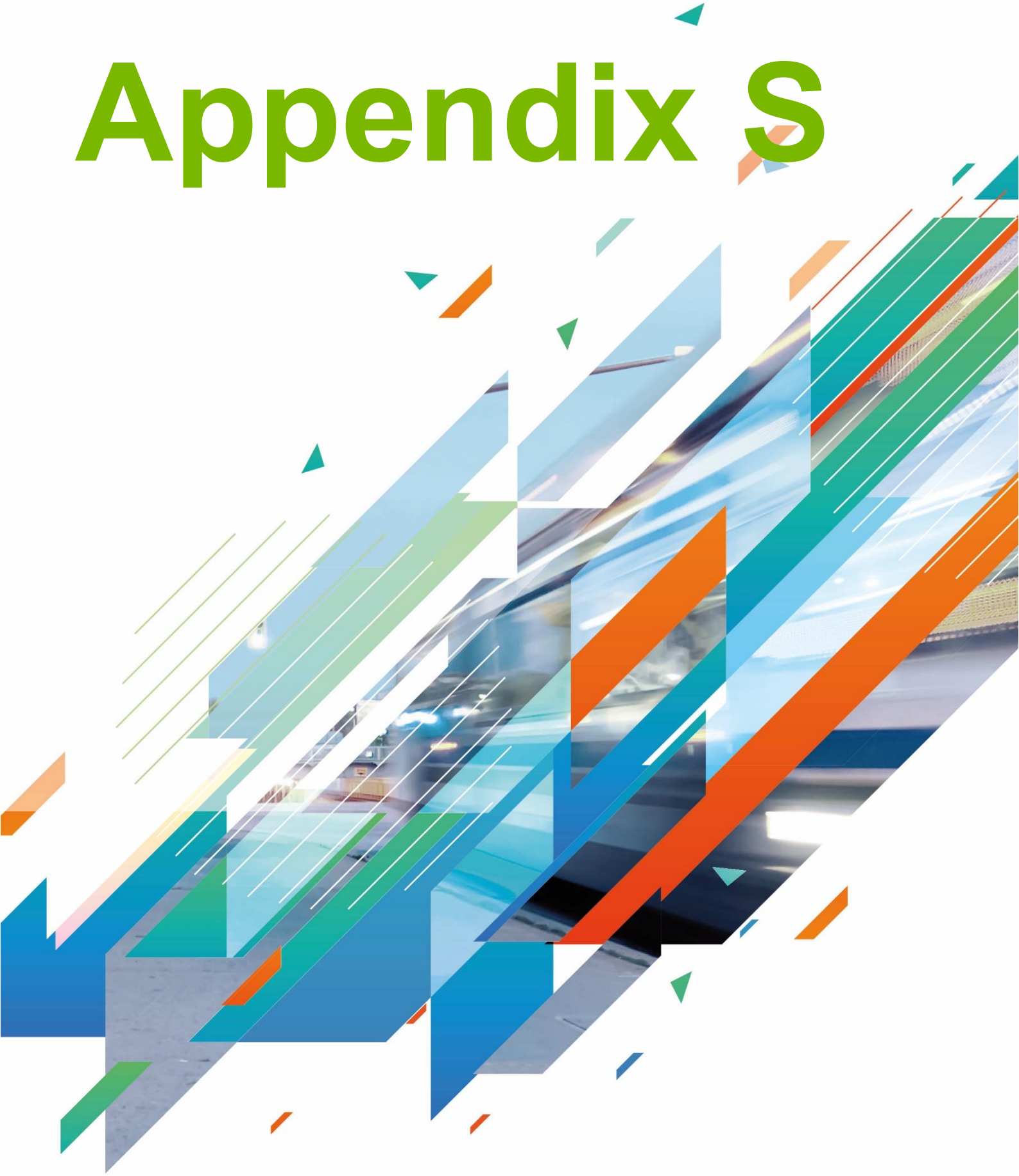
Appendix S



Botany Integration Options

Technical Note

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Subject	**Botany Integration Options**		

This technical note details the option assessment for a Botany Station, including options for routing services into and around Botany, and possible station designs. The design of Botany Station is being considered as part of the Airport to Botany (A2B) Mass Rapid Transit (MRT) project. The assessment of a station at Botany and surrounding services requires consideration of and integration between the A2B project, the Auckland Manukau Eastern Transport Initiative (AMETI) project, and local bus services.

Introduction

A station at Botany will need to integrate local, AMETI and A2B services. Similarly, A2B services beyond Botany should be designed to complement existing local and proposed AMETI services. This technical note is structured with the following sections and content:

1. Overview: summary of the key contents within the rest of the report.
2. Underlying conditions and assumptions: expected demands and vehicle types.
3. Projected bus volumes and bus stop requirements: local bus network, bus volumes and stop requirements, and design requirements for bus stops.
4. Corridor options: options for where and how to terminate the A2B MRT service.
5. Assessment of corridor options: metrics and assessment of each of the corridor options, and the emerging preferred option.
6. Botany Station options: conceptual options for types of stations at Botany Town Centre.
7. Assessment of station options: metrics and assessment of each of the station options, and the emerging preferred option.
8. Summary: review of the emerging preferred options.

1 Overview

This technical note assesses the A2B service conditions in and around Botany Town Centre, including commentary of the underlying assumptions, corridor routing options for A2B services, and station design for all services connecting with Botany. This section summarises the key findings throughout the technical report. More detail on commentary provided here can be found within the technical note.

1.1 Assumptions

The key underlying conditions and assumptions are:

- Peak demand: 1,600-1,900 passengers per hour;
- A2B service running with 5-minute peak and 10-minute off-peak headways;
- A2B vehicle type is likely to be double-articulated vehicles with three sections (24 metres long, 150 passenger capacity);
- AMETI and local buses operate as indicated in the AMETI plans[1]; and
- A station at Botany Town Centre is expected to require:
  - 17-18 bus bays for active passenger stops to accommodate passenger alighting and boarding, including short term dwell for timekeeping purposes.
  - In addition, approximately 4 non-passenger stops are anticipated to support longer duration layover (driver change, crew beaks, schedule layover, repositioning etc).
  - The number of passenger and non-passenger bus bays required could be reduced with alternate bus network designs, for example greater through-routing of local routes, or relocating the terminus of some routes to locations other than Botany.

1.2 Corridor options

With these assumptions, a set of five types of corridor routing options for the A2B services are considered. A one-page visual of these options is included in Section 9 on page 50. The options that are assessed, and their key benefits and/or challenges, are:

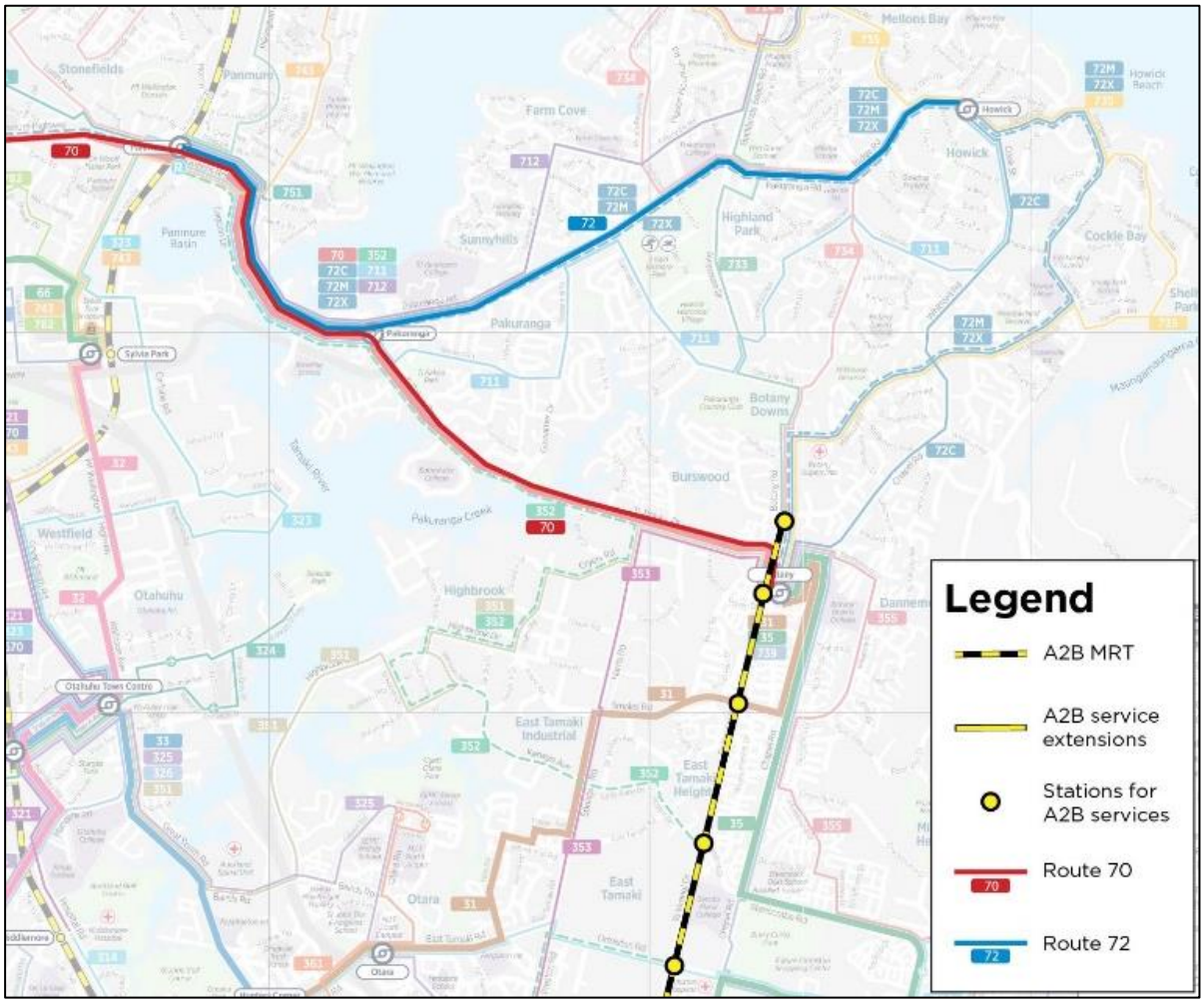
1. **Botany terminus**: Limited space available in Botany Town Centre would make layovers difficult if A2B services terminate at Botany.
2. **Service extensions without infrastructure**: Extends the reach of the frequent transit network but introduces potentially significant unreliability to the main MRT corridor.
3. **Service and infrastructure extensions**: Extends the MRT network to more people, however the costs of infrastructure outweigh the benefits of extending the MRT network to relatively low density and low demand areas.
4. **AMETI integration**: Connects the A2B and AMETI services into one long MRT service, however this would require the joint service to terminate at Panmure, compared to the current AMETI service plans, which extend that service via Ellerslie, Greenlane and Newmarket to the city centre.
5. **AMETI service (70) through-route**: This would extend route 70 to Ormiston, creating a more direct service for Ormiston, however this would extend a route which is already very long, reduce legibility of the MRT network (particularly the A2B services), and require additional

[1] *Auckland Manukau Eastern Transport Initiatives (AMETI) Eastern Busway (Panmure to Botany): Functional Specifications and Operational Plan Version 0.3 (20 June 2018)*

design work for the A2B network to facilitate additional bus movements between the MRT corridor and local roads.

The emerging preferred option for the routing of A2B services is a hybrid option between options 1 and 3. The service and infrastructure will extend just north of Botany Town Centre, to terminate in an area (as yet undefined) with more space available to facilitate layovers and turnarounds of services; this is shown in Figure 22.

Figure 1: A2B emerging preferred corridor option



1.3 Station options

Four types of station options for a station at Botany Town Centre are also evaluated. A one-page visual of these options is included in Section 10 on page 51. The station options, and the key benefits and challenges, are:

1. **Distributed street corridor**: This option would be the cheapest as it considers only the minimal necessary interventions. It does not facilitate the turnaround of any service groups, nor does it integrate as well with surrounding land use as the other options.
2. **Sectorised street corridor**: This option reduces deviations for any service group to their stops and provides good connectivity across Te Irirangi Drive due to the assumed pedestrian concourse. However, it requires significant development of the Te Irirangi Drive road corridor.

3. **RTN station with local bus interchange**: This option improves directness of transfers by grouping all MRT stops in the median of Te Irirangi Drive and provides good connectivity across Te Irirangi Drive through the assumed pedestrian concourse. However, it requires the requisition of land adjacent to the road corridor to develop a station for local buses.
4. **Offline station**: This option maximises directness of transfers by grouping all stops into one offline station. However, this requires significant land acquisition in a metropolitan centre, would involve potentially significant deviations of both MRT and local services into the station, and would interfere with general traffic due to the high volumes of vehicles manoeuvring into and out of an offline station.

Each of the station options has some clear benefits and disbenefits. The emerging preferred option for a station at Botany Town Centre is option 2, a sectorised street corridor; the concept for this option is indicated in Figure 23. Some of the key features that led to its preference over the other options are:

- Good connectivity between each set of stops and each side of Te Irirangi Drive through signalised crossings at the intersection and a pedestrian concourse over the station,
- Minimal deviations for services to get to their stops, and
- Negligible land consumption from the metropolitan centre.

Figure 2: A2B emerging preferred station option

2 Underlying conditions and assumptions

The following underlying conditions and assumptions are extended from other work on the A2B MRT project and should be seen as provisional as the project is currently underway.

- **Demand:**
  - AFC modelling of the base ATAP 1.1 package, with network variations to reflect the New Network, and the A2B service modelled with 5-minute peak headways travelling from the Airport to Botany via Puhinui and Manukau.
  - 1,600-1,900 passengers per hour at the busiest point.
  - BRT is appropriate for A2B for projected demands and service requirements.
- **Service plan and operating model:**
  - A2B service running with 5-minute peak and 10-minute off-peak headways.
  - A2B preferred as a closed system with single service pattern.
    - More compact running way and inline stops are cheaper to build and require less land.
    - More legible and 'rail-like'; easier for customers to use as a trunk element of a connected network.
    - A closed system has less potential for delay, more efficient operations, and better cost recovery.
  - Signal priority will be implemented to give buses priority through the main phase.
- **Vehicle type:**
  - Large vehicles are required, such as double-decker, articulated or double-articulated buses.
  - Table 2-1 indicates that in the long term (by 2048), double articulated buses with three-minute headways will be most appropriate for the A2B services. This vehicle type and headway meets Auckland Transport's ideal occupancy rate of 60%.
  - Therefore, assumed vehicle type is a high quality 'tram style' articulated bus (although this does not preclude light rail from consideration). Articulated buses are appropriate because:
    - There is sufficient stop space available for the use of articulated buses, and
    - Single level articulated buses are better than double deckers for passenger comfort, space for luggage, potential for all-door boarding with more doors, and therefore reduced dwell times.
  - Double decker buses are not used for A2B services, due to the aforementioned benefits of articulated buses.
  - Articulated bus options all assume single driver cabs, and are:
    - Articulated bus with two sections: 18m long, 100 passengers, or
    - Double articulated bus with three sections: 24m long, 150 passengers.
  - AMETI services are assumed to use primarily double-decker buses, interoperating with some single-decker buses. The AMETI specifications indicate the Eastern Busway design assumes a vehicle length of 13.5m[2].
  - Local buses are assumed to use single or double-decker buses (ie not articulated buses).

[2] *Auckland Manukau Eastern Transport Initiatives (AMETI) Eastern Busway (Panmure to Botany): Functional Specifications and Operational Plan Version 0.3 (20 June 2018)*

Table 2-1: Vehicle capacities

Mode	Peak hour demand, Botany Town Centre, 2048*	Capacity per vehicle	Hourly capacity with five-minute headways	Utilisation at five-minute headways (ideal = 60%)	Hourly capacity with three-minute headways	Utilisation at three-minute headways (ideal = 60%)
Standard bus	1,800 – 1,900	70	840	214 – 226%	1,400	129 – 136%
Double decker bus	1,800 – 1,900	100	1,200	150 – 158%	2,000	90 – 95%
Articulated bus (18m length)	1,800 – 1,900	100	1,200	150 – 158%	2,000	90 – 95%
Double articulated bus (24m length)	1,800 – 1,900	150	1,800	100 – 106%	3,000	60 – 63%

Forecasted peak hour demand from AFC's MSM III model.

- **Station/stop design:**
  - Inline stops for the A2B service do not require indented bays/bypass lanes.
  - The inline stops should have two stops to allow a second bus to call at the platform before the first has departed (i.e. at least 48m long to allow 2x24m long buses at the same time).
    - The service model is based upon a regular, even headway of one vehicle at a time under normal conditions. However, a second bay allows operations to be robust against occasional delays and disruptions, and to mitigate the effects of bunching on adjacent intersections and cross streets.
    - This also provides future proofing against greater than expected bus frequency/capacity requirements in the future.
  - Ticketing process will be the same as existing rail ticketing, i.e. platforms will have ticket vending machines and HOP card readers to tag on before boarding, drivers will not check tickets, and boarding and alighting will use all doors.
    - Station/stop design will need to provide space for the HOP card readers, and possibly fare gates.
    - Revenue protection must be done by ticket inspectors.

3 Projected bus volumes and bus stop requirements

Note that this section assumes that the New Network for East Auckland is not changed or updated in any way. Data regarding AMETI Eastern Busway and local buses accessing Botany has been taken verbatim from the following document, supplied to the project team by the AMETI project[3].

As most services are planned to terminate at Botany, this involves significant requirements for stops and layover spaces. However, there is some potential to alter the services in East Auckland, to introduce more 'through' routes that terminate and layover away from Botany Town Centre.

This section outlines the maximum expected bus stop requirements based on the current network plans. Changes to the bus network in and around Botany could reduce the number of terminating

[3] *Auckland Manukau Eastern Transport Initiatives (AMETI) Eastern Busway (Panmure to Botany): Functional Specifications and Operational Plan Version 0.3 (20 June 2018)*

buses and therefore the number of stops required for a station in Botany. This will be investigated in a subsequent stage of the A2B project.

3.1 Bus services

Figure 3 shows the 2026 Network with the AMETI Eastern Busway in place. This indicates that all local and busway services are intended to terminate at Botany, except the 705 and 706 peak-only routes which run through from Ormiston and Howick respectively.

Figure 3: AMETI 2026 network plan[4]

3.2 Future peak bus volumes by route group

Table 3-1 shows the projected peak bus volumes arriving at Botany Town Centre in the future. This table indicates an expected 79 buses arriving per hour in 2026 and around 119 buses per hour arriving at Botany by 2046. Botany Town Centre is projected to serve similar numbers of both local buses and MRT buses (from either the Eastern Busway or A2B MRT corridor). The projected bus volumes for the AMETI and local services are sourced from AMETI documentation[4].

[4] *Auckland Manukau Eastern Transport Initiatives (AMETI) Eastern Busway (Panmure to Botany): Functional Specifications and Operational Plan Version 0.3 (20 June 2018)*

Table 3-1: Projected peak bus volumes by route group at future Botany Station

Type	Details	No. of routes	Vehicle type	Buses per hour peak direction at peak	
				2026	2046
Eastern Busway Group (AMETI) - to/from west via Ti Rakau Drive	Core frequent route (70)	1	Double decker (up to 13.5m long)	12	20
	Local routes (to Harris Road only: 351,353)	2	Single decker rigid (up to 13.5m long)	8	12
	Peak only routes (705,706)	2	Single decker rigid (up to 13.5m long)	6	8
			Total Eastern Busway	**26**	**40**
A2B Group - to/from south (and north) via Te Irirangi Drive	Airport to Botany core frequent service	1	24m long double-articulated BRT bus[5]	12	20
			Total A2B MRT	**12**	**20**
Local Bus Group - to/from east, via Botany Road or Dannemora Drive	Via Botany Road (72M/X, 733, 734, 735)	4	Double decker and single decker rigid (up to 13.5m long)	19	28
	Via Dannemora Drive (31, 35, 355, 72C, 739)	5	Double decker and single decker rigid (up to 13.5m long)	22	31
			Total local buses	**41**	**59**
All at Botany		15	**Total at Botany**	**79**	**119**

3.3 Future bus stop requirements by route group

Table 3-2 shows estimates for the bus stop requirements of a Botany Station for each group of buses (AMETI, A2B, and local), based on the projected bus volumes for each group of routes.

3.3.1 Capacity per bus bay

Two sets of figures are shown for each group: the indicative number of bus bays required *per direction* if the route runs through, and the indicative number of bus bay required *in total* if the route terminates at Botany.

- Through-running requirements are based on an average capacity of 25 buses through per hour, per bay.
- Terminal requirements are based on an average capacity of 8 buses terminating per hour, per bay.

[5] In the short-term, if demands permit it, single-articulated buses may be used instead of double-articulated buses, however the 5-minute peak headway should not be increased.

3.3.2 Overall indicative bus bay requirements

The table below shows a high-level assessment of the total number of bus bays required. An indicative configuration of bays and stop groups is discussed for each station option in the following section.

These nominal figures have been determined in conjunction with AT Metro, for the purposes of comparing high-level station configurations and footprints. A more precise specification should be determined for short listed configurations, with more detailed consideration of a range of network, infrastructure and routing factors.

Furthermore, for all options an additional allocation of four dedicated non-passenger layover bays is indicated, in addition to the requirements of each stop group, to support all bus operations at Botany.

Table 3-2: Estimated bus stop requirements and indicative specification

Group	Details	BPH, peak direction, at peak 2046	IF TERMINATING Total bays required	IF THROUGH Bays per direction
Eastern Busway Group (AMETI)	Core frequent route (70)	20	3	1
	Local routes (351,353)	12	2	1
	Peak only routes (705,706)	8	1	1
	Total Eastern Busway	**40**	**6**	**3**
A2B Group	A2B core frequent service	20	3	2[6]
	Total A2B MRT	**20**	**3**	**2**
Local Bus Group	Via Botany Road (72M/X, 733, 734, 735)	28	4	2
	Via Dannemora Drive (31, 35, 355, 72C, 739)	31	4	2
	Total local buses	**59**	**8**	**4**
Universal layover (for all routes)			**4**	
All at Botany		**119**	**21**	**18 (9 per direction)**

3.3.3 ATCOP geometric design requirements for bus stops

The following are a list of geometric requirements for bus stop design from the Auckland Transport Code of Practice (ATCOP), with reference to the standard for fully indented, independently operable offline bays.

- Offline and inline bus bays:
  - Bus bay length for standard 13.5m long single decker and double decker: 15m

[6] Note that whilst the frequency of buses could feasibly be serviced by just one bus bay, as an RTN service there should be two bays available in case services bunch and end up running close together.

- Bus bay length for 24m long BRT style double-articulated bus: 26m (*estimated, not specified in ATCOP*)

- Offline bus bays only:
  - Entry taper ("lead in") approaching stop: 20m
  - Exit taper ("lead out") departing stop: 11m
  - Separation between bus bays: 9m

Offline bus stops should be calculated including lead in, the number of bus bays required at the appropriate length, plus an additional separation distance between each adjacent bay (for stops with two or more bays), plus the lead out distance.

Inline bus stop length is equal to number of bus bays required at the appropriate length (15m standard, or 26m for BRT articulated buses). Lead in, separation distance and lead out are not required.

ATCOP should be consulted for further detail on bus stop geometric requirements, specification and layout. Other arrangements such as kerbside stops and bus border extensions have other design standards.

4 Corridor options

This section details some operational options for running the A2B services to or beyond Botany. The options include variations of terminating the busway and/or services at Botany, Highland Park, and Howick, and variations of extending the services beyond the end of the busway itself.

All of the network options for extending A2B services beyond Botany have very little impact on the local network, so there is no need for significant local network changes to drive the need for an MRT extension.

Table 4-8 at the end of this section summarises the corridor options and their key features, and Section 9 includes a one-page summary of all the corridor options.

4.1 Option 1: Botany terminus

Option 1 considers terminating the A2B MRT infrastructure and services at Botany Town Centre. The A2B services would terminate at Botany, with a layover time before running in the opposite direction. AMETI services using the Eastern Busway would have a similar operational plan with termination and layovers at Botany Town Centre, except for the two peak-only through routes.

For this option it is assumed that A2B services will stop, turnaround and layover in the vicinity of Botany Town Centre.

The advantages of this option are:

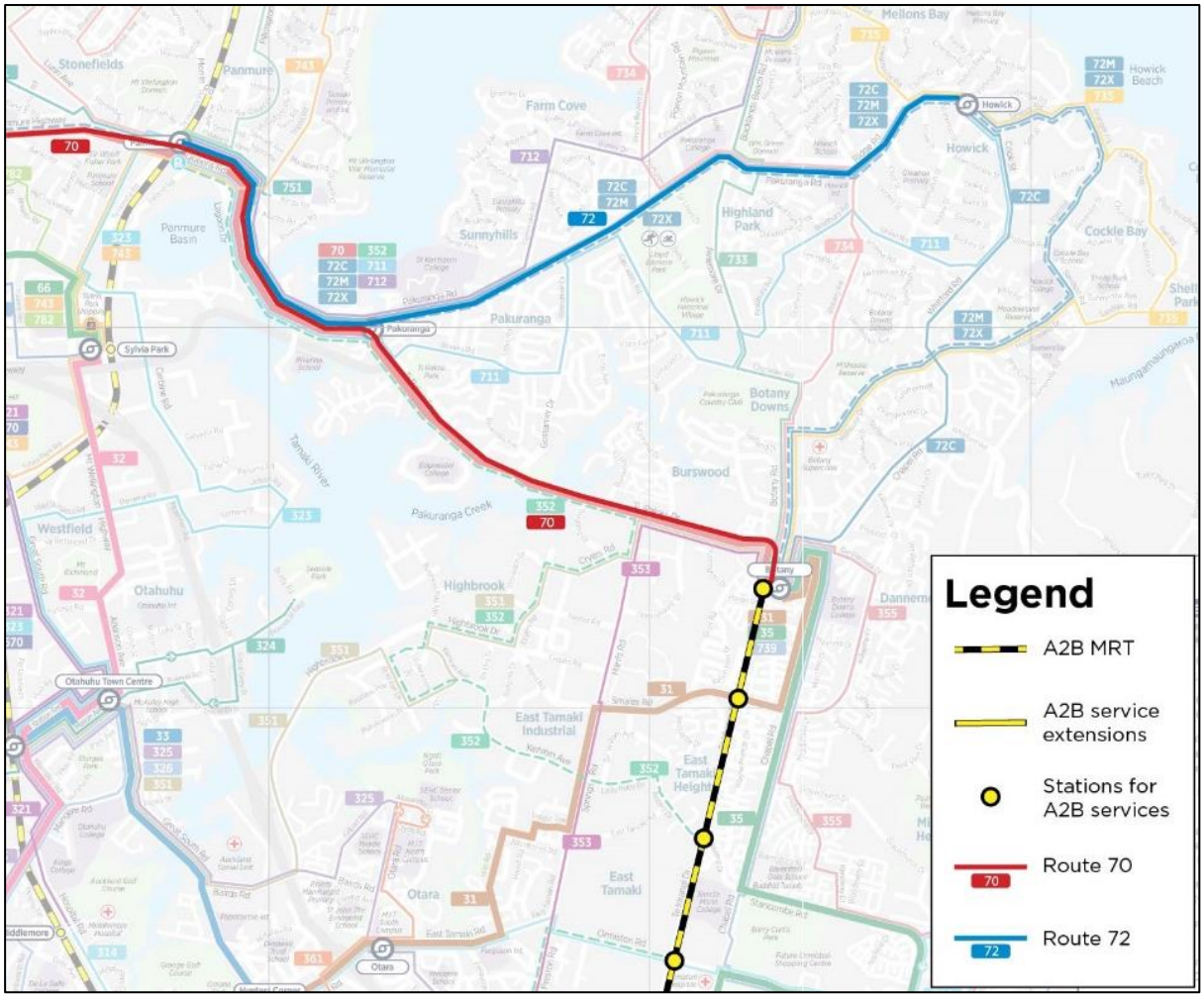
- It offers easy transfer opportunities at Botany between A2B, AMETI and local services; and
- There is no overlapping of services with proposed AMETI or local services.

Table 4-1: Option 1 indicative stop requirement and configuration

Group	Details	Terminal bays	Through bays	Indicative design requirement
Eastern Busway Group	Core frequent route (70)	3	-	1 x standard triple bay (3x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.

Group	Details	Terminal bays	Through bays	Indicative design requirement
(AMETI)	Local routes (351,353)	2	-	1 x standard double bay (2x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.
	Peak only routes (705,706)	-	1+1	2 x single bay through stops (one per direction) for peak only.
	Total Eastern Busway	**5**	**1+1**	
A2B Group	A2B core frequent service	3	-	1 x extra-long triple bay (3x24m plus lead in, separation, lead out) offline terminal stop (extra-long for BRT style articulated buses). OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.
	Total A2B MRT	**3**		
Local Bus Group	Via Botany Road (72M/X, 733, 734, 735)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Via Dannemora Drive (31, 35, 355, 72C, 739)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Total local buses	**8**	**-**	
Universal layover (for all routes)		**4**		Four bays in close proximity to passenger stops
Total Bays		**20**	**2**	***22 bays in total***

Figure 4: Option 1, Botany terminus



4.2 Option 2A: Service-only extension

Option 2A does not extend the A2B infrastructure beyond Botany Town Centre, however it does extend the A2B services through Botany Downs, Highland Park and Bucklands Beach.

For option 2A, it is assumed that no additional priority infrastructure is provided at all along the service extension. Additionally, it is noted that whilst service-only extensions are more common for bus-based modes, it is also possible to have a low-priority infrastructure extension for light rail with minimal segregation from general traffic.

- The advantages of this option include:
  - Essentially replaces the existing local route 733 bus, with a frequent service along the Bucklands Beach Peninsula;
  - Allows streamlining of local bus network through connection opportunities at Highland Park/ Bucklands Beach;
  - Shared Botany Station makes for easy transfers to AMETI and local services; and
  - No interlining or conflict with proposed AMETI services.
- A disadvantage of this option is:

– The service-only extension exposes the main MRT corridor (south of Botany) to potential delays and unreliability.

Table 4-2: Option 2A indicative stop requirement and configuration

Group	Details	Terminal bays	Through bays	Indicative design requirement
Eastern Busway Group (AMETI)	Core frequent route (70)	3	-	1 x standard triple bay (3x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.
	Local routes (351,353)	2	-	1 x standard double bay (2x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.
	Peak only routes (705,706)	-	1+1	2 x single bay through stops (one per direction) for peak only.
	Total Eastern Busway	**5**	**1+1**	
A2B Group	A2B core frequent service	-	2+2	2 x 48m long double bay (2x24m) stops, one in each direction (extra-long for BRT style articulated buses). Inline stops without lead in, separation distance or lead out if own corridor, or with lead in and lead out if shared with other route groups.
	Total A2B MRT	**-**	**2+2**	
Local Bus Group	Via Botany Road (72M/X, 733, 734, 735)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Via Dannemora Drive (31, 35, 355, 72C, 739)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Total local buses	**8**	**-**	
Universal layover (for all routes)		**4**		Four bays in close proximity to passenger stops
Total Bays		**17**	**6**	***23 bays in total***

Figure 5: Option 2A, Service-only extension

4.3 Option 2B: Part-busway extension

Option 2B includes the same service extension as in option 2A, however it includes a busway extension to the Botany Road/Cascades Road intersection, the most unreliable segment of the corridor north of Botany.

This option includes the assumption that local services will share the busway extension along Botany Road. As with option 2A, it is possible for the service extension to operate with either bus-based or light rail modes.

The key advantage of this option compared with option 2A is:

- Extension of busway covers the most unreliable segment of the corridor north of Botany, reducing the likelihood of delays and variability that would propagate to services operating along the main A2B corridor.

Table 4-3: Option 2B summary stop requirement and configuration, see Table 4-2 for full details

Group	Terminal bays	Through bays	Indicative design requirement
Total Eastern Busway	**5**	**1+1**	1 x standard triple bay offline terminal stop, 1 x standard double bay offline terminal stop, 2 x single bay through stops, one in each direction.
Total A2B MRT	**-**	**2+2**	2 x long double bay stops, one in each direction
Total local buses	**8**	**-**	2 x standard quadruple bay offline terminal stop
Universal layover	**4**		Four bays in close proximity to passenger stops
Total Bays	**17**	**6**	***23 bays in total***

Figure 6: Option 2B, Part-busway extension

4.4 Option 3A: Highland Park terminus

Option 3A includes a service and busway extension to Highland Park, as shown in

Figure 7. This option would essentially replace the Botany to Highland Park component of route 733 with a full MRT corridor.

This option assumes that sufficient space for stopping, turnaround and layover for A2B services would be provided at (or near) Highland Park. It is assumed that local services will also operate on the busway extension.

- Key advantages of this option include:

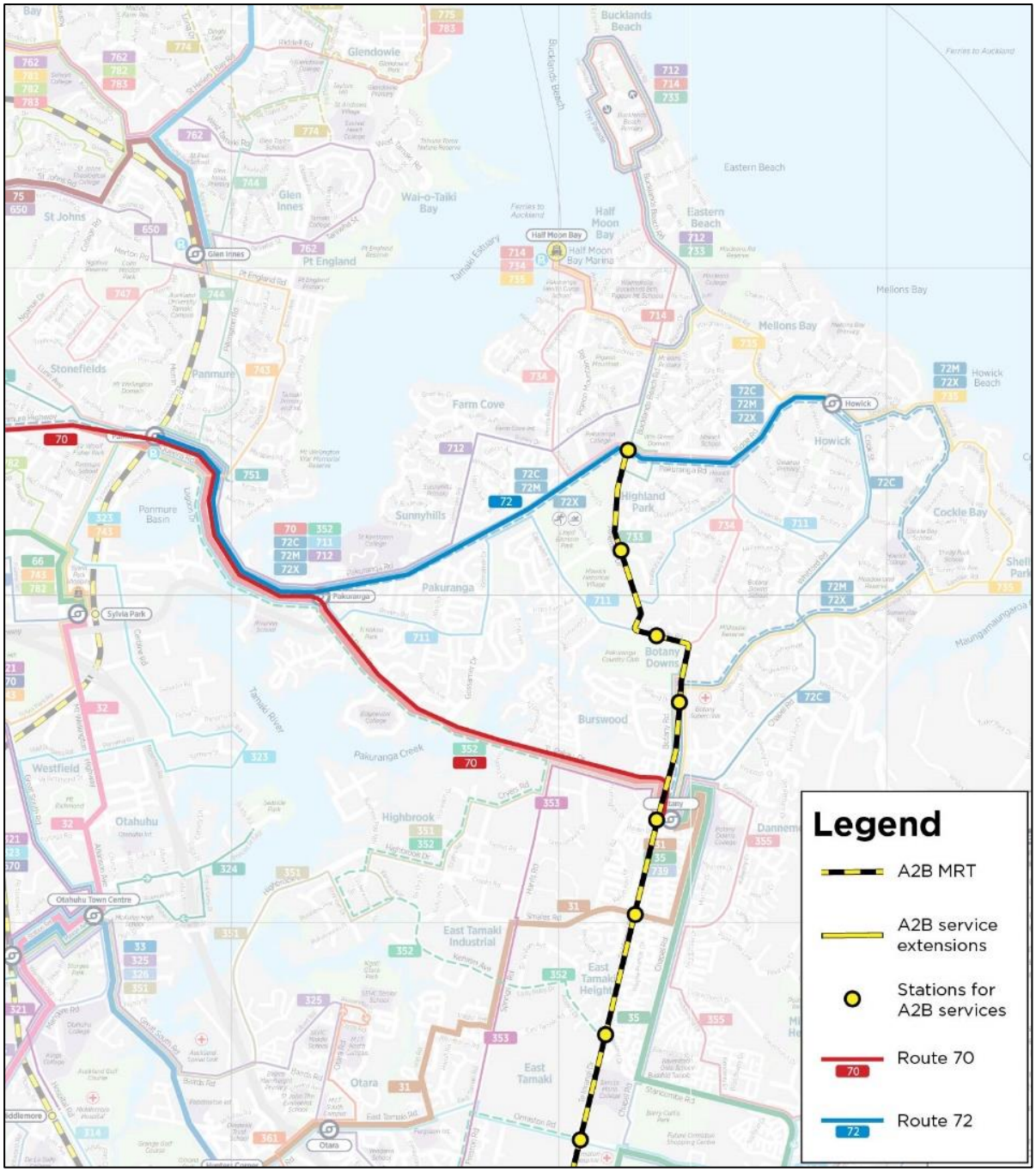
- Extension of busway and services improves the accessibility of the MRT network to people living north of Botany Town Centre;
- Easy passenger transfer to local and AMETI routes at Botany and Highland Park;
- Allows streamlining of local bus network; and
- No interlining/conflict with AMETI.

- A disadvantage of this option is:
  - Conflicts with local buses on Botany Road immediately north of Botany Town Centre.

Table 4-4: Option 3A summary stop requirement and configuration, see Table 4-2 for full details

Group	Terminal bays	Through bays	Indicative design requirement
Total Eastern Busway	**5**	**1+1**	1 x standard triple bay offline terminal stop, 1 x standard double bay offline terminal stop, 2 x single bay through stops, one in each direction.
Total A2B MRT	**-**	**2+2**	2 x long double bay stops, one in each direction
Total local buses	**8**	**-**	2 x standard quadruple bay offline terminal stop
Universal layover	**4**		Four bays in close proximity to passenger stops
Total Bays	**17**	**6**	***23 bays in total***

Figure 7: Option 3A, Highland Park terminus



4.5 Option 3B: Howick terminus

Option 3B extends the A2B infrastructure to the north beyond Botany, along Botany Road and Ridge Road to Howick. This service would duplicate the segment of route 734 along Botany Road.

It is assumed that sufficient space would be provided in Howick to enable stopping, turnaround and layover for A2B services. It is also assumed that local services will operate on the busway extension.

- The key advantages of option 3B include:
  - Extension of busway and services improves the accessibility of the MRT network to people living north of Botany Town Centre;

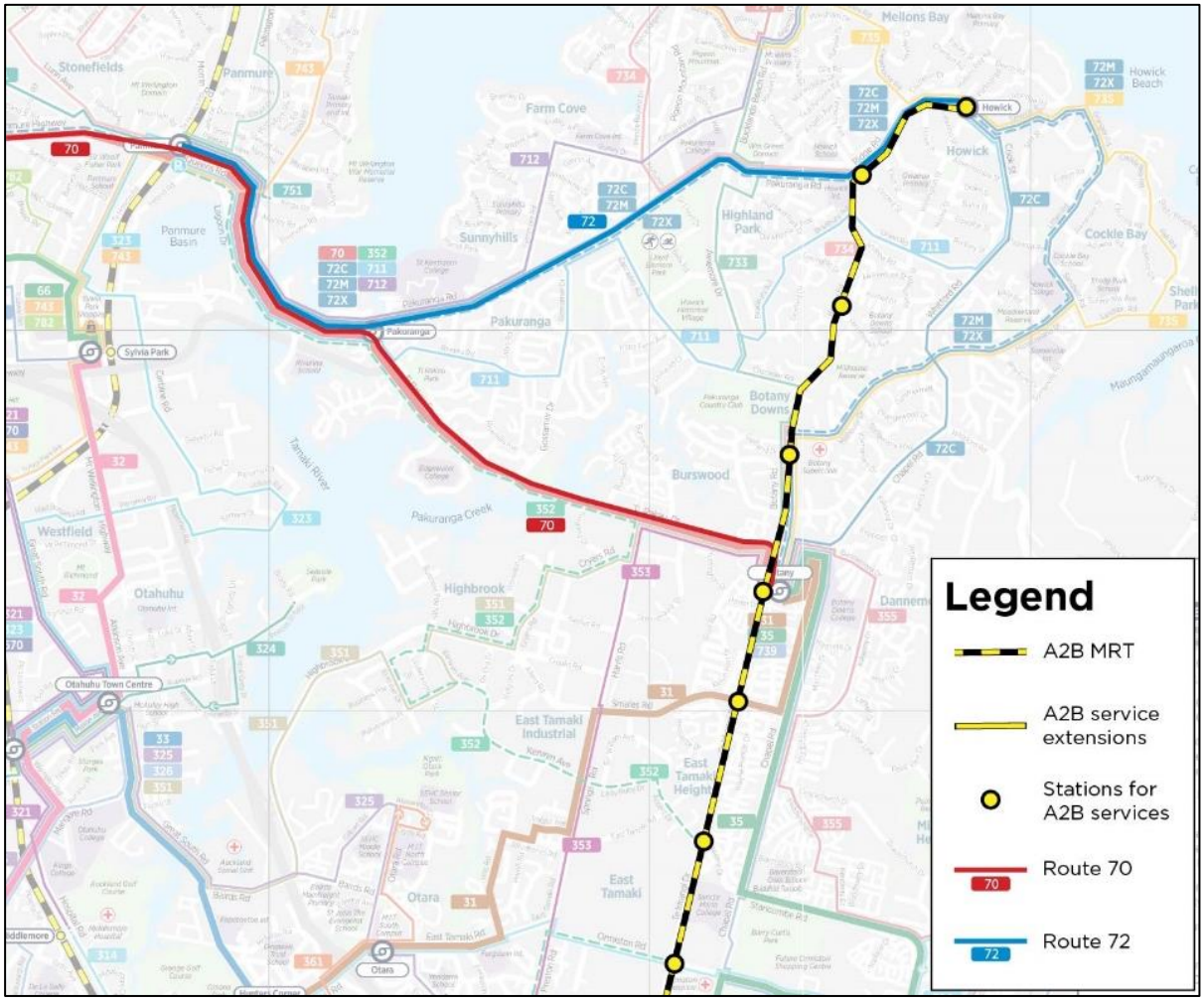
- Easy passenger transfer to local and AMETI buses at Botany, Ridge Road and Howick;
- Allows streamlining of the local bus network; and
- No interlining/conflict with AMETI services.

- A disadvantage of this option is:
  - Conflicts with several local buses on Botany Road immediately north of Botany Town Centre and on Ridge Road towards Howick.

Table 4-5: Option 3B summary stop requirement and configuration, see Table 4-2 for full details

Group	Terminal bays	Through bays	Indicative design requirement
Total Eastern Busway	**5**	**1+1**	1 x standard triple bay offline terminal stop, 1 x standard double bay offline terminal stop, 2 x single bay through stops, one in each direction.
Total A2B MRT	**-**	**2+2**	2 x long double bay stops, one in each direction
Total local buses	**8**	**-**	2 x standard quadruple bay offline terminal stop
Universal layover	**4**		Four bays in close proximity to passenger stops
Total Bays	**17**	**6**	***23 bays in total***

Figure 8: Option 3B, Howick terminus



4.6 Option 4: AMETI integration

Option 4 proposes directly connecting the Eastern Busway (AMETI) with the A2B MRT. This option would necessitate consideration of routing choices for the existing local bus network.

For option 4, it is assumed that the A2B MRT infrastructure would connect directly to the Eastern Busway to facilitate integrated services, and that this integrated service replaces route 70 from Panmure to Botany[7].

It is also assumed that the full extended A2B route from the airport to Panmure would need to meet the peak frequency required of the radial AMETI section, which is much higher than the frequencies recommended for A2B by default.

This option requires the modes for AMETI and A2B to be compatible – this means the A2B vehicles would need to be a type of bus that meets the design of the AMETI corridor (ie double articulated buses may not be feasible to operate on the Eastern Busway).

- Some key routing considerations for option 4 include:

[7] Whilst it is possible that route 72 could be extended to replace the rest of route 70, no assumptions are made that those network changes would occur. This is instead raised as a necessary routing consideration for this option.

- Frequent service between Botany and Panmure:
  - Should route 70 continue to operate as the frequent service for this connection; or
  - Should the A2B services be extended to serve that connection instead of (or as well as) route 70?
- Frequent services from Panmure to the city centre:
  - Should route 72 replace route 70 as the frequent service connecting Panmure to the city centre?
- If route 72 replaces route 70 as the Panmure to city centre service, and A2B services replace route 70 as the Botany to Panmure service, route 70 would be removed from the network.

- Some key advantages of option 4 include:
  - Facilitates simple connections to AMETI services, whilst still providing connections to local services at Botany; and
  - Easy passenger transfer to additional local services and trains at Panmure and Pakuranga.
- Some key disadvantages include:
  - Potential interlining/conflict with AMETI, with implications on running way and stop layouts; and
  - Requires revisiting Eastern Busway operating plan and service projections for this MRT link.

Table 4-6: Option 4 indicative stop requirement and configuration

Group	Details	Terminal bays	Through bays	Indicative design requirement
Eastern Busway Group (AMETI)	*Core frequent route (70)*	N/A	N/A	*None (replaced with through-running A2B route)*
	Local routes (351,353)	2	-	1 x standard double bay (2x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.
	Peak only routes (705,706)	-	1+1	2 x single bay through stops (one per direction) for peak only.
	Total Eastern Busway	**2**	**1+1**	
A2B Group	A2B to Eastern core frequent service	-	2+2	2 x 48m long double bay (2x24m) stops, one in each direction (extra-long for BRT style articulated buses). Inline stops without lead in, separation distance or lead out if own corridor, or with lead in and lead out if shared with other route groups.
	Total A2B MRT	**-**	**2+2**	
Local Bus Group	Via Botany Road (72M/X, 733, 734, 735)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Via Dannemora Drive (31, 35, 355, 72C, 739)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Total local buses	**8**	**-**	

Group	Details	Terminal bays	Through bays	Indicative design requirement
Universal layover (for all routes)		**4**		Four bays in close proximity to passenger stops
Total Bays		**14**	**3+3**	***20 bays in total***

Figure 9: Option 4, AMETI integration

4.7 Option 5: AMETI service (70) through-route

Option 5 extends the main AMETI Eastern Busway service (route 70, City Centre to Botany via Great South Road, Ellerslie-Panmure Highway and Eastern Busway) via the first section of the A2B corridor on Te Irirangi Drive, in order to begin and end at Ormiston Town Centre. This option may or may not extend the A2B infrastructure to the north beyond Botany, as per previous options.

Option 5 assumes that the final segment of route 70 (ie from Te Irirangi Drive to Ormiston Town Centre) will be on local roads, with no MRT infrastructure extensions. The assessment of this option also assumes the A2B services terminate at Botany, however this could be combined with any of the options 1–3 (including sub-options).

This option could have some design implications for the northern end of the A2B MRT corridor to support additional turning movements for the route 70 service[8].

- The key advantages of option 5 include:
  - Removes the need for a transfer at Botany for some city-bound trips from Ormiston and Flat Bush.
  - Improves Ormiston's access to the city centre, via the potential for a single-seat ride directly to the city centre, however this would be much slower than travelling via bus to Middlemore (existing route 314 – planned to be frequent) or Panmure (proposed peak route 706), and then catching a train to the city centre.
  - Some opportunity to reduce peak and local bus volumes between Ormiston and Botany.
- Some disbenefits of this option are:
  - Requires A2B infrastructure design to facilitate route 70 double deckers turning on and off the A2B MRT corridor and operating through some shared stops with the main A2B service.
  - Increases route length, service delivery costs and potential for unreliability on route 70.
  - Duplication of services between route 70 and the A2B service just south of Botany Town Centre, which also reduces the legibility of the network.
  - Duplication of route 70 with route 35 will undermine the justification for route 35 to be part of the frequent network, despite its role in providing coverage to the areas east of Te Irirangi Drive.

Table 4-7: Option 5 indicative stop requirement and configuration

Group	Details	Terminal bays	Through bays	Indicative design requirement
Eastern Busway Group (AMETI)	Core frequent route (70)		2+2	2 x double bay through stops (one per direction) for Core Frequent and peak only.
	Local routes (351,353)	2	-	1 x standard double bay (2x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.
	Peak only routes (705,706)	-	N/A	*Shared with Core Frequent above*
	Total Eastern Busway	**2**	**2+2**	

[8] These implications have not been assessed in the MCA process as they do not directly relate to any of the criteria. However, if this option were to proceed, the integration of route 70 onto the A2B corridor would need to be designed for.

Group	Details	Terminal bays	Through bays	Indicative design requirement
A2B Group	A2B core frequent service	3	-	1 x extra-long triple bay (3x24m plus lead in, separation, lead out) offline terminal stop (extra-long for BRT style articulated buses). OR: 1 x drop off bay, with 1 x separate layover bay in close proximity to 1 x pick up bay.
	Total A2B MRT	**3**		
Local Bus Group	Via Botany Road (72M/X, 733, 734, 735)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Via Dannemora Drive (31, 35, 355, 72C, 739)	4	-	1 x standard quadruple bay (4x13.5m plus lead in, separation, lead out) offline terminal stop OR: 1 x drop off bay, with 2 x separate layover bay in close proximity to 1 x pick up bay.
	Total local buses	**8**	**-**	
Universal layover (for all routes)		**4**		Four bays in close proximity to passenger stops
Total Bays		**17**	**2+2**	***21 bays in total***

Figure 10: Option 5, AMETI Core Service through route to Ormiston

4.8 Summary of corridor options

Table 4-8 summarises the corridor and routing options for the A2B MRT corridor and services. The key decisions for each option include where to end the dedicated busway, where to terminate the other services, and if/how to integrate with AMETI services.

A one-page overview of all the corridor options is included in Section 9 on page 50.

Table 4-8: Corridor options for A2B services beyond Botany

Option	A2B corridor	A2B service patterns	Total bays for stops / layovers
1: Botany terminus	Ends at Botany.	Services terminate at Botany station.	▪ 22 bays
2A: Service-only extension	Ends at Botany.	Service extension to Bucklands Beach via local streets (up to 8km one-way).	▪ 23 bays
Part-busway extension	Extends partway along Botany Road (extra 1.6km).	Service extension to Bucklands Beach via local streets (up to 8km one-way).	▪ 23 bays
3A: Highland Park terminus	Extends to Highland Park (additional 4.2km).	Service extension along the extended busway to Highland Park.	▪ 23 bays
3B: Howick terminus	Extends to Howick (additional 6km).	Service extension along the extended busway to Howick.	▪ 23 bays
4: AMETI integration	Connects into planned Eastern Busway (AMETI corridor).	Possible service extensions to Panmure via the Eastern Busway. Service planning requires integration with AMETI plans.	▪ 20 bays
5: AMETI Core service extension	Connects into planned Eastern Busway (AMETI corridor).	Terminates at Botany or continues further north.	▪ 21 bays

5 Assessment of corridor options

5.1 Investment objectives

Table 5-1 maps the A2B investment objectives with the AMETI investment objectives and identifies what KPIs are used in the MCA assessment to score the impact of each corridor option. The A2B investment logic map contains additional KPIs that are not shown; this table only presents the KPIs that are considered to differentiate between options and can be measured with the information available. The KPI numbering is inherited from the A2B investment logic map and therefore some numbers are excluded, whilst others have been broken out into sub-components.

Table 5-1: Investment objectives from A2B and AMETI programmes, and KPIs for corridor assessment

Four Wellbeings	A2B Problem	A2B Benefits / Investment Objectives	AMETI Investment Objectives	A2B KPI
Economic Social Cultural	Costly, unreliable, long and complicated trips severely limit people's ability to meet daily needs for work, learning & socialising, reinforcing ongoing deprivation.	1. More equitable access to jobs, learning and social activities.	1. Provide a multi modal transport corridor that connects Pakuranga and Botany to the wider network and increases access to a choice of transport options.	KPI 1: Population accessible to Airport, Manukau and Botany by public transport
				KPI 2: Jobs accessible from Ormiston, Otara, Botany, Manukau and Papakura
Economic Social Cultural	Poor east-west travel choices in southern area constrain current & future growth, undermining prosperity for Aucklanders.	2. Provide public transport for south and east Auckland that is easy to use, reliable, fast, resilient and affordable.	3. Improve the efficiency and resilience of the transport network surrounding … Botany by providing a dedicated route for public transport to and from the eastern suburbs. 4. Provide transport infrastructure that improves linkages, relieves network constraints and improves journey time, frequency and reliability of the transport network.	KPI 7a: Peak travel time reliability of A2B services
				KPI 7b: Peak travel time reliability of AMETI services
				KPI 7c: Peak travel time reliability of local services
				KPI 8: Directness/Ease of use (transfers)
				KPI 10: Public transport demand
		3. Promote urban regeneration improved built environment and economic opportunities.	2. Provide transport infrastructure that integrates with land uses and supports a quality, compact urban form ... along the Pakuranga to Botany Busway corridor. 6. Contribute to place shaping ... along the Busway Corridor by providing better connections and accessibility between and within the Centre and along the Corridor for all transport users, including public transport users, pedestrians and cyclists.	KPI 1: Population accessible to Airport, Manukau and Botany by public transport
				KPI 2: Jobs accessible from Ormiston, Otara, Botany, Manukau and Papakura
				KPI 11: Improved access to the airport area and Local, Town and Metropolitan Centres.
Social Environmental	Perceptions of poor personal safety limit uptake of public transport & active modes.	5. Healthier and safer people.	7. Create a corridor that is safe for all road users, including public transport passengers, cyclists and pedestrians.	KPI 18: Ability for people to walk to PT stops and stations
				KPI 19: Extent of improved local walking and cycling connections

5.2 MCA assessment

Table 5-2 summarises the KPI scores for the MCA assessment of the investment objectives, as well as KPI scores for an operational and feasibility assessment of each of the options. All options are scored relative to the 'do minimum' (Option 1). The comments provided briefly explain the methodology and/or reasons for the scores that are given to each option.

Table 5-2: KPI scoring of the corridor options (scores from -3 to 3)

KPI	1 Botany terminus	2A Service-only extension	2B Part-MRT extension	3A Highland Park terminus	3B Howick terminus	4 AMETI integration	5 AMETI service extension	Comments
KPI 1: Population accessible to Airport, Manukau and Botany by public transport	0	1	1	1	2	2	2	Catchments from the Airport only just reach Botany in the 45-minute threshold, so there is no differentiation between the options. Additionally, it already takes less than 45 minutes to get to Botany from all of the extension options, beyond which any subsequent transfers result in a slower trip than using other existing services, so the Botany catchments also show no differentiation. Therefore, options are scored based on the 45-minute catchments from Manukau. MRT infrastructure extensions score higher because those services travel faster, so the catchments extend further than options without PT priority. 3B scored higher than 3A because of the quality of base case local connections to Howick and Highland Park.
KPI 2: Jobs accessible from Ormiston, Otara, Botany, Manukau and Papakura	0	0	1	2	2	2	2	As for KPI 1, the catchments for Botany and Papakura do not differentiate between the options. The options with MRT infrastructure extensions scored higher because the catchments extend further than the service-only extensions, which are slower.
KPI 7a: Peak travel time reliability for A2B services	0	-3	-2	0	0	-1	-1	Extensions of A2B services on local roads exposes the service to significant potential reliability issues (options 2A/2B). A separated rapid transit network (RTN) extension is longer but is well protected from general traffic interaction that would introduce variability to travel times (options 3A/3B). A2B service extensions along the AMETI corridor introduce potential for some variation in A2B travel times due to the open system design of the AMETI corridor (option 4), especially the interaction of multiple local and MRT vehicles of different configurations at shared stops and terminals. AMETI service extensions along the A2B MRT corridor might reduce reliability of A2B services, due to additional interlining and shared stops (option 5). Nonetheless, these variations will be relatively minor due to the high standard of bus priority infrastructure on both corridors.
KPI 7b: Peak travel time reliability for AMETI services (Panmure to Botany segment)	0	0	0	0	0	1	-1	Reliability of AMETI services are not affected by options 1, 2A/B or 3A/B. Option 4 exposes the AMETI route to variation in travel times along the A2B corridor that would flow onto the AMETI corridor, which will be compounded by the additional length of the A2B service in this option. Option 5 exposes the AMETI service to delays from interlining and stop-sharing on the shared part of the A2B corridor, as well as the small segment of local roads in Ormiston. Nonetheless, these variations will be relatively minor due to the high standard of bus priority infrastructure on most of the route.
KPI 7c: Peak travel time reliability for local services	0	0	1	2	2	0	0	Reliability of local services are not affected by options 2A, 4 or 5, as there is minimal to no overlapping of services or infrastructure. In options 2B, 3A and 3B, reliability of local services is expected to improve due to the extension of dedicated infrastructure that overlaps with local services and the assumption that local services will be entitled to use this infrastructure.

KPI	1 Botany terminus	2A Service-only extension	2B Part-MRT extension	3A Highland Park terminus	3B Howick terminus	4 AMETI integration	5 AMETI service extension	Comments
KPI 8: Directness/ease of transfers (including legibility)	0	2	2	2	2	-1	1	Options 2A-3B extend the RTN to new areas, create an interchange opportunity at Highland Park/Howick, and connects the RTN with the frequent route 72, providing more direct access for southbound trips via the RTN. Option 4 improves the directness of A2B services (trips beginning between Manukau and Botany) to Panmure interchange (for which there is relatively low demand[9]); however, it reduces directness of trips to Ellerslie, Greenlane and Newmarket from between Botany and Panmure (for which there is much more demand[9]), including introducing a double transfer for some local Botany routes through to destinations beyond Panmure. Option 4 is scored as -1 to reflect the magnitude of these overs and unders. Option 5 offers more direct services for some trips from Ormiston, however the overlap of services reduces legibility of the network.
KPI 10: Public transport demand	0	1	1	2	2	0	2	All options are expected to increase patronage as they make some services more direct. Options 3A/3B score higher than 2A/2B due to the increased performance on MRT corridors creating greater demand compared to services on local roads. Option 4 improves the directness of some trips at the expense of the directness of other trips. It scores a 0 to reflect that it will have mixed effects of journeys, however due to connectivity improvements, it is unlikely to reduce total public transport demand. Option 5 scores well because it creates a direct service from Ormiston to Pakuranga, Panmure, Ellerslie, Newmarket and the City Centre, in addition to the Botany to Airport corridor, so is likely to induce a moderate level of demand.
KPI 11: Improved access to Local, Town and Metropolitan Centres	0	1	1	2	2	0	2	This is measured by identifying the area of Neighbourhood, Local, Town and Metropolitan Centres that overlap with the walking catchment from the extensions in the options. Options 3A, 3B and 5 extend the MRT services to Highland Park, Howick or Ormiston Town Centres. Options 2A and 2B also cover Highland Park, however with minimal infrastructure priority, only a 500m catchment is considered, so the area of centres accessible is less. Option 4 does not cover any additional areas beyond what will be covered by each of the MRT corridors independently.
KPI 18: Ability for people to walk to PT stops and stations	0	2	2	2	2	0	0	This metric assesses the additional people that will have access to the frequent and rapid transit network[10] compared with existing network (ie people that cannot currently walk to frequent/rapid services but could do so in the option). Options 4 and 5 extend services across areas that already have frequent services, so there would be no improvements for this metric. All other options provide improvements of a similar quantum to this metric.
KPI 19: Extent of improved local walking and cycling connections	0	0	1	2	2	0	0	MRT extensions are likely to receive additional investment and attract walking and cycling improvements (beyond what is already likely to occur with existing plans). Therefore, options 2B, 3A and 3B score positively. All other options score 0, as they do not extend the MRT infrastructure beyond the planned A2B and AMETI corridors.

[9] Analysis of MSM transport modelling for the A2B short list assessment indicates that the total demand (public transport and car demand) for trips that would have improved directness under option 4 is around 1,300 trips per day, whilst the demand for trips that would have worsened directness under option 4 is around 3,500 trips per day. The total demand is compared to ensure no false assumptions about patronage are made, because public transport demand would change based on these service changes.

[10] Note that a walking distance of 500m is used for the frequent transit network and 1,000m is used for the rapid transit network.

KPI	1 Botany terminus	2A Service-only extension	2B Part-MRT extension	3A Highland Park terminus	3B Howick terminus	4 AMETI integration	5 AMETI service extension	Comments
Operational and feasibility assessment								
Operational impacts	0	-3	-2	-1	-1	-1	-2	Option 2A involves a long extension to the A2B service on congested streets without priority, which will be considerably less reliable than the priority section, so more buses and layover space will be required to provide resilience to delays. Option 2B is similar, but the MRT extension covers the most unreliable segment of the extension, so the negative effects would be at a reduced scale. Options 3A and 3B have long extensions of route but should be fairly reliable due to full MRT infrastructure, so would have small negative impacts (due to the longer services). Option 4 scores slightly negatively because more planning and resilience is required for extending services across 2 MRT corridors, to minimise impacts of flow-on delays across the length of the extended route. For option 5, the overlap of the very frequent route 70 with the A2B service has reliability concerns, especially in the context of extending the already very long route 70 via a mix of busway and local street, so additional planning and operations provisions might be necessary to minimise delays.
Operational costs	0	-3	-3	-2	-2	-3	-2	Options 2A and 2B have long service extensions at higher frequencies than the local routes they replace, with some amount of unreliability, so the cost of providing these service extensions is expected to be high. Options 3A and 3B have similar cost implications of extended high frequency routes, but are expected to be faster and more reliable, so lower operating costs for service delivery and recovery time are expected. Option 4 is a long service extension at very high frequencies, based on the assumption that the full extended A2B route would need to meet the peak frequency required of the AMETI section. The cost of providing this service extension includes the cost of operating the A2B services at a much higher frequency than is suggested for these services by default. Option 5 is a moderate length extension of a very frequent service that may be susceptible to additional delays on the local roads near Ormiston. This is in addition to operating the A2B service. The costs of extending route 70 (every 3-4 minutes) to Ormiston, with the required resilience planning, is expected to be comparatively high due to the peak service frequency proposed.
Property/consents	0	0	-2	-3	-3	0	0	Options 2A, 4 and 5 have no implications because they use the existing road corridor. Options 2B, 3A and 3B require property acquisition along the length of the MRT extensions.
Constructability	0	0	-1	-2	-2	0	0	Options 2A, 4 and 5 have no implications because they use the existing road corridor (this assumes a bus-based mode. Light rail would have construction implications similar to 3A and 3B for option 2A and would not be feasible for option 4). Options 2B, 3A and 3B involve MRT corridor extensions, and significant traffic management.
Environmental impacts	0	0	-1	-2	-2	0	0	The MRT corridor extensions score negatively because they generally require additional road space (/width), taking away from ‘green space’.

5.3 Emerging preferred option

Following the option assessment and discussions between Auckland Transport and the A2B and AMETI project teams, an emerging preferred option was agreed upon. This option is a variation on option 1, in that the A2B service and infrastructure is extended slightly north of Botany Town Centre. This lessens the space requirements for a station in Botany Town Centre, where land is more valuable and in higher demand than outside of the town centre.

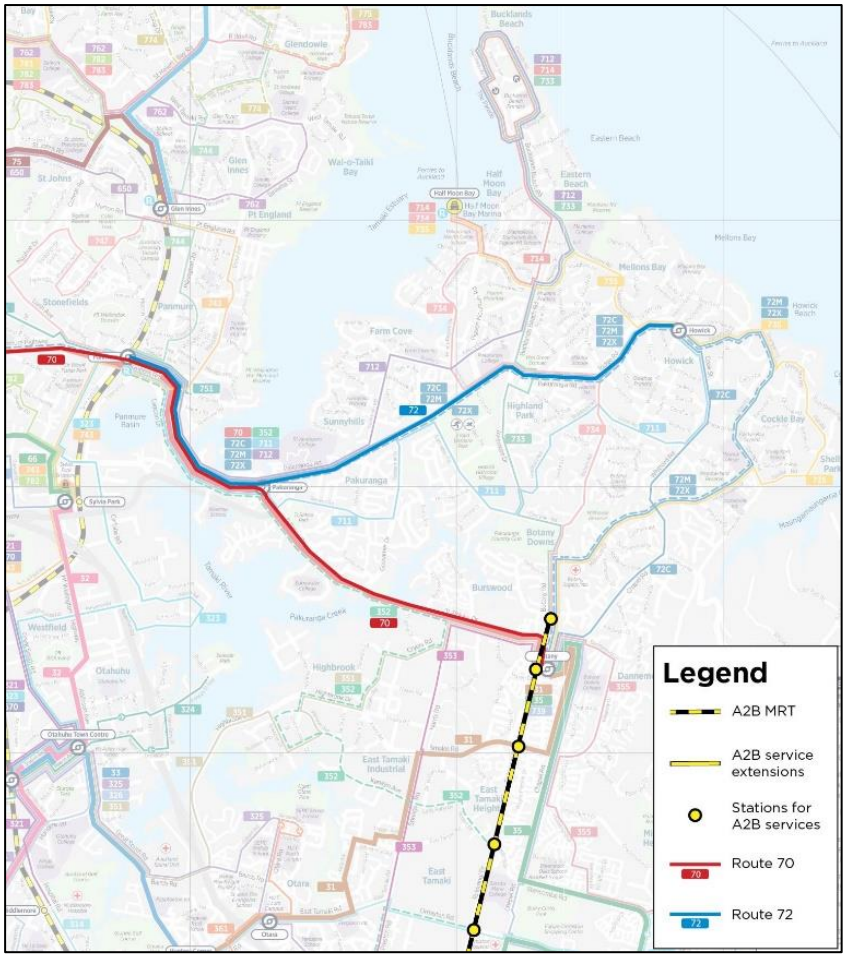
Options 2 and 3 were discarded, primarily due to the lower demand of public transport services north of Botany Town Centre.

Options 4 was discarded, mainly because it reduces the directness of trips originating between Botany and Panmure to destinations further along route 70, including Ellerslie, Greenlane, Newmarket and the city centre Universities.

Option 5 was discarded as it extends the already long service route 70 to an area that will mostly be serviced by the A2B MRT services and introduces additional design requirements and overlapping services between Botany Town Centre and Ormiston, reducing legibility of the network.

Figure 11 shows the emerging preferred corridor option, a North Botany Terminus. This shows the A2B MRT service extending north beyond Botany Town Centre, to an (as yet) undefined location that will provide better conditions for a turnaround and layover location for the A2B services. There is still some flexibility as to where and how exactly the turnaround would function; however, it will be beneficial to move this function outside of the town centre area.

Figure 11: Emerging preferred corridor option, North Botany Terminus

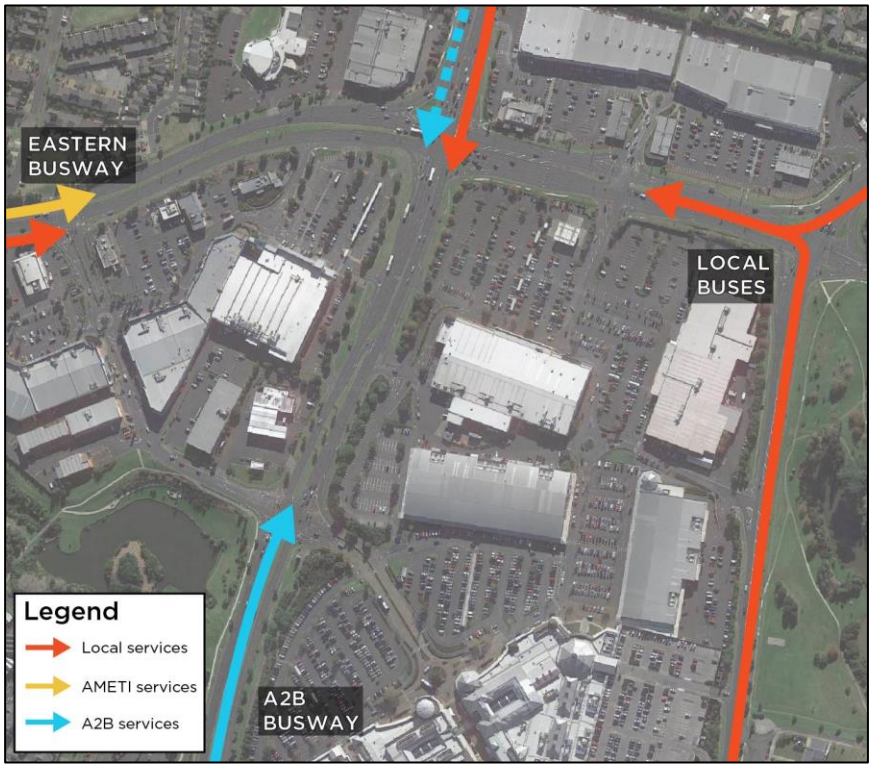


6 Botany Station options

This section details some concepts for station designs in and around Botany Town Centre to support the A2B MRT corridor and services, as well as the local and AMETI services. Figure 12 shows the three service groups that would connect with a station at Botany Town Centre. These groups are:

- Eastern Busway (AMETI) services: from the west along Ti Rakau Drive;
- A2B services: from the south along Te Irirangi Drive (and likely from the north along Botany Road); and
- Local buses: from the north along Botany Road and Chapel Road, from the south along Chapel Road, and from the west along Ti Rakau Drive.

Figure 12: Service groups for Botany Station



As was identified in section 3.3, the bus stop requirement for each service group is:

- Eastern busway: 2 triple-bay terminal stops, 13.5m bays;
- A2B services: 3-4 stops (depending on whether services terminate at Botany or not), 24m bays; and
- Local buses: 2 quadruple-bay (or 4 double-bay) terminal stops, 13.5m bays.

The total number of stops required at the station does not change much for each of the corridor options, therefore the total station size (and the concepts for station designs) are based on the maximum expected stop requirements.

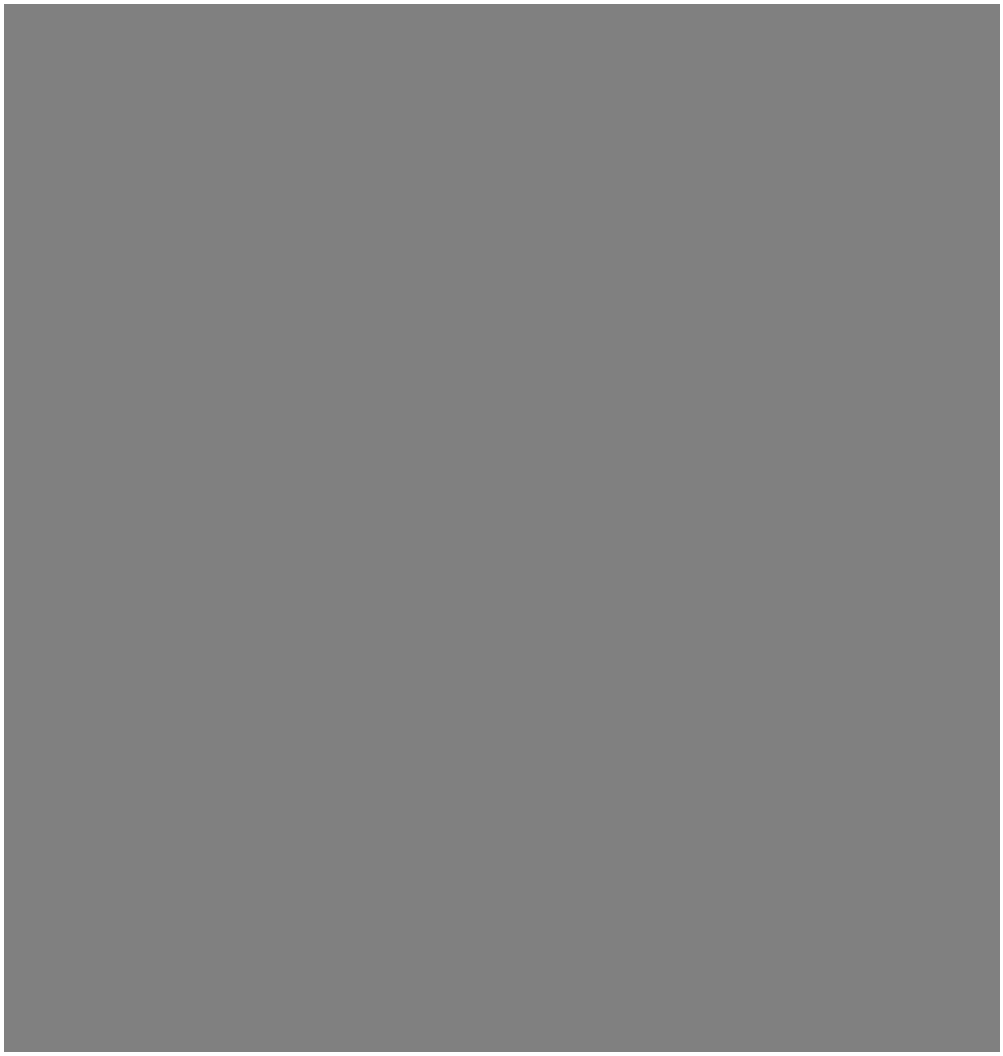
The rest of this section describes each of the station concepts, which are also presented in a one-page visual in Section 10.

6.1 Distributed street corridor

Another option for routing and stop placement through Botany Town Centre is the distribution of stops for each group of services across several roads within short walking distances of each other (ie around an intersection). The distributed street corridor is a design that has been used for light rail interchanges internationally, whereby passengers walk around the corner of an intersection to transfer to vehicles travelling in a different direction.

The distributed street corridor design is considered the ‘do minimum’ option, therefore it is assumed that it would not involve significant infrastructure or design investments beyond what is required to deliver high quality bus stops in an urban environment (ie shelters and pedestrian crossings would be included, but no overbridge or ‘station’ style improvements).

Two potential locations and the related footprints for a distributed street corridor structure at Botany is shown in Figure 13.



The images in Figure 14 show some variations in the stop placements and circulation options for the distributed street corridor style station. This illustrates that there are many options for stop placements and circulation, for either of the station locations.

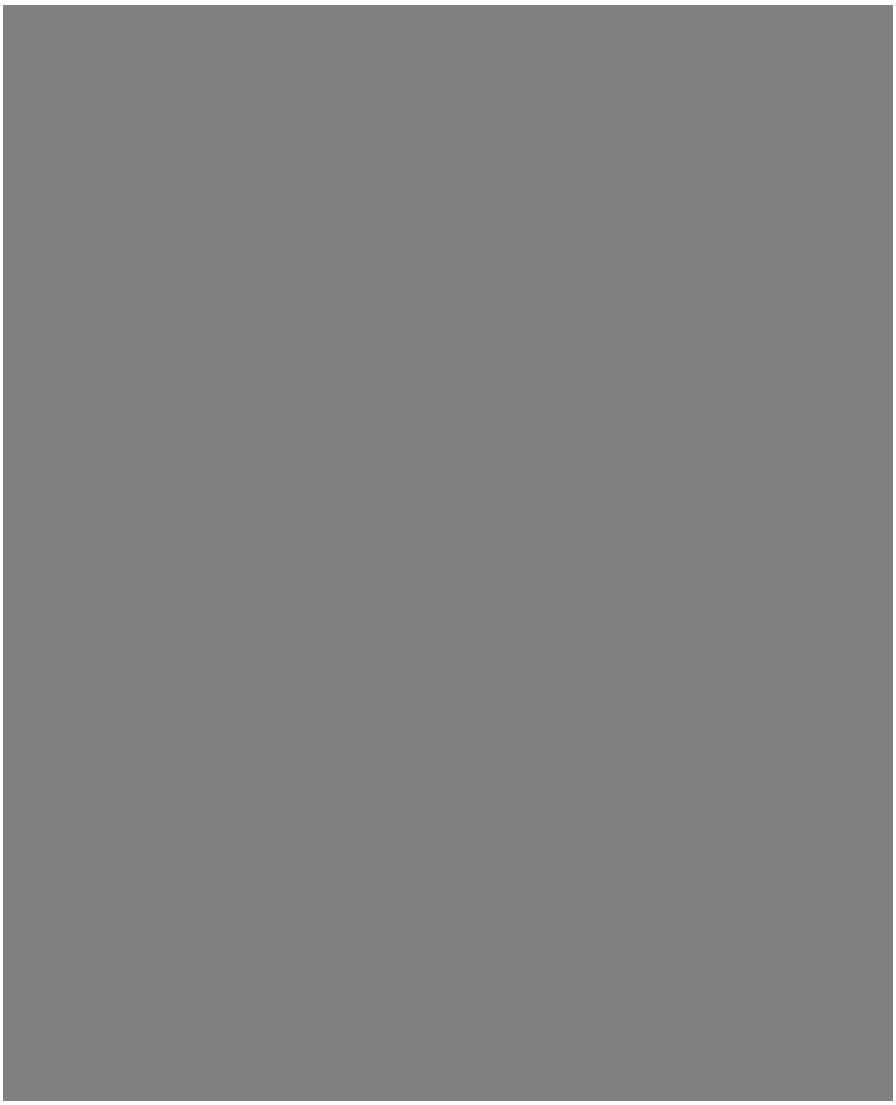
Figure 14: Distributed street corridor circulation options

6.2 Sectorised street corridor

It can be beneficial for stops to be placed alongside one another in the same street corridor to ease the transfer between service groups. This concept has two main options: all stops are inline, creating one very long bus stop; or service groups stop across the cross-section of the intersection, requiring road crossings to transfer between service groups.

This option is assumed to include a vertical concourse to improve pedestrian access between each side of Te Irirangi Drive and the median station platforms. In the assessment of this option, it is also assumed that the AMETI services can do a one-way loop at the Botany end (to avoid the need for a turnaround such as is shown in the 'Sectorised 2' option.

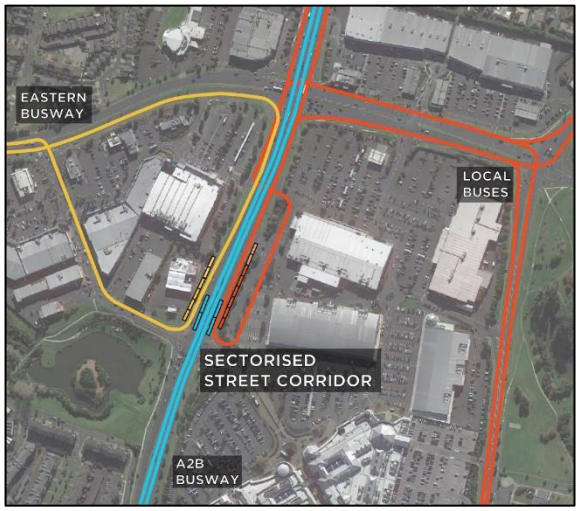
Figure 15 shows two potential footprints for a sectorised street corridor station.



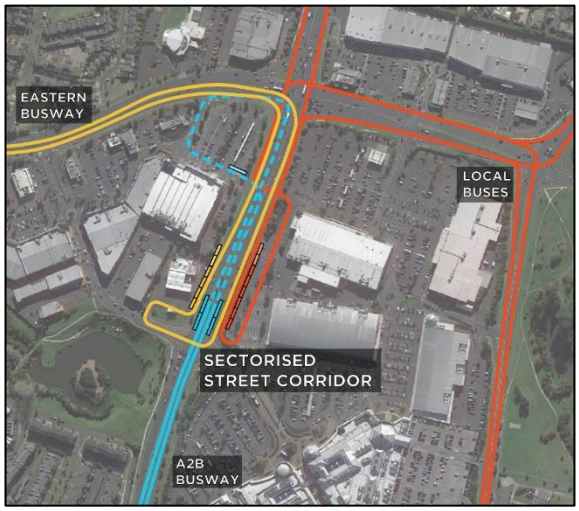
They key feature of these options is that each service group is within a short walk of each other group. As with the previous designs, there are various options for routing services through a sectorised street corridor. The images in Figure 16 show various options for stop placement and route circulation within the group of sectorised street corridor station options.

Figure 16: Sectorised street corridor circulation options

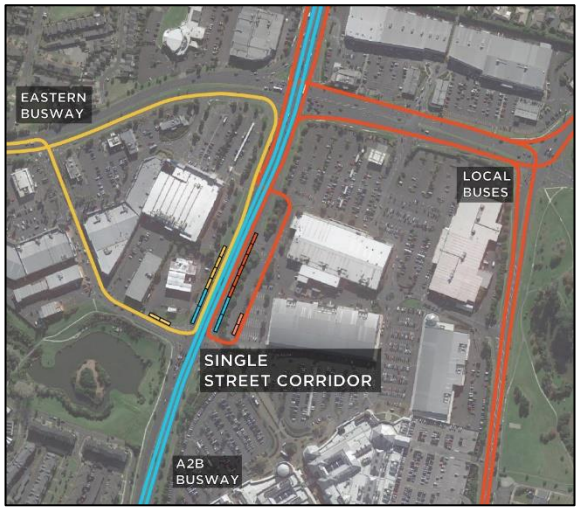
Sectorised 1: Eastern Busway one-way loop via Te Koha Road and A2B through



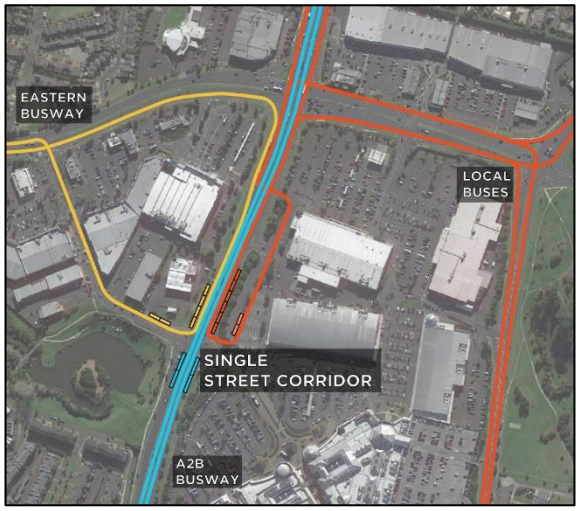
Sectorised 2: Eastern Busway one-way loop via main roads and A2B terminating



Sectorised 3: all stops located within Te Irirangi Drive corridor (single pair of large stops).



Sectorised 4: all stops located within Te Irirangi Drive corridor, with A2B using stops to the south of intersection.



Note that the existing stop locations could be used to continue serving local routes, removing the need to construct a new turnaround for local buses as is shown in the images above.

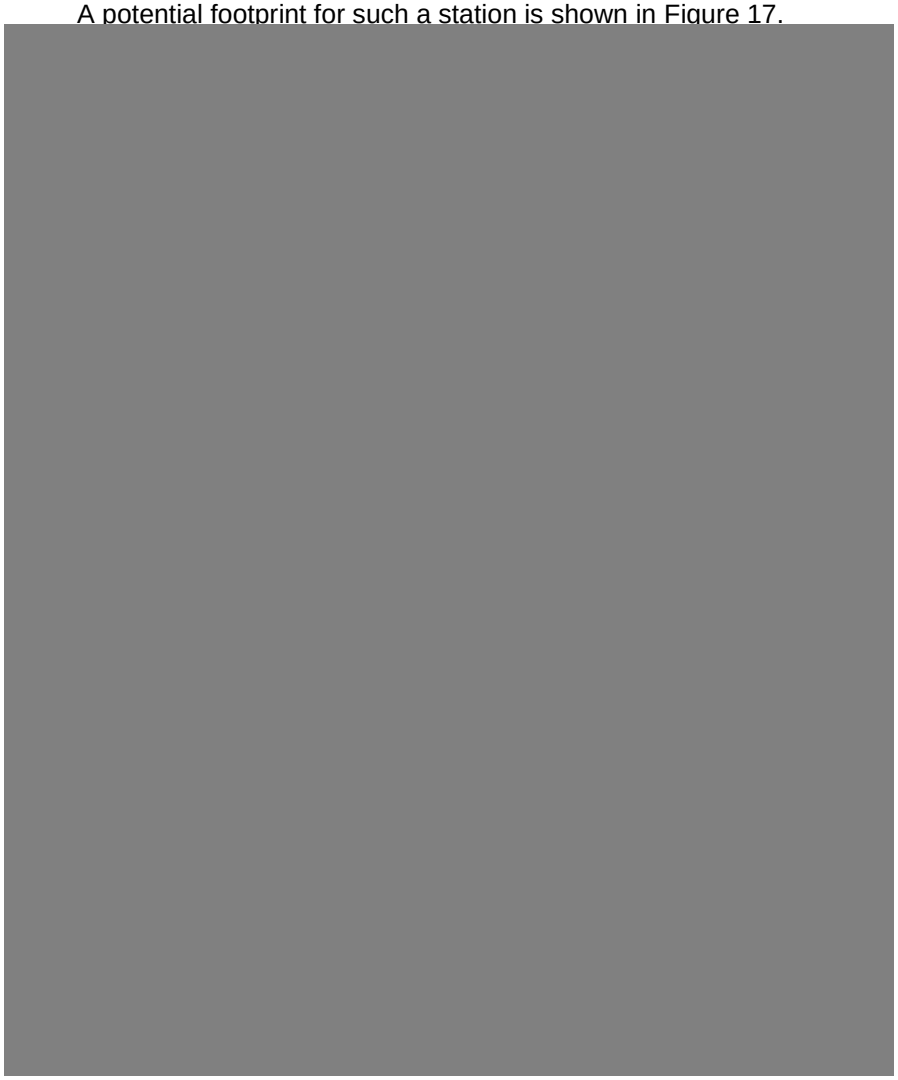
6.3 RTN station with local bus interchange

A grouped street corridor structure is different to the distributed and sectorised street corridor stations in that the AMETI and local bus stops are grouped to one side of Te Irirangi Drive, whilst the A2B buses stop inline on Te Irirangi Drive.

For the assessment of this option, it is assumed that all MRT services (ie A2B and AMETI) stop within the MRT corridor in the median of Te Irirangi Drive, with stopping bays and regular lanes to pass stopped vehicles. Meanwhile, local services would divert to a local off-street bus interchange, adjacent to the road corridor. It is assumed this option would include standard station facilities at the local bus interchange, and a grade-separated pedestrian concourse to provide access between the local

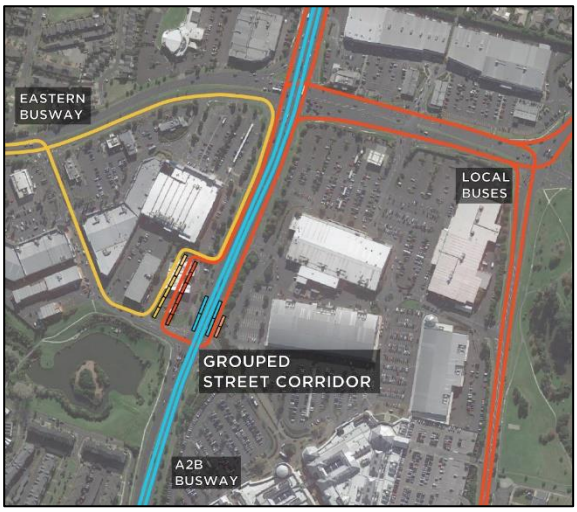
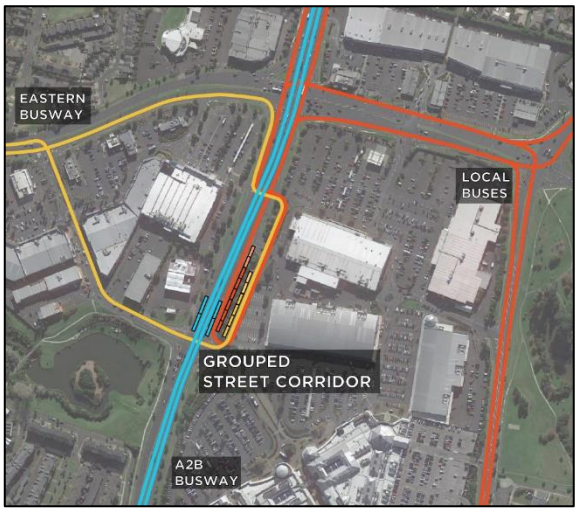
interchange, MRT in line station, and both sides of Te Irirangi Drive. It is also assumed that the AMETI services can do a one-way loop at the Botany end using Te Koha Drive (or a new bus road built in parallel), Te Irirangi Drive and Ti Rakau Drive (to avoid the need for offline turnarounds).

A potential footprint for such a station is shown in Figure 17.



In practice, this station design would result in a bus station being built on land to one side of Te Irirangi Drive, with through running A2B buses stopping in the street corridor alongside. If the A2B services were to terminate here, a sub-option would exist where A2B vehicles also terminate at the station to the east or west after turning around north of the inline MRT station. Figure 18 shows some circulation options for this station concept.

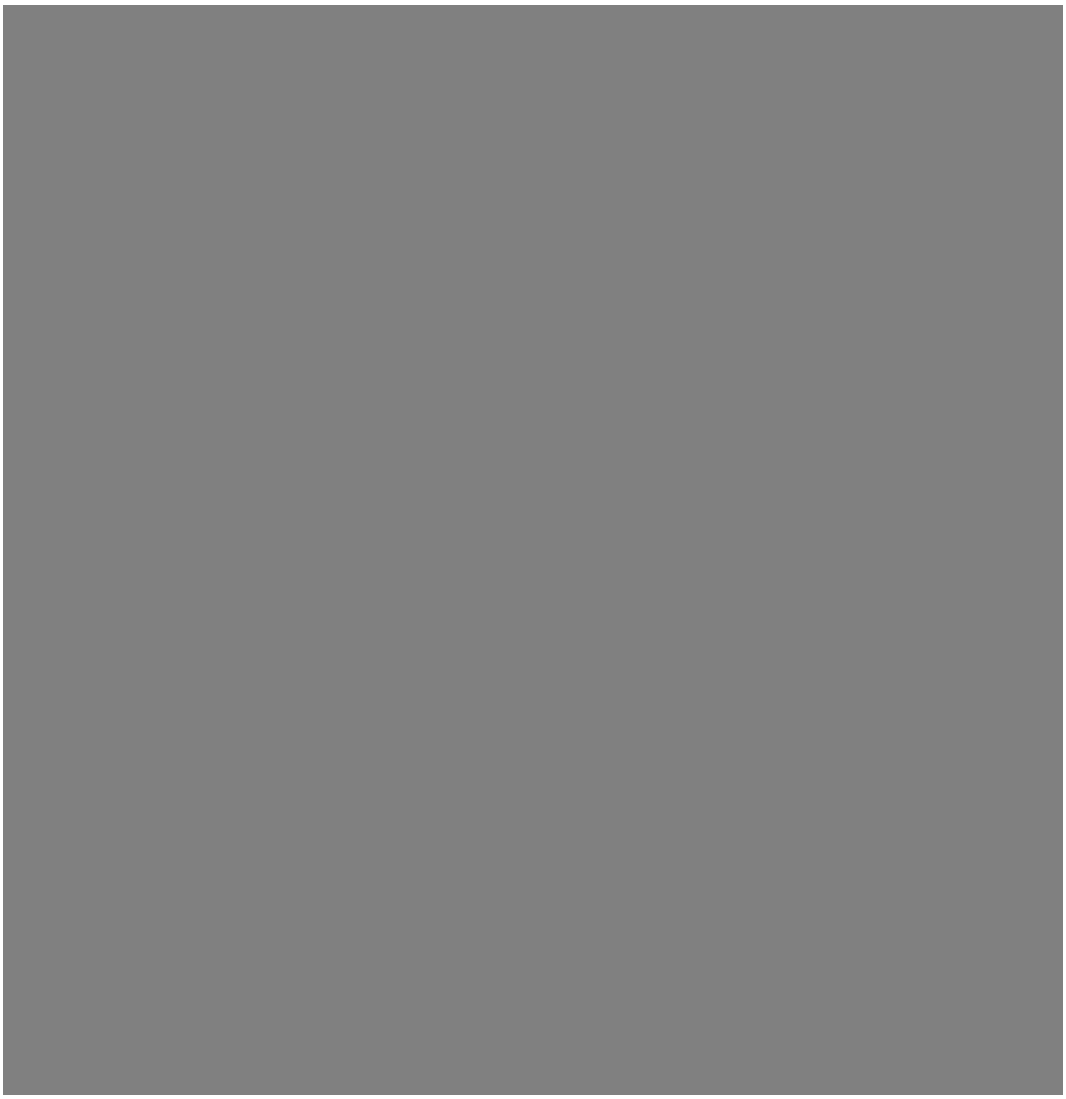
Figure 18: RTN station with local bus interchange, circulation options

RTN station and local interchange 1: West side station for AMETI and local buses, A2B on street (petrol station site)	RTN station and local interchange 2: East side station for AMETI and local buses, A2B in street (carpark site)
	

6.4 Offline station

There are several options for an offline station in and around Botany Town Centre. For assessing this option, it is assumed that all stops, turnarounds and layover spaces would be contained within the station footprint, and that the station would be located close to the same intersection as is assumed for all of the other options (Te Irirangi Drive, Te Koha Road and Botany Town Centre Drive). It is also assumed that pedestrian station access from west of Te Irirangi Drive would use signalised intersection crossing facilities, with no specific investments in vertical concourses, as is assumed for options 2 and 3. Bus access to the station is assumed to use the existing signals at the intersection of Te Koha Road, Te Irirangi Drive and Town Centre Drive.

Figure 19 shows some possible locations and footprints for an offline station in Botany Town Centre.



The three options above have been mapped in Figure 20, with possible circulation alignments for each option. Note that none of the locations discriminate between the termination or through-running of the A2B services. The is illustrated by options 1a and 1b for an offline station, whereby the only difference is the through-running of the A2B service.

6.5 Summary of station options

Table 6-1 summarises the station options for a station at Botany Town Centre. The key factors for each station design are where each service group stops in relation to each other service group. A one-page overview of all station options is included in Section 10 on page 51.

Table 6-1: Station options for Botany Town Centre

Option	Concept	Separation between service groups
1: Distributed street corridor	Each service group stops on a separate approach to an intersection.	Each group in close to an intersection but on different approaches.
2: Sectorised street corridor	All stops are in the same corridor, using median stops and/or side-of-road stops.	Service groups are either in the median in one long line, OR A2B uses the median, AMETI

Option	Concept	Separation between service groups
		uses the western and local buses use the eastern side of the road.
3: RTN station with local bus interchange	MRT services use stops in the median and local services use a local bus interchange.	MRT services in the median and local services in a separate station adjacent to the road corridor with the MRT stops.
4: Offline station	All services stop in one large, offline station.	Each service group has a separate platform.

7 Assessment of station options

Note that assumptions made for the station assessment include:

- Each station option is assumed to be located on (or as near as possible to) the intersection of Te Irirangi Drive, Te Koha Road and Botany Town Centre Drive.
- A2B services are always assumed to terminate north of Botany Town Centre, as described in Section 5.3.
- Any station location could be designed to work with different vehicle types, depending on the final preferred mode for the wider A2B programme.
- It is assumed that the station would require a total of 18-23 bus bays (as outlined in Section 3.3), however there may be opportunities to introduce efficiencies in the network around Botany, particularly for the frequent and local services. Changes to the required number of bus bays will feed into the design of the station as it progresses into a detailed design.
- Section 7.2 shows the results from the MCA of the station options for a Botany station.

7.1 Investment objectives

Table 7-1 maps the A2B and AMETI investment objectives together and identifies what KPIs are used in the MCA assessment to score the impact of each option. As for Table 5-1, this table only presents the KPIs that are considered to differentiate between options and can be measured with the information available and does not show other KPIs from the A2B investment logic map.

Table 7-1: Investment objectives from A2B and AMETI programmes, and KPIs for station assessment

Four Wellbeings	A2B Problem	A2B Benefits / Investment Objectives	AMETI Investment Objectives	A2B KPI
Economic Social Cultural	Poor east-west travel choices in southern area constrain current & future growth, undermining prosperity for Aucklanders.	2. Provide public transport for south and east Auckland that is easy to use, reliable, fast, resilient and affordable.	3. Improve the efficiency and resilience of the transport network surrounding … Botany by providing a dedicated route for public transport to and from the eastern suburbs. 4. Provide transport infrastructure that improves linkages, relieves network constraints and improves journey time, frequency and reliability of the transport network.	KPI 6: Generalised cost of travel
				KPI 7a: Peak travel time reliability (in service operations)
				KPI 7b: Peak travel time reliability (out of service operations)
				KPI 8: Directness / Ease of use (transfers)
		3. Promote urban regeneration improved built environment and economic opportunities.	2. Provide transport infrastructure that integrates with land uses and supports a quality, compact urban form ... along the Pakuranga to Botany Busway corridor. 6. Contribute to place shaping ... along the Busway Corridor by providing better connections and accessibility between and within the Centre and along the Corridor for all transport users, including public transport users, pedestrians and cyclists.	KPI 11: Improved access to the airport area and Local, Town and Metropolitan Centres.
				AMETI KPI 1[11]: Ability to minimise land consumption for the station
				AMETI KPI 2: Integrates with surrounding land uses (quality urban design)
Environmental Cultural Social	Current transport system has adverse environmental effects and does not recognise cultural identity and taonga.	4. Reduce the effects of the transport system on the environment and taonga.	None	KPI 13: Water quality effects of transport system
				KPI 20: Impacts on general traffic
Social Environmental	Perceptions of poor personal safety limit uptake of public transport & active modes.	5. Healthier and safer people.	7. Create a corridor that is safe for all road users, including public transport passengers, cyclists and pedestrians.	KPI 18: Ability for people to walk to PT stops and stations
				KPI 19: Extent of improved local walking and cycling connections

[11] The 'AMETI KPIs' are not included in the wider A2B MRT assessment. These have been added into the assessment for a station at Botany to reflect the AMETI investment objectives 2 and 6, however they are not necessarily KPIs for the wider AMETI programme.

7.2 MCA assessment

Table 7-2 summarises the KPI scores for the MCA assessment of the investment objectives (outlined in Table 7-1), as well as KPI scores for an operational and feasibility assessment of each for each of the station options. All options are scored relative to the 'do minimum' (Option 1). The comments provide brief explanations of methodology and/or reasons for the scores that are given to each option.

Table 7-2: KPI scoring of station options (scores from -3 to 3)

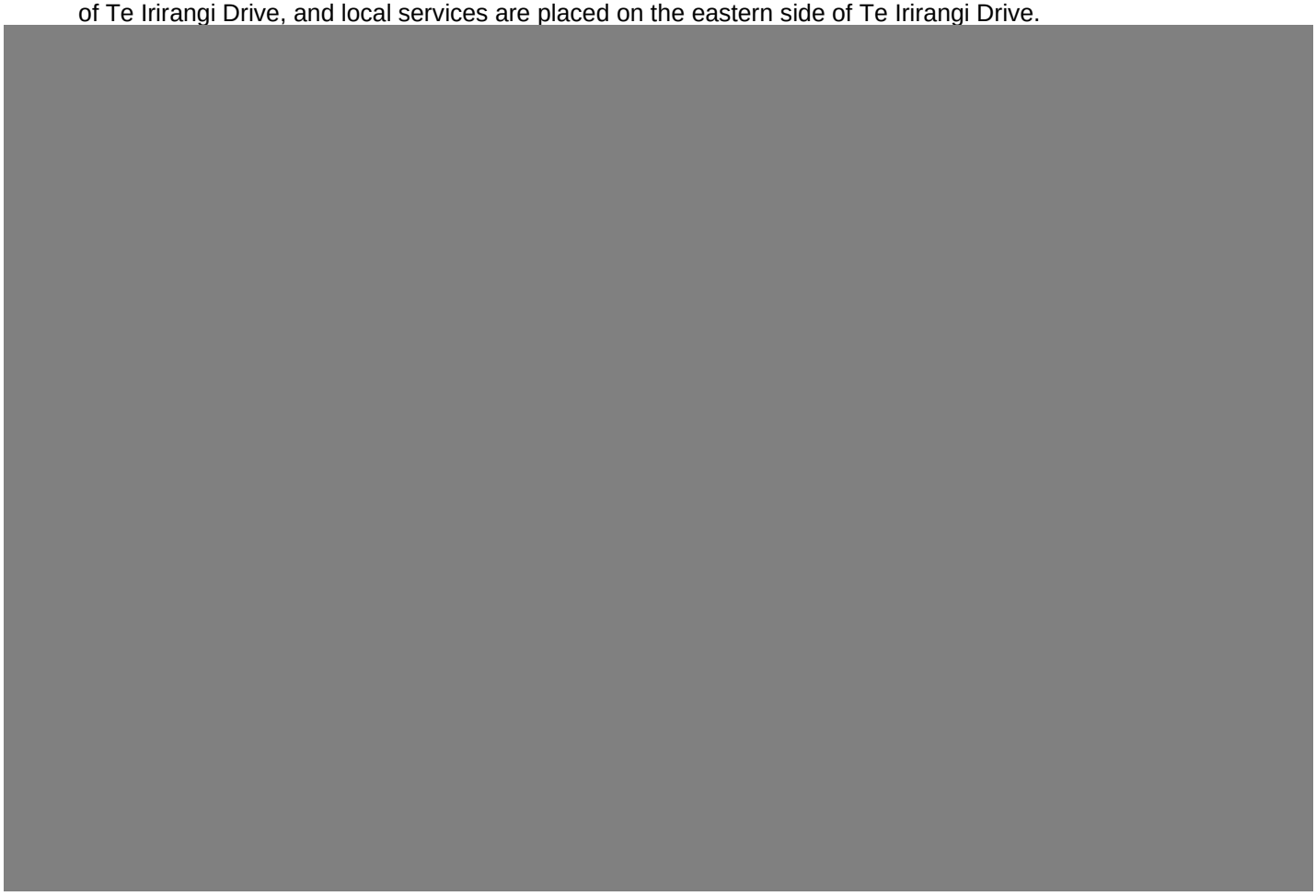
KPI	1 Street corridor, distributed	2 Street corridor, sectorised	3 RTN station with local interchange	4 Offline station	Comments
KPI 6: Generalised cost of travel	0	1	1	1	This option measures the 'cost' of each station option in terms of the time taken to service the station. The calculation for estimating a generalised cost considers: ▪ Travel times to get to the stops ▪ Priority and non-prioritised intersections traversed ▪ Station quality penalty for transfers (based on forecasted number of transfers from transport model outputs) ▪ Weightings for each service group's cost based on the demand for that service group Option 1 scores lowest because of the substantial transfer penalty for standard stops. Options 2 and 3 have similar travel times as option 1, but they have a moderate station quality (for transfers), so have a lower transfer penalty. Option 4 has the lowest station quality penalty (for transfers) but suffers from longer travel times, because of the diversions of services to get to the station.
KPI 7a: Peak travel time reliability (in-service operations)	0	0	-1	-2	Options 3 and 4 require some degree of diversions of services to get to the bus stops. In options 1 and 2, all services stop in line with the service operations.
KPI 7b: Peak travel time reliability (out-of-service operations)	0	1	2	3	Option 3 has layover spaces for local services within the local interchange, and option 4 includes in-place layover spaces for all services within the station area, so fewer out-of-service deviations are required compared with options 1 and 2. Option 2 is better than option 1, because the routing of services to layover areas is easier/less disruptive.
KPI 8: Directness / Ease of use (transfers)	0	1	1	2	Option 4 provides for the easiest transfers as all service groups stop within the same station space, however as the station is expected to be large, walking distances can still be long. Options 2 and 3 are expected to provide easier transfers than option 1, as vertical concourses for pedestrian access are assumed for these options.
KPI 11: Improved access to Local, Town and Metropolitan Centres	0	1	1	2	Options 2 and 3 score higher than option 1 because these station concepts are slightly closer to the Metropolitan Centre (compared with option 1, which involves many stops being at least one large road crossing away). Option 4 scored the highest, as the station could be placed within the Metropolitan Centre zone itself (although one option is outside of the designated Metropolitan Centre zone).
AMETI KPI 1: Ability to minimise land consumption for the station	0	-1	-1	-3	[redacted]
AMETI KPI 2: Integrates with surrounding land uses (quality urban design)	0	1	2	3	Option 4 scores highest for urban design, as a full offline station will likely involve more development and additional amenities, with a greater focus on user experience. Options 2 and 3 locate stops near one another, so they also provide opportunities for supporting developments and good urban design in their vicinity.
KPI 13: Water quality effects of transport system	0	0	0	0	No differentiation between the options because they all develop on already paved (or mostly paved) land.

KPI	1 Street corridor, distributed	2 Street corridor, sectorised	3 RTN station with local interchange	4 Offline station	Comments
KPI 20: Impacts on general traffic	0	0	-2	-3	Options 1 and 2 primarily involve services stopping along the road corridor, so they will not turn across general traffic lanes. Options 3 and 4 involve large volumes of buses turning in and out of an offline station, so may cause delays to general traffic flow.
KPI 18: Ability for people to walk to PT stops and stations	0	0	0	0	No differentiation between the options at this level of detail because they are all in approximately the same general location.
KPI 19: Extent of improved local walking and cycling connections	0	2	2	0	Options 2 and 3 are likely to include a pedestrian bridge or other walking connection over Te Irirangi Drive, which is a busy road with destinations on either side of it.
Operational and feasibility assessment					
Operational impacts and costs	0	1	1	3	Option 4 is the simplest possible station design for public transport operations because all services can turnaround within the station. Options 2 and 3 also have benefits, because AMETI services can turnaround as part of their service routing using Te Koha Drive, Te Irirangi Drive and Ti Rakau Drive, so only local services have to turnaround offline. In option 1, all services have to turnaround offline.
Property/consents	0	-1	-1	-3	[redacted]
Capital cost		-2	-2	-3	[redacted].
Constructability	0	-1	-1	1	Option 4 will have the simplest construction, as all construction is away from the road corridor, so there will be fewer traffic management requirements during construction. Options 2 and 3 will involve some construction directly on the road corridor, so this will be more disruptive.
Environmental impacts	0	0	0	0	No discernible differences between the options. Note that a detailed assessment by environmental specialists has yet to be completed and will be included within Part 2 of the Business Case

7.3 Emerging preferred option

Following initial consultation between the A2B project team, AMETI project team and Auckland Transport, the sectorised street corridor option is the emerging preferred option, as it yields similar (albeit not as substantial) benefits as the RTN station with local interchange and offline station options, with considerably fewer disbenefits.

Figure 21 shows a more detailed footprint and street design for the emerging preferred option. This option places the A2B stops in the median of Te Irirangi Drive with inline stops (ie no capacity for overtaking, as only the A2B services will use this space). AMETI stops are placed on the western side of Te Irirangi Drive, and local services are placed on the eastern side of Te Irirangi Drive.



8 Summary

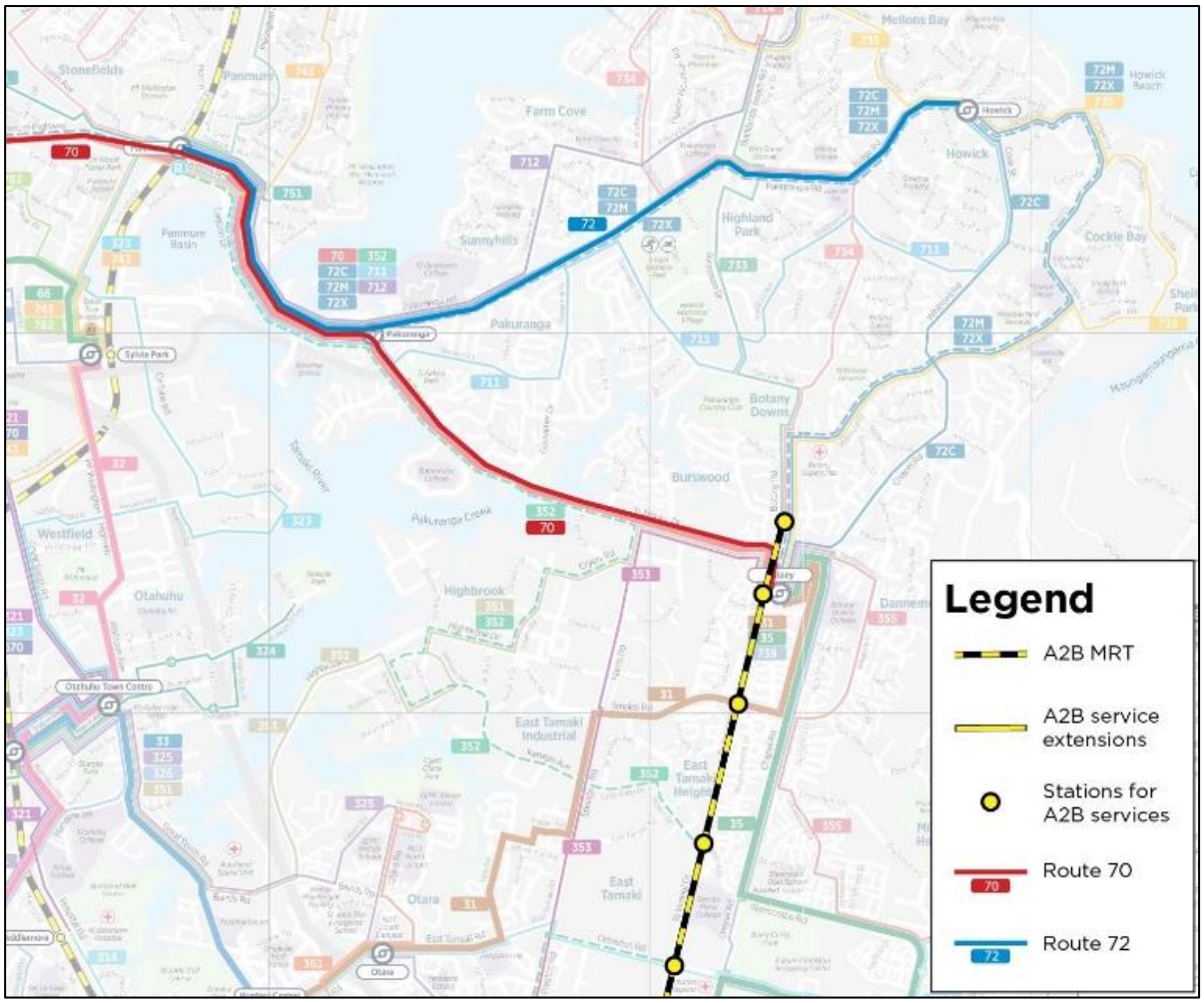
This technical note has assessed A2B service conditions in and around Botany Town Centre, including commentary of the underlying assumptions, corridor routing options for A2B services, and station design for all services connecting to Botany. This summary section highlights the emerging preferred option for the corridor alignment for A2B services and the station design at Botany.

8.1 Corridor options

The emerging preferred option for the routing of A2B services is a hybrid option between options 1 and 3. Option 1 is to terminate the A2B service at Botany and option 3 is to extend the services and infrastructure to Highland Park or Howick.

The emerging preferred option is for the A2B services and infrastructure to extend just north of Botany Town Centre, to terminate in an area (as yet undefined) with more space available to facilitate layovers and turnarounds of services; this is shown in Figure 22.

Figure 22: A2B emerging preferred corridor option



8.2 Station options

Each of the station options considered has some clear benefits and disbenefits. The emerging preferred option for a station at Botany Town Centre is option 2, a sectorised street corridor design; the concept for this is shown in Figure 23. Some of the key features of this option, that led to its preference over the others, are:

- Good connectivity between each set of stops and each side of Te Irirangi Drive through signalised crossings at the intersection and a pedestrian concourse over the station,
- Minimal deviations for services to get to their stops, and
- Negligible land consumption from the metropolitan centre.

A schematic cross-section of the emerging preferred option is indicated in the figure below.

8.3 Further development of emerging preferred option

The emerging preferred station option is recommended subject to resolving the following technical issues:

- An appropriate means of turning around local bus services. Terminating location services require repositioning before departing / commencing a service in the opposite direction. This needs to be done effectively as it will impact the reliability of services if delayed. The high number of terminating services results in a high number of vehicles requiring an effective circulation solution.

- An eastbound connection between the eastern busway and Botany Station, near Te Koha Place. Botany interchange provides a connection between two RTN busways. The emerging preferred station location and public transport operational pattern requires an eastbound connection to around Te Koha Place to allow vehicles to serve the kerbside platforms.
- A turnaround for Airport to Botany services north of Ti Rakau Drive. This needs to be done effectively as it will impact the reliability of services if delayed. This will require trade-offs between providing this via the existing road network (which could increase operational cost) or through a new off-street facility (which could require property acquisition).

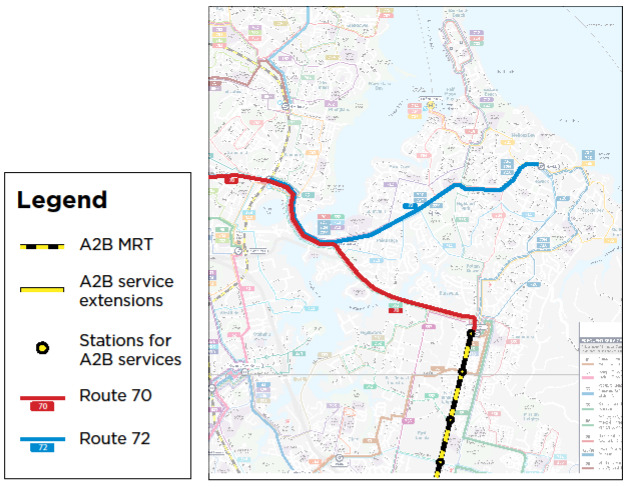
Further analysis of these issues will be undertaken within Part 2 of the Business Case.

Botany Corridor

There are four main corridor options for routing beyond Botany:

1. Terminate the MRT corridor at Botany
2. Service extensions (with or without MRT infrastructure)
3. MRT infrastructure extension (Highland Park or Howick)
4. AMETI integration (connected infrastructure)

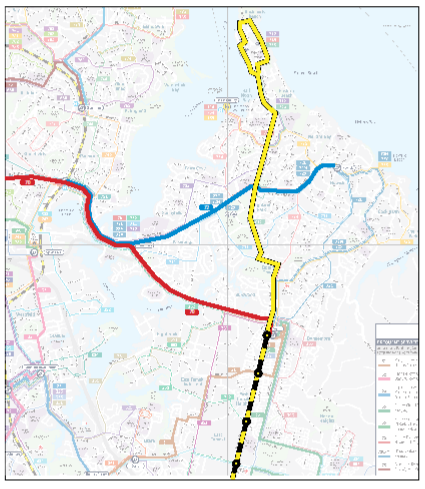
1. Botany terminus



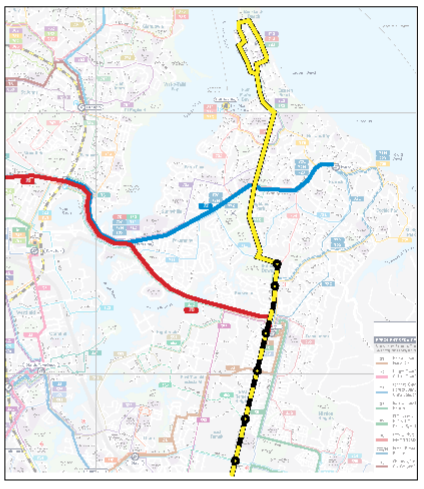
Service Extensions

These options consider extending the A2B services from Botany on to Bucklands Beach via Highland Park, on local roads, possibly with a part-extension of the MRT infrastructure along Botany Road.

2A. Service-only extension



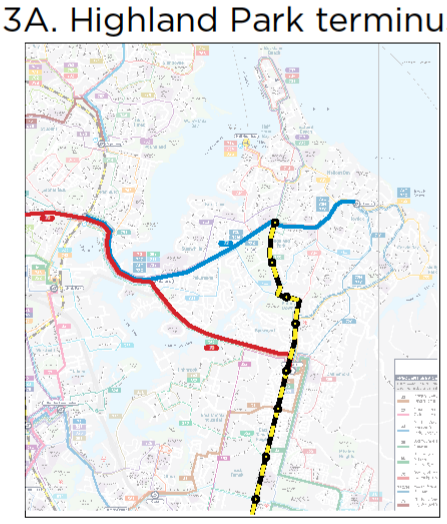
2B. Part-MRT extension



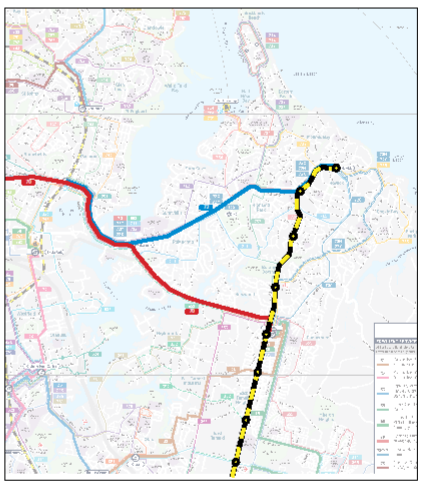
Infrastructure Extensions

These options involve extending the A2B MRT infrastructure and services from Botany to either Highland Park or Howick.

3A. Highland Park terminus



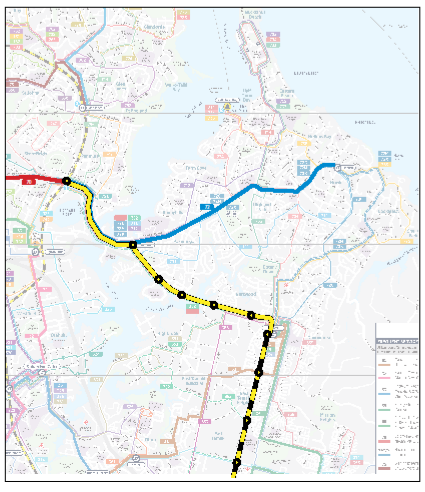
3B. Howick terminus



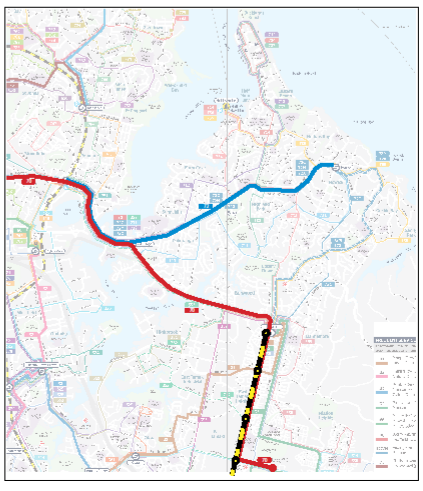
AMETI Options

These options both terminate the A2B infrastructure at Botany, directly connect the Eastern busway and the A2B MRT corridor, and make some service changes.

4. AMETI integration



5. AMETI service extension



Approved by:

Title	Name	Position	Signature	Date
Author	[redacted]	Senior Consultant / Transport Planner	[redacted]	30/04/2020
Reviewer	[redacted]	Principal, Transport Planner		30/04/2020