised as pick-up/drop-off locations for A2B stations.

Park and ride is not appropriate for the A2B Medium-Term as park and ride has been addressed in the High Level Station Access Assessment (502334-7000-REP-KK-0028). Therefore, it is recommended that no park and ride facilities are provided for A2B in the medium-term.

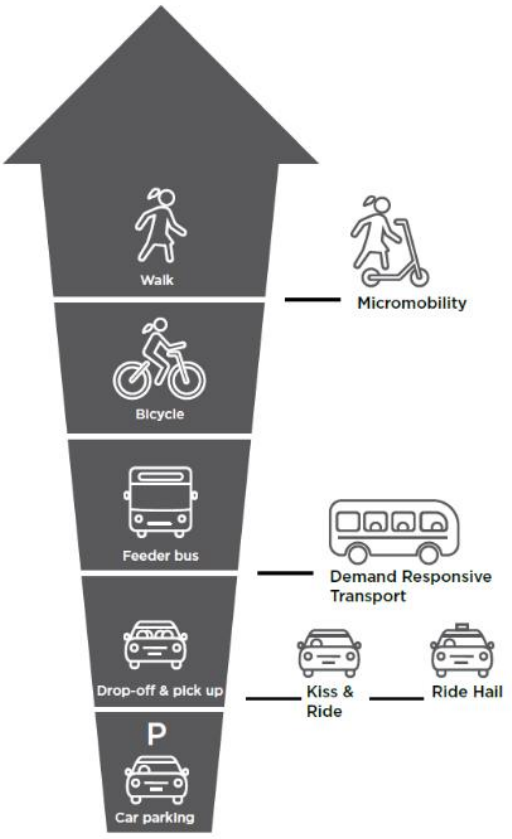


Figure 14-1: Modal hierarchy for station access

Methodology for station access recommendations

The methodology for recommending station access interventions in the medium-term is described below. The first two steps involve identifying generic interventions that can be applied to all relevant areas identified, whilst the third step relates to identifying which specific interventions are most appropriate to include in the medium-term timeframes.

The following subsections describe how different types of intervention locations were identified as appropriate for the medium-term station access/timeframe. These interventions drew on knowledge from the full set of

interventions considered in the previous station access assessments (502334-7000-REP-KK-0028). The intervention locations are shown as schematics on maps in the following pages.

A comprehensive map of the areas forming the basis for the station catchment options evaluation is shown in the figure below.

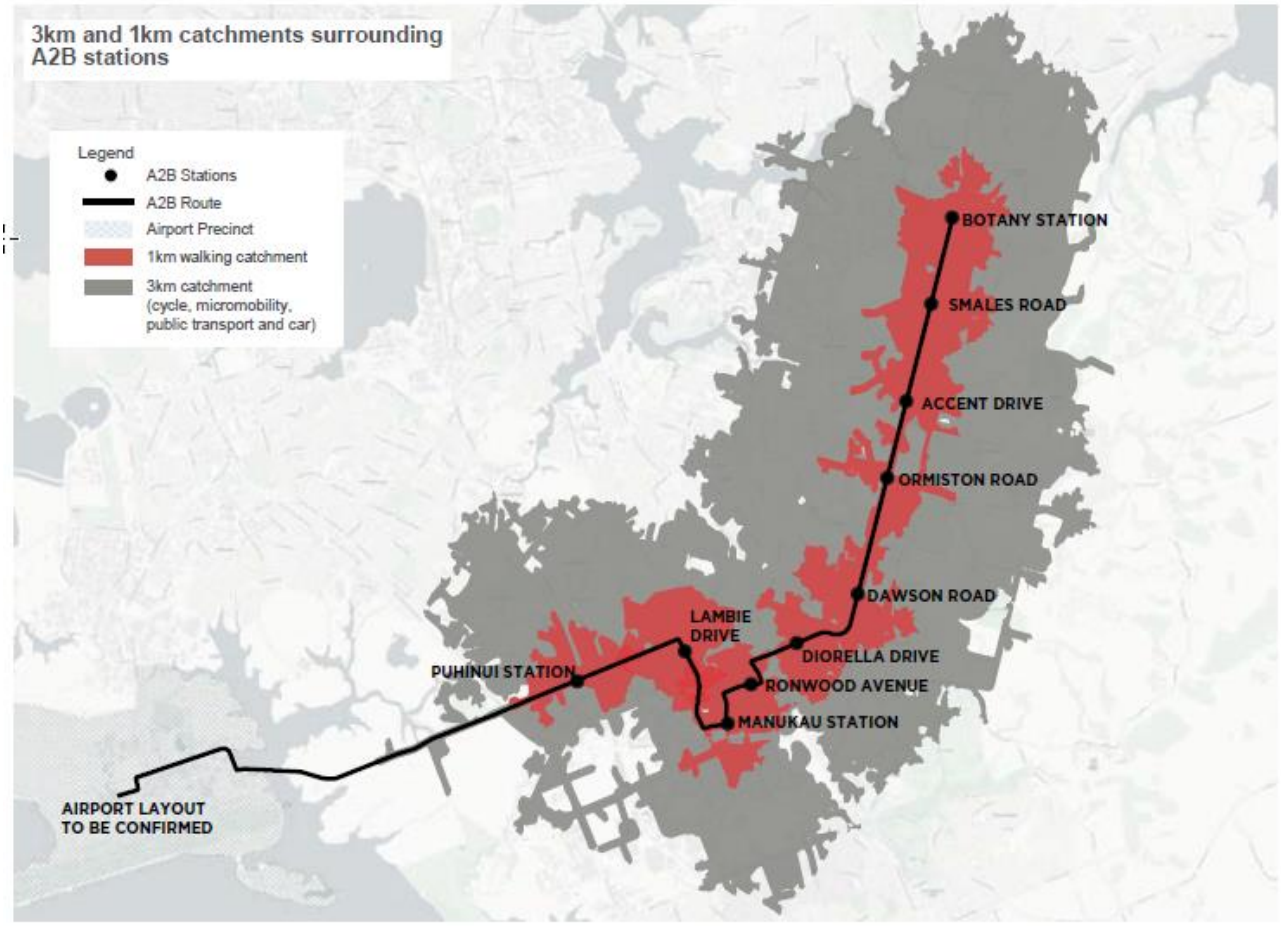


Figure 14-2: A2B Station Catchments - 1 km & 3 km

Step 1: Identify intervention locations

a. Identify appropriate areas for speed limit reductions

High-speeds create a severance barrier to pedestrians and cyclists travelling along and across a road. Reducing speed limits creates a safer and more amenable environment for pedestrians and cyclists and can be done with a small budget.

Neighbourhood areas and metropolitan town centres within 1km of each station as identified in the previous high-level station access assessments (502334-7000-REP-KK-0028) are recommended to have speed limits reduced to 30km/h.

Neighbourhood areas were defined by identifying arterial and connector streets which bound residential areas into ‘cells’ of the larger neighbourhood. These areas offer the opportunity to create ‘Low Traffic Neighbourhoods’. There are multiple benefits from creating low traffic neighbourhoods including lower air pollution, improved road safety, more cohesive social environment, and walking and cycling becoming the natural choice for everyday journeys. Key components of ‘Low Traffic Neighbourhoods’ are modal filters, gateway treatments and slow vehicle speeds.

To be effective, speed limit changes require physical infrastructure changes to help the street environment better reflect the desired speed and behaviour of drivers in vehicles. Speed limit changes will support access to A2B stations and also aligns with Auckland Transport’s Safe Speeds Programme. It is recommended that

speed limit changes along the A2B corridor are incorporated under the Safe Speeds Programme to ensure consistency with other speed limit changes across Auckland.

b. Locate existing pedestrian links to be upgraded

It is recommended that all pedestrian links within 1km of each station are upgraded. These upgrades should include human-scale lighting for the whole pathway, repaving uneven paths, bollard removal or replacement with accessible bollards, and wayfinding to the A2B stations and key destinations in the area.

Most pedestrian links provide shortcuts for people travelling by walking, cycling or micromobility to A2B stations. Whilst some pedestrian links do not necessarily provide shortcuts to the stations, they are important for encouraging local trips to be made by foot or bike and encouraging general travel behaviour changes in the areas most affected by A2B.

At this stage of assessment, it is recommended that every pedestrian link has upgraded/new lighting, bollard replacement/removal, wayfinding to the A2B station and other key destinations. Site visits should be conducted to identify which stations have uneven paths and therefore require repaving.

c. Identify other specific interventions

The first two steps involved identifying generic interventions that could be applied consistently across the station access areas. The third step was to identify specific barriers or opportunities, within the station access areas, that could be addressed in the medium-term.

The user experience was embodied by considering how a resident, employee or student in the area would navigate to the stations from adjacent neighbourhood areas and key destinations within the vicinity of the station. By creating example journeys and experiences, interventions were identified that would be most useful to enable access for the widest group of people, including mobility-impaired people.

Previous work was captured by drawing on the *Proposed Station Access Networks* and *Summary of Recommendations* identified in the high-level station access assessments (502334-7000-REP-KK-0028). For the five stations that were assessed in the detailed station access assessments (502334-7000-REP-KK-0028), recommended interventions from the priority routes were considered including how much they relate to the medium-term station access objectives.

The following considerations were made when reviewing the long-term recommendations from the high-level and detailed station access assessments (502334-7000-REP-KK-0028) completed for the ultimate A2B project:

- Barriers: identify barriers that prevent or restrict access to the station. Barriers include missing footpaths or cycle paths, lack of crossing facilities and poor side street crossings.
- Safety: incorporate understanding of risk and safety concerns from the previous assessments.
- Local knowledge: include experience from previous site visits.
- Proximity to stations: consider proximity to stations, because interventions closest to stations will impact more people than interventions further away.
- Neighbourhood areas adjacent to the station: prioritise active modes. Motor vehicle movements may therefore be restricted or indirect. Key entry points/ gateways into these neighbourhood areas should illustrate a change in environment and will encourage and create long-term desirable behaviours. Interventions may include restricting vehicle movements that impact safety of active modes or simplifying side street access to be left-in, left-out or entry only.

Step 2: Detail interventions at each location

For each intervention location identified above, the specific details of the interventions were then considered. In Section 7.3.4, the details of interventions for each location are described, and an approximate cost for the set of interventions has been estimated and included.

Step 3: Core medium-term interventions

A wider suite of recommended improvements for medium-term station access work are included in Appendix A**.** In order to reduce the costs of medium-term station access work, the interventions included within the A2B Medium Term costs are limited to those identified as ‘essential for enhanced access’.

The wider changes are considered to have merit and could be delivered through either increasing the A2B Medium Term budget on a targeted basis, or re-prioritising related programmes.

Core elements of station access included in the Medium Term costs are as follows:

a. Intersection interventions limited to:

   i. treatment of slip lanes and slip lane approaches through the installation of raised tables with zebra crossing (or signal crossing) over the slip lane and slip lane approach speed reduction (through surface treatment or vertical deflection) AND

   ii. ensure pedestrian crossings are located on each arm of the intersection.

Estimated cost: $75,000 instead of $600,000 per intersection

b. New cycle paths limited to:

   i. Proposed concrete or rubber separators which can be bolted onto the existing road surface and provide protection for the cycle space, along midblock sections (instead of permanent cycle path which would result in the kerb line being shifted out into the road corridor)

Estimated cost: $400m per meter of cycle path instead of $875 per meter of cycle path

The total cost of the enhanced and desirable station access options are compared in Table 8-4.

Intervention recommendations

The following schematic maps show where the core station access interventions are in the Medium-Term at each station and includes a set of ‘enhanced’ interventions to accord with the less capital-intensive approach of the medium term strategy, and a set of ‘desirable’ interventions as an alternative option.

Table 14-19 to Table 14-27 details each of the enhanced station access interventions and their approximate costs. These costs are the breakdown of the enhanced station access column in Table 8-4.

Enhanced Station Access Option

The below recommendations are for the enhanced station access interventions.

Table 14-1: Puhinui Station – [redacted]

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Side street	1S	[redacted]	Kerb extensions with island diverter for vehicles (Exit or entry only), Left in left out only (New central raised median)	Essential to support safe, direct and coherent access to the station for vulnerable modes
Side street	2S	[redacted]	Kerb extensions with island diverter for vehicles (Exit or entry only), Left in left out only (New central raised median)	
Side street	3S	[redacted]	New modal filter (Close entrance/close access for cars at this intersection)	This neighbourhood area has multiple vehicle entry and exit options. There is huge value in closing this to vehicle movements as its located meters away from a station entrance. Closing it means pedestrians using Clendon Ave will enjoy a street with minimal car movements and low speeds. Pedestrians and people on bikes moving along Puhinui will have a safe and direct route to and from the station. Removing turning vehicles movements from this intersection especially movements coming from Puhinui road will make a significant positive difference in both perceived and actual safety.
Side street	4S	[redacted]	Kerb extensions with island diverter for vehicles (Exit or entry only), Left in left out only (New central raised median)	
Crossing facility	5C	[redacted]	New controlled midblock crossing (signals or zebra)	
Crossing facility	8C	[redacted]	New controlled midblock crossing (signals or zebra)	
Crossing facility	9C	[redacted]	New controlled midblock crossing (signals or zebra)	
Crossing facility	10C	[redacted]	New controlled midblock crossing (signals or zebra)	This has been detailed up to be included in short term work - but location of the crossing should be closer to Wallace Road as this is where desire line exists
Crossing facility	11C	[redacted]	New controlled midblock crossing (signals or zebra)	Roundabout included here in short term work- but needs to have zebra on all arms of roundabout

Table 14-2: Lambie Station intervention details – [redacted]

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Side street	1S	[redacted]	Kerb extensions with island diverter for vehicles (Exit or entry only), Left in left out only (New central raised median)	Essential to support safe, direct and coherent access to the station for vulnerable modes
Side street	2S	[redacted]	Kerb extensions with island diverter for vehicles (Exit or entry only), Left in left out only (New central raised median)	Provide a key entry point into the 'low traffic neighbourhood area' important to create vehicle behaviours we want to have in these areas at these points.
Side street	3S	[redacted]	Reduce side street crossings with kerb build outs, Left in left out only (New central raised median)	
Crossing facility	1C	[redacted]	New controlled midblock crossing (signals or zebra)	
Pedestrian link	1P	[redacted]	Wayfinding, Lighting, Remove staples	
Pedestrian link	3P	[redacted]	Wayfinding, Lighting, Remove staples	Offers a significant short cut for pedestrians here for a large area of residents in very close proximity to station

Table 14-3: Manukau and Ronwood Stations: [redacted]

Intervention type	Key on schematic	Estimated	Intervention details	Notes
Commercial Driveway	1D	[redacted]	New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in left out only (New central raised median)	
Commercial Driveway	2D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in left out only (New central raised median)	
Commercial Driveway	6D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings	
Intersection	2I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	All residents in the south need to move through here to access Manukau and the station
Intersection	3I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Intersection	4I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	All residents in the east must move through this intersection due to the motorway corridor
Intersection	6I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Intersection	7I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Intersection	8I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Intersection	10I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Intersection	11I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection	
Mid-block	1M		Add tactical cycle path (concrete or rubber separators)	Ensure Ronwood west of Davies Ave has cycle paths integrated
Mid-block	1M		Add tactical cycle path (concrete or rubber separators)	
Mid-block	2M		Add tactical cycle path (concrete or rubber separators)	
Mid-block	2M		Add tactical cycle path (concrete or rubber separators)	
Mid-block	3M		Add tactical cycle path (concrete or rubber separators)	All residents in the east and south must move along this corridor to reach Manukau and the station

Mid-block	4M		Add tactical cycle path (concrete or rubber separators)	All residents in the east and south must move along this corridor to reach Manukau and the station
Pedestrian link	4P		Wayfinding, Lighting, Remove staples	This path includes a section through Pak ‘n’ save carpark
Side Street	1S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in left out only (New central raised median)	As above these access points must be crossed by vulnerable modes to reach the station
Side Street	2S		New modal filter (Close street to cars)	As above these access points must be crossed by vulnerable modes to reach the station
Side Street	3S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)	

Table 14-4: Diorella Station – total cost estimate $30,000

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Side street	3S		New modal filter (Close street to cars)	Access for vehicles here complicates intersection. Recommend closing to vehicles and providing access through for active modes only
Side street	4S		New modal filter (Close street to cars)	Access for vehicles here complicates intersection. Recommend closing to vehicles and providing access through for active modes only
Side street	6S		Left in left out only (New central raised median)	Directly next to the station area. Need to remove vehicles movements that are particularly dangerous for active modes, which are uncontrolled right turns
Side street	9S		Left in left out only (New central raised median)	Provide a key entry point into the 'low traffic neighbourhood area' and safety across this side street is important due to proximity to station and large resident catchment that need to move through this point

Table 14-5: Dawson Station: [redacted]

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Mid-block intervention	5M	[redacted]	Add tactical cycle path (concrete or rubber separators)	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic here
Mid-block intervention	6M		Add tactical cycle path (concrete or rubber separators)	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic here
Side street treatment	1S		New modal filter (Close street to cars)	
Side street treatment	2S		New threshold treatment with pedestrian and cycling priority	
Crossing facility intervention	2C		Upgrade midblock crossing	
Crossing facility intervention	3C		Upgrade midblock crossing	
Intersection	1I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	Scale down flat bush road arm of this intersection, remove slip lane from Dawsons into flat bush. and make a single crossing experience (probably best to be controlled) across Flat bush road
Intersection	2I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Pedestrian link intervention	1P		Wayfinding, Lighting, Remove staples	
Pedestrian link intervention	2P		Wayfinding, Lighting, Remove staples	Offers a significant short cut for pedestrians here for a large area of residents in very close proximity to station

Table 14-6: Ormiston station: total estimated cost $630,000

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Mid-block intervention	3M		Add safe hit posts and painted buffer onto existing cycle lane	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block intervention	4M		Add safe hit posts and painted buffer onto existing cycle lane	"
Side street treatment	1S		Left in left out only (New central raised median), New threshold treatment with pedestrian and cycling priority	Wide uncontrolled intersection - could be signalised to include crossing across Ormiston RD
Side street treatment	2S		New modal filter (Close street to cars)	This intervention supports new behaviours for traffic movements through this neighbourhood area, which will support safer and more attractive active mode movement
Side street treatment	4S			
Side street treatment	6S			Access to become out here only onto Te Irirangi Dr. This access point is very close to station area, do not want fast moving cars turning off Te I Dr onto shopping area
Commercial Driveway	4D			
Intersection	1I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	

Table 14-7: Accent Station: total estimated cost $610,000

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Mid-block	1M		Add tactical cycle path (concrete or rubber separators)	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	2M		Add tactical cycle path (concrete or rubber separators)	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	3M		Add shared path from buffer (between the property boundary and the kerb)	Provide a safe and comfortable route for business on the west of the corridor
Side street	1S		Left in left out only (New central raised median), New threshold treatment with pedestrian and cycling priority	Close proximity to station
Crossing facility	1C		New controlled midblock crossing (signals or zebra)	

Table 14-8: Smales station: total cost estimate $2,080,000

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Mid-block	3M		Add tactical cycle path (concrete or rubber separators)	All residents from west will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	4M		Add tactical cycle path (concrete or rubber separators)	"
Mid-block	7M		Add tactical cycle path (concrete or rubber separators)	All residents from the east will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	8M		Add tactical cycle path (concrete or rubber separators)	"
Side street	3S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority	
Side street	4S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority	
Side street	5S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority	
Side street	6S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority	
Intersection	1I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Pedestrian link	10P		Wayfinding, Lighting, Remove staples	
Pedestrian link	11P		Wayfinding, Lighting, Remove staples	Providing direct access to station for adjacent residents
Pedestrian link	12P		Wayfinding, Lighting, Remove staples	Providing direct access to station for adjacent residents
Side street	2S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority	

Table 14-9: Botany Station total cost estimate: [redacted]

Intervention type	Key on schematic	Estimated cost	Intervention details	Notes
Mid-block intervention	3M		Add tactical cycle path (concrete or rubber separators)	
Mid-block intervention	4M		Add tactical cycle path (concrete or rubber separators)	
Mid-block intervention	7M		Add tactical cycle path (concrete or rubber separators)	
Mid-block intervention	8M		Add tactical cycle path (concrete or rubber separators)	
Side street treatment	1S		New threshold treatment with pedestrian and cycling priority, Left in left out only (New central raised median)	To ensure priority and safety for active modes across these access points
Side street treatment	2S		New threshold treatment with pedestrian and cycling priority, Left in left out only (New central raised median)	To ensure priority and safety for active modes across these access points
Intersection	4I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	This is a significant barrier to access - Everyone who lives to the north an east of this intersection has to move through it to access the services in Botany and the station
Intersection	5I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	Everyone who lives to the north of this intersection must move through it to access the services in Botany and the station
Crossing facility intervention	2C		New controlled midblock crossing (signals or zebra)	important to support movement into the Botany centre from the east suburbs
Pedestrian link intervention	6P		Wayfinding, Lighting, Remove staples	Direct connection from neighbourhood area into station area, important to support walking trips
Pedestrian link intervention	9P		Wayfinding, Lighting, Remove staples	
Pedestrian link intervention	10P		Wayfinding, Lighting, Remove staples	
Intersection	3I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	
Intersection	12I		Slip lane treatment, ensure pedestrian crossing on all arms of intersection	

Desirable Station Access Option

The below recommendations are for the desirable station access interventions.

Table 14-10: Puhinui Station –

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path			
Mid-block	2M		Add missing cycle / micromobility path			
Side street	1S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	Essential to support safe, direct and coherent access to the station for vulnerable modes
Side street	2S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	
Side street	3S		New modal filter (Close entrance/close access for cars at this intersection)			This neighbourhood area has multiple vehicle entry and exit options. There is huge value in closing this to vehicle movements as it is located meters away from a station entrance. Closing it means pedestrians using Clendon Ave will enjoy a street with minimal car movements and low speeds. Pedestrians and people on bikes moving along Puhinui Road will have a safe and direct route to and from the station. Removing turning vehicles movements from this intersection (especially movements coming from Puhinui Road) will make a significant positive difference in both perceived and actual safety.
Side street	4S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	
Side street	5S		Kerb extensions with island diverter for vehicles (Exit or entry only)			
Side street	6S		Kerb extensions with island diverter for vehicles (Exit or entry only)	Yes		This has been detailed up to be included in short-term work but the intervention proposed here reflects the much lower volume road
Side street	7S		Kerb extensions with island diverter for vehicles (Exit or entry only)			Provide a key entry point into the 'low traffic neighbourhood area' important to create vehicle behaviours we want to have in these areas at these points.
Side street	8S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)			Provide a key entry point into the 'low traffic neighbourhood area'

Side street	9S		New threshold treatment with pedestrian and cycling priority			
Side street	10S		New threshold treatment with pedestrian and cycling priority			
Side street	11S		Reduce side street crossings with kerb build outs			
Crossing facility	1C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	2C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	3C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	4C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	5C		New controlled midblock crossing (signals or zebra)	Yes	Yes	
Crossing facility	6C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	7C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	8C		New controlled midblock crossing (signals or zebra)			
Crossing facility	9C		New controlled midblock crossing (signals or zebra)		Yes	
Crossing facility	10C		New controlled midblock crossing (signals or zebra)	Yes	Yes	This has been detailed up to be included in short term work - but location of the crossing should be closer to Wallace Road as this is where desire line exists
Crossing facility	11C		New controlled midblock crossing (signals or zebra)		Yes	Roundabout included here in short term work- but needs to have zebra on all arms of roundabout
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection, Ensure traffic arms on each arm	Yes		This has been detailed up to be included in short-term work but the proposal needs to include pedestrian crossings on all intersection arms
Intersection	2I		Create signals			
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			

Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	6P		Wayfinding, Lighting, Remove staples			
Pedestrian link	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link	8P		Wayfinding, Lighting, Remove staples			
Pedestrian link	9P		Wayfinding, Lighting, Remove staples			

Table 14-11: Lambie Station intervention details

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path		Yes	Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	2M		Add missing cycle / micromobility path		Yes	Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	3M		Add missing cycle / micromobility path			
Mid-block	4M		Add missing cycle / micromobility path			
Side street	1S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	Essential to support safe, direct and coherent access to the station for vulnerable modes
Side street	2S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	Provide a key entry point into the 'low traffic neighbourhood area'; important to create vehicle behaviours we want to have in these areas at these points.
Side street	3S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)		Yes	
Side street	4S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)			
Side street	5S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)			
Side street	6S					This street can be accessed from many other points and does not require direct access from Carruth Dr
Crossing facility	1C		New controlled midblock crossing (signals or zebra)		Yes	
Crossing facility	2C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	3C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	4C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	5C		New controlled midblock crossing (signals or zebra)	Yes		

Crossing facility	6C		New controlled midblock crossing (signals or zebra)			
Crossing facility	7C		New controlled midblock crossing (signals or zebra)			
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	2I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Pedestrian link	1P		Wayfinding, Lighting, Remove staples		Yes	
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples		Yes	Offers a significant shortcut for pedestrians here for a large area of residents in very close proximity to station
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Commercial Driveway	1D		New threshold treatment with pedestrian and cycling priority, Reduce side street crossings with kerb build outs	Yes		
Commercial Driveway	2D		New threshold treatment with pedestrian and cycling priority, Reduce side street crossings with kerb build outs	Yes		

Table 14-12: Manukau and Ronwood Stations:

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path	Yes		Ensure Ronwood west of Davies Ave has cycle paths integrated
Mid-block	2M		Add missing cycle / micromobility path	Yes		Ensure Ronwood west of Davies Ave has cycle paths integrated
Mid-block	3M		Add missing cycle / micromobility path		Yes	All residents in the east and south must move along this corridor to reach Manukau and the station
Mid-block	4M		Add missing cycle / micromobility path		Yes	All residents in the east and south must move along this corridor to reach Manukau and the station
Mid-block	5M		Add missing cycle / micromobility path	Yes		
Mid-block	6M		Add missing cycle / micromobility path	Yes		
Mid-block	7M		Add missing cycle / micromobility path			
Mid-block	8M		Add missing cycle / micromobility path			
Mid-block	9M		Add missing cycle / micromobility path			
Mid-block	10M		Add missing cycle / micromobility path			
Commercial Driveway	1D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)	Yes		
Commercial Driveway	2D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)	Yes		
Commercial Driveway	3D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)			
Commercial Driveway	4D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)			
Commercial Driveway	5D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings	Yes		
Commercial Driveway	6D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			

Commercial Driveway	7D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			
Commercial Driveway	8D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			
Commercial Driveway	9D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			
Side Street	1S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	As above, these access points must be crossed by vulnerable modes to reach the station
Side Street	2S		New modal filter (Close street to cars)		Yes	As above, these access points must be crossed by vulnerable modes to reach the station
Side Street	3S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)	Yes		
Side Street	4S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)			
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection	Yes		
Intersection	2I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection		Yes	All residents in the south need to move through here to access Manukau and the station
Intersection	3I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection		Yes	
Intersection	4I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection		Yes	All residents in the east must move through this intersection due to the motorway corridor
Intersection	5I		Ensure pedestrian crossing on all arms of intersection , Create cycle protection through intersection, Reduce number of traffic lanes	Yes		
Intersection	6I		Ensure pedestrian crossing on all arms of intersection , Create cycle protection through intersection, Reduce number of traffic lanes	Yes		

Intersection	7I		Create cycle protection through intersection, Reduce lane width	Yes		
Intersection	9I		Ensure pedestrian crossing on all arms of intersection , Create cycle protection through intersection, Reduce number of traffic lanes, Remove slip lanes	Yes		
Intersection	11I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection	Yes		
Intersection	13I		Remove slip lanes, Create cycle protection through intersection, Ensure pedestrian crossing on all arms of intersection, Reduce number of traffic lanes			
Intersection	15I		Remove slip lanes, Create cycle protection through intersection, Ensure pedestrian crossing on all arms of intersection	Yes		
Intersection	12I		Remove slip lanes	Yes		
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			This path includes a section through Pak'n Save carpark
Crossing facility	1C		New controlled midblock crossing (signals or zebra)			

Table 14-13: Diorella Station

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path			Connection to Redoubt Road proposed infrastructure
Mid-block	2M		Add missing cycle / micromobility path			Connection to Redoubt Road proposed infrastructure
Side street	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	2S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	3S		New modal filter (Close street to cars)		Yes	Access for vehicles here complicates intersection. Recommend closing to vehicles and providing access through for active modes only
Side street	4S		New modal filter (Close street to cars)		Yes	Access for vehicles here complicates intersection. Recommend closing to vehicles and providing access through for active modes only
Side street	5S		Left in-left out only (New central raised median)			
Side street	6S				Yes	Directly next to the station area. Need to remove vehicles movements that are particularly dangerous for active modes, which are uncontrolled right turns
Side street	7S					Provide a key entry point into the 'low traffic neighbourhood area'
Side street	8S					Provide a key entry point into the 'low traffic neighbourhood area'
Side street	9S				Yes	Provide a key entry point into the 'low traffic neighbourhood area' and safety across this side street is important due to proximity to station and large resident catchment that need to move through this point
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			

Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Intersection	1I		Create a slow speed accessible roundabout, integrate safe crossing on all legs for pedestrians and cycling, Integrate separated cycle paths around whole roundabout			
Intersection	2I		Remove slip lanes, reduce number of traffic lanes, Create cycle protection through intersection	Yes		

Table 14-14: Dawson Station: total cost estimate $7,000,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block intervention	1M		Add missing cycle / micromobility path			
Mid-block intervention	2M		Add missing cycle / micromobility path			
Mid-block intervention	3M		Add missing cycle / micromobility path			
Mid-block intervention	4M		Add missing cycle / micromobility path			
Mid-block intervention	5M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block intervention	6M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Side street treatment	1S		New modal filter (Close street to cars)			
Side street treatment	2S		New threshold treatment with pedestrian and cycling priority		Yes	
Side street treatment	3S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street treatment	4S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			Provide a key entry point into the 'low traffic neighbourhood area'
Crossing facility intervention	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	2C		Upgrade midblock crossing		Yes	
Crossing facility intervention	3C		Upgrade midblock crossing			

Crossing facility intervention	4C		Upgrade midblock crossing			Currently a signal crossing- just needs to be integrated with new cycle paths
Crossing facility intervention	5C		Upgrade midblock crossing			
Crossing facility intervention	**6C**		New controlled midblock crossing (signals or zebra)			
Intersection	1I		Create cycle protection through intersection, Reduce number of traffic lanes			
Intersection	2I		Create signals, Ensure traffic arms on each arm, Create cycle protection through intersection		Yes	
Intersection	3I		Create roundabout			
Intersection	4I		Create roundabout			
Pedestrian link intervention	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	2P		Wayfinding, Lighting, Remove staples		Yes	Offers a significant short cut for pedestrians here for a large area of residents in very close proximity to station
Pedestrian link intervention	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	5P		Wayfinding, Lighting, Remove staples			

Table 14-15: Ormiston station: total estimated cost $5,000,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block intervention	1M		Add safe hit posts and painted buffer onto existing cycle lane			
Mid-block intervention	2M		Add safe hit posts and painted buffer onto existing cycle lane			
Mid-block intervention	3M		Add safe hit posts and painted buffer onto existing cycle lane		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block intervention	4M		Add safe hit posts and painted buffer onto existing cycle lane		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Side street treatment	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority		Yes	Wide uncontrolled intersection - could be signalised to include crossing across Ormiston RD
Side street treatment	2S		New modal filter (Close street to cars)		Yes	This intervention supports new behaviours for traffic movements through this neighbourhood area, which will support safer and more attractive active mode movement
Side street treatment	3S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street treatment	4S				Yes	
Side street treatment	5S					Reduce intersection radii so slower speeds can be achieved for turning vehicles
Side street treatment	6S				Yes	Access to become out here only onto Te Irirangi Dr. This access point is very close to station area, do not want fast moving cars turning off Te Irirangi Dr onto shopping area
Pedestrian link intervention	1P		Wayfinding, Lighting, Remove staples			

Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	2I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	3I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			Important to improve to support movement and access from the suburbs in the west here
Intersection	4I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	5I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	6I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	7I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection	Yes		
Crossing Facility	1C		New controlled midblock crossing (signals or zebra)			This could be integrated with 1S to become a signalised intersection OR could just be a signal pedestrian crossing located west of Michael Jones Drive
Crossing Facility	2C		New controlled midblock crossing (signals or zebra)			Safe connection for people to access the park and use the park as connection to station
Commercial Driveway	1D					This driveway is close to the station, so it is important to improve access across the driveway.
Commercial Driveway	2D					This driveway is close to the station, so it is important to improve access across the driveway.
Commercial Driveway	3D					This driveway is close to the station, so it is important to improve access across the driveway.
Commercial Driveway	4D				Yes	

Table 14-16: Accent Station: total estimated cost $2,800,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	2M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	3M		Add shared path from buffer (between the property boundary and the kerb)		Yes	Provide a safe and comfortable route for business on the west of the corridor
Side street	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority		Yes	Close proximity to station
Side street	2S		New threshold treatment with pedestrian and cycling priority			
Side street	3S		New threshold treatment with pedestrian and cycling priority			
Crossing facility	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility	2C		New controlled midblock crossing (signals or zebra)	Yes		An existing overbridge is located here - We recommend rebuilding at-grade crossing
Crossing facility	3C		Upgrade midblock crossing			
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection, Ensure traffic arms on each arm			
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			

Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	6P		Wayfinding, Lighting, Remove staples			
Pedestrian link	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples, Create roundabout			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples, New threshold treatment with pedestrian and cycling priority			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	8P		Wayfinding, Lighting, Remove staples			

Table 14-17: Smales station: total cost estimate $7,900,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path			
Mid-block	2M		Add missing cycle / micromobility path			
Mid-block	3M		Add missing cycle / micromobility path		Yes	All residents from west will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	4M		Add missing cycle / micromobility path		Yes	All residents from west will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	5M		Add missing cycle / micromobility path			
Mid-block	6M		Add missing cycle / micromobility path			
Mid-block	7M				Yes	All residents from the east will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	8M				Yes	All residents from the east will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Side street	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	2S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	3S		Left in-left out only (New central raised median), New threshold		Yes	

			treatment with pedestrian and cycling priority			
Side street	4S				Yes	
Side street	5S				Yes	
Side street	6S				Yes	
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection, Ensure traffic arms on each arm			
Intersection	2I		Create roundabout			Mini roundabout
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	6P		Wayfinding, Lighting, Remove staples			
Pedestrian link	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link	8P		Wayfinding, Lighting, Remove staples			
Pedestrian link	9P		Wayfinding, Lighting, Remove staples			
Pedestrian link	10P		Wayfinding, Lighting, Remove staples			
Pedestrian link	11P		Wayfinding, Lighting, Remove staples		Yes	Providing direct access to station for adjacent residents
Pedestrian link	12P		Wayfinding, Lighting, Remove staples		Yes	Providing direct access to station for adjacent residents
Pedestrian link	13P		Wayfinding, Lighting, Remove staples			
Pedestrian link	14P		Wayfinding, Lighting, Remove staples			

Pedestrian link	15P		Wayfinding, Lighting, Remove staples			
Pedestrian link	16P		Wayfinding, Lighting, Remove staples			
Pedestrian link	17P		Wayfinding, Lighting, Remove staples			
Pedestrian link	18P		Wayfinding, Lighting, Remove staples			
Crossing facility	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility	2C		New controlled midblock crossing (signals or zebra)			
Crossing facility	3C		New controlled midblock crossing (signals or zebra)	Yes		An existing overbridge is located here - We recommend rebuilding at-grade crossing
Crossing facility	4C		New controlled midblock crossing (signals or zebra)	Yes		An existing underpass is located here - We recommend rebuilding at-grade crossing
Crossing facility	5C		New controlled midblock crossing (signals or zebra)	Yes		

Table 14-18: Botany Station total cost estimate: $14,300,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block intervention	1M		Add missing cycle / micromobility path			
Mid-block intervention	2M		Add missing cycle / micromobility path			
Mid-block intervention	3M		Add missing cycle / micromobility path	Yes	Yes	
Mid-block intervention	4M		Add missing cycle / micromobility path	Yes	Yes	
Mid-block intervention	5M		Add missing cycle / micromobility path			Neighbourhood area intervention
Mid-block intervention	6M		Add missing cycle / micromobility path			Neighbourhood area intervention
Mid-block intervention	7M		Add missing cycle / micromobility path		Yes	
Mid-block intervention	8M		Add missing cycle / micromobility path		Yes	
Mid-block intervention	9M		Add missing cycle / micromobility path			
Mid-block intervention	10M		Add missing cycle / micromobility path			
Mid-block intervention	11M		Add missing cycle / micromobility path			
Side street treatment	1S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)		Yes	To ensure priority and safety for active modes across these access points
Side street treatment	2S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)		Yes	To ensure priority and safety for active modes across these access points
Side street treatment	3S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	4S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	5S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention

Side street treatment	6S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	7S		Left in-left out only (New central raised median)			Neighbourhood area intervention
Side street treatment	8S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	9S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	10S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	11S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	12S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)			
Side street treatment	13S		New threshold treatment with pedestrian and cycling priority			
Intersection	1I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	2I		Remove slip lanes, Create cycle protection through intersection, Reduce lane widths			
Intersection	3I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	4I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths	Yes	Yes	This is a significant barrier to access - Everyone who lives to the north an east of this intersection has to move through it to access the services in Botany and the station
Intersection	5I		Remove slip lanes, Create cycle protection through intersection, Ensure traffic arms on each arm, Reduce number of traffic lanes and widths		Yes	Everyone who lives to the north of this intersection has to move through it to access the services in Botany and the station
Intersection	6I		Plant the roundabout + increase the size of the inner circle + reduce side street crossing distance			Neighbourhood area intervention

Intersection	7I		Plant the roundabout + increase the size of the inner circle + reduce side street crossing distance			Neighbourhood area intervention
Intersection	8I		Plant the roundabout + increase the size of the inner circle + reduce side street crossing distance			Neighbourhood area intervention
Intersection	9I		Create cycle protection through intersection			
Intersection	10I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	11I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	12I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths	Yes		
Crossing facility intervention	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	2C		New controlled midblock crossing (signals or zebra)		Yes	Important to support movement into the Botany centre from the east suburbs
Crossing facility intervention	3C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	4C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	5C		New controlled midblock crossing (signals or zebra)			
Pedestrian link intervention	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	5P		Wayfinding, Lighting, Remove staples			

Pedestrian link intervention	6P		Wayfinding, Lighting, Remove staples		Yes	Direct connection from neighbourhood area into station area, important to support walking trips
Pedestrian link intervention	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	8P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	9P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	10P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	11P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	12P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	13P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	14P		Wayfinding, Lighting, Remove staples			
Commercial Driveway	1D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority	Yes		
Commercial Driveway	2D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority	Yes		
Commercial Driveway	3D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority			
Commercial Driveway	4D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority, Left in left only (New central raised median)			

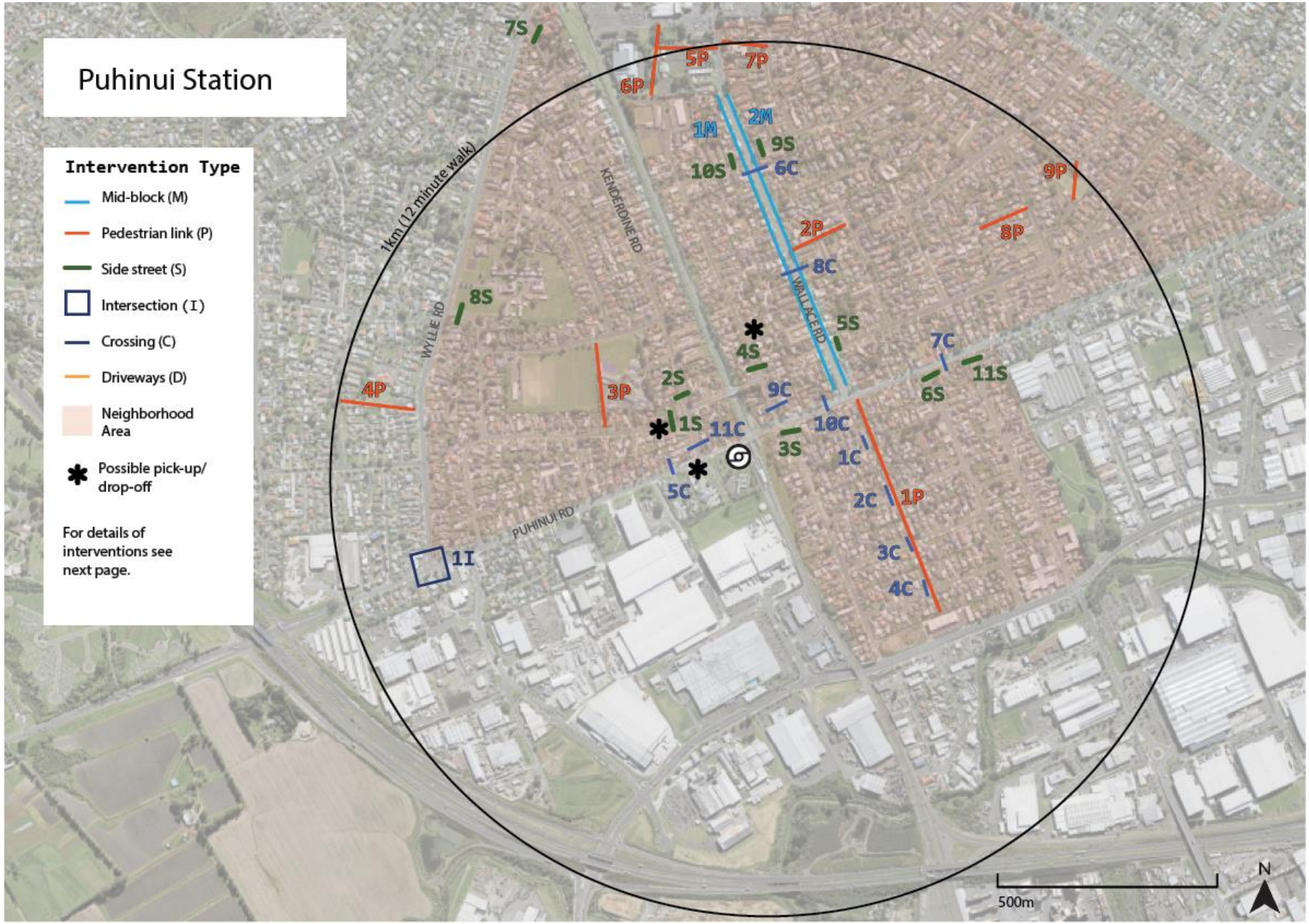

Puhinui Station
Intervention Type
Mid-block (M)
Pedestrian link (P)
Side street (S)
Intersection (I)
Crossing (C)
Driveways (D)
Neighborhood Area
Possible pick-up/ drop-off
For details of interventions see next page.
1km (12 minute walk)
KENDERDINE RD
WYLLIE RD
WALLACE RD
PUHINUI RD
7S
5P
7P
6P
1M
2M
9S
10S
6C
9P
8P
2P
8C
8S
5S
4S
7C
11S
6S
4P
3P
2S
9C
1S
11C
10C
3S
1C
5C
2C
1P
3C
4C
1I
500m
N

Table 14-19: Puhinui Station – total cost estimate $3,900,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path			
Mid-block	2M		Add missing cycle / micromobility path			
Side street	1S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	Essential to support safe, direct and coherent access to the station for vulnerable modes
Side street	2S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	
Side street	3S		New modal filter (Close entrance/close access for cars at this intersection)			This neighbourhood area has multiple vehicle entry and exit options. There is huge value in closing this to vehicle movements as it is located meters away from a station entrance. Closing it means pedestrians using Clendon Ave will enjoy a street with minimal car movements and low speeds. Pedestrians and people on bikes moving along Puhinui Road will have a safe and direct route to and from the station. Removing turning vehicles movements from this intersection (especially movements coming from Puhinui Road) will make a significant positive difference in both perceived and actual safety.
Side street	4S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	
Side street	5S		Kerb extensions with island diverter for vehicles (Exit or entry only)			
Side street	6S		Kerb extensions with island diverter for vehicles (Exit or entry only)	Yes		This has been detailed up to be included in short-term work but the intervention proposed here reflects the much lower volume road
Side street	7S		Kerb extensions with island diverter for vehicles (Exit or entry only)			Provide a key entry point into the 'low traffic neighbourhood area' important to create vehicle behaviours we want to have in these areas at these points.
Side street	8S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)			Provide a key entry point into the 'low traffic neighbourhood area'

Side street	9S		New threshold treatment with pedestrian and cycling priority			
Side street	10S		New threshold treatment with pedestrian and cycling priority			
Side street	11S		Reduce side street crossings with kerb build outs			
Crossing facility	1C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	2C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	3C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	4C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	5C		New controlled midblock crossing (signals or zebra)	Yes	Yes	
Crossing facility	6C		New uncontrolled midblock crossing (refuge island or raised platform)			
Crossing facility	7C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	8C		New controlled midblock crossing (signals or zebra)			
Crossing facility	9C		New controlled midblock crossing (signals or zebra)		Yes	
Crossing facility	10C		New controlled midblock crossing (signals or zebra)	Yes	Yes	This has been detailed up to be included in short term work - but location of the crossing should be closer to Wallace Road as this is where desire line exists
Crossing facility	11C		New controlled midblock crossing (signals or zebra)		Yes	Roundabout included here in short term work- but needs to have zebra on all arms of roundabout
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection, Ensure traffic arms on each arm	Yes		This has been detailed up to be included in short-term work but the proposal needs to include pedestrian crossings on all intersection arms
Intersection	2I		Create signals			
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			

Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	6P		Wayfinding, Lighting, Remove staples			
Pedestrian link	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link	8P		Wayfinding, Lighting, Remove staples			
Pedestrian link	9P		Wayfinding, Lighting, Remove staples			

Table 14-20: Lambie Station intervention details – total cost estimate $7,600,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path		Yes	Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	2M		Add missing cycle / micromobility path		Yes	Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	3M		Add missing cycle / micromobility path			
Mid-block	4M		Add missing cycle / micromobility path			
Side street	1S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	Essential to support safe, direct and coherent access to the station for vulnerable modes
Side street	2S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	Provide a key entry point into the 'low traffic neighbourhood area'; important to create vehicle behaviours we want to have in these areas at these points.
Side street	3S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)		Yes	
Side street	4S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)			
Side street	5S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)			
Side street	6S					This street can be accessed from many other points and does not require direct access from Carruth Dr
Crossing facility	1C		New controlled midblock crossing (signals or zebra)		Yes	
Crossing facility	2C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	3C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	4C		New controlled midblock crossing (signals or zebra)	Yes		
Crossing facility	5C		New controlled midblock crossing (signals or zebra)	Yes		

Crossing facility	6C		New controlled midblock crossing (signals or zebra)			
Crossing facility	7C		New controlled midblock crossing (signals or zebra)			
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	2I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Pedestrian link	1P		Wayfinding, Lighting, Remove staples		Yes	
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples		Yes	Offers a significant shortcut for pedestrians here for a large area of residents in very close proximity to station
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Commercial Driveway	1D		New threshold treatment with pedestrian and cycling priority, Reduce side street crossings with kerb build outs	Yes		
Commercial Driveway	2D		New threshold treatment with pedestrian and cycling priority, Reduce side street crossings with kerb build outs	Yes		

Table 14-21: Manukau and Ronwood Stations: total cost estimate $19,300,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path	Yes		Ensure Ronwood west of Davies Ave has cycle paths integrated
Mid-block	2M		Add missing cycle / micromobility path	Yes		Ensure Ronwood west of Davies Ave has cycle paths integrated
Mid-block	3M		Add missing cycle / micromobility path		Yes	All residents in the east and south must move along this corridor to reach Manukau and the station
Mid-block	4M		Add missing cycle / micromobility path		Yes	All residents in the east and south must move along this corridor to reach Manukau and the station
Mid-block	5M		Add missing cycle / micromobility path	Yes		
Mid-block	6M		Add missing cycle / micromobility path	Yes		
Mid-block	7M		Add missing cycle / micromobility path			
Mid-block	8M		Add missing cycle / micromobility path			
Mid-block	9M		Add missing cycle / micromobility path			
Mid-block	10M		Add missing cycle / micromobility path			
Commercial Driveway	1D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)	Yes		
Commercial Driveway	2D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)	Yes		
Commercial Driveway	3D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)			
Commercial Driveway	4D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings , Left in-left out only (New central raised median)			
Commercial Driveway	5D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings	Yes		
Commercial Driveway	6D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			

Commercial Driveway	7D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			
Commercial Driveway	8D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			
Commercial Driveway	9D		New threshold treatment with pedestrian and cycling priority, Reduce width of crossings			
Side Street	1S		Kerb extensions with island diverter for vehicles (Exit or entry only), Left in-left out only (New central raised median)		Yes	As above, these access points must be crossed by vulnerable modes to reach the station
Side Street	2S		New modal filter (Close street to cars)		Yes	As above, these access points must be crossed by vulnerable modes to reach the station
Side Street	3S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)	Yes		
Side Street	4S		Reduce side street crossings with kerb build outs, Left in-left out only (New central raised median)			
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection	Yes		
Intersection	2I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection		Yes	All residents in the south need to move through here to access Manukau and the station
Intersection	3I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection		Yes	
Intersection	4I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection		Yes	All residents in the east must move through this intersection due to the motorway corridor
Intersection	5I		Ensure pedestrian crossing on all arms of intersection , Create cycle protection through intersection, Reduce number of traffic lanes	Yes		
Intersection	6I		Ensure pedestrian crossing on all arms of intersection , Create cycle protection through intersection, Reduce number of traffic lanes	Yes		

Intersection	7I		Create cycle protection through intersection, Reduce lane width	Yes		
Intersection	9I		Ensure pedestrian crossing on all arms of intersection , Create cycle protection through intersection, Reduce number of traffic lanes, Remove slip lanes	Yes		
Intersection	11I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection	Yes		
Intersection	13I		Remove slip lanes, Create cycle protection through intersection, Ensure pedestrian crossing on all arms of intersection, Reduce number of traffic lanes			
Intersection	15I		Remove slip lanes, Create cycle protection through intersection, Ensure pedestrian crossing on all arms of intersection	Yes		
Intersection	12I		Remove slip lanes	Yes		
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			This path includes a section through Pak'n Save carpark
Crossing facility	1C		New controlled midblock crossing (signals or zebra)			

Table 14-22: Diorella Station – total cost estimate $3,300,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path			Connection to Redoubt Road proposed infrastructure
Mid-block	2M		Add missing cycle / micromobility path			Connection to Redoubt Road proposed infrastructure
Side street	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	2S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	3S		New modal filter (Close street to cars)		Yes	Access for vehicles here complicates intersection. Recommend closing to vehicles and providing access through for active modes only
Side street	4S		New modal filter (Close street to cars)		Yes	Access for vehicles here complicates intersection. Recommend closing to vehicles and providing access through for active modes only
Side street	5S		Left in-left out only (New central raised median)			
Side street	6S				Yes	Directly next to the station area. Need to remove vehicles movements that are particularly dangerous for active modes, which are uncontrolled right turns
Side street	7S					Provide a key entry point into the 'low traffic neighbourhood area'
Side street	8S					Provide a key entry point into the 'low traffic neighbourhood area'
Side street	9S				Yes	Provide a key entry point into the 'low traffic neighbourhood area' and safety across this side street is important due to proximity to station and large resident catchment that need to move through this point
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			

Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Intersection	1I		Create a slow speed accessible roundabout, integrate safe crossing on all legs for pedestrians and cycling, Integrate separated cycle paths around whole roundabout			
Intersection	2I		Remove slip lanes, reduce number of traffic lanes, Create cycle protection through intersection	Yes		

Table 14-23: Dawson Station: total cost estimate $7,000,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block intervention	1M		Add missing cycle / micromobility path			
Mid-block intervention	2M		Add missing cycle / micromobility path			
Mid-block intervention	3M		Add missing cycle / micromobility path			
Mid-block intervention	4M		Add missing cycle / micromobility path			
Mid-block intervention	5M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block intervention	6M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Side street treatment	1S		New modal filter (Close street to cars)			
Side street treatment	2S		New threshold treatment with pedestrian and cycling priority		Yes	
Side street treatment	3S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street treatment	4S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			Provide a key entry point into the 'low traffic neighbourhood area'
Crossing facility intervention	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	2C		Upgrade midblock crossing		Yes	
Crossing facility intervention	3C		Upgrade midblock crossing			

Crossing facility intervention	4C		Upgrade midblock crossing			Currently a signal crossing- just needs to be integrated with new cycle paths
Crossing facility intervention	5C		Upgrade midblock crossing			
Crossing facility intervention	**6C**		New controlled midblock crossing (signals or zebra)			
Intersection	1I		Create cycle protection through intersection, Reduce number of traffic lanes			
Intersection	2I		Create signals, Ensure traffic arms on each arm, Create cycle protection through intersection		Yes	
Intersection	3I		Create roundabout			
Intersection	4I		Create roundabout			
Pedestrian link intervention	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	2P		Wayfinding, Lighting, Remove staples		Yes	Offers a significant short cut for pedestrians here for a large area of residents in very close proximity to station
Pedestrian link intervention	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	5P		Wayfinding, Lighting, Remove staples			

Table 14-24: Ormiston station: total estimated cost $5,000,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block intervention	1M		Add safe hit posts and painted buffer onto existing cycle lane			
Mid-block intervention	2M		Add safe hit posts and painted buffer onto existing cycle lane			
Mid-block intervention	3M		Add safe hit posts and painted buffer onto existing cycle lane		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block intervention	4M		Add safe hit posts and painted buffer onto existing cycle lane		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Side street treatment	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority		Yes	Wide uncontrolled intersection - could be signalised to include crossing across Ormiston RD
Side street treatment	2S		New modal filter (Close street to cars)		Yes	This intervention supports new behaviours for traffic movements through this neighbourhood area, which will support safer and more attractive active mode movement
Side street treatment	3S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street treatment	4S				Yes	
Side street treatment	5S					Reduce intersection radii so slower speeds can be achieved for turning vehicles
Side street treatment	6S				Yes	Access to become out here only onto Te Irirangi Dr. This access point is very close to station area, do not want fast moving cars turning off Te Irirangi Dr onto shopping area
Pedestrian link intervention	1P		Wayfinding, Lighting, Remove staples			

Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	2I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	3I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			Important to improve to support movement and access from the suburbs in the west here
Intersection	4I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	5I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	6I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection			
Intersection	7I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection	Yes		
Crossing Facility	1C		New controlled midblock crossing (signals or zebra)			This could be integrated with 1S to become a signalised intersection OR could just be a signal pedestrian crossing located west of Michael Jones Drive
Crossing Facility	2C		New controlled midblock crossing (signals or zebra)			Safe connection for people to access the park and use the park as connection to station
Commercial Driveway	1D					This driveway is close to the station, so it is important to improve access across the driveway.
Commercial Driveway	2D					This driveway is close to the station, so it is important to improve access across the driveway.
Commercial Driveway	3D					This driveway is close to the station, so it is important to improve access across the driveway.
Commercial Driveway	4D				Yes	

Table 14-25: Accent Station: total estimated cost $2,800,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	2M		Add missing cycle / micromobility path		Yes	All residents from east and south will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	3M		Add shared path from buffer (between the property boundary and the kerb)		Yes	Provide a safe and comfortable route for business on the west of the corridor
Side street	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority		Yes	Close proximity to station
Side street	2S		New threshold treatment with pedestrian and cycling priority			
Side street	3S		New threshold treatment with pedestrian and cycling priority			
Crossing facility	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility	2C		New controlled midblock crossing (signals or zebra)	Yes		An existing overbridge is located here - We recommend rebuilding at-grade crossing
Crossing facility	3C		Upgrade midblock crossing			
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection, Ensure traffic arms on each arm			
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			

Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	6P		Wayfinding, Lighting, Remove staples			
Pedestrian link	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples, Create roundabout			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples, New threshold treatment with pedestrian and cycling priority			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	8P		Wayfinding, Lighting, Remove staples			

Table 14-26: Smales station: total cost estimate $7,900,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block	1M		Add missing cycle / micromobility path			
Mid-block	2M		Add missing cycle / micromobility path			
Mid-block	3M		Add missing cycle / micromobility path		Yes	All residents from west will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	4M		Add missing cycle / micromobility path		Yes	All residents from west will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	5M		Add missing cycle / micromobility path			
Mid-block	6M		Add missing cycle / micromobility path			
Mid-block	7M				Yes	All residents from the east will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Mid-block	8M				Yes	All residents from the east will need to travel along sections of this. Critical to provide both an alternative option of transport to the car or bus and to provide a buffer for pedestrians from the traffic along this road
Side street	1S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	2S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority			
Side street	3S		Left in-left out only (New central raised median), New threshold treatment with pedestrian and cycling priority		Yes	

Side street	4S				Yes	
Side street	5S				Yes	
Side street	6S				Yes	
Intersection	1I		Remove slip lanes, Reduce number of traffic lanes, Create cycle protection through intersection, Ensure traffic arms on each arm			
Intersection	2I		Create roundabout			Mini roundabout
Pedestrian link	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link	5P		Wayfinding, Lighting, Remove staples			
Pedestrian link	6P		Wayfinding, Lighting, Remove staples			
Pedestrian link	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link	8P		Wayfinding, Lighting, Remove staples			
Pedestrian link	9P		Wayfinding, Lighting, Remove staples			
Pedestrian link	10P		Wayfinding, Lighting, Remove staples			
Pedestrian link	11P		Wayfinding, Lighting, Remove staples		Yes	Providing direct access to station for adjacent residents
Pedestrian link	12P		Wayfinding, Lighting, Remove staples		Yes	Providing direct access to station for adjacent residents
Pedestrian link	13P		Wayfinding, Lighting, Remove staples			
Pedestrian link	14P		Wayfinding, Lighting, Remove staples			
Pedestrian link	15P		Wayfinding, Lighting, Remove staples			

Pedestrian link	16P		Wayfinding, Lighting, Remove staples			
Pedestrian link	17P		Wayfinding, Lighting, Remove staples			
Pedestrian link	18P		Wayfinding, Lighting, Remove staples			
Crossing facility	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility	2C		New controlled midblock crossing (signals or zebra)			
Crossing facility	3C		New controlled midblock crossing (signals or zebra)	Yes		An existing overbridge is located here - We recommend rebuilding at-grade crossing
Crossing facility	4C		New controlled midblock crossing (signals or zebra)	Yes		An existing underpass is located here - We recommend rebuilding at-grade crossing
Crossing facility	5C		New controlled midblock crossing (signals or zebra)	Yes		

Table 14-27: Botany Station total cost estimate: $14,300,000

Type	Label	Estimated cost	Details	Part of A2B corridor?	Enables enhanced access?	Notes
Mid-block intervention	1M		Add missing cycle / micromobility path			
Mid-block intervention	2M		Add missing cycle / micromobility path			
Mid-block intervention	3M		Add missing cycle / micromobility path	Yes	Yes	
Mid-block intervention	4M		Add missing cycle / micromobility path	Yes	Yes	
Mid-block intervention	5M		Add missing cycle / micromobility path			Neighbourhood area intervention
Mid-block intervention	6M		Add missing cycle / micromobility path			Neighbourhood area intervention
Mid-block intervention	7M		Add missing cycle / micromobility path		Yes	
Mid-block intervention	8M		Add missing cycle / micromobility path		Yes	
Mid-block intervention	9M		Add missing cycle / micromobility path			
Mid-block intervention	10M		Add missing cycle / micromobility path			
Mid-block intervention	11M		Add missing cycle / micromobility path			
Side street treatment	1S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)		Yes	To ensure priority and safety for active modes across these access points
Side street treatment	2S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)		Yes	To ensure priority and safety for active modes across these access points
Side street treatment	3S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	4S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	5S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention

Side street treatment	6S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	7S		Left in-left out only (New central raised median)			Neighbourhood area intervention
Side street treatment	8S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	9S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	10S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	11S		New threshold treatment with pedestrian and cycling priority			Neighbourhood area intervention
Side street treatment	12S		New threshold treatment with pedestrian and cycling priority, Left in-left out only (New central raised median)			
Side street treatment	13S		New threshold treatment with pedestrian and cycling priority			
Intersection	1I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	2I		Remove slip lanes, Create cycle protection through intersection, Reduce lane widths			
Intersection	3I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	4I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths	Yes	Yes	This is a significant barrier to access - Everyone who lives to the north an east of this intersection has to move through it to access the services in Botany and the station
Intersection	5I		Remove slip lanes, Create cycle protection through intersection, Ensure traffic arms on each arm, Reduce number of traffic lanes and widths		Yes	Everyone who lives to the north of this intersection has to move through it to access the services in Botany and the station
Intersection	6I		Plant the roundabout + increase the size of the inner circle + reduce side street crossing distance			Neighbourhood area intervention

Intersection	7I		Plant the roundabout + increase the size of the inner circle + reduce side street crossing distance			Neighbourhood area intervention
Intersection	8I		Plant the roundabout + increase the size of the inner circle + reduce side street crossing distance			Neighbourhood area intervention
Intersection	9I		Create cycle protection through intersection			
Intersection	10I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	11I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths			
Intersection	12I		Remove slip lanes, Create cycle protection through intersection, Reduce number of traffic lanes and widths	Yes		
Crossing facility intervention	1C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	2C		New controlled midblock crossing (signals or zebra)		Yes	Important to support movement into the Botany centre from the east suburbs
Crossing facility intervention	3C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	4C		New controlled midblock crossing (signals or zebra)			
Crossing facility intervention	5C		New controlled midblock crossing (signals or zebra)			
Pedestrian link intervention	1P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	2P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	3P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	4P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	5P		Wayfinding, Lighting, Remove staples			

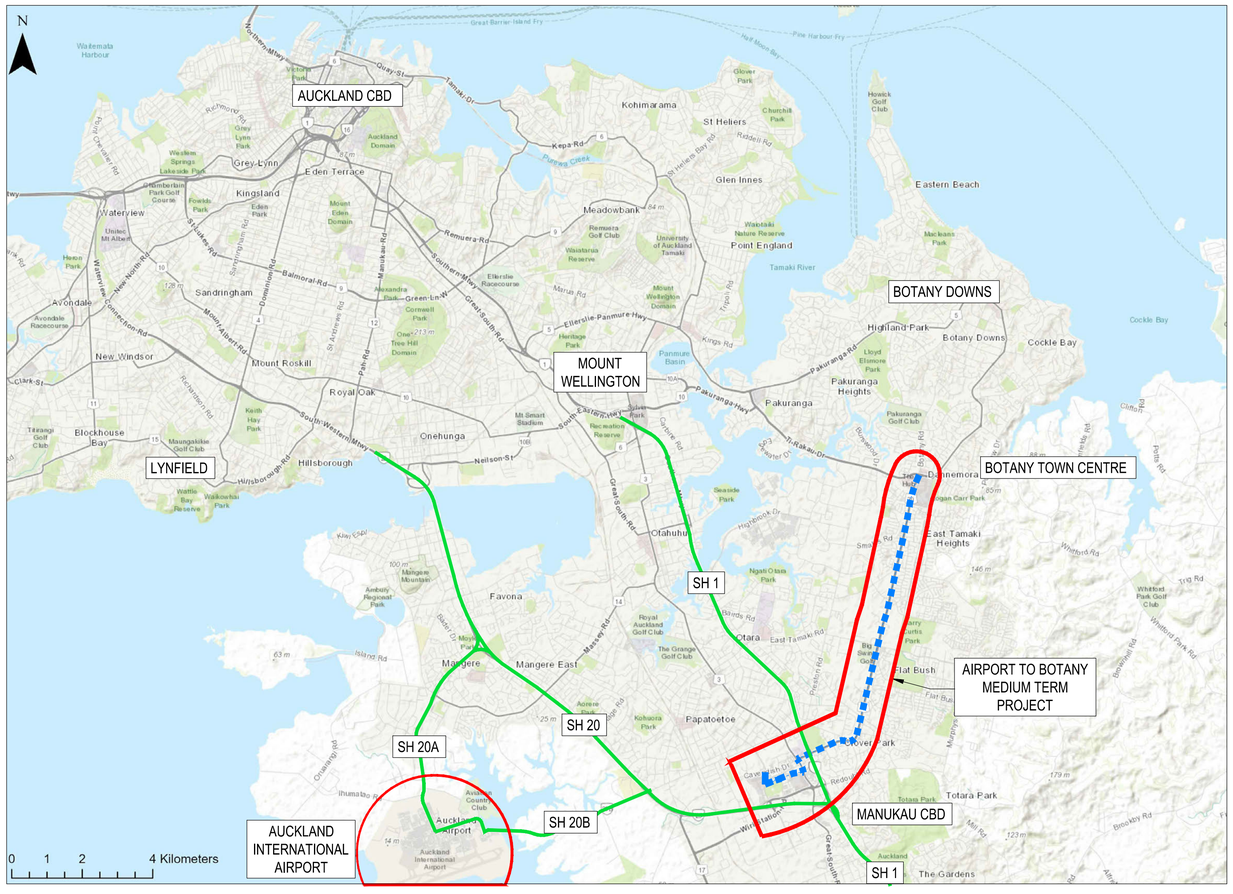
Pedestrian link intervention	6P		Wayfinding, Lighting, Remove staples		Yes	Direct connection from neighbourhood area into station area, important to support walking trips
Pedestrian link intervention	7P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	8P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	9P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	10P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	11P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	12P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	13P		Wayfinding, Lighting, Remove staples			
Pedestrian link intervention	14P		Wayfinding, Lighting, Remove staples			
Commercial Driveway	1D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority	Yes		
Commercial Driveway	2D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority	Yes		
Commercial Driveway	3D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority			
Commercial Driveway	4D		Reduce side street crossings with kerb build outs, New threshold treatment with pedestrian and cycling priority, Left in left only (New central raised median)			

Appendix B

Refined Bus Priority Option Concept Drawings

AUCKLAND TRANSPORT

AIRPORT TO BOTANY
MEDIUM TERM
BUS CORRIDOR



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PRELIMINARY
NOT FOR CONSTRUCTION

SIZE	DATE	DRAWING No.	PROJECT No.	WBS	TYPE	DISC	NUMBER	REV
A1	12/05/2020		502334	8000	DRG	RR	0001	A

Rev Date: 2020-05-12 13:39:00 Office: Auckland Filename: pw:\designshare.au.aurecon.info:PW_AUDC1_01\Documents\Projects\502xxx\502334 - Airport to Botany RTC, SSBC\c3\Deliver Design\502334-8000-DRG-RR-0001.dwg

DRAWING INDEX: ROADS & ROADSIDE FEATURES

DRG No.	REV	TITLE
502334 8000 DRG RR 0001	A	DRAWING COVER SHEET
502334 8000 DRG RR 0002	A	DRAWING INDEX SHEET
502334 8000 DRG RR 0100	D	PREFERRED OPTION - GENERAL ARRANGEMENT KEY PLAN
502334 8000 DRG RR 0101	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 1
502334 8000 DRG RR 0102	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 2
502334 8000 DRG RR 0103	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 3
502334 8000 DRG RR 0104	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 4
502334 8000 DRG RR 0105	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 5
502334 8000 DRG RR 0106	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 6
502334 8000 DRG RR 0107	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 7
502334 8000 DRG RR 0108	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 8
502334 8000 DRG RR 0109	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 9
502334 8000 DRG RR 0110	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 10
502334 8000 DRG RR 0111	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 11
502334 8000 DRG RR 0112	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 12
502334 8000 DRG RR 0113	D	PREFERRED OPTION - GENERAL ARRANGEMENT PLAN SHEET 13

CLIENT

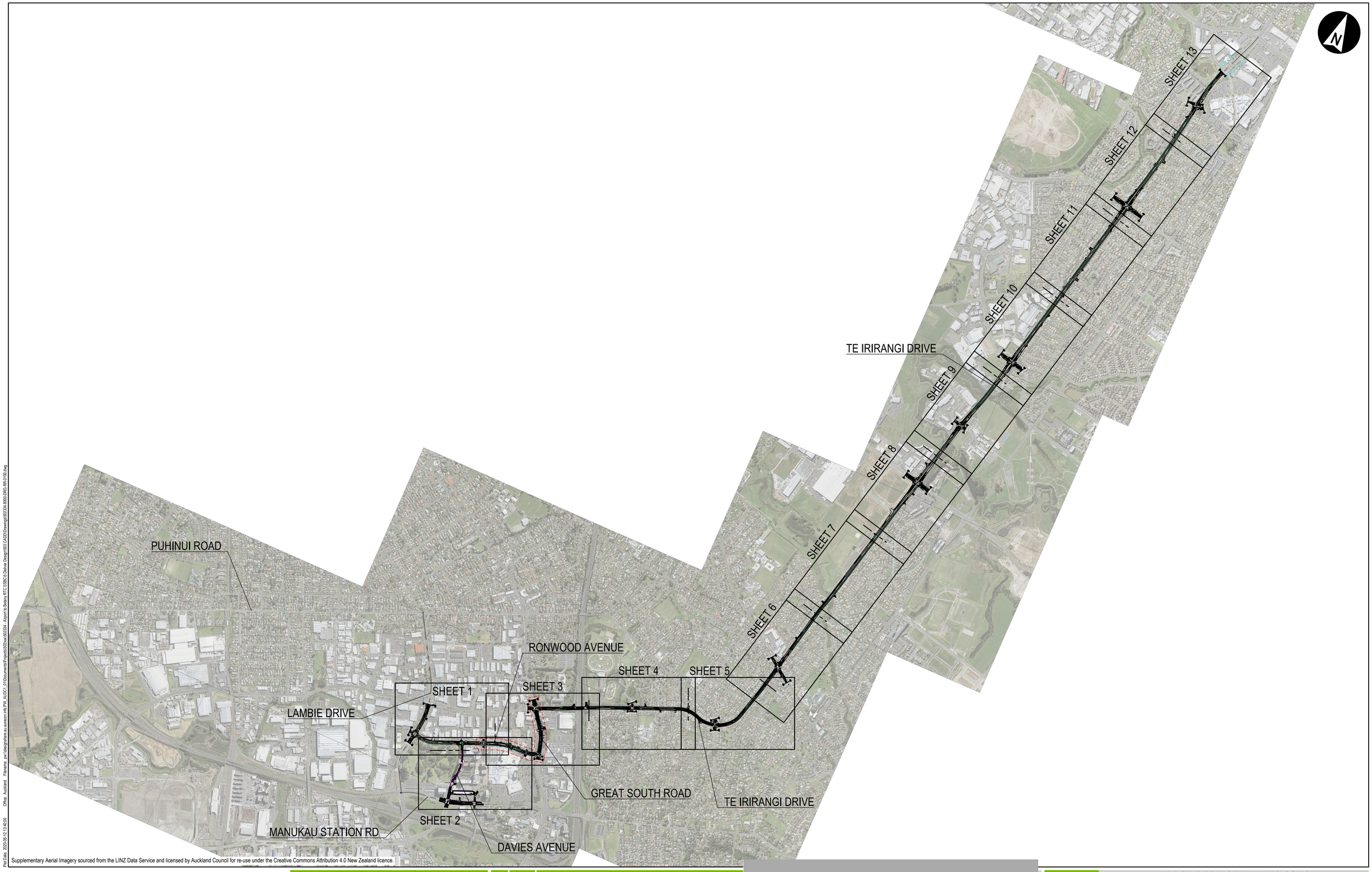
REV	DATE	REVISION DETAILS
A	12.05.20	ISSUED FOR INFORMATION

PROJECT: AIRPORT TO BOTANY RTC SSBC

TITLE: MEDIUM TERM OPTION
DRAWING INDEX

DRAWING No.

PROJECT No.	WBS	TYPE	DISC	NUMBER	REV
502334	8000	DRG	RR	0002	A



CLIENT

REV	DATE	REVISION DETAILS
A	12.05.20	ISSUED FOR INFORMATION

PROJECT	AIRPORT TO BOTANY RTC SSBC
TITLE	MEDIUM TERM OPTION GENERAL ARRANGEMENT PLAN KEY PLAN

DRAWING No.	PROJECT No.	WBS	TYPE	DISC	NUMBER	REV
	502334	8000	DRG	RR	0100	A

Appendix C

Cost Estimate

TRUE-COST
CONSTRUCTION COST CONSULTANTS

A2B Medium Term Bus Corridor

Business Case Estimate

Prepared for:

Aurecon

Issued date:

1/10/2020

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2.0 BASIS OF ESTIMATE

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2.3 Contingency and Funding Risk 6
2.4 Estimate Allowances 7
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Appendices

Appendix A Project Estimate Summary
Appendix B Detailed Estimate

Revision History

1.0	Draft Issued to Aurecon.	22-May-2020
2.0	Final Issued to Aurecon.	01-Oct-2020

Verification

Internal Peer Rev

1.0 INTRODUCTION

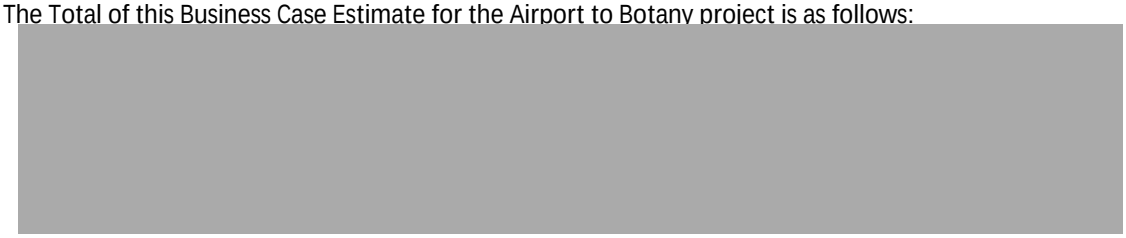
1.0 EXECUTIVE SUMMARY

This Business Case Estimate prepared by Truecost Ltd is for the Airport to Botany project and is based on design completed to date. The estimate has been prepared for Aurecon to confirm the financial cost of constructing the project.

The project involves the construction of a Rapid Trasport bus network between Manakau and Botany Town Centre forming part of the Airport to Botany Rapid Transit project.

The estimate is based on outlined information supplied by Aurecon NZ within Email dated 4-09-2019 including Drawings and Outline Specification.

The Total of this Business Case Estimate for the Airport to Botany project is as follows:



As limited documentation has been provided the Business Case Estimate contains a number of assumptions based on historic projects of similar nature, therefore refer to the 'Preambles' section of the estimate for allowances made in the preparation of this estimate.

2.0 BASIS OF ESTIMATE

2.1 Methodology

This Business Case Estimate prepared by Truecost Ltd for the Airport to Botany project has been compiled using best practice procedure in accordance with estimation manuals and methods of measurements. The Business Case Estimate has been broken down into elemental format where the main design elements of the design were quantified to reflect the level of detail shown within the design drawings and documents provided.

NZTA's "Cost Estimation Manual" (SMO14) has been used for the elemental layout of the Civil works of the estimate, the objectives of the manual are to set out the standards for cost estimation in a best practice manner that meets industry goals.

NZS 4224:1983 "Code of practice for measurement of civil engineering quantities" has been used for quantity measurement of civil work in preparation of the items within the elemental sections of the Business Case Estimate estimate.

Generally the following methodology guidelines have been used when preparing the Business Case Estimate for the Airport to Botany project:

- Gather all project documentation that may impact on the cost of the project,
- Define the scope of work and translate into a schedule of quantities,
- Define the construction methodology and program and translate into a schedule of quantities,
- Gather estimated rates/allowances and ensure they are reasonable/appropriate for the item of work they apply to,
- Undertake an arithmetical check,
- Determine the contingency and funding risk allowances,
- Review the appropriateness of the output result,
- Define the assumptions made,
- Prepare a report summarising the estimate methodology, findings and recommendations.

Upon Truecost Ltd's completion of the DRAFT Business Case Estimate, a copy was sent to Aurecon for a detailed review of the scope of work and to verfy that the estimate scope of work has been correctly translated into the schedule of quantities.

2.2 Purpose

The Purpose of the Business Case Estimate for the Airport to Botany project is for:

- Financial Planning/Funding: Stakeholders require cost estimates of all projects to help with long-term/short-term financial planning. The Expected estimate is used for economic analysis, the Risk Contingency estimate is used for sesitivity testing of the "Benefit Cost Ratio" (BCR),

- Programming: Stakeholders use the Programme Business Case for funding prioritisation based on the allocation process. Stakeholder's use of the BCR requires reliable estimates of cost throughout the development of projects to optimise planning and delivery timeframes,

- Option Selection: The cost estimates of options are used to select the preferred option for the development of each project,

- Project Specification: Stakeholders use cost estimates to determine appropiate standards and mitigation measures to be adopted for each project,

- Cost Control: To maintain optimal programme performance, cost estimates need to be continually updated during the project delivery.

2.3 Contingency and Funding Risk

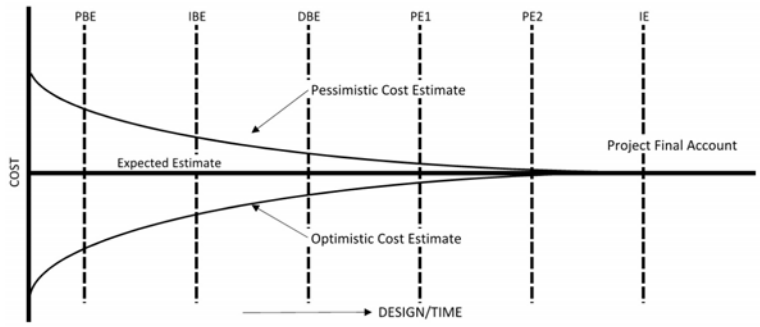
No formal risk assement has been completed for the Business Case Estimate for the Airport to Botany project, therefore a contingency value of 30% has been applied to the Base Estimate and used to calculate the Expected Estimate.

A futher assessment has been completed for the Funding Risk Contingency and a value of 20% has been applied to the Base Estimate to calculate the 95th percentile Estimate*.

It is worth noting that the resultant Expected Estimate and the 95th Percentile Estimate contingencies are typical for cost estimates undertaken at the Business Case Estimate stage of the design process. This is based on the experience of the Engineers and Quantity Surveyors team for the potential cost consequence of risks such as design development, scope creep, contractor's claims/variations and residual pricing risk.

In line with acceptable estimation limitations the Business Case Estimate for the Airport to Botany project has a level of accuracy of minus 15% to plus 20%.

The below graph shows the estimate lifecycle and provides the percived amount of risk at each stage of the estimates lifecycle.



(The 95th percentile estimate means statistically 95% of projects' out turn cost will be below this figure and 5% will be above it)

2.4 Estimate Allowances

The following allowances have been included in the 'Project Development Phase - Investigation and Reporting' section of the Business Case Estimate for the Airport to Botany project:

- Consultancy fees of 3% of the base Physical Works,
- Stakeholder Managed Costs of 1.5% of the base Physical Works.

The following allowances have been included in the 'Pre-implementation Phase - Design & Project Documentation' section of the Business Case Estimate for the Airport to Botany project:

- Consultancy fees of 9.5% of the base Physical Works,
- Stakeholder Managed Costs of 2% of the base Physical Works,

The following allowances have been included in the 'Implementation Fees - MSQA' section of the Business Case Estimate for the Airport to Botany project:

- Consultancy fees of 3% of the base Physical Works,
- Stakeholder Managed Costs of 1.5% of the base Physical Works,
- Consent Monitoring Fees of 1.5% of the base Physical Works.

The following general allowances have been included in the 'Implementation - Physical Works' section of the Business Case Estimate for the Airport to Botany project:

- Main Contractor on-site Preliminary and General cost of 25% of the physical works,
- Main Contractor off-site overheads and margin of 12.5% of the physical works,
- For detailed allowances within the estimates refer to the 'Preambles' section of the estimate.

2.5 Estimate Exclusions

The following has been excluded in the Business Case Estimate for the Airport to Botany project:

- Asbestos and contaminated material removal and disposal,
- Rock excavation and disposal,
- Escalation from the time of the estimate,
- Sunk costs,
- Finance costs.
- Reserve Contribution,
- Legal fees,
- Cost share agreements,
- Future-proofing
- Goods and Services Tax (GST)

APPENDIX A

PROJECT ESTIMATE SUMMARY

PROJECT ESTIMATE SUMMARY

APPENDIX B

TRUE-COST
CONSTRUCTION COST CONSULTANTS
32/852 Mt EDEN RD, AUCKLAND
021 497 775

DETAILED ESTIMATE

Code	Description	Quantity	Unit	Rate	Total
	PREAMBLES				
	General Preambles				
A-1	NZS 4224:1983 "Code of practice for measurement of civil engineering quantities" has been used for quantity measurement in preparation of this estimate		note		
A-2	NZTA SMO14 "Cost Estimation Manual" has been used for the preparation of this estimate		note		
A-3	As limited documentation has been provided for this estimate, it is based on design assumptions from the civil/structural engineer and the experience of the Quantity Surveyor based on historic projects of similar nature		note		
A-4	In line with acceptable NZTA estimation limitations this estimate has a level of accuracy of minus 12.5% to plus 25%		note		
A-5	This estimate assumes the work is to be competitively tendered		note		
	Allowances				
A-6	Project Development Consultancy fees of 3.0% of the Nett Physical Works (excl P&G) value		note		
A-7	Project Development Stakeholder Managed Costs of 3.0% of the Nett Physical Works (excl P&G) value		note		
A-8	Pre-implementation Consultancy Fees of 9.5% of the Nett Physical Works (excl P&G) value		note		
A-9	Pre-implementation Stakeholder Managed Costs of 3.0% of the Nett Physical Works (excl P&G) value		note		
A-10	Implementation Consultancy Fees (MSQA) of 4.0% of the Nett Physical Works (excl P&G) value		note		
A-11	Implementation Stakeholder Managed Costs (MSQA) of 2.0% of the Nett Physical Works (excl P&G) value		note		
A-12	Implementation Main Contractor MSQA Fees of 2.0% of the Nett Physical Works (excl P&G) value		note		
A-13	On-Site Preliminary and General cost of 18% of the Nett Physical Works		note		
A-14	Off-Site overheads and Margin 12% of the Nett Physical Works		note		
A-15	Design development of 5% of the direct costs		note		
	Exclusions				
A-16	Property Purchase Costs		note		
A-17	Property Compensation Costs		note		
A-18	Property Owner Accommodation Works		note		
A-19	Asbestos and Contaminated material removal and disposal		note		
A-20	Rock excavation and disposal		note		

A2B Medium Term Bus Corridor — Business Case Estimate

Code	Description	Quantity	Unit	Rate	Total
A-21	Local Authority Fees		note		
A-22	Escalation from the time of this estimate		note		
A-23	Sunk costs		note		
A-24	Finance costs		note		
A-25	Legal fees		note		
A-26	Cost share agreements		note		
A-27	Future-proofing costs		note		
A-28	Goods and Services Tax (GST)		note		
	PREAMBLES				**0**

A2B Medium Term Bus Corridor — Business Case Estimate

Code	Description	Quantity	Unit	Rate	Total
	NETT PROJECT PROPERTY COST				
	Property purchase costs				
B-1	Allowance for property purchase costs	1	item		Excl
	Property compensation costs				
B-2	Allowance for property compensation costs	1	item		Excl
	Property Owner Accommodation works				
B-3	Allowance for property owner accommodation works	1	item		Excl
	NETT PROJECT PROPERTY COST				**0**

DETAILED ESTIMATE

DETAILED ESTIMATE

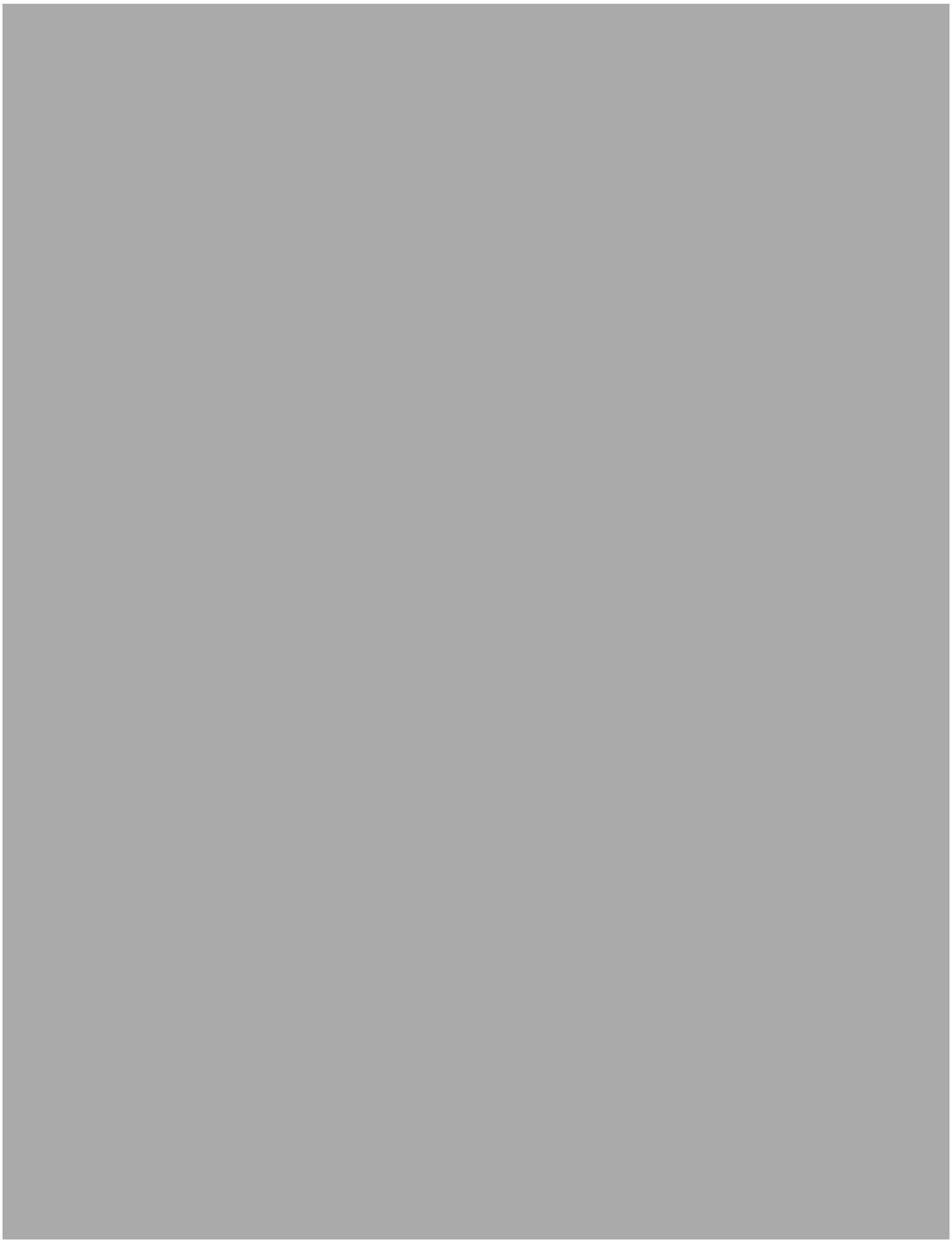
DETAILED ESTIMATE

DETAILED ESTIMATE

DETAILED ESTIMATE

DETAILED ESTIMATE

DETAILED ESTIMATE



DETAILED ESTIMATE

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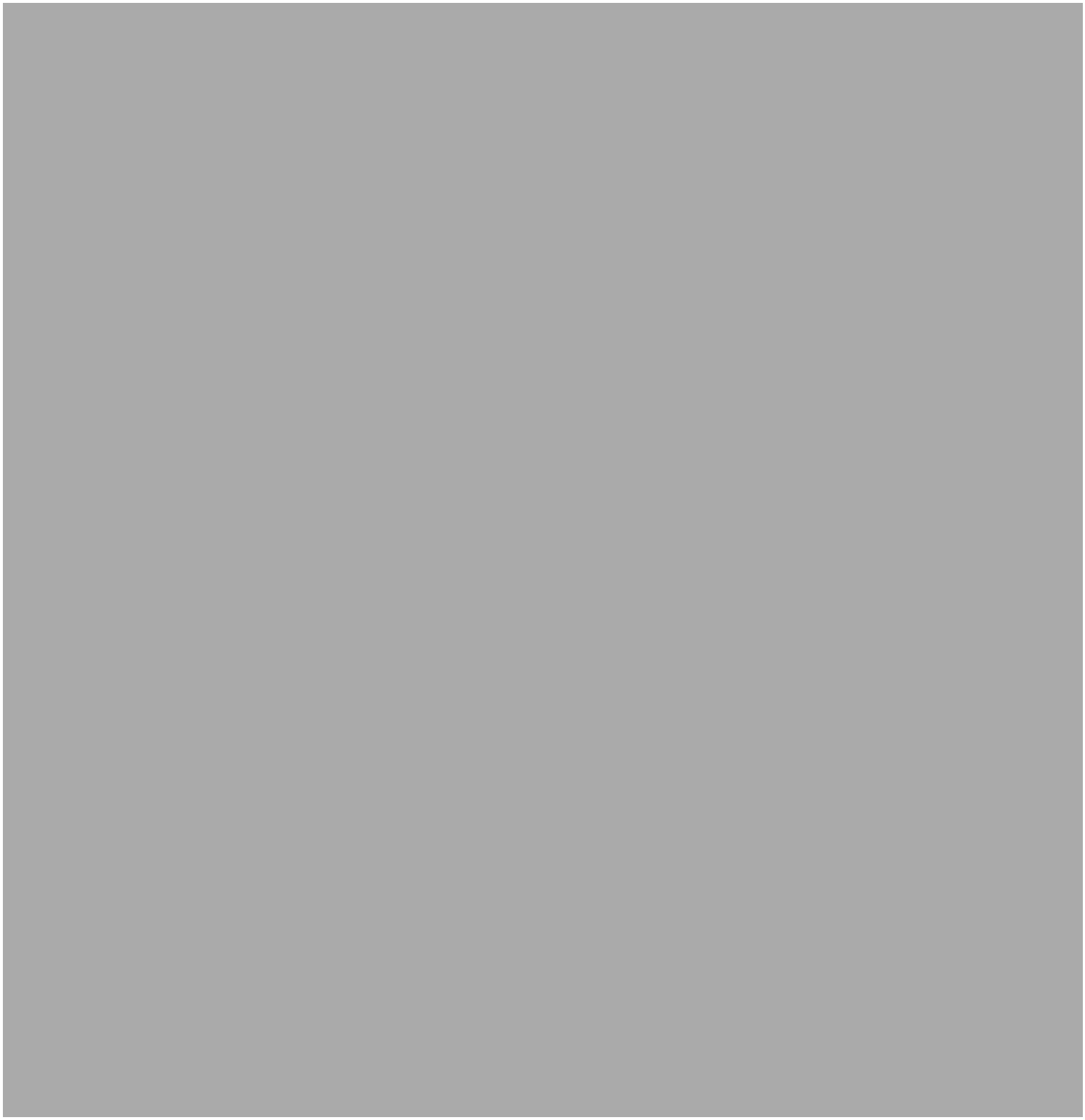
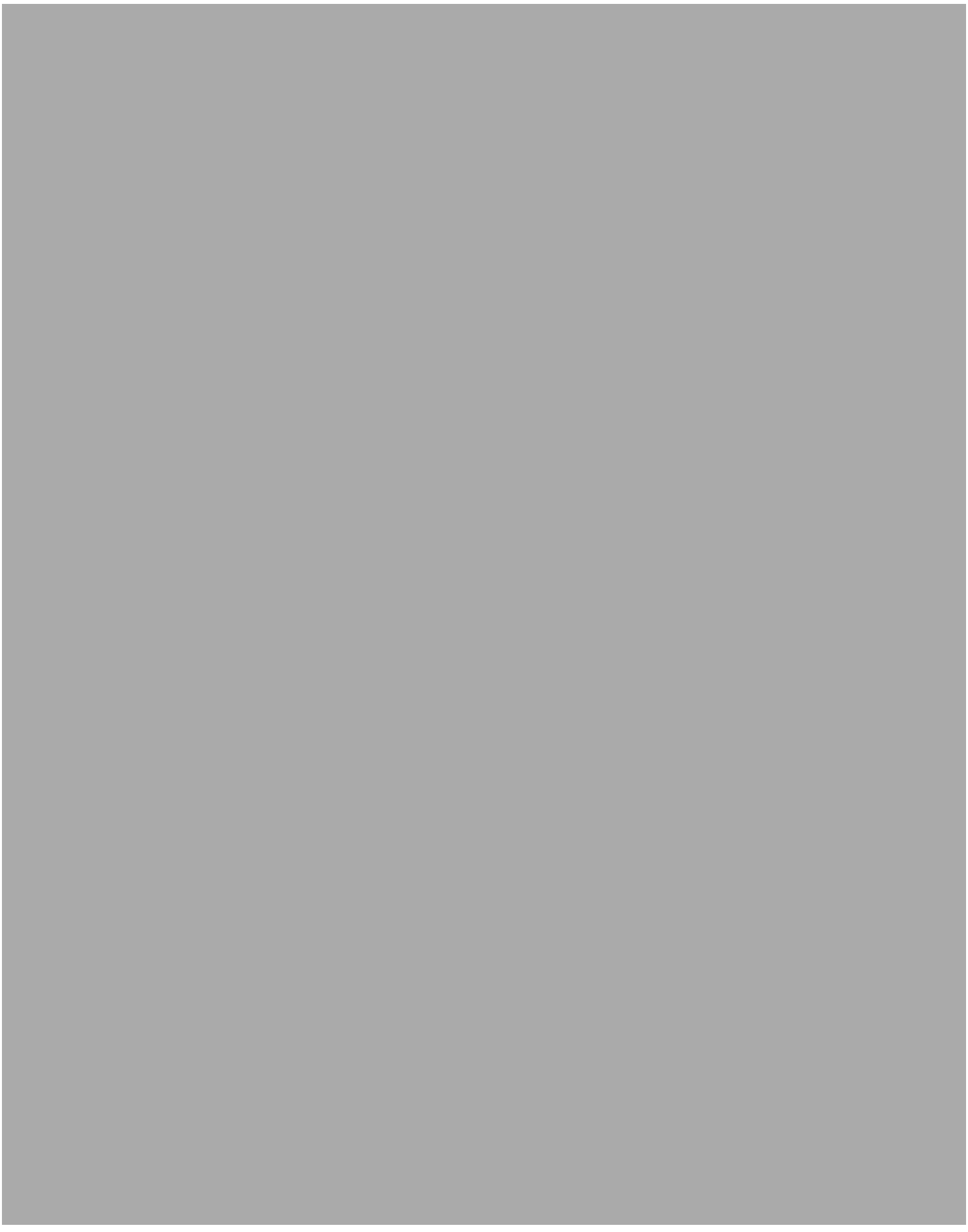


DETAILED ESTIMATE

DETAILED ESTIMATE



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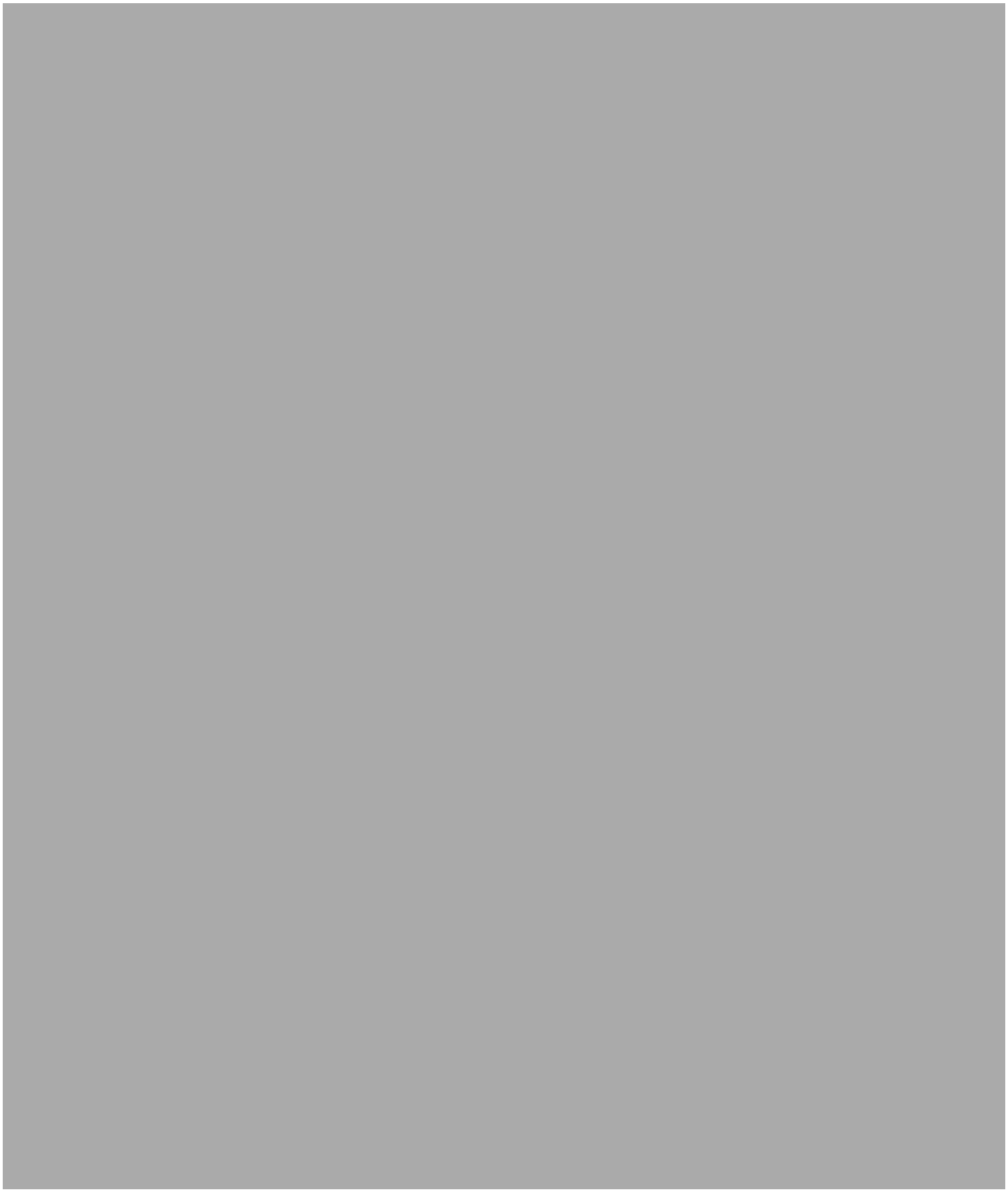

Appendix D

Planning and Consenting Report

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Technical Note

To	**Auckland Transport**	From	[redacted]
Copy	[redacted]	Reference	**502334-8000-TEC-NN-0003**
Date	**22/05/2020**	Pages (including this page)	**11**
Subject	**Medium Term Consenting Strategy – A2B**		

1 Introduction

This is a Consenting Strategy for 'Horizon 2 – Medium Term Airport Access Improvement Programme' (Figure 1). Auckland Transport (AT) are to deliver by 2025 bus priority improvements with interim bus stations between Botany and Manukau. Botany Station is to be constructed as part of the Auckland Manukau Eastern Transport Initiative (AMETI) / Eastern Busway Alliance (EBA).

The medium-term works are confined to within the existing road corridor. The preferred option for the works will include converting existing traffic lanes and on-street parking into transit lanes.

The medium-term works will include high quality station amenities such as bespoke bus shelters, CCTV, passenger information boards, street lighting, landscaping and wide platforms/footpaths leading into stations. Pedestrian safety will also be improved through the construction of raised zebra crossings. More detail on medium-term works can be found within the 'Medium Term Strategy'.

Throughout the Medium-Term Consenting Strategy, it is assumed that no property acquisition will occur.

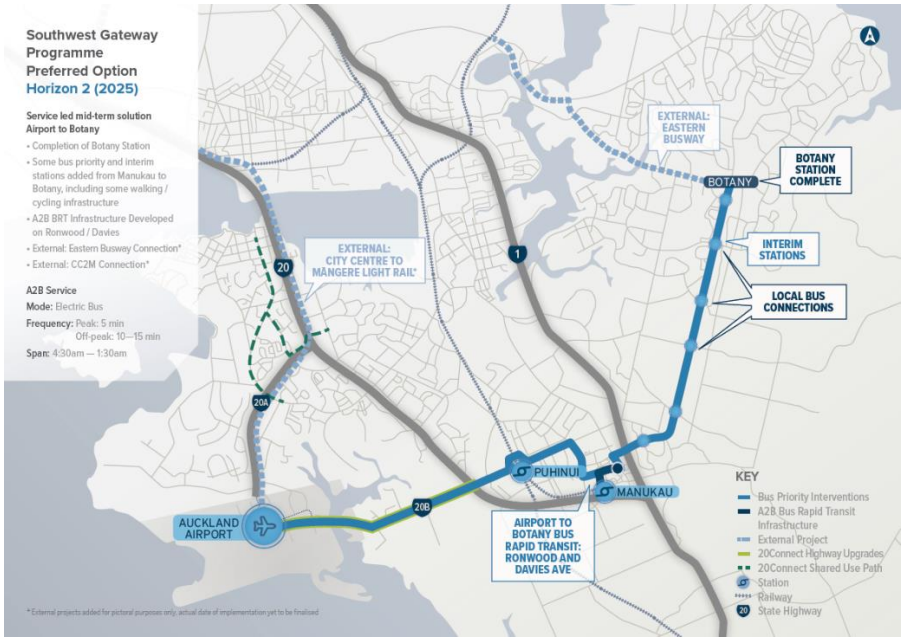

Figure 1: Horizon 2 Medium Term Airport Access Improvement Programme

2 Planning and Site Considerations

There are a range of planning and site considerations for the medium-term works.

Overlays and Controls

The project area is subject to or adjacent to the following overlays and controls within the AUP:

Overlay	Location within the Project area
Aircraft Noise Overlay	Applicable to the entire project area south of the intersection of Tonu-U Court and Te Irirangi Drive.
National Grid Corridor	This overlay intersects different parts within the project area: ■ The intersection with Ti Rakau Drive and Te Irirangi Drive ■ Along Te Irirangi Drive from 213 Te Irirangi Drive Clover Park to 199 Te Irirangi Drive Clover Park ■ Along Te Irirangi Drive from 142 Te Irirangi Drive Clover Park to Orlando Reserve ■ Along Te Irirangi Drive from the Manukau Velodrome to Great South Road
National Grid Corridor (National Grid Yard)	This overlay intersects different parts within the project area: ■ Along Te Irirangi Drive from 213 Te Irirangi Drive Clover Park to 199 Te Irirangi Drive Clover Park ■ Along Te Irirangi Drive from 142 Te Irirangi Drive Clover Park to Orlando Reserve ■ The intersection with Te Irirangi Drive and the SH1 Motorway Off-Ramp
High-Use Aquifer Management Area Overlay	Applicable to the project area South/Southwest of the intersection with Te Irirangi Drive and the SH1 Motorway Off-Ramp.
High-Use Stream Management Area Overlay	Applicable to the project area South/Southwest of Great South Road (including Ronwood Avenue, Davies Avenue, Lambie Drive and Manukau Station Road).
Arterial Road Control	Along Te Irirangi Drive, Great South Road and Manukau Station Road
Stormwater Management Control Area Flow 2	The entire project area South/Southwest from the intersection of Te Irirangi Drive and Great South Road.

Macroinvertebrate Community Index	Entire project area.
Height Variation Control	There are two different height variation controls (East Tamaki 22.5m and 27m) on the northern section of Te Irirangi Drive
Building Frontage Control	This control occurs at different areas along the project route: ■ General commercial frontage control on the northern section along Te Irirangi Drive. ■ General commercial frontage along Ronwood Avenue, Great South Road, Davies Avenue, Manukau Station Road and part of Lambie Drive.
Vehicle Access Restriction Control	This is applicable for a section on Lambie Drive and the intersection of Irirangi Drive and the SH1 Southern Motorway Off-Ramp.

Of particular relevance is the Stormwater Management Control Area Flow 2 which is discussed further below.

Designations

Several designations apply to the land within or directly adjacent to the Project Area:

Requiring Authority	Designation	Location within the Project area	Purpose
Auckland International Airport Ltd	1102 Airspace Restriction Designation	Located over the entire project area	Protection of aeronautical functions – obstacle limitation surfaces
Transpower New Zealand	8516 Electricity transmission	Along Te Irirangi Drive from Te Koha Road to Aclare Place	The construction, operation and maintenance of a double circuit underground 220kV cable as part of the upper North Island Grid Upgrade Project
Transpower New Zealand	8517 Electricity generation	Crosses Te Irirangi Drive near 310 Te Irirangi Drive Clover Park	The construction, operation and maintenance of a double circuit underground 220kV cable as part of the upper North Island Grid Upgrade Project

First Gas Limited	9104 Gas Transmission Pipeline	Crosses Te Irirangi Drive at the intersection with Smales Road	The operation, maintenance, upgrade and renewal of the existing gas transmission pipelines and all ancillary structures and activities.
Auckland Transport	1808 Road widening	On the corner of Ormiston Road and Te Irirangi Drive	Road widening
Auckland Transport	1802 Road widening	On the corner of Ormiston Road and Te Irirangi Drive	Road widening
Auckland Transport	1822 Ronwood Avenue car park	2 Davies Avenue	Public off-street parking, including ongoing maintenance, repairs and like for like replacement works to the existing parking facility and minor operational improvements to the same.
Auckland Transport	1817 Ronwood Avenue car park	8 Davies Avenue	Public off-street parking, including ongoing maintenance, repairs and like for like replacement works to the existing parking facility and minor operational improvements to the same.
Watercare Services Limited	9540 Water supply	Crosses Te Irirangi Drive at the intersection with Boundary Road	Water supply purposes – Hunua No4 watemain
New Zealand Transport Agency	6714 State Highway 1 improvements	Southern Motorway SH1 intersection with Te Irirangi Drive	To undertake maintenance, operation, use and improvement to the State Highway network
Minister for Tertiary Education, Skills and Employment	6102 AUT Manukau campus	640 Great South Road	Construction, undertaking, establishment, management, operation and maintenance of a tertiary educational facility

Section 176 (1)(b) of the RMA, states no person, without the prior written consent of that requiring authority, do anything in relation to the land that is subject to the designation that would prevent or hinder a public work or project or work to which the designation relates (i.e. Transpower New Zealand, First Gas Limited and Watercare Services Limited). It is unlikely the works would hinder or prevent these designations, however consultation with the requiring authorities noted above is recommended to confirm this.

3 Required Approvals and Analysis of Approval Methods

This section sets out the likely approvals required for the medium-term route. It considers:

- RMA approvals – including the AUP and relevant national environmental standards; and
- Other statutory approvals under Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA), and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011.

This list of statutory approvals should be reviewed and confirmed based on further information and detailed design during the pre-implementation phase.

3.1 Auckland Unitary Plan:

The AUP(OP) was made partially operative on 15 November 2016 and last updated 14 February 2020[1].

An important AUP section for these works is 'E26 Infrastructure'. The objectives of this chapter include allowing the development, maintenance, upgrading and renewal of infrastructure, while ensuring the resilience of infrastructure is improved and continuity of service is enabled. It also highlights the social, economic, cultural and environmental benefits that infrastructures provide. E26 aims to ensure all road networks in the Auckland region provide for the needs of all road users and modes of transport, while maintaining and enhancing the safety and efficiency of the transport network.

Specific to this project, Rule E26.2.3.2 (A70) states that public amenities within the existing un-zoned road network are permitted activities, if they comply with the standards in E26.2.5.4. The standards under E26.2.5.4 require the following:

- Temporary works, buildings and structures must be removed from the road on completion of works;
- After completion of works, the ground must be reinstated to at least the condition existing prior to any work starting;
- Working within the formation width of the road must be incidental to and serve a supportive function for the existing public road or is required for the safety of road users or is required for the safely of adjacent landowners or occupiers.
- Road network activities involving the construction, renewal or minor upgrading of road pavement (excluding footpaths), bridges, retaining walls and tunnels, that are within 20m of any building or structure that is listed as a primary feature in Schedule 14.1, shall prepare a vibration management plan.

[1] As of 20 May 2020.

Public amenities are defined as facilities established for the convenience of the amenity of the public, which include the following:

- Landscaping and planting;
- Bicycle stands and cycle parking structures;
- Rubbish bins;
- Drinking fountains;
- Directional signage and information boards;
- Lighting; and
- Shelters.

Furthermore, Chapters E8, E9 and E10 are also relevant for the medium-term works due to the effects it will have on stormwater. The objectives of these chapters are based on managing stormwater networks to protect public health and to prevent and minimise any adverse effects of contaminants on freshwater and coastal water quality. It also states that the best practicable option must be adopted to minimise the adverse effects of stormwater discharges from the stormwater network and the road network.

Specifically, chapter E10 relates to stormwater management area controls –Flow 2, which are applicable to various parts of the project. This control seeks to protect and enhance Auckland's rivers, streams and aquatic biodiversity in urban areas from development, the increases of impervious surfaces and changes in hydrology. Stormwater management area control – Flow 2 areas typically discharge to streams with moderate to high values and sensitivity to stormwater, but generally with higher levels of existing impervious area within the catchment. Chapter E10 aims to manage and minimise any adverse effects from stormwater runoff from impervious surfaces within the controlled areas. Where redevelopment or new impervious areas are created in the controlled areas, stormwater hydrology mitigation will be required.

The following provides a high-level summary of the potentially relevant regional and district plan rules under the AUP. This is not a comprehensive list.

Auckland Unitary Plan: Consent Triggers

Reference	Rule	Status	Comment
Rule E9.4.1 (A7) High contaminant generating car parks and high use roads.	Development of a new or redevelopment of an existing high use road greater than 5,0000m^2.	Controlled	The project will involve new impervious areas, while also redeveloping these surfaces on a high use road.
Rule E10.4.1 (A10) Stormwater management area – Flow 2	Development of new or redevelopment of existing impervious areas greater than 5,000m2 for a road, motorway or state highway operated by a	Discretionary	The project will involve creating new impervious areas, while also redeveloping these surfaces within the stormwater

	road controlling authority or rail corridor within Stormwater management area control - Flow 2 that does not comply with Standard E10.6.1 and Standard E10.6.4.2		management area controls - Flow 2. Standard E10.6.1 and Standard E10.6.4.2 relates to Hydrology Mitigation via stormwater management devices and/or system. Given space constraints in the road corridor it is best to assume the worst-case scenario. that this may not be feasible.

Auckland Unitary Plan: Relevant Permitted Activity Rules

Reference	Rule	Status	Comment
Rule E4.4.1 (A1) Other discharges of contaminants	Discharge of water and/or contaminants (including washwater) onto or into land and/or water from road construction activities.	Permitted	During construction, discharges of water and contaminants may occur from road construction activities.
Rule E8.4.1 (A1) Stormwater Discharge and Diversion	Diversion of stormwater runoff from lawfully established impervious areas directed into an authorised stormwater network or a combined sewer network that complies with Standard E8.6.2.1	Permitted	Stormwater discharges will be directed to the Council controlled network which operates under a Network Discharge Consent, please see 3.2 below.
Rule E17.4.1 (A9) Trees in Roads	Tree removal of any tree less than 4m in height and less than 400mm in girth	Permitted (otherwise Restricted Discretionary)	At the time of writing, no trees will be removed, however this rule is included in case any unexpected tree removal is required during works.
E25.4.1(A1) Noise and Vibration	Activities that comply with all the relevant	Permitted	The construction within the road corridor should be able to

	permitted activity standards		comply with standards E25.6.29 and E25.6.30[2]. The operational noise is in keeping with the existing urban character.
E26.2.3.1(A49) Utilities	Underground pipelines and ancillary structures for the conveyance of water, wastewater and stormwater (including above ground ancillary structures associated with underground pipelines)	Permitted	Alteration and additional underground pipelines maybe required.
Rule E26.2.3.2 (A67) Road Network Activities	Construction, operation, use, maintenance and repair of road network activities	Permitted	The changes to the public road network will be permitted activities.
Rule E26.2.3.2 (A70) Public amenities	Public amenities	Permitted	The new cycling facilities, signage, shelters and lighting etc associated with the works will be permitted where they are located within the public road network.
E26.4.3.1(A87) Works within the protected tree root zone	*Works within the protected root zone that comply with Standard E26.4.5.2*	Permitted (otherwise Restricted Discretionary)	At the time of writing this, no works within the protected root zone of street trees are proposed. However, as the design advances it is possible that compliance with this rule cannot be achieved.
E26.5.3.2(A95)	Earthworks up to 2500m^2 other than for	Permitted	Earthworks can be staged and

[2] Standards E25.6.29 and E25.6.30 are subject to PC14, which incorporates the vibration standards into standard E25.6.29 and shortens standard E25.6.30.

Earthworks	maintenance, repair, renewal, minor infrastructure upgrading.		progressively stabilised to maintain the activity within the permitted thresholds (less than 2,500m^2 at any one time) in accordance with the notation above activity table E26.5.3.
E26.5.3.2(A96) Earthworks	Earthworks up to 2500m^3 other than for maintenance, repair, renewal, minor infrastructure upgrading.	Permitted	Earthworks can be staged and progressively stabilised.
E26.5.3.2(A100)	Earthworks for maintenance, repair, renewal, minor infrastructure upgrading, service connections	Permitted	Earthworks will be required for the relocation and removal of utility structures and upgrades.

3.2 Network Discharge Consent:

Auckland Council holds a network discharge consent (DIS60069613) [NDC] for the diversion and discharge consent for all the existing and future stormwater discharge from the public network. This covers the Auckland region-wide network and was granted (subject to conditions) by consent order 30 October 2019. If the proposed development can comply with the NDC requirements, then this will remove the requirement to obtain a separate private discharge consent (Rule: E8.4.1 (A2)).

Schedule 4 of the NDC details Development Requirements specific to AT projects that connect into the public stormwater network.

General performance requirements are that there shall be:

- No new/additional habitable floor affected by flooding in 1% AEP event and no increase in frequency of existing flooding;
- No significant increase in risk to the operation and structural integrity of other infrastructure in 1% AEP event;
- No increase in inundation that affects a building on a property in 10% AEP; and
- No loss in overland flow path capacity, unless provided by other means.

Where these requirements cannot be met, a SMP that includes supporting information to justify an alternative as the Best Practicable Option (BPO) for the given project is required.

The NDC specifies that where an adopted Stormwater Management Plan (SMP) for the area is included in Schedule 10 of this consent that stormwater management or connection requirements will also be required to be in accordance with the SMP, in addition to all the general performance recruitments. At the time of writing, only one SMP was approved 'Fairview Ave-NEIL' (adopted October 2019)[1] but it is anticipated that additional SMP's will be adopted over time.

In addition, there are specific water quality requirements applicable to development of new or redevelopment of existing impervious surface area for high use roads (more than 5,000 vehicles per day) where the existing road corridor is constrained off-setting within the same catchment may form part of the mitigation approach:

- There shall be treatment of the new road area and any existing road area directed to same point by a water quality device designed in accordance with GD01/ TP 10 for the relevant contaminants; or
- An equivalent area of high use road within same catchment shall be treated by a water quality device designed in accordance with GD01/TP 10 for the relevant contaminants; or
- An alternative level of mitigation determined through a SMP that applies an Integrated Stormwater Management Approach, meets the NDC Objectives and Outcomes in Schedule 2 and is the BPO for the given project.

Lastly there are specific flooding requirements relating to the 10% AEP event that apply. For Projects with areas of 5,000m² or more of new impervious area they are to:

- Ensure that there is sufficient capacity within the pipe network downstream of the connection point (at maximum probable development of the contributing catchment) to cater for the additional stormwater runoff associated with the new impervious area in a 10% AEP event; or
- Attenuate stormwater flows and volume such that there is no increase in peak flow in a 10% AEP event from the total road impervious area draining to the pipe network downstream of the connection point to that prior to the new impervious area; or
- Demonstrate that flows in excess of the pipe capacity in a 10% AEP event downstream of the connection point will not increase flooding of any other property and will not create a nuisance or hazard.

As the designs for the medium-term works advance, they will need to ensure Auckland Council's ongoing ability to comply with this NDC.

3.3 National Environmental Standard for Assessing and Managing Contaminants in Soils to Protect Human Health 2011 (NES SOIL)

The road corridor is not identified as a HAIL site and it is unlikely an NES (Soil) consent would be required. However, further investigations will be required once the project design is finalised.

3.4 Archaeological Authority

An Archaeological Authority is recommended for this project given known archaeological sites are within the Project area.

The following are Cultural Heritage Inventory (CHI) sites on or near the road corridor;

- CHI 12113 / R11_1973 – Archaeological Site
- CHI 14118 / R11_2152 – Archaeological Site
- CHI 20284 – Reported Historic Site

In addition, construction and earthworks may uncover previously unrecorded sites which has the potential to be considered a minor adverse effect. As an approach to manage unforeseen risk, the requirements of HNZPTA should be reviewed in relation to the detailed design during the pre-implementation phase to consider and confirm the need to seek an authority.

4 Summary

Given the works are confined to the road corridor, the resource consent requirements are likely to be restricted to stormwater (quality and management) only.

An archaeological authority may be required for the project. This will need to be confirmed during the pre-implementation phase.

It is unlikely an NES soil consent would be required for the works as they confined to within the road corridor, however this should also be reviewed along with the need to complete further investigations during the pre-implementation phase. Impacts on street trees as the design advances may result in additional triggers for resource consent.

It is unlikely the works would hinder or prevent other over-lapping designations within the road corridor, however consultation with the applicable requiring authorities is recommended to confirm this.

Subject to these effects being appropriately managed and mitigated, the resource consent application (based on the limited information we have and on prior experience) would likely be determined by the Consent Authority (Auckland Council) on a non-notified basis.

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