

AIRPORT TO BOTANY

Botany Station Options Assessment Auckland Transport

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1 Introduction

1.1 Purpose of Report

This report assesses improvement options for Botany bus station to respond to the problems, and investment objectives identified for the Airport to Botany Rapid Transit Single Stage Business Case (SSBC). The report describes previous assessments and an updated study undertaken in 2019.

In order to identify a recommended option, a multi-criteria analysis (MCA) framework has been developed to assess the options against the identified problems, benefits and investment objectives. The report also presents Botany Bus Station layout designs and options for routing services into and through Botany.

The design of Botany Station is being considered as part of the Airport to Botany (A2B) Rapid Transit project. The assessment of a station at Botany and surrounding services requires consideration of and integration between the A2B project, the Eastern Busway project, and local bus services.

1.2 Content

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

- Background: summary of the superseded 2018 options assessment.
- Botany Options Assessment 2019: summary of the bus services requiring terminal facilities and required geometric design requirements.
- Development of Options: conceptual options for types of stations at Botany Town Centre alongside where and how to terminate the A2B Rapid Transit service.
- Assessment Framework: summary of investment objectives and KPIs used as a benchmark to be compared against.
- Multi Criteria Assessment: analysis of emerging preferred options and criteria development
- MCA Summary and Recommendation: summary and review of MCA results
- MCA Assessment: transport planning assessment, assessment of environmental effects and planning, and implementability assessment
- Recommended Options and Next Steps: review of workshop outcomes and recommended option.

2 Background

2.1 Botany Station Options Assessment 2018

A previous interchange options assessment was carried out for Botany Station detailed in technical note 502334-6000-TEC-KK0010 dated 29 January 2019. This included options for routing services into and around Botany, and possible station designs. The design of Botany Station was being considered as part of the Airport to Botany (A2B) Rapid Transit project. The assessment of a station at Botany and surrounding services requires consideration of and integration between the A2B project, the Eastern Busway project, and local bus services. A multi-criteria analysis (MCA) framework was established to assess the options against the identified investment objectives alongside KPIs to score the impact of each option. The two separate investment objectives for A2B and Eastern Busway were jointly included in the MCA to reflect the strategic drivers of both projects, with KPIs and measures developed from these.'

The A2B investment objectives are as follows:

- a) More equitable access to jobs, learning and social activities.
- b) Provide public transport for south and east Auckland that is easy to use, reliable, fast, resilient and affordable.
- c) Promote urban regeneration improved built environment and economic opportunities.
- d) Reduce the effects of the transport system on the environment and taonga.
- e) Healthier and safer people.


The Eastern Busway investment objectives are as follows:

- a) Provide a multi modal transport corridor that connects Pakuranga and Botany to the wider network and increases access to a choice of transport options.
- b) Provide transport infrastructure that integrates with land uses and supports a quality, compact urban form along the Pakuranga to Botany Busway corridor.
- c) 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.
- d) Provide transport infrastructure that improves linkages, relieves network constraints and improves journey time, frequency and reliability of the transport network.
- e) 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.
- f) Create a corridor that is safe for all road users, including public transport passengers, cyclists and pedestrians.

2.1.1 Interface with Eastern Busway

The optioneering undertaken for the A2B and 20Connect SSBC considers an 'ultimate' Botany Station that provides for A2B, Eastern Busway and local bus services in 2048. The A2B Botany Station optioneering reflects a SSBC-stage of design (concept design). It also acknowledges that further optioneering will be undertaken by the Eastern Busway Alliance (EBA), which will be delivering the Eastern Busway by 2025, ahead of A2B.

The AT Eastern Busway project team have been involved throughout the A2B Botany Station options assessment process. At the time of writing, the EBA commenced in October 2019. The A2B project team have provided A2B's Botany Station options assessment materials, including short-listed online and offline station



layout options to the EBA to inform their further optioneering. Importantly, the A2B Botany Station optioneering undertaken to-date has identified A2B's functional requirements at Botany. It is acknowledged that the location and form of the station may evolve as the EBA undertakes further options assessment, engagement and progresses the design in more detail.

It is intended that Botany Station will be delivered in stages:

- Stage 1 – Botany Station will be consented, funded and delivered by EBA, opening 2025. Includes designating for the ultimate (Stage 2 2030) station footprint and future-proofing for A2B.
- Stage 2 – Botany Station upgrade funded and delivered by A2B, opening 2030.

The A2B project team will continue to work with the EBA to confirm A2B's functional requirements at Botany Station.

2.1.2 2018 Recommended Public Transport Network

The 2018 technical report identified an emerging preferred option for the corridor and station for the A2B services and station design at Botany:

The emerging preferred option was for the A2B services and infrastructure to extend just north of Botany Town Centre, to terminate in an area with more space available to facilitate layovers and turnarounds of services. The routing of the A2B service was a hybrid option between the termination of the A2B service at Botany and extending the services and infrastructure to Highland Park or Howick.

Each of the station options considered has some clear benefits and dis-benefits. The emerging preferred option for a station at Botany Town Centre is a sectorised street corridor design. Some of the key features of this option, that led to its preference over the others, were:

- 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.
- Negligible land take from the metropolitan centre.

The emerging preferred station option was 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).

2.1.3 Bus Services Requiring Terminal Facilities

Projected bus volumes and bus stop requirements show that most services are planned to terminate at Botany, requiring significant space for stops and layover bays. The 2026 Network in Figure 2-1 shows that with the Eastern Busway in place, all local and busway services are intended to terminate at Botany. This excludes the 705 and 706 peak-only routes.



Figure 2-1 Eastern Busway 2026 Network Plan

A2B service plan and operating model conditions and assumptions are outlined as follows:

- 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.

2.1.4 Geometric Design Criteria

Technical note 502334-6000-TEC-KK-0010 outlines the requirements of station/stop design, indicative bus bay requirements, and corresponding ATCOP geometric design requirements.

The following station/stop conditions and assumptions were outlined:

- 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 54m long to allow 2x24m long buses at the same time as well as a 6m gap).
 - 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 Updated Botany Station Options Assessment 2019

3.1 Bus Services Requiring Terminal Facilities

3.1.1 Base case network and bus volumes

This section outlines the base case bus network and bus volumes for Botany station with the addition of the A2B service and the Eastern Busway service plan. Data regarding Eastern Busway and local buses accessing Botany has been supplied to the project team by the Eastern Busway project¹.

Figure 3-1 shows the 2026 Network with the Eastern Busway 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. This involves significant requirements for passenger bus stops and layover spaces.



Figure 3-1: Eastern Busway 2026 network plan¹

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 Rapid Transit buses (from either the Eastern Busway or A2B corridor). The projected bus volumes for the Eastern Busway and local services are sourced from Eastern Busway documentation².

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

² 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 terminating/originating peak bus volumes by route group at future Botany Station

Type	Details	No. of routes	Vehicle type	Buses per hour peak direction at peak	
				2028	2048
Eastern Busway Group (Eastern Busway) - 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 ³	12	20
	Total A2B			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
<u>All at Botany</u>		<u>15</u>	<u>Total at Botany</u>	<u>79</u>	<u>119</u>

3.1.2 Assumption for capacity per bus bay: Passenger stops

Two sets of figures are shown for each group in section 3.1.4, and shows 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 volume of 24 buses through per hour, per bay, or 2.5 minutes per bus on average. This is comprised of an allowance for 60 seconds each for manoeuvring in and out of the stops and straightening against the kerb, plus 30 seconds dwell time for passenger boarding and alighting.
- Where multiple different routes use the same through or arrival stop, additional bays may be warranted to account for the potential for separate routes to arrive simultaneously.
- Layover requirements are based on an average capacity of 6 buses laying over per hour, per bay. This is based on the required 10-minute driver break/recovery stop for timekeeping. Further layover bays are also required as described below.

³ 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.

3.1.3 Bus Network Options

A detailed review of potential changes to the local bus network is provided in the technical note on the Local Bus Network and Infrastructure Changes (Please refer to technical note: 502334-6000-TEC-DD-0008). In this technical note, a set of five routing scenarios are outlined, each of which has different requirements for the interchange station at Botany, as well as at several other interchange locations. At a high-level, the scenarios involve through-routing and terminating of each of the service groups as presented in Table 3-2.

Table 3-2: Routing scenarios through/to Botany Station

Service group	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
A2B	Through	Terminate	Through	Terminate	Through (to Eastern Busway)
Eastern Busway	Terminate	Terminate	Terminate	Terminate	Through (from A2B)
'Locals'	Terminate	Terminate	Through	Through	Through

A further Scenario 6 was developed as part of the optimisation of the emerging preferred Botany Station Options which assumed the termination of A2B and Eastern Busway services and through-routing approximately half of all local services. This scenario is described in technical note: 502334-6000-TEC-DD-0008 and Section 7.1.

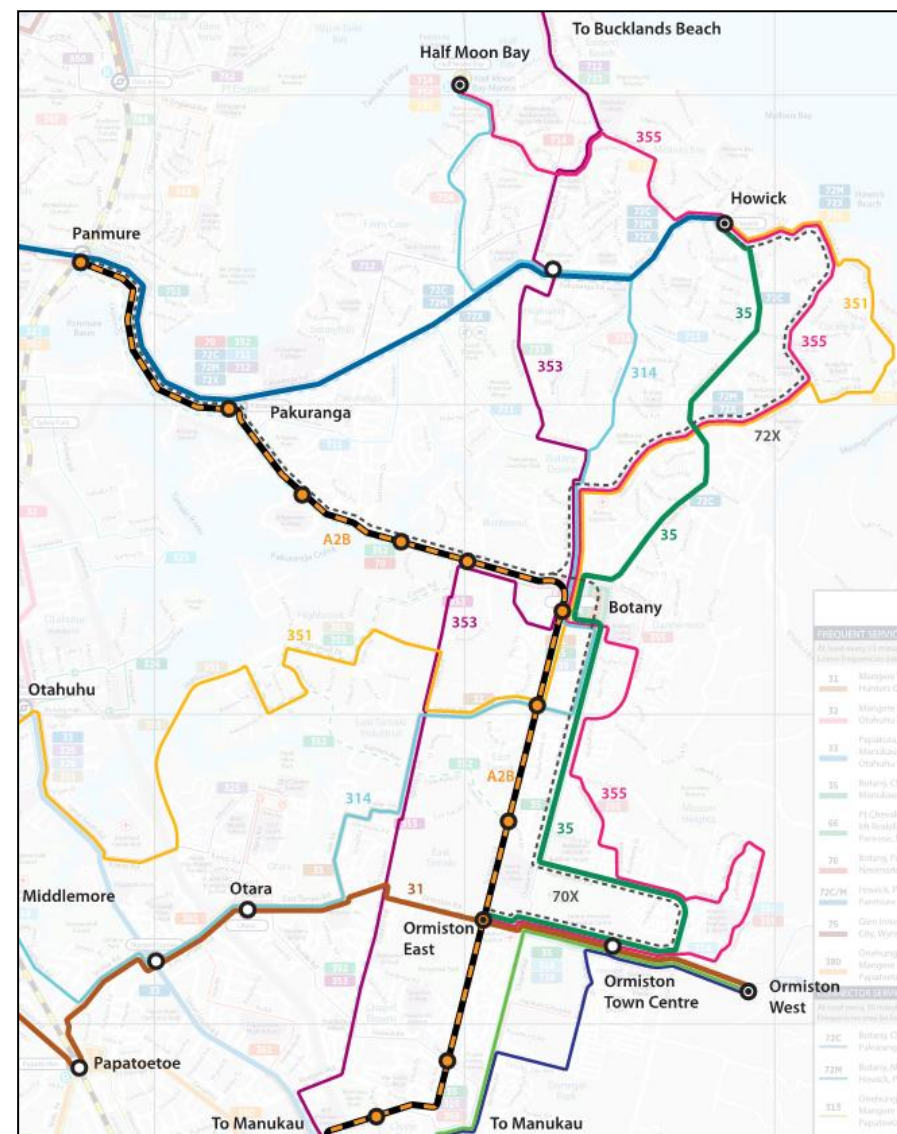
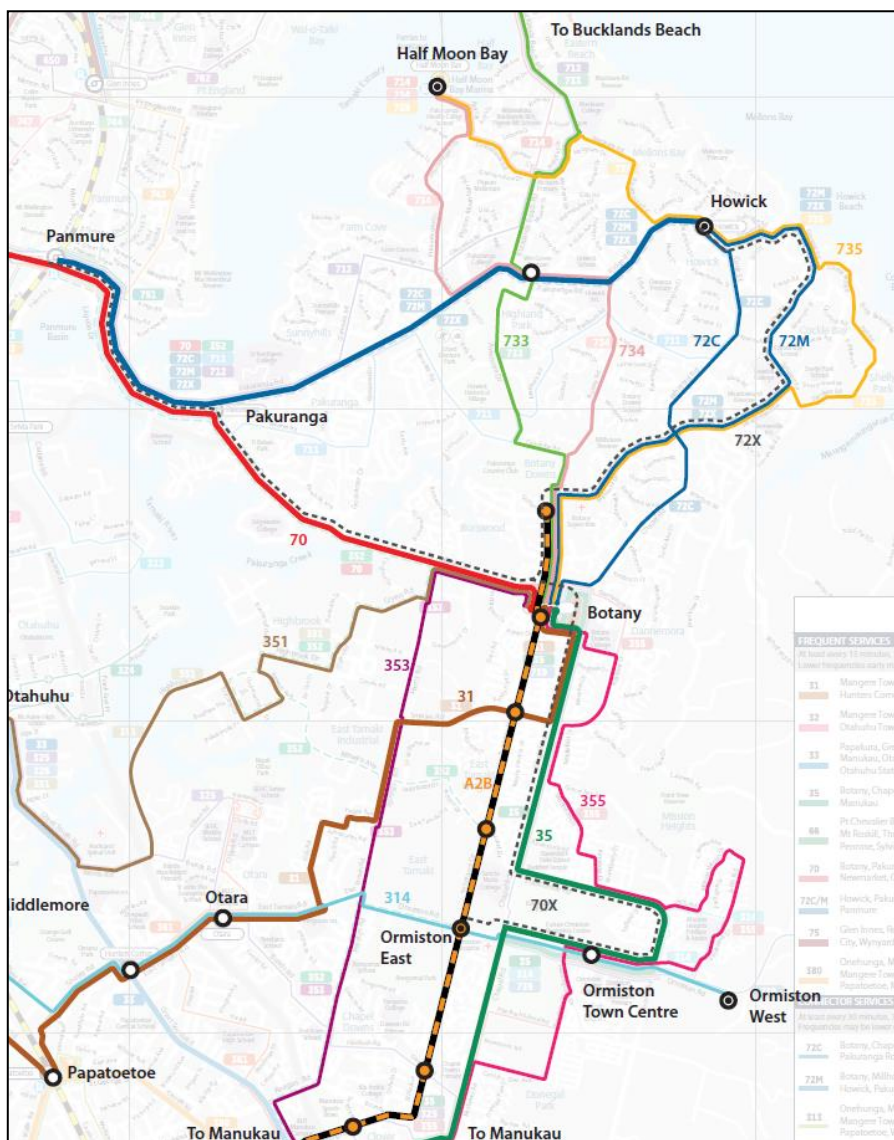
Table 3-4 to Table 3-8 show Scenario 1 (all terminate except A2B) and Scenario 5 (all through-route) respectively. Each of the other scenarios is a variation on each of these two network maps.

The interchange requirements at Botany and the other key interchange locations are shown in Table 3-3. For a comprehensive description of which services through-route and terminate at Botany, see the rest of this section. For a similar description for each of the other interchange locations and potential local bus network changes, please refer to technical note 502334-6000-TEC-DD-0008.

Table 3-3: Number of bays required for each interchange location under each scenario

Interchange location	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Howick	2	2	4	4	4
Ormiston East	2	2	3	3	3
Ormiston West⁽¹⁾	0	0	4	4	4
Botany	29	33	14	18	8
North of Botany	6	0	6	0	0

Note (1): All buses serving the Ormiston West bus stops will use the passenger stops on-street on Ormiston Road, with terminating services continuing to an adjacent layover and turnaround facility located on Florence Carter Drive.



3.1.4 Bays required at Botany Station

Scenario 1: All services terminate except A2B

The table below shows a high-level assessment of the total number of bus bays required, covering passenger stops and layover bays.

Under scenario 1, the bus stop requirement at Botany for the terminating services is 27 bays, comprised of 5 bays for passenger drop off, 6 bays for passenger pick up and 16 bays for layover and time keeping. In addition to these, one extra-long (24m+) bay should be located on Te Irirangi Drive in each direction for the A2B through services. Bus bays should be configured into separate stop areas based on the stop grouping in. Each stop group should be configured as indented bays for independent operation. Layover bays should be located between the drop off and pick up bays with a short and direct route, ideally with line of sight to the pick-up stops.

Table 3-4: Bus bay requirements for: all services terminate at Botany except A2B (peak-only routes bypass)

Group	Details	BPH, peak direction, at peak 2048	NORTHBOUND THROUGH STOPS	SOUTHBOUND THROUGH STOPS	DROP OFF Passenger bays required	LAYOVER layover bays	PICK UP Passenger bays required	TOTAL
Eastern Busway Group	Core frequent route (70)	20	-	-	2	6	1	
	Local routes (351,353)	12	-	-	(combined)	(combined)	1	
	Total Eastern Busway	32	-	-	2	6	2	10
A2B Group	A2B core frequent service	20	1	1	-	-	-	
	Total A2B	20	1	1	-	-	-	2
Local Bus Group	Via Botany Road (72M/X, 733, 734, 735)	28	-	-	3	10	2	
	Via Dannemora Drive (31, 35, 355, 72C, 739)	31	-	-	(combined)	(combined)	2	
	Total local buses	59	-	-	3	10	4	17
Peak only group	Peak only routes (705,706) <i>not via Botany</i>	8	-	-	-	-	-	-
	Total peak-only	-	-	-	-	-	-	-
<u>All at Botany</u>		91 terminating, 20 through per direction	1	1	5	16	6	29

Scenario 2: All services terminate at Botany

Table 3-5 shows the bus bay requirements for a scenario whereby all services terminate at Botany, except peak-only routes, which bypass Botany. The total bus stop requirement at Botany to serve a fully terminating network would be 33 bays, comprised of 6 bays for passenger drop off, 7 bays for passenger pick up, and 20 bays for layover and timekeeping. Of these, one drop-off, three layover and one pick up bay should be extra-long (24m+) for the A2B RTN service. The remainder should be standard size bus bays. Bus bays should be configured into separate bus stops based on the stop grouping above. Subgroups of routes can share drop off bays but should have separate pick up stops for legibility. Each stop group should be configured as indented bays for independent operation. Layover bays should be located between the drop off and pick up bays with a short and direct route, ideally with line of sight to the pickup stops.

Table 3-5: Bus bay requirements for: all services terminate at Botany (peak-only routes bypass)

Group	Details	BPH, peak direction, at peak 2048	NORTHBOUND THROUGH STOPS	SOUTHBOUND THROUGH STOPS	DROP OFF Passenger bays required	LAYOVER layover bays	PICK UP Passenger bays required	TOTAL
Eastern Busway Group	Core frequent route (70)	20	-	-	2	6	1	
	Local routes (351,353)	12	-	-	(combined)	(combined)	1	
	Total Eastern Busway	32	-	-	2	6	2	10
A2B Group	A2B core frequent service	20	-	-	1	4	1	
		20	-	-	1	4	1	6
Local Bus Group	Via Botany Road (72M/X, 733, 734, 735)	28	-	-	3	10	2	
	Via Dannemora Drive (31, 35, 355, 72C, 739)	31	-	-	(combined)	(combined)	2	
	Total local buses	59	-	-	3	10	4	17
Peak only group	Peak only routes (705,706) <i>not via Botany</i>	8	-	-	-	-	-	-
	Total peak-only	NA	-	-	-	-	-	-
<u>All at Botany</u>		111 terminating	0	0	6	20	7	33

Scenario 3: Eastern Busway terminates. Local buses and A2B through-run

Table 3-6 shows the bus bay requirements for scenario 3. The terminal bus stop requirement at Botany to serve the Eastern Busway group would be 6 bays, comprised of one drop off bay, one pick up bay, and 4 layover-timekeeping bays. In addition, one extra-long (24m+) bay should be located on Te Irirangi Drive in each direction for the A2B through services, and one standard length triple-bay stop should be located in each direction for local through services. Bus bays should be configured into separate bus stops based on the stop grouping above. Each stop group should be configured as indented bays for independent operation. Layover bays should be located between the drop off and pick up bays with a short and direct route, ideally with line of sight to the pick-up stops.

Table 3-6: Bus bay requirements for: Eastern Busway terminates at Botany, local and A2B services run through

Group	Details	BPH, peak direction, at peak 2048	NORTHBOUND THROUGH STOPS	SOUTHBOUND THROUGH STOPS	DROP OFF Passenger bays required	LAYOVER layover bays	PICK UP Passenger bays required	TOTAL
Eastern Busway Group	Core frequent route (70)	20	-	-	1	4	1	
	Total Eastern Busway	20	-	-	1	4	1	6
A2B Group	A2B core frequent service	20	1	1	-	-	-	
	Total A2B	20	1	1	-	-	-	2
Local bus through group	35 + 72C Ormiston West to Howick	8			-	-	-	
	314 + 734 Middlemore to Half Moon Bay	4			-	-	-	
	351 + 735 Otahuhu to Howick	6	3 (combined)	3 (combined)	-	-	-	
	353 + 753 Manukau to Bucklands Beach	6			-	-	-	
	355 and 72M Ormiston West to Half Moon Bay	7			-	-	-	
	Total Local	31	3	3	-	-	-	6
Peak only group	Peak only routes (705,706) <i>not via Botany</i>	8	-	-	-	-	-	-
	Total peak-only	NA	-	-	-	-	-	-
<u>All at Botany</u>		20 terminating, 51 through per direction	4	4	1	4	1	14

Scenario 4: Eastern Busway and A2B terminate, local buses through run

Table 3-7 presents the bus bay requirements for scenario 4. Under this scenario, the terminal bus stop requirement at Botany to serve the Eastern Busway group would be 12 bays, comprised of two drop off bays, two pick up bays, and 8 layover-timekeeping bays. Of these, one drop-off, one pick-up and four layover bays should be extra-long (24m+) for the A2B service. In addition, one standard length triple-bay stop should be located in each direction on or near Te Irirangi Drive for local through services. Bus bays should be configured into separate bus stops based on the stop grouping above. Each stop group should be configured as indented bays for independent operation. Layover bays should be located between the drop off and pick up bays with a short and direct route, ideally with line of sight to the pick-up stops.

Table 3-7: Bus bay requirements for: Eastern Busway and A2B terminate, local buses run through

Group	Details	BPH, peak direction, at peak 2048	NORTHBOUND THROUGH STOPS	SOUTHBOUND THROUGH STOPS	DROP OFF Passenger bays required	LAYOVER layover bays	PICK UP Passenger bays required	TOTAL
Eastern Busway Group	Core frequent route (70)	20	-	-	1	4	1	
	Total Eastern Busway	20	-	-	1	4	1	6
A2B Group	A2B core frequent service	20	-	-	1	4	1	
	Total A2B	20	-	-	1	4	1	6
Local bus through group	35 + 72C Ormiston West to Howick	8			-	-	-	
	314 + 734 Middlemore to Half Moon Bay	4			-	-	-	
	351 + 735 Otahuhu to Howick	6	3 (combined)	3 (combined)	-	-	-	
	353 + 753 Manukau to Bucklands Beach	6			-	-	-	
	355 and 72M Ormiston West to Half Moon Bay	7			-	-	-	
	Total Local	31	3	3	-	-	-	6
Peak only group	Peak only routes (705,706) <i>not via Botany</i>	8	-	-	-	-	-	-
	Total peak-only	NA	-	-	-	-	-	-
<u>All at Botany</u>		40 terminating, 31 through per direction	3	3	2	8	2	18

Scenario 5: All services through-run

Table 3-8 shows the bus bay requirements for a scenario whereby all local services through run, and A2B and Eastern Busway connect into a single service, terminating at the Airport and at Puhinui, and running through at Botany. Under this scenario, the total bus stop requirement at Botany to serve a fully through-routed network would be 8 bays. This would be comprised of one single-bay extra-long (24m+) through stop for RTN buses, and one triple-bay standard through stop for local buses on Te Irirangi Drive in the northbound direction, and the same in the southbound direction. The local bus stops should be configured as indented bays for independent operation as through-stops. The RTN bays can be inline if operating in a dedicated lane or indented if sharing lanes with the local buses. No layover bays are required under this scenario.

Table 3-8: Bus bay requirements for: local services through-run, A2B and Eastern Busway connect up and through-run

Group	Details	BPH, peak direction, at peak 2048	NORTHBOUND THROUGH STOPS	SOUTHBOUND THROUGH STOPS	DROP OFF Passenger bays required	LAYOVER layover bays	PICK UP Passenger bays required	TOTAL
RTN through group	A2B(+ 70) Airport to Panmure combined RTN	20	1	1	-	-	-	
	Total RTN	20	1	1	-	-	-	2
Local bus through group	35 + 72C Ormiston West to Howick	8	3 (combined)	3 (combined)	-	-	-	
	314 + 734 Middlemore to Half Moon Bay	4			-	-	-	
	351 + 735 Otahuhu to Howick	6			-	-	-	
	353 + 753 Manukau to Bucklands Beach	6			-	-	-	
	355 and 72M Ormiston West to Half Moon Bay	7			-	-	-	
	Total Local	31	3	3	-	-	-	6
Peak only group	<i>Peak only routes (705,706) not via Botany</i>	8	-	-	-	-	-	-
	Total peak-only	NA	-	-	-	-	-	-
<u>All at Botany</u>		0 terminating, 51 through per direction	4	4	-	-	-	<u>8</u>

3.2 Geometric Design requirements

3.2.1 Underlying Conditions and Assumptions

The following underlying conditions and assumptions are compiled from other work on the A2B project.

■ Demand Modelling Assumptions:

- AFC modelling Scenario 48134: 2048 AM model including the A2B service with 5-minute headways travelling between the Airport and Botany via Puhinui and Manukau.
- Approximately 2,700 passengers per hour on A2B at the busiest point.
- BRT is appropriate for A2B for projected demands and service requirements.

■ Service plan and operating model:

- A2B service running with at least 10-minute headways all day, and up to 4-minute headways in peak.
- A2B will operate as a closed system with a single service pattern and inline stops. Bypass lanes are to be provided where required by AT.
- Signal priority will be implemented to give buses priority through the main phase.

■ Botany Station Patronage

- Projected Boardings 2048 (2-hour AM peak) = 4,177
- Daily average patronage 2048 = 19,934
- Total daily transfers 2048 = 14,388 (72% of users)
- Modelling confirmed the overall patronage split at Botany:
 - 65% Eastern Busway passengers
 - 35% A2B passengers
 - 75% of passengers using station transfer bus to bus
 - 25% of passengers arrive by other modes

■ Vehicle type:

-
-
-
- Table 3-9 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 is close to meeting Auckland Transport's ideal peak occupancy rate of 85%.
 - A2B buses are assumed to be double-articulated bus: 24m long, capacity of 150 passengers. Articulated bus options all assume single-ended chassis with doors on the kerbside only.
 - Eastern Busway services are assumed to use primarily double-decker buses, interoperating with some single-decker buses. The Eastern Busway specifications indicate the Eastern Busway design assumes a maximum vehicle length of 13.5m.⁴

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

- Local buses are assumed to use single or double-decker buses (i.e. not articulated buses), with a maximum vehicle length of 13.5m.

Table 3-9: Vehicle capacities for A2B

Mode	Peak hour demand, peak load point, 2048	Capacity per vehicle	Hourly capacity with five-minute headways	Utilisation at five-minute headways (ideal = 85%)	Hourly capacity with three-minute headways	Utilisation at three-minute headways (ideal = 85%)
Standard bus	2,700	70	840	321%	1,400	193%
Double decker bus	2,700	100	1,200	225%	2,000	135%
Articulated bus (18m length)	2,700	100	1,200	225%	2,000	135%
Double articulated bus (24m length)	2,700	150	1,800	150%	3,000	90%

■ **Station/stop design:**

- Inline stops for the A2B service will be designed to include bypass lanes where required.
- 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 sell or check tickets, and boarding and alighting will use all doors.
 - Station/stop design will need to provide space for the HOP card readers and ticket vending machines.
 - Fare gates are not proposed. Revenue protection will be done by ticket inspectors.
- Bus driver break facilities (e.g. toilets) must be provided within a reasonable distance of layover locations.

3.2.2 ATCOP geometric design requirements for bus stops (ideal requirements)

At the time of writing ATCOP provided the following guidance. Future design phases should consider the most up to date standards or practice guidelines.'

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 bus stops should be calculated including entry taper (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 exit taper (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.

Bus box dimensions

- Bus box including straightening distance:
 - Bus bay length for standard 13.5m long single decker and double decker: 15m length, 2.5m to 3m wide.
 - Bus bay length for 24m long BRT style double-articulated bus: 27m length, 2.5m to 3m wide (*estimated, not specified in ATCOP*)

Ideal taper dimensions

- Ideal tapers for offline bus bays:
 - Entry taper (“lead in”) approaching stop: 20m
 - Exit taper (“lead out”) departing stop: 11m
 - Separation between bus bays: 9m

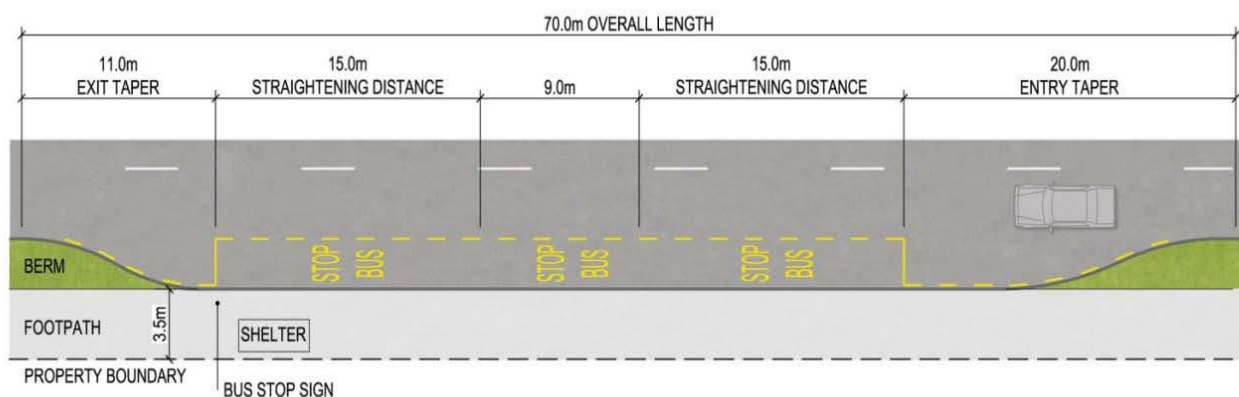


Figure 3-4: ATCOP Figure 131

3.2.3 ATCOP geometric design requirements for bus stops (if ideal taper dimensions cannot be achieved)

ATCOP provides the following guidance for bus stop geometry in urban environments if the above ideal dimensions cannot be achieved. This group of dimension standard may be more appropriate to a purpose designed bus terminal at Botany that is outside of a mixed traffic environment.

- Minimum tapers for offline bus bays:
 - Entry taper (“lead in”) approaching stop: 15m
 - Exit taper (“lead out”) departing stop: 9m
 - Separation between bus bays: 9m

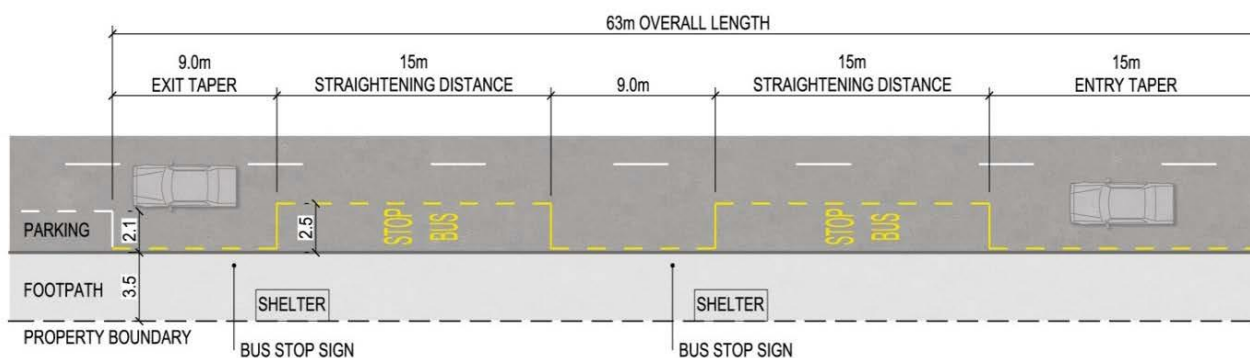


Figure 3-5: ATCOP figure 125

3.2.4 Turning radii for articulated buses

Manufacturers specifications for the turning circle of a VanHool Exquicity 24m double-articulated bus are reported in the following table, as indicative of the requirements for any double-artic bus.

It is assumed that any rigid bus (with tag steer as appropriate) can also be accommodated within these radii as per general international guidance for bus turning, however this is not currently listed in ATCOP guidelines.

We note that than corners and roundabouts designed to minimum curve radii may require very slow transit speeds and minimal margin of error for drivers and can result in poor passenger comfort. Excessively tight corners can result in lower speeds and subsequently, congestion between buses. Any routes that support high volumes of buses and/or in-service routing with passengers on board should delivered with higher than minimum radii to allow faster, smoother cornering.

These are indicative figures only for the purposes of option development. Detailed design of stations should undertake detailed tracking analysis of all bus movements.

Table 3-10: Bus radius requirements

Dimension	Minimum required	Nominal preferred
Inside radius	5.2 m	7 m
Outside radius	12.2 m	14 m
Roundabout outside diameter	24.4 m	28 m



4 Development of Options

4.1 Options

A number of options have been developed. These comprise a do-Minimum scenario included to be a reference case against which all Botany Station options were assessed. It represents the minimum level of expenditure or work that is required to maintain an existing level of service. An additional 5 main scenarios have been assessed, with additional sub-options.

These generally comprise:

- Sub option A: Offline option
- Sub option B: Online option

All option sketches are attached in Appendix A.



4.2 Do Minimum

The do minimum option consists of the following:

- Six bus stops on the existing bus station location while utilising the botany town centre roundabout to turn around or reposition. These will require kerb realignment to fit the larger platform.
- Two existing layover areas are available for four buses on the southern end of the mall and two buses along Te Irirangi Drive by Pak'n'Save.
- Four proposed layover bays along Chapel Road and two on Te Irirangi Drive. The proposed bus layover bays on Chapel Road will impede the existing on-road cycle lanes.
- Local bus services will operate as per their existing routes, alongside additional Eastern Busway and A2B routes.
- Te Irirangi Drive will see a dedicated bus lane provided in the central median to tie into the A2B design, as well as a buffer, cycle lane, and footpath on both sides of the road.



4.3 Scenario 1: Local Buses and Eastern Busway Terminate Airport to Botany continues north

Scenario 1 encompasses two designs, options A and B, both accommodating for the termination of the Eastern Busway service and local services at Botany Station, whilst the A2B service will travel through Botany Station and terminate further north.

4.3.1 Scenario 1 - Option A


Scenario 1 option A is a hybrid online/offline station located on the central median area

This option involves the following:

- A one-way busway (assumed kerbside) will be constructed between Ti Rakau Drive and Te Koha Road, where six Eastern Busway layover bays will also be implemented. The eastern end of Botany Station on Te Irirangi Drive has two drop off and two pick up bays on a bus lane dedicated to Eastern Busway buses connecting back onto Ti Rakau Drive.
- The A2B road transit corridor continues onto Te Irirangi Drive where one drop off and one pick up bay will be implemented and a turnaround for the service north of the station.
- On the western side of Botany Station will be a dedicated bus lane for local services entering a loop where 10 layover bays, four pick-up bays and three drop off bays will be provided. An overpass will be provided to enable users to access all platforms from any side of the road.
- Two lanes for general traffic are provided for each direction, increasing in number at intersections to accommodate for turning movements.
-
- Alongside this, a buffer, cycle lane, and footpath will be provided on both sides of the road along Te Irirangi



4.3.2 Scenario 1 - Option B

- A two-lane two-way busway will run [REDACTED] towards the grade separated station, where one pick-up and one drop off bay is provided.
 - Local bus bays provided on the grade separated platform will also include three pick-up bays and three drop-off bays, while ten layover bays for local bus services will be located on an existing car park.
 - [REDACTED]
 - An at-grade A2B platform consisting of one drop-off and one pick-up bay will also be provided.
 - Access to the grade-separated platform will be via lifts and stairs located at four points on the platform.
 - Like option A, a buffer, cycle lane, and footpath will be provided on both sides of the road alongside pedestrian and cycle crossings maintained on all legs of affected intersections.
- 

4.4 Scenario 2: All services terminate at Botany

4.4.1 Scenario 2 - Option A

- Located within this station are ten local service layover bays and four A2B layover bays, while six Eastern Busway layover bays are located along Te Irirangi Drive.
- Local bus services have three drop-off bays and four pick-up bays, whilst Eastern Busway services have two drop-off bays and two pick-up bays, and A2B services have one drop-off and one pick-up bay.
- A2B and Eastern Busway services will be able to enter Te Koha Road via a 2-way busway.
- A new signalised intersection will be provided for vehicles exiting the interchange whilst a slip lane will be provided at the entrance of Town Centre Drive for vehicles entering the interchange.
- Outside of the new signalised intersection, general traffic lanes remain largely unaffected.
- [REDACTED]
- The buffer, cycle lane and footpath provided on both sides of the road will end at the new signalised intersection and the path on the eastern side of Te Irirangi Drive will have an alignment entering the Town Centre property.

Figure 4-4: Scenario 2 - Option A

4.4.2 Scenario 2 - Option B

Scenario 2 option B is a hybrid online/offline station with an online A2B and Eastern Busway service turnaround facility. This option involves the following:

- Right turn lanes at the end of Te Irirangi Drive are shortened to account for the space requirements of this facility.
- A two-way A2B/ Eastern Busway leading to the online station will be provided.
- The A2B and Eastern Busway bays are split based on their use, with one A2B drop off bay and two Eastern Busway drop off bays on one side, and one A2B pick up bay and two Eastern Busway pick up bays on the other side.
- A dedicated bus lane for local buses feeds into an offline interchange where four local bus pick up bays and three drop off bays are provided.
- 10 local bus layover bays are also provided in this section.
- Within the central median section also includes six Eastern Busway layover bays and four A2B layover bays.
- A buffer, cycle lane, and footpath are provided on both sides of the road, with pedestrian and cycle crossings provided at all crossing points to accommodate.
- An overpass is to be provided over the layover road for pedestrians to access the platform safely.




4.5 Scenario 3: Eastern Busway terminates at Botany Local Buses through route A2B continues north

Scenario 3 involves the through movements of the A2B and local services, while the Eastern Busway service terminates at Botany Station. The A2B service turns around at Cascades Road.

4.5.1 Scenario 3 - Option A

Scenario 3 option A is an online station design with a north turnaround for the A2B service. This option involves the following:

- The north and southbound bays contain three local bus bays each and are connected to bus lanes dedicated to local buses.
 - The northbound bays also have two drop-off bays and two pick-up bays for Eastern Busway services.
 - In the central median station, one drop-off bay and one pick-up bay for A2B are provided.
 - The central median station connects to the A2B road transit corridor which continues along Te Irirangi Drive.
 - A buffer, cycle lane and footpath are provided on both sides of Te Irirangi Drive, which extends onto Botany Road. This is complimented by the provision of pedestrian and cycle crossings on all intersection legs.
 - A one-way busway is provided for A2B and Eastern Busway services between Ti Rakau Drive and Te Koha Road and contains four Eastern Busway layover bays in this section.
- 



4.5.2 Scenario 3 - Option B

■

- Access to this central median platform is via a two-way Eastern Busway from Ti Rakau Drive, and a two-way Eastern Busway ramp from existing Town Centre roundabout.
- Eastern Busway and local bus services are to utilise this central median platform, where one pick-up and one drop-off bay is provided for Eastern Busway, and three pick-up and three drop-off bays are provided for local services.
- Four Eastern Busway service layover bays are also provided on the grade separated platform.
- Access is provided to the lower/upper levels of the platform using lifts/stairs on each side of Te Irirangi Drive and at the A2B platforms.
- The A2B road transit corridor continues along Te Irirangi Drive and an at-grade platform is provided for A2B services where one drop-off bay and one pick-up bay is provided.
- A buffer, cycle lane, and footpath are provided on both sides of the road along Te Irirangi Road and continues onto Botany Road. These are complemented by the provision of pedestrian and cycle crossings

4.6 Scenario 4: A2B & Eastern Busway terminate at Botany Local Buses through route

Scenario 4 involves the termination of the A2B and Eastern Busway service at Botany Station where both services will turnaround after a layover. A2B services approach via the A2B road transit corridor along Te Irirangi Road, while the Eastern Busway services approach on the two-way busway from Ti Rakau Drive. Local services will use Botany Station as a through route for pick-up and drop-off.

4.6.1 Scenario 4 - Option A

- [REDACTED]
- [REDACTED]
- [REDACTED]
- A single exit to the interchange exists on Te Irirangi Drive alongside a new signalised intersection dedicated to exiting bus movements.
- Layover bays are provided for the terminating A2B and Eastern Busway services, with six and four layover bays provided respectively.
- Local bus services are provided three pick-up and three drop-off bays, Eastern Busway bus services are provided two pick-up and two drop-off bays, and A2B bus services are provided one pick-up bay and one drop-off bay.
- The walking and cycling facilities in this design terminate at the new signalised intersection on Te Irirangi Drive accompanied alongside the provision of pedestrian and cycle crossings at all intersection legs.
- The portion of walking and cycling facilities that runs alongside the interchange is to be sheltered beneath the existing canopy.

4.6.2 Scenario 4 - Option B


Scenario 4 option B is an online station with an online A2B and Eastern Busway turnaround facility within the central median station. This option involves the following:

- Both the northbound and southbound platforms accommodate for local buses and have three pick-up and drop-off bays on each platform.
- Delays accessing the southbound platform is minimised via a bus lane accommodating for local buses along Te Irirangi Drive.
- A2B and Eastern Busway services enter the interchange from Te Irirangi – Te Koha Road – Town Centre Road intersection where drop-off bays, pick-up bays, and layover bays are all provided.
- Both the A2B and Eastern Busway services have one drop-off bay, one pick-up bay, and four layover bays respectively.
- An overpass is provided over Te Irirangi Drive for access on either side of the road, as well as onto the A2B/ Eastern Busway platforms.
- Realignment of the road will be required along Te Irirangi Drive alongside the reduction in length of right turn lanes at the Ti Rakau Drive – Te Irirangi Drive – Botany Road intersection.
- A buffer, cycle lane, and footpath are provided on both sides of the road, which terminates at Ti Rakau Drive.



4.7 Scenario 5: All services through route

Scenario 5 involves all bus services, A2B, Eastern Busway, and Local being through movements. This option involves the following:

- The proposed station is online and involves the A2B and Eastern Busway services becoming one connected service.
 - The northbound platform holds one A2B/ Eastern Busway bay and three local bus bays, while the southbound platform is a replica of the northbound platform.
 - The Te Irirangi Drive approach at the Te Irirangi Drive - Te Koha Road - Town Centre Road will have a new right turn lane implemented that is exclusive to buses, with new and widened medians being constructed to tie into existing medians.
 - Local buses will be routed along Parkway Drive and join the road transit corridor in Botany.
 - The buffer, cycle lane, and footpath in this design will end at the Te Irirangi Drive - Te Koha Road - Town Centre Road intersection.
 - As per other designs, an A2B/ Eastern Busway will be implemented between Ti Rakau Drive and Te Koha Road alongside a road transit corridor that ties into the A2B design.
- 

5 Assessment Framework

The station options were assessed against a framework agreed to by all project stakeholders. The three assessment criteria included Airport to Botany and Eastern Busway investment objectives, and were grouped into transportation planning, engineering implementability, and an assessment of environmental effects.

Table 5-1: Transport Planning Investment Objectives from A2B and Eastern Busway programmes

Investment objectives				
Criteria	A2B Investment objectives	Eastern Busway Investment objectives	KPI	Measure
Transport Planning	Provide more equitable access and travel choices to jobs, learning, cultural and social activities in the south and east of Auckland	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.	Capacity of the system to meet demand	Capacity of the station to cater for the forecast number of buses required by 2048
			Public transport travel times through station	Assessment of travel times for PT services to access, drop off/pick up passengers, and exit the station, weighted by service groups
	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.	Local bus travel time reliability	Implications of the station design on variability of travel times for local buses both at Botany Station and at other stops along their routes.
			Rapid transit travel time reliability	Implications of the station design on variability of travel times for Eastern Busway and A2B service groups both at Botany Station and at other stations.
			Ease of transfers and customer experience	Ease of transferring between service groups, based primarily on the platform configuration and customer experience



Investment objectives				
Criteria	A2B Investment objectives	Eastern Busway Investment objectives	KPI	Measure
	Promote urban regeneration improved built environment and economic opportunities.	<p>2. Provide transport infrastructure that integrates with land uses and supports a quality, compact urban form ... along the Pakuranga to Botany Busway corridor.</p> <p>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.</p>	Access to key destinations from station	Station location relative to key destinations, and connectivity to those destinations (could also include new destination in oversite development)
	Reduce the effects of the transport system on the environment and taonga.	None	Air pollution	Mode shift resulting from option will reduce car travel, thus reducing pollution
	To improve health, safety, and security of people	7. Create a corridor that is safe for all road users, including public transport passengers, cyclists and pedestrians.	Local walking and cycling connections	Technical assessment of the opportunities to improve local walking and cycling connections.
			Access to station by active modes	Assessment of ease of accessing the station by active modes



Table 5-2: Implementability KPIs for station assessment

Criteria	KPI	Measure
Engineering Implementability	Constructability	How straightforward is it to implement the option? What are the challenges with construction methodology and staging or constraints. What is the surrounding environment like including: topography, gradients, utilities, existing infrastructure etc.
	Construction Disruption	Construction impacts on people and businesses regarding traffic, access levels, duration etc.
	Construction cost and risk	Estimated construction costs, including complexity and risk in construction.
	Operating cost	Estimated operating cost implications for public transport services, based on the station circulation and design
	Safety in design and construction	Are there significant hazards associated with the option which pose a health and safety risk in design, build and final product? Can safety be developed into the design process to control it? Level of complexity in risk management through safety in design.
	Operation and maintenance	Assessment of maintenance and operational implications over the projected life.
	Property	Extent and complexity of properties that require acquisition. Potential number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
	Consentability	Level of complexity of gaining approvals (e.g. activity status, risk of appeal, accordance with policy direction). Level of compliance with regulatory plans e.g. could the option include activities which are prohibited/ non-complying under the policies and rules of the district or regional plan?
	Third Party Consents	Potential to require third party consents as a result of property take, requirement to run RTC or buses on private roads, site configuration etc.



Table 5-3: KPIs for assessment of environmental effects

Criteria	KPI	Subtopic	Measure
Assessment of environmental effects	Landscape, visual and urban design	Natural character and landscape	Extent, nature and degree of effects on natural character, features, and landscape.
		Visual	Extent, nature and degree of effects on visual amenity.
		Urban design	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.
	Social/community impact	Accessibility	Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.
		Community	Extent and degree of change to groups and activities, including sense of community and known aspirations and plans, and sensitive construction receivers.
	Stormwater	Stormwater quality	Impact of operational stormwater discharges on water quality within the catchment.
		Stormwater quantity	Impact of operational stormwater discharges on flooding within the catchment, including vulnerability to impacts of climate change such as increased storm events, and opportunities to increase resilience.
	Contaminated land	Contamination Management	Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.
	Traffic Network Effects	Traffic implications	Extent and degree of the change on the traffic network
	Noise	Operational Noise	Extent, nature and degree of operational noise effects.

6 Technical Assessments

6.1 Transport Planning Assessment

Refer to tech note 502334-7000-TEC-KK-0046 in Appendix B for further details on the methodology and outputs for the transport planning component of the Botany Station multi-criteria assessment (MCA).

6.1.1 Impact on Public Transport Network Planning

The Botany Station MCA options have been designed with either all local buses terminating or all local buses through-routing. Once the preferred station design has been identified, it can be further progressed to add or remove local bus layover bays, to reflect the desired level of through-routing/terminating local buses.

In order to ensure the MCA processes considers the implications of each station design on future network planning for the public transport network, a criterion has been included, relating to public transport network planning.

This score takes into account the balance of two effects:

- The extent to which the station design can easily be modified during planning to reflect the ideal layover requirements for local buses, and
- The extent to which the station will limit future changes to the public transport network for local services (i.e. can future networks add/remove local buses through or terminating at Botany).

6.1.2 Capacity of the system to meet demand

The first KPI is an assessment of the station's capacity to cater for the forecast number of buses required by 2048, according to the functional specification for local services as part of the Eastern Busway (project). All options scored 3, because they have been designed to meet the forecast demand, whereas the do minimum scored 0, because there isn't enough space to add the required number of bays to the current bus stops, to meet the long-term demands at Botany Station.

6.1.3 Public transport 'Generalised Cost' of Station Access and Transfers

This KPI involved a 'generalised cost' type assessment (weighted for each service group by the modelled demands) of time to access and egress the station (based on circulation/access routes), number of major intersections and number of minor or give way intersections traversed, and station quality for transferring passengers.

Approach and Assumptions

For each station design, a score for PT travel times through the station was computed to inform the multi-criteria analysis process. This assessment was conducted for each service group, namely:

- Eastern Busway services
- A2B services
- Local buses approaching from the south

- Local buses approaching from the north

Travel times to/from the station

The circulation (access and egress) assumptions for the do minimum scenario are described in Table 6-1. For each option, the circulation is shown in boxes on the station design sketches.

Table 6-1: Do minimum bus circulation description

Service group	Approach (Departure is reverse)
Eastern Busway	East along Ti Rakau Drive, south on Te Irirangi Drive, Town Centre Drive
A2B	North along Te Irirangi Drive, Town Centre Drive
Local buses from south	Existing “New Network” circulation: north on Chapel Road, west on Ti Rakau Drive, south on Te Irirangi Drive, Town Centre Drive
Local buses from north	Existing “New Network” circulation: south on Te Irirangi Drive, Town Centre Drive

Figure 6-1 shows the ‘screenline’ boundaries that were used to estimate the distance and therefore travel time to access and egress the station options. Distance estimates are approximate and only consider in-service travel, as this is what affects the ‘generalised cost’ for passengers. Distance estimates are the total for both approach and departure from the station, as most services experience similar demands in each direction (throughout the day). When the A2B service extends north, this distance is excluded because few people use that link, and this would disproportionately increase the average generalised cost for users of Botany Station in the options where A2B extends north.

It is generally assumed that buses travel at a ‘high’ speed on main roads, and a ‘low’ speed on roads through retail precincts and through the station/past platforms. The average speed estimates are: ‘high’ speed is 35km/h for Eastern Busway and local buses, ‘high’ speed is 40km/h for A2B because of the dedicated running way, and ‘low’ speed is 15km/h.

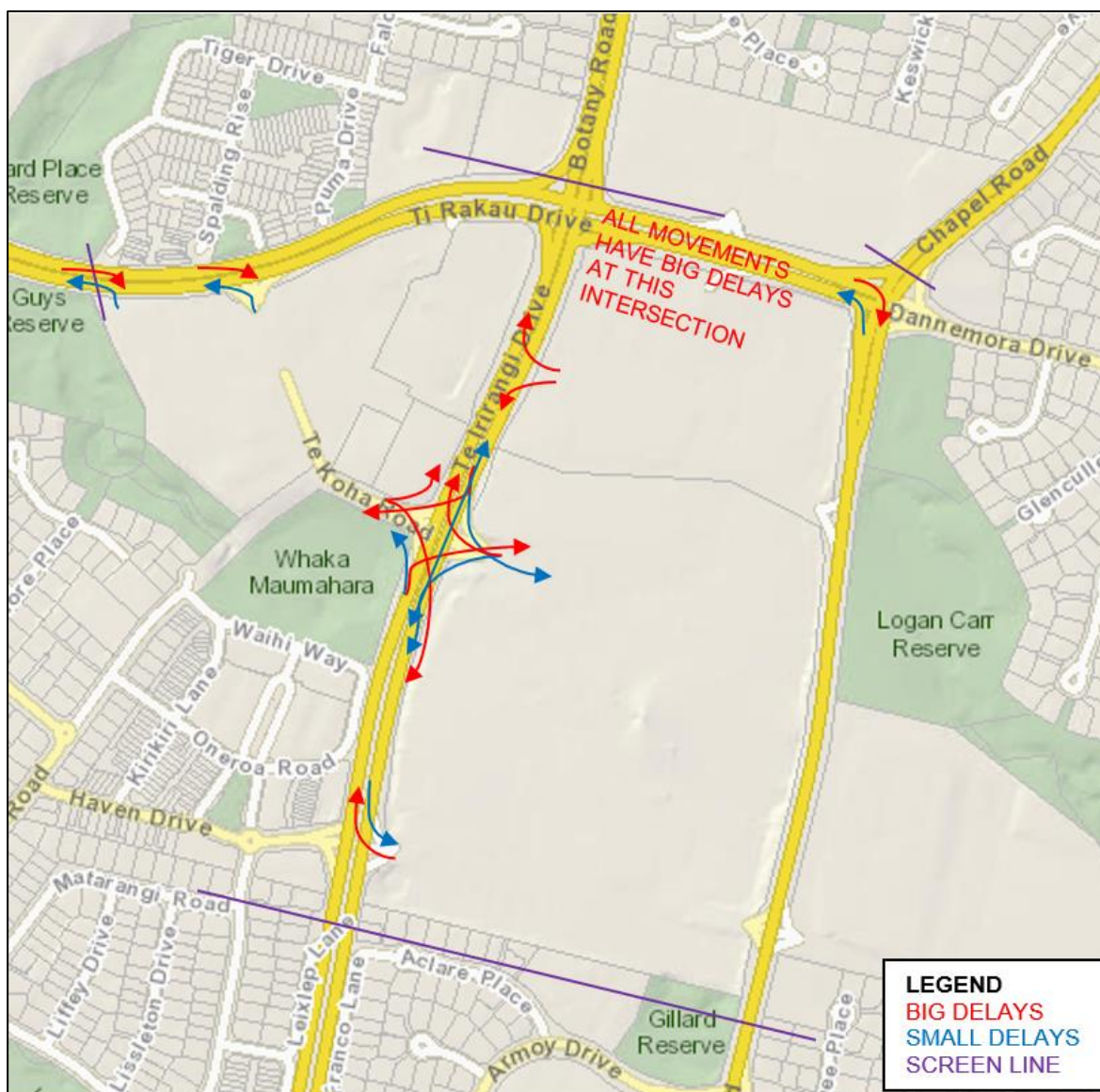


Figure 6-1: Boundaries for station access travel times

Estimated intersection delays


Each circulation option involves travelling through various intersections. Each intersection movement is classified as contributing either 'big' or 'small' delays, based on whether the service is travelling with or against main traffic movements, and whether the intersection is signalised or not).

The assumptions about 'big' and 'small' delays are mostly shown in the Figure 6-1 annotations. Some intersections, with very small side roads, do not assume any delays for the 'main' (typically straight-through) movement.

A 'big' delay is an average delay of 40 seconds, and a 'small' delay is an average of 20 seconds.

Station quality

Each station is also given a transfer penalty, based on the station quality penalties applied in Auckland Forecasting Centre's Macro Strategic Model (MSM). In this model, the travel time penalty for standard bus stops is 10 minutes, 8 minutes for 'purpose' interchanges, and 5 minutes for 'high quality' interchanges.



For this 'generalised cost' type assessment, the do minimum is considered as 'standard bus stops', the offline options are considered 'high quality' because they are generally more compact, with shorter transfer distances for users, and all other (grade separated and in line style) designs are considered 'purpose' interchanges, because they typically have longer transfer distances.

Weighting of service groups and station quality

The total estimated 'generalised cost' is weighted for each service group by the relative demand of each service group. For local buses, the demand split between the north and south approaches is assumed to be equal. Additionally, transfer penalties are only applied to the proportion of travellers who are expected to transfer at Botany Station (e.g. if 50% of travellers are expected to transfer, then the 'average' penalty is half of the transfer penalty time). Demands used for weighting are from the May 2019 model runs (noted as 'v5'), using scenario 48134 (A2B).

OPEX estimates

Each option was scored on its "OPEX per bus". Because the do min option only caters for ~70 buses compared to ~105 buses for the options, the total OPEX for the do min is lower than for some of the options. However, all of the other options reduce circulation requirements compared with the do min, so it doesn't make sense to compare on this absolute value. Hence the use of the 'relative' comparator, being the OPEX per bus.

The outputs of the above model incorporate all elements of in-service travel and can therefore be used to estimate OPEX implications for each option, by utilising the service-hour and service-km estimates for each station design and applying these to the projected bus volumes. It is assumed that the Peak Vehicle Requirement (PVR) component of cost will not be affected by the station design, as there should be enough resilience in the existing PVR's for station travel times not to affect them.

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Results

This criterion is a 'generalised cost' type assessment, meaning it is affected by several factors including approach, departure and circulation distances; intersection traversals; and station quality. These effects are counted for each service group and weighted by the relevant demands. This makes it hard to unpick what has increased/decreased the 'generalised cost' for each option. The direction and scale of effect from each of these factors is shown in Table 6-2.

Table 6-2: Ranking of effects of each station design compared to do minimum

Element	1A	1B	2A	2B	3A	3B	4A	4B	5A
Generalised cost (do min = 12.6 min)	10.3	10.3	9.5	9.7	9.5	9.7	9.1	10.0	9.0
Net effect	1	1	3	2	3	2	3	2	3
Total distance (including approach, station circulation, departure)									
Eastern Busway	2	2	1	2	2	2	1	1	3
A2B	1	1	-1	2	1	1	-1	-1	2
Northbound locals	-1	-2	-1	-1	3	-2	-2	3	3
Southbound locals	2	2	2	2	3	2	2	3	3
Intersection delays (including station entrance and exit)									
Eastern Busway	1	3	-1	0	1	3	-1	0	1
A2B	-2	-2	-1	2	-2	-2	-1	2	-2
Northbound locals	2	3	2	2	2	2	2	2	2
Southbound locals	0	0	0	0	1	3	1	1	1
Station quality	1	1	3	1	1	1	3	1	1

6.1.4 Local bus travel time reliability

This KPI assesses how each station design is likely to affect the variability of travel times for local buses approaching and departing from Botany Station. This measure is qualitative and takes into account:

- Directness of access to the station, including intersection traversal to access the station (less direct routes have more opportunity for delays)
- Station circulation (more circulation increases opportunity for delays)
- Separation of stops from general traffic (if buses must merge into traffic from stops, this introduces variability to travel times)

Options 1A and 1B are similar to the do minimum (score = 0), mainly because local buses still need to enter Botany Town Centre (even if just slightly) to access the station, and the station itself involves reasonable circulation.

Options 2B and 3B scored slightly better than do minimum (score = 1), because, although they have similar station approaches, once they enter the station (including layover spaces) they are fully separated from general traffic. Note that 3B scored better than 1B because the layover spaces in 1B needed to be placed somewhat separately from the station itself.

Options 2A and 4A scored moderately better than do minimum (score = 2) because the station is fully separated from general traffic, but local buses still need to cross intersections to access the station, and there is lots of circulation of the station itself.

Options 3A and 5 scored significantly better than do minimum (score = 3) because local buses stop inline and merge into a bus lane (less variability than merging into general traffic lanes).

6.1.5 Rapid transit travel time reliability

This KPI assesses how each station design is likely to affect the variability of travel times for *Rapid Transit Services* to access, drop off/pick up and depart from Botany Station. This measure is qualitative.

Options 2A, 2B, 4A and 4B scored moderately better than do minimum (score = 2) because the rapid transit stops at these stations are all fully separated from general traffic, however these station designs do require both A2B and Eastern Busway services to cross large intersections to access the stops.

Options 1A, 1B, 3A, 3B and 5 scored significantly better than do minimum (score = 3) because all rapid transit stops are in line with the service patterns, minimising additional intersection conflicts and deviations from services.


6.1.6 Ease of transfers and customer experience

This metric assesses each station on how well it facilitates transfers between different services at Botany Station. It considers legibility, and horizontal and vertical transfer distances. Note that vertical transfers are often necessary at large public transport stations, due to the frequency of buses; this also applies to Botany Station. However, despite this necessity, vertical transfers are more difficult for people to navigate than horizontal transfers, and this has been taken into account in the scoring.

Options 1A, 2B, 3A and 4B all scored slightly better than the do minimum (score = 1) because transfer distances are large, and vertical transfers are necessary for most transfers.

Options 1B, 3B and 5 all scored better than the do minimum (score = 2) because some transfers can be made across a single platform, whilst still require vertical transfers.

Options 2A and 4A scored significantly better than the do minimum for ease of transfers (score = 3) because all transfers can be made from the same platform, with no vertical movements. However, it is noted that



these options require premium signage to ensure that the transfers remain legible, given the complexity of stop arrangements for the two rapid transit lines and local buses going in various directions.

6.1.7 Access to key destinations from station

This is a qualitative measure that assesses the station location relative to key destinations, and the connectivity from the station to those destinations.

Options 2A and 4A scored the same as the do minimum (score = 0) because they are 'standalone' stations on the east side of Te Irirangi. They provide good connectivity to the main part of Botany Town Centre.

Options 1B, 3B and 5 scored slightly better than do minimum (score = 1) because they provide direct access to each side of Te Irirangi Drive to facilitate access to both the main Botany Town Centre and *The Hub* on the west side of Te Irirangi Drive, as well as providing reasonably direct access to the residential area to the southwest.

Options 1A, 2B, 3A and 4B scored better than do minimum (score = 2) because they provide direct access to each side of Te Irirangi Drive to facilitate access to both the main Botany Town Centre and *The Hub* on the west side of Te Irirangi Drive. The access provided by these options is closer to the main developments than what is achieved in options 1B, 3B and 5, above.

6.1.8 Air Pollution

This KPI is a qualitative measure of the amount of mode shift that is expected to be driven by each of the station designs. Note that detailed modelling could not be conducted for each station design, so it was not possible to assess this quantitatively. All options provide high quality stations and can support many more buses per hour than the do minimum, so better services can be provided alongside each of these station options. Therefore, all options scored 3 (much better than do minimum).

6.1.9 Local walking and cycling connections

This KPI is a qualitative, technical assessment of the effects of the station design on the local walking and cycling connections.

Options 2A and 4A scored worse than do minimum (score = -1) because they force local a large deviation in the local walking and cycling connections along Te Irirangi Drive. It is not possible to direct them straight along Te Irirangi Drive, without significant delays at signalised intersections, due to the significant number of buses entering and exiting Botany Station.

Options 2B, 4B and 5 scored a bit better than do minimum (score = 1) because they provide both an at-grade and grade separated crossing opportunity of Te Irirangi Drive.

Options 1A, 1B, 3A and 3B scored better than the do minimum (score = 2) because in these options, A2B extends further north, and with it, the high-quality local walking and cycling facilities will also be extended to support station access further north.

6.1.10 Access to station by active modes

This measure is a qualitative assessment of the ease of accessing the station for pedestrians, bicyclists and other micro-mobility users.

Options 2A and 4A scored a bit better than the do minimum (score = 1) because they only provide high-quality access to destinations on the east side of Te Irirangi Drive. However, they do outperform the do minimum because they provide access concourses both to the north and the south of the station platform.

Options 2B, 4B and 5 scored better than the do minimum (score = 2) because the vertical concourses provide direct access to people on both sides of Te Irirangi Drive. The at-grade signalised crossings will remain, however the elevated concourse provides an additional option, which is particularly valuable for vulnerable and cautious travellers.

Options 1A, 1B, 3A and 3B scored much better than do minimum (score = 3) because the vertical concourses provide direct access to people on both sides of Te Irirangi Drive. Additionally, the extension of A2B, and its associated walking and cycling facilities, provide better station access connections for people to the north of Botany Town Centre.

6.2 Engineering Assessment

Please refer to tech note 502334-7000-TEC-RR-0048 in Appendix C for further details on the engineering assessment which contributed to the overall MCA scoring of each option.

6.2.1 Constructability

All options aside from option 1B and option 3B had moderate to major construction works but nothing out of the ordinary. Implementation will be straightforward, and construction methods and staging will be non-challenging. Option 1B and 3B involve the elevated platform which brings with it some challenges to implement and somewhat challenging construction methods and staging.

Options 1B and 3B scored the worst (score = 2) due to its difficulty in construction and requirement to work at heights with lots of temporary work. The overhead structure is also difficult to construct over water.

Options 1A and 3A scored 3, as they require major construction works in the provision of a RTC extension north of Botany. Substantial road widening is required, as well as the protection or relocation of a significant watermain running under Botany Road, requiring further staging.

Options 2A, 2B, 4A, 4B, and 5 scored the highest at a score of 4. These options required only moderate construction works as they did not require significant new infrastructure. The only structures to be built are easy to construct footbridges, with retaining walls required in some options. All options have relatively standard utilities relocation.

6.2.2 Construction Disruption

Options 1A, 1B, 3A, and 3B have a high amount of construction impacts due to either the elevated platform or the RTC extension north of Botany. The main cause of disruption for these options is the staging required to carry out construction works for the waterman under Botany Road that will add complexity and additional time considerations to the programme. These four options scored 2. Options 2B and 4B scored 3 as they had a moderate amount of construction impacts. These two options would have considerable disruption to the existing Z Station. Options 2A, 4A and 5 scored the highest at 4 as they had a minor amount of construction impacts.

6.2.3 Construction Cost

6.2.4 Safety in design and construction

Options 1B and 3B both have a moderate level of health and safety in design, primarily due to the grade separated feature. The risks of working over water, as well as deep and large foundations that could clash with services result in the lowest score of 3. All remaining options have a low to moderate level of health and safety in design which results in a score of 4. These options have no significant risk associated with regarding structures other than the typical construction risks in the town centre, which can be managed through the health and safety in design process.

6.2.5 Operation and maintenance

Option 1A, 1B, 2B, 3A, and 3B have moderate maintenance and operation costs and have therefore scored a 3. This is a result of the extra maintenance required from the structural design elements such as expansion joints and bridges.

. Options 2A, 4A, 4B, and 5 have minor to moderate maintenance and operation costs and have therefore scored a 4.

6.3 Planning and Environmental Assessment

Please refer to tech note 502334-7000-TEC-NN-0047 in Appendix E for further details on the MCA scoring and description in the planning and environmental assessment.

6.3.1 Landscape, visual and urban design

Landscape

Options 1B, 3B and 5 all have the potential to result in adverse landscape effects on the Whaka Maumahara Reserve. Options 1B and 3B would result in major direct impacts on the Whaka Maumahara Reserve and have scored -2 to reflect this. Scenario 5 would result in minor impacts and has scored a -1.

The remaining options are not identified as having any natural character values or landscape features along or near the alignment that could be impacted. They avoid direct impacts on the highly modified waterway located within Whaka Maumahara Reserve.

Visual

Except for the Do Minimum Option (which is visually predominantly contained within existing town centre development) all options have scored negatively (moderate to significant adverse effects).

The remaining options result in the loss of the lightly planted medium through intensification of the road corridor, loss of roadside screening vegetation increasing views of the vehicle traffic on Te Irirangi Drive and/or result in overpasses that provide pedestrian access to the platform which create an elevated

Urban Design

From an Urban Design perspective, the option scoring ranged from (significant adverse effects (-3) to moderate positive effects (+2).

- The Do Minimum option scored most positively (2) due the location of the interchange being in closest proximity to the primary destination in the Botany Town Centre (the shopping mall). In addition, it results in the smallest land take with the least disruption of existing land uses, performs well from a CPTED perspective and has no grade separation.
- Options 2A, 4A and 5 all scored positively (1) given they result in platforms that are easy to understand and legible (one platform). Option 5 is considered to connect well with the surrounding housing, provides opportunity for the interchange to be integrated with the urban environment in the future and has a smaller land take than other options, and simpler route structure that will help make the PT service easier to understand.
- Options 3A and 4B scored neutral (0). Both these options place the interchange in the centre of an inhospitable busy road environment, away from the town centre and main destinations. There is a recommendation that the “leftover” space created by the layover bays should be planted or heavily landscaped.
- Options 1A and 2B both scored negatively (-1) given the location of the interchange leaving limited scope for future adjacent complimentary development to occur, along with the location of the interchange in the centre of an inhospitable busy road environment, away from the town centre and main destinations
- Options 3B and 1B both scored poorly (-2 and -3 respectively) given they force all users of the interchange to use an elevated crossing, the ramps located within the town centre car park will make future development that integrates with the interchange at this location challenging, given the reduction in access and legibility to the town centre. Option 1B scored worse given the additional layover parking implications for integration and development opportunities in the Town Centre.

6.3.2 Social and community impact

Botany Town Centre is an important local centre for the surrounding suburbs of Dannemora, Huntington Park, Northpark, Golflands and East Tamaki Heights. Social infrastructure in the town centre includes the Botany Library, Botany Downs Secondary College, St Columba Presbyterian Church, Eastview Baptist Church and International Baptist Church. Logan Carr Reserve and Kellaway Reserve are located to the east of the town centre.

Accessibility

Majority of the options will provide positive social effects due to improved access to and from the Botany Town Centre (a centre of retail and commercial jobs), which allows for improved accessibility and greater social wellbeing. All options have scored +1 (minor positive effects) except for the Do Minimum, Option 2B (for community only) and Scenario 5.

The Do minimum option is considered to result in a neutral effect given existing access to people to reach services, jobs and properties is largely unchanged. In addition, Scenario 5 does not provide as direct access to the Botany Town Centre as other options (scoring a -1).

The assessment notes that given the large width of Te Irirangi Dive that people wishing to cross east to west have limited movement and that for some of the options this will require the use of an overpass. The

provision of an overpass (Options 1A, 2B, 3A, 4B and 5) may make it difficult for people who have mobility requirements to cross from one side of the road to the other.

Improved access to and from the Botany Town Centre will improve with many of the options but those options that do not extend north Ti Rakau Drive (Options 1A, 1B, 3A and 3B) will mean that north bound travel using an RTN service remains restricted.

Community

All options except for Scenario 5 are considered to have a neutral or positive effect on community. This is because they all have the potential to result in an increased sense of community through improved transport provision in the Botany Town Centre and ability to access services and facilities. Directly adjacent sensitive construction receivers are minimal.

The Do Minimum would result in a neutral effect (neither positive nor negative effects). It would not result in a major change to impact existing groups, activities and sense of community. Construction work would be minor and as such minimal, temporary impact on sensitive receivers only.

The assessment notes that there is the potential for the quantity of services (local buses, A2B Eastern Busway) to segregate one side of Te Irirangi Drive from the other in some option but acknowledges that multiple services also provide travel choice to surrounding community.

Scenario 5 has been scored a -1 given its location closer to the residential dwellings north of Te Irirangi Drive and there is potential that the interchange and overpass may further segregate and isolate these residential properties from the Town Centre.

6.3.3 Stormwater

The project area that is urban and heavily developed with the proposed interchange development options typically occurring within existing hardscape/impervious surface areas. The project area is outside a Stormwater Management Area – Flow (SMAF) but there is a risk of existing downstream flooding as shown on Auckland Council GeoMaps. The majority of the downstream commercial area, and some residential areas are shown to be within the 1% AEP Maximum Probable Development flood plain.

Stormwater runoff from the proposed works is anticipated to require treatment, because the Botany Interchange will receive a high volume of vehicles, due to A2B and Eastern Busway link roads, classed as high-use roads (HURs).

Stormwater Quality

Except for the Do Minimum, Option 2A, 4A and 5 which scored 0 (neutral) all other options have scored negatively from a stormwater quality perspective. Neutral scores reflect that the existing stormwater run-off from Te Irirangi Drive and adjacent areas is currently being attenuated and treated at Whaka Maumahara pond and that these interchange options are only anticipated to have a neutral effect on stormwater treatment (i.e. through the removal of the kerb grass median on Te Irirangi Drive). For each of these options any addition stormwater volume generated by the interchange is anticipated to be able to be treated by Whaka Maumahara pond or via underground treatment options.

Options 1B and 3B (the two options located within Whaka Maumahara Reserve that also extend north onto botany Road) have scored the poorest from a stormwater quality perspective (-3) given Whaka Muamahara stormwater pond is anticipated to be adversely affected by the works to carry out a grade-separated platform (including a reduction in capacity), and the removal of vegetated areas on either side of Te Irirangi Drive and Botany Road to accommodate the RTN corridor.

Options 1A and 3A have scored -2 (moderate adverse effects) given there is limited space on both sides of the road to provide centralised devices (i.e. wetlands) or longitudinal devices (i.e. swales) to assist with stormwater treatment). In addition, underground mitigation (i.e. stormwater filter cartridges) is anticipated to be required for both options. The assessment notes that if full acquisition of adjacent properties occurs then this may enable the opportunity for water quality wetlands and swales to be provided on this property.

Options 2B and 4B have been scored -1 (minor adverse effects) given the removal of kerb grass median and green berm alongside Te Irirangi road of road to accommodate bus corridor and platform would have a minor adverse effect on stormwater treatment. In addition, there is limited space on one side of the road (not both as in Options 1A and 3A) to provide centralised devices (i.e. wetlands) or longitudinal devices (i.e. swales) to assist with stormwater treatment).

Stormwater Quantity

All options have scored negatively in regard to stormwater quantity with the two worst Options 1B and 3B (the two grade separated options over Whaka Maumahara Reserve that extend north) given these options are anticipated to reduce the capacity of the pond (structural elements for the grade separated platform) which may increase the risk of flooding in adjacent areas. These changes represent a significant adverse effect on stormwater quantity when compared to the other options (and have scored a -3) given the removal of pervious areas, however the assessment notes that this does not mean it the effect on stormwater quantity un-mitigable.

Options 1A and 3A are both anticipated to have moderate adverse effects. Both of these options will require the removal of the kerb grass median on Te Irirangi Drive, green areas on Park N' Save/ Briscoes Carpark, and green berm alongside Botany Road which is anticipated to have a moderate adverse impact on flood risk (greater stormwater quantity generated).

All remaining options have scored -1 to reflect that every option will result in the removal of grass median on Te Irirangi Drive to accommodate the RTN corridor and additional vegetation and landscaping on additional properties which would increase the risk of flooding if the additional run-off volume cannot be mitigated.

Lastly, overland flow paths cross Te Irirangi Drive from east to west across the road near the Whaka Maumahara pond and on Botany Road and this will need to be considered in all options.

6.3.4 Contaminated Land

All options have scored negatively to reflect that there is the potential to encounter contaminated soils.

The area comprising the Botany Town Centre and immediate surrounds was developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes. In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition.

A PSI will be complete prior to progressing with the preferred option and this will advise on whether any additional testing is required to confirm soil contamination and the associated necessary construction management procedures.

Te Irirangi Drive has been in operation for over 15 years and based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works.

There is an operational service station at 550 Te Irirangi Drive (Lot 7 DP 196004) and all options that will impact this site (Options 1A, 2B, 3A and 4B) to the point that the building is impacted or there is likely to be

disturbance within the vicinity of the underground fuel tanks have scored less favourably to reflect the greater level of risk associated with contamination for this land use activity.

6.3.5 Traffic Network Effects

All options except for the do minimum, Options 3A and 4A and 5 scored a -2 the effects of the extent and degree of change that they would have on the traffic network. Typically, these options result in the removal of the Countdown and Pak'n'Save accesses resulting in changes to vehicle circulation to people accessing these sites, and the need for new traffic signals at the Botany Superclinic station and additional phases at existing intersections.

- Options 3A and 4B scored a -1 recognising that they would have less adverse effects on the traffic network.
- Scenario 5 was the only option of those presented that scored positively and this reflects that it can utilise signal timings in the 'Do Minimum' option to reduce signal time.
- The base case was scored neutral given there would be no changes to the existing traffic network.

6.3.6 Noise

All options, except for Options in Scenario 1 and 3, scored a 0 given there would be anticipated to be neutral effects caused by the increase in operational noise from the RTN and Botany Interchange. The proposed interchange would be operating within a built up, high volume traffic environment contributing to a reasonably high level of ambient noise and the interchange is not anticipated to cause any positive or adverse noise effects. It is noted that traffic noise caused from road traffic is already dominant along the proposed routes and many receivers are likely to be desensitised to any increase in operational noise (such as commercial activity).

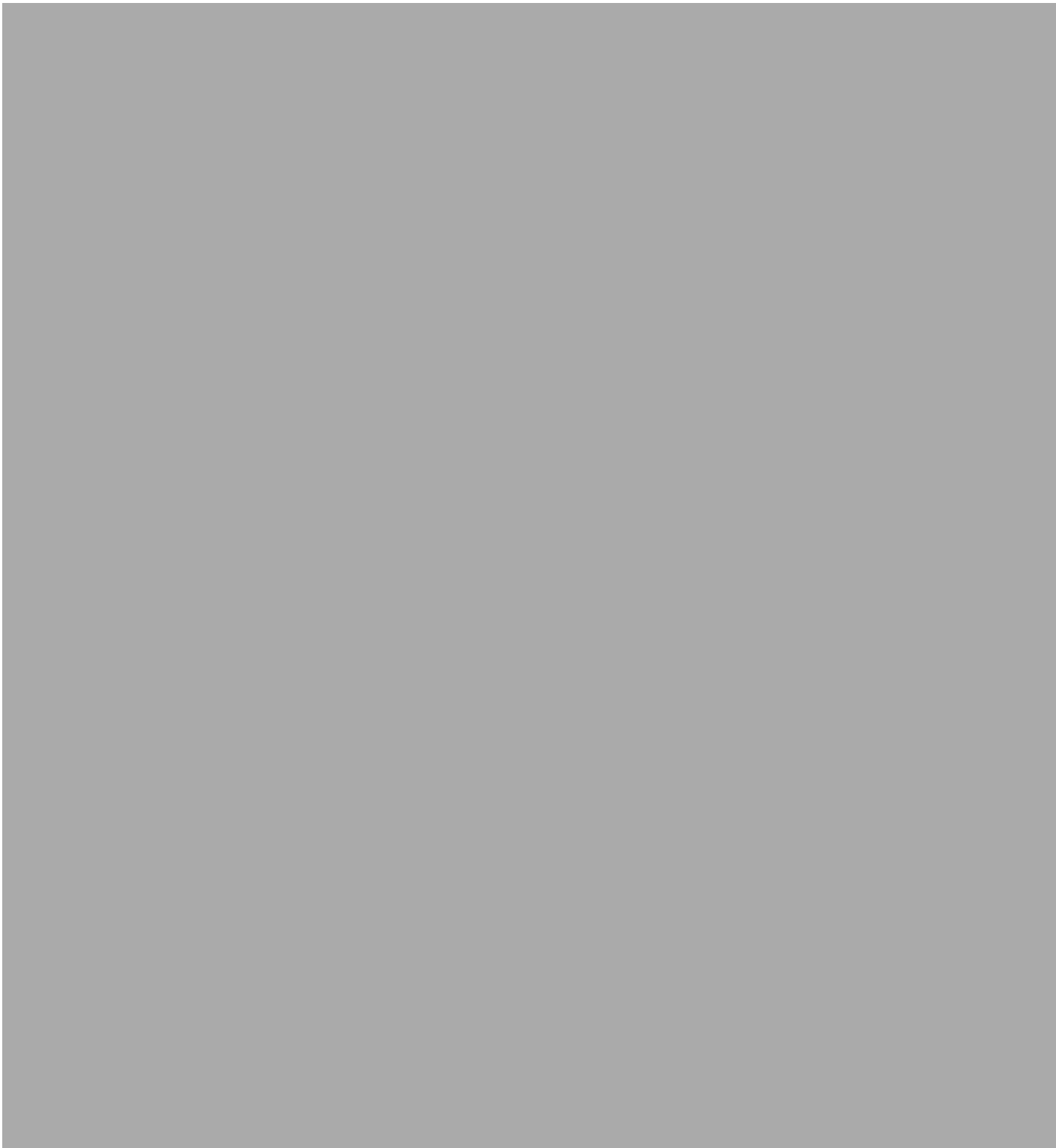
The two grade separated options (Options 1B and 3B) are anticipated to result in greater adverse noise effects and are also located closer to the residential property located directly south of the stormwater pond (with no noise barriers located in between). Consequently, they have been scored -1 to reflect that this is a slightly poorer outcome.

Lastly, the options extending north of Ti Rakau Drive (Options 1A, 1B, 3A and 3B) will have the inclusion of 4 x A2B layover bays on Botany Road just south of Millhouse Drive. These have the potential to create adverse noise effects caused from vehicles idling (they will be operated as a high frequency turnover with a 10m wait time for the bays). While this noise will be mitigated by the layover bays being centrally located within the road corridor, they are still located near sensitive noise receivers (residential properties located to the west and east and the Botany Downs Maternity Unit). Even with the assumption that those residential properties would be acquired this has the potential to result in adverse operational effects for residential properties set back one property from Botany Road and these options have been scored -1 to reflect this.

During construction, adverse noise effects would likely be experienced by sensitive receptors along all option corridors. Management of noise during construction would need to be addressed through the preparation and implementation of a Construction Noise and Vibration Management Plan.

6.3.7 Property

- [REDACTED]



6.3.8 Consentability

Relevant planning considerations in the wider area assessed are:

- there is a 'general commercial frontage' notation for the eastern side of Te Irirangi Drive. The Business – Metropolitan Centre Zone policies seek buildings with frontages subject to the General Commercial Frontage Control achieve a reasonable level of street activation, building continuity along the frontage, pedestrian amenity and safety and visual quality.

- the Transpower New Zealand Ltd Designation #8516 for the Brownhill Road to Pakuranga Underground Electricity Transmission Cables which run along the western side of the Te Irirangi Drive road corridor from Aclare Place to Te Koha Road. Works within this designation area may require requiring authority approval from Transpower New Zealand Ltd.
- 280 Botany Road (Hawthorndene Grounds) is a subject to a historic heritage overlay and is A* category with the primary feature the residence (the interior of the building is excluded) with the overlay extending to the Botany Road frontage. Where the scenarios extend north of Ti Rakau Drive, corridor widening will intersect with the heritage overlay and likely require tree removals (and rules apply to the removal of trees greater than 3m in height within this overlay).
- the northern portion of Te Irirangi Drive in (close to the Ti Rakau Drive intersection) is located within the National Grid Substation Corridor Overlay. There are restrictions that impacts within this overlay including new underground network utilities.
- [REDACTED]
- new buildings (A33) within the Business Metropolitan Centre Zone [REDACTED] will require consent as a Restricted Discretionary Activity (the interchange will be considered a building) (H9.4.1(A33)). In addition, any activity not provided for (i.e. a public transport facility) will be require consent as a Non-Complying Activity (H9.4.1(A1)). There also built form standards relating to building height (maximum 72.5m), and landscaping (2m strip along the street frontage between the street and car parking, loading or service areas visible from the street).
- new buildings within the Business Mixed Use Zone (The Hub) will require consent as a Restricted Discretionary activity (i.e. the overpasses associated with the interchange) (H13.4.1(A45)). In addition, any activity not provided for (i.e. a public transport facility) will be require consent as a Non-Complying Activity (H9.4.1(A1)). There also built form standards relating to building height (27m), and landscaping (2m strip along the street frontage between the street and car parking, loading or service areas visible from the street).
- buildings within the Open Space Conservation Zone (Whaka Maumahara Reserve) that do not comply with one or more built form standards require consent as a Discretionary Activity. Any structure (i.e. the above grade options) within the Open Space Conservation will not comply with the built form standards for this zone. Built form standards relate to building height (22.5m – taken from the adjacent Residential Terrace Housing and Apartments Building Zone), building gross floor area (50m²), maximum site coverage (1%) and maximum impervious surface area (10%). In addition, public transport facilities are not provided for within the zone and would require consent as a Non-Complying Activity (H7.9.1 (A1)).

Within the Auckland Unitary Plan (AUP), the proposed Botany Interchange would full under the definition of a public transport facility – *facility for the transfer of passengers on/off and between public transport services*. It includes bus layovers, drive rest facilities, passenger waiting areas etc.

Overall, those options which are deemed to have the highest level of notification risk (relating to the number of properties with more than minor effects and the relative difficulty anticipated in obtaining the required written approvals), have scored the poorest. The following outlines the scoring rationale:

- The Do Min option has scored 0, with all other options having various level of consenting complexity. This is because it is largely within the existing road corridor where public transport infrastructure is anticipated and provided for.

- [REDACTED]



[REDACTED]

[REDACTED] Lastly, both these options extend north of Ti Rakau Drive resulting in a likelihood that they will interact with the heritage overlay at 280 Botany Road and require consent for any tree removals. Both options have been scored -3.

- [REDACTED]
[REDACTED]
[REDACTED] Options 1A and 3A extend north and are likely to require consent for works within the heritage overlay [REDACTED] where tree removal is anticipated to be required to enable the road corridor widening. [REDACTED]
[REDACTED]

- [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Despite the risks involved it is reflected that many of these options would require fairly typical or low risk consenting for major infrastructure.

6.3.9 Third Party Consents

All options are anticipated to generate third party consent implications in some form and consequently all options have been scored negatively. The implications include new potential bulk and location non-compliances because of reduced site areas and reconfigured site boundaries and removal of landscaping, vehicle access / carparking and loading areas that are likely required by underlying resource consents which will precipitate site reconfigurations⁸ and consent amendments.

- [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
- [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
- [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

⁸ and potentially rendering sites unusable – which is not evaluated here but scored in the Property criteria



Overall the Do Min option and Scenario 5 have scored the most favourably in terms of Third-Party consent implications due to the smallest extent of impact on private property and consequently they have the lowest risk of triggering third party consent requirements.

7 MCA Summary and Recommendation

7.1 Recommended Public Transport Service Pattern

In developing options for Botany Interchange, a range of service operating patterns were tested to determine how many bus stops and layover spaces were required.

Terminating all services at Botany results in the largest station footprint requirement due to the need to provide additional bus stop and layover spaces for all local and rapid transit services. By contrast, through-routing all services reduces the footprint requirement at Botany but requires additional platforms, turnaround facilities and layover spaces to be provided at other locations where the services terminate.

Following internal engagement with subject-matter experts within AT's Service Network Development, Infrastructure Specifications and Integrated Network Planning teams, through-running all local services was not seen as viable for a range of reasons.

- Joining local routes risks creating long and unreliable services that do not serve customer catchment needs.
- This may also result in remainder sections of routes that are uneconomic and do not serve customer needs (dead-running).
- Catchments either side of Botany are not balanced, with industrial/commercial to southwest, residential to north and east, which does not enable logical through-routing.

However, it is feasible to through-route some local services, where network and customer needs can still be met and where it is appropriate to do so. A hybrid network option 'Scenario 6', was developed as the preferred service pattern. Refer to technical note: 502334-6000-TEC-DD-0008 for a detailed overview of the proposed local bus network changes under Scenario 6. In summary:

- Scenario 6 is a mid-point between Scenario 2 (all locals terminate) and Scenario 4 (all locals through-route):
 - Three to five local services through-route: 35, 354, 356 / 705 + 706 depend on EB4link alignment
 - Six services terminate: 70, 72, 351, 353, 733, A2B

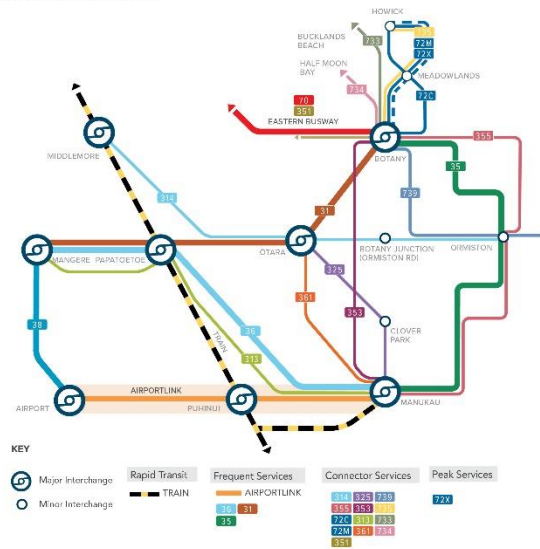
The recommended operating pattern confirmed the termination of both rapid transit lines at Botany Station and through-routes approximately half of the local bus services where it is practical and desirable to do so. This preferred network scenario ensures services serve strategic and catchment needs, retain existing coverage, minimise long and unreliable out-of-service circulation movements, take into account OPEX considerations and that services joined together for through-routing do not leave partial severed routes that are uneconomic to run.

This preferred network option is recommended to be implemented at the opening of Eastern Busway and the stage 1 Botany Station in 2025. A map of the recommended bus service network is provided in Figure 7-1 and Figure 7-2 below.

Bus Network 2021

Not all services shown

Following the opening of Puhia Station.



Proposed Bus Network 2025

Not all services shown

Local bus network would be implemented to align with the opening of Eastern Busway in 2025.

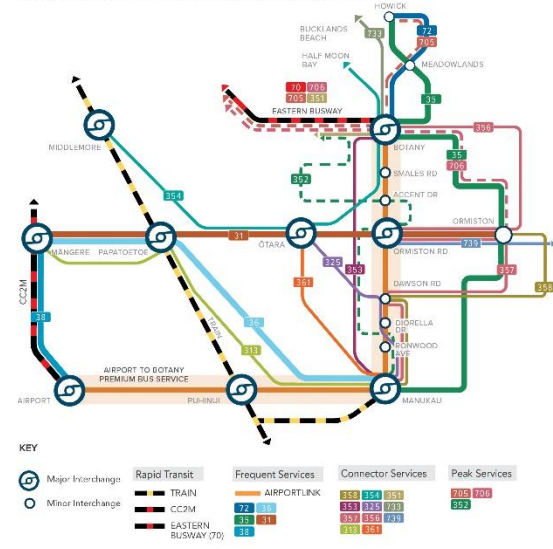


Figure 7-1: Recommended Public Transport Network (2025)

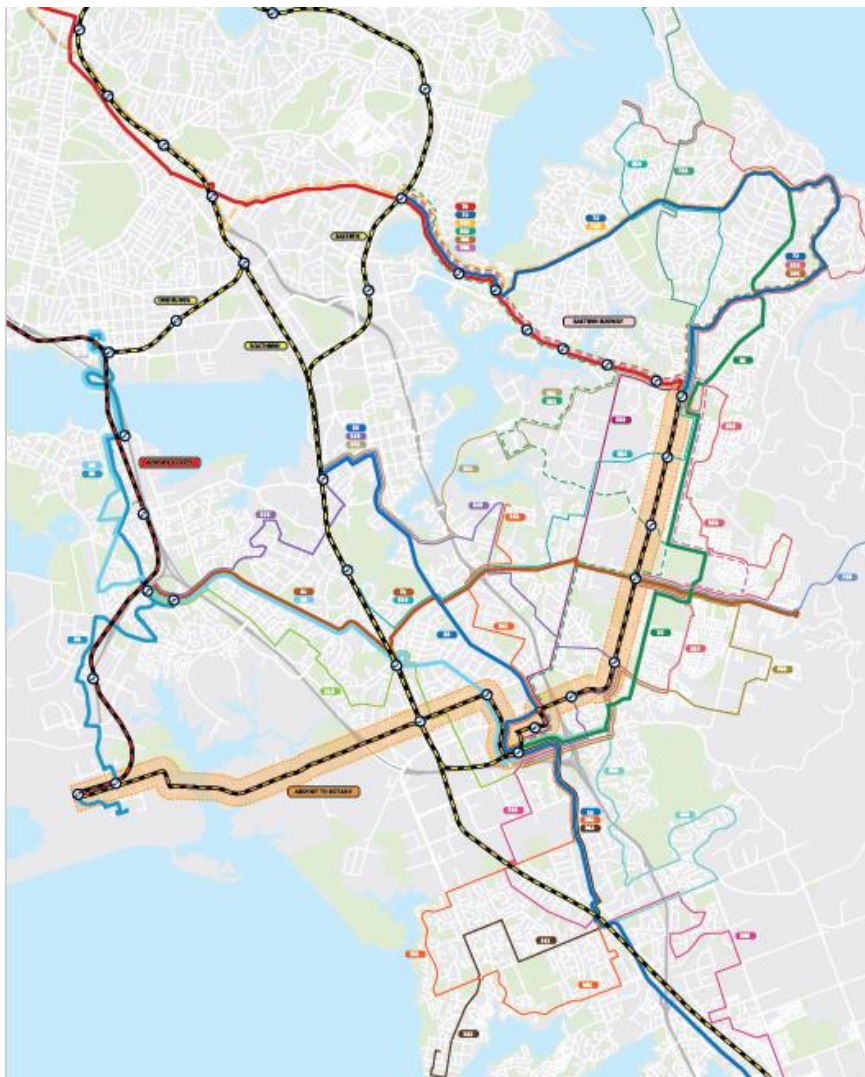


Figure 7-2: Recommended Public Transport Network (Long-term)

7.1.1 Recommended Network - Bus Stop and Layover Requirements

Boarding and alighting passenger forecasts were predicted using AFC modelling outputs for the year 2048. Based on the modelling outputs, the number of bus platforms and layover bays that are required at the Botany Station were identified.

Table 7-1 below summarises the bus stop and layover requirements for each of the bus services that operate at Botany Station.

Table 7-1: Botany Station Preferred Option Bus Stop and Layover Requirements

Bus Services	Bus Stop / Layover Length	No. of Bus Stops	No. of Bus Layovers
A2B	24 m (Double articulated bus)	2 (1 per direction)	4*
AMETI	13.5 m (Large bus double decker / Extra-large bus)	4 (2 per direction)	6*
Local (#351, 353, 354, 356, 733, 72, 35)	13.5 m (Standard bus / extra-large bus / large bus double decker)	5 (2 drop off, 3 pick-up)	4*
TOTAL	25		

- *Assumes opportunity to use AT-owned Howick & Eastern Bus Depot on Ti Rakau Drive for 5-6 long term bus layovers, should there be insufficient space to accommodate the required number of bus layovers within the station.
- Property lease negotiation required and associated costs unknown. Initial review of existing lease has been undertaken by AT Property Team.
- Driver facilities will be required, and their size and location will need to be confirmed by the EBA.
- The provision of kiss and ride / drop-off / on-demand facilities as well as accessible parking requirements are important requirements for the station. The location of these will need to be confirmed by the EBA.

7.2 Options Analysis Workshop

The Options Assessment Workshop was held with Auckland Transport and Waka Kotahi NZ Transport Agency stakeholders on 3 December 2019 to assess each of the options against the investment objectives and MCA.

A range of Pre-Options Assessment Workshop meetings were held in November 2019 with:

- AT Metro
- Eastern Busway project team
- Auckland Transport Funding Team
- Auckland Transport Planning and Property teams

7.2.1 Pre-Workshop Notes

The following comments were received during pre-MCA meetings:

- [illegible]

7.2.2 Options Eliminated

It was agreed at the Options Assessment Workshop that the following options should be eliminated for the following reasons:

Do Minimum

The do minimum option does not directly provide any significant infrastructure to meet investment objectives. It is therefore the base case which scores a zero rating for all of its assessment criteria. All other options are compared relative to this option to determine its performance.

Grade-separated options

Options 1B and 3B are the most expensive options. The total construction cost of these options are more than double all other options. These options will result in improved travel time and reliability for Eastern Busway services. There is also a relatively lower impact on private property. Its disadvantages are that local bus services will need to deviate to use the grade-separated facility, and its high visual and amenity impact. This is especially reflected in the low scoring of both options in the extent, nature and degree of effects on visual amenity which is considered a risk for these options in its ability to receive consent. Both these options were eliminated due to high cost and deviation required for local services to use grade separated facilities.

All through-route option

Option 5 scored relatively positively across most options in the MCA. It was determined that it would have a streamlined customer experience with ease of transfer at a single station. It would also have minimal impact on property in Botany. This option however ran a safety risk of customers crossing between buses at dangerous points. This option results in flow-on effects onto nearby interchanges such as Panmure,

where it would be difficult to find capacity to terminate the A2B and Eastern Busway services. This leads to a potential impact on property elsewhere alongside increased project costs. The all through-route was ultimately eliminated as it was not compatible with the recommended local network.

- A2B through-routing north would also result in duplication with a number of local services approaching the station from the north. AT operates a hub and spoke model, with local services feeding the station providing for high quality interchanges onto rapid transit services for customers.
- Current / future planned land use north of Botany does not support the need for A2B to extend north at this time.

Online options – A2B going north

Options 1A and 3A are the most compact station designs, with a slightly more compact design than the inline turnaround options. The RTN service performance is also improved through a reduction in conflicting vehicle movements with local bus services and increased reliability. Journey times and reliability is also improved for through-routing services.

. Transferring customers must also use the overbridge, resulting in longer and more difficult transfers. Customers are also exposed to safety risks as live traffic needs to be crossed at dangerous points. This option was ultimately eliminated as the A2B option could not be optimised to reduce property impact.

7.2.3 Emerging preferred Options

Offline options

Options 2A and 4A provide high quality customer experience through the use of a single platform which allows easier transfers. Care must be taken in this regard to ensure delineation between different services do not become less clear. With A2B services terminating at Botany, there will be lower operating expenditure by minimising dead-running for turnaround and layover. However, the flexibility for future expansion north for A2B services will be reduced.

The need to enter an offline facility, circulate, and exit will cause delays and reduce reliability. Bus congestion is another downside of this option due to the many conflicting bus movements. Customers will also see an increased risk due to dangerous crossing points. Offline options were not eliminated.

Online Options – with A2B turnaround

Should the A2B service terminate at Botany, operating expenditure will decrease as dead running for turnaround and layovers are decreased.

This option poses safety risks for customers crossing live traffic at dangerous points, as well as drivers crossing at layover bays close to traffic.

7.3 Optimised Options

Following the pre-MCA workshop meetings, Off-line (2A) and In-line (2B) emerging preferred station options were further developed to optimise three key elements:

- A further 'Scenario 6' network was developed with AT Metro, further developing Scenarios 2 and 4 (refer to Section 7.1)
- Confirmed A2B and Eastern Busway services terminate
- More detailed assessment of local bus network requirements
- Reduced number of long-term layover bays provided at Botany Station
- Six long term layover bays (approximately half the total number) provided at nearby Howick and Eastern Bus Depot or other suitable location as identified during by the EBA during the next optioneering phase
- [REDACTED]
- [REDACTED]

These options are shown in the figures below and are also attached in Appendix A.



Figure 7-3: Optimised Off-line Station - Scenario 2 - Option A.1



7.3.1 Performance

The recommended option identified in the subsequent MCA workshop was scenario 2 – option B.1, an In-line Option with turnaround facility. This option optimised scenario 2 – option B and is a hybrid online/offline station with an online A2B and Eastern Busway turnaround. The in-line section of the station accommodates for only A2B and Eastern Busway services with one pick-up bay and one drop-off bay for A2B services, while Eastern Busway services have two pick-up bays and two drop-off bays. Six Eastern Busway layover bays and four A2B layover bays are also provided within this station to optimise efficiency and eliminate the effect of traffic conditions.

. Conflicting vehicle movements are also reduced by separating rapid transit services and local bus services. An overpass is provided over the layover road to access each platform, with access located directly adjacent to the cycle lane and footpath which runs along each side of Te Irirangi Road.

7.3.2 Future Proof

Scenario 2 option B.1 is optimised to accommodate for future expansion through the six Eastern Busway layover bays which can be used as pick-up or drop-off bays if the platform is extended. Likewise, four A2B layover bays can be converted in the future to pick-up or drop-off bays should the platform be extended, and future demand require it. In the scenario where the turnaround facility for A2B and Eastern Busway services be relocated further north, the proposed turnaround facility can be extended north in the future. This provided the benefit of performance of rapid transit services, flexibility to expand in the future without increasing footprint, as well as higher potential for oversite development.

7.3.3 Recommended Option

The preferred Botany Station option is a hybrid online/offline station with online A2B and Eastern Busway platforms, layover and turnaround. The key features are:

- All rapid transit (Airport to Botany and Eastern Busway) services are fully accommodated on-line, with spaces to pick-up and drop-off passengers and layover and turnaround facilities. This reduces conflicts between rapid transit services and local buses, general traffic and active modes, allowing rapid transit services to avoid congestion and operate more reliably to / from and within the station.
- One pick up bay and one drop-off bay are provided for A2B services, while Eastern Busway services have two pick-up and drop-off bays. Rapid transit passengers will arrive and depart on platforms facing the direction they are travelling in, offering customers a high quality 'train station' style experience.
- Four A2B and six Eastern Busway layover bays are provided online.
- Local buses are directed into an offline station via a bus-only lane. In this area, six layover bays, four pick-up bays, and three drop-off bays are provided. Bus congestion in the offline station is reduced by separating local buses from rapid transit services.
- A pedestrian bridge is provided over Te Irirangi Drive to access each platform, with access located directly adjacent to the cycle lane and footpath which runs along each side of Te Irirangi Road. This grade separated crossing provides safe pedestrian transfers and access to all services.
- The station design and functional requirements reflect a balanced local network and operational scenario, where some local bus services are through-routed where network and customer needs can still be met, and where it is feasible and appropriate to do so. This ensures services serve catchment needs, retain existing coverage, and OPEX considerations are taken into account.
- Opportunities for reduced long term layovers at Botany Station, with some potentially provided off-site, for example adjacent to the nearby Howick & Eastern Bus Depot.
- The option offers flexibility and the ability to accommodate future growth of rapid transit services within the existing online footprint and does not preclude a future extension of the rapid transit corridor to the north to serve additional catchments if required.
- There are opportunities to work with property owners for land use and transport integration outcomes, which can be progressed by the EBA.

As outlined above in Section 2, further options assessment for Botany Station will be undertaken by the EBA as part of the Eastern Busway project, which is programmed for delivery ahead of A2B, opening in 2025. Due to the SSBC-level of the options assessment completed to-date, it is acknowledged that that station's location and form may evolve as further engagement and detailed assessment is completed by EBA. As such, the A2B project team will continue to work with the EBA to confirm A2B's functional requirements within the station. This will ensure A2B is future-proofed for within the Stage 1 station delivered by EBA in 2025. The A2B project will undertake a Stage 2 upgrade to align with the opening of A2B in 2030.



7.4 Workshop Comments and Actions

This section provides outlines additional investigations and analysis undertaken to incorporate comments received from Auckland Transport stakeholders and peer reviewers.

7.4.1 Alternative Station location using different Eastern Busway link

[Redacted text block]

Following the development of this alternative option, assessments undertaken have shown the following challenges:

- [Redacted list item]

- The proposed alignment of the Link Road conflicts with an existing stream and stormwater pond. Any construction works that impact these will likely result in a difficult consenting process and may require additional earthworks to mitigate the conflicts;
- [REDACTED];
- Due to the wide corridor width required for a Botany Station at this location, there are tie-in issues between the road alignment and the adjacent intersections to the north (Te Irirangi Drive / Te Koha Road) and to the south (Te Irirangi Drive / Haven Drive).
- Local bus circulation issues due to the location of the station. This will lead to increased operating cost for repositioning and circulation.
- The location of the station is further away from the town centre.

7.4.2 Construction Cost Estimates and underground station options

[REDACTED]

An underground bus station was also eliminated due to the costs, construction impact, and poor customer experience associated with any underground options. An underground option will also need to accommodate double-decker vehicles, which will further increase costs, and increase size due to the ramps and clearance required.

7.5 Road Safety Audit

A Road Safety Audit for the recommended Botany Station option was conducted and classified issues by their safety risk and identified one serious, one significant and five moderate issues.



The serious and significant issues included:

- A conflict area at the entrance of the local bus layover at Town Centre Drive.
- Alterations requirements for the Te Irirangi Drive / Ti Rakau Drive intersection due to the wide terminus median.

The safety and design matters raised in the RSA have been acknowledged. Due to Botany Station's interface with the Eastern Busway project and the imminent EBA contract award at the time of writing, further design development was not undertaken by A2B to further respond to matters raised in the RSA. The A2B Botany Station designs and RSA have been handed over to the EBA for further consideration as part of their optioneering and design development. The RSA is included in Appendix G.

7.6 Cost Estimates

A parallel cost estimate was prepared for the preferred station option and is included as Appendix J1 to the SSBC, and Appendix D of this report.

7.7 Opportunities

The following opportunities were identified during the options assessment process with AT stakeholders and the Eastern Busway project team for further investigation during the next project phase, depending on the outcomes of the further optioneering undertaken by the EBA:

- Promoting and enabling transit-oriented development and good land transport outcomes in Botany Town Centre
 - Working with landowners / Panuku and AT Property on shared outcomes, for example:
 - Potential for oversite development / airspace rights
 - Retail 'sleeving' of station
 - Pedestrian bridge connections to developments
 - Leasing
- Station access improvements for active modes in the station's walk-up and cycling catchment.

7.8 A2B Pre-Rapid Transit Service 2035

The future Botany Station optioneering undertaken by the EBA will need to further consider staging of the proposed network. As part of the SSBC, A2B has proposed a pre-rapid transit service, opening in 2025 to coincide with the opening of the new Botany Station (refer to Medium Term Report 502334-8000-REP-JJ-0001)

In summary:

- The A2B medium-term strategy is based on a service-led approach, involving the delivery of a public transport service to build demand and embed travel patterns before investing in infrastructure.
- New service will extend the AirportLink service from Manukau to Botany (currently running between the Airport and Manukau) and will follow the ultimate Airport to Botany route and stopping pattern.
- The service will be supported by relatively low-cost bus priority improvements and interim stations to ensure journeys are sufficiently fast and reliable and attractive to customers.
- The recommended fleet for the A2B medium-term service is 18m single-articulated e-buses (opening 2025, subject to funding).
- The target peak frequency of a vehicle every 7-minutes – enables customers to ‘turn up and go’ but not so frequent as to cause bunching.
- The fleet and frequency will be confirmed with bus services/network development teams in the coming years.

7.9 A2B fleet staging, headway and timing

The A2B and 20Connect SSBC, Medium Term Report (502334-8000-REP-JJ-0001) and Fleet Staging Technical Note (502334-7000-TEC-KK-0026) sets out the proposed A2B fleet staging, modelled headway and assumed opening dates for each service. Vehicles progress from standard electric bus (AirportLink) to A2B articulated and double articulated vehicles over time, as set out in Table 7-2 below.

Table 7-2: Proposed A2B fleet staging, headway and timing

Horizon / Service	Opening	Vehicle	Headway, minutes
Horizon 1 AirportLink	2021	Standard electric bus	10 min base headway, all day
Horizon 2 A2B Medium Term service	2025	Articulated vehicles	10 min base headway (7 min in peak)
Horizon 3 Airport to Botany Rapid Transit service	2030	Articulated vehicles	10 min base headway (5 min in peak)
Horizon 4 Airport to Botany Rapid Transit service	2035	Double-articulated vehicles	Extrapolated between: 2028 - 10 min base headway (5 min in peak) & 2048 - 5 min base headway (2 min in peak)

The proposed fleet staging, service headways and timing of A2B delivery will need to be considered in the future optioneering of Botany Station.

7.10 Next steps

Following the MCA workshop, the next steps identified were:

- There is a need to undertake a further initial options assessment alongside the Eastern Busway project to assess the potential implications on station layout and operation due to different alignments of the final 600m section of Eastern Busway connecting into Botany Station. Consideration of these matters was not included within this Botany Station Options Assessment, as this assessment was based on an assumption agreed with Auckland Transport that this alignment will be via Te Koha for all options.
- High-level functional requirements will be developed and updated throughout the process to capture the requirements of the station and inform future design phases undertaken by both Eastern Busway and A2B.
- Further optioneering of Botany Station will be undertaken by the Eastern Busway project. It is acknowledged that the location and form of the station may evolve as the EBA undertakes further options assessment, engagement and progresses the design in more detail.
- It is intended that Botany Station will be delivered in stages:
 - Stage 1 – Botany Station will be consented, funded and delivered by EBA, opening 2025. Includes designating for the ultimate (Stage 2 2030) station footprint and future-proofing for A2B.
 - Stage 2 – Botany Station upgrade funded and delivered by A2B, opening 2030.
- The A2B project team will continue to work with the EBA throughout the optioneering process to confirm A2B's functional requirements at Botany Station.
- Local bus turnaround / repositioning should be further developed by the EBA, depending on the location / configuration of the final station and alignment of the last 600m of Eastern Busway. It is recommended by AT Metro that a future local bus turnaround avoids Botany Town Centre Drive. This is privately owned and negotiation to increase use of this would likely be required. It is noted that Botany Town Centre landowners are currently required to provide for bus stops in their current resource consent.
- The provision of kiss and ride / drop-off / on-demand facilities as well as accessible parking requirements are important requirements for the station. The location of these will need to be confirmed by the EBA.
- School bus services are to be further considered in the station optioneering undertaken by the EBA.
- Further consideration of promoting and enabling land integration opportunities.

The background of the entire page is a complex, abstract composition. It features a blurred photograph of a train, likely at a station, which is partially obscured by a series of overlapping, semi-transparent geometric shapes. These shapes include large triangles, rectangles, and parallelograms in various colors: shades of blue, green, orange, and purple. The shapes are arranged in a way that creates a sense of depth and movement, as if they are floating or layered over the train image. Some shapes have thin white lines or borders, adding to the intricate design. The overall effect is modern and dynamic.

A

Botany Station Option Sketches

The background of the page is a complex, abstract composition. It features a central, blurred image of a train moving through a tunnel, with light trails suggesting motion. This central image is overlaid with numerous semi-transparent, overlapping geometric shapes, primarily triangles and parallelograms, in shades of blue, orange, green, and purple. These shapes are arranged in a way that creates a sense of depth and movement, with some elements appearing to recede into the background while others come forward. The overall effect is a dynamic and modern visual representation of transportation and planning.

B

Transport Planning Assessment Technical Note

To	Auckland Transport	From	
Copy		Reference	
Date	26 September 2019	Pages (including this page)	10
Subject	Botany Station MCA, Transport Planning Assessment		

The purpose of this note is to summarise the methodology and outputs for the transport planning component of the Botany Station multi-criteria assessment. Note that the do minimum option is always scored 0 because it is the benchmark for assessment, and all other options are scored positively or negatively (between -3 and +3) based on how much better or worse they perform than the do minimum option.

1 Investment objective 1: Provide more equitable access and travel choices

1.1 Capacity of the system to meet demand

The first KPI is an assessment of the station's capacity to cater for the forecast number of buses required by 2048, according to the functional specification for local services as part of the AMETI (Eastern Busway) project.

All options scored 3, because they have been designed to meet the forecast demand, whereas the do minimum scored 0, because there isn't enough space to add the required number of bays to the current bus stops, to meet the long-term demands at Botany Station.

1.2 Public transport 'generalised cost' of station access and transfers

This KPI involved a 'generalised cost' type assessment (weighted for each service group by the modelled demands) of time to access and egress the station (based on circulation/access routes), number of major intersections and number of minor or give way intersections traversed, and station quality for transferring passengers.

1.2.1 Approach and assumptions

For each station design, a score for PT travel times through the station was computed to inform the multi-criteria analysis process. This assessment was conducted for each service group, namely:

- AMETI/Eastern Busway services
- A2B services
- Local buses approaching from the south
- Local buses approaching from the north

Travel times to/from the station

The circulation (access and egress) assumptions for the do minimum scenario are described in Table 1. For each option, the circulation is shown in boxes on the station design sketches.

Table 1: Do minimum bus circulation description

Service group	Approach (Departure is reverse)
AMETI/Eastern Busway	East along Ti Rakau Drive, south on Te Irirangi Drive, Town Centre Drive
A2B	North along Te Irirangi Drive, Town Centre Drive
Local buses from south	Existing “New Network” circulation: north on Chapel Road, west on Ti Rakau Drive, south on Te Irirangi Drive, Town Centre Drive
Local buses from north	Existing “New Network” circulation: south on Te Irirangi Drive, Town Centre Drive

Figure 1 shows the ‘screenline’ boundaries that were used to estimate the distance and therefore travel time to access and egress the station options. Distance estimates are approximate and only consider in-service travel, as this is what affects the ‘generalised cost’ for passengers. Distance estimates are the total for both approach and departure from the station, as most services experience similar demands in each direction (throughout the day). When the A2B service extends north, this distance is excluded because few people use that link, and this would disproportionately increase the average generalised cost for users of Botany Station in the options where A2B extends north.

It is generally assumed that buses travel at a ‘high’ speed on main roads, and a ‘low’ speed on roads through retail precincts and through the station/past platforms. The average speed estimates are: ‘high’ speed is 35km/h for Eastern Busway and local buses, ‘high’ speed is 40km/h for A2B because of the dedicated running way, and ‘low’ speed is 15km/h.

Estimated intersection delays

Each circulation option involves travelling through various intersections. Each intersection movement is classified as contributing either 'big' or 'small' delays, based on whether the service is travelling with or against main traffic movements, and whether the intersection is signalised or not).

Some intersections, with very small side roads, do not assume any delays for the 'main' (typically straight-through) movement.

A 'big' delay is an average delay of 40 seconds, and a 'small' delay is an average of 20 seconds.

Station quality

Each station is also given a transfer penalty, based on the station quality penalties applied in Auckland Forecasting Centre's Macro Strategic Model (MSM). In this model, the travel time penalty for standard bus stops is 10 minutes, 8 minutes for 'purpose' interchanges, and 5 minutes for 'high quality' interchanges.

For this 'generalised cost' type assessment, the do minimum is considered as 'standard bus stops', the offline options are considered 'high quality' because they are generally more compact, with shorter

transfer distances for users, and all other (grade separated and in line style) designs are considered 'purpose' interchanges, because they typically have longer transfer distances.

Weighting of service groups and station quality

The total estimated 'generalised cost' is weighted for each service group by the relative demand of each service group. For local buses, the demand split between the north and south approaches is assumed to be equal. Additionally, transfer penalties are only applied to the proportion of travellers who are expected to transfer at Botany Station (e.g. if 50% of travellers are expected to transfer, then the 'average' penalty is half of the transfer penalty time).

Demands used for weighting are from the May 2019 model runs (noted as 'v5'), using scenario 48134 (A2B).

1.2.2 Results

This criterion is a 'generalised cost' type assessment, meaning it is affected by several factors including approach, departure and circulation distances; intersection traversals; and station quality. These effects are counted for each service group and weighted by the relevant demands. This makes it hard to unpick what has increased/decreased the 'generalised cost' for each option. The direction and scale of effect from each of these factors is shown in Table 2.

Table 2: Ranking of effects of each station design compared to do minimum

Element	1A	1B	2A	2B	3A	3B	4A	4B	5A
Generalised cost (do min = 12.6 min)	10.3	10.3	9.5	9.7	9.5	9.7	9.1	10.0	9.0
Net effect	1	1	3	2	3	2	3	2	3
Total distance (including approach, station circulation, departure)									
AMETI	2	2	1	2	2	2	1	1	3
A2B	1	1	-1	2	1	1	-1	-1	2
Northbound locals	-1	-2	-1	-1	3	-2	-2	3	3
Southbound locals	2	2	2	2	3	2	2	3	3
Intersection delays (including station entrance and exit)									
AMETI	1	3	-1	0	1	3	-1	0	1
A2B	-2	-2	-1	2	-2	-2	-1	2	-2
Northbound locals	2	3	2	2	2	2	2	2	2
Southbound locals	0	0	0	0	1	3	1	1	1
Station quality	1	1	3	1	1	1	3	1	1

2 Investment objective 2: Provide public transport that is easy to use, reliable, fast, resilient and affordable

2.1 Local bus travel time reliability

This KPI assesses how each station design is likely to affect the variability of travel times for local buses approaching and departing from Botany Station. This measure is qualitative and takes into account:

- Directness of access to the station, including intersection traversal to access the station (less direct routes have more opportunity for delays)
- Station circulation (more circulation increases opportunity for delays)
- Separation of stops from general traffic (if buses must merge into traffic from stops, this introduces variability to travel times)

Options 1A and 1B are similar to the do minimum (score = 0), mainly because local buses still need to enter Botany Town Centre (even if just slightly) to access the station, and the station itself involves reasonable circulation.

Options 2B and 3B scored slightly better than do minimum (score = 1), because, although they have similar station approaches, once they enter the station (including layover spaces) they are fully separated from general traffic. Note that 3B scored better than 1B because the layover spaces in 1B needed to be placed somewhat separately from the station itself.

Options 2A and 4A scored moderately better than do minimum (score = 2) because the station is fully separated from general traffic, but local buses still need to cross intersections to access the station, and there is lots of circulation of the station itself.

Options 3A and 5 scored significantly better than do minimum (score = 3) because local buses stop inline and merge into a bus lane (less variability than merging into general traffic lanes).

2.2 Rapid transit travel time reliability

This KPI assesses how each station design is likely to affect the variability of travel times for *Rapid Transit Services* to access, drop off/pick up and depart from Botany Station. This measure is qualitative.

Options 2A, 2B, 4A and 4B scored moderately better than do minimum (score = 2) because the rapid transit stops at these stations are all fully separated from general traffic, however these station designs do require both A2B and AMETI services to cross large intersections to access the stops.

Options 1A, 1B, 3A, 3B and 5 scored significantly better than do minimum (score = 3) because all rapid transit stops are inline with the service patterns, minimising additional intersection conflicts and deviations from services.

2.3 Ease of transfers

This metric assesses each station on how well it facilitates transfers between different services at Botany Station. It considers legibility, and horizontal and vertical transfer distances. Note that vertical transfers are often necessary at large public transport stations, due to the frequency of buses; this also

applies to Botany Station. However, despite this necessity, vertical transfers are more difficult for people to navigate than horizontal transfers, and this has been taken into account in the scoring.

Options 1A, 2B, 3A and 4B all scored slightly better than the do minimum (score = 1) because transfer distances are large, and vertical transfers are necessary for most transfers.

Options 1B, 3B and 5 all scored better than the do minimum (score = 2) because some transfers can be made across a single platform, whilst still require vertical transfers.

Options 2A and 4A scored significantly better than the do minimum for ease of transfers (score = 3) because all transfers can be made from the same platform, with no vertical movements. However, it is noted that these options require premium signage to ensure that the transfers remain legible, given the complexity of stop arrangements for the two rapid transit lines and local buses going in various directions.

3 Investment objective 3: Promote urban regeneration

3.1 Access to key destinations from station

This is a qualitative measure that assesses the station location relative to key destinations, and the connectivity from the station to those destinations.

Options 2A and 4A scored the same as the do minimum (score = 0) because they are 'standalone' stations on the east side of Te Irirangi. They provide good connectivity to the main part of Botany Town Centre.

Options 1B, 3B and 5 scored slightly better than do minimum (score = 1) because they provide direct access to each side of Te Irirangi Drive to facilitate access to both the main Botany Town Centre and *The Hub* on the west side of Te Irirangi Drive, as well as providing reasonably direct access to the residential area to the southwest.

Options 1A, 2B, 3A and 4B scored better than do minimum (score = 2) because they provide direct access to each side of Te Irirangi Drive to facilitate access to both the main Botany Town Centre and *The Hub* on the west side of Te Irirangi Drive. The access provided by these options is closer to the main developments than what is achieved in options 1B, 3B and 5, above.

4 Investment objective 4: Reduce the effects of the transport system on the environment and taonga

4.1 Air pollution

This KPI is a qualitative measure of the amount of mode shift that is expected to be driven by each of the station designs. Note that detailed modelling could not be conducted for each station design, so it was not possible to assess this quantitatively. All options provide high quality stations and can support many more buses per hour than the do minimum, so better services can be provided alongside each of these station options. Therefore, all options scored 3 (much better than do minimum).

5 Investment objective 5: Improve health, safety and security of people

5.1 Local walking and cycling connections

This KPI is a qualitative, technical assessment of the effects of the station design on the local walking and cycling connections.

Options 2A and 4A scored worse than do minimum (score = -1) because they force local a large deviation in the local walking and cycling connections along Te Irirangi Drive. It is not possible to direct them straight along Te Irirangi Drive, without significant delays at signalised intersections, due to the significant number of buses entering and exiting Botany Station.

Options 2B, 4B and 5 scored a bit better than do minimum (score = 1) because they provide both an at-grade and grade separated crossing opportunity of Te Irirangi Drive.

Options 1A, 1B, 3A and 3B scored better than the do minimum (score = 2) because in these options, A2B extends further north, and with it, the high-quality local walking and cycling facilities will also be extended to support station access further north.

5.2 Access to station by active modes

This measure is a qualitative assessment of the ease of accessing the station for pedestrians, bicyclists and other micromobility users.

Options 2A and 4A scored a bit better than the do minimum (score = 1) because they only provide high-quality access to destinations on the east side of Te Irirangi Drive. However, they do outperform the do minimum because they provide access concourses both to the north and the south of the station platform.

Options 2B, 4B and 5 scored better than the do minimum (score = 2) because the vertical concourses provide direct access to people on both sides of Te Irirangi Drive. The at-grade signalised crossings will remain, however the elevated concourse provides an additional option, which is particularly valuable for vulnerable and cautious travellers.

Options 1A, 1B, 3A and 3B scored much better than do minimum (score = 3) because the vertical concourses provide direct access to people on both sides of Te Irirangi Drive. Additionally, the extension of A2B, and its associated walking and cycling facilities, provide better station access connections for people to the north of Botany Town Centre.

6 Implementability criteria related to transport planning

6.1 Operating cost per bus

This measure is used to assess the operating cost implications of each station design. Initially the overall OPEX within the station boundaries (as described in Figure 1) were estimated, however, the do minimum option can only cater for ~70 buses, whereas the other options can cater for over 100 buses. Because of this, the overall operating cost in the do minimum is much lower than all other options. Therefore, this measure evolved to be the operating cost per bus, to be comparable across options.

6.1.1 Approach and assumptions

The *Eastern Busway Functional Specifications and Operational Plan v0.3* (AMETI, 23/07/2018) informed the projected number of Eastern Busway and local buses that are expected in 2048. Note that the number of buses for the do minimum scenario is smaller because there is less capacity at Botany Station in this option. Table 3 shows the (peak) buses per hour that were used for the measure.

Table 3: Estimated buses per hour in the peak, at Botany Station

Options	AMETI	A2B	Locals from south	Locals from north
Do minimum	12	12	24	24
1A: Local and AMETI terminate, online interchange	20	20	43	28
1B: Local and AMETI terminate, grade-separated	20	20	43	28
2A: All terminate, offline interchange	20	20	43	28
2B: All terminate, online interchange	20	20	43	28
3A: AMETI terminates, online interchange	20	20	31	31
3B: AMETI terminates, grade-separated interchange	20	20	31	31
4A: AMETI and A2B terminate, offline interchange	20	20	31	31
4B: AMETI and A2B terminate, online interchange	20	20	31	31
5: None terminate, online interchange	20	20	31	31

The service-hours and service-kilometres were estimated for each of the service groups, based on the station access, egress, and circulation assumptions (the same as for the *Public transport 'generalised cost' of station access and transfers* measure). It is assumed that the Peak Vehicle Requirement (PVR) component of cost will not be affected by the station design, as there should be enough resilience in the existing PVR's for station travel times not to affect them.

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The total operational cost from service-hours and service-kilometres within the Botany Station area were computed for all services in the peak, and then divided by the total number of buses, to get a weighted average OPEX per bus (weighted by the proportion of buses in each service group).

6.1.2 Results

All options outperformed the do minimum option, because they have more direct access to the stops, albeit some involve reasonable circulation of the station itself.

Options 1B and 2A scored a bit better than do minimum (score = 1). These options both involve reasonable in-service circulation of stations. Because these options involve layovers for local buses, the services have to circulate the station separately for drop off and pick up, whereas if they were through-routed, they would just run along the platforms once.

Options 1A, 3B and 4A scored somewhat better than the do minimum (score = 2). Each of these options still involves circulation of an arrangement of platforms, albeit less than the options that only scored 1.

Options 2B, 3A, 4B and 5 all scored much better than the do minimum (score = 3). Each of these options involved all service stopping inline, in some manner. Therefore, there is no additional in-service circulation that adds time and distance to services.

6.2 Public transport network operating cost

This measure is included to assess the wider network operating cost implications of the through-routing requirements of some of the station designs.

All options scored worse than the do minimum (-2 or -3) because in the do minimum, services would have to be limited to account for the reduced capacity of a Botany Station. Only ~70 buses per hour in peak would be run, compared to over 100 buses per hour in peak for all of the option scenarios.

Options 3A, 3B, 4A and 4B scored worse than the other options (score = -3) because these options assume that all local buses through-route. There are operating cost implications of this, because the buses to the north of Botany do not run as frequently as the buses to the south, so there would be an increase in frequency for the buses to the north.

Option 5 scored -2 (the same as the options where all local buses terminate) despite the same assumption that all local buses through-route, and the operating cost implications that come with that. This is because the linking of A2B services with AMETI services removes the duplication of layover requirements at Botany between the two services. In the other scenarios, AMETI has layovers at Panmure and Botany and A2B has them at Botany and the Airport, whereas in this option the combined route only has layovers at Panmure and the Airport. The operating cost effect of this is expected to be similar to (ie outweigh) the effects of the additional operating cost for through-routing everything.

6.3 Public transport network planning

This measure was included to help understand the flexibility of each station design to add or remove layover locations. A high score reflects a station design that will be very flexible (in its current state or with some small variations) for future public transport network planning, and a lower score reflects less flexibility.

This is a qualitative measure that takes into account:

- The extent to which the station design can easily be modified during planning to reflect the ideal layover requirements for local buses, and
- The extent to which the station will limit future changes to the public transport network for local services (ie can future networks increase or decrease the number of local buses terminating or through-routing at Botany).

Options 3B and 5 scored 0 because they have no layover spaces for local buses, and there are no convenient places to add layover spaces for them.

Options 3A, 4A scored 1 because they have no layover spaces for local buses in the base designs, however, one or two layover bays may be able to be added into, or near, these station designs.

Option 4B scored 2 because they have no layover spaces for local buses in the base designs, however, several layover bays could be added near the service platforms.

Options 1A, 1B, 2A and 2B scored 3 because they have enough layover bays for all expected local bus services.

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Engineering Assessment Technical Note

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Name of assessor (incl. qualifications and organisation):	
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1 Introduction

This document provides an assessment of the Botany interchange options for the Airport to Botany (A2B) Single Stage Business Case (SSBC). It details the considerations which have been used to inform the assessment and is designed to contribute to the Multi-Criteria Analysis (MCA) which is being undertaken for the options.

2 Methodology

This assessment has taken into consideration the implementability of the proposed options. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.

A high-level desktop assessment of the following criteria for the proposed options has been undertaken (Table 1).

Table 1: Feasibility criteria

Constructability	<p>Level of complexity:</p> <ul style="list-style-type: none"> How straightforward is it to implement this option? Are there any challenges with construction methodology and staging or constraints? Consider topography, gradients, utilities, ground conditions, contaminated land, tie-ins to existing infrastructure etc.
Construction disruption	<p>Construction impacts on people and businesses regarding:</p> <ul style="list-style-type: none"> Traffic Existing access levels Duration Economic impacts on businesses / communities / town centres
Construction cost	<p>Assessed cost for construction of options including:</p> <ul style="list-style-type: none"> Complexity and risk in construction (including consideration of constructability) Complexity in the programme
Safety in design and construction	<p>Level of design and construction risks:</p> <ul style="list-style-type: none"> Are there significant hazards associated with the option which pose a health and safety risk in design, build and final product? Can safety be developed into the design process to control it?

	<ul style="list-style-type: none"> Level of complexity in risk management through safety in design.
Operation and maintenance	<p>Any factors that may affect the ability to operate or maintain the option over its projected life:</p> <ul style="list-style-type: none"> Any major ongoing or additional costs and/or whole of life costs? Level of maintenance activities required Capability to carry out maintenance activities.

Table 2 details how the engineering and design feasibility criteria has been scored for each option.

Table 2: Scoring of feasibility criteria

Rating	Description
5	Straight forward and minor works. Low level of health and safety in design. Negligible/minor construction impacts, construction costs and maintenance and operation costs
4	Moderate works. Low to moderate level of health and safety in design. Minor to Moderate maintenance and operation costs. Minor amount of construction impacts and construction costs.
3	Major construction works. Moderate to high level of health and safety in design. Moderate maintenance and operation costs. Moderate amount of construction impacts and construction costs.
2	Uncommon construction works. High level of health and safety in design. Moderate to high maintenance and operation costs. high amount of construction impacts and construction costs.
1	Construction that has never been done in NZ. Significant/extreme level of health and safety in design. Significant maintenance and operation costs. Significant amount of construction impacts and construction costs.

3 Options Assessment

This section outlines the implementability scoring and commentary for each option to inform the MCA.

Table 3: Base case assessment

Base Case	Score
Existing Environment (Do minimum)	
n/a	n/a
<p>Summary</p> <p>The Base Case assumes no change to the existing road network, expect for slight kerb realignment at the existing platforms along Town Centre Drive and the addition of painted bus markings for layover bays around the Botany town centre area. There will be negligible/minor construction impacts (in comparison to the rest of the options proposed), and on-going maintenance and operations which is business as usual. For this reason, we have not assessed the implementation feasibility of the Base Case.</p>	

Table 4: Scenario 1 - Option A Assessment

Scenario 1 – Option A Online interchange - All services terminate at Botany except A2B	Score
<p>Constructability</p> <p>Major construction works, particularly because of the RTC extension north of Botany, but nothing unusual. This option will be straightforward to implement, with non-challenging construction methods and staging.</p> <p>Roads: Large retaining wall and substantial widening to Te Irirangi Drive required. Additional widening required along Botany Road. Two footbridges, easy to construct.</p> <p>Utilities: Existing underground Transpower lines through the middle of TI Dr carriageway to be relocated or lowered to retain existing cover. Relocation of Chorus Fibre Optics (CFO) and high voltage 11kV lines (HV) will be required. Construction staging and standovers with utility owners required prior to construction. Other non-critical utilities such as LV electricity and comms might need to be protected or relocated. As part of the northern extension footprint, a watermain (which seems to be a main water supply) running under Botany Road may require protection or relocation, with appropriate staging required.</p> <p>Stormwater: Existing pond may not have capacity to manage increase in runoff volume from a larger impervious area - therefore attenuation of flows could be problematic. Extensive network upgrade work will likely be required due to footprint of option. Botany extension offers limited space for green infrastructure.</p> <p>Potential Wetland: The greenspace between the carpark and Te Irirangi Drive could be utilised for a wetland which would only be suitable for managing flows from southern portion of the Te Irirangi Drive widening due to topographic restrictions.</p> <p>Detention tanks/filter cartridges: Relatively straightforward construction of onsite treatment and detention could be provided by detention tanks and filter cartridge devices.</p> <p>Existing Pond: Initial high-level look at GeoMaps, the flood plain would suggest the local pond may not be at full capacity, however due to the impermeable area increase this may not be feasible.</p> <p>Network Requirements: Extensive network upgrading likely due to footprint of proposed scheme.</p> <p>_____</p> <p>_____.</p>	3
<p>Construction disruption</p> <p>High amount of construction impacts, particularly because of RTC extension north of Botany.</p> <p>_____</p> <p>_____.</p> <p>Utilities: The staging required to carry out construction works for the watermain under Botany Road will add complexity and additional time considerations to the programme.</p> <p>Structures: Minor disruption due to structures.</p>	2
<p>Construction cost and risk</p> <p>_____</p> <p>_____</p>	2
<p>Safety in design and construction</p> <p>Low to moderate level of health and safety in design</p> <p>Roads/Stormwater: Central platforms are on a busy road posing a H&S risk.</p> <p>Utilities: Working with and near high voltage lines such as underground Transpower, HV electricity and gas possess risk to construction workers.</p> <p>Structures: Typical construction risks in town centre, can be managed through health and safety in design process.</p>	4
<p>Operation and maintenance</p> <p>Moderate maintenance and operation costs.</p> <p>Roads/structures: Lift maintenance required. _____</p> <p>_____</p>	3

<p>Utilities: Maintenance of utilities under the carriageway such as Transpower will be difficult. It is ideal not to place utilities under RTN hence, appropriate relocation and maintenance access to be identified.</p> <p>Stormwater: Wetlands/detention tanks/filter cartridge require annual inspection and maintenance. Would require a layby area to access filter cartridges - Minor disruption. Existing pond may already have a maintenance regime. If underground detention tanks are required along Botany Road, maintenance of these may require extended traffic management, depending on their placement - Potential for significant disruption.</p>	
<p>Summary</p> <p>Major construction works that are straightforward to implement, with high amounts of construction disruption and medium construction costs. Low to moderate level of health and safety in design and construction and moderate maintenance and operation.</p>	

Table 5: Scenario 1 - Option B Assessment

Scenario 1 – Option B	Score
<p>Grade-separated interchange - All services terminate at Botany except A2B</p> <p>Constructability</p> <p>Uncommon construction works, particularly because of the elevated platform. This option may have some challenges to implement, with somewhat challenging construction methods and staging.</p> <p>Roads: Working at heights. Lots of temporary work, falsework. Encroaches on SW pond, possible staging required or de-watering.</p> <p>_____.</p> <p>Utilities: Existing underground Transpower lines through the middle of TI Dr carriageway to be relocated or lowered to retain existing cover. Construction staging and stand overs with utility owners required prior to construction. Other non-critical utilities such as LV electricity and comms might need to be protected or relocated. As part of the northern footprint, watermain running under Botany Road may require protection or relocation. _____ . additional length of critical asset increasing construction complexity.</p> <p>Stormwater: Existing pond may not have capacity to manage increase in runoff volume from a larger impervious area - therefore attenuation of flows could be problematic. Extensive network upgrade work will likely be required due to footprint of option. Botany extension offers limited space for green infrastructure.</p> <p>Potential Wetland: The greenspace between the carpark and Te Irirangi Drive could be utilised for a wetland. This would only be suitable for managing flows from southern portion of the Te Irirangi Drive widening due to topographic restrictions.</p> <p>Detention tanks/filter cartridges: On site treatment and detention could be provided by detention tanks and filter cartridge devices. Relatively straightforward construction.</p> <p>Existing Pond: Initial high-level look at GeoMaps flood plain would suggest the local pond may not be at full capacity. Due to the impermeable area increase this may not be feasible.</p> <p>Network Requirements: Extensive network upgrading likely due to foot print of proposed scheme.</p> <p>_____.</p>	2
<p>Construction disruption</p> <p>High amount of construction impacts, particularly because of the elevated platform</p> <p>Roads: Loss of parking for layover bays. Pedestrian exit from upper level surrounded by roads. Disruption along Botany Road for the RTC extension. Many road closures for beam lifts and barrier installation work. Disruption to main entrance with bus / car conflicts. Long time to build.</p> <p>Structures: Major disruption due to structures.</p> <p>Utilities: The staging required to carry out construction works for the watermain under Botany Road will add complexity and additional time considerations to the programme.</p>	2
<p>Construction cost and risk</p> <p>_____.</p>	1

<p>Safety in design and construction</p> <p>Moderate level of health and safety in design, primarily due to the grade separated feature.</p> <p>Roads/Stormwater: Guardrail required to main road. Higher risk due to height. Bus and pedestrians have minimal conflict with cars.</p> <p>Utilities: Working with and near high voltage lines such as underground Transpower, HV electricity and gas possess risk to construction workers.</p> <p>Structures: Significant construction risk of heavy beam lift for structures, working over water, deep and large foundations that could clash with services. Can be partially managed through health and safety in design process, but still high residual risks.</p>	3
<p>Operation and maintenance</p> <p>Moderate maintenance and operation costs.</p> <p>Roads/structures: More maintenance of structures than other options, particularly if concrete is adopted for ramps and elevated platform. Only need to service bridge expansion joints and bearings. Lighting required under structure/ongoing power costs. Lift maintenance.</p> <p>Utilities: Additional length of critical assets (Transpower) affected and additional maintenance costs and maintenance bay to be considered which will add costs to the overall life cycle of the project.</p> <p>Stormwater: Wetlands/detention tanks/filter cartridge require annual inspection and maintenance. Would require a layby area to access filter cartridges - Minor disruption. If existing pond is utilised this may already have a maintenance regime. For the botany Extension, if underground detention tanks are required, maintenance of these may require extended traffic management, depending on their placement - Potential for significant disruption.</p>	3
<p>Summary</p> <p>Uncommon construction works that may have some challenges to implement, with high amounts of construction disruption and significant construction costs. Moderate level of health and safety in design and construction and moderate maintenance and operation.</p>	

Table 6: Scenario 2 - Option A Assessment

Scenario 2 – Option A Offline interchange - All services terminate at Botany	Score
<p>Constructability</p> <p>Moderate construction works but nothing unusual. This option will be straightforward to implement, with non-challenging construction methods and staging</p> <p>Roads: Majority of construction offline. Large retaining wall and potential building wall support.</p> <p>Structures: Two footbridges, easy to construct.</p> <p>Utilities: Existing underground Transpower lines through the middle of TI Dr carriageway to be relocated or lowered to retain existing cover, a section of CFO and HV electricity cables, non-critical utilities affected through bus interchange construction in the private property and expected to be managed without significant risks</p> <p>Stormwater: No space for above ground stormwater management on site. Detention tanks/filter cartridge – On site treatment and detention could be provided by detention tanks and filter cartridge devices. Simple construction.</p> <p>Existing Pond: Initial high-level look at GeoMaps flood plain would suggest the local pond is not at full capacity. Would have to be clarified with Council what the pond is currently designed for. No permanent works impact on existing pond. It's worth noting that the change in impermeable area is small which may result in no attenuation being required i.e. treatment only.</p>	4

<p>Construction disruption</p> <p>Minor amount of construction impacts since station is offline.</p> <p>[Redacted]</p> <p>[Redacted]</p> <p>[Redacted]</p> <p>[Redacted]</p> <p>[Redacted]</p> <p>Structures: Minor disruption, less than 1 year</p> <p>Stormwater: Detention tanks/filter cartridge - Would be less than minor. Would form part of the construction of the overall terminal. Existing Pond – Potential upsizing of existing infrastructure - Minor disruption, less than 1 year</p>	4
<p>Construction cost and risk</p> <p>[Redacted]</p>	4
<p>Safety in design and construction</p> <p>Low to moderate level of health and safety in design</p> <p>Roads/Stormwater: Less disruption to main road.</p> <p>Utilities: Working with and near high voltage lines such as underground Transpower, HV electricity and gas possess risk to construction workers, relocation of a section of CFO & HV electricity cables near the intersection is required however; no significant additional risks from the construction of the bus interchange around non-critical utilities.</p> <p>Structures: No significant risk associated with the option regarding structures other the typical construction risks in the town centre, which can be managed through the health and safety in design process.</p>	4
<p>Operation and maintenance</p> <p>Minor to moderate maintenance and operation costs.</p> <p>Roads/structures: Minor if concrete footbridges are adopted. Lift maintenance required. Total area for this option is an additional approx. 11,000m2. However, the long-term maintenance of the interchange can be carried out in isolation. Works are within the capability of the NZ maintenance crew.</p> <p>Utilities: Maintenance of utilities under the carriageway such as Transpower will be difficult. It is ideal not to place utilities under RTN hence, appropriate relocation and maintenance access to be considered. Some effects from a section of CFO and HV electricity cables, no significant additional maintenance required for local utilities at the bus interchange</p> <p>Stormwater: Detention tanks/filter cartridge – Annual inspection and maintenance. Would require a layby area to access filter cartridges. Minor disruption. Existing Pond – Likely to already have an operation and maintenance regime in place</p> <p>Structures: Minor if concrete footbridges are adopted. Lift maintenance required.</p>	4
<p>Summary</p> <p>Moderate construction works that are straightforward to implement, with minor amounts of construction disruption and low to medium construction costs. Low to moderate level of health and safety in design and construction and minor to moderate maintenance and operation.</p>	

Table 7: Scenario 2 - Option B Assessment

Scenario 2 – Option B	Score
Online interchange - All services terminate at Botany	
<p>Constructability</p> <p>Moderate construction works but nothing unusual. This option will be straightforward to implement, with non-challenging construction methods and staging.</p> <p>Roads: Retaining wall required. Substantial widening to Te Irirangi Drive. Large area of wasted space near roundabout. Reduced car stacking at intersection</p>	4



<p>Structures: One long footbridge over Te Irirangi Drive, easy to construct</p> <p>Utilities: Existing underground Transpower lines through the middle of TI Dr carriageway to be relocated or lowered to retain existing cover, considerable lengths of CFO, Vodafone optic, HV electricity and gas lines affected which would need to be protected/relocated during construction. Pre-construction methodology and location of asset is to be determined</p> <p>Stormwater: Existing pond may not have capacity to manage increase in runoff volume from a larger impervious area - therefore attenuation of flows could be problematic. Extensive network upgrade work will likely be required due to footprint of option. Botany extension offers limited space for green infrastructure.</p> <p>Potential Wetland: The greenspace between the carpark and Te Irirangi Drive could be utilised for a wetland. This would only be suitable for managing flows from southern portion of the Te Irirangi Drive widening due to topographic restrictions.</p> <p>Detention tanks/filter cartridge: On site treatment and detention could be provided by detention tanks and filter cartridge devices. Relatively straightforward construction.</p> <p>Existing Pond: Initial high-level look at GeoMaps flood plain would suggest the local pond may not be at full capacity. Due to the impermeable area increase this may not be feasible.</p> <p>Network requirements: Extensive network upgrading likely due to foot print of proposed scheme</p>	
<p>Construction disruption</p> <p>Moderate amount of construction impact.</p> <p></p> <p>Structures: Minor disruption, less than 1 year</p> <p>Stormwater: Works would form part of the overall construction phasing - Refer to roads for details on construction disruption</p>	3
<p>Construction cost and risk</p> <p></p>	3
<p>Safety in design and construction</p> <p>Low to moderate level of health and safety in design</p> <p>Roads/Stormwater: Guardrail required to main road. Surrounded by roads / Jaywalking issue. Central platforms on busy road</p> <p>Utilities: working with and near high voltage lines such as underground Transpower, HV electricity and gas possess risk to construction workers. Appropriate construction staging, identification of all existing utilities during detail design stage is essential to avoid any unknown risks.</p> <p>Structures: No significant risk associated with the option, other the typical construction risks in town centre, can be managed through health and safety in design process.</p>	4
<p>Operation and maintenance</p> <p>Moderate maintenance and operation costs.</p> <p>Roads/structures: Lift maintenance required. Elevated walkway discharges to rear of Briscoes not the most direct route to town centre. Minor maintenance if concrete footbridges are adopted.</p> <p>Utilities: Maintenance of utilities under the carriageway such as Transpower will be difficult. It is ideal not to place utilities under RTN hence, appropriate relocation and maintenance access to be considered. Maintenance of CFO, HV electricity cables and gas lines needs to be considered when identifying relocation.</p> <p>Structures: Minor if concrete footbridges are adopted. Lift maintenance required</p> <p>Stormwater: Wetlands, Detention tanks/filter cartridge – Annual inspection and maintenance. Would require a layby area to access filter cartridges. Minor disruption. If existing pond is utilised this may already have a maintenance regime.</p>	3
<p>Summary</p> <p>Major construction works that are straightforward to implement, with moderate amounts of construction disruption and medium construction costs. Low to moderate level of health and safety in design and construction and moderate maintenance and operation.</p>	

Table 8: Scenario 3 - Option A Assessment

Scenario 3 – Option A Online interchange – Local buses through running and A2B extends north	Score
<p>Constructability</p> <p>Major construction works, particularly because of RTC extension north of Botany, but nothing unusual. This option will be straightforward to implement, with non-challenging construction methods and staging.</p> <p>Structures: One long footbridge over Te Irirangi Drive, easy to construct</p> <p>Utilities: In addition to effects on underground Transpower lines, relocation of CFO and HV cables will be required. As part of the northern extension footprint, a watermain (which seems to be a main water supply) running under Botany Road may require protection or relocation, with appropriate staging required.</p> <p>Stormwater: Existing pond may not have capacity to manage increase in runoff volume from a larger impervious area - therefore attenuation of flows could be problematic. Extensive network upgrade work will likely be required due to footprint of option. Botany extension offers limited space for green infrastructure.</p> <p>Potential Wetland: The greenspace between the carpark and Te Irirangi Drive could be utilised for a wetland. This would only be suitable for managing flows from southern portion of the Te Irirangi Drive widening due to topographic restrictions.</p> <p>Detention tanks/filter cartridge: On site treatment and detention could be provided by detention tanks and filter cartridge devices. Relatively straightforward construction.</p> <p>Existing Pond - Initial high-level look at GeoMaps flood plain would suggest the local pond may not be at full capacity. Due to the impermeable area increase this may not be feasible.</p> <p>Network requirements: Extensive network upgrading likely due to foot print of proposed scheme.</p> <p>Botany Extension: Limited space to provide attenuation and treatment. Likely that new detention tanks will need to be installed or additional land take. Extensive network upgrading likely due to foot print of proposed scheme</p>	<p>3</p>
<p>Construction disruption</p> <p>High amount of construction impacts.</p> <p>Utilities: The staging required to carry out construction works for the watermain under Botany Road will add complexity and additional time considerations to the programme.</p> <p>Structures: Minor disruption, less than 1 year</p> <p>Stormwater: Works would form part of the overall construction phasing - Refer to roads for details on construction disruption</p>	<p>2</p>
<p>Construction cost and risk</p>	<p>2</p>
<p>Safety in design and construction</p> <p>Low to moderate level of health and safety in design</p> <p>Roads/Stormwater: Surrounded by roads / Jaywalking issue. Central platforms on busy road. Guardrail required to main road (to protect lifts).</p> <p>Utilities: Working with and near high voltage lines such as underground Transpower, Vector electricity and gas possess risk to construction workers. Appropriate construction staging, identification of all existing utilities during detail design stage is essential to avoid any unknown risks.</p> <p>Structures: no significant risk associated with the option, other the typical construction risks in town centre, can be managed through health and safety in design process.</p>	<p>4</p>
<p>Operation and maintenance</p>	<p>3</p>

<p>Moderate maintenance and operation costs.</p> <p>Roads/structures: Lift maintenance required. [REDACTED]</p> <p>Utilities: Existing underground Transpower lines through the middle of TI Dr carriageway to be relocated or lowered to retain existing cover. Construction staging and stand overs with utility owners required prior to construction. Other non-critical utilities such as LV electricity and comms might need to be protected or relocated. Maintenance of CFO, HV electricity cables, gas line and a significant length of watermain needs to be considered as well as maintenance access bay when identifying relocation adding costs to the overall life cycle of the project</p> <p>Structures: Minor if concrete footbridges are adopted. Lift maintenance required</p> <p>Stormwater: Wetlands, Detention tanks/filter cartridge – Annual inspection and maintenance. Would require a layby area to access filter cartridges. Minor disruption. If existing pond is utilised this may already have a maintenance regime. Botany Extension - If underground detention tanks are required, maintenance of these may require extended traffic management, depending on their placement - Potential for significant disruption.</p> <p>Summary</p> <p>Major construction works that are straightforward to implement, with high amounts of construction disruption and medium construction costs. Low to moderate level of health and safety in design and construction and moderate maintenance and operation.</p>	
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Table 9: Scenario 3 - Option B

Scenario 3 – Option B	Score
<p>Grade-separated interchange - Local buses through running and A2B extends north</p> <p>Constructability</p> <p>Uncommon construction works, particularly because of the elevated platform. This option may have some challenges to implement, with somewhat challenging construction methods and staging</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>Utilities: In addition to effects on underground Transpower lines, relocation of CFO and HV cables will be required. As part of the northern extension footprint, a watermain (which seems to be a main water supply) running under Botany Road may require protection or relocation, with appropriate staging required.</p> <p>Stormwater: Existing pond may not have capacity to manage increase in runoff volume from a larger impervious area - therefore attenuation of flows could be problematic. Extensive network upgrade work will likely be required due to footprint of option. Botany extension offers limited space for green infrastructure.</p> <p>Works in Existing Pond: If work are required within exiting pond this may not be accepted by Council due to contamination of existing treatment pond. There is also the concern that works (pier/foundation) would reduce the existing pond capacity.</p> <p>[REDACTED]</p> <p>[REDACTED] anaging flows from southern portion of the Te Irirangi Drive widening due to [REDACTED]</p> <p>Detention tanks/filter cartridge: On site treatment and detention could be provided by detention tanks and filter cartridge devices. Relatively straightforward construction.</p> <p>Existing Pond: Initial high-level look at GeoMaps flood plain would suggest the local pond may not be at full capacity. Due to the impermeable area increase this may not be feasible.</p> <p>[REDACTED]</p> <p>Botany Extension: Limited space to provide attenuation and treatment. Likely that new detention tanks will need to be installed or additional land take. Extensive network upgrading likely due to foot print of proposed scheme.</p>	2
<p>Construction disruption</p> <p>[REDACTED]</p>	2

<p>Roads: Long time to build. Minimal disruption at local bus terminating points - Ormiston East, Ormiston West and Howick. Disruption along Botany Road for the RTC extension.</p> <p>Utilities: The staging required to carry out construction works for the watermain under Botany Road will add complexity and additional time considerations to the programme.</p> <p>Stormwater: Works would form part of the overall construction phasing - Refer to roads for details on construction disruption</p>	
<p>Construction cost and risk</p>	1
<p>Safety in design and construction</p> <p>Moderate level of health and safety in design, primarily due to the grade separated feature.</p> <p>Roads/Stormwater: Guardrail required to main road</p> <p>Utilities: Working with and near high voltage lines such as underground Transpower, Vector electricity and gas possess risk to construction workers. Appropriate construction staging, identification of all existing utilities during detail design stage is essential to avoid any unknown risks.</p> <p>Structures: Significant construction risk of heavy beam lift, working over water, deep and large foundations that could clash with services. Can be partially managed through health and safety in design process, but still high residual risks.</p>	3
<p>Operation and maintenance</p> <p>Moderate maintenance and operation costs.</p> <p>Roads/structures: More maintenance of structures than other options, particularly if concrete is adopted for ramps and elevated platform. Only need to service bridge expansion joints and bearings. Lighting required under structure / ongoing power costs. Lift maintenance.</p> <p>Utilities: Maintenance of utilities under the carriageway such as Transpower will be difficult. It is ideal not to place utilities under RTN hence, appropriate relocation and maintenance access to be considered. Maintenance of CFO, HV electricity cables, gas line and a significant length of watermain needs to be considered as well as maintenance access bay when identifying relocation adding costs to the overall life cycle of the project</p> <p>Structures: Moderate if concrete is adopted for ramps and elevated platform, only need to service bridge expansion joints and bearings. Lift maintenance required.</p> <p>Stormwater: Wetlands/detention tanks/filter cartridge – Annual inspection and maintenance. Would require a layby area to access filter cartridges. Minor disruption. If existing pond is utilised this may already have a maintenance regime. Botany Extension - If underground detention tanks are required this maintenance of these may requires extended traffic management, depending on their placement - Potential for significant disruption.</p>	3
<p>Summary</p> <p>Uncommon construction works that may have some challenges to implement, with high amounts of construction disruption and significant construction costs. Moderate level of health and safety in design and construction and moderate maintenance and operation.</p>	

Table 10: Scenario 4 - Option A Assessment


<p>Scenario 4 – Option A</p> <p>Offline interchange – All services terminate at Botany except local buses</p>	<p>Score</p>
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<p>Constructability</p> <p>Moderate construction works but nothing unusual. This option will be straightforward to implement, with non-challenging construction methods and staging.</p> <p>Roads: Large retaining wall and potential building wall support. Minimal additional infrastructure at local bus terminating points - Ormiston East, Ormiston West and Howick.</p> <p>Utilities: Existing underground Transpower lines through the middle of TI Dr carriageway to be relocated or lowered to retain existing cover. Construction staging and stand overs with utility owners required prior to construction. Other non-critical utilities such as LV electricity and comms might need to be protected or relocated. A section of CFO, HV electricity cables and non-critical utilities affected through bus interchange construction in the private property expected to be managed without significant risks.</p> <p>Structures: Two short footbridges, easy to construct.</p> <p>Stormwater: Increase in impermeable area is minor compared with other option. May be possible to provide treatment only. Furthermore, there is a reduced risk that the existing pond capacity would not be able to be used as part of the stormwater management philosophy.</p> <p>Potential Wetland: The greenspace between the carpark and Te Irirangi Drive could be utilised for a wetland. This would only be suitable for managing flows from southern portion of the Te Irirangi Drive widening due to topographic restrictions.</p> <p>Detention tanks/filter cartridge: On site treatment and detention could be provided by detention tanks and filter cartridge devices. Relatively straightforward construction.</p> <p>Existing Pond: Initial high-level look at GeoMaps flood plain would suggest the local pond may not be at full capacity. Due to the impermeable area increase this may not be feasible.</p>	4
<p>Construction disruption</p> <p>Minor amount of construction impacts. since station is offline.</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>Structures: Minor disruption, less than 1 year</p> <p>Stormwater: Works would form part of the overall construction phasing - Refer to roads for details on construction disruption</p>	4
<p>Construction cost and risk</p> <p>[REDACTED]</p>	4
<p>Safety in design and construction</p> <p>Low to moderate level of health and safety in design</p> <p>Roads/Stormwater: Less disruption to main road. Bus and pedestrians minimal conflict with cars/through traffic</p> <p>Utilities: In addition to the do min option, relocation of a section of CFO & HV electricity cables near the intersection is required however; no significant additional risks from the construction of the bus interchange around non-critical utilities.</p> <p>Structures: no significant risk associated with the option, other the typical construction risks in town centre, can be managed through health and safety in design process.</p>	4
<p>Operation and maintenance</p> <p>Minor to moderate maintenance and operation costs.</p> <p>Roads/structures: Minor if concrete footbridges are adopted. Lift maintenance required. Long-term maintenance of the interchange can be carried out in isolation. Works are within the capability of the NZ maintenance crew.</p> <p>Utilities: Maintenance of utilities under the carriageway such as Transpower will be difficult. It is ideal not to place utilities under RTN hence, appropriate relocation and maintenance access to be considered. Some effects from a section of CFO and HV electricity cables, no significant additional maintenance required for local utilities at the bus interchange</p>	4

<p>Utilities: Working with and near high voltage lines such as underground Transpower, HV electricity and gas possess risk to construction workers. Appropriate construction staging, identification of all existing utilities during detail design stage is essential to avoid any unknown risks.</p> <p>Structures: No significant risk associated with the option, other the typical construction risks in town centre, can be managed through health and safety in design process.</p>	
<p>Operation and maintenance</p> <p>Minor to moderate maintenance and operation costs.</p> <p>Utilities: Maintenance of utilities under the carriageway such as Transpower will be difficult. It is ideal not to place utilities under RTN hence, appropriate relocation and maintenance access to be considered. Maintenance of CFO, HV electricity cables and gas lines needs to be considered when identifying relocation and maintenance access bay</p> <p>Structures: Minor if concrete footbridges are adopted. Lift maintenance required</p> <p>Stormwater: Wetlands/detention tanks/filter cartridge – Annual inspection and maintenance. Would require a layby area to access filter cartridges. Minor disruption If existing pond is utilised this may already have a maintenance regime.</p>	4
<p>Summary</p> <p>Moderate construction works that are straightforward to implement, with moderate amounts of construction disruption and medium construction costs. Low to moderate level of health and safety in design and construction and minor to moderate maintenance and operation.</p>	

Table 12: Scenario 5 Assessment

Scenario 5	Score
Online interchange – All services through route	
<p>Constructability</p> <p>Moderate construction works but nothing unusual. This option will be straightforward to implement, with non-challenging construction methods and staging.</p> <p>Roads: Minimal retaining. Minimal additional infrastructure at local bus terminating points - Ormiston East, Ormiston West and Howick.</p> <p>Utilities: Construction complexity and constraints from relocation or protection of underground Transpower cable only</p> <p>Structures: One long footbridge over Te Irirangi Drive, easy to construct.</p> <p>Stormwater: Increase (potentially negligible) in impermeable area is minor compared with other option. May be possible to provide treatment only. Furthermore, there is a reduced risk that the existing pond capacity would not be able to be used as part of eth stormwater management philosophy.</p> <p>Detention tanks/filter cartridge: On site treatment and detention could be provided by detention tanks and filter cartridge devices. Relatively straightforward construction.</p> <p>Existing Pond: Initial high-level look at GeoMaps flood plain would suggest the local pond may not be at full capacity. No impact on existing pond. The widening of Te Irirangi Drive would require attenuation of flow.</p>	4
<p>Construction disruption</p> <p>Minor amount of construction impacts.</p> <p>Roads: Less disruption to surrounding businesses / parking areas. SUP feels 'open' and park like surrounds e.g. side of wetland. Smaller footprint / confined work area. Minimal disruption at local bus terminating points - Ormiston East, Ormiston West and Howick.</p> <p>Utilities: Stand overs for works over Transpower lines may be required</p> <p>Structures: Minor disruption, less than 1 year</p>	4

Stormwater: Works would form part of the overall construction phasing - Refer to roads for details on construction disruption	
Construction cost and risk 	4
Safety in design and construction Low to moderate level of health and safety in design Roads/Stormwater: Guardrail required to main road Utilities: Working with and near high voltage lines such as underground Transpower, Vector electricity and gas possess risk to construction workers. Appropriate construction staging, identification of all existing utilities during detail design stage is essential to avoid any unknown risks. Structures: No significant risk associated with the option, other the typical construction risks in town centre, can be managed through health and safety in design process.	4
Operation and maintenance Minor to moderate maintenance and operation costs. Roads/structures: Smaller footprint / less lighting required / maintenance. Easy to build as small and simple Utilities: Maintenance of utilities under the carriageway such as Transpower will be difficult. It is ideal not to place utilities under RTN hence, appropriate relocation and maintenance access to be considered. maintenance of CFO, HV electricity cables and gas lines needs to be considered when identifying relocation. Structures: Minor if concrete footbridges are adopted. Lift maintenance required Stormwater: Wetlands, Detention tanks/filter cartridge – Annual inspection and maintenance. Would require a layby area to access filter cartridges. Minor disruption if existing pond is utilised this may already have a maintenance regime	4
Summary Moderate construction works that are straightforward to implement, with minor amounts of construction disruption and low construction costs. Low to moderate level of health and safety in design and construction and minor moderate maintenance and operation.	

Approvals:

	Author	Reviewer
Name		
Signature		
Designation	Transport Engineer	Associate

D



Cost Estimates

Botany Interchange

Business Case Estimate

Prepared for:

Aurecon

Issued date:

1/09/2020



1.0 INTRODUCTION

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2.0 BASIS OF ESTIMATE

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Appendices

Appendix A Project Estimate Summary

Appendix B Detailed Estimate

Revision History

1.0 Draft Issued to Aurecon. 01-Sep-2020

Verification

Internal Peer Review By:



This report has been prepared by Truecost Ltd on the specific instructions of Aurecon. It is solely for Aurecon's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Truecost Ltd or Aurecon has not given its prior written consent, is at that person's own risk.

1.0 INTRODUCTION

1.0 EXECUTIVE SUMMARY

This Business Case Estimate prepared by Truecost Ltd is for the A2B Botany Interchange 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 Bus Interchange between Te Koha Road and Te Rakau Drive in the Botany Town Centre forming part of the Airport to Botany Rapid Transit project and Ameti.

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

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.

20 BASIS OF ESTIMATE

21 Methodology

This Business Case Estimate prepared by Truecost Ltd for the A2B Botany Interchange 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 A2B Botany Interchange 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 verify that the estimate scope of work has been correctly translated into the schedule of quantities.

22 Purpose

The Purpose of the Business Case Estimate for the A2B Botany Interchange 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 sensitivity 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 appropriate 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.

23 Contingency and Funding Risk

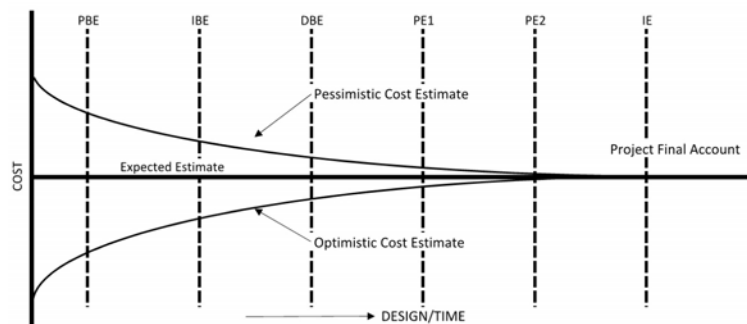
No formal risk assessment has been completed for the Business Case Estimate for the A2B Botany Interchange project, therefore a contingency value of 30% has been applied to the Base Estimate and used to calculate the Expected Estimate.

A further 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 A2B Botany Interchange project has a level of accuracy of minus 15% to plus 20%.

The below graph shows the estimate lifecycle and provides the perceived 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)

24 Estimate Allowances

The following allowances have been included in the 'Project Development Phase - Investigation and Reporting' section of the Business Case Estimate for the A2B Botany Interchange 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 A2B Botany Interchange 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 A2B Botany Interchange 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 A2B Botany Interchange 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.

25 Estimate Exclusions

The following has been excluded in the Business Case Estimate for the A2B Botany Interchange 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)



PROJECT ESTIMATE SUMMARY



DETAILED ESTIMATE



Botany Interchange

Business Case 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 Property Costs of \$58,126,520 as advised by Auckland Transport		note		
A-7	Project Development Consultancy fees of 3.0% of the Nett Physical Works (excl P&G) value		note		
A-8	Project Development Stakeholder Managed Costs of 1.5% of the Nett Physical Works (excl P&G) value		note		
A-9	Pre-implementation Consultancy Fees of 9.5% of the Nett Physical Works (excl P&G) value		note		
A-10	Pre-implementation Stakeholder Managed Costs of 2.0% of the Nett Physical Works (excl P&G) value		note		
A-11	Implementation Consultancy Fees (MSQA) of 3.0% of the Nett Physical Works (excl P&G) value		note		
A-12	Implementation Stakeholder Managed Costs (MSQA) of 1.5% of the Nett Physical Works (excl P&G) value		note		
A-13	Implementation Main Contractor MSQA Fees of 1.5% of the Nett Physical Works (excl P&G) value		note		
A-14	On-Site Preliminary and General cost of 25% of the Nett Physical Works		note		
A-15	Off-Site overheads and Margin 12.5% of the Nett Physical Works		note		
A-16	Design development of 5% of the direct costs		note		
	Exclusions				
A-17	Property Purchase Costs		note		
A-18	Property Compensation Costs		note		
A-19	Property Owner Accommodation Works		note		
A-20	Asbestos and Contaminated material removal and disposal		note		



Botany Interchange

Business Case Estimate

Code	Description	Quantity	Unit	Rate	Total
A-21	Rock excavation and disposal		note		
A-22	Local Authority Fees		note		
A-23	Escalation from the time of this estimate		note		
A-24	Sunk costs		note		
A-25	Finance costs		note		
A-26	Legal fees		note		
A-27	Cost share agreements		note		
A-28	Future-proofing costs		note		
A-29	Goods and Services Tax (GST)		note		
	PREAMBLES				0

Auckland Transport
Botany Interchange Scenario 2
Option B.1
Parallel Estimate – Business Case
17 September 2020



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REVISION HISTORY

Revision Number	Revision	Revision Date	Prepared By	Checked By
1	Issued for review	7 Sept 20	<div></div>	<div></div>

This report has been prepared by Alta on the specific instruction of the client. It is intended solely for the clients use in accordance with the agreed scope and contract conditions. It has been based on relevant information provided prior to or during the assignment to the relevant revision date.

Reliance on this report by any person other than the client without Alta’s written consent is entirely at their own risk.

Electronic file name: Botany Interchange Parallel Estimate

1 IN BRIEF

Alta has been engaged by the Auckland Transport to provide a parallel estimate of the Botany Interchange project, Scenario 2 Option B.1. The project involves construction of a bus interchange, road widening, dedicated bus lanes and intersection upgrades. The project is currently at an optioneering stage and an indicative concept design has been provided (consisting of 1 outline drawing). Due to the low level of design information, this estimate should be considered budgetary with a lower level of accuracy.

SUMMARY OF ESTIMATE VALUES



2 ESTIMATE

This estimate has been prepared based on the drawing provided by Aurecon and a briefing meeting with Aurecon and Auckland Transport. The build-up of rates has generally been from first principles and bench marked against rates used on other similar projects in the Auckland region. All pricing has been indexed to a 2020 base date.

Where assumptions have been made due to limited design information or where multiple options exist, they have been detailed in section 4 of this report. The level of detail provided in the drawings is low, being at an indicative concept stage.

We have relied on information provided by Aurecon for the Airport to Botany business case in establishing earthworks, pavement and services scope of works, as well as design information from the Constellation and Rosedale Bus Stations from Auckland Transport to establish the scope and extent of the bus interchange facilities.

Truecost Limited have undertaken the Engineers Estimate for Aurecon, although we understand this was priced as part of an options assessment, therefore at a reasonably high level. Following completion of our estimate we met with Truecost to reconcile and compare estimates. Their estimate was initially lower, with their base construction cost being around \$45m, opposed to our \$65m. The table below provides a comparison of estimates following discussion around assumed scope;

Item	Alta	Aurecon/Truecost
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Following our reconciliation meeting the following changes were made to both estimates;

- Truecost increased earthworks, retaining walls, traffic services, service relocation, landscaping, extraordinary construction costs and preliminary and general items
- Alta decreased earthworks, traffic services, services and landscaping items.

We have assumed this project sits within the Eastern Busway Stages 2/3/4 project and as such, will be delivered as an Alliance. Our pricing takes this into account. Truecost had not originally allowed for this, and have updated their pricing to suit.

3 RISK

Due to the early stage of design, a detailed risk assessment and Monte Carlo simulation has not been undertaken. Project risk has been reviewed based on the level of information provided. For the expected estimate, we have allowed a 30% contingency on the base estimate. For the 95th percentile funding risk we have allowed a further 20%. These amounts have been considered based on the low level of design information.

4 ESTIMATE ASSUMPTIONS

The property costs have been provided by Auckland Transport and the base estimate includes a 10% contingency. Implementation fees and project preliminary and general costs assume the project will be delivered by the Alliance. Further assumptions and detail of what has been allowed in the estimate are included below.

ENVIRONMENTAL COMPLIANCE

- We have allowed for all monitoring, construction, maintenance, and removal of temporary erosion and sediment controls

EARTHWORKS

- Commercial property () is included in our estimate. This includes an allowance for removal of the tanks and any contaminated ground.
- We have assumed all existing drainage will be removed and reconfigured for the new layout.
- Retaining walls to the east have been allowed to be removed and the existing carpark lowered to provide a consistent grade across the facility.
- We have assumed removal of the existing full depth pavement for replacement with new pavement.

GROUND IMPROVEMENTS

- We have allowed for nominal undercut volumes across the new pavement area.

DRAINAGE

- We have assumed new drainage will be required across the whole site to match the new road alignment.
- We have allowed for a treatment device to treat water from the bus parking areas.
- We have assumed all other pipework can connect into the existing 2050mm stormwater pipe and discharge into the existing pond.

PAVEMENT AND SURFACING

- All pavement measured are as per the drawing provided.
- We have used the same pavement build up provided by Aurecon for the Airport to Botany business case, which largely assumed full depth pavement reconstruction.

RETAINING WALLS

- New retaining walls have been allowed for around the eastern side of the interchange where currently shown, although moved further to the east.
- We have also allowed for new retaining along the side of the existing pond on Te Iriangi Drive, where there looks to be a change in height.

TRAFFIC SERVICES

- New lighting columns have been allowed across the entire area
- Traffic signal replacement has been allowed for at the Te Iriangi Drive / Haven Dive intersection, Te Iriangi Drive / Te Koha intersection, and for the southern side of the Te Iriangi Drive / Ti Rakau Drive intersection.
- Green pavement marking has been assumed for all bus lanes between Te Koha Drive and Ti Rakau Drive.
- Electronic signboards have been allowed for at the main interchange bus stops.
- Pedestrian fencing has been included along all retaining walls, back side of the SUP and between the interchange platform and live traffic lanes

- Between Haven Drive and Te Koha Drive additional lighting has been allowed along the shared use path.

UTILITY AND SERVICES

- We have used utility relocation drawings provided by Aurecon for the Airport to Botany business case. This largely includes relocation of Vector HV, Vector LV, Vector Comms, and Chorus Fibre into the shoulder of the road in a shared service trench.
- Nominal allowances have been made for protecting and diverting existing water and sewer mains, 2100mm stormwater pipe and service lid adjustments.

LANDSCAPING

- General landscape planting and tree pits have been included along the length of the road and through the interchange

EXTRA ORDINARY COSTS

- The interchange structure is included within this section. We have assumed a similar design to that being constructed at the Constellation Drive interchange, which includes covered platforms, 4 x lift and stair towers and a steel structured over bridge.
- We have allowed for a ticket office, toilets, PA and intercom system, external power supply, CCTV and security system, platform seating, bike parking, rubbish bins and wayfinding.
- Other scope has been included to allow for a fully enclosed structure.

TRAFFIC MANAGEMENT AND TEMPORARY WORKS

- Temporary traffic management including all traffic management crews, barriers, signs and, other materials have been priced.
- We have included temporary pavement and temporary tie ins between the existing and new alignments.

PRELIMINARY AND GENERAL

- Preliminary and general costs have been benchmarked against similar types of projects. The preliminary and general costs are equivalent to 25% of direct costs. This is typical for the type of project and contract delivery model.
- Preliminary and general costs include management, supervision, site facilities, offices, bonds, insurances, fees, permits, survey, stakeholder management, and HSEQ management

5 APPENDIX

Appendix	Description	Source
Appendix 1	Overall project summary	Alta
Appendix 2	Interchange only summary	Alta
Appendix 3	Haven Drive to Te Koha summary	Alta

Scenario 2- Option A

INDICATIVE COST ESTIMATE

Prepared for:

Aurecon NZ

Issued date:

4/09/2019



Scenario 2 - Option A

INDICATIVE COST ESTIMATE

Code	Description	Quantity	Unit	Rate	Total
A	<u>PREAMBLES</u>				
	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		
	<u>Allowances</u>				
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 15% 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		
	<u>Exclusions</u>				
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		



Scenario 2 - Option A

INDICATIVE COST 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

Scenario 1 - Option B

INDICATIVE COST ESTIMATE

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Scenario 2- Option B

INDICATIVE COST ESTIMATE

Prepared for:

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Scenario 5

INDICATIVE COST ESTIMATE

Prepared for:

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Issued date:

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E

Planning Assessment Technical Note



Technical Note

To	Patrick Buckley	From	
Copy	Renata Smit	Reference	502334-7000-TEC-KK-0047
Date		Pages (including this page)	15
Subject	Planning and Environment Assessment		

A preliminary assessment of the potential effects on the environment was carried out for the Airport to Botany (A2B) Multi Criteria Analysis (MCA) of the Botany Interchange options, the purpose of which is to inform the preferred option for Single Stage Business Case (SSBC) for A2B for further consideration and assessment.

This cover note provides a summary of the method and assumptions used, a summary of scores, and a summary of the main points raised by the environmental specialists.

Attachments to this cover note include:

- Attachment A: Technical notes issued by environmental specialists
- Attachment B: Botany Interchange Design options
- Attachment C: Botany Interchange Design – Descriptions and Assumptions Memorandum

1 Methodology and assumptions

Specialist assessments were undertaken in the topic areas of property, consentability, third party consents, landscape, visual and urban design, social / community, stormwater, contaminated land, traffic network operation and operational noise¹. The assessments are based on the descriptions and schematics of the short list options provided. Overall, ten options (including a do minimum) were assessed.

Each of the specialists assigned each option a score ranging between -3 (significant adverse effect) to 3 (significant positive benefit) (**Table 1**). The focus was on the assessment of the option, as opposed to a focus on the score itself. Environmental specialists inputted to the specific assessment criteria and the assumptions deemed important to consider as part of the assessment. Weighting has not been applied to the scores.

¹ The noise assessment was a broad qualitative assessment carried out by the planning team and did not involve an acoustic specialist.



Table 1 Scoring scale

Scoring scale
3 (Significant positive effects)
2 (Moderate positive effects)
1 (Minor positive effects)
0 (Neutral effects)
-1 (Minor adverse effects)
-2 (Moderate to significant adverse effects)
-3 (Significant adverse or unmitigable effects)

2 Description of the Botany Interchange options

There are ten Botany Interchange list options for A2B. **Table 2** summaries each of the options.

Table 2 Description of Botany Interchange Options

Option	Description
Do Minimum - Base Case	Do Minimum
Scenario 1 All Services Terminate at Botany (except A2B)	Option A Botany Terminus Online Interchange
	Option B Botany Terminus Grade Separated Interchange
Scenario 2 All Services Terminate at Botany	Option A Botany Terminus Offline Interchange
	Option B Botany Terminus Online Interchange
Scenario 3 Local Buses through Running and A2B extends North	Option A Botany Terminus Online Interchange
	Option B Botany Terminus Grade Separated Interchange
Scenario 4 All Services Terminate at Botany except Local Buses	Option A Botany Terminus Offline Interchange
	Option B Botany Terminus Online Interchange
Scenario 5 All Services Through Route	Botany Terminus Online Interchange

3 Summary of MCA scores for the environmental workstream

The Botany Interchange scores ranged between -3 (significant adverse) and 2 (moderate positive) (**Table 3**). Overall early engagement with owner / occupiers in the town centre will influence both the design and 'how negative' an option is scored where it various occupies private land. This is particularly so for property and planning scores. All scores exclude consideration of any mitigation measures that may be undertaken to address perceived or potential effects.

While several experts have identified significant adverse effects associated with some of the options none have identified unmitigable effects despite scoring some options a -3 score).

Table 3 MCA scoring for environmental criteria

Discipline	Measure	Criteria	Do Minimum	Scenario 1 All Services Terminate at Botany (except A2B)		Scenario 2 All Services Terminate at Botany		Scenario 3 Local Buses through Running and A2B extends North		Scenario 4 All Services Terminate at Botany except Local Buses		Scenario 5 All Services Through Route
			Base Case	Option A	Option B	Option A	Option B	Option A	Option B	Option A	Option B	Scenario 5
Property	Property	Extent and complexity of properties that require acquisition. Potential number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.	0	-3	-1	-2	-3	-2	-1	-2	-2	1
Planning	Consentability	Level of complexity of gaining approvals (e.g. activity status, risk of appeal, accordance with policy direction). Level of compliance with regulatory plans e.g. could the option include activities which are prohibited/ non-complying under the policies and rules of the district or regional plan?	0	-2	-3	-2	-2	-2	-3	-2	-1	-1
	Third Party Consents	Potential to require third party consents as a result of property take, site configuration etc.	-1	-3	-3	-2	-2	-3	-2	-2	-2	-1
Landscape, Visual and Urban Design	Natural character and landscape	Extent, nature and degree of effects on natural character, features, and landscape.	0	0	-2	0	0	0	-2	0	0	-1
	Visual	Extent, nature and degree of effects on visual amenity.	0	-2	-3	-2	-2	-2	-3	-2	-2	-2
	Urban design	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.	2	-1	-3	1	-1	0	-2	1	0	1
Social / Community Impact	Accessibility	Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.	0	1	1	1	1	1	1	1	1	-1
	Community	Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.	0	1	1	1	1	1	1	1	1	-1
Stormwater	Stormwater quality	Impact of operational stormwater discharges on water quality within the catchment	0	-2	-3	0	-1	-2	-3	0	-1	0
	Stormwater Quantity	Impact of operational stormwater discharges on flooding within the catchment, including vulnerability to impacts of climate change such as increased storm events, and opportunities to increase resilience.	-1	-2	-3	-1	-1	-2	-3	-1	-1	-1
Contaminated Land	Contamination Management	Potential to encounter and ability to manage the effects of contaminated soils and groundwater on human health and the environment.	-1	-2	-1	-1	-2	-2	-1	-1	-2	-1
Traffic	Traffic Network Operation	Extent and degree of the change on the traffic network.	0	-2	-2	-2	-2	-1	-2	-2	-1	1
Noise	Operational Noise	Extent, nature and degree of operational noise effects.	0	-1	-1	0	0	-1	-1	0	0	0

It should be noted that Scenario 5 (All Services Through Route) has generally scored quite favourably in the environmental and planning MCA. This option will require all services to terminate elsewhere within the wider transport network and this is anticipated to result in significant property impacts elsewhere (i.e. at the Airport, Panmure, and north of Botany). The impacts and any connotations that this would have for the criteria above (i.e. consentability implications, subsequent third-party consent requirements), landscape, visual, urban design and social etc., have not yet been assessed.

A horizontal bar chart titled "U.S. should take action to address climate change" showing the percentage of respondents who believe the U.S. should take action to address climate change. The chart is broken down by age group (18-29, 30-49, 50-69, 70+) and gender (Male, Female). The y-axis lists the categories, and the x-axis shows the percentage from 0 to 100. The bars are colored in shades of gray, with darker shades for males and lighter shades for females. The data is as follows:

Category	Gender	Percentage
Total	Male	85%
	Female	82%
	Male	80%
	Female	78%
18-29	Male	95%
	Female	92%
	Male	90%
	Female	88%
30-49	Male	88%
	Female	85%
	Male	82%
	Female	80%
50-69	Male	80%
	Female	78%
	Male	75%
	Female	72%
70+	Male	72%
	Female	70%
	Male	68%
	Female	65%

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3.2 Planning

Consenting

Relevant planning considerations in the wider area assessed are:

- there is a 'general commercial frontage' notation for the eastern side of Te Irirangi Drive. The Business – Metropolitan Centre Zone policies seek buildings with frontages subject to the General Commercial Frontage Control achieve a reasonable level of street activation, building continuity along the frontage, pedestrian amenity and safety and visual quality.
- the Transpower New Zealand Ltd Designation #8516 for the Brownhill Road to Pakuranga Underground Electricity Transmission Cables which run along the western side of the Te Irirangi Drive road corridor from Aclare Place to Te Koha Road. Works within this designation area may require requiring authority approval from Transpower New Zealand Ltd.
- 280 Botany Road (Hawthorndene Grounds) is a subject to a historic heritage overlay and is A* category with the primary feature the residence (the interior of the building is excluded) with the overlay extending to the Botany Road frontage. Where the scenarios extend north of Te Rakau Drive, corridor widening will intersect with the heritage overlay and likely require tree removals (and rules apply to the removal of trees greater than 3m in height within this overlay).
- the northern portion of Te Irirangi Drive in (close to the Ti Rakau Drive intersection) is located within the National Grid Substation Corridor Overlay. There are restrictions that impacts within this overlay including new underground network utilities.
- [REDACTED]
- new buildings (A33) within the Business Metropolitan Centre Zone [REDACTED] will require consent as a Restricted Discretionary Activity (the interchange will be considered a building) (H9.4.1(A33)). In addition, any activity not provided for (i.e. a public transport facility) will be require consent as a Non-Complying Activity (H9.4.1(A1)). There also built form standards relating to building height (maximum 72.5m), and

landscaping (2m strip along the street frontage between the street and car parking, loading or service areas visible from the street).

- new buildings within the Business Mixed Use Zone (The Hub) will require consent as a Restricted Discretionary activity (i.e. the overpasses associated with the interchange) (H13.4.1(A45)). In addition, any activity not provided for (i.e. a public transport facility) will be require consent as a Non-Complying Activity (H9.4.1(A1)). There also built form standards relating to building height (27m), and landscaping (2m strip along the street frontage between the street and car parking, loading or service areas visible from the street).
- buildings within the Open Space Conservation Zone (Whaka Maumahara Reserve) that do not comply with one or more built form standards require consent as a Discretionary Activity. Any structure (i.e. the above grade options) within the Open Space Conservation will not comply with the built form standards for this zone. Built form standards relate to building height (22.5m – taken from the adjacent Residential Terrace Housing and Apartments Building Zone), building gross floor area (50m²), maximum site coverage (1%) and maximum impervious surface area (10%). In addition, public transport facilities are not provided for within the zone and would require consent as a Non-Complying Activity (H7.9.1 (A1)).

Within the AUP, the proposed Botany Interchange would full under the definition of a public transport facility – *facility for the transfer of passengers on/off and between public transport services*. It includes bus layovers, drive rest facilities, passenger waiting areas etc.

Overall, those options which are deemed to have the highest level of notification risk (relating to the number of properties with more than minor effects and the relative difficulty anticipated in obtaining the required written approvals), have scored the poorest. The following outlines the scoring rationale:

- The Do Min option has scored 0, with all other options having various level of consenting complexity. This is because it is largely within the existing road corridor where public transport infrastructure is anticipated and provided for.
- The above grade options (Options 1B and 3B) are anticipated to result in more than minor adverse visual effects and given the proximity to the residential properties to the south this is anticipated to create significant amenity effects. They also require ramps to be established within the Town Centre which will result in severance of the parking area in front of the mall and it is anticipated that this would be a notification risk. In addition, these options require the establishment of a large structure within the Open Space Zone where buildings and impervious surface areas are not anticipated nor provided for and would require consent as non-complying activities. Although in terms of the land use consents, the Requiring Authority would likely Designate the required land (rather than apply for a non-complying land use consent). Lastly, both these options extend north of Te Rakau Drive resulting in a likelihood that they will interact with the heritage overlay at 280 Botany Road and require consent for any tree removals. Both options have been scored -3.
- [REDACTED]. Options 1A and 3A extend north and are likely to require consent for works within the heritage overlay at 280 Botany Road where tree removal is anticipated to be required to enable the road corridor widening. [REDACTED]
- Option 4B and 5 have both scored -1 as they are largely within existing road corridor, minimising the consenting complexities. [REDACTED]

Despite the risks involved it is reflected that many of these options would require fairly typical or low risk consenting for major infrastructure.

[illegible]

Response	Percentage
Yes	78%
No	18%
Don't know	4%

-
- A horizontal bar chart with three main categories on the y-axis: 'All respondents', 'Men', and 'Women'. Each category has four bars representing different age groups: '18-29', '30-49', '50-69', and '70+'. The x-axis represents the percentage of respondents, ranging from 0 to 100. The bars are colored in a light gray shade.
- | Group | Age Group | Percentage (%) |
|-----------------|-----------|----------------|
| All respondents | 18-29 | ~95 |
| | 30-49 | ~92 |
| | 50-69 | ~90 |
| | 70+ | ~78 |
| Men | 18-29 | ~95 |
| | 30-49 | ~98 |
| | 50-69 | 100 |
| | 70+ | ~88 |
| Women | 18-29 | 100 |
| | 30-49 | 100 |
| | 50-69 | ~95 |
| | 70+ | ~85 |

Overall the Do Minimum option and Scenario 5 have scored the most favourably in terms of Third-Party consent implications due to the smallest extent of impact on private property and consequently they have the lowest risk of triggering third party consent requirements.

3.3 Landscape, visual and urban design

Landscape

Responsibility	Percentage
Current government	85%
Previous government	10%
Neither	5%

The remaining options are not identified as having any natural character values or landscape features along or near the alignment that could be impacted.

Visual

Except for the Do Minimum Option (which is visually predominantly contained within existing town centre development) all options have scored negatively (moderate to significant adverse effects).

⁵ and potentially rendering sites unusable – which is not evaluated here but scored in the Property criteria

The remaining options result in the loss of the lightly planted medium through intensification of the road corridor, loss of roadside screening vegetation increasing views of the vehicle traffic on Te Irriangi Drive and/or result in overpasses that provide pedestrian access to the platform which create an elevated structure

Urban Design

From an Urban Design perspective, the option scoring ranged from (significant adverse effects (-3) to moderate positive effects (+2).


- The Do Minimum option scored most positively (2) due the location of the interchange being in closest proximity to the primary destination in the Botany Town Centre (the shopping mall). In addition, it results in the smallest land take with the least disruption of existing land uses, performs well from a CPTED perspective and has no grade separation.
- Options 2A, 4A and 5 all scored positively (1) given they result in platforms that are easy to understand and legible (one platform). Option 5 is considered to connect well with the surrounding housing, provides opportunity for the interchange to be integrated with the urban environment in the future and has a smaller land take than other options, and simpler route structure that will help make the PT service easier to understand.
- Options 3A and 4B scored neutral (0). Both these options place the interchange in the centre of an in-hospitable busy road environment, away from the town centre and main destinations. There is a recommendation that the “leftover” space created by the layover bays should be planted or heavily landscaped.
- Options 1A and 2B both scored negatively (-1) given the location of the interchange leaving limited scope for future adjacent complimentary development to occur, along with the location of the interchange in the centre of an in-hospitable busy road environment, away from the town centre and main destinations
- Options 3B and 1B both scored poorly (-2 and -3 respectively) given they force all users of the interchange to use an elevated crossing,

3.4 Social and Community Impact

Botany Town Centre is an important local centre for the surrounding suburbs of Dannemora, Huntington Park, Northpark, Golflands and East Tamaki Heights. Social infrastructure in the town centre includes the Botany Library, Botany Downs Secondary College, St Columba Presbyterian Church, Eastview Baptist Church and International Baptist Church. Logan Carr Reserve and Kellaway Reserve are located to the east of the town centre.

Accessibility

Majority of the options will provide positive social effects due to improved access to and from the Botany Town Centre (a centre of retail and commercial jobs), which allows for improved accessibility and greater social wellbeing. All options have scored +1 (minor positive effects) except for the Do Minimum, Option 2B (for community only) and Scenario 5.



The Do Minimum option is considered to result in a neutral effect given existing access to people to reach services, jobs and properties is largely unchanged. In addition, Scenario 5 does not provide as direct access to the Botany Town Centre as other options (scoring a -1).

The assessment notes that given the large width of Te Irirangi Drive that people wishing to cross east to west have limited movement and that for some of the options this will require the use of an overpass. The provision of an overpass (Options 1A, 2B, 3A, 4B and 5) may make it difficult for people who have mobility requirements to cross from one side of the road to the other.

Improved access to and from the Botany Town Centre will improve with many of the options but those options that do not extend north Te Rakau Drive (Options 1A, 1B, 3A and 3B) will mean that north bound travel using an RTN service remains restricted.

Community

All options except for Scenario 5 are considered to have a neutral or positive effect on community. This is because they all have the potential to result in an increased sense of community through improved transport provision in the Botany Town Centre and ability to access services and facilities. Directly adjacent sensitive construction receivers are minimal.

The Do Minimum would result in a neutral effect (neither positive nor negative effects). It would not result in a major change to impact existing groups, activities and sense of community. Construction work would be minor and as such minimal, temporary impact on sensitive receivers only.

The assessment notes that there is the potential for the quantity of services (local buses, RTN, AMETI) to segregate one side of Te Irirangi Drive from the other in some option but acknowledges that multiple services also provide travel choice to surrounding community.

Scenario 5 has been scored a -1 given its location closer to the residential dwellings north of Te Irirangi Drive and there is potential that the interchange and overpass may further segregate and isolate these residential properties from the Town Centre.

3.5 Stormwater

The project area that is urban and heavily developed with the proposed interchange development options typically occurring within existing hardscape/impervious surface areas. The project area is outside a Stormwater Management Area – Flow (SMAF) but there is a risk of existing downstream flooding as shown on Auckland Council GeoMaps. The majority of the downstream commercial area, and some residential areas are shown to be within the 1% AEP Maximum Probable Development flood plain.

Stormwater runoff from the proposed works is anticipated to require treatment, because the Botany Interchange will receive a high volume of vehicles, due to A2B and AMETI link roads, classed as high-use roads (HURs).

Stormwater Quality

Except for the Do Minimum, Option 2A, 4A and 5 which scored 0 (neutral) all other options have scored negatively from a stormwater quality perspective. Neutral scores reflect that the existing stormwater run-off from Te Irirangi Drive and adjacent areas is currently being attenuated and treated at Whaka Maumahara pond and that these interchange options are only anticipated to have a neutral effect on stormwater treatment (i.e. through the removal of the kerb grass median on Te Irirangi Drive). For each of these options any addition stormwater volume generated by the interchange is anticipated to be able to be treated by Whaka Maumahara pond or via underground treatment options.

Options 1B and 3B (the two options located within Whaka Maumahara Reserve that also extend north onto Botany Road) have scored the lowest from a stormwater quality perspective (-3) given Whaka Muamahara stormwater pond is anticipated to be adversely affected by the works to carry out a grade-separated platform (including a reduction in capacity), and the removal of vegetated areas on either side of Te Irirangi Drive and Botany Road to accommodate the RTN corridor.

Options 1A and 3A have scored -2 (moderate adverse effects) given there is limited space on both sides of the road to provide centralised devices (i.e. wetlands) or longitudinal devices (i.e. swales) to assist with stormwater treatment). In addition, underground mitigation (i.e. stormwater filter cartridges) is anticipated to be required for both options.

Options 2B and 4B have been scored -1 (minor adverse effects) given the removal of kerb grass median and green berm alongside Te Irirangi Drive of road to accommodate bus corridor and platform would have a minor adverse effect on stormwater treatment. In addition, there is limited space on one side of the road (not both as in Options 1A and 3A) to provide centralised devices (i.e. wetlands) or longitudinal devices (i.e. swales) to assist with stormwater treatment).

Stormwater Quantity

All options have scored negatively in regard to stormwater quantity with the two worst Options 1B and 3B (the two grade separated options over Whaka Maumahara Reserve that extend north) given these options are anticipated to reduce the capacity of the pond (structural elements for the grade separated platform) which may increase the risk of flooding in adjacent areas. These changes represent a significant adverse effect on stormwater quantity when compared to the other options (and have scored a -3) given the removal of pervious areas, however the assessment notes that this does not mean the effect on stormwater quantity un-mitigable.

Options 1A and 3A are both anticipated to have moderate adverse effects. Both of these options will require the removal of the kerb grass median on Te Irirangi Drive, and green berm alongside Botany Road which is anticipated to have a moderate adverse impact on flood risk (greater stormwater quantity generated).

All remaining options have scored -1 to reflect that every option will result in the removal of grass median on Te Irirangi Drive to accommodate the RTN corridor and additional vegetation and landscaping on additional properties which would increase the risk of flooding if the additional run-off volume cannot be mitigated.

Lastly, overland flow paths cross Te Irirangi Drive from east to west across the road on Botany Road and this will need to be considered in all options.

3.6 Contaminated Land

All options have scored negatively to reflect that there is the potential to encounter contaminated soils.

The area comprising the Botany Town Centre and immediate surrounds was developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes. In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition.

A PSI will be complete prior to progressing with the preferred option and this will advise on whether any additional testing is required to confirm soil contamination and the associated necessary construction management procedures.

Te Irirangi Drive has been in operation for over 15 years and based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons

and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works.

There is an operational service station at 550 Te Irirangi Drive (Lot 7 DP 196004) and all options that will impact this site (Options 1A, 2B, 3A and 4B) to the point that the building is impacted or there is likely to be disturbance within the vicinity of the underground fuel tanks have scored less favourably to reflect the greater level of risk associated with contamination for this land use activity.

3.7 Noise

All options, except for Options in Scenario 1 and 3, scored a 0 given there would be anticipated to be neutral effects caused by the increase in operational noise from the RTN and Botany Interchange. The proposed interchange would be operating within a built up, high volume traffic environment contributing to a reasonably high level of ambient noise and the interchange is not anticipated to cause any positive or adverse noise effects. It is noted that traffic noise caused from road traffic is already dominant along the proposed routes and many receivers are likely to be desensitised to any increase in operational noise (such as commercial activity).

The two grade separated options (Options 1B and 3B) are anticipated to result in greater adverse noise effects and are also located closer to the residential property located directly south of the stormwater pond (with no noise barriers located in between). Consequently, they have been scored -1 to reflect the resultant adverse noise effect.

Lastly, the options extending north of Te Rakau Drive (Options 1A, 1B, 3A and 3B) will have the inclusion of 4 x A2B layover bays on Botany Road just south of Millhouse Drive. These have the potential to create adverse noise effects caused from vehicles idling (they will be operated as a high frequency turnover with a 10m wait time for the bays). While this noise will be mitigated by the layover bays being centrally located within the road corridor, they are still located near sensitive noise receivers

During construction, adverse noise effects would likely be experienced by sensitive receptors along all option corridors.

3.8 Traffic Network Operation

All options except for the do minimum, Options 3A and 4A and 5 scored a -2 the effects of the extent and degree of change that they would have on the traffic network.


Options 3A and 4B scored a -1 recognising that they would have less adverse effects on the traffic network.

Scenario 5 was the only option of those presented that scored positively and this reflects that it can utilise signal timings in the 'Do Minimum' option to reduce signal time.

The base case was scored neutral given there would be no changes to the existing traffic network.

3.9 Additional Considerations

The above assessments have been undertaken looking at the impacts of the various options on the Botany Town Centre. Where the options will result in local buses terminated at locations outside of the Botany Town Centre (applies to Scenario 3, 4 and 5) there are three locations that are included as



additional terminal locations that would be required. the three terminal locations have not been considered specifically a part of this scoring but are detailed below:

Ormiston East

Ormiston East terminus would use the intersection of Ormiston Road and Shepherds Lane for turnaround and on-street layover. Requires approx. 2 layover bays and 1 pickup/drop off stop, a turnaround facility, driver break facilities (including a toilet). Turnaround facility and driver break facility may require small amount of property.

Ormiston West

Ormiston West terminus located on-street on Florence Carter Avenue. The intersection between this street and Ormiston Road will be signalised, the roundabout to the south on this street will be used for turnaround of buses. Requires approx. 4 on-street layover bays. Drivers on break can use public facilities at new development site on Florence Carter Avenue. Negligible property required.

Howick

Howick terminus would require 4 layover spaces. These can be provided on-street near the town centre, and drivers can use public facilities while on break.

The assumption used for the assessment was that for the local bus through-running options that terminate elsewhere in the network that there will be minor property impact at those termination points. If a preferred option from this MCA is one of these options, then property impact would be considered and assessed in more detail.


It is anticipated that only the Ormiston East termination point would likely result in adverse effects given it may require property acquisition. The surrounding land is zoned Residential Mixed Housing Suburban to the west of the intersection and to the east of the intersection is the Rural Urban Boundary with the land zoned Rural Countryside Living Zone. Any impacts of this additional layover are considered unlikely to alter the scoring outlined above.

Attachments:

- Attachment A: Technical notes issued by environmental specialists
- Attachment B: Botany Interchange Design Options
- Attachment C: Botany Interchange Design – Descriptions and Assumptions Memorandum



Approvals:

	Author	Reviewer
Name		
Signature		
Designation	Senior Consultant, Environment and Planning	Associate, Environment and Planning

Technical Note

To		From	
Copy		Reference	502334
Date	2019-09-20	Pages (including this page)	12
Subject	Airport to Botany: Botany Interchange Design Options: Multi-Criteria Analysis Scoring Sheet: Landscape, visual and urban design effects		

The following provides an assessment of the options for the Botany Interchange Design, as part of the preferred option route for the Airport to Botany (A2B) Single-Stage Business Case (SSBC).

The Botany Interchange options have been assessed separately and in isolation from one another. The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for this section of the preferred option route.

The source information assessed is desktop analysis only. The ten assessments are based on:

- A2B Botany Interchange Schematics (dated 9 August 2019); and
- Preferred Options Assessment and Assumptions Memorandum (dated 28 August 2019).

The options are outlined in Table 1. The scores and assessments are presented in Tables 2-11.

Table 1. Botany Interchange Options Summary

Group	Option	Description
Base Case	Do Minimum	
Scenario 1 <i>All Services Terminate at Botany (except A2B)</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 2 <i>All Services Terminate at Botany</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 3 <i>Local Buses through Running and A2B extends North</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 4 <i>All Services Terminate at Botany except Local Buses</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 5 <i>All Services Through Route</i>	Scenario 5	Botany Terminus Online Interchange

Botany Interchange Design Options Assessment

Table 2 Multi Criteria Analysis Scoring Sheet – Base Case/Do Minimum





Option: Base Case / Do Minimum			
Name of assessor (incl. qualifications and organisation)			
Area of assessment		Landscape, visual and urban design effects	
Score:			
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.	
0	0	2	
<p>Notes:</p> <p>Reasons / Comments</p> <ul style="list-style-type: none">  Predominantly visually contained within existing town centre development. Avoids direct impacts on  residential areas south and west of Botany Town Centre. Loss of existing immature roadside vegetation negligible. Places the PT interchange closest to the primary destination (the shopping mall) and at the heart of the town centre. Does not sterilise adjacent development - could easily be consumed in development adjacent or above the interchange in this location. Smallest land take - least disruption on existing land uses. Simple to initiate and easily expandable. Good from a CPTED perspective with platforms close to other areas of activity and no grade separation. <p>Assumptions</p> <ul style="list-style-type: none">  <p>Other Information relied upon</p> <ul style="list-style-type: none"> Southern tie-in to A2B design not assessed. 			

Table 3 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option A

Scenario 1/Option A: Botany Terminus Online Interchange		
Name of assessor (incl. qualifications and organisation)		
Area of assessment		Landscape, visual and urban design effects
Score:		
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.
0	-2	-1
Notes:		
Reasons / Comments		
<ul style="list-style-type: none"> Intensification of road corridor resulting in the loss of the lightly planted median. Loss of roadside screening vegetation opening views from Ti Irirangi Drive users, the reserve and the residential area north of the interchange of large format retail buildings Places the PT interchange in the centre of an inhospitable busy road environment, not close to the main destinations and away from the heart of the town centre. Results in awkward relationship with the side of buildings leaving little scope for future adjacent complimentary development. Places passengers onto platforms separated by busy traffic lanes - not ideal from CPTED point of view. Difficult to access the interchange from the shopping mall - will require additional public realm works to create an attractive and legible route to the interchange through car parking areas. 		
Assumptions		
<ul style="list-style-type: none"> Widening of road corridor to both sides of the existing road resulting in loss of front and side gardens to residential properties north of the town centre can be mitigated by property acquisition or through negotiation with property owner. 		
Other Information relied upon		
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed. 		



Table 4 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option B

Scenario 1/Option B: Botany Terminus Grade Separated Interchange		
Name of assessor (incl. qualifications and organisation)		
Area of assessment		Landscape, visual and urban design effects
Score:		
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.
-2	-3	-3
Notes:		
Reasons / Comments		
<ul style="list-style-type: none"> Intensification of road corridor resulting in the loss of the lightly planted median. Major visual intrusion on residential area to the north from the elevated structure and bus bays along the east side of the reserve and loss of recreational amenity land. Loss of roadside screening vegetation opening views from the north to large format retail buildings High visual impact of an elevated bus structure in the urban landscape, with particular impact on the green space environment. Places PT interchange away from the heart of the town centre. Hard to scale - must be built all at day one. Forces all users to use elevated crossings. Difficult to foresee this being part of integrated future development or development taking place alongside this structure. Ramps for buses sterilises the car park between the interchange effectively ruling out future development on this site. Difficult to access the interchange from the shopping mall - will require additional public realm works to create an attractive and legible route to the interchange through car parking areas. 		
Assumptions		
<ul style="list-style-type: none"> Widening of road corridor to both sides of the existing road resulting in loss of front and side gardens to residential properties north of the town centre can be mitigated by property acquisition or through negotiation with property owner. 		
Other Information relied upon		
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed. 		

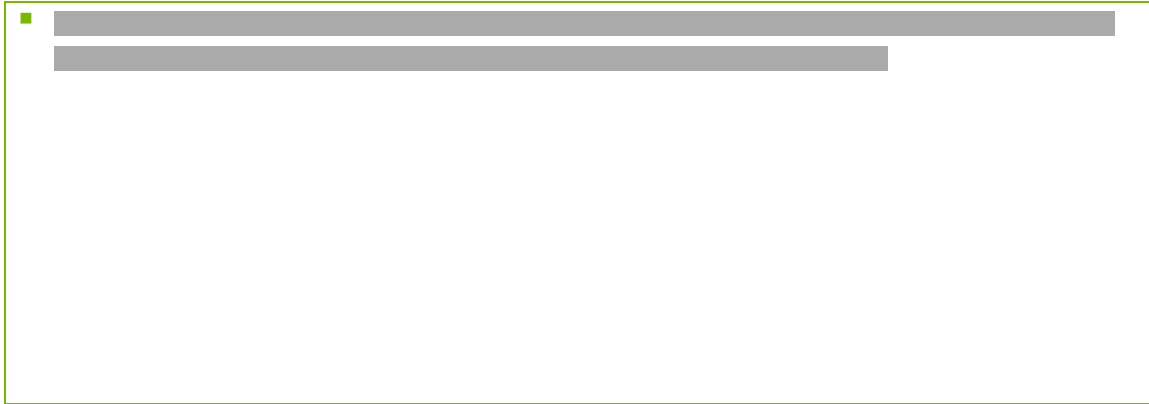


Table 5 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option A




Scenario 2/Option A: Botany Terminus Offline Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment		Landscape, visual and urban design effects	
Score:			
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.	
0	-2	1	
Notes:			
Reasons / Comments			
<ul style="list-style-type: none">  Intensification of road corridor resulting in the loss of the lightly planted median. Loss of roadside screening vegetation opening views from the northern residential areas,  Ti Irirangi Drive of large format retail buildings and / or new bus station and extensively paved bus interchange. One platform creates an easy to understand and legible interchange. Located away from the busy highway, but still not ideally located with respect to the main destination of the shopping mall and the heart of the town centre. Forces all users to use elevated crossings. Results in awkward relationship with the side of buildings leaving little scope for future adjacent complimentary development. Difficult to foresee this being part of integrated future development or development taking place alongside this interchange. 			
Assumptions			
<ul style="list-style-type: none"> 			
Other Information relied upon			
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed 			

Table 6 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option B

Scenario 2/Option B: Botany Terminus Online Interchange		
Name of assessor (incl. qualifications and organisation)		
Area of assessment		Landscape, visual and urban design effects
Score:		
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.
0	-2	-1
Notes:		
Reasons / Comments		
<ul style="list-style-type: none"> Intensification of road corridor resulting in the loss of the lightly planted median. Moderate visual intrusion on the residential area from the elevated structure spanning the full length of the existing road corridor. Loss of roadside screening vegetation opening views from Ti Irirangi Drive users, reserve and residential area from the north to large format retail buildings Places the PT interchange in the centre of an inhospitable busy road environment, not close to the main destinations and away from the heart of the town centre. Results in awkward relationship with the side of buildings leaving little scope for future adjacent complimentary development. Places passengers onto platforms separated by busy traffic lanes - not ideal from CPTED point of view. Difficult to access the interchange from the shopping mall - will require additional public realm works to create an attractive and legible route to the interchange through car parking areas. Results in excessive areas of "left-over" space around lay-over bays, although these admittedly could be planted / heavily landscaped. 		
Assumptions		
<ul style="list-style-type: none"> 		
Other Information relied upon		
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed 		

Table 7 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option A

Scenario 3/Option A: Botany Terminus Online Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment		Landscape, visual and urban design effects	
Score:			
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.	
0	-2	0	
Notes:			
Reasons / Comments			
<ul style="list-style-type: none"> Intensification of road corridor resulting in the loss of the lightly planted median. Moderate visual intrusion on the residential area from the elevated structure spanning the full length of the existing road corridor. Loss of roadside screening vegetation opening views from Ti Irirangi Drive users, reserve and residential area from the north to large format retail buildings. Places the PT interchange in the centre of an inhospitable busy road environment, not close to the main destinations and away from the heart of the town centre. There is room for adjacent urban development which could help to integrate the interchange into the urban environment in the future. Places passengers onto platforms separated by busy traffic lanes - not ideal from CPTED point of view. Difficult to access the interchange from the shopping mall - will require additional public realm works to create an attractive and legible route to the interchange through car parking areas. Results in excessive areas of "left-over" space around lay-over bays, although these admittedly could be planted / heavily landscaped. 			
Assumptions			
<ul style="list-style-type: none"> Widening of road corridor to both sides of the existing road resulting in loss of front and side gardens to residential properties north of the town centre can be mitigated by property acquisition or through negotiation with property owner. 			
Other Information relied upon			
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed 			

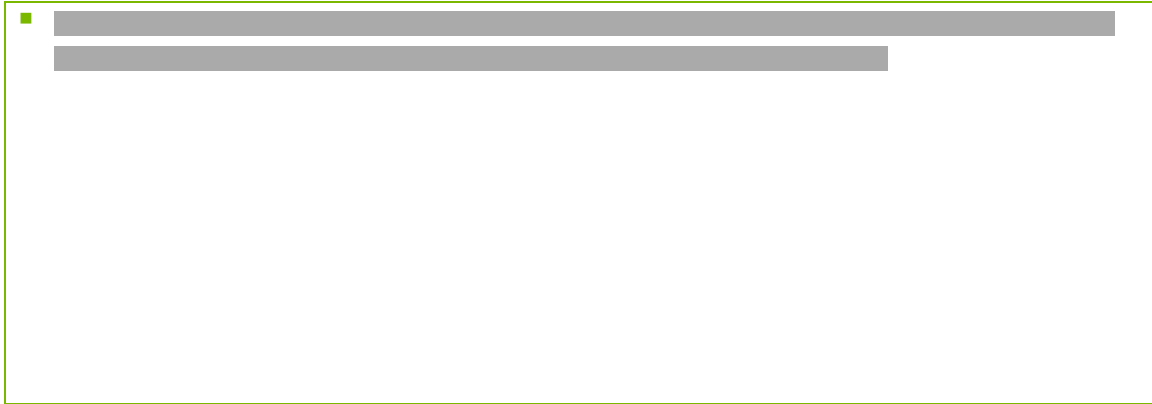


Table 8 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option B









Scenario 3/Option B: Botany Terminus Grade Separated Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment		Landscape, visual and urban design effects	
Score:			
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.	
-2	-3	-2	
Notes:			
Reasons / Comments			
<ul style="list-style-type: none">  Intensification of road corridor resulting in the loss of the lightly planted median. Major visual intrusion on the  residential area from the elevated structure and bus bays along the east side of the reserve and loss of recreational amenity land. Loss of roadside screening vegetation opening views from the north to large format retail buildings High visual impact of an elevated bus structure in the urban landscape, with particular impact on the  green space environment. Places PT interchange away from the heart of the town centre. Hard to scale - must be built all at day one. Forces all users to use elevated crossings. Difficult to foresee this being part of integrated future development or development taking place alongside this structure. Ramps for buses sterilises the car park between the interchange effectively ruling out future development on this site, although less so than 1B. Difficult to access the interchange from the shopping mall - will require additional public realm works to create an attractive and legible route to the interchange through car parking areas. 			
Assumptions			
<ul style="list-style-type: none"> Additional works will be required to integrate into existing fabric - creating pedestrian connections to the nearby destinations including the main Botany Mall.     Widening of road corridor to both sides of the existing road resulting in loss of front and side gardens to residential properties north of the town centre can be mitigated by property acquisition or through negotiation with property owner. 			
Other Information relied upon			
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed. 			







Table 9 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option A

Scenario 4/Option A: Botany Terminus Offline Interchange		
Name of assessor (incl. qualifications and organisation)		
Area of assessment		Landscape, visual and urban design effects
Score:		
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.
0	-2	1
Notes:		
Reasons / Comments		
<ul style="list-style-type: none"> Intensification of road corridor resulting in the loss of the lightly planted median. Moderate visual intrusion on the residential area from the elevated structure spanning the full length of the existing road corridor. Loss of roadside screening vegetation opening views from Ti Irirangi Drive users, reserve and residential area from the north to large format retail buildings One platform creates an easy to understand and legible interchange. Located away from the busy highway, but still not ideally located with respect to the main destination of the shopping mall and the heart of the town centre. Forces all users to use elevated crossings. Results in awkward relationship with the side of buildings leaving little scope for future adjacent complimentary development. Difficult to foresee this being part of integrated future development or development taking place alongside this interchange. 		
Assumptions		
<ul style="list-style-type: none"> 		
Other Information relied upon		
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed. 		

Table 10 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option B

Scenario 4/Option B: Botany Terminus Online Interchange		
Name of assessor (incl. qualifications and organisation)		
Area of assessment		Landscape, visual and urban design effects
Score:		
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.
0	-2	0
Notes:		
Reasons / Comments		
<ul style="list-style-type: none"> Avoids direct impacts on the highly modified waterway located within Whaka Maumahara Reserve. Intensification of road corridor resulting in the loss of the lightly planted median. Moderate visual intrusion on [redacted] residential area from the elevated structure spanning the full length of the existing road corridor. Loss of roadside screening vegetation opening views from Ti Irirangi Drive users, reserve and residential area from the north to large format retail buildings Places the PT interchange in the centre of an inhospitable busy road environment, not close to the main destinations and away from the heart of the town centre. There is room for adjacent urban development which could help to integrate the interchange into the urban environment in the future. Places passengers onto platforms separated by busy traffic lanes - not ideal from CPTED point of view. Difficult to access the interchange from the shopping mall - will require additional public realm works to create an attractive and legible route to the interchange through car parking areas. Results in excessive areas of "left-over" space around lay-over bays, although these admittedly could be planted / heavily landscaped. 		
Assumptions		
<ul style="list-style-type: none"> Additional works will be required to integrate into existing fabric - creating pedestrian connections to the nearby destinations including the main Botany Mall. [redacted] 		
Other Information relied upon		
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed. 		

Table 11 Multi Criteria Analysis Scoring Sheet – Scenario 5

Scenario 5: Botany Terminus Online Interchange		
Name of assessor (incl. qualifications and organisation)		
Area of assessment		Landscape, visual and urban design effects
Score:		
Extent, nature and degree of effects on natural character, features, and landscape.	Extent, nature and degree of effects on visual amenity.	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.
-1	-2	1
Notes:		
Reasons / Comments		
<ul style="list-style-type: none">  Intensification of road corridor resulting in the loss of the lightly planted median. Moderate visual intrusion on the  residential area from the bus terminal buildings parallel to Ti Irirangi Road. Loss of roadside screening vegetation opening views from Ti Irirangi Drive users, reserve and residential area to the north of large format retail buildings Places the PT interchange in the centre of an inhospitable busy road environment, not close to the main destinations and away from the heart of the town centre. Smaller land take than other options, and simpler route structure will help to make PT service easier to understand. There is room for adjacent urban development which could help to integrate the interchange into the urban environment in the future. Good connection to adjacent medium density housing, although does place elevated structure immediately adjacent to residential properties which will create an issue. Places passengers onto platforms separated by busy traffic lanes - not ideal from CPTED point of view. Difficult to access the interchange from the shopping mall - will require additional public realm works to create an attractive and legible route to the interchange through car parking areas. 		
Assumptions		
<ul style="list-style-type: none"> Additional works will be required to integrate into existing fabric - creating pedestrian connections to the nearby destinations including the main Botany Mall.  		
Other Information relied upon		
<ul style="list-style-type: none"> Southern tie-in to A2B design not assessed. 		

Approved by:

Title	Name	Qualification	Signature	Date
Author		BA (Hons) Landscape Design, Dip Landscape Architecture		20 th Sept 2019
Author		BA(Hons) Town Planning, Diploma Town Planning, MA Urban Design		20 th Sept 2019
Reviewer				

Technical Note

To		From	
Copy		Reference	502334
Date	2019-09-12	Pages (including this page)	22
Subject	Airport to Botany: Botany Interchange Design Options: Multi-Criteria Analysis Scoring Sheet: Social Impact		

The following provides an assessment of the options for the Botany Interchange Design, as part of the preferred option route for the Airport to Botany (A2B) Single-Stage Business Case (SSBC).

The Botany Interchange options have been assessed separately and in isolation from one another. The assessment details the considerations which have been used to inform the assessment, as well as observations about future / potential social change which do not inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for this section of the preferred option route.

The source information assessed is desktop analysis only. The ten assessments are based on:

- A2B Botany Interchange Schematics (dated 9 August 2019); and
- Preferred Options Assessment and Assumptions Memorandum (dated 4 September 2019).

Attachment 1 outlines a high-level overview of the existing social environment at Botany Town Centre to provide the social context for this assessment. It also provides information about selected future plans or aspirations for the Botany Town Centre.

The options are outlined in Table 1. The scores and assessments are presented in Tables 2 to 11 respectively.

Table 1. Botany Interchange Options Summary

Group	Option	Description
Base Case	Do Minimum	
Scenario 1 <i>All Services Terminate at Botany (except A2B)</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 2 <i>All Services Terminate at Botany</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 3 <i>Local Buses through Running and A2B extends North</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 4 <i>All Services Terminate at Botany except Local Buses</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 5 <i>All Services Through Route</i>	Scenario 5	Botany Terminus Online Interchange

Botany Interchange Design Options Assessment

Table 2 Multi Criteria Analysis Scoring Sheet – Base Case/Do Minimum

Option: Base Case / Do Minimum	
Name of assessor (incl. qualifications and organisation)	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
0	0
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Accessibility:</i> <ul style="list-style-type: none"> – Existing access for people to reach services, jobs and properties is largely unchanged. ■ <i>Community:</i> <ul style="list-style-type: none"> – Potential impact on existing groups, activities and sense of community is neutral as the do minimum option is not likely to result in major change to the community. Construction work would be minor and as such minimal, temporary impact on sensitive receivers only. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note) and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. <p><u>Other Information relied upon</u></p>	

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 3 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option A

Scenario 1/Option A: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <p>■ <i>Accessibility:</i></p> <ul style="list-style-type: none"> – Improved access to and from the Botany Town Centre. Potential for access to services, properties and businesses to the south of the town centre likely to be improved due to RTN extending into that area. Access to jobs outside of Botany Town Centre potentially improved. For people wishing to cross Te Irirangi Drive (east-west movement) access is limited due to the width of road and the use of the overpass which is then required. <p>■ <i>Community:</i></p> <ul style="list-style-type: none"> – Potential for increased sense of community through improved transport provision in the Botany Town Centre and ability to access services and facilities. Directly adjacent sensitive construction receivers are minimal. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note). Where the design extends north of the Botany 	

Town Centre the surrounding community is also considered. and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population.

Other Information relied upon

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 4 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option B

Scenario 1/Option B: Botany Terminus Grade Separated Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <p>■ <i>Accessibility:</i></p> <ul style="list-style-type: none"> – Improved access to and from the Botany Town Centre. Potential for access to services, properties and businesses to the north of the town centre likely to be improved due to RTN extending into that area. Access to jobs outside of Botany Town Centre potentially improved. For people wishing to cross Te Irirangi Drive (east-west movement) it is possible that access would be limited due to the width of road and the use of the overpass which is then required. <p>■ <i>Community:</i></p> <ul style="list-style-type: none"> – Potential for increased sense of community through improved transport provision in the Botany Town Centre and ability to access services and facilities. Directly adjacent sensitive construction receivers are minimal. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note). Where the design extends north of the Botany 	

Town Centre the surrounding community is also considered. and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population.

Other Information relied upon

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 5 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option A

Scenario 2/Option A: Botany Terminus Offline Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Accessibility:</i> <ul style="list-style-type: none"> – Improved access to and from the Botany Town Centre but access (using an RTN service) restricted for north bound travel. Access to retail jobs in the town centre improved. Census information for the Howick Local Board Area suggests that many people living nearby rely on travelling outside of the Botany area for work. Overpass may cause issues for people with mobility impairments. ■ <i>Community:</i> <ul style="list-style-type: none"> – Potential for increased sense of community through improved transport provision in the Botany Town Centre. Directly adjacent sensitive construction receivers are minimal. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note). Where the design extends north of the Botany Town Centre the surrounding community is also considered. and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. 	

Other Information relied upon

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 6 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option B

Scenario 2/Option B: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Accessibility:</i> <ul style="list-style-type: none"> – Improved access to and from the Botany Town Centre but access (using an RTN service) restricted for north bound travel. Access to retail jobs in the town centre improved. Census information for the Howick Local Board Area suggests that many people living nearby rely on travelling outside of the Botany area for work. – Overpass may make it more difficult for those with mobility requirements to cross. ■ <i>Community:</i> <ul style="list-style-type: none"> – Potential for increased sense of community through improved transport provision in the Botany Town Centre. Directly adjacent sensitive construction receivers are minimal. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note). Where the design extends north of the Botany Town Centre the surrounding community is also considered. and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. 	

Other Information relied upon

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 7 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option A

Scenario 3/Option A: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <p>■ <i>Accessibility:</i></p> <ul style="list-style-type: none"> – Potential for local buses, RTN and AMETI to provide choice of access to and from the Botany Town Centre and outside of the town centre. Access to jobs outside of Botany Town Centre potentially improved. Overpass may make it difficult for people who have mobility requirements to cross from one side of the road to the other. <p>■ <i>Community:</i></p> <ul style="list-style-type: none"> – Potential for increased sense of community through improved transport provision in the Botany Town Centre. Directly adjacent sensitive construction receivers are minimal. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note). Where the design extends north of the Botany Town Centre the surrounding community is also considered. and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. <p><u>Other Information relied upon</u></p>	

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 8 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option B

Scenario 3/Option B: Botany Terminus Grade Separated Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <p>■ <i>Accessibility:</i></p> <ul style="list-style-type: none"> – Potential for local buses, RTN and AMETI to provide choice of access to and from the Botany Town Centre and outside of the town centre. Access to jobs outside of Botany Town Centre potentially improved. Overpass may make it difficult for people who have mobility requirements to cross from one side of the road to the other. <p>■ <i>Community:</i></p> <ul style="list-style-type: none"> – Potential for increased sense of community through improved transport provision in the Botany Town Centre. Directly adjacent sensitive construction receivers are minimal. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note) and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. <p><u>Other Information relied upon</u></p>	

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 9 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option A

Scenario 4/Option A: Botany Terminus Offline Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <p>■ <i>Accessibility:</i></p> <ul style="list-style-type: none"> – Integration with the Botany Town Centre which may provide opportunity for good connection for people on foot. Improved access to and from the Botany Town Centre. Access to jobs outside of Botany Town Centre potentially improved. The two overpasses may cause access issues for some people with mobility impairments. <p>■ <i>Community:</i></p> <ul style="list-style-type: none"> – Potential for multiple running of services (local buses, RTN, AMETI) to segregate one side of Te Irirangi Drive from the other. However, multiple services also provide travel choice to surrounding community. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note) and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. <p><u>Other Information relied upon</u></p>	

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 10 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option B

Scenario 4/Option B: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
1	1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Accessibility:</i> <ul style="list-style-type: none"> – Improved access to and from Botany Town Centre, which provides a centre for retail and commercial jobs. Access to jobs outside of Botany Town Centre potentially improved. ■ <i>Community:</i> <ul style="list-style-type: none"> – Potential for multiple running of services (local buses, RTN, AMETI) to segregate one side of Te Irirangi Drive from the other. However, multiple services also provide travel choice to surrounding community. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note). Where the design extends north of the Botany Town Centre the surrounding community is also considered. and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. <p><u>Other Information relied upon</u></p>	

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Table 11 Multi Criteria Analysis Scoring Sheet – Scenario 5

Scenario 5: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Social Impact
<p>Score:</p> <p>3 significant positive effects</p> <p>2 moderate positive effects</p> <p>1 minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor/moderate and adverse effects</p> <p>-2 significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>	
<p>Accessibility: Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.</p>	<p>Community: Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.</p>
-1	-1
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <p>■ <i>Accessibility:</i></p> <ul style="list-style-type: none"> – Direct access to Botany Town Centre not provided by the RTN nor local buses which may result in reduced accessibility between services, properties and businesses and the surrounding community (when compared with the other options). Overpass over Te Irirangi Drive may present access issues for people with mobility impairments. <p>■ <i>Community:</i></p> <ul style="list-style-type: none"> – The movement of multiple services (RTN and local buses) adjacent to the Botany Town Centre may result in segregation between the town centre and residential dwellings. The overpass may hinder this connection further. Minimal disturbance to sensitive construction receivers. <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The assessment is based on the existing sensitive receivers surrounding Botany Town Centre and does not account for future land use changes. ■ The assessment of potential social impact focuses on the scenario / transport provision. It does not consider the detailed design of the street layout and potential impact on access or community. ■ Design information to inform the assessment of potential impact on certain individuals or groups, such as women, disabled people, older or younger people, parents with prams, was not available for this assessment. This should be considered at the detailed design phase. ■ The social impact assessment uses two study areas: 1) Botany Town Centre and its immediate surrounds (as shown on Figure 1 of the briefing note) and 2) Howick Local Board Area, which provides a broad understanding of the surrounding and dependent population. <p><u>Other Information relied upon</u></p>	

- Census of Population and Dwellings (2013) (Census 2013), Stats NZ. Note that the Census 2018 data was not available at the time of writing and has not been used to inform this assessment.

Approved by:

Title	Name	Qualification	Signature	Date
Author		BPlan (Hons)		11/9/19
Reviewer		MSc City & Regional Planning, BA (Hons)		12/09/19

Attachment 1: Summary of the social environment at Botany Town Centre

The following provides a high-level overview of the existing social environment at Botany Town Centre. It is focussed on the two criteria used in the MCA – accessibility and community. The Census of Population and Dwellings (2013) (Stats NZ) is used to inform the overview. The 2018 Census information was not available at the time of writing and as such is not used as part of this summary.

Overview

Botany Town Centre is in the Howick Local Board Area (Howick LBA). The population in the Howick LBA is growing, with an additional 13,000 people between 2006 and 2013. The population is ethnically diverse, with a high proportion of Asian people (39%) when compared with Auckland as a whole. There is a high reliance on using private vehicles to get to work. There is a high proportion of people who work as professionals, managers and clerical and administrative workers. This suggests that those who live in the area travel outside of it to work, despite the town centre providing a high number of jobs in the retail sector.

Social infrastructure

Botany Town Centre is an important local centre for the surrounding suburbs of Dannemora, Huntington Park, Northpark, Golflands and East Tamaki Heights. Social infrastructure in the town centre includes the Botany Library, Botany Downs Secondary College, St Columba Presbyterian Church, Eastview Baptist Church and International Baptist Church. Logan Carr Reserve and Kellaway Reserve are located to the east of the town centre. A stormwater pond and surrounding reserve is located to the west of the town centre.

Botany Town Centre is bounded by major roads (Te Irirangi Drive to the north and east, and Chapel Road to the south). Residential dwellings are located to the north and west. A large at-grade carpark surrounds the existing Botany Town Centre. Existing public transport connections to and from the town centre are limited.

Current plans and aspirations for the Botany Town Centre

A private developer, AMP Capital, is managing a redevelopment of *Botany Town Centre* which is an existing retail and commercial mall. The redevelopment will expand on the existing gross lettable area. The redevelopment website states that the targeted completion was for Winter 2019. The project would generate additional jobs in the retail sector.

Auckland Transport are delivering the AMETI busway which will link to Botany Town Centre.

One of the key outcomes in the Howick Local Board Plan (Auckland Council, 2017) is for 'involved and connected communities'. Botany is identified as a new, developing area in the plan.

Technical Note

To		From	
Copy		Reference	502334
Date	2019-11-04	Pages (including this page)	19
Subject	Airport to Botany: Botany Interchange Design Options: Multi-Criteria Analysis Scoring Sheet: PROPERTY ASSESSMENT		

The following provides an assessment of the options for the Botany Interchange Design, as part of the preferred option route for the Airport to Botany (A2B) Single-Stage Business Case (SSBC).

The Botany Interchange options have been assessed separately and in isolation from one another.

The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for this section of the preferred option route.

The source information assessed is desktop analysis only. The ten assessments are based on:

- A2B Botany Interchange Schematics (dated 9 August 2019 (Aurecon Plan)); and
- Preferred Options Assessment and Assumptions Memorandum (dated 4 August 2019).

The options are outlined in Table 1. The scores and assessments are presented in Tables 2-11.

Table 1. Botany Interchange Options Summary

Group	Option	Description
Base Case	Do Minimum	
Scenario 1	Option A	Botany Terminus Online Interchange
<i>All Services Terminate at Botany (except A2B)</i>	Option B	Botany Terminus Grade Separated Interchange
Scenario 2	Option A	Botany Terminus Offline Interchange
<i>All Services Terminate at Botany</i>	Option B	Botany Terminus Online Interchange
Scenario 3	Option A	Botany Terminus Online Interchange
<i>Local Buses through Running and A2B extends North</i>	Option B	Botany Terminus Grade Separated Interchange
Scenario 4	Option A	Botany Terminus Offline Interchange
<i>All Services Terminate at Botany except Local Buses</i>	Option B	Botany Terminus Online Interchange
Scenario 5	Scenario 5	Botany Terminus Online Interchange
<i>All Services Through Route</i>		

Botany Interchange Design Options Assessment

Table 2 Multi Criteria Analysis Scoring Sheet – Base Case/Do Minimum

Option: Base Case / Do Minimum

Name of assessor (incl. qualifications and organisation)

LLB / BA
Property Acquisition – Auckland
Transport

Area of assessment

Impacted properties shown on the Do Minimum plan

Score:

- 3 Significant positive effects
- 2 Moderate positive effects
- 1 Minor positive effects
- 0 Neutral Effects
- 1 Minor/moderate adverse effects
- 2 Significant adverse effects
- 3 Significant adverse or un-mitigatable effects

Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
Score	0

Notes:

- The reference to the Town Centre includes the Briscoes and Rebel Sports big block retail building and the AMP/Botany Town Centre. Where PaknSave and the land it occupies is affected, that is referred to as PaknSave.
- Impacts to South Te Irirangi Drive


Property impacts to 3 properties to the west side of Te Irirangi Road:

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

■ Impacts to Town Centre

- Partial minor land requirement affecting strip of road frontage. Assume no or minor number of carparks affected.
- AT understands the Town Centre carparks are shared across the property (Note: this needs to be confirmed), and presumably via terms of the commercial leases (Note: any lease arrangements would need to be confirmed).
- Note that Condition 19 of the RC for Botany Town Centre (BRS 6081/588, Proposal 14724, AMP Investments Ltd 26 July 1999) requires provision of a public transport facility (includes bus stops and shelter etc) to be provided in or next to the Town Square.
- AT understands that the 6 bus stops shown in this Option are proposed to be located where the current bus facility is located. Any upgrade to this facility, provided the footprint is similar to the existing one, may be within the terms of the existing consent.
- Note the RC provides for the roads within the Town Centre to be available for public access. The property impacts under this scenario are minor in comparison to the other options.
- Note: RC will need to be fully reviewed.
- Owner of Town Centre land: Pspib/cppib Waiheke Inc (Canadian Registered Company), Canadian fund manager
- 17 hectares, legally described as Lot 1 DP 192219, Lot 2 DP 207478, ROT 67446 and 67447, North Auckland Registry.
- Note: Company records show that AMP Capital Investors NZ Ltd are the authorised person to accept service in NZ.

■ Assumptions

- 
- Note that there are existing resource consents for the Town Centre, which require provision of a public transport hub, and roads allowing for public vehicle use.

■ Other Information relied upon

- Note that a plan showing more details of the alignment would be useful to assist with identifying the property addresses, and clearing marking the main businesses occupying the affected buildings eg PaknSave, BK, Countdown, among others.
- RC for Botany Town Centre (BRS 6081/588, Proposal 14724, AMP Investments Ltd 26 July 1999)

Table 3 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option A

Scenario 1/Option A: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation)	As above
Area of assessment	As per the Aurecon Sheet for 1A
Score:	
3	Significant positive effects
2	Moderate positive effects
1	Minor positive effects
0	Neutral Effects
-1	Minor/moderate adverse effects
-2	Significant adverse effects
-3	Significant adverse or un-mitigatable effects
Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
Score	-3
<p>[REDACTED]</p> <p>[REDACTED]</p> <ul style="list-style-type: none"> ■ [REDACTED] - [REDACTED] ■ [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] ■ [REDACTED] [REDACTED] [REDACTED] [REDACTED] 	

Other Information relied upon

- Nil

Table 4 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option B

Scenario 1/Option B: Botany Terminus Grade Separated Interchange

Name of assessor (incl. qualifications and organisation)

As above

Area of assessment

As per the Aurecon Sheet for 1B

Score:

- 3 Significant positive effects
- 2 Moderate positive effects
- 1 Minor positive effects
- 0 Neutral Effects
- 1 Minor/moderate adverse effects
- 2 Significant adverse effects
- 3 Significant adverse or un-mitigatable effects

Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
Score	-1

Notes:

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

Table 5 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option A

Scenario 2/Option A: Botany Terminus Offline Interchange	
Name of assessor (incl. qualifications and organisation)	As above
Area of assessment	Aurecon Plan for 2A
Score: 3 Significant positive effects 2 Moderate positive effects 1 Minor positive effects 0 Neutral Effects -1 Minor/moderate adverse effects -2 Significant adverse effects -3 Significant adverse or un-mitigatable effects	
Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
Score	-2
Notes: This Option is similar to Scenario 4 Option A and has been given the same -2 score as a result. Reasons / Comments ■ [Redacted] - [Redacted] ■ [Redacted] - [Redacted] - [Redacted] ■ [Redacted] - [Redacted] - [Redacted]	

Table 6 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option B

Scenario 2/Option B: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation)	As above
Area of assessment	Aurecon Plan 2B
Score:	
3	Significant positive effects
2	Moderate positive effects
1	Minor positive effects
0	Neutral Effects
-1	Minor/moderate adverse effects
-2	Significant adverse effects
-3	Significant adverse or un-mitigatable effects
Criteria (delete/add as required)	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
Score	-3
Notes:	
[Redacted]	
[Redacted]	[Redacted]
- [Redacted]	[Redacted]
[Redacted]	[Redacted]
- [Redacted]	[Redacted]
- [Redacted]	[Redacted]
- [Redacted]	[Redacted]
[Redacted]	[Redacted]
- [Redacted]	[Redacted]
[Redacted]	[Redacted]
- [Redacted]	[Redacted]

Scenario 3/Option A: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation)	As above
Area of assessment	As above
Score:	
3	Significant positive effects
2	Moderate positive effects
1	Minor positive effects
0	Neutral Effects
-1	Minor/moderate adverse effects
-2	Significant adverse effects
-3	Significant adverse or un-mitigatable effects
Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
Score	-2

Table 8 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option B

Scenario 3/Option B: Botany Terminus Grade Separated Interchange	
Name of assessor (incl. qualifications and organisation)	As above
Area of assessment	Aurecon Plan for 3B
Score:	
3	Significant positive effects
2	Moderate positive effects
1	Minor positive effects
0	Neutral Effects
-1	Minor/moderate adverse effects
-2	Significant adverse effects
-3	Significant adverse or un-mitigatable effects
Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.
Score	-1
<p>■ [Redacted]</p> <p>■ [Redacted]</p> <p>■ [Redacted]</p> <p>- [Redacted]</p> <p>■ [Redacted]</p> <p>- [Redacted]</p> <p>- [Redacted]</p> <p>- [Redacted]</p> <p>- [Redacted]</p> <p>- [Redacted]</p> <p>■ [Redacted]</p> <p>- [Redacted]</p> <p>■ [Redacted]</p> <p>- [Redacted]</p>	

Notes:

[Redacted text block containing multiple paragraphs and bullet points, all obscured by grey boxes.]

Table 10 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option B

Scenario 4/Option B: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation)	As above
Area of assessment	Aurecon Plan 4B

Score:

- 3 Significant positive effects
- 2 Moderate positive effects
- 1 Minor positive effects
- 0 Neutral Effects
- 1 Minor/moderate adverse effects
- 2 Significant adverse effects
- 3 Significant adverse or un-mitigatable effects

Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981
Score	-2

Notes:

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

Table 11 Multi Criteria Analysis Scoring Sheet – Scenario 5

Scenario 5: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation)	As above
Area of assessment	Aurecon Plan 5
Score: 3 Significant positive effects 2 Moderate positive effects 1 Minor positive effects 0 Neutral Effects -1 Minor/moderate adverse effects -2 Significant adverse effects -3 Significant adverse or un-mitigatable effects	
Criteria	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981
Score	1
<div> <div></div> <div> <div></div> <div></div> </div> <div></div> <div></div> <div></div> <div></div> </div>	

Title	Name	Qualification	Signature	Date
Author				4-11-2019
Reviewer				5/11/19.

Technical Note

To		From	
Copy		Reference	502334
Date	2019-08-29	Pages (including this page)	12
Subject	Airport to Botany: Botany Interchange Design Options: Multi-Criteria Analysis Scoring Sheet: Contaminated Land		

The following provides an assessment of the options for the Botany Interchange Design, as part of the preferred option route for the Airport to Botany (A2B) Single-Stage Business Case (SSBC).

The Botany Interchange options have been assessed separately and in isolation from one another. The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for this section of the preferred option route.

The source information assessed is desktop analysis only. The ten assessments are based on:

- A2B Botany Interchange Schematics (dated 9 August 2019); and
- Preferred Options Assessment and Assumptions Memorandum (dated 28 August 2019).

The options are outlined in Table 1. The scores and assessments are presented in Tables 2-11.

Table 1. Botany Interchange Options Summary

Group	Option	Description
Base Case	Do Minimum	
Scenario 1 <i>All Services Terminate at Botany (except A2B)</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 2 <i>All Services Terminate at Botany</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 3 <i>Local Buses through Running and A2B extends North</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 4 <i>All Services Terminate at Botany except Local Buses</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 5 <i>All Services Through Route</i>	Scenario 5	Botany Terminus Online Interchange

Botany Interchange Design Options Assessment

Table 2 Multi Criteria Analysis Scoring Sheet – Base Case/Do Minimum

Option: Base Case / Do Minimum	
Name of assessor (incl. qualifications and organisation)	Stanley Howell – Aurecon, CEnvP(SC)
Area of assessment	Site Contamination
Score:	
3	Negligible/minor impacts to the environment and/or significant positive effects
2	Minor impacts to the environment and/or moderate positive effects
1	Low impacts to the environment and/or minor positive effects
0	Neutral Effects
-1	Minor effects on the environment and adverse effects
-2	Moderate to significant adverse effects
-3	Significant adverse or un-mitigatable effects
<div>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</div>	
<div>-1</div>	
Notes:	
<u>Reasons / Comments</u>	
<div><div>■ Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</div><div><div>– No current or historical contaminating activities were noted within the development footprint of this proposed option</div><div>– The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works</div></div></div>	
<u>Assumptions</u>	
<div><div>■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes</div><div>■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition</div><div>■ Civil works associated with redevelopment are unlikely to encounter groundwater</div><div>■ A PSI will be complete prior to progressing with the preferred option</div></div>	
<u>Other Information relied upon</u>	
<div><div>■ A review of historical and current aerial photography available on Auckland Council Geomaps</div><div>■ A review of historical aerial photography available on Retrolens</div><div>■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039</div></div>	

Table 3 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option A

Scenario 1/Option A: Botany Terminus Online Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-2</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-2			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – An active service station is present within the development footprint of this proposed option. – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 4 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option B

Scenario 1/Option B: Botany Terminus Grade Separated Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-1			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – No current or historical contaminating activities were noted within the development footprint of this proposed option – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 5 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option A

Scenario 2/Option A: Botany Terminus Offline Interchange			
Name of assessor (incl. qualifications and organisation)	S [REDACTED]		
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-1			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – No current or historical contaminating activities were noted within the development footprint of this proposed option – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 6 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option B

Scenario 2/Option B: Botany Terminus Online Interchange			
Name of assessor (incl. qualifications and organisation)	S [REDACTED]		
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-2</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-2			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – An active service station is present within the development footprint of this proposed option. – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 7 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option A

Scenario 3/Option A: Botany Terminus Online Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-2</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-2			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – An active service station is present within the development footprint of this proposed option. – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 8 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option B

Scenario 3/Option B: Botany Terminus Grade Separated Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-1			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – No current or historical contaminating activities were noted within the development footprint of this proposed option – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 9 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option A

Scenario 4/Option A: Botany Terminus Offline Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-1			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – No current or historical contaminating activities were noted within the development footprint of this proposed option – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 10 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option B

Scenario 4/Option B: Botany Terminus Online Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-2</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-2			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – An active service station is present within the development footprint of this proposed option. – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management during civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Table 11 Multi Criteria Analysis Scoring Sheet – Scenario 5

Scenario 5: Botany Terminus Online Interchange			
Name of assessor (incl. qualifications and organisation)			
Area of assessment	Site Contamination		
<p>Score:</p> <p>3 Negligible/minor impacts to the environment and/or significant positive effects</p> <p>2 Minor impacts to the environment and/or moderate positive effects</p> <p>1 Low impacts to the environment and/or minor positive effects</p> <p>0 Neutral Effects</p> <p>-1 Minor effects on the environment and adverse effects</p> <p>-2 Moderate to significant adverse effects</p> <p>-3 Significant adverse or un-mitigatable effects</p>			
<table border="1"> <tr> <td>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.</td> </tr> <tr> <td>-1</td> </tr> </table>		Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.			
-1			
<p>Notes:</p> <p><u>Reasons / Comments</u></p> <ul style="list-style-type: none"> ■ <i>Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment:</i> <ul style="list-style-type: none"> – /No current or historical contaminating activities were noted within the development footprint of this roposed option – The roadway has been in operation for over 15 years; based on likely construction materials, techniques, infilling, levelling and contaminants in roadway run-off which include metals, hydrocarbons and asbestos, diffuse contamination is anticipated across the project area which will require a nominal level of management in advance of civil works <p><u>Assumptions</u></p> <ul style="list-style-type: none"> ■ The area associated Botany Town Centre and immediate surrounds were developed to their current configuration in the late 1990s to early 2000s, from land previously used for pastoral purposes ■ In-filling of the gully that ran east-west across the development area and subsequent levelling and grading may have resulted in discrete pockets of unexpected contaminant deposition ■ Civil works associated with redevelopment are unlikely to encounter groundwater ■ A PSI will be complete prior to progressing with the preferred option <p><u>Other Information relied upon</u></p> <ul style="list-style-type: none"> ■ A review of historical and current aerial photography available on Auckland Council Geomaps ■ A review of historical aerial photography available on Retrolens ■ A review of the Aurecon Technical Note 502334-7000-TEC-KD-0039 			

Approved by:

Title	Name	Qualification	Signature	Date
Author		BSc, CEnvP (SC)		20/9/19
Reviewer		BSc, MSc (Hons), CChem, MRSC, MNZIC		20/9/19

Technical Note

To		From	
Copy		Reference	502334
Date	2020-02-27	Pages (including this page)	17
Subject	Airport to Botany: Botany Interchange Design Options: Multi-Criteria Analysis Scoring Sheet: STORMWATER		

The following provides a stormwater assessment of the proposed options for the Botany Interchange Design, as part of the preferred option route for the Airport to Botany (A2B) Single-Stage Business Case (SSBC).

The Botany Interchange options have been assessed separately from one another. The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for this section of the preferred option route.

The source information is assessed in a desktop investigation only. The ten assessments are based on:

- A2B Botany Interchange Schematics (dated 9 August 2019); and
- Preferred Options Assessment and Assumptions Memorandum (dated 28 August 2019).

The options are outlined in Table 1. The scores and assessments are presented in Tables 4 to 13.

Table 1 Botany Interchange Options Summary

Group	Option	Description
Base Case	Do Minimum	
Scenario 1 <i>All Services Terminate at Botany (except A2B)</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 2 <i>All Services Terminate at Botany</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 3 <i>Local Buses through Running and A2B extends North</i>	Option A	Botany Terminus Online Interchange
	Option B	Botany Terminus Grade Separated Interchange
Scenario 4 <i>All Services Terminate at Botany except Local Buses</i>	Option A	Botany Terminus Offline Interchange
	Option B	Botany Terminus Online Interchange
Scenario 5 <i>All Services Through Route</i>	Scenario 5	Botany Terminus Online Interchange

1 Stormwater Background

By consulting information available on Auckland Council GeoMaps, it was identified that the area of project falls within Pakuranga Creek stormwater catchment, sized 2918 ha, with Tamaki River being the catchment receiving environment.

Floodplains and flood prone areas are identified in Auckland Council GeoMaps. On Te Irirangi Drive, between Whaka Maumahara Pond and Botany Town Centre, it indicates an 1% Annual Exceedance Probability (AEP) event that can give rise to flooding problems. At this location, overland flow paths are running east to west and north to west directions, crossing Te Irirangi Drive at low points, and flowing towards the Whaka Maumahara pond (Figure 1).

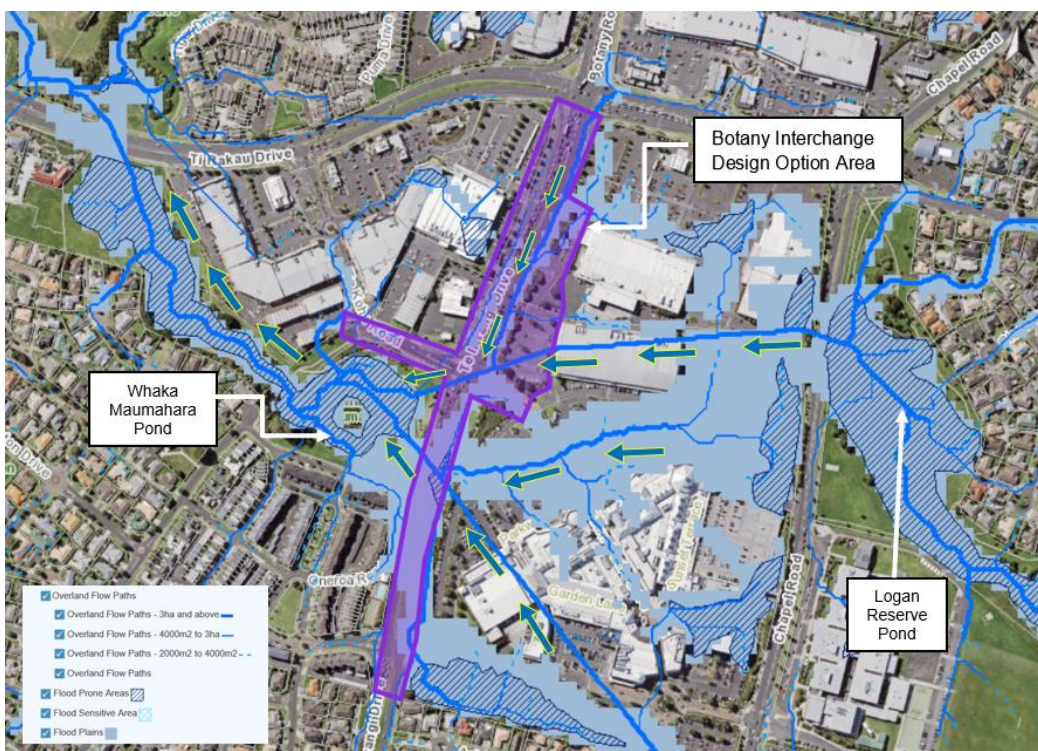


Figure 1: Botany Town Centre Flooding Zones (Source: Auckland Council GeoMaps 2019)

Further north of the proposed Interchange is the proposed Rapid Transit Corridor (RTC) along a 1.4km long section of Botany Road. Here no relevant flood plains have been identified. The existing overland flow paths are crossing the road in three points: running east to west, near the intersection with Tarnica Road; running east to west on near to Xtreme Entertainment; and running west to east on Millhouse Drive (Figure 2).

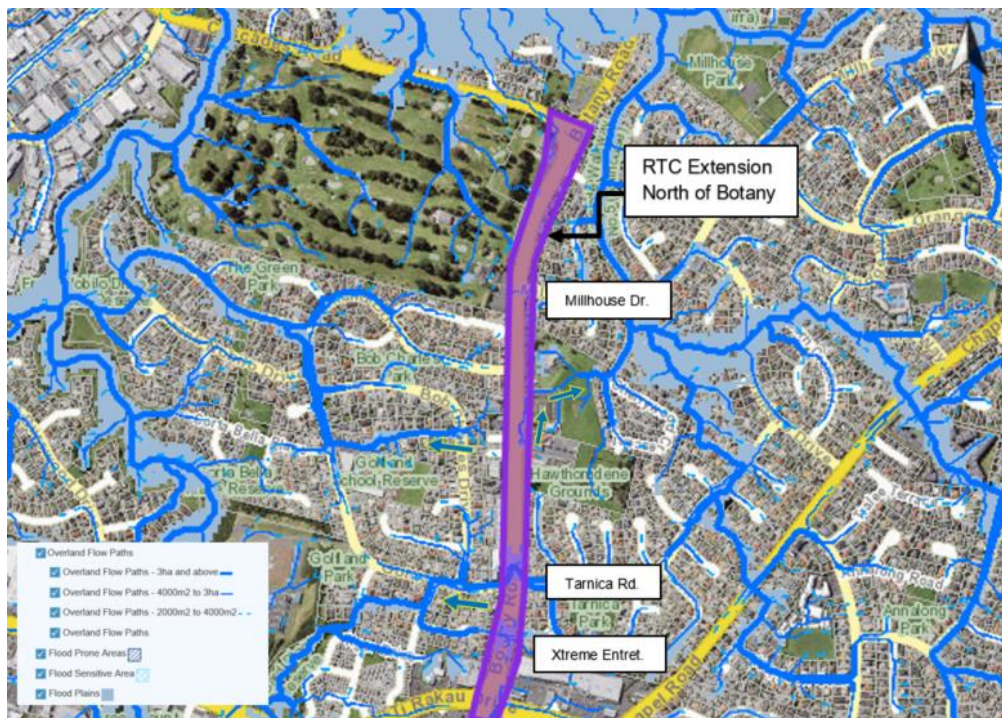


Figure 2: Botany North Extension Flooding Zones (Source: Auckland Council GeoMaps 2019)

It was also identified that:

- The whole Botany Interchange location does not fall within a Stormwater Management Area – Flow (SMAF);
- The whole Botany Interchange location is already a heavily developed/ built area. Most of the project is expected to be carried out in existing hardscape (impervious) areas.

2 Stormwater Management Philosophy

The potential stormwater impacts, and mitigations have been assessed based on both stormwater quality requirements, as well as peak flow attenuation requirements (for stormwater quantity) as per requirements of the Auckland Unitary Plan (AUP) as follows:

- AUP E8: Diversion and Discharge – peak flow attenuation of stormwater runoff will likely require detention, because:
 - Flooding problems that can be raised on a 1%AEP event;
- AUP E9: Stormwater Quality – stormwater runoff from the proposed works will likely require treatment, because:
 - Botany Down Terminus will receive a high volume of vehicles, due to A2B and AMETI link roads, and therefore will be classed as high-use roads (HURs) under the Auckland Unitary Plan (AUP);
- Overland flowpaths to be managed to allow existing peak flow to be conveyed without restriction.
- Existing road crests and sags identified on Auckland Council GeoMaps to understand potential space constraints and opportunity for stormwater management along the corridor and near road sag points.

Exclusions and Clarifications

- This assessment has been based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads were assumed to have over >5000 vehicles per day, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment.
- The assessment assumed the proposed landscape replacement will only partially replace the permeable areas, i.e. the amount of permeable area from pre-development to post-development will be reduced.
- The assessment has not considered existing culvert crossings because the information is incomplete on Auckland Council GeoMaps.
- The assessment has not considered the construction and economic feasibility of any of the mentioned mitigation systems.
- The proposed Rapid Transit Corridor (RTC) is constrained by commercial and residential developments adjacent to the road corridor.

Other Source Information

- Auckland Council Geo Maps.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Auckland Unitary Plan Operative in Part (AUP OIP), Chapter E9 Stormwater Quality – High Contaminant generating car parks and high use roads (2019).
- Auckland Transport Code of Practice, Chapter 17 – Road Drainage (2013).

MCA Scoring

All options were assessed against the following scoring criteria:

Table 2 Scoring criteria

Score	Statement
3	Significant positive effects
2	Moderate positive effects
1	Minor positive effects
0	Neutral to negligible effects
-1	Minor adverse effects
-2	Moderate to significant adverse effects
-3	Significant adverse or un-mitigatable effects

The scoring criteria have been assigned to different impacts regarding water quality and water quantity, as shown below:

Water quality:

- **0:** No impact on Whaka Maumahara pond. Construction of bus platform only in one side of Te Irirangi Drive.
- **-1:** No impact on Whaka Maumahara pond. Construction of bus platform in both sides of Te Irirangi Drive.
- **-2:** No impact on Whaka Maumahara pond. Construction of bus platform in both sides of Te Irirangi Drive and Botany Road.
- **-3:** Impact on Whaka Maumahara pond. Construction of bus platform in both sides of Te Irirangi Drive and Botany Road.

Water quantity:

- **-1:** Impact on Te Irirangi Drive only.
- **-2:** Impact on Te Irirangi Drive and Botany Road.
- **-3:** Impact on Whaka Maumahara pond.

3 Summary of results

A summary of the final scores for each option is shown in Table 3:

Table 3 Stormwater Multi-Criteria Analysis - Summary of Final Score

Group	Option	Description	Final Score	
			Water Quality	Water Quantity
Base Case	Do Minimum		0	-1
Scenario 1 <i>All Services Terminate at Botany (except A2B)</i>	Option A (North)	Botany Terminus Online Interchange	-2	-2
	Option B (North)	Botany Terminus Grade Separated Interchange	-3	-3
Scenario 2 <i>All Services Terminate at Botany</i>	Option A	Botany Terminus Offline Interchange	0	-1
	Option B	Botany Terminus Online Interchange	-1	-1
Scenario 3 <i>Local Buses through Running and A2B extends North</i>	Option A (North)	Botany Terminus Online Interchange	-2	-2
	Option B (North)	Botany Terminus Grade Separated Interchange	-3	-3
Scenario 4 <i>All Services Terminate at Botany except Local Buses</i>	Option A	Botany Terminus Offline Interchange	0	-1
	Option B	Botany Terminus Online Interchange	-1	-1
Scenario 5 <i>All Services Through Route</i>	Scenario 5	Botany Terminus Online Interchange	0	-1

By assessing one option against another, the options that presented better joint score were “Do Minimum”, “Scenario 2 - Option A”, “Scenario 4 – Option A” and “Scenario 5”.

Detailed assessment of all options is shown in the following Appendix A.

Appendix A: Botany Interchange Design Options Assessment

Table 4 Multi Criteria Analysis Scoring Sheet – Base Case/Do Minimum

Option: Base Case / Do Minimum					
Name of assessor (incl. qualifications and organisation)					
Area of assessment	Stormwater Treatment and Management				
Score: <table border="1"> <thead> <tr> <th>Water Quality</th> <th>Water Quantity</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>-1</td> </tr> </tbody> </table>		Water Quality	Water Quantity	0	-1
Water Quality	Water Quantity				
0	-1				
Reasons / Comments WATER QUALITY CRITERIA <ul style="list-style-type: none"> ■ Stormwater treatment: Score 0 <p>On Te Irirangi Drive</p> <ul style="list-style-type: none"> – Stormwater run-off currently being attenuated and treated at Whaka Maumahara pond. – Limited space on one side of the road to provide centralised devices, such as wetlands. – Limited space in one side of the road to provide longitudinal devices, such as swales. – Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed. – Assumed negligible effect on stormwater treatment through the area, due the removal of kerb grass median and adjacent grass berm to accommodate bus corridor. WATER QUANTITY CRITERIA <ul style="list-style-type: none"> ■ Overland flow path: Score -1 <ul style="list-style-type: none"> – On Te Irirangi Drive, overland flow paths cross the road at low points, flowing from east to west towards the Whaka Maumahara pond (Figure 1). On both sides of the road, existing footpaths and berms also act as overland flow paths. The proposed changes to accommodate the project must consider the management of existing overland flow paths to avoid / minimise impacts to other properties. ■ Flooding: Score -1 <ul style="list-style-type: none"> – Increasing impermeable areas with the removal of permeable areas (i.e. kerb grass median), to accommodate RTC Bus Lane on Te Irirangi Drive, would have a minor adverse effect as it may increase the risk of flooding if the additional run-off volume cannot be mitigated. 					

Table 5 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option A

Scenario 1/Option A: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Stormwater Treatment and Management
Score:	
Water Quality	Water Quantity
-2	-2
<p>Reasons / Comments</p> <p>WATER QUALITY CRITERIA</p> <p>■ Stormwater treatment: Score -2</p> <p>On Te Irirangi Drive:</p> <ul style="list-style-type: none"> Stormwater run-off from is currently been attenuated and treated at Whaka Maumahara pond. Limited space on both sides of the road to provide centralised devices (such as wetlands). Limited space on both sides of the road to provide longitudinal devices (such as swales). Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed <p>On Botany Road:</p> <ul style="list-style-type: none"> Based on the currently available design, there is limited space to provide aboveground stormwater treatment. It is likely that underground treatment (i.e. stormwater filter cartridges) will be required. If the acquisition of adjacent properties is considered as part of the project, water quality wetlands/swales can be proposed on the future available land. Assumed moderate adverse effect on stormwater treatment through the area, due the removal of kerb grass median and of green berm on both Te Irirangi Drive and Botany Road to accommodate bus corridor. <p>WATER QUANTITY CRITERIA</p> <p>■ Overland flow path: Score -2</p> <ul style="list-style-type: none"> On Te Irirangi Drive, overland flow paths cross the road, flowing from east to west towards the Whaka Maumahara pond (Figure 1). On both sides of the road, existing footpaths and berms also act as overland flow paths. On Botany Road overland flow paths cross the road (Figure 2), which potentially could be impacted with the construction of the central RTC. The proposed changes to accommodate the project, must consider the management of existing overland flow paths to avoid / minimise impacts to other properties. <p>■ Flooding: Score -2</p> <ul style="list-style-type: none"> The removal of some pervious areas, as proposed in the present option, would have a moderate adverse effect on flood risk. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the permeable areas to be removed: 	

Scenario 1/Option A: Botany Terminus Online Interchange

- a) on Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane;
- b) Park N' Save/ Briscoes Carpark trees/green areas to be removed due the construction of the bus platform and over pass;
- c) on Botany Road both side green berm to be removed due the road widening.

Table 6 Multi Criteria Analysis Scoring Sheet – Scenario 1/Option B

Scenario 1/Option B: Botany Terminus Online Interchange

Name of assessor (incl. qualifications and organisation)

Area of assessment

Stormwater Treatment and Management

Score:

Water Quality	Water Quantity
-3	-3

Reasons / Comments

WATER QUALITY CRITERIA

■ **Stormwater treatment: Score -3**

On Te Irirangi Drive and Botany Road:

- Removal of green areas on both sides of the road to accommodate bus corridor.
- Based on the currently available design, limited space to provide aboveground stormwater treatment. Likely to require underground treatment (i.e. stormwater filter cartridges).

On Botany Road:

- If the acquisition of adjacent properties is considered as part of project, water quality wetlands/swales can be proposed on future available land.
- Assumed significant adverse effect on stormwater treatment, due the assumption of capacity reduction of the Whaka Maumahara pond, to accommodate the construction of bus platform and overpass foundations.

WATER QUANTITY CRITERIA

■ **Overland flow path: Score -2**

- On Te Irirangi Drive, overland flow paths cross the road, flowing from east to west towards the Whaka Maumahara pond (Figure 1). On both sides of the road, existing footpaths and berms also act as overland flow paths.
- On Botany Road overland flow paths cross the road (Figure 2), which potentially could be impacted with the construction of the central RTC.
- The proposed changes to accommodate the project, must consider the management of existing overland flow paths to avoid / minimise impacts to other properties.

Scenario 1/Option B: Botany Terminus Online Interchange

■ **Flooding: Score -3**

- The removal of some pervious areas, as proposed in the present option, would have a significant adverse effect on flood risk. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the permeable areas to be removed:
 - a) on Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane;
 - a) Park N' Save/ Briscoes Carpark trees/green areas to be removed due the construction of the bus platform and over pass;
 - a) along Botany Road both side green berm to be removed due widening of the road.
- The reduction of capacity of the Whaka Maumahara pond may increase the risk of flooding on adjacent areas.
- These changes suppose a significant adverse effect on the stormwater quantity when compared to other options. Although, it does not represent an un-mitigatable effect, as other mitigation options can still be provided.

Table 7 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option A

Scenario 2/Option A: Botany Terminus Offline Interchange

Name of assessor (incl. qualifications and organisation) Lia Dias/ Albert Ho

Area of assessment Stormwater Treatment and Management

Score:

Water Quality	Water Quantity
0	-1

Reasons / Comments

WATER QUALITY CRITERIA

■ **Stormwater treatment: Score 0**

On Te Irirangi Drive

- Stormwater run-off currently being attenuated and treated at Whaka Maumahara pond.
- Limited space on one side of the road to provide centralised devices, such as wetlands.
- Limited space in one side of the road to provide longitudinal devices, such as swales.
- Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed.
- Assumed negligible effect on stormwater treatment through the area, due the removal of kerb grass median and adjacent grass berm to accommodate bus corridor.

Scenario 2/Option A: Botany Terminus Offline Interchange

WATER QUANTITY CRITERIA

■ **Overland flow path: Score -1**

- On Te Irirangi Drive, overland flow paths cross the road in some points, flowing from east to west towards the Whaka Maumahara pond (refer Figure 1).
- On both sides of the road existing footpaths and berms also act as overland flow paths.
- The proposed changes to accommodate the project must consider the management of existing overland flow paths to avoid / minimise impacts to other properties.

■ **Flooding: Score -1**

- The removal of some pervious areas, as proposed in the present option, would have a minor adverse effect as it may increase the risk of flooding if additional run-off volume not be able to be mitigated. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the areas to be removed:
 - a) on Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane;
 - b) at Park N' Save/ Briscoes Carpark trees/green areas to be removed due the construction of the bus platform and over pass and widening of the road.

Table 8 Multi Criteria Analysis Scoring Sheet – Scenario 2/Option B

Scenario 2/Option B: Botany Terminus Online Interchange

Name of assessor (incl. qualifications and organisation)

Area of assessment Stormwater Treatment and Management

Score:

Water Quality	Water Quantity
-1	-1

Reasons / Comments

WATER QUALITY CRITERIA

■ **Stormwater treatment: Score -1**

On Te Irirangi Drive:

- Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed.
- Limited space on one side of the road to provide centralised devices, such as wetlands.
- Limited space in one side of the road to provide longitudinal devices, such as swales.
- Assumed minor adverse effect on stormwater treatment, due the removal of kerb grass median and green berm on both sides of road to accommodate bus corridor and platform.

WATER QUANTITY CRITERIA

■ **Overland flow path: Score -1**

Scenario 2/Option B: Botany Terminus Online Interchange

- On Te Irirangi Drive, overland flow paths cross the road in some points, flowing from east to west towards the Whaka Maumahara pond (refer Figure 1).
- On both sides of the road, existing footpaths and berms also act as overland flow paths.
- The proposed changes to accommodate the project must consider the management of existing overland flow paths to avoid / minimise impacts to other properties.

■ **Flooding: Score -1**

- The removal of some pervious areas, as proposed in the present option, would have a minor adverse effect as it may increase the risk of flooding if additional run-off volume not be able to be mitigated. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of permeable areas to be removed:
 - a) on Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane;
 - b) Countdown/Z Petrol Carpark trees/green areas are proposed to be removed due the construction of the bus platform, over pass and widening of the road;
 - c) at Park N' Save/ Briscoes Carpark trees/green areas will be removed due the construction of the bus platform and over pass widening of the road.

Table 9 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option A

Scenario 3/Option A: Botany Terminus Online Interchange

Name of assessor (incl. qualifications and organisation)

Area of assessment Stormwater Treatment and Management

Score:

Water Quality	Water Quantity
-2	-2

Reasons / Comments

WATER QUALITY CRITERIA

■ **Stormwater treatment: Score -2**

On Te Irirangi Drive:

- Stormwater run-off from is currently been attenuated and treated at Whaka Maumahara pond.
- Limited space on both sides of the road to provide centralised devices (such as wetlands).
- Limited space on both sides of the road to provide longitudinal devices (such as swales).
- Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed

On Botany Road:

- Based on the currently available design, there is limited space to provide aboveground stormwater treatment. It is likely that underground treatment (i.e. stormwater filter cartridges) will be required.

Scenario 3/Option A: Botany Terminus Online Interchange

If the acquisition of adjacent properties is considered as part of the project, water quality wetlands/swales can be proposed on the future available land.

- Assumed moderate adverse effect on stormwater treatment through the area, due the removal of kerb grass median and of green berm on both Te Irirangi Drive and Botany Road to accommodate bus corridor.

WATER QUANTITY CRITERIA

■ **Overland flow path: Score -2**

- On Te Irirangi Drive, overland flow paths cross the road flowing from east to west towards the Whaka Maumahara pond (refer Figure 1). On both sides of the road existing footpaths and berms also act as overland flow paths.
- On Botany Road overland flow paths cross the road (refer Figure 2), which potentially will be impacted by the proposed construction of central RTC.
- The proposed changes to accommodate the project must consider the management of existing overland flow paths to avoid / minimise impacts to other properties.

■ **Flooding: Score -2**

- The removal of some pervious areas as proposed in the present option would have a moderate adverse effect on flood risk. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the permeable areas to be removed:
 - a) Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane;
 - b) at Park N' Save/ Briscoes Carpark trees/green areas to be removed due the construction of the bus platform and over pass widening of the road;
 - c) at Countdown/Z Petrol Carpark trees/green areas to be removed due the construction of the bus platform, over pass and widening of the road;
 - d) Botany Road both side green berm to be removed due the road widening.

Table 10 Multi Criteria Analysis Scoring Sheet – Scenario 3/Option B

Scenario 3/Option B: Botany Terminus Grade Separated Interchange

Name of assessor (incl. qualifications and organisation)

Area of assessment

Stormwater Treatment and Management

Score:

Water Quality	Water Quantity
-3	-3

Scenario 3/Option B: Botany Terminus Grade Separated Interchange

Reasons / Comments:

WATER QUALITY CRITERIA

■ **Stormwater treatment: Score -3**

On Te Irirangi Drive and Botany Road:

- Removal of green areas on both sides of the road to accommodate bus corridor.
- Based on the currently available design, limited space to provide aboveground stormwater treatment. Likely to require underground treatment (i.e. stormwater filter cartridges).

On Botany Road:

- If the acquisition of adjacent properties is considered as part of project, water quality wetlands/swales can be proposed on future available land.
- Assumed significant adverse effect on stormwater treatment, due the assumption of capacity reduction of the Whaka Maumahara pond, to accommodate the construction of bus platform and overpass foundations.

WATER QUANTITY CRITERIA

■ **Overland flow path: Score -2**

- On Te Irirangi Drive, overland flow paths cross the road flowing from east to west towards the Whaka Maumahara pond (refer Figure 1). On both sides of the road, existing footpaths and berms also act as overland flow paths.
- On Botany Road overland flow paths cross the road (refer Figure 2) which may potentially be impacted with the construction of central RTC.
- The proposed changes to accommodate the project must consider the management of existing overland flow paths to avoid / minimise impacts to other properties.

■ **Flooding: Score -3**

- The removal of some pervious areas, as proposed in the present option, would have a significant adverse effect on flood risk. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the permeable areas to be removed:
 - b) Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane;
 - c) Park N' Save/ Briscoes Carpark trees/green areas to be removed due widening of the road;
 - d) Countdown/Z Petrol Carpark trees/green areas to be removed due widening of the road;
 - e) Along Botany Road both side green berm to be removed due widening of the road.
- The reduction of capacity of the Whaka Maumahara pond may increase the risk of flooding on adjacent areas.
- These changes suppose a significant adverse effect on the stormwater quantity when compared to other options. Although, it does not represent an un-mitigatable effect, as other mitigation options can still be provided.

Table 11 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option A

Scenario 4/Option A: Botany Terminus Offline Interchange	
Name of assessor (incl. qualifications and organisation) 	
Area of assessment	Stormwater Treatment and Management
Score:	
Water Quality	Water Quantity
0	-1
<p>Reasons / Comments:</p> <p>WATER QUALITY CRITERIA</p> <p>■ Stormwater treatment: Score 0</p> <p>On Te Irirangi Drive</p> <ul style="list-style-type: none"> – Stormwater run-off currently being attenuated and treated at Whaka Maumahara pond. – Limited space on one side of the road to provide centralised devices, such as wetlands. – Limited space in one side of the road to provide longitudinal devices, such as swales. – Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed. – Assumed negligible effect on stormwater treatment through the area, due the removal of kerb grass median and adjacent grass berm to accommodate bus corridor. <p>WATER QUANTITY CRITERIA</p> <p>■ Overland flow path: Score -1</p> <ul style="list-style-type: none"> – On Te Irirangi Drive, overland flow paths cross the road flowing from east to west towards the Whaka Maumahara pond (refer Figure 1). – On both sides of the road, existing footpaths and berms also act as overland flow paths. – The proposed changes to accommodate the project must consider the management of existing overland flow paths to avoid / minimise impacts to other properties. <p>■ Flooding: Score -1</p> <ul style="list-style-type: none"> – The removal of some pervious areas, as proposed in the present option, would have a minor adverse effect as it may increase the risk of flooding if additional run-off volume is not mitigated. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the areas to be removed: <ul style="list-style-type: none"> a) Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane; b) Park N' Save/ Briscoes Carpark trees/green areas to be removed due widening of the road; c) Countdown/Z Petrol Carpark trees/green areas to be removed due widening of the road. 	

Table 12 Multi Criteria Analysis Scoring Sheet – Scenario 4/Option B

Scenario 4/Option B: Botany Terminus Online Interchange					
Name of assessor (incl. qualifications and organisation) 					
Area of assessment	Stormwater Treatment and Management				
Score: <table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Water Quality</td> <td style="width: 50%;">Water Quantity</td> </tr> <tr> <td style="text-align: center;">-1</td> <td style="text-align: center;">-1</td> </tr> </table>		Water Quality	Water Quantity	-1	-1
Water Quality	Water Quantity				
-1	-1				
Reasons / Comments: WATER QUALITY CRITERIA <ul style="list-style-type: none"> ■ Stormwater treatment: Score -1 <p>On Te Irirangi Drive:</p> <ul style="list-style-type: none"> – Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed. – Limited space on one side of the road to provide centralised devices, such as wetlands. – Limited space in one side of the road to provide longitudinal devices, such as swales. – Assumed minor adverse effect on stormwater treatment, due the removal of kerb grass median and green berm on both sides of road to accommodate bus corridor and platform. WATER QUANTITY CRITERIA <ul style="list-style-type: none"> ■ Overland flow path: Score -1 <ul style="list-style-type: none"> – On Te Irirangi Drive, overland flow paths cross the road in some points, flowing from east to west towards the Whaka Maumahara pond (refer Figure 1). – On both sides of the road, existing footpaths and berms also act as overland flow paths. – The proposed changes to accommodate the project must consider the management of existing overland flow paths to avoid / minimise impacts to other properties. ■ Flooding: Score -1 <ul style="list-style-type: none"> – The removal of some pervious areas, as proposed in the present option, would have a minor adverse effect as it may increase the risk of flooding if additional run-off volume is not mitigated. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the areas to be removed: <ul style="list-style-type: none"> a) Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane; b) Park N' Save/ Briscoes Carpark trees/green areas to be removed due widening of the road; c) Countdown/Z Petrol Carpark trees/green areas to be removed due widening of the road. 					

Table 13 Multi Criteria Analysis Scoring Sheet – Scenario 5

Scenario 5: Botany Terminus Online Interchange	
Name of assessor (incl. qualifications and organisation)	
Area of assessment	Stormwater Treatment and Management
Score:	
Water Quality	Water Quantity
0	-1
<p>Reasons / Comments:</p> <p>WATER QUALITY CRITERIA</p> <p>■ Stormwater treatment: Score 0</p> <p>On Te Irirangi Drive</p> <ul style="list-style-type: none"> – Stormwater run-off currently being attenuated and treated at Whaka Maumahara pond. – Limited space on one side of the road to provide centralised devices, such as wetlands. – Limited space in one side of the road to provide longitudinal devices, such as swales. – Potential opportunity to use Whaka Maumahara pond to treat additional run-off. In the case the pond cannot be used to treat additional volumes, underground treatment options can be proposed. – Assumed negligible effect on stormwater treatment through the area, due the removal of kerb grass median and adjacent grass berm to accommodate bus corridor. <p>WATER QUANTITY CRITERIA</p> <p>■ Overland flow path: Score -1</p> <ul style="list-style-type: none"> – On Te Irirangi Drive, overland flow paths cross the road flowing from east to west towards the Whaka Maumahara pond (refer Figure 1). – On both sides of the road existing footpaths and berms also act as overland flow paths. – The proposed changes to accommodate the project either up and down Botany, must consider the management of existing overland flow paths to avoid / minimise impacts to other properties. <p>■ Flooding: Score -1</p> <ul style="list-style-type: none"> – The removal of some pervious areas, as proposed in the present option, would have a minor effect on the environment if additional run-off volume cannot be mitigated. Some of the removed areas are intended to be redesigned in future phases of the project. The following areas are listed to give an overview of the quantity of permeable areas to be removed: <ul style="list-style-type: none"> a) Te Irirangi Drive kerb grass median to be removed to accommodate RTC bus lane; b) Botany Town Centre Carpark trees/green area to be removed due widening of the road. 	

Approved by:





Title	Name	Qualification	Signature	Date
Author		BEng		27/072020
Reviewer		BE (Hons), ME, CPEng		27/02/2020

Property	<ul style="list-style-type: none"> Where the station design interferes with loading areas for surrounding properties, alternative loading areas can be provided. Property assessment by AT will provide who the impacted land owners are Property boundaries shown in the legend are based off LINZ data (and not building lines) [this is important as the footprint on land near Haven & Te Irirangi Drive could be in common areas not controlled by AT or AC if that is not the case]. For all options where A2B extends north of Botany, assume those residential properties are full acquisition based on that concept footprint / assume site access, carparking and landscaping to all commercial and non-residential activity could be reconfigured to continue operation / third party consent implications. A signalised intersection will be provided to access the Botany Superclinic and will not require additional land take over what is shown in the sketches. Along the Golfcourse/retirement village section, property acquisition of up to 6m is required.
Walking and Cycling	<ul style="list-style-type: none"> Pedestrian and cycle crossings will be provided across all legs at all intersections, including where the station is directly adjacent to the intersection.
AMETI	<ul style="list-style-type: none"> AMETI link road is excluded and not to be assessed. AMETI link road will be constructed and still enable access to the petrol station and burger king site for public vehicles
Transport Network Operations	<ul style="list-style-type: none"> The proposed interchange options are providing for anticipated demand (not future-proofed demand). Assume the use of Crescent Lane (to the south of the existing mall) for local buses is business as usual for AT Assume local buses stay on the general traffic lanes where a dedicated RTC is provided. Where the northbound RTC transitions to on-road bus lanes north of Millhouse Drive, local buses can use these. For all options where local services through-run (i.e. Scenario 3, 4, 5): <ul style="list-style-type: none"> Ormiston East terminus would use the intersection of Ormiston Road and Shepherds Lane for turnaround and on-street layover. Requires approx. 2 layover bays and 1 pick up/drop off stop, a turnaround facility, driver break facilities (including a toilet). Turnaround facility and driver break facility may require small amount of property. Ormiston West terminus located on-street on Florence Carter Avenue. The intersection between this street and Ormiston Road will be signalised, the roundabout to the south on this street will be used for turnaround of buses. Requires approx. 4 on-street layover bays. Drivers on break can use public facilities at new development site on Florence Carter Avenue. Negligible property required. Howick terminus would require 4 layover spaces. These can be provided on-street near the town centre, and drivers can use public facilities while on break." Assume that for the local bus through-running options that terminate elsewhere in the network that there will be minor property impact at those termination points. If a preferred option from this MCA is one of these options, then property impact is to be considered and assessed in more detail.

Driver Rest Areas	<ul style="list-style-type: none"> For options where A2B buses through route and terminate at Golfland Drive, north of Botany assume that driver break facilities will be provided on the Superclinic site and assume further cost and property implications to provide this facility will apply. For drivers of services which terminate at Botany, assume they can use the mall/petrol station toilets, except for option 4B (see option-specific assumptions for 4B).
Landscaping	<ul style="list-style-type: none"> Landscaping along both sides of Te Irirangi Drive will be redesigned to support the desired urban environment around the footpaths and cycle paths being provided along the road. Where possible, the raised median blocks will be landscaped or utilised for stormwater purposes.
General	<ul style="list-style-type: none"> Assume that the physical environment will cater for people with physical and/or cognitive impairments. Stairs and lifts will be provided (no ramps). Assume that existing levels will be retained (except for the proposed grade separated options (Scenario 1 – Option B and Scenario 3 – Option B). The pedestrian overpasses above each station design can be moved to avoid property impact and to maximise connectivity opportunities for users of the overpasses. Assume the interchanges options will have HOP card vending machines and tag-on posts for people using the services. For all options where A2B extends north of Botany assume that the four A2B layover bays on Sheet 502334-7000-SKT-CC-00369-36A will have high occupancy turnover with a 10 minute wait time for the layover bays. Assume that a decision is yet to be made on whether A2B continues north from Botany Town Centre. Should A2B extend past the town centre, all intersections along the extended RTC will be redesigned to reflect the design philosophy along the rest of the corridor - the intersections will be compacted as much as possible, especially through the replacement of left-slip lanes with signalised left turns at the intersections,

3 Criteria

The Environment and Planning criteria, along with the individuals responsible for scoring each criterion are included below. Please note there are additional criteria included in the assessment that address matters related to transport planning and implementability.

Discipline	Measure		Individual
Property	Property	Number of properties that require acquisition. Number of sites that can/cannot be repurposed following implementation. Level of anticipated risk associated with property negotiation and acquisition under the Public Works Act 1981.	AT 
Planning	Consentability	Level of complexity of gaining approvals (e.g. activity status, risk of appeal, accordance with policy direction). Level of compliance with regulatory plans e.g. could the option include activities which are prohibited/ non-complying under the policies and rules of the district or regional plan?	Aurecon   ()
	Third Party Consents	Potential to require third party consents as a result of property take, site configuration etc.	Aurecon

Landscape, visual and urban design	Natural character and landscape	Extent, nature and degree of effects on natural character, features, and landscape.	
	Visual	Extent, nature and degree of effects on visual amenity.	
	Urban design	Extent, nature and degree of effects on urban design, including open space. Integration with surrounding land uses.	
Social/community impact	Accessibility	Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses. Accessibility of jobs.	
	Community	Extent and degree of change to groups and activities, including sense of community and to known aspirations and plans, and sensitive construction receivers.	
Stormwater	Stormwater quality	Impact of operational stormwater discharges on water quality within the catchment	
	Stormwater quantity	Impact of operational stormwater discharges on flooding within the catchment, including vulnerability to impacts of climate change such as increased storm events, and opportunities to increase resilience.	
Contaminated land	Contamination Management	Potential to encounter and ability to manage the effects of contaminated soils and groundwater on human health and the environment.	
Traffic Network	Traffic Network Operation	Extent and degree of effects of the change on the traffic network.	
Noise and Vibration	Operational Noise	Extent, nature and degree of operational noise effects.	

4 Scoring

The options are to be scored against the criteria using the following 7-point score system:

- | | |
|----|---|
| 3 | Negligible/minor impacts to the environment and/or significant positive effects |
| 2 | Minor impacts to the environment and/or moderate positive effects |
| 1 | Low impacts to the environment and/or minor positive effects |
| 0 | Neutral Effects |
| -1 | Minor effects on the environment and adverse effects |
| -2 | Moderate to significant adverse effects |
| -3 | Significant adverse or un-mitigatable effects |

Appendices:

Appendix A: Botany Interchange Option Specific Descriptions

Appendix B: A2B Botany Interchange Design Option Schematics

Summary of each option

- | | |
|-----------------------|---|
| – Base Case | Do Minimum |
| – Scenario 1 Option A | Botany Terminus Online Interchange |
| – Scenario 1 Option B | Botany Terminus Grade Separated Interchange |
| – Scenario 2 Option A | Botany Terminus Offline Interchange |
| – Scenario 2 Option B | Botany Terminus Online Interchange |
| – Scenario 3 Option A | Botany Terminus Online Interchange |
| – Scenario 3 Option B | Botany Terminus Grade Separated Interchange |
| – Scenario 4 Option A | Botany Terminus Offline Interchange |
| – Scenario 4 Option B | Botany Terminus Online Interchange |
| – Scenario 5 | Botany Terminus Online Interchange |

Memorandum

Appendix A Botany Interchange Option Specific Descriptions and Assumptions

Group	Option	Name	Specific Option Assumptions
Do Minimum (Base Case)	Do Minimum	Botany Terminus – Do Minimum Option	<ul style="list-style-type: none"> Both the A2B and AMETI services terminate at Botany, with a maximum of 12 services per hour each (using vehicles <= 13.5m in length), to allow for sufficient capacity for other local services. 6 pickup/drop off stops will be located at the existing stop locations. 12 layover stops are required to support these stops and can be dispersed across Botany Town Centre. This option will be able to support most (assume peak-only services will bypass Botany to fit station capacity - station will be AT MAXIMUM capacity with this network) of the proposed network in the AMETI functional specification for 2026 plus A2B. No pedestrian overpasses will be provided, and A2B corridor extent (including walking and cycling facilities) will not go further north than Town Centre Drive. Assess physical changes from Parkway Drive/Te Irirangi Drive intersection to tie-in just north of the Town Centre Drive/Te Irirangi Drive intersection and upgrade to existing bus stop on Town Centre Drive as well as added layover bays around the existing network.
Scenario 1 All Services Terminate at Botany (except A2B)	Option A	Botany Terminus Online Interchange	<ul style="list-style-type: none"> Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to Cascades Road/Botany Road intersection. Stormwater mitigations will be underground. (i.e. retention tanks) No at-grade crossings will be provided to the eastern platform, as the volume of buses using the layover loop will be too great.

		<ul style="list-style-type: none"> Assume that there are at-grade informal crossings only for bus drivers across the southern located layover area to access bus driver break facilities (volume of bus drivers is low enough that it won't cause problems to the interchange flow).
	Option B Botany Terminus Grade Separated Interchange	<ul style="list-style-type: none"> Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to Cascades Road/Botany Road intersection. No structures impacted. Grade-separated platform is the same level throughout its length. Grade-separated platform is to be raised by piers. No pedestrian or cyclist access up the ramps to the grade-separated platforms. Opportunity to use the Whaka Maumahara pond for stormwater mitigation. Assume that bus drivers who layover on the grade-separated platform layover bays can informally cross the elevated bus lane to access bus driver break facilities. (volume of bus drivers is low enough that it won't cause problems to the interchange flow).
Scenario 2 All Services Terminate at Botany	Option A Botany Terminus Offline Interchange	<ul style="list-style-type: none"> Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to tie-in before Ti Rakau Dr intersection Pedestrian and cycle paths along Te Irirangi Drive will divert around the station to avoid crossing the busy station access points. The paths will track under the eaves of the southern building and across Town Centre Drive to the west of the two car park accesses (i.e. not crossing at the 3 existing pedestrian crossings), and continue west along Town Centre Drive to connect to the footpath and cycle path for Te Irirangi Drive to the south of Botany Town Centre. Stormwater mitigations will be underground. (i.e. retention tanks)

			<ul style="list-style-type: none"> Assume that only bus drivers can cross the interchange informally (where overpasses are not provided) to access bus driver break facilities. (volume of bus drivers is low enough that it won't cause problems to the interchange flow)
	Option B	Botany Terminus Online Interchange	<ul style="list-style-type: none"> Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to Te Irirangi Dr/Ti Rakau Dr intersection Stormwater mitigations will be underground (i.e. retention tanks). All site and loading accesses on the east side of Te Irirangi Drive between Te Koha Road and Ti Rakau Drive intersections removed / altered. Loss of carparks No at-grade crossings will be provided to the eastern platform, as the volume of buses using the layover loop will be too great. Assume that there are at-grade informal crossings only for bus drivers across the southern located layover area to access bus driver break facilities. (volume of bus drivers is low enough that it won't cause problems to the interchange flow). Bus drivers in the central layover area must walk to the platforms and cross over Te Irirangi drive using the over-passes to access break facilities.
Scenario 3 Local Buses Running and A2B extends North	Option A	Botany Terminus Online Interchange	<ul style="list-style-type: none"> Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to Cascades Road/Botany Road intersection. Stormwater mitigations will be underground. (i.e. retention tanks). Local bus layover will need to be provided elsewhere in the transport network. Minor property impacts will occur elsewhere in the network and these will be assessed in subsequent assessments.

Scenario 4 All Services Terminate at Botany except Local Buses	Option B	Botany Terminus Grade Separated Interchange	<ul style="list-style-type: none"> Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to Cascades Road/Botany Road intersection. No structures impacted. Grade-separated platform is the same level throughout its length. Grade-separated platform is to be raised by piers. No pedestrian or cyclist access up the ramps to the grade-separated platforms. Opportunity to use the Whaka Maumahara pond for stormwater mitigation. [REDACTED] Local bus layover will need to be provided elsewhere in the transport network. Minor property impacts will occur elsewhere in the network and these will be assessed in subsequent assessments.
	Option A	Botany Terminus Offline Interchange	<ul style="list-style-type: none"> Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to tie-in before Ti Rakau Dr intersection. [REDACTED] The walking and cycling facilities travel beneath the Briscoes building canopy but do not require alterations to the building. Pedestrian and cycle paths along Te Irirangi Drive will divert around the station to avoid crossing the busy station access points. The paths will track under the eaves of the southern building, and will cross Town Centre Drive to the west of the two car park accesses (ie not crossing at the 3 existing pedestrian crossings), and continue west along Town Centre Drive to connect to the footpath and cycle path for Te Irirangi Drive to the south of Botany Town Centre. Stormwater mitigations will be underground (i.e. retention tanks). [REDACTED] [REDACTED] Assume that only bus drivers can cross the interchange informally (where overpasses are not provided) to access bus driver break facilities. (volume of bus drivers is low enough that it won't cause problems to the interchange flow).

			<ul style="list-style-type: none"> Local bus layover will need to be provided elsewhere in the transport network. Minor property impacts will occur elsewhere in the network and these will be assessed in subsequent assessments.
	Option B	Botany Terminus Online Interchange	<ul style="list-style-type: none"> Approaches to Te Irirangi Drive / Ti Rakau Drive Intersection will require widening to align with the proposed interchange. Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to Te Irirangi Dr/Ti Rakau Dr intersection. Stormwater mitigations will be underground. (i.e. retention tanks). Bus drivers in the central layover area must walk to the platforms and cross over Te Irirangi drive using the over-passes to access break facilities. Driver break facilities (e.g. toilets) will be provided on the western side of Te Irirangi Drive (in the current petrol station site). These are required for this option only, as this option will likely result in removal of the petrol station site and its public toilets. The layover spaces for this option are more than a 3-minute walk from the nearest public toilets in Botany Town Centre, which is unreasonable for the driver break times. Local bus layover will need to be provided elsewhere in the transport network. Minor property impacts will occur elsewhere in the network and these will be assessed in subsequent assessments.
Scenario 5 All Services Through Route	Scenario 5	Botany Terminus Online Interchange	<ul style="list-style-type: none"> AMETI and A2B operates as one service in this option (Airport to Panmure). All services will terminate elsewhere in the transport network. Minor property impacts will occur elsewhere in the network and these will be assessed in subsequent assessments. Assess physical changes from Parkway Drive/ Te Irirangi Drive intersection to tie-in just after Te Irirangi Drive/Te Koha Rd intersection. Can use the Whaka Maumahara pond for stormwater mitigation in addition to retention tanks.



F



Multi-Criteria Assessment

[illegible][illegible][illegible]

A&B Rating: Strong Buy Multi criteria analysis - Assessment worksheet				Criteria											
				Weight											
				Rating											

The background of the entire page is a blurred photograph of a road at night or dusk, with light trails from vehicles. Overlaid on this are numerous semi-transparent, colorful geometric shapes and lines. These include large diagonal bands of blue, orange, and green, as well as smaller triangles and rectangles in the same color palette. The overall effect is dynamic and modern.

G

Road Safety Audit

CONCEPT DESIGN ROAD SAFETY AUDIT
BOTANY TERMINUS ONLINE INTERCHANGE
PREPARED FOR AUCKLAND TRANSPORT
20 July 2020



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QUALITY STATEMENT

PROJECT MANAGER	ROAD SAFETY AUDIT TEAM LEADER
<div></div>	
PREPARED BY	
<div></div>	20 July 2020
CHECKED BY	
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Botany Terminus Online Interchange

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1 Introduction

1.1 Safety Audit Definition and Purpose

A road safety audit is a term used internationally to describe an independent review of a future road project to identify any safety concerns that may affect the safety performance. The audit team considers the safety of all road users and qualitatively reports on road safety issues or opportunities for safety improvement.

A road safety audit is therefore a formal examination of a road project, or any type of project which affects road users (including cyclists, pedestrians, mobility impaired etc.), carried out by an independent competent team who identify and document road safety concerns.

A road safety audit is intended to help deliver a safe road system and is not a review of compliance with standards.

The primary objective of a road safety audit is to deliver a project that achieves an outcome consistent with Safer Journeys and the Safe System approach, which is a safe road system increasingly free of death and serious injury. The road safety audit is a safety review used to identify all areas of a project that are inconsistent with a Safe System and bring those concerns to the attention of the client so that the client can make a value judgement as to appropriate action(s) based on the risk guidance provided by the safety audit team.

The key objective of a road safety audit is summarised as:

'to deliver completed projects that contribute towards a safe road system that is increasingly free of death and serious injury by identifying and ranking potential safety concerns for all road users and others affected by a road project.'

A road safety audit should desirably be undertaken at project milestones such as:

- concept stage (part of business case);
- scheme or preliminary design stage (part of pre-implementation);
- detail design stage (pre-implementation or implementation); or
- pre-opening or post-construction stage (implementation or post-implementation).

A road safety audit is not intended to be a technical or financial audit and does not substitute for a design check of standards or guidelines. Any recommended treatment of an identified safety concern is intended to be indicative only, and to focus the designer on the type of improvements that might be appropriate. It is not intended to be prescriptive and other ways of improving the road safety or operational problems identified should also be considered.

In accordance with the procedures set down in the NZTA Road Safety Audit Procedures for Projects Guidelines - Interim release May 2013 the audit report should be submitted to the client who will instruct the designer to respond. The designer should consider the report and comment to the client on each of any concerns identified, including their cost implications where appropriate, and make a recommendation to either accept or reject the audit report recommendation.

For each audit team recommendation that is accepted, the client will make the final decision and brief the designer to make the necessary changes and/or additions. As a result of this instruction the designer shall action the approved amendments. The client may involve a safety engineer to provide commentary to aid with the decision.

Decision tracking is an important part of the road safety audit process. A decision tracking table is embedded into the report format at the end of each set of recommendations. It is to be completed by the designer, safety engineer, and client for each issue, and should record the designer's response, client's decision (and asset manager's comments in the case where the client and asset manager are not one and the same) and action taken.

A copy of the report including the designer's response to the client and the client's decision on each recommendation shall be given to the road safety audit team leader as part of the important feedback loop. The road safety audit team leader will disseminate this to team members.

1.2 The Project

The project consists of a new bus terminus at Botany Town Centre for the Botany to Airport rapid transit service. It would also serve as an interchange between the Airport to Botany rapid transit service and the Eastern Busway, formerly known as AMETL.

[REDACTED]

[REDACTED] All buses would drop passengers off at a platform on the western side, then turnaround 180° and pick passengers up from the other side. All passengers transferring between Airport to Botany and Eastern Busway services would cross the busway to reach the platform on the other side. All passengers commencing or ending their journey at the Botany Terminus would cross one or other carriageway of Te Irirangi Drive. At-grade signalised pedestrian crossings and a footbridge spanning the whole of Te Irirangi Drive and the station platforms will facilitate these pedestrian movements.

[REDACTED]

The existing bus stops along Town Centre Drive will be decommissioned.

A 2 m cycleway and 2 m footpath is proposed on each side of Te Irirangi Drive.

[REDACTED]

1.3 The Road Safety Audit Team

This road safety audit has been carried out in accordance with the NZTA Road Safety Audit Procedure for Projects Guidelines – Interim release May 2013, by:

- [REDACTED]

- [REDACTED]

The road safety auditors had visited the site twice in October 2019 for a previous road safety audit and did not feel that it was necessary to visit the site again.

1.4 Previous Road Safety Audits

The road safety audit team members are not aware of any previous road safety audits for the Botany terminus online interchange.

1.5 Scope of this Road Safety Audit

This is a concept design road safety audit of the project described in Section 1.2 i.e. Scenario 2 Option B.1. This road safety audit excludes any alterations to the existing intersection between Ti Rakau Drive and Te Irirangi Drive that would be required, as none is shown on the drawing.

1.6 Report Format

The potential road safety problems identified have been ranked as follows.

The expected crash frequency is qualitatively assessed on the basis of expected exposure (how many road users will be exposed to a safety issue) and the likelihood of a crash resulting from the presence of the issue. The severity of a crash outcome is qualitatively assessed on the basis of factors such as expected speeds, type of collision, and type of vehicle involved.

Reference to historic crash rates or other research for similar elements of projects, or projects as a whole, have been drawn on where appropriate to assist in understanding the likely crash types, frequency and likely severity that may result from a particular concern.

The frequency and severity ratings are used together to develop a combined qualitative risk ranking for each safety issue using the concern assessment rating matrix in Table 1-1. The qualitative assessment requires professional judgement and a wide range of experience in projects of all sizes and locations.

Table 1-1: Concern Assessment Rating Matrix

Severity (likelihood of death or serious injury)	Frequency (probability of a crash)			
	Frequent	Common	Occasional	Infrequent
Very likely	Serious	Serious	Significant	Moderate
Likely	Serious	Significant	Moderate	Moderate
Unlikely	Significant	Moderate	Minor	Minor
Very unlikely	Moderate	Minor	Minor	Minor

While all safety concerns should be considered for action, the client or nominated project manager will make the decision as to what course of action will be adopted based on the guidance given in this ranking process with consideration to factors other than safety alone. As a guide a suggested action for each concern category is given in Table 1-2.

Table 1-2: Concern Categories

Concern	Suggested action
Serious	Major safety concern that must be addressed and requires changes to avoid serious safety consequences.
Significant	Significant safety concern that should be addressed and requires changes to avoid serious safety consequences.
Moderate	Moderate safety concern that should be addressed to improve safety.
Minor	Minor safety concern that should be addressed where practical to improve safety.

In addition to the ranked safety issues it is appropriate for the safety audit team to provide additional comments with respect to items that may have a safety implication but lie outside the scope of the safety audit. A comment may include items where the safety implications are not yet clear due to insufficient detail for the stage of project, items outside the scope of the audit such as existing issues not impacted by the project or an opportunity for improved safety but not necessarily linked to the project itself. While typically comments do not require a specific recommendation, in some instances suggestions may be given by the auditors.

1.7 Documents Provided

The road safety audit team was provided a single unnumbered concept drawing 502334-700-SKT-CC-####-A.

1.8 Disclaimer

The findings and recommendations in this report are based on an examination of available relevant plans, the specified road and its environs, and the opinions of the SAT. However, it must be recognised that eliminating safety concerns cannot be guaranteed since no road can be regarded as absolutely safe and no warranty is implied that all safety issues have been identified in this report. Safety audits do not constitute a design review nor are they an assessment of standards with respect to engineering or planning documents.

Readers are urged to seek specific technical advice on matters raised and not rely solely on the report.

While every effort has been made to ensure the accuracy of the report, it is made available on the basis that anyone relying on it does so at their own risk without any liability to the safety audit team or their organisations.

2 Safety Concerns

This section contains safety concerns ranked in accordance with suggested system in the NZTA Road Safety Audit Procedure for Projects Guidelines – Interim release May 2013. This section also contains unranked safety comments that are either:

- in response to a specific request for the road safety audit team to comment on a particular aspect; or
- of a general nature; or
- cannot be related to any specific safety concern; or
- relate to previous safety concerns that may have been misinterpreted; or
- relate to subsequent design developments that could become safety concerns in a future safety audit; or
- relate to safety concerns that the designers are already aware of; or
- relate to design elements where the safety implications are not yet clear due to insufficient detail for the stage of the project.

These comments are included for the consideration of the designers and the client. Decision tracking tables are included to record responses, as attention paid to the comments may contribute to improving overall road safety.

2.1 Operation

2.1.1 Choice of terminus layout

Moderate

The road safety audit team does not know what other possible layout options may have been considered for the bus terminal or why the Scenario 2 – Option B.1 online interchange concept has been chosen specially over other options.

The Scenario 2 – Option B.1 online interchange concept seems to favour the bus movements as buses would enter and turn around very easily with the minimum of delay and conflict with general traffic when compared with other options such as an offline bus station e.g. Panmure, Constellation, or Albany interchanges. However, the chosen layout requires passengers to cross the busway, Te Irirangi Drive, and Ti Rakau Drive. The footbridge cannot necessarily be relied upon to provide the necessary mitigation when the option of darting across the road or even waiting at the pedestrian signals is so much more time and energy efficient.¹ The chosen layout would also have a major effect on the intersection of Te Irirangi Drive, Botany Road and Ti Rakau Drive as discussed in Section 2.4.1.

An offline station similar to Panmure Interchange on the eastern side of Te Irirangi Drive would require only those from the relative smaller Huntington Park and The Hub catchment area to cross Te Irirangi Drive. The desire line is shown by the light blue arrow in Figure 3 in Section 2.2.3.

Another example to reduce vulnerable road user conflict would be an anti-clockwise bus circulation with a single central platform, such as Albany Interchange. There would be enough width within the Te Irirangi Drive median just south of Te Koha Road to provide a bus cross-over.

Since the bus drivers will probably lay over at the interchange for a break, the efficient circulation of the buses would not seem to be a necessity at the expense of a safer more passenger-friendly layout.

Many of the individual vulnerable road user safety concerns that follow relate directly to the choice of terminus layout.

The ranking of this safety concern is based on the aggregation of many of the following individual safety concerns.

Recommendation(s)

1. Consider whether the online interchange layout chosen provides the best balance between public transport operational requirements or efficiency and the safety of passengers crossing the busway between station platforms, Te Irirangi Drive, and Ti Rakau Drive.

¹ People with travelling luggage would have to use lifts, which are generally much slower than stairs or escalators.

- Consider the effect of the chosen layout on the safety of the Te Irirangi Drive, Botany Road and Ti Rakau Drive altered intersection.

Frequency Crashes are likely to be occasional	Severity Death or serious injury is likely	Rating The safety concern is moderate
Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm functional requirements of Botany Station with Auckland Transport. The Interchange layout will be refined further as part of the next stage of design and should consider recommendations.	
Safety Engineer comment	Designer's response is noted. It is recommended that Eastern Busway Project Alliance to take the recommendations suggested by the road safety auditor on board, rather than limited to refinements of the current layout. It is also recommended that the new design to be complied with the TDM with Safe System and universal designs principles within the interchange as well as the intersections interface with the interchanges for all road users (ie including vulnerable road users such as pedestrians, cyclists and motorcyclists)	
Client decision	The Airport to Botany (A2B) Rapid Transit Single Stage Business Case (SSBC) is currently being completed, which includes the optioneering for an ultimate Botany Station (2030+) that provides for both A2B and Eastern Busway. In parallel, the Eastern Busway Alliance (EBA) commenced in October 2019. The A2B Botany Station optioneering reflects the SSBC-stage of design (concept design) and acknowledges that further optioneering will be undertaken by the EBA. As such, the A2B project team have provided previous optioneering materials, including online and offline station layout options. The project team will pass on the road safety recommendations above to the EBA team to inform their optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	
Action taken	Road Safety Audit to be provided to EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	

2.1.2 Interface with Eastern Busway

The Botany terminus interchange seems to have been designed mainly for Airport to Botany services, with the designers having to assume that the Eastern Busway would connect via Te Koha Road. While the proposed Eastern Busway bus movements would work based on that assumption, the briefing meeting suggested that there was still a large degree of uncertainty surrounding the Eastern Busway. The road safety auditors were not given the expected patronage figures of the two services but suspect that the Eastern Busway would have to cater for similar if not greater passenger numbers.

The general safety concern is that less than full integration between the two services may lead to sub-optimum outcomes for vulnerable road users; for example, by creating unnecessary extra road crossings, or not catering for all pedestrian and cyclist desire lines, or not anticipating informal or illegal pop-up kiss-and-ride and park-and-ride areas and the desire lines to and from those areas. Refer to Section 2.2.4 for further discussion on park-and-ride and kiss-and-ride facilities.

Since the Eastern Busway and Airport to Botany services will share the same terminus (probably equally), equal consideration should be given to the operation and safety of vulnerable road users on both services. Although the Eastern Busway is unlikely to be completed further than Pakuranga Plaza for many years, well-established bus services (e.g. route 70) already operate along Ti Rakau Drive and should therefore be catered for now, rather than waiting for Eastern Busway to be fully completed.

Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm functional requirements of Botany Station with Auckland Transport. The Interchange layout will be refined further as part of the next stage of design and should consider recommendations.
Safety Engineer comment	Designer's response is noted. It is recommended that Eastern Busway Project Alliance to take the recommendations suggested by the road safety auditor on board, rather than limited to refinements of the current layout. It is also

	recommended that the new design to be complied with the TDM with Safe System and universal designs principles within the interchange as well as the intersections interface with the interchanges for all road users (ie including vulnerable road users such as pedestrians, cyclists and motorcyclists)
Client decision	Agree with comments above. Refer to client decision comments in Section 2.1.1. Eastern Busway route assumption was based on best knowledge at the time of developing the SSBC but is likely to change as the Alliance further develops the Eastern Busway scheme. This RSA will be provided to the EBA team to inform interchange design development. A2B project team to work with the EBA to confirm functional requirements at Botany Station.
Action taken	RSA to be provided to EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.

2.1.3 Speed limits

The current speed limits on Te Irirangi Drive are 80 km/h through the Te Koha Road intersection and 60 km/h through the Ti Rakau Drive intersection. The road safety audit team has assumed that the speed limits would be lowered to appropriately safe speed limits throughout the area of influence of the terminus interchange.

Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm speed limits on Te Irirangi Drive with Auckland Transport.
Safety Engineer comment	Agree with the auditor's recommendation - to achieve a safe and appropriate speed for the users of the interchange (including the ones that are on foot / bicycle / motorcycle)
Client decision	Agree with all comments above. Refer to client decision comments in Section 2.1.1. Vision Zero considerations are important. A2B project team will seek the inclusion of Te Irirangi Drive in future tranches of AT's speed management programme being delivered by AT's Road Safety team. Initial discussions have been held with this team. A similar approach is recommended to the EBA team, or for speed limit reduction to be included in the Eastern Busway project for the station surrounds.
Action taken	A2B project team to seek the inclusion of Te Irirangi Drive in future tranches of the speed management programme. RSA to be provided to EBA team to inform Botany Interchange optioneering, with a recommendation to consider a reduction in speed limits along the Eastern Busway corridor.

2.2 Vulnerable and Multimodal Road Users

2.2.1 Separate opposing drop-off and pick-up platforms

Moderate

The clockwise circulation of the buses requires all passengers transferring between Airport to Botany and Eastern Busway services to cross the busway from the drop-off platform to the pick-up platform on the other side of the terminus. It requires anyone transferring to local bus services to cross Te Irirangi Drive southbound carriageway as well. Although there would be a signalised pedestrian crossing and a footbridge, passengers will probably take the least line of resistance if it is raining or their connecting bus is ready to depart. Passengers know that bus terminus buses will always depart on time. They will therefore know whether they have time to wait for traffic signals or have the time to use the footbridge.²

Bus drivers cannot always fall in behind one another and move forward in an orderly manner as it depends on arrival times and on how long it takes to discharge passengers. There is thus the safety concern that a

² Anecdotally, the author has seen frail elderly people try to run down escalators and stairs to waiting trains and buses. It is human nature to run for the bus.

passenger will run across the busway from between two buses and in front of a bus that cannot join the end of the queue due to lack of space.

With the proposed arrangement, some passengers would have to cross two roads i.e. Te Irirangi Drive first, then the busway, and those from Huntington Park and The Hub catching local buses would have to wait to cross three roadways.

A single central platform with anti-clockwise stops either side, such as the Albany Interchange, would remove the safety issue of crossing the busway and reduce the number of roadways crossings to mostly one per passenger. Some local bus passengers would have to cross only two instead of three roadways.

Recommendation(s)

1. Reduce the number of roadways that passengers have to cross.
2. As recommended in Section 2.1.1, consider whether the safest option has been selected for vulnerable road users.

Frequency Crashes are likely to be occasional	Severity Death or serious injury is likely	Rating The safety concern is moderate
Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm functional requirements of Botany Station with Auckland Transport. Interchange layout (e.g. platform location, number of crossings, circulation of buses) to be refined further in the next stage of design and consider recommendations.	
Safety Engineer comment	Agree with the auditors' comments above – and as commented above, good and convenient crossing facilities and connectivity are absolutely critical and to ensure appropriate speed management devices are in place to achieve an operating speed as close to survival speed of pedestrians at the crossing points.	
Client decision	Agree with concerns noted. Refer to client decision comments in Section 2.1.1. This RSA will be provided to the EBA team to inform interchange design development. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	
Action taken	RSA to be provided to EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	

2.2.2 Online interchange layout

Moderate

As discussed in Section 2.1.1, the online bus terminus requires all passengers to cross Te Irirangi Drive; and, as discussed in Section 2.2.1, passengers will be inclined not to wait for signals or use the footbridge if they know their bus is departing soon. For Airport to Botany and Eastern Busway services it could be argued that

the passenger could wait another few minutes for the next bus in line to depart as they all go to the same destination e.g. routes 35 and 70, provided that it is only a few minutes. However, for local bus services there are specific buses that do not run as frequently, which passengers will want to catch.

An offline option on the eastern side of Te Irirangi Drive could require some passengers to cross only a single one-way busway and would reduce the number of crossings for passengers from Huntington Park and The Hub.

Recommendation(s)

1. Reduce the number of roadways that passengers have to cross.
2. As recommended in Section 2.1.1, consider whether the safest option has been selected for vulnerable road users.

Frequency Crashes are likely to be occasional	Severity Death or serious injury is likely	Rating The safety concern is moderate
Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm functional requirements/ online interchange layout of Botany Station with Auckland Transport. The Interchange layout will be refined further as part of the next stage of design and should consider recommendations.	
Safety Engineer comment	Please refer comments in section in 2.1.1 and 2.2.1	
Client decision	Agree with concerns noted. Refer to client decision comments in Section 2.1.1. This RSA will be provided to the EBA team to inform interchange design development. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	
Action taken	RSA to be provided to EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	

2.2.3 Position of footbridge and pedestrian desire lines

Moderate

The proposed overbridge does not seem to lie on any desire line and requires users to pass through supermarket back-of-house surroundings on both sides of Te Irirangi Drive as shown by the red arrows in Figure 3.³ However, the footbridge does tie in with the proposed footpath and cycleway along the western side of Te Irirangi Drive. In the dark, people may be reluctant to walk to and from the footbridge, particularly along the eastern side. Empty after hours car parks and bus layovers are often a haven for nefarious activities at night.

A major desire line would be from Botany Town Centre along Town Centre Drive via the Te Koha Road intersection to the southern access to the platforms, as shown by the brown arrow in Figure 3. Few people would walk beyond the platform to use the bridge; and walking through or alongside the bus layover area would not be particularly pleasant.

A desire line would be from ice skating and bowling recreational facilities on the northern side of Ti Rakau Drive. The bridge would not serve such a desire line as people would cross to directly to and from the turnaround area as shown by the dark blue arrows in Figure 3. Providing fences to direct pedestrians to crossing points is not recommended as they can trap pedestrians in the road; and there is always a point where pedestrians can simply walk around the end of the fence. Fencing can also be a personal security issue as it limits escape routes.⁴

³ It is assumed that the service station and takeaway restaurant on the western side would be demolished.

⁴ Consider crime prevention through environmental design.

Figure 3: Desire lines and position of footbridge

Also refer to desire lines from both formal and informal pick-up drop-off or kiss-and-ride facility discussed in Section 2.2.4. Example of such routes are shown by the gold arrows in Figure 3.

The major identified desire lines should be made as attractive, comfortable, and safe from a personal security point of view as possible to encourage pedestrians to walk to the safest crossing points. Covered walkways with transparent wind screens would be recommended.

Recommendation(s)

1. Consider whether the proposed footbridge is in the most advantageous position that would encourage its maximum use by pedestrians and cyclists to avoid crossing at-grade or jaywalking.
2. Provide high-quality pedestrian facilities along major desire lines to encourage pedestrians to follow a route to the safest crossing place.
3. Avoid routing pedestrians through unsavoury areas such as back-of-house or bus layover areas.
4. Do not resort to pedestrian fencing.

Frequency Crashes are likely to be occasional	Severity Death or serious injury is likely	Rating The safety concern is moderate
Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm location of footbridges at Botany Station with Auckland Transport. Location of footbridge and pedestrian crossings to be refined further in the next stage of design considering the recommendations.	
Safety Engineer comment	Agree with auditors' recommendation and consider universal design that would cater for all types of pedestrians and support the recommendations of no pedestrian fencing.	
Client decision	Agree with concerns noted. Refer to client decision comments in Section 2.1.1. This RSA will be provided to the EBA team to inform interchange design development. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	

Action taken	RSA to be provided to EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.
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2.2.4 Kiss-and-ride and park-and-ride areas

Moderate

The drawing does not show any provision for kiss-and-ride or park-and-ride areas.

The Airport to Botany service is likely to attract airline passengers who will wish to drive or be driven only as far as Botany Town Centre where they could be dropped off or where parking would be free, e.g. residential street parking, or at least considerably cheaper than at the airport. This would also save the hassle of dealing with bulky travel luggage on local bus services.

There are also Auckland CBD commuters (Route 70) who may wish to skip the local bus services at times, e.g. if they are running late, and park at or be dropped off or collected at Botany Town Centre.

It is unlikely that Botany Town Centre administrators would be amenable to their parking areas being used as an informal park-and-ride facility, so there may be illegal parking on verges in the surrounding areas. Depending on the level of surveillance employed, some drivers may even risk stopping in the local bus stops briefly to let passengers off. While formal park-and-ride facilities might not be conducive to reducing congestion on the roads, providing a dedicated airport parking and kiss-and-ride facilities could reduce congestion on the roads between Botany and the airport and motivate people to use the safer bus service instead.

A proportion of users that will have travel luggage highlights the importance of providing safe facilities for them to walk from the drop-off point to the platform, conceivably with a luggage trolley.

Recommendation(s)

1. Accommodate the needs of passengers who may wish to be dropped off or picked up at the Botany terminus interchange and the drivers who would need to either park or circulate through a kiss-and-ride zone. Pay particular attention to the desire lines of such commuters and travellers, especially considering that they may have travel luggage and be pushing trolleys.
2. Anticipate illegal parking on verges or other undesirable and unsafe areas in the surrounding areas and make provision for all-day parking e.g. satellite airport parking.

Frequency Crashes are likely to be occasional	Severity Death or serious injury is likely	Rating The safety concern is moderate
Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm provision of a kiss-and-ride or park-and-ride facility with Auckland Transport.	
Safety Engineer comment	Agreed with the auditors' comments.	
Client decision	<p>Refer to client decision comments in Section 2.1.1. AT's Auckland Park and Ride Programme Business Case does not identify park and ride at Botany as being necessary or desirable due to the accessibility afforded by future rapid transit and local bus services. A2B's Station Access Studies do not recommend park and ride at Botany Station.</p> <p>However, while not shown on the station concept design, kiss and ride facilities are recommended by A2B's Station Access Studies to be provided at or near Botany Station. The provision of kiss and ride should be considered as part of updates to the station functional requirements by the EBA, and agreed with AT. More recent rapid transit stations developed on the network provide kiss and ride facilities.</p> <p>RE: concern that drivers of private vehicles may stop in local bus bays to drop off passengers is noted and will be passed on to the EBA team to consider in developing their Botany Interchange recommended option.</p>	
Action taken	RSA to be provided to EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	

2.3 Local Bus Layover

2.3.1 Entrance arrangement at Town Centre Drive

Significant

The local bus layover entrance splits into two roadways, one entering directly into the two layout bays from the south, and the other looping around to enter the six layout bays from the east. The layover area would be entered from the northbound busway diagonally across the Te Koha Road Town Centre Drive intersection and also by making a U-turn after dropping passengers off in the southbound carriageway of Te Irirangi Drive.



Figure 4: Local bus layover bays

The arrangement creates a large conflict area between buses and pedestrians and cyclists crossing. The layout shows the crosswalk lines intersecting within the Town Centre Drive intersection. This is unsafe as it does not lead pedestrians or cyclists to the kerb. There is also the possibility that motorists turning left would find themselves in the entrance to the bus layover bays.

Recommendation(s)

1. Preferably shift the bus layover bays to an area that does not conflict with pedestrian desire lines between Botany Town Centre and the platforms and footbridge.
2. If the layover bays are to remain in their proposed location, create a single left-turn entrance to the layover away from the complexities of the Te Koha Road Town Centre Drive intersection, perhaps off the car park ring road instead as shown by the yellow arrow in Figure 4.
3. Reduce the pedestrian and cyclist crossing distance across Town Centre Drive and ensure that the crosswalk lines lead pedestrians to the kerbside and do not intersection within the intersection.

Frequency Crashes are likely to be common	Severity Death or serious injury is likely	Rating The safety concern is significant
Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm functional requirements of Botany Station with Auckland Transport. Location of layover bays at	

	Botany Interchange to be refined further in the next stage of design and should consider recommendations.
Safety Engineer comment	Please refer to comment in section 2.1.1 and 2.2.1
Client decision	Refer to client decision comments in Section 2.1.1. The green tracking area shown on the drawing between the A2B busway and the offline layover is an error, as the rapid transit buses will not use the offline layover which is instead intended for local buses. Nevertheless, agree that various vehicle movements at this location in relation to active modes may cause potential conflicts. This RSA will be provided to the EBA team to inform interchange design development.
Action taken	RSA to be provided to EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.

2.4 Te Irirangi Drive Ti Rakau Drive Intersection

2.4.1 Alterations due to wide terminus median

Serious

The proposed new median containing the terminus interchange will be 23 m wide at the Ti Rakau Drive intersection.

The road safety auditors accept that the drawing does not show any alterations to the Te Irirangi Drive Ti Rakau Drive intersection to accommodate the wide median in Te Irirangi Drive at this concept stage. The auditors have therefore assumed that the most likely minimum required alteration would be to widen the median and realign the lanes in Botany Road to match the median and tie into the lanes in Te Irirangi



Figure 5: Ti Rakau Drive intersection

The existing intersection has a poor safety record. This may be a result of the large number of lanes on all four approaches requiring a large intersection area with long clearance times.⁵ The wide median would increase the size of the intersection and clearance times considerably. It is also likely that drivers will turn into the wrong carriageway into the face of oncoming traffic in poor visibility e.g. a wet night with low traffic flows.

The wide median would require two-stage pedestrian crossings across Te Irirangi Drive and Botany Road. This would increase pedestrian and cyclist waiting times, thus reducing the amenity, and possibly leading to increased jaywalking, especially as the destination for many would be the bus terminus interchange.

The drawing does not show a pedestrian or cyclist crossing across the southern side of the intersection. This may be a drafting oversight as there is an existing crossing. However, the callout in Figure 5 is noted.

⁵ A red-light safety camera was installed at this intersection recently.

Recommendation(s)

1. Refer to the discussion on choice of terminus interchange layout in Section 2.1.1.
2. Preferably, alter the intersection to improve the safety of the existing intersection.
3. Ensure that the required alterations would not lower the safety of the existing intersection.
4. Provide controlled pedestrian and cyclist crossings across all roadways on all four sides of the intersection as called out in Figure 5, including slip lanes.

Frequency Crashes are likely to be frequent	Severity Death or serious injury is likely	Rating The safety concern is serious
Designer response	Noted and agreed. Eastern Busway Project Alliance to re-confirm tie in with adjacent intersections with Auckland Transport. The Interchange layout will be refined further as part of the next stage of design and should consider recommendations.	
Safety Engineer comment	Please refer to comments in section 2.1.1, 2.2.1 and 2.2.3	
Client decision	Refer to client decision comments in Section 2.1.1. Agree with concerns noted. This RSA will be provided to the EBA team to inform interchange design development. The Eastern Busway may run through this intersection, requiring further changes. Safety and Vision Zero are important considerations in the future design and operation of the station, two busways, cycling, pedestrian facilities and surrounding intersections. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	
Action taken	RSA to be provided to the EBA team to inform Botany Interchange optioneering. A2B project team to work with the EBA to confirm functional requirements at Botany Station.	

3 Audit Statement

We declare that we remain independent of the design team and have not been influenced in any way by any party during this road safety audit.

We certify that we have used the available plans, and have examined the specified roads and their environment, to identify features of the project we have been asked to look at that could be changed, removed, or modified in order to improve safety.

We have noted the safety concerns that have been evident in this audit and have made recommendations that may be used to assist in improving safety.

Signed



Date 20 July 2020

Keith Weale, BSc(Eng), BEng(Hons), MSc(Eng), CMEngNZ, CPEng
Principal Transportation Engineer, Stantec, Auckland

Signed



Date 20 July 2020

Nick Gluyas, BE(Civil)(Hons), CMEngNZ, CPEng
ANZ Market Sector Leader, Transportation Delivery, Stantec, Auckland

4 Response and Decision Statements

System designers and the people who use the roads must all share responsibility for creating a road system where crash forces do not result in death or serious injury.

4.1 Designer's Responses

I have studied and considered the auditors' safety concerns and recommendations for safety improvements set out in this road safety audit report and I have responded accordingly to each safety concern with the most appropriate and practical solutions and actions, which are to be considered further by the safety engineer (if applicable) and project manager.

Signed



Date 30/07/2020

4.2 Safety Engineer's Comments (if applicable)

I have studied and considered the auditors' safety concerns and recommendations for safety improvements set out in this road safety audit report together with the designer's responses. Where appropriate, I have added comments to be taken into consideration by the project manager when deciding on the action to be taken.

Signed



Date 16th August 2020

[Safety Engineer's name, qualification, position, company]

4.3 Project Manager's Decisions

I have studied and considered the auditors' safety concerns and recommendations for safety improvements set out in this road safety audit report, together with the designer's responses and the comments of the safety engineer (if applicable), and having been guided by the auditor's ranking of concerns have decided the most appropriate and practical action to be taken to address each of the safety concerns.

Signed



Date 22 February 2021

[Project Manager's name, qualification, position, company]

4.4 Designer's Statement

I certify that the project manager's decisions and directions for action to be taken to improve safety for each of the safety concerns have been carried out.

Signed



Date 2nd March 2021

4.5 Safety Audit Close Out

The project manager is to distribute the audit report incorporating the decisions to the designer, safety audit team leader, safety engineer, and project file.

Date: 03 March 2021

Auckland

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