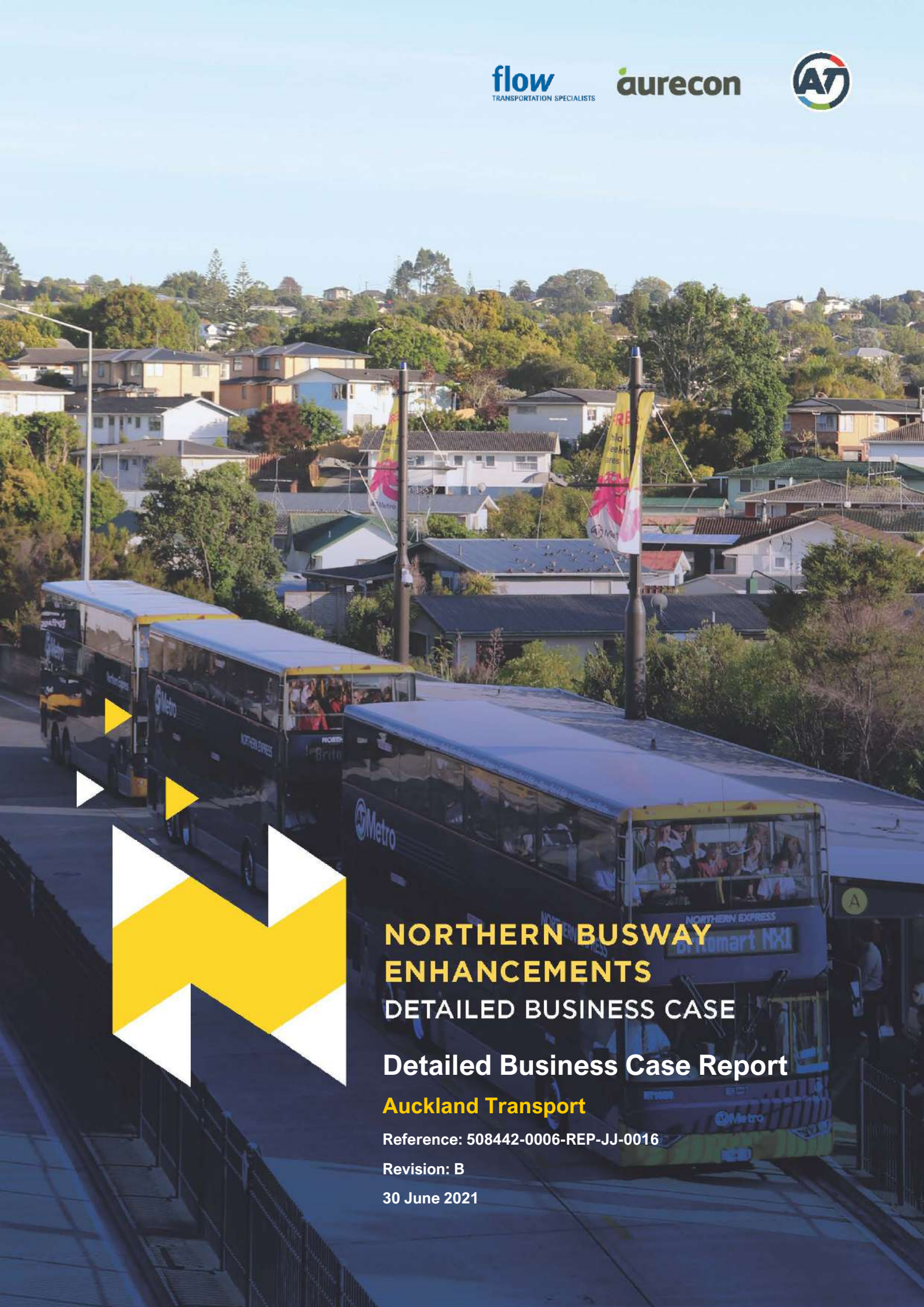

NORTHERN BUSWAY ENHANCEMENTS
DETAILED BUSINESS CASE

Detailed Business Case Report

Auckland Transport

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Executive Summary

This detailed business case (DBC) focuses on Auckland's Northern Busway. The busway has been a very successful element of Auckland's rapid transit network (RTN) with passenger growth exceeding that of both the rail network and the rest of the bus network.

This exceptional growth will further increase pressure on the Northern Busway as forecasted passenger transport demand is likely to exceed the functional capacity of core North Shore–City Centre public transport corridors by the 2030s.

The Additional Waitematā Harbour Connections Indicative Business Case (IBC) confirms the need to address the growing level of transport demand across the Waitematā Harbour in the long term. It also recognises the need to continue to improve the public transport connections in the interim by progressively enhancing the capacity of the Northern Busway. This is expected to meet ongoing growth in cross-harbour public transport demand, support mode shift to public transport and the ongoing success of Auckland's city centre while the potential future additional investment in rapid transit to the North Shore is investigated and implemented.

In this context, this detailed business case recommends a programme of operational and infrastructure improvements to the Northern Busway that can be delivered within the next 10-15 years. The recommended programme is scalable, depending on the timing of future investments in rapid transit to the North Shore.

Recommended Busway Enhancements Programme

The business case recommends a series of improvements to enhance the capacity and improve the reliability of the Northern Busway. It is envisaged that the full suite of improvements will collectively enable the busway to meet projected demand and provide a high-quality service that meets customer expectations up to 2038.

The recommended option consists of the following:

- **Focused infrastructure improvements that can be implemented within a short timeframe.** This includes Minor platform length and width extensions at Albany, Constellation, Sunnynook, Smales Farm, Akoranga Stations and signal phasing optimisation and bus stop upgrades on Fanshawe Street.
- **Busway Station upgrades** aimed at significantly improving capacity, safety and reliability of all public transport services. This includes additional local bus platforms and bus circulation changes as well as new pedestrian overpasses at selected stations.

Proposed future layouts for Constellation and Sunnynook Stations

- **Extensions to bus shoulder lanes** on SH1.
- **Potential managed lanes** on SH1 as an option to add additional public transport priority without significant investment in infrastructure
- **Busway infrastructure extensions** to provide fully segregated infrastructure on SH1 and Fanshawe Street.

The enhancement programme further recommended additional **Systemwide Improvements** to optimise operations, reduce crowding and improve the quality of customer experience across the system. These improvements include

- all-door boarding,
- off-board fare collection,
- level boarding,
- headway management, and
- queuing arrangements for platforms.

The recommended programme is illustrated below:

Northern Busway Enhancements Recommended Programme

The construction cost for the Northern Busway Enhancements programme is $275m. This includes the cost of all individual components. The total cost, including a 5.7% Auckland Transport funding admin cost, is $291m.

Cost Breakdown per Horizon

Horizon	Horizon 1	Horizon 2	Horizon 3	Horizon 4
Timeframe	2021 - 2023	2023 - 2027	2026 - 2029	2025 - 2035
Capital Cost	$14m	$81m	$9m	$172m

The entire recommended programme has a BCR of 1.8. The BCR for Horizons 1 and 2, which are recommended for implementation regardless of the decision to implement an additional rapid transit connection is assessed as 4.

Staging Strategy

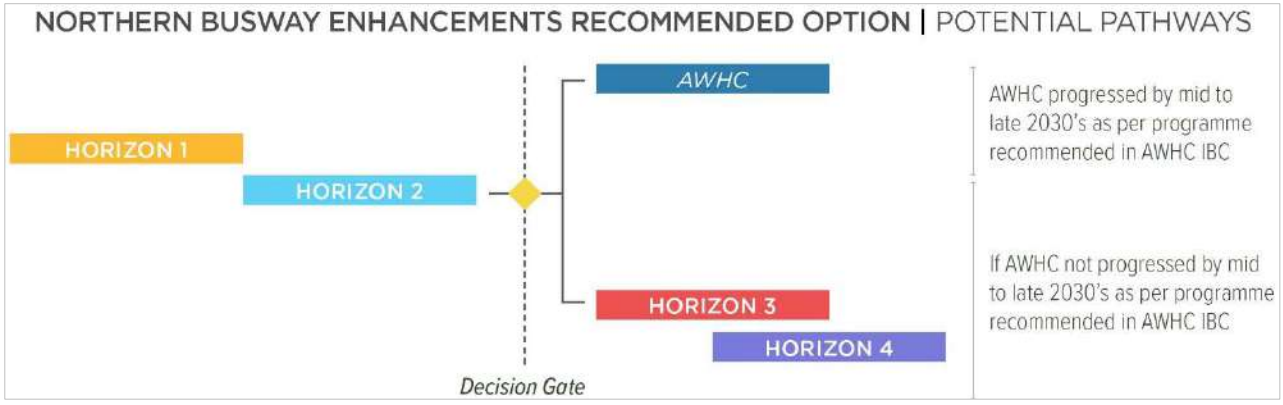
A staging strategy has been developed for the recommended programme. This strategy recognises the dependencies with other projects (e.g. AWHC/Supplementary RTN connection to the North Shore, Northern Pathway etc. as well as capital and operating budgets. The staged delivery of these interventions has several strategic benefits, including:

- It allows existing problems to be addressed and benefits to be realised in the shorter-term with less costly interventions (compared to a full-investment non-staged approach which is less attractive under current funding constraints).
- It allows for more informed decision making at each stage, assessing the effectiveness of interventions and better targeting future interventions under the programme.
- It provides the opportunity to increase value for money outcomes by targeting investment for greatest benefit, while also spreading the quantum of funding requirements over a longer period.

The staged delivery approach includes a decision gate linked to the progress of the AWHC.

The Horizon 1 and 2 interventions are considered necessary to maintain the effectiveness of the Northern Busway given the likely timing of a future, supplementary rapid transit connection.

The Horizon 3 and 4 interventions are the highest cost and risk options. Their implementation needs to be carefully considered in the content of the nature and timing of and additional, supplementary rapid transit connection. A Decision Gate is proposed prior to commitment to these improvements.



Recommended option pathways

Strategic fit

This investment is highly aligned with the GPS and supports all four priorities by:

- Improving **Safety** through a series of infrastructure improvements on the Northern Busway. This includes more segregated priority for public transport vehicles and station enhancement that improves pedestrian safety.

- Providing **Better Travel Options** by improving the transport options used to access social and economic opportunities by a large proportion of Auckland's population.
- **Improving Freight Connections** by enhancing a crucial rapid transit connection, thereby reducing pressure on the SH1 freight corridor.
- Contributing to **Climate Change** by improving low carbon transport system that supports emissions reductions, and improving safety and inclusive access

The impact of not investing

The problems identified for this business case are:

- *An existing lack of priority and infrastructure means that the busway is unable to perform optimally and not all journeys to, from and within the North Shore are well-served.*
- *Inability to effectively serve forecasted demand along the Northern Busway will result in a degradation of service quality, worsen environmental impacts and constrain quality growth.*

This business case confirms the investment programme required to enhance the capacity of the busway system to enable it to meet projected demand to the mid-2030s, where after, it is expected to be supplemented by a higher capacity mode to support its ongoing operation.

The Northern Busway is a high performing system that is key to Auckland's public transport system but is close to its effective operational limit in many areas. Without these improvements the performance of the busway will gradually degrade, which will eventually have a significant impact on the efficiency of the system and customer experience. Ultimately, this will have a negative effect on public transport mode share on this regionally significant system.

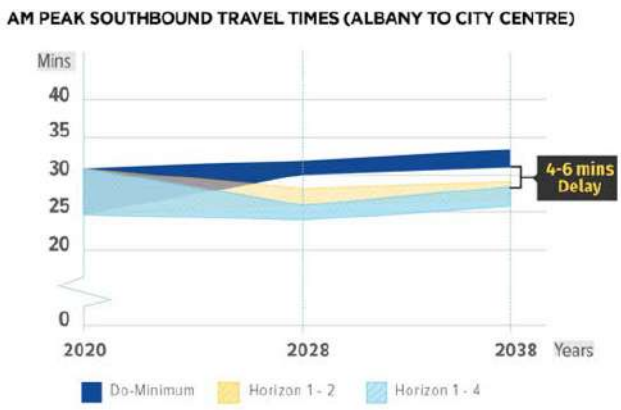
The options assessments confirmed the steady worsening of the average dwell times at each of the stations, resulting in dwell times averaging more than 60 seconds at all the busway stations. The detailed micro-simulation modelling conducted proves that increased bus volumes and patronage on the busway will lead to poor operational performance at stations. The infrastructure measures identified in the programme aims to improve the stations by increasing the efficiency and capacity to reduce dwell times.

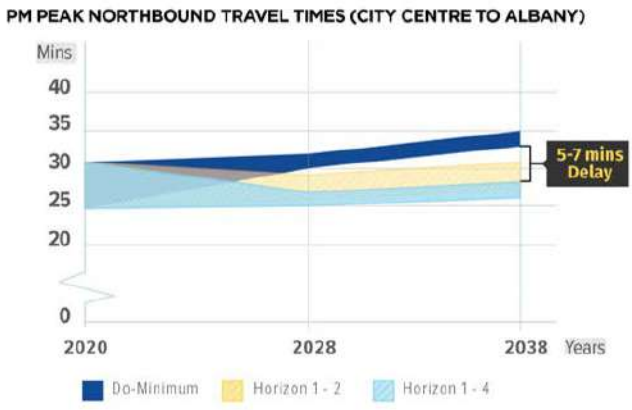
If station improvements are not implemented, the performance of the busway stations will further degrade from the mid 2020's, as limited station capacity and long dwell times lead to overcrowding on platforms and increased platooning and bunching of vehicles, which results in significant operational issues and delays in the City Centre.

While some of the performance deficiencies may be seen as "soft failures", there is a real concern that with the increased volumes, even minor operational incidents during peak hour operations (such as one bus dwelling for longer than average), will have significant and cascading effects on subsequent busway RTN buses.

Auckland's Rapid Transit Network is intended to be the highest level exemplary public transport service, that gives fast and consistent regional access, to provide a reliable and superior alternative to driving. The lack of investment will severely compromise the ability of the Northern Busway to operate as an RTN due to increased and variable travel times and overcrowded facilities.

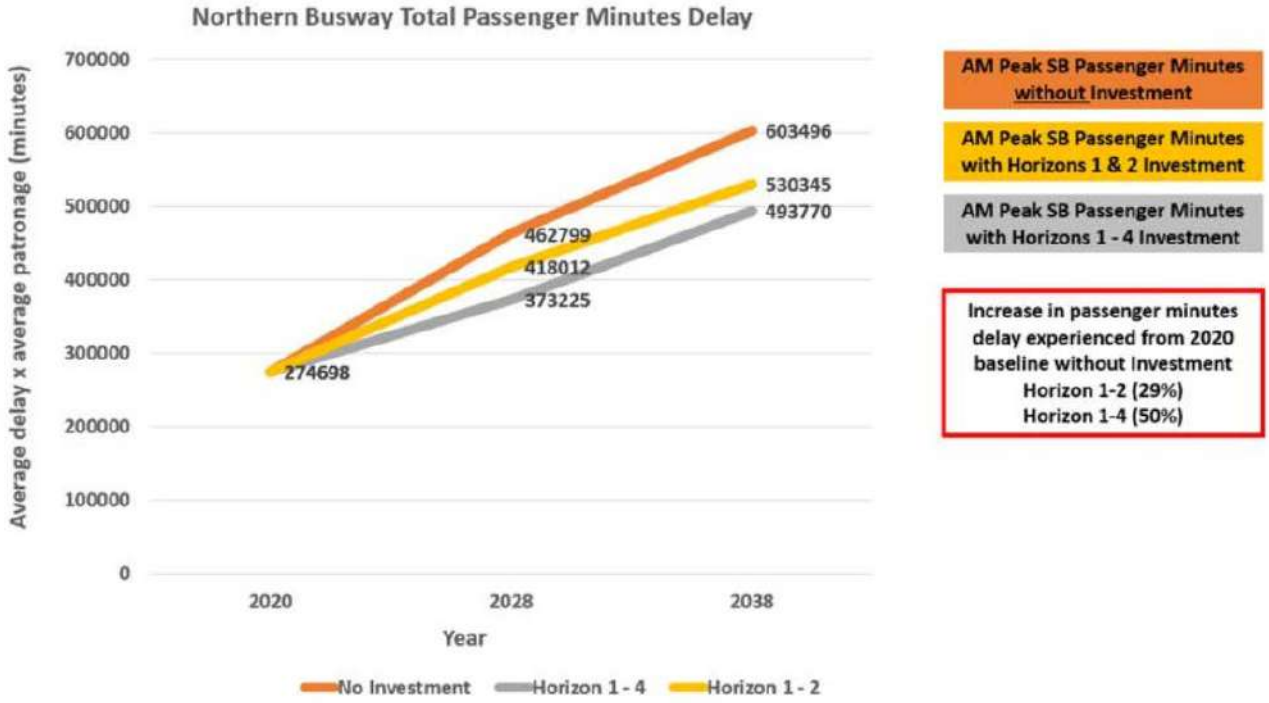
Without investment, the travel times between Albany and the City Centre is forecasted to increase by 20%.





Northern Busway travel time with and without investment

Without investment, the increase in passenger minutes delay experienced from a 2020 baseline would be 29% higher than what it would be if Horizon 1 and 2 were implemented, and 50% higher than what it would be if all horizons are implemented.



Northern Busway passenger delays with and without investment

Benefits and Objectives

The benefits of addressing these problems are expected to be that:

- Public transport continues to provide and improves competitive options for trips to, from and within the North Shore
- Access to economic and social opportunities is further improved
- The need for additional crossings of the Harbour can be delayed
- High quality growth, improved amenity and reduced environmental impacts are supported

These benefits are used as the basis for developing investment objectives and performance measures used for assessing options and alternatives:

- Retain and improve public transport competitiveness
- Improve access to economic and social opportunities
- Optimise capacity of the public transport connections to the North Shore
- Enable Auckland to achieve quality, compact growth and improved amenity

Effectiveness of the recommended programme

The recommended programme achieves the investment objectives, while enabling a staged implementation pathway to enable optimisation of the investment in the context of related projects and the performance of the busway.

This business case demonstrates that the programme can be expected to deliver benefits across all horizons. The recommended programme:

- Retains and improves the competitiveness of public transport in all modelled decades.
- Increases the number of jobs and population falling within the 45-minute public transport catchment by between 2 and 8% depending of the direction and time of travel.

- Improves the capacity of the busway system by addressing capacity constraints identified in various sections of the system and increases the modelled person throughput in all horizons.
- Improves travel times by 20% when compared to the do-minimum:
    - AM peak southbound travel times are expected to improve by approximately 6 minutes in 2026 and 5 minutes in 2036.
    - PM peak northbound travel times are expected to improve by approximately 5 minutes in 2026 and 7 minutes in 2036.
- In addition, the model estimates significant savings in greenhouse gas emissions.

Readiness for Implementation

The programme is within the mandates of AT and Waka Kotahi to deliver. Horizons 1 and 2 are primarily within AT's mandate and 3 and 4 within Waka Kotahi's mandate. Horizons 1, 2 and 3 are deliverable within existing designations.

It is intended that Horizons 1 and 2 of the Project are funded and delivered by AT, however it is intended to have representation from Waka Kotahi in the Governance structure from inception as a key stakeholder. The Governance structure may be amended as the project moves into H3 and H4 works.

The Northern Busway is complex in relation to its scale, involvement of two parties, the programme duration and the number of interfacing projects many of which are still in option development, including specifically:

- Two infrastructure asset owners
- Two Requiring Authorities (designation holders)
- Multi-year (decade) programme
- Potential multiple funding sources with funding yet to be committed.
- Interfacing projects with higher priority

These aspects relate to and influence the governance arrangements (asset ownership, legal rights, funding) and the proposed dynamic approach to managing the programme.

It is proposed that Auckland Transport are the lead agency for the delivery of Horizons 1 and 2. It is anticipated that they also be the sole funding agency given the works are primarily associated with their assets.

For Horizons 3 and 4 it anticipated that Auckland Transport will take the role of lead agency but with the support of Waka Kotahi with both parties contributing to the funding of these works.

A governance structure is proposed for the delivery of Horizons 1 and 2 which is expected to evolve should Horizons 3 and 4 be implemented due to the state highway-based assets involved. It is anticipated that a series of framework agreements will be required to support the governance arrangements and delivery of the programme through delivery of the programme.

Contents

Appendices

Figures

Tables

1 Introduction and Background

This detailed business case (DBC) focuses on Auckland's Northern Busway. The busway has been a very successful element of Auckland's rapid transit network (RTN) with passenger growth exceeding that of both the rail network and the rest of the bus network.

This exceptional growth will further increase pressure on the Northern Busway as forecasted passenger transport demand is likely to exceed the functional capacity of core North Shore–City Centre public transport corridors by the 2030s.

The DBC builds on the findings of the 2019 Additional Waitematā Harbour Connections indicative business case (IBC) to identify a programme of operational and infrastructure improvements that can be delivered within the next 10-15 years.

The Additional Waitematā Harbour Connections IBC provides recommendations as to how to address the growing level of transport demand across the Waitematā Harbour. The findings of the IBC pertaining to the busway were:

- There is an urgent need to progressively add capacity to enhance performance of the Northern Busway to meet ongoing growth in cross-harbour public transport demand, support mode shift to public transport and support the ongoing success of Auckland's city centre.
- While an enhanced busway will deliver important benefits, by the mid to late-2030s it is expected to struggle to meet growing demand. After considering a wide range of options, the preferred approach is to provide an additional rail-based rapid transit connection across the harbour that will supplement the Enhanced Busway which can continue to serve the significant ongoing residential growth to the North.

These enhancements to the busway are critical to the requirement and timing of a supplementary RTN and are the only feasible way to service this growing demand for the next 10-15 years.

1.1 Purpose

The purpose of the Northern Busway Enhancements DBC is to develop a programme of improvements to enhance the capacity of the busway system to address the current and anticipated operational deficiencies and enable the busway to meet projected demand to the mid-2030s. The DBC investigates potential options that align to government strategy, stakeholder requirements and the investment objectives of the project.

1.2 Governance and Partners

The business case is being managed by Auckland Transport (AT) on behalf of itself and Waka Kotahi NZ Transport Agency (Waka Kotahi). This work is integrated with wider strategic work programmes that address growth, development and access across the city and will attract interest from a range of stakeholders including both Waka Kotahi and AT, as well as Auckland Council, local boards, and Auckland Council Controlled Organisations (CCOs).

1.2.1 Organisational Overview

Waka Kotahi is responsible for giving effect to the Government Policy Statement on land transport 2021 (GPS), which sets out the Government's strategic direction for investment I the land transport network. The responsibilities of Waka Kotahi encompass planning and funding activities, supporting public transport, building the networks that connect communities, and ensuring the people and vehicles that use the system are safe to do so. One of the principal responsibilities for Waka Kotahi in Auckland is the effective operation of the city's motorway network.

Auckland Council is the local authority responsible for all local government decisions and responsibilities in Auckland.

Functions of the Council that are particularly relevant to this project include:

- Preparing and giving effect to the Auckland Plan, a long-term strategic document that guides the region's growth and development over the next 30 years and integrates social, economic and cultural objectives.
- Regulatory functions relating to the Unitary Plan, which is the 'rulebook' that shapes growth under the Resource Management Act 1991.

AT is a Council Controlled Organisation of Auckland Council responsible for all the region's transport services (excluding state highways) – from roads and footpaths to cycling, parking and public transport. AT is also responsible for the critical planning documents, the Regional Land Transport Plan and the Regional Public Transport Plan.

Figure 1-1: Project Partners

1.3 Previous Work

A significant amount of work has been carried out to date to address the identified issues associated with the Northern Busway and public transport within the wider North Shore and city centre area. The principal studies are listed below:

AWHC Indicative Business Case, 2019

In 2019, Waka Kotahi in partnership with AT and Auckland Council developed an IBC to investigate additional Waitematā harbour connections. The business case explored a range of options for both road and public transit connections across the harbour. The business case recommended the staged delivery of transport improvements between the isthmus and North Shore including:

- Upgrading / enhancing the Northern Busway over a 10-15-year timeframe
- Developing a rail based rapid transit between the city centre and the North Shore to supplement the busway in the mid-2030s
- Investigating SH1 capacity and resilience improvements, and potential future connections.

The indicative timing for each phase of the programme as proposed in the AWHC business case (2019) is shown in Figure 1-2. Based on previously completed projects of a similar scale and nature it is anticipated there will be a 10 to 15 year lead time to deliver the major infrastructure components of the programme (including the rail and road connection) which means the interim improvements to the busway will need to be effective until at least the mid-2030s. A design year of 2038 is used in this business case.

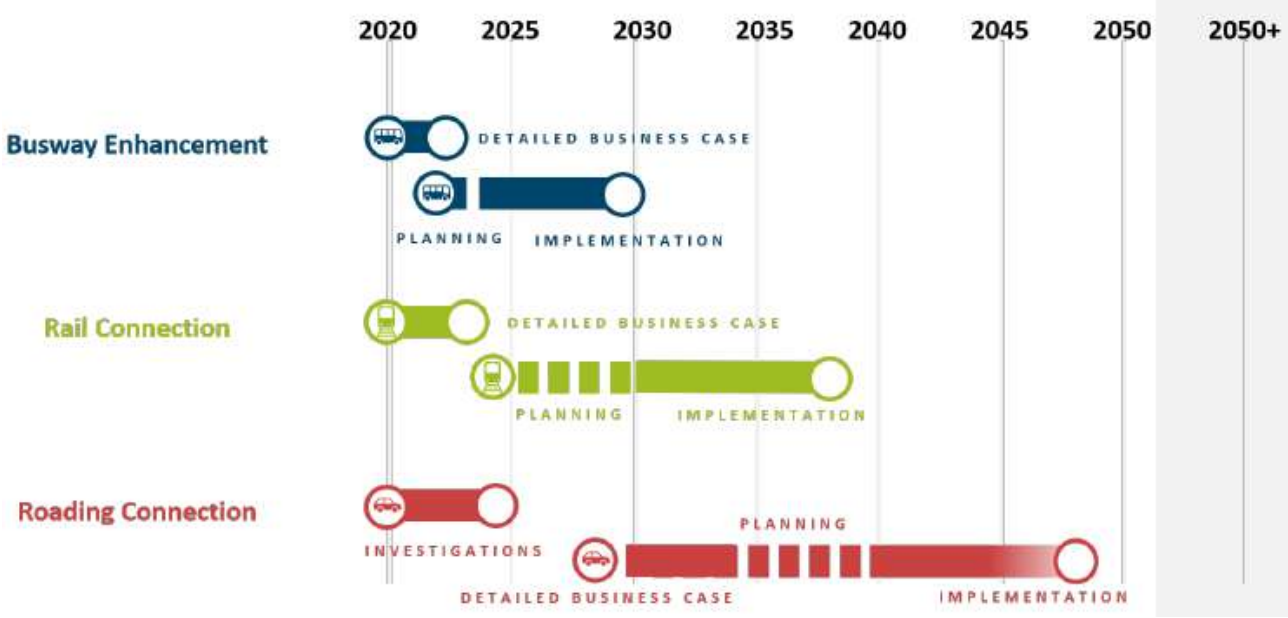


Figure 1-2: AWHC IBC indicative programme timing

North Shore Rapid Transit Programme Business Case, 2017

In 2016, AT developed a programme business case (PBC) for the development of rapid transit to the North Shore. This PBC considered a broad range of programme alternatives including demand management, land use and supply responses that considered alternative rapid transit options. The PBC concluded the existing busway would reach its effective capacity in the mid-2030s and a higher capacity system would be required after this. While the PBC outlines the problem definition, case for investment and the likely timing requirements for additional rapid transit capacity to the North Shore, it does not specify the required improvements and feasibility in depth.

City Centre Masterplan Refresh + Access for Everyone, 2020

The City Centre Masterplan Refresh included a proposal for “Access for Everyone", a new traffic circulation plan that will limit motorised through-traffic. Access for Everyone aims to reduce peak-time traffic levels within the city centre and achieve mode shift towards public transport, walking, cycling and micro-mobility.

Fanshawe Street Bus Priority & Wynyard Quarter Bus Interchange, 2016

In 2016, AT developed an IBC for the Fanshawe Street Bus Priority and Wynyard Bus Interchange project. To address the increase in city centre public transport patronage envisioned in the Auckland Plan, the IBC investigated a range of options to develop an “effective, efficient and high-quality public transport network within and to Wynyard Quarter and along Fanshawe Street”.

To provide priority for Northern Express services that use the Northern Busway (and some isthmus services), the IBC investigated eight options along Fanshawe Street in addition to the ‘do minimum’. These included options for northern, central, southern alignments, hybrid running ways, kerbside bus priority and grade separation.

A shortlist of options for Fanshawe Street were proposed to be progressed to a DBC, all with alignments serving busway routes. Options differed in the provision of kerbside alignments for certain sections due to option costs and impacts (including property access restrictions).

Other Related Policies and Plans

While these studies are the most recent and specific to the issue, there have been many workstreams of relevance to the issue. In the last ten years, the following policies and plans have been prepared and investigations taken place.

Figure 1-3: Northern Busway Related Plans

1.4 Business Case Entry Point

The point of entry for this business case is as a detailed business case (DBC). It is a direct follow-up of the 2019 AWHC Indicative Business Case.

2 Strategic Overview

This section provides the local strategic context for the project. It covers both the physical and socio-economic context and how the project aligns with the adopted direction and policies of the partner organisations.

2.1 Study Area

The study area for the business case is the North Shore of Auckland, which considers the peninsula from Albany to the city centre [1]. Within the study area is the corridor of interest where improvements will be considered as part of this project and is illustrated in Figure 2-1. The corridor of interest includes:

- The Northern Busway from Albany Station to the Lower Albert Bus Interchange (LABI), including sections of SH1 and Fanshawe Street.
- The busway stations (Albany, Rosedale, Constellation, Sunnynook, Smales Farm and Akoranga) and the areas immediately surrounding the busway stations.

The wider context area - North Auckland - extends from Orewa and Supporting Growth areas north of Albany to the city centre. However, optioneering does not consider transport infrastructure north of Albany, as supporting public transport for this area is being investigated by the *Supporting Growth* Alliance – see Section 2.8.4.

[1] For the purpose of this business case, the North Shore is considered to be the peninsula which was the territory of the former North Shore City Council, while 'North Auckland' also includes those parts of Auckland City further north including the area around Silverdale and the Hibiscus Coast which was formerly part of Rodney District.

Figure 2-1: Study Area

2.2 Future Population and Employment Growth

The Auckland Plan 2050 [2] outlines Auckland's importance to New Zealand as a whole, in social and economic terms. The Auckland Plan notes that Auckland is home to one third of New Zealand's population and contributes 40% of its gross domestic product and states *"Auckland's contribution to the economy lifts the standard of living for all New Zealanders. New Zealand needs Auckland to succeed, just as Auckland needs the rest of New Zealand."*

Auckland is home to around 1.7 million people in 2021 and this is expected to increase to 2.4 million by the late 2040s. The North Shore is proposed to accommodate a significant proportion of Auckland's growth. It is currently home to around 21% of the region's residential population. The population of the area north of the Waitematā Harbour extending to Silverdale and its surrounding growth area ('North Auckland') is forecast to increase by 85,000 from 306,000 to 391,000, (+28%) by 2038, maintaining the current share of around 20% of the region's population [3].

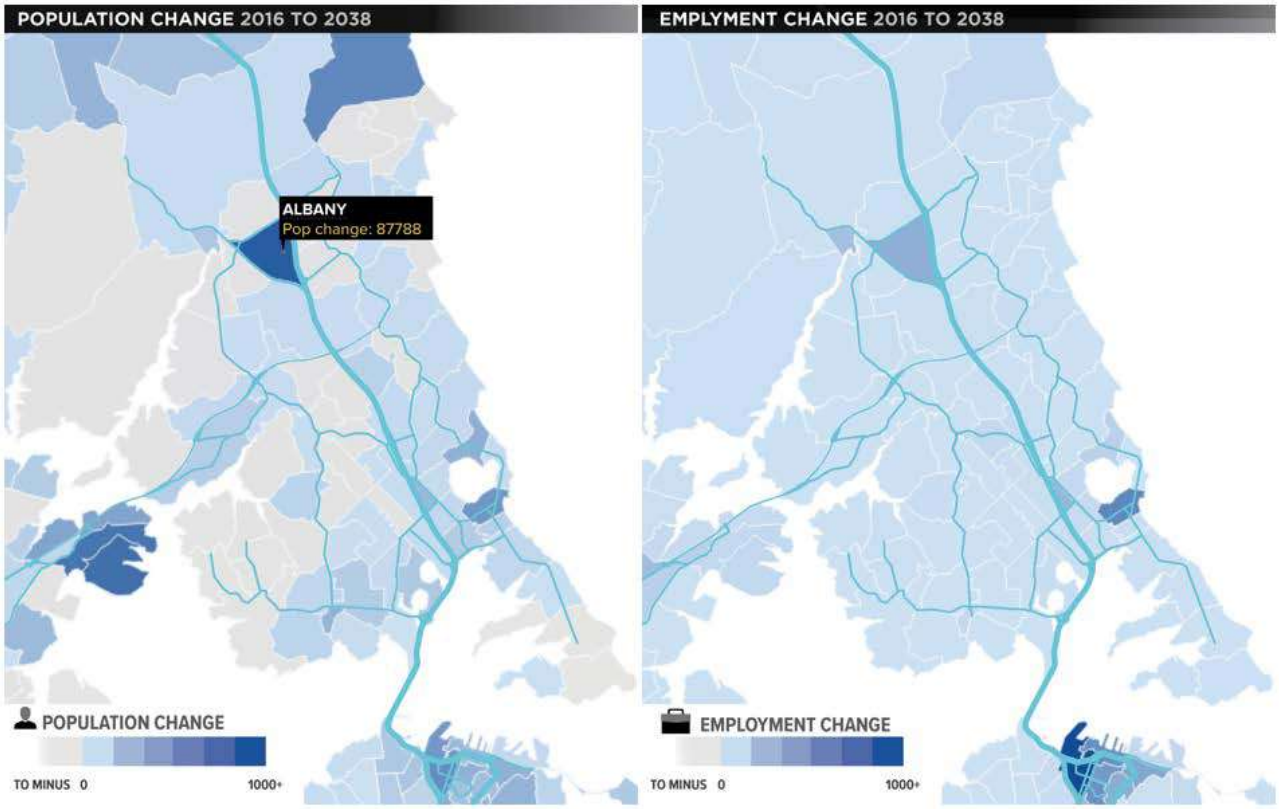


Figure 2-2: Population and Employment Change – 2016 to 2038 (MSM i11.6)

In terms of employment, the study area, including the city centre currently accounts for 250,000 (36%) of Auckland's 690,000 jobs. This is split between the North Shore providing 135,000 jobs and the city centre (including the fringe) providing 125,000 jobs. The location of jobs on the North Shore are considerably more dispersed in comparison to jobs located in the city centre and are generally spread across several medium to relatively low-density employment areas.

Figure 2-2 above presents the forecasted change in population and employment along the corridor of interest and the North Shore area. The forecasts show:

- A significant growth in population is expected in Albany and the supporting growth areas located further north (Silverdale, Dairy Flats etc) with a population increase from 6,400 in 2016 to 112,000 in 2038.
- Employment is also expected to increase within the North Shore, particularly around Albany, Takapuna and the supporting growth areas.

Overall, employment growth on the North Shore will not sustain the expected growth in population. As a result, it is anticipated a greater number of people will be travelling to employment opportunities located outside of the North

[2] Auckland Plan 2050 p 8 and 9
3 Auckland Forecasting Centre, MSM outputs, i11.6

Shore. As outlined in the Auckland Plan 2050, the city centre and fringe will continue to be key employment destinations for Auckland therefore the number of people travelling from the North Shore to access employment opportunities in the city centre and fringe is expected to increase.

2.2.1 Key Centres

In 2038 it is expected that the city centre and fringe area will remain Auckland's predominate high value, high density employment area, accounting for almost a quarter of all jobs in the region. Figure 2-3 illustrates the 44% growth expected in the City Centre.

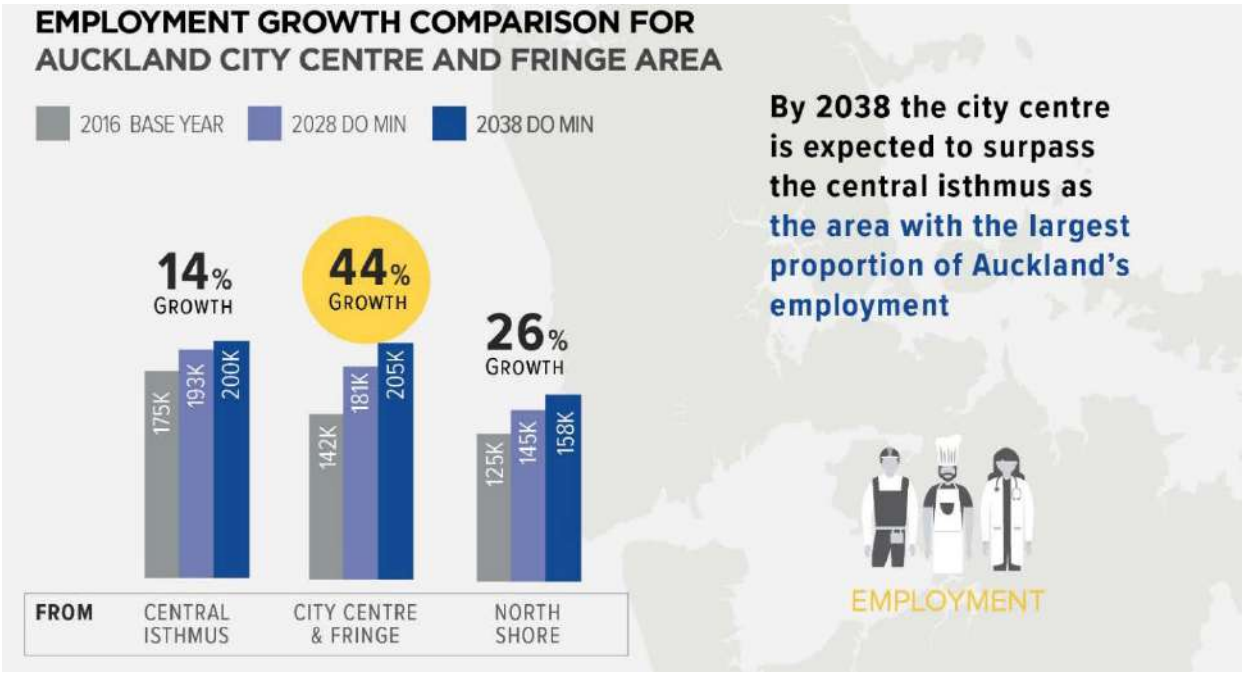


Figure 2-3: Employment and growth comparison for Auckland City Centre and Fringe area

Albany:

The Auckland Plan 2050 designates Albany as a key "node" that is critical to regional growth.

The Albany area has a long development history with planning for the urbanisation of the area beginning in the 1960s. Significant residential and business growth and intensification is expected in Albany. In time, and supported by industrial areas such as Rosedale, Albany will provide a diverse range of employment, housing, education, community, and civic facilities. Albany also performs a strategic role in supporting the future urban areas of Wainui East, Silverdale and Dairy Flat. Between 2016 and 2038 it is expected that Albany's population will increase by 8,800, and employment by 3,300.

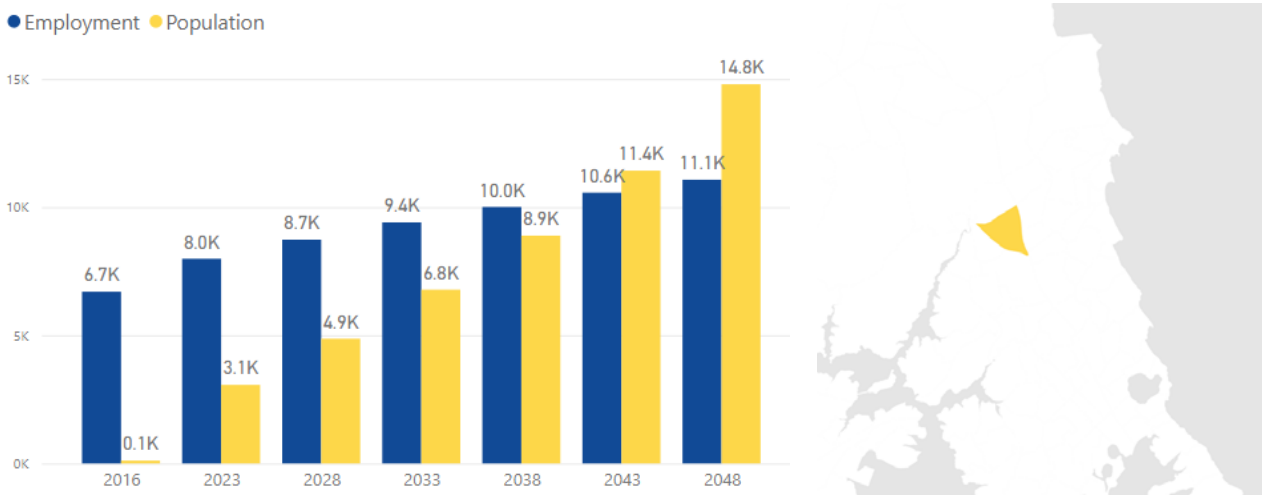


Figure 2-4: Albany Population and Employment (MSM, i11.6)

Takapuna:

Takapuna is also zoned as a metropolitan centre. Figure 2-5 below shows future forecasted employment and population. Takapuna will remain the most significant employment zone on the North Shore with approximately 16,500 jobs in 2038, up from 10,500 in 2016 or a 57% increase. Nearby Smales Farm is also expected to experience significant growth with an increase in population of 2,500 people, and 2,700 added jobs between 2016 and 2038.

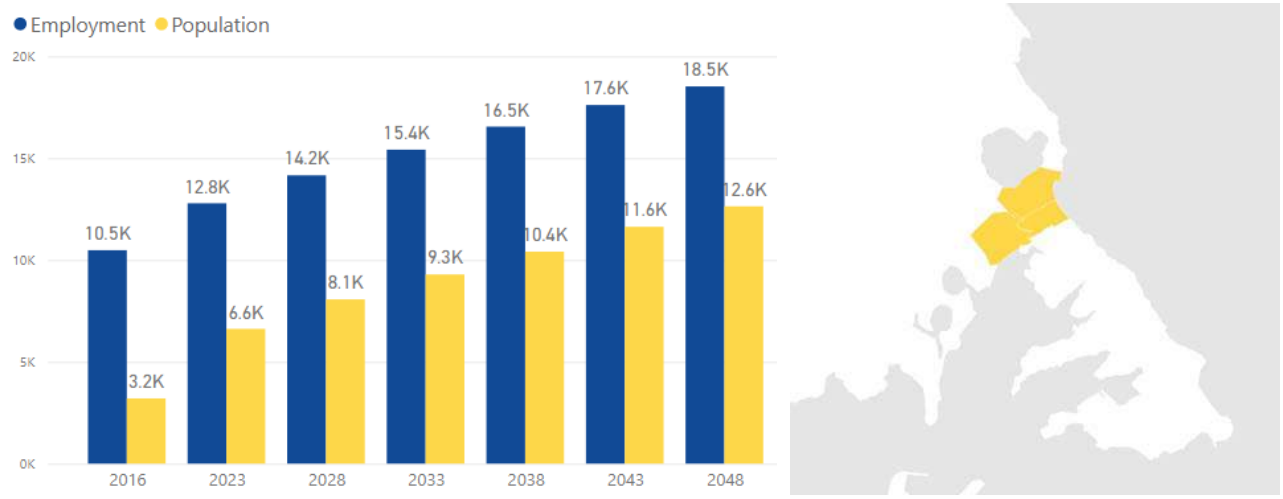


Figure 2-5: Takapuna Population and Employment (MSM, i11.6

2.2.2 Unitary Plan

Figure 2-7 illustrates the spatial distribution of various planning zones for the study area. Albany and Takapuna are zoned as metropolitan centres, enabling building heights up to 18 storeys. Rosedale and Wairau Valley are zoned for light industry business uses (purple areas).

In addition to encouraging the intensification of existing centres, the unitary plan also enables new urban growth areas around Dairy Flat, Silverdale, Orewa and Warkworth (yellow areas in Figure 2-7). These new urban growth areas are substantial and will have implications for transport demand once developed. New urban growth zones in the North-West will also mean increased transport demands on the State Highway 18 corridor between the North Shore and Westgate.

Figure 2-6: Unitary Plan (Legend)

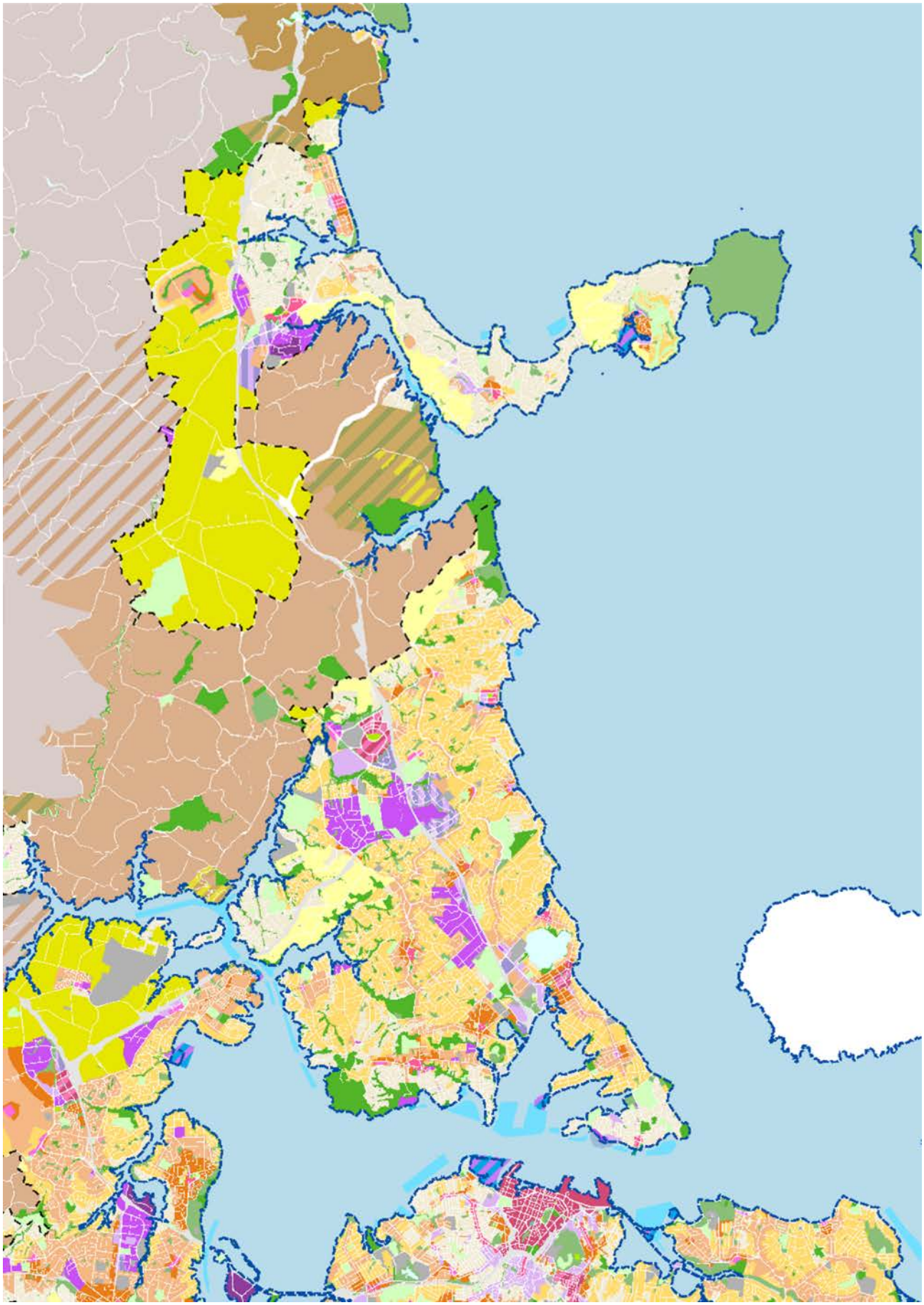


Figure 2-7: Unitary Plan

2.3 Transport Context

2.3.1 Travel Demand

Overall, the majority of trips made from the North Shore are internal trips made by private vehicles. Approximately three quarters of all trips made from the North Shore (internal and external) are made by private vehicles, this is broadly the same pattern as for all trips within Auckland.

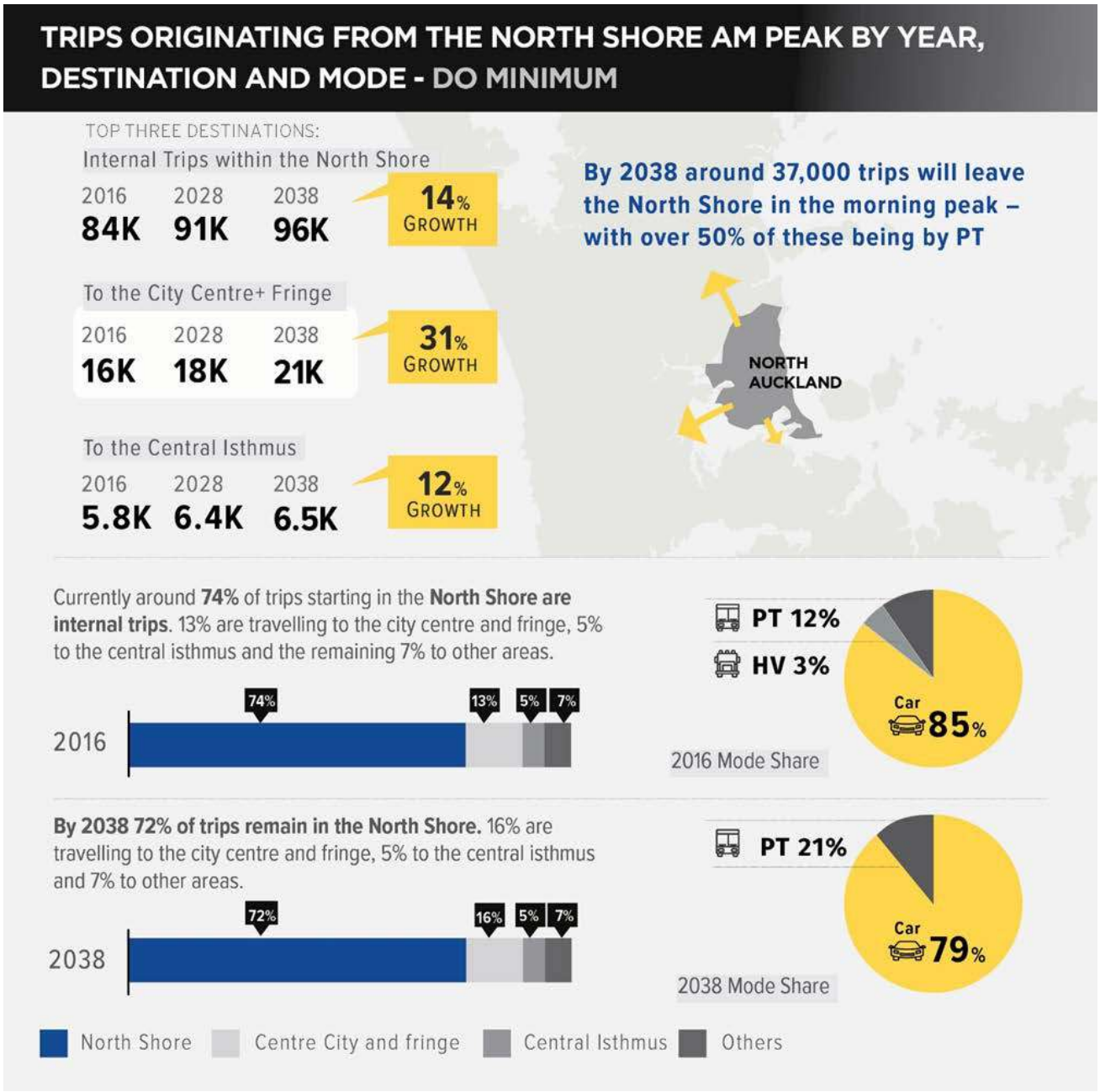


Figure 2-8: Trips Originating from the North Shore AM Peak by year, destination and mode (MSM i11.6)

Figure 2-8 shows that external to the North Shore, the majority of trips are expected to continue south across the Waitematā Harbour accessing the employment and other opportunities in the city centre and wider isthmus. By 2038 around 35,000 trips from the North Shore are expected to cross the Waitematā Harbour in the AM peak, up from 27,000 in 2016, with the majority of these trips going to the city centre and fringe and the central isthmus. The 21,000 city-bound journeys in 2038 comprise 56% of all AM peak trips that originate in the North Shore and leave the North Shore. This illustrates that the people of North Shore, now and in the future, have a large reliance on the connection to the city centre and the remainder of the Auckland region via the Auckland Harbour Bridge for jobs, education and other opportunities.

Travel external to the North Shore and in particular to the city centre is expected to grow at a significantly higher rate than internal travel.

Table 2-1: Increases in travel from the North Shore 2016 and 2038 (MSM i11.6)

Travel scenarios	2016	2038	% Change
Total travel originating on the North Shore in the AM peak	113,000	132,000	Increase of 17%
Internal trips within the North Shore in the AM peak	84,000	96,000	Increase of 13%
Trips from the North Shore to the City Centre and Fringe in the AM peak	15,600	20,700	Increase of 33%

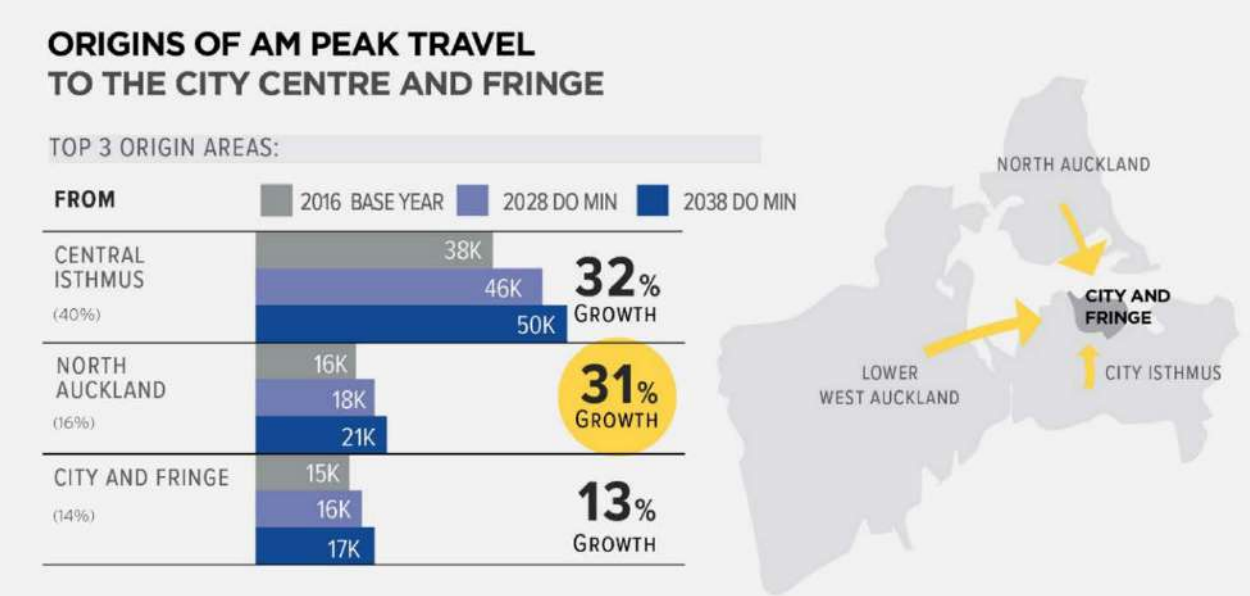


Figure 2-9: Origins of AM Peak Travel to the City Centre and Fringe

The Central Isthmus provides 40% of the city centre's workforce and is served by a total of 10 frequent bus routes on major arterials and three railway lines.

The North Shore is the next largest trip origin for the city centre and fringe, providing 16% of the city centre's workforce. In comparison to the Central Isthmus, employees living on the North Shore accessing jobs in the city centre are served by only one key connection (the Auckland Harbour Bridge).

This is significant in the strategic context given the productivity of the city centre and its important role in realising Auckland's land use objectives for a quality, compact city as expressed in the Auckland Plan 2050.

2.3.2 Transport Connections

Access to the North Shore from the rest of Auckland is currently constrained by the Waitematā Harbour which limits the available transport connections to the following corridors:

- The Auckland Harbour Bridge, which carries the highest volume of people per day on a specific corridor in New Zealand, with on average 171,000 vehicles per day (around 205,000 people assuming an occupancy of 1.2 people per vehicle) and an estimated 50,000 public transport trips, carried by 1,460 bus services a day.
- Ferry connections, which carry approximately 4,000 people in the AM peak
- The Upper Harbour bridge, which in 2048 is forecast to carry 15,000 cars and 3,000 people by bus.
- A single proposed walking and cycling connection across the Auckland Harbour Bridge.

The North Shore's connection to the city centre and isthmus is heavily reliant on the Harbour Bridge. The existing State Highway 1 (SH 1) corridor across the harbour currently only provides for general vehicle traffic and public transport service with no provision for walking or cycling. A pedestrian connection between the North Shore and the city centre

(The Northern Pathway) is currently committed to be delivered by the New Zealand Upgrade Programme with construction proposed to commence in 2022. Once implemented, The Northern Pathway will provide a connection for walking and cycling between the North Shore (Northcote Point) and the existing shared use path at Westhaven. This new facility will enhance the choice available for travel between the North Shore and city centre.

Ferry services operate from several locations on the North Shore and provide opportunities for travel choice for people with access to ferry wharves and destinations in the city centre. Ferry services currently provide 5.1% of AM peak inbound mode share to the city centre or around 4,000 people during the morning peak. It is expected this This is expected to increase in the future retaining a 5.2% share in 2048. While an important component of access in the AWHC corridor of movement, it is unlikely that ferry transport will fully resolve the scale of the access problem likely to exist in the future.

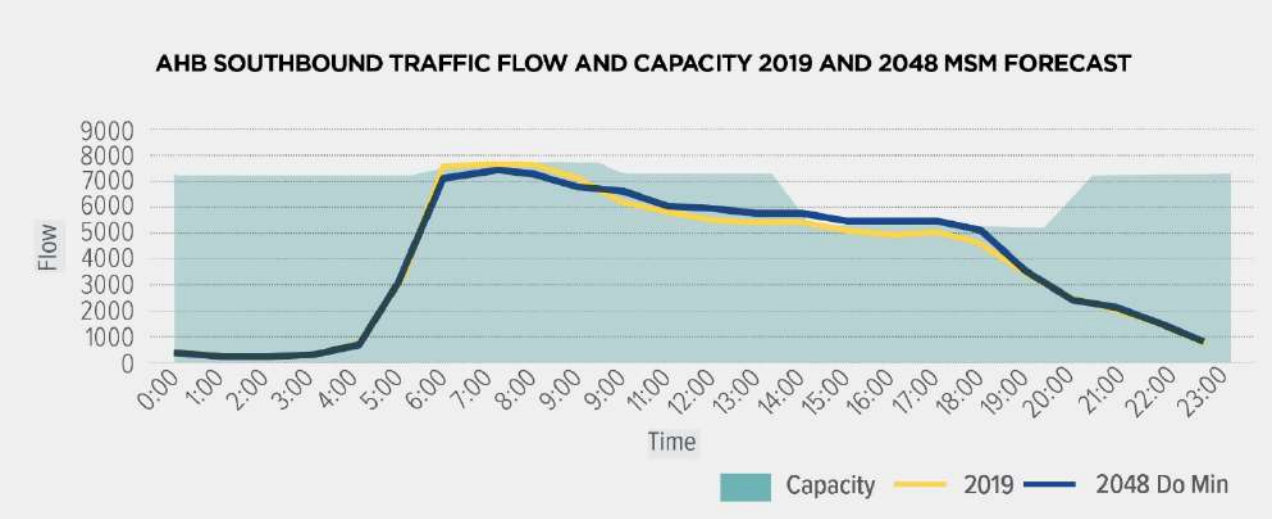
2.3.3 The Auckland Harbour Bridge

The Auckland Harbour Bridge serves a dual purpose, being part of the major state highway network (SH1) for general traffic while also serving as North Auckland's main public transport connection to the city centre and isthmus.

Previous work completed as part of the AWHC IBC confirmed the Auckland Harbour Bridge connection is current at maximum capacity at peak times with an extended morning peak period, typically commencing around 6am and continuing until 10am. Figure 2-10 below shows that the Harbour Bridge is currently at capacity in both northbound and southbound directions, during the morning and evening peak periods. These trends are projected to continue, with peak conditions continuing to spread to other times of the day.

Note that the capacity per direction changes over the day as the moveable barrier reassigns traffic lanes. In addition, the southbound peak capacity is constrained by the three southbound lanes (plus busway lane) north of Onewa Road, so is lower than the northbound peak capacity.

By the late 2040s it is expected the SH1 corridor across the Waitemata Harbour will be at 90% capacity for at least 12 hours of the day. At this level of capacity, journey times across the harbour will be long and unreliable.



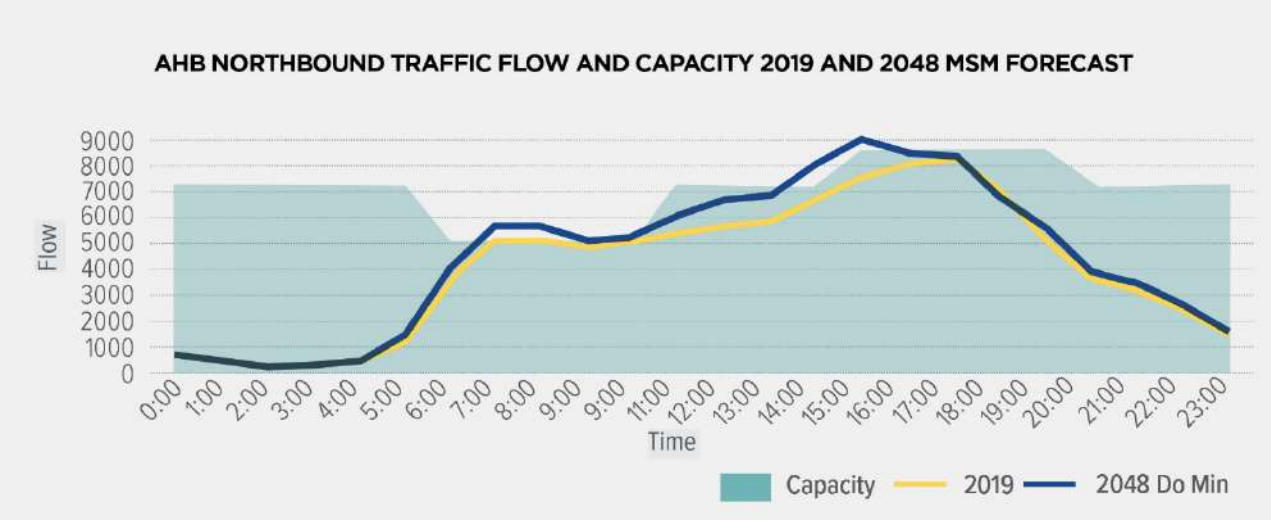


Figure 2-10: Auckland Harbour Bridge (AHB) traffic flow and capacity 2019 and 2048

2.3.4 The Northern Busway and North Shore Network

The Northern Busway system is part of Auckland's Rapid Transit Network and is the only RTN corridor serving the North Shore. The network is based on a trunk and feeder network, whereby the Northern Busway functions as the spine of the North Shore network, and other less frequent local 'feeder' services connect the wider north shore to the busway, and key station interchanges.

Three main services operate as the trunk services operating at high frequencies all day between the Northern Shore and the city centre.

- NX1 – Albany Station to Lower Albert Street. Some services start at Hibiscus Coast Station.
- NX2 – Albany Station to Midtown and Universities. Some services start at Hibiscus Coast Station.
- 866 – Albany Station to Newmarket via Ponsonby.

Onewa Road services and some Takapuna services run directly to the city centre, joining the busway at Onewa Interchange and Esmonde Road Interchange respectively. The North Shore bus network is illustrated in Figure 2-11.

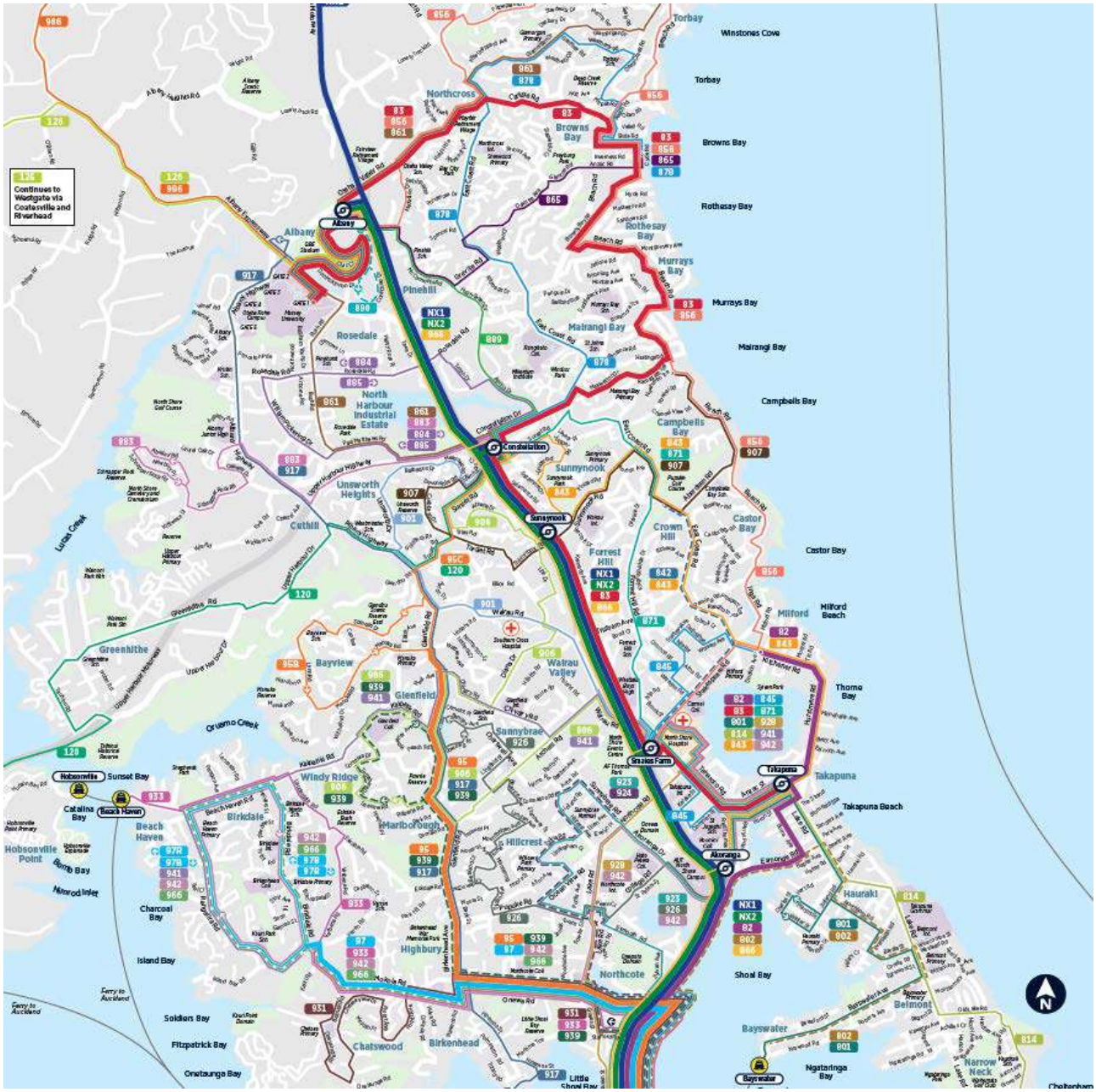


Figure 2-11: North Shore Bus Network (2021)

Table 2-2 below summarises the annual patronage for rapid transit buses operating on the Northern Busway and other public transport services across Auckland. Patronage on the busway has grown by an average annual rate of 25% growing from 1,600,000 (2009) to 8,000,000 (2019) annual passengers in only 10 years. Growth rates on the Northern Busway have consistently outpaced growth on the rest of the Auckland RTN.

The North Shore is highly dependent upon the busway, with the harbour bridge carrying 91% of all public transport from the North Shore in AM peak.

Table 2-2: Annual public transport patronage in Auckland 2006 -2019 [4]

Year	Train - (Rapid)	Busway - (Rapid)	Buses – Excluding Busway	Ferry
2006	5,596,500	519,100	42,190,900	4,202,200
2007	6,084,400	702,900	41,856,000	4,428,100

[4] AT Metro Patronage Report (July 2005 to December 2019)

Year	Train - (Rapid)	Busway - (Rapid)	Buses – Excluding Busway	Ferry
2008	7,405,100	1,305,500	44,101,200	4,332,500
2009	7,966,400	1,638,100	44,736,800	4,497,900
2010	9,106,600	1,928,100	47,921,400	4,595,100
2011	10,837,800	2,233,900	51,182,100	5,035,400
2012	10,056,600	2,239,400	51,984,200	4,813,600
2013	10,611,000	2,304,500	51,630,300	5,166,600
2014	12,515,700	2,664,600	55,451,000	5,167,900
2015	15,379,700	3,392,100	57,084,700	5,720,300
2016	18,111,200	4,590,697	56,046,003	6,039,900
2017	20,329,615	5,223,235	59,387,974	6,163,208
2018	20,722,149	6,046,815	63,091,068	6,120,558
2019	21,887,400	7,978,900	67,048,900	6,240,300
Average Annual Growth Rate	**11.39%**	**24.85%**	**3.68%**	**3.18%**

Improvements currently underway

Across the Northern Busway (including planned extensions) various projects are either underway or scheduled for the near future to address existing and anticipated issues.

Hibiscus Coast Station & Park and Ride

Status - Completed January 2021

- New bus station facility, including coffee kiosk, an AT HOP top-up machine, toilets, bike parking, and enclosed waiting areas
- Increased Park and Ride capacity
- Customer experience improvements due to amenity improvements
- Increased bus stop capacity.

Northern Corridor Improvements

Extension of fully segregated busway between Constellation Station and Albany Station (2022)

Upgrades to Constellation Station to change it from terminus to through station (2022)

Platform extensions, new northbound busway platform and pedestrian overpass

- New Rosedale Station (2024)
- Travel time and public transport reliability benefits due to 3.5km of additional segregated busway
- Capacity improvements due to platform extensions and station upgrades
- New Rosedale station provides additional capacity and reduces pressure on Albany and Constellation Station.

Cycling Facilities Improvement Programme

Status – Due for completion 2021

- Additional and improved cycling facilities at Akoranga, Smales Farm and Constellation bus stations
- New bike shelters have also been installed, allowing for more bikes to be stored inside or undercover.
- In addition to this, dedicated motorcycle parks within the park and ride area are now available at Akoranga, Smales Farm and Constellation bus stations.

Lower Albert Street Bus Interchange

Status – Completed and operational April 2021

A new bus interchange has recently opened on Lower Albert Street. This upgrade was delivered in partnership with the City Rail Link (CRL) project and Auckland Council's streetscape programme. The Lower Albert Street Bus Interchange caters for North Shore buses on the western side, and western buses on the eastern side.

- Widened high quality footpaths and improved CCTV and lighting
- Improved passenger information facilities – modern digital information boards
- Real time audio for arrival times
- Capacity improvements due to platform extensions and station upgrades.

Downtown Public Transport Infrastructure Improvements

Status - Planned completion in 2021

Part of programme aimed at improving city centre bus operation and performance. These improvements are ongoing and include the implementation of additional bus priority (eastbound bus priority on Sturdee Street between Nelson Street and Lower Albert Street, northbound bus priority on the western side of Lower Hobson Street, westbound bus lane on the southern kerb side of Quay Street and eastbound right turn bus lane for buses turning into Lower Albert Street from Quay Street)

- Upgrades of existing bus stop facilities and additional consideration for layover and circulation of buses within the downtown precinct.
- Increased reliability of public transport services in this corridor
- Additional layover capacity.

2.3.5 Northern Busway Stations

There are six busway stations located along the Northern Busway corridor. These stations are listed and described below.

Albany Station – is located to the west of SH1, immediately south of the Oteha Valley Road interchange. Albany is the busiest of the northern busway stations. The station has a significant at-grade car park area to the north of the station and a pick-up/drop-off area to the south, with limited surrounding development at present. The area is expected to see significant commercial and residential development in the future.

Rosedale Station – construction of Rosedale Station is due for completion in 2024. The station will be located on the south-eastern side of the intersection of SH1 and Rosedale Road. Local stops will be provided on Rosedale Road, with busway platforms located above on the busway structure. The station will alleviate pressure on Albany and Constellation stations and improve accessibility for local residential and employment catchments to high quality public transport. Once the station is completed, several local bus services will be rerouted to the station from Albany and Constellation to improve the overall performance of the network.

Constellation Station – is located on the eastern side of SH1 south of the intersection of SH1, Constellation Drive and the Upper Harbour Highway. Constellation functions as a main interchange point in the network, facilitating a significant number of public transport journeys within the North Shore. Construction of a northbound platform is underway as part of Northern Corridor Improvements (NCI) work and is due for completion in 2022.

Sunnynook Station – is located on the north-eastern corner of the intersection of Sunnynook Road and SH1. Local bus services operate on Sunnynook Road and are served by on street stops with access to the main station platforms provided from Sunnynook Road.

Smales Farm Station – is located on the eastern side of SH1, at the end of Shakespeare Road. Smales Farm is located within a swathe of commercial and community uses close to Westlake Girls High School and North Shore Hospital. Plan change 23 will transform Smales Farm into a growing 'mixed development' hub.

Akoranga Station – is located on the eastern side of SH1 to the north of the Esmonde Road interchange. Akoranga Station is the southern-most bus station on the Northern Busway. It serves the Northcote area, and connects areas including Takapuna and Beach Haven to the busway. Akoranga station also serves the Auckland University of Technology North campus.

In addition to the busway stations, stops located on Fanshawe Street and the Lower Albert Bus Interchange (LABI) provide important access to the busway for passengers travelling between the North Shore and the city centre.

There are a range of stops located on Fanshawe Street between Beaumont Street and Lower Albert Street that serve the Northern Express, Onewa Road, and Takapuna services.

The LABI is located at the lower end of Albert Street, adjacent to Commercial Bay and is one of the most important passenger/bus interfaces in Auckland's city centre serving over 200 buses during peak periods. LABI serves the NEX1 and Birkenhead bus services from the North Shore with 76 buses per hour currently using the interchange in the morning peak. In 2026, this will increase to 94 buses per hour in the morning peak and 99 buses per hour in the evening peak[5].

2.3.6 RTN Requirements

The Rapid Transit Network (RTN) in Auckland is characterised by the elements described in Figure 2-12 below, extracted from the RPTP. The "*Rapid"* level is the highest in the public transport hierarchy, with high frequency services operating all day (at least 7am to 7pm) every day (7 days a week) on a dedicated right-of-way.

The RPTP defines RTN and FTN services as the 'backbone' of the PT network, critical to the future expansion of transport network capacity. Under the definition outlined in the RPTP, RTN services need to be frequent, efficient, and reliable. While the Northern Busway is considered a part of Auckland's RTN, providing high frequency services (every 2 – 5 minutes during peak periods) for customers, the busway does not operate on a dedicated right-of-way for the length of the route.

[5] Auckland Forecasting Centre, MSM outputs 2026

Figure 2-12: AT's Aspirational Hierarchy of Services [6]

2.3.7 Customer Experience

A range of destinations on Auckland's North Shore and Auckland City Centre itself are accessible via bus services which use the Northern Busway stations as hubs. A wide range of customers require access to, from and within the study area not only for work, but also to access education, services, and other facilities.

While the city centre is an important destination accessible via the Northern Busway, a range of other key destinations along its route can be accessed by a number of busway stations which operate as interchange hubs for feeder bus services.

The surrounding area is developing into an economic hub both locally and regionally, with a growing agglomeration of businesses. This is coupled with substantial residential growth.

Operational deficiencies are already being observed on the busway and the local public transport system. These deficiencies are expanded upon further in Section 3. Over time, it is anticipated that worsening operational deficiencies will lead to a degradation of service and impact the overall customer experience.

2.4 Environmental Context

2.4.1 Coastal Marine Area

Any connection between the city centre and the North Shore must interact with the Waitematā Harbour which is a highly valued and sensitive environment. In recognising the importance of coastal environments, the coastal marine area (CMA) and adjacent coastline is subject to tight restrictions under the Resource Management Act 1991. The coastal marine area within the project area is largely classified under the Auckland Unitary Plan Operative in Part (AUP-OP) as a Significant Ecological Area – Marine (SEA-Marine 1 and SEA-Marine 2) overlay (as seen by the cross hatching below), requiring greater levels of care and restriction.

SEA-Marine 1 overlay are areas which, due to inherent value or physical form, are considered the most vulnerable to any adverse effects of development, while SEA-Marine 2 overlay are regionally significant areas which are more robust. The presence of SEA-Marine 1 and 2 overlays mean that special consideration must be given to the management of the effects on the values of these areas by any development or use.

[6] https://at.govt.nz/media/1979652/rptp-full-doc-final.pdf

Figure 2-13: Significant Ecological Areas of the Study Area

The New Zealand Coastal Policy Statement (NZCPS) and Unitary Plan both give a strong policy direction towards a careful and precautionary approach in the coastal environment. These documents seek to avoid reclamation within the CMA, unless there are no alternatives, and to protect the habitat of nationally significant indigenous species.

Figure 2-14: Shoal Bay SEA Marine overlays, with the M1 areas in dark blue and the M2 areas in light blue

2.4.2 Volcanic Viewshaft Overlay

Part of SH1 is subject to a 'Regionally Significant Volcanic Viewshaft' Overlay, as shown in Figure 2-15. These viewshafts seek to protect public views of volcanic cones around the Auckland Region, and impose strict rules for buildings and structures within their 'projections.'

Typically, any new structures that enter these projections are automatically non-complying activities and must be publicly notified. Typically, a non-complying activity refers to an activity not expected or appropriate within a specific area and the activity will be subject to a greater degree of assessment and scrutiny.

Figure 2-15: The portion of the E10 Volcanic Viewshaft affecting the corridor of interest

2.4.3 Coastal Inundation

Large portions of the existing Northern Motorway/Busway corridor between Akoranga Bus Station and the Auckland Harbour Bridge are within the 'coastal storm inundation 1 percent annual exceedance probability (AEP) plus 1 m sea-level rise' area.

Under Rule E36.4.1 (A54) in the Natural Hazards and Flooding chapter of the Unitary Plan, infrastructure within the Strategic Transport Corridor Zone is a permitted activity. There are no applicable standards to comply with.

2.4.4 Coastal Cliff Remnants

Coastal cliff remnants are present along the alignment, both to the north and south of the bridge. These cliffs follow the former coastline (before the motorway was constructed) and contain SEA-protected vegetation, including mature Pohutukawa. Two sites of significance to Mana Whenua are also present adjacent to these cliffs south of the bridge.

The section of motorway to the south of the Harbour Bridge is particularly constrained, both by Westhaven Drive to the north and by the coastal cliffs to the south. Any widening works in this corridor will require works to these trees, regional-level earthworks to modify the cliffs, works within the sites of significance to Mana Whenua and the loss of some public open space.

2.5 Cultural Context

Coastal areas are significant taonga (treasure) to Māori; spiritually and functionally - as a source of food (kaimoana), carving materials, and trade. The taonga status of water bodies mean that Mana Whenua are regarded as guardians for the water and its surrounding environment, imposing an obligation to protect and enhance the water's wellbeing for future generations. Currently Ngāti Whātua Ōrākei have an active pending claim with the New Zealand High Court under the Recognition orders under the Marine and Coastal Area (Takutai Moana) Act 2011[6].

Functionally the harbour has been the main anchorage area for the Auckland region for centuries. The harbour is sheltered from many storms by the North Shore resulting in slow currents. It contains some deep channels for easy navigation, and the drowned valley system means the terraces on the shore have been convenient landing areas before the official ports were created. This sailing and trading heritage is enduring, today Ports of Auckland operates as the most efficient port in Australasia[7], and the Waitematā Harbour sees hundreds of ship movements every day.

Sites of significance/importance to Mana Whenua are identified within or near to the AWHC corridor, including; Wai Kōkota and Te Tō - Victoria Park, Te Onewa (Stokes Point) pa, Te Rōutu o Ureia – Pt Erin, Motungaengae (Watchman Island) and Te Kō pua a Matakamokamo – Tuff Crater (subject of Plan Change 22 (PC22)[8]). The Onepoto explosion crater cliffs and the original shoreline and foreshore both sides of harbour (including the cliffs adjacent to the existing AHB at Northcote Point) are also noted.

2.6 Organisational Outcomes, Impacts and Objectives

The sections below give an overview of the organisational goals and outcomes sought by the Project Partners, AT and Waka Kotahi, that are of relevance to the Northern Busway Enhancements. Alignment of a project with the partner organisations' outcomes, impacts and objectives is an important indicator of the project's importance and likelihood of success.

2.6.1 Waka Kotahi – NZ Transport Agency

Statement of Performance Expectations 2020/2021

The annual Statement of Performance Expectations sets out what Waka Kotahi will deliver in the year, and how this will be measured. The 2020/2021 statement summarises the benefits of public transport.

Public transport improves customers' travel choices, increases people's access to social and economic opportunities, eases congestion and makes better use of the existing transport system. Public transport also reduces the impact of transport on the environment and contributes to reducing the number of deaths and serious injuries from road crashes. Public transport supports vibrant and liveable urban communities and effective land use.

2.6.2 Auckland Transport

Auckland Transport Statement of Intent 2020/21 – 2022/23

The AT Statement of Intent (SoI) sets out strategic transport priorities for AT for three years. The nine strategic priorities are:

- Making Auckland's Transport System Safe by eliminating harm

- Improving the Resilience and Sustainability of the Transport System and significantly reducing greenhouse gas emissions
- Accelerating Better Travel Choice for Aucklanders
- Better Connecting People, Places, Goods and Services
- Enabling and Supporting Auckland's Growth
- Focus on Financial Accountability and Benefit Realisation
- Provide an Excellent Customer Experience for all Services and Customers
- Collaborative Partnering with our Funders, Partners, Mana Whenua, Stakeholders, and Communities
- Enhance Capability of our People and Practices, Enable our Business through Effective Leadership, the Right Culture, and Efficient Systems and Processes.

2.7 Transport Policies, Strategies and Plans

2.7.1 Government Policy Statement 2021

The Government Policy Statement on Land Transport 2021 (GPS 2021) sets out the Government's priorities for expenditure from the National Land Transport Fund over the decade from 2020/21 – 2029-30. These priorities are:

- **Safety:** Developing a transport system where no-one is killed or seriously injured
- **Better Travel Options:** Providing people with better transport options to access social and economic opportunities
- **Improving Freight Connections:** Improving freight connections for economic development
- **Climate Change:** Developing a low carbon transport system that supports emissions reductions, while improving safety and inclusive access

As stated above in the Statement of Performance Expectations published by Waka Kotahi, the provision and improvement of public transport networks contributes to road safety, provides access to social and economic opportunities, and reduces the impacts of the transport sector on the environment. It is therefore considered that the DBC is fully in alignment with the GPS 2021.

2.7.2 Auckland Transport Alignment Project

The Auckland Transport Alignment Project (ATAP) is a joint project including AT, Auckland Council, Waka Kotahi, Ministry of Transport, the Treasury and the State Services Commission. It outlines a suite of projects intended to transform Auckland's transport network over the decade 2018 – 2028.

The ATAP identifies that improvements to the Northern Busway will be required and lists both the upgrades to the busway between Orewa and the city centre, and a Takapuna connection (the Takapuna spur) as future projects.

ATAP 2018

The ATAP 2018 outlines several projects that have implications for or interact with the Northern busway: ATAP commits to providing bus shoulder lanes from Albany to Orewa over the next decade, which will have potential network implications for the busway, including increased passenger volumes and vehicle frequencies and consideration of Albany as a "through" station for services originating or terminating in Orewa.

Bus priority improvements on Fanshawe Street and the extension of the Northern Busway from Constellation to Albany are also listed as committed projects over the next decade that are relevant to the North Shore corridor. The Fanshawe Street components will need to be monitored in relation to how much of this is delivered by the City Centre to Māngere LRT project, and any gaps.

2.7.3 Better Travel Choices

In December 2019 the ATAP partners published *Better Travel Choices*, a 'mode shift' plan developed in order to give guidance on interventions that will encourage a move from private vehicles to walking, cycling and public transport. Better Travel Choices demonstrates how mode shift can be supported over the next five years. In achieving this, one of the keys 'levers' is:

Making shared and active modes more attractive – improving the quality, quantity and performance of public transport facilities and services, and walking and cycling facilities.

This 'lever' is then implemented by focusing on three key areas. The areas are:

- Continuing to expand, improve and optimise public transport services
- Improving the efficiency and attractiveness of public transport through well-targeted infrastructure investments and network optimisation
- Accelerate the implementation of major bus and cycle lane programmes, as well as key rapid transit initiatives.

The busway improvements proposed in this DBC will contribute to all three of the above areas.

2.7.4 Auckland Regional Land Transport Plan

The Auckland Regional Land Transport Plan 2018-28 (RLTP) describes the priorities for the next ten years of investment in the transport network as agreed in the ATAP and sets out the funding for the projects identified.

The RLTP lists the Northern Busway enhancements within its 'Capital Programme', however it is listed here as an unfunded project.

2.7.5 Regional Public Transport Plan 2018-2028

The Auckland RPTP is aligned with recent versions of the GPS, the Auckland Plan 2050, ATAP and the Auckland RLTP in that it seeks to ensure that Auckland is served by a safe, accessible, and reliable public transport system. The RPTP identifies that having rapid transit services that can bypass or have priority through congested corridors is a key component in making public transport the preferred travel choice for Aucklanders. The RPTP states that AT regards the creation of additional bus interchanges and additional bus lanes to support the 'frequent network' as being a high priority for investment. This shows that the interim enhancements for the Northern Busway would be consistent with the aims stated in the RPTP.

2.8 City Development Policies, Strategies and Plans

2.8.1 The Auckland Plan 2050

The Auckland Plan 2050 is the "long-term spatial plan to ensure Auckland grows in a way that will meet the opportunities and challenges of the future" (AP p.5).

The plan is divided into six targeted 'areas' of which 'Transport and Access' is one. Each of these 'areas' has a desired outcome, which in the case of the area of 'Transport and Access' is – "Aucklanders will be able to get where they want to go more easily, safely and sustainably." This outcome is then further broken down into three 'directions' and seven 'focus areas. Focus Area 4 is to "Make walking, cycling and public transport preferred choices for many more Aucklanders".

Improvements to the Northern Busway will help to improve the public transport services on the North Shore and therefore encourage more Aucklanders to choose public transport over private vehicles.

Table 2-3: Auckland Plan 2050 Outcomes

Auckland Plan Outcomes		Relevance to the Northern Busway enhancements
	Aucklanders live in secure, healthy, and affordable homes, and have access to a range of inclusive public places.	Providing reliable access and quality choice of access to jobs, education and social opportunities will influence the ability to provide housing for Aucklanders on the North Shore and access for people to the places and opportunities they require.
	Aucklanders will be able to get where they want to go more easily, safely and sustainably.	Improving the performance of the Northern Busway will improve the ability of a large population of people to get where they want to go and provide them with a more sustainable alternative with fewer environmental and health impacts.
	Aucklanders preserve, protect and care for the natural environment as our shared cultural heritage for its intrinsic value and for the benefit of present and future generations	Improving the mode share of public transport supports a more compact urban form, reduces emissions and creates more environmentally sustainable growth which will assist in caring for the natural environment.
	Auckland is prosperous, with many opportunities, and delivers a better standard of living for everyone.	Improving the connectivity of productive urban centres will enable people and business to connect more effectively and meet their needs. An improvement in the quality of these connections will have a direct impact on productivity and as a result, prosperity.
	All Aucklanders will be part of and contribute to society, access opportunities, and have the chance to develop to their full potential	The ability of people to engage in society, connect with others and make use of all the opportunities the city and its community provide is influenced by the quality and cost (time and financial) of access available.
	A thriving Māori identity is Auckland's point of difference in the world – it advances prosperity for Māori and benefits all Aucklanders	Addressing transport connections between the North Shore and the city can improve Māori identity through recognising Māori culture and history and protecting taonga in design. Improving access to social and cultural opportunities will contribute to improved wellbeing and prosperity for Māori.

2.8.2 Auckland Unitary Plan

The Auckland Unitary Plan (Operative in Part) identifies some areas for intensification and others for greenfield expansion. The Unitary Plan allows for intensification around Birkenhead, Northcote, Takapuna, and Sunnynook through the creation of terraced housing and apartment building zones. The improvements to the busway and the addition of the Takapuna spur will ensure that the busway is able to accommodate this growth and continue to provide appropriate access for residents to the city centre and other areas.

2.8.3 City Centre Masterplan

The City Centre Masterplan (CCMP) is a non-statutory supporting document to the Auckland Plan 2050 and an input to the Unitary Plan and supports other Council strategies. It sets the strategic direction for the city centre for the next 20 years.

The CCMP presents a vision of a city centre that is:

- More family-friendly
- More pedestrian-friendly
- More environmentally friendly

The City Centre Masterplan Refresh included a proposal for "Access for Everyone", a new traffic circulation plan that will limit motorised through-traffic and favour public transport, walking and cycling. Access for Everyone (A4E) aims to reduce peak-time traffic levels within the city centre and achieve better mode shift towards public transport, walking, cycling and micro-mobility.

A4E requires a mode shift of approximately 11,000 people from vehicles to public transport or active modes over and above current projections for peak-time trips into the city centre. This would lead to a 75% public transport mode share into the city centre by 2030.

Improvements to public transport connections to the North Shore that reduce the reliance on and delivery of private vehicles to the city centre will be supportive of achieving these objectives through increasing mode share, reducing reliance on private cars and delivering more people to the city centre through more efficient use of valuable street space.

2.8.4 Supporting Growth

The Supporting Growth work recognises that significant transport infrastructure will we needed to support the considerable growth that is planned for the north of Auckland – from 6,400 to 112,000 population by the mid-2040s. At the heart of the planned future transport network in the Silverdale area is extension of the RTN linking Albany to Dairy Flat, Silverdale, Wainui and Grand Drive via an extension of the Northern Busway.

As a result of COVID-19, however, Auckland Council is implementing an Emergency Budget which has reduced AT's budget. This means that all projects in Warkworth, Silverdale, Dairy Flat and Wainui are delayed and have now been put on hold. When they are reinstated, they will add to the pressure on the Busway.

3 Problems and Opportunities

An Investment Logic Map (ILM) was developed at a workshop with a wide range of AT, Council and Waka Kotahi staff.

The project partners in attendance are outlined in table Table 3-1 below.

Table 3-1: Stakeholders Involved in Investment Logic Mapping Workshop

Name	Organisation
Nalisha Kesha	Auckland Transport
Daniel Newcombe	Auckland Transport
Chris Morgan	Auckland Transport
Simon Milner	Auckland Transport
Pete Moth	Auckland Transport
Luke Elliott	Auckland Transport
Steve Wrenn	Auckland Transport
Debajeet Baruah	Auckland Transport
Sujata Sinha	Auckland Transport
Susan Barakat	Auckland Transport
Sylvia Jung	Auckland Transport
Ali Rajaiy	Auckland Transport
Jane Small	Auckland Transport
Joshua Arbury	Waka Kotahi NZ Transport Agency
Hayley King	Waka Kotahi NZ Transport Agency
Alicia Taylor	Waka Kotahi NZ Transport Agency
Alastair Cribbens	Auckland Council
Steve Dudley	Aurecon
Philip de Wet	Aurecon
Andy Maule	Flow

Invitees of the ILM workshop were requested to contribute ideas and views reflecting those of their represented organisation and departmental strategies. The draft ILM was distributed to all stakeholders for comment. A completed version was distributed to the group on 13 March 2020 (refer to Figure 3-1 below).

The problems identified were:

- An existing lack of priority and infrastructure means that the busway is unable to perform optimally and not all journeys to, from and within the North Shore are well served (50%)
- Inability to effectively serve forecast demand along the Northern Busway will result in a degradation of service quality, worsen environmental impacts, and constrain quality growth (50%)

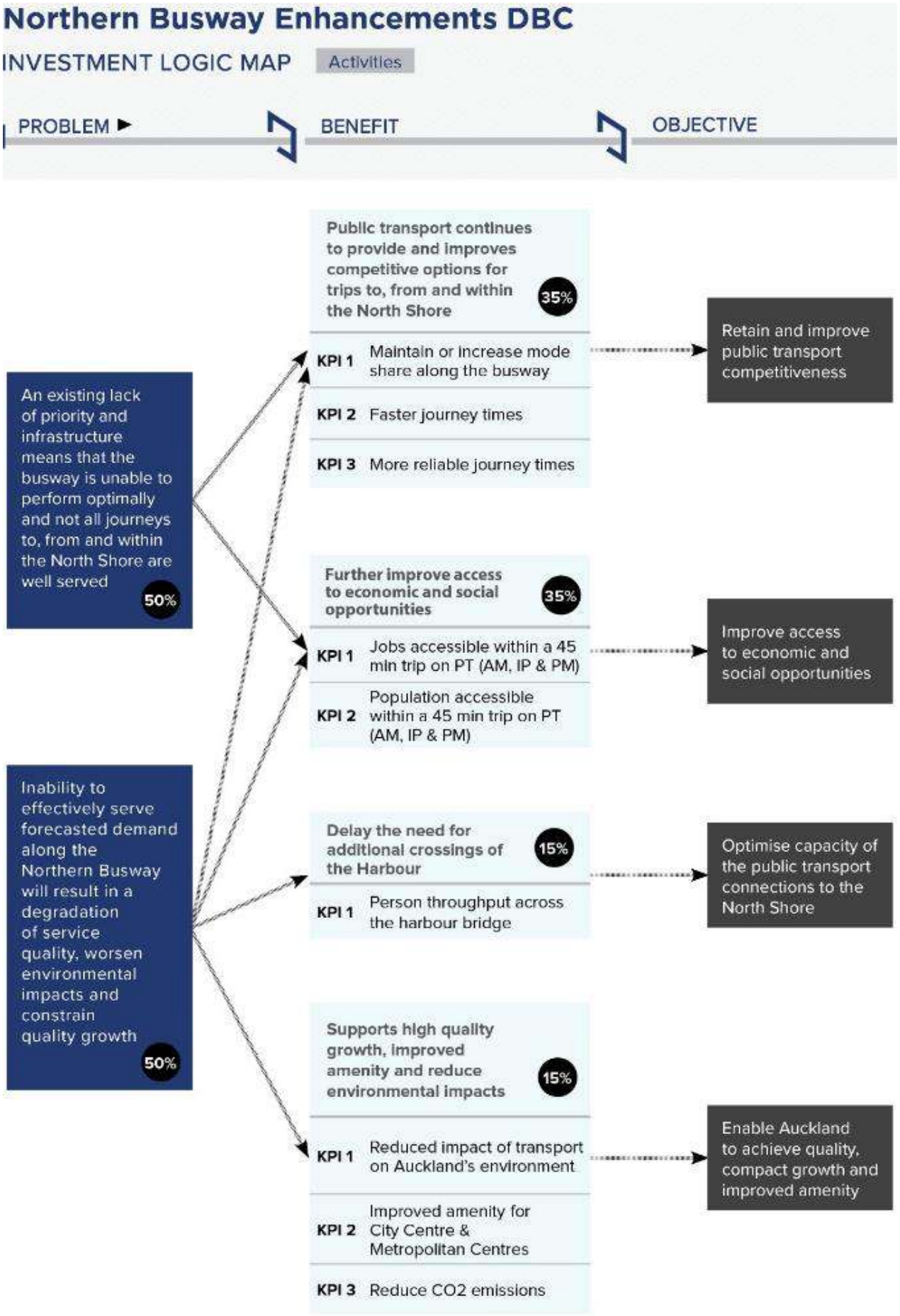


Figure 3-1: Investment Logic Map

3.1 Problem Statements

Busway performance and degradation of service quality included within Problem statement 1 and 2 refers to issue experienced at busway stations and stops, and sections of the corridor. In the case of the two problem statements, it is realised that the system is beginning to reach capacity and become less efficient, and consequently will start to fail in delivering the patronage goals of the busway and Auckland's RTN as set out in the AT RPTP. Subsequent sections of this Strategic Case provide evidence to assess the problem statements.

3.2 Status of Evidence Base

The evidence base in support of the problem statements is strong and illustrates how, without the required improvements, the performance of the busway will gradually degrade over the next two decades.

This will result in a significant impact on the efficiency of the system and the customer experience. These issues are likely to be exacerbated by the predicted residential and employment growth on Auckland's North Shore and City Centre, which will increase demand and patronage on the Northern Busway services. Consequently, the RTN services on the Northern Busway may be viewed as less attractive by customers, resulting in stalled or declining patronage numbers.

Recent investigations and business cases (Northern Busway Station Capacity Investigations 2016, NSRTN PBC 2018, New Bus Station SSBC 2018, AWHC IBC 2019) have confirmed a steady worsening of the average dwell times at each of the stations, resulting in dwell times averaging more than 60 seconds at all the busway stations.

Increased patronage on the busway is likely to lead to overcrowding and poor operational performance at stations. If station improvements are not implemented, the performance of the busway stations will further degrade from the mid 2020's, as limited station capacity and long dwell times lead to overcrowding on platforms and increased platooning / bunching of vehicles. This will lead to increased travel time variability for all busway services.

The City Centre is the most constrained section of the system. Without the planned improvements, all City Centre corridors and termini are likely to be under sustained pressure in peak times. This will lead to degraded performance, with dwell times becoming more variable, increased bunching of buses and accumulation of passengers at stops congesting waiting areas and footpaths for other users.

The City Centre sections of the corridor are affected by bus bunching caused further north in the corridor, and further constrained by signal cycle times and available street block lengths, which have finite capacity limits. If this is not addressed, the impacts to bus users would be significant, and a likely driver of mode shift away from public transport.

There is a risk that with increased volumes, even minor operational incidents during peak hour operations (such as one bus dwelling for longer than average), will have significant and cascading effects on subsequent busway RTN buses.

Auckland's Rapid Transit Network is intended to be the highest level exemplary public transport service, providing fast and consistent regional access, and a reliable and superior alternative to driving. The lack of investment will severely compromise the ability of the Northern Busway to operate as an RTN due to increased and variable travel times and overcrowded facilities.

3.2.1 Projected Growth in Demand

Ridership on the Northern Busway bus services has steadily increased over the last decade and several capacity upgrades to the busway system have occurred since its opening (or are in progress) to accommodate the increasing demand. These include the rollout of double decker buses, additional services, a new station and park and ride at Silverdale, extension of the busway between Constellation and Albany, additional park and ride spaces at Albany, a new busway station at Rosedale as well as upgrades to the Constellation Station.

The improvements resulted in spectacular ridership growth on the busway system. Since 2015, this growth rate has exceeded that of both the rail network and the rest of the bus network. Growth in annual patronage on the busway over the last five years has been 162% which has been over four times higher than the total public transport growth which has only risen by 38% since 2013.

Figure 3-2 below indicates the projected passenger and vehicle volume growth at Northern Busway Stations which indicates a 189% increase in total passenger boarding's and alighting's during the morning peak, as well as a significant increase in vehicle volumes at busway and local platforms.

The increase in vehicle volumes will also impact and increase the operational and capacity-related constraints in the City Centre.

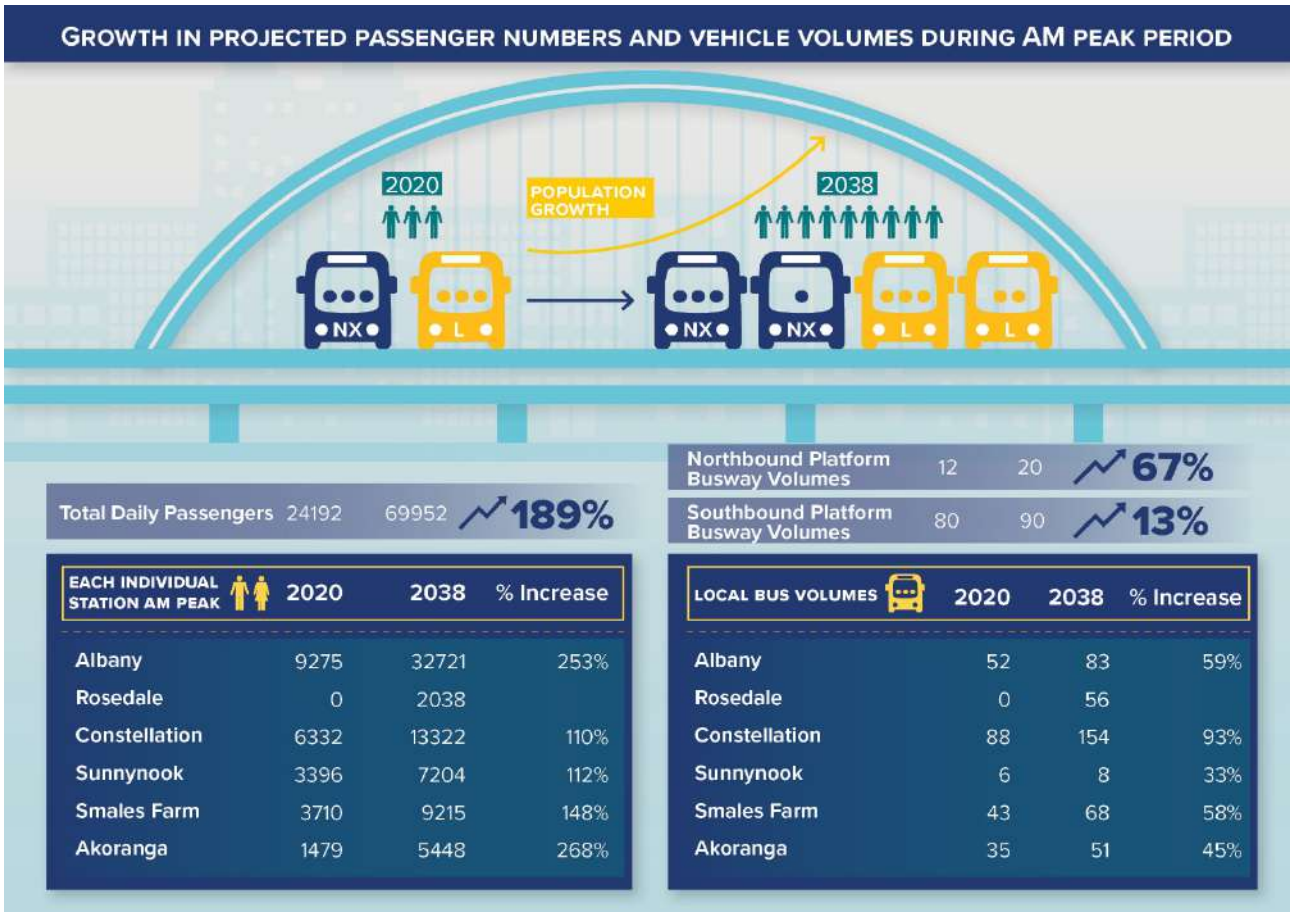


Figure 3-2: Projected Passenger and Vehicle Growth (MSM i11.6)

The 2019 annual patronage on the Northern Busway was 8 million. Forecasted modelling from Auckland's Forecasting Centre projects that this will increase to almost 22 million passengers by 2038, which represents a 175% growth in patronage.

3.3 Problem One - Evidence

An existing lack of priority and infrastructure means that the busway is unable to perform optimally and not all journeys to, from and within the North Shore are well-served.

3.3.1 Priority and Infrastructure

Figure 3-3 below shows the existing extent of bus priority provided along the Northern Busway corridor. The section between Albany and Akoranga has full priority, with lower levels of provision further south, including on the Harbour Bridge itself.

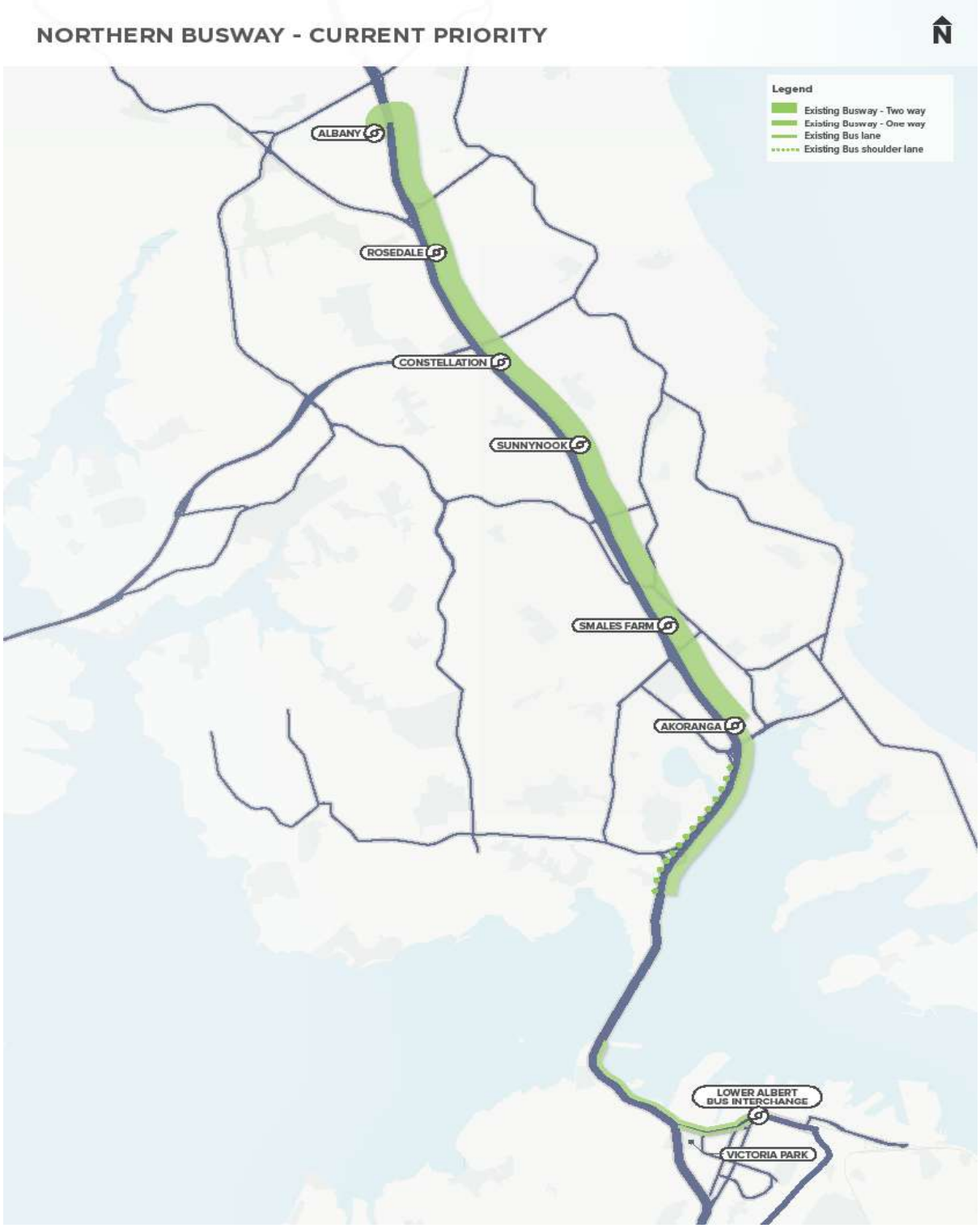


Figure 3-3: Current Bus Priority on Northern Busway (Post Completion of NCI Works)

The busway from Albany station to Akoranga station provides fully segregated priority for buses. Bus shoulder lanes are provided on sections of SH1 between Akoranga station and Fanshawe Street. The bus shoulder lanes accommodate 150 buses an hour in peak hours. The extent of the current priority on SH1 is summarised below.

- Only 46% of the seven km of SH1 corridor in the southbound direction has some form of bus priority, and since it uses motorway shoulders, it is affected by incidents on SH1
- Only 29% of the seven km corridor in the northbound direction has some form of bus priority, and since it also uses motorway shoulders, it is affected by incidents on SH1.

Within the city centre there are bus shoulder lanes provided along Fanshawe Street. There are however some gaps at the approaches to LABI and limited priority through intersections.

Figure 3-4 below shows the existing priority and forecast 2038 patronage along the length of the busway, between Hibiscus Coast and Lower Albert Street [7]. This illustrates the sections of the busway with the highest volume of people have the lowest quality of priority. It should be noted that the large reduction in patronage between the Auckland Harbour Bridge and Lower Albert Bus Interchange is due to the NX2 services serving the Learning Quarter via Wellesley Street East, and not attributable to a large number of alighting's in this area.

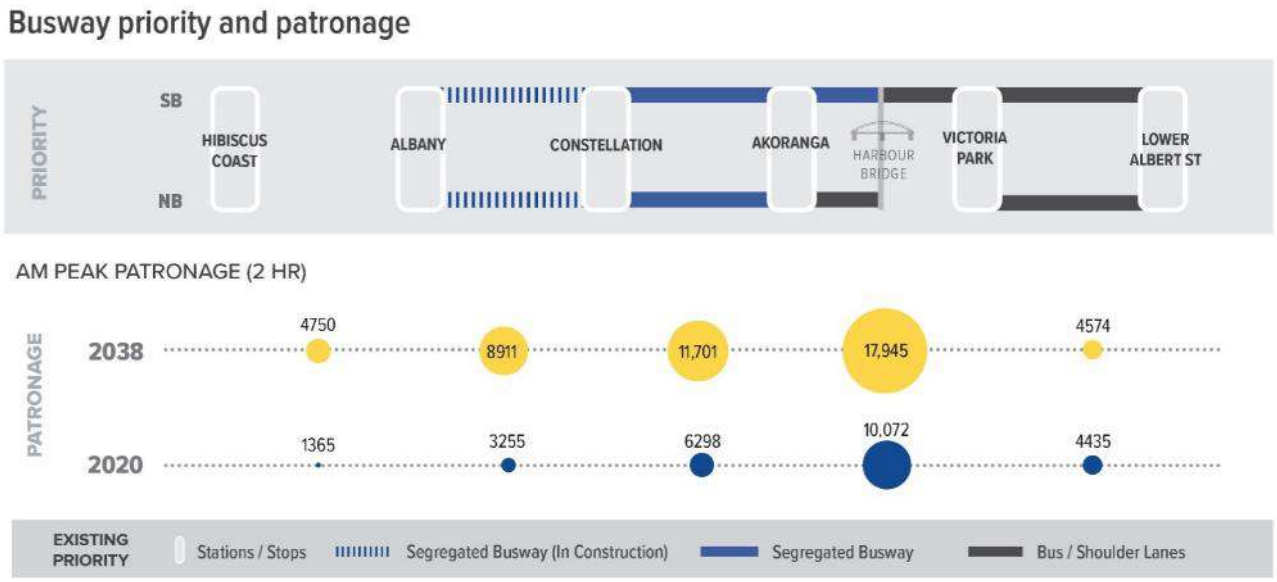


Figure 3-4: Busway priority and patronage

3.3.2 Busway Performance

Travel Time and Reliability:

Figure 3-5 below shows the travel time reliability comparisons between public transport and general traffic between Albany and the city centre, illustrating the travel time variability of public transport services in both peak periods. Research with customers conducted by AT demonstrated that reliability in the public transport system is a top concern to current non-users, a major factor in 70% of potential users "rejecting" public transport as an option.

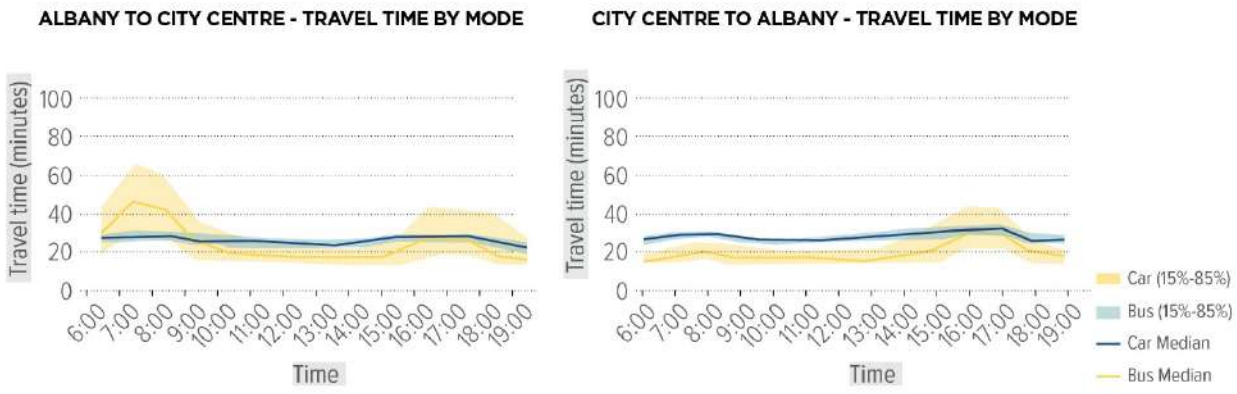


Figure 3-5: Albany to City Centre Travel Time Reliability (March 2019)

Figure 3-6 below shows the travel time reliability for three distinct sections of the corridor:

[7] Auckland Forecasting Centre, MSM outputs (i11.6)

- Constellation to Akoranga Station – the existing six km segregated busway between Constellation and Akoranga Station. Travel times include dwell times at intermediate stations (Sunnynook and Smales Farm).
- Akoranga Station to Victoria Park – This section of the corridor is approximately seven km and currently has limited priority, which includes a two km one-way busway for southbound services and sections of bus shoulder lanes.
- Victoria Park to Lower Albert Bus Interchange – This section is approximately two km in length, with bus priority lanes provided for the majority of this section. There are multiple signalised intersections and pedestrian crossings, including those along Fanshawe Street, which impacts the reliability of services.

The figure illustrates that travel times are significantly more variable, and longer during peak-times in sections with limited priority when compared to the fully segregated busway. The issue is further highlighted when considering that the busway and SH1 section is approximately the same length and that the busway travel time includes dwell times at two stations.

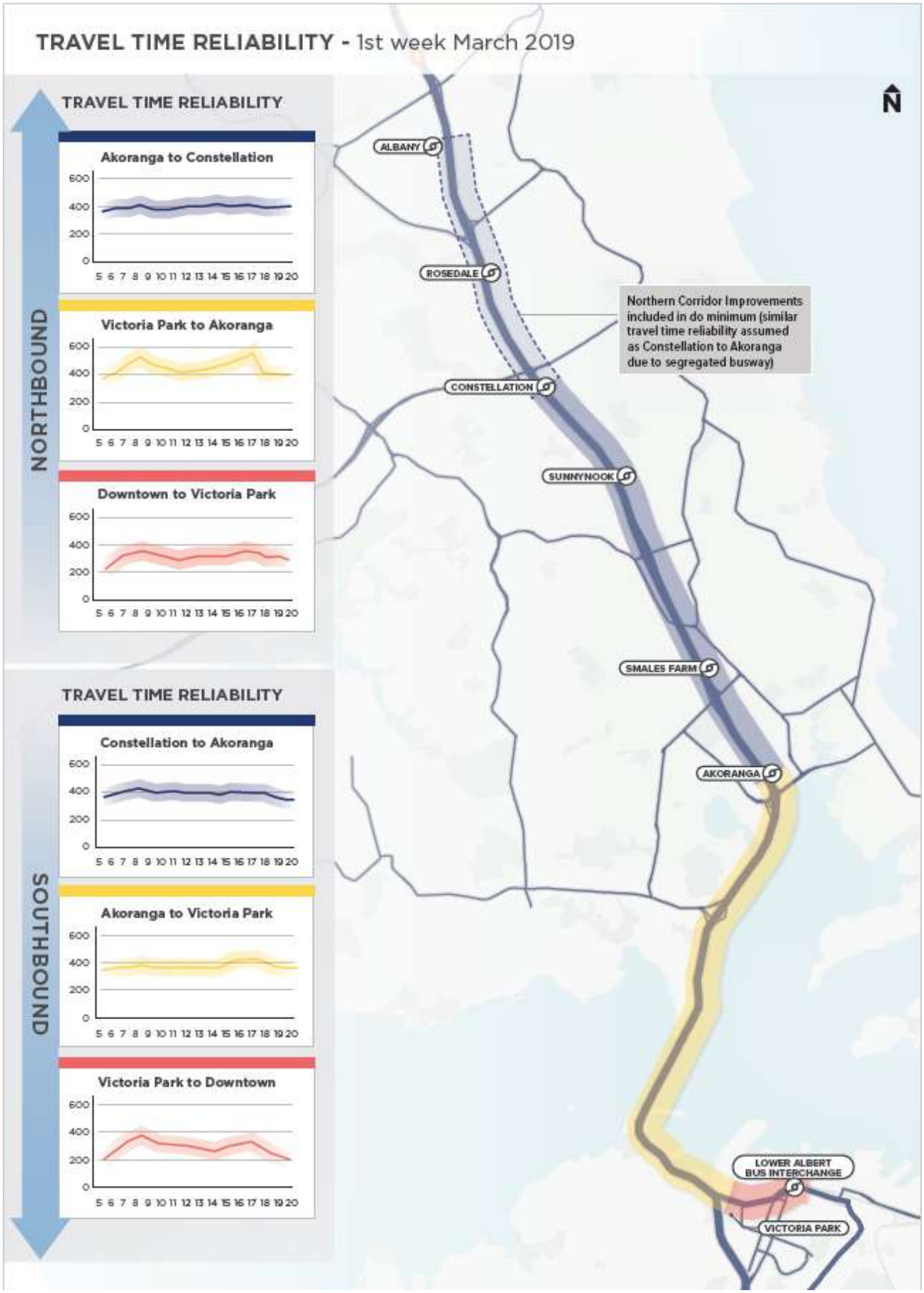


Figure 3-6: Travel Time Variability along Corridor [8]

[8] Bus GPS data provided by AT, March 2019

3.3.3 Insufficient Station Platform Capacity

As demand increases, elements of the busway – including the stations - are expected to exceed capacity, resulting in reduced levels of service and an inability to meet demand.

Currently, dwell times at Northern Busway stations range between 50 to 100 seconds per vehicles during morning and evening peaks. The long dwell times result in platooning of vehicles along the busway, which has a negative impact on the reliability of services, and customer journey times and experience. As stations reach operational capacity it is likely to lead to degraded performance, with dwell times becoming longer and more variable and an increased occurrence of bunching of buses.

Figure 3-7: Evidence of insufficient platform capacity at Sunnynook Station

The Transit Capacity and Quality of Service Manual (TCQSM) provides guidance on transit capacity, quality of service issues and influencing factors. It provides information on various types of public transportation and a framework for measuring availability, comfort and convenience from the passenger and transit providers points of view.

The TCQSM includes an evaluation tool that calculates the capacity of a bus stop or station based on a set of criteria, including dwell time, road classification, design failure rate (occupied bus stop on bus arrival), coefficient of variation of dwell time (standard dwell time deviation over average dwell time), and time. This information enables the calculation of current capacity and predict impacts of future expected growth rates.

Capacity assessments conducted as part of this business case, re-confirmed the findings of recent studies and support observation that the existing station layouts do not provide sufficient capacity for busway or local services, and will significantly degrade over the coming years with increasing bus volumes.

Table 3-2:Theoretical Platform Capacity

Southbound Platform	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038
Albany	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Rosedale	N/A	29%	30%	31%	32%	34%	35%	37%	39%	41%
Constellation	104%	107%	111%	116%	120%	124%	129%	134%	140%	146%

Southbound Platform	2020	2022	2024	2026	2028	2030	2032	2034	2036	2038
Sunnynook	152%	159%	167%	175%	184%	193%	204%	215%	227%	240%
Smales	89%	93%	98%	104%	110%	116%	123%	130%	139%	148%
Akoranga	63%	67%	71%	75%	79%	84%	90%	96%	103%	111%
Northbound Platform	**2020**	**2022**	**2024**	**2026**	**2028**	**2030**	**2032**	**2034**	**2036**	**2038**
Albany	106%	112%	117%	124%	131%	138%	146%	156%	166%	177%
Rosedale	N/A	48%	51%	54%	57%	61%	65%	69%	74%	80%
Constellation	N/A	56%	59%	62%	65%	69%	73%	78%	83%	88%
Sunnynook	76%	81%	86%	92%	98%	106%	114%	123%	134%	146%
Smales	65%	67%	70%	72%	75%	78%	81%	84%	87%	91%
Akoranga	104%	109%	115%	121%	128%	135%	144%	153%	163%	174%
Local Platforms	**2020**	**2022**	**2024**	**2026**	**2028**	**2030**	**2032**	**2034**	**2036**	**2038**
Albany	122%	128%	135%	141%	147%	157%	166%	175%	184%	193%
Rosedale	N/A	41%	45%	49%	53%	57%	62%	67%	73%	79%
Constellation	132%	76%	80%	85%	90%	95%	100%	105%	111%	116%
Sunnynook	8%	8%	9%	10%	10%	11%	12%	13%	14%	15%
Smales	56%	61%	67%	72%	78%	84%	91%	98%	105%	113%
Akoranga	41%	43%	45%	47%	49%	51%	53%	55%	58%	60%

0 – 50%	Well within capacity
50 – 80%	Within capacity
80 – 100%	Close to capacity (experiencing operational issues)
Over 100%	Exceeding capacity

3.3.4 Dwell Time Variability

There is currently high variability observed in the bus dwell times at Albany, Constellation, Smales and Sunnynook stations, which indicates a poor level of service in terms of reliability of waiting times experienced by waiting Northern Busway passengers, leading to deteriorating customer experience. Dwell times refer to the length of time a bus is stopped at each station or platform. Dwell times include the time taken for passenger boarding and alighting and the time for the bus to arrive at the loading and unloading area.

Dwell time surveys were undertaken in March 2019 for southbound services at the five Northern Busway stations in the AM and PM peak hours. The following data was gathered from the surveys:

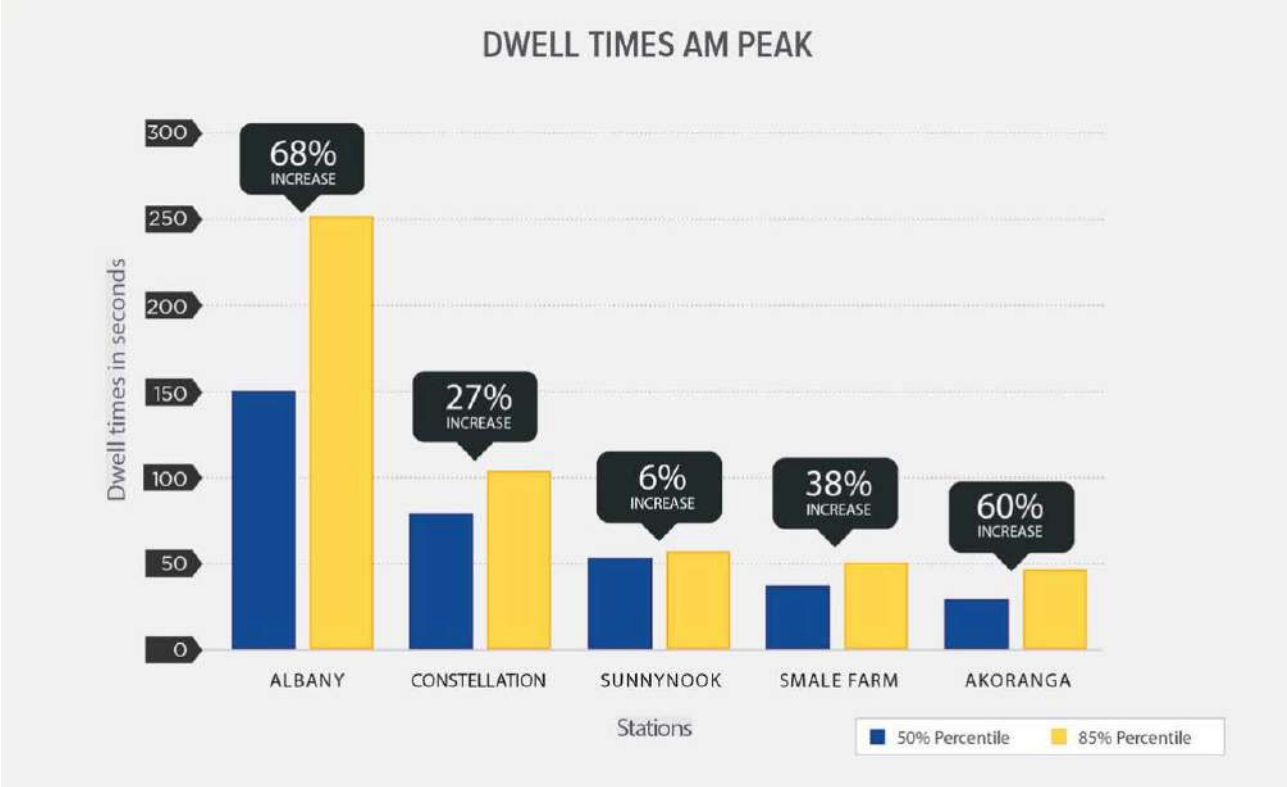


Figure 3-8: Bus Dwell Times AM Peak, Dwell Time Surveys (March, 2019)

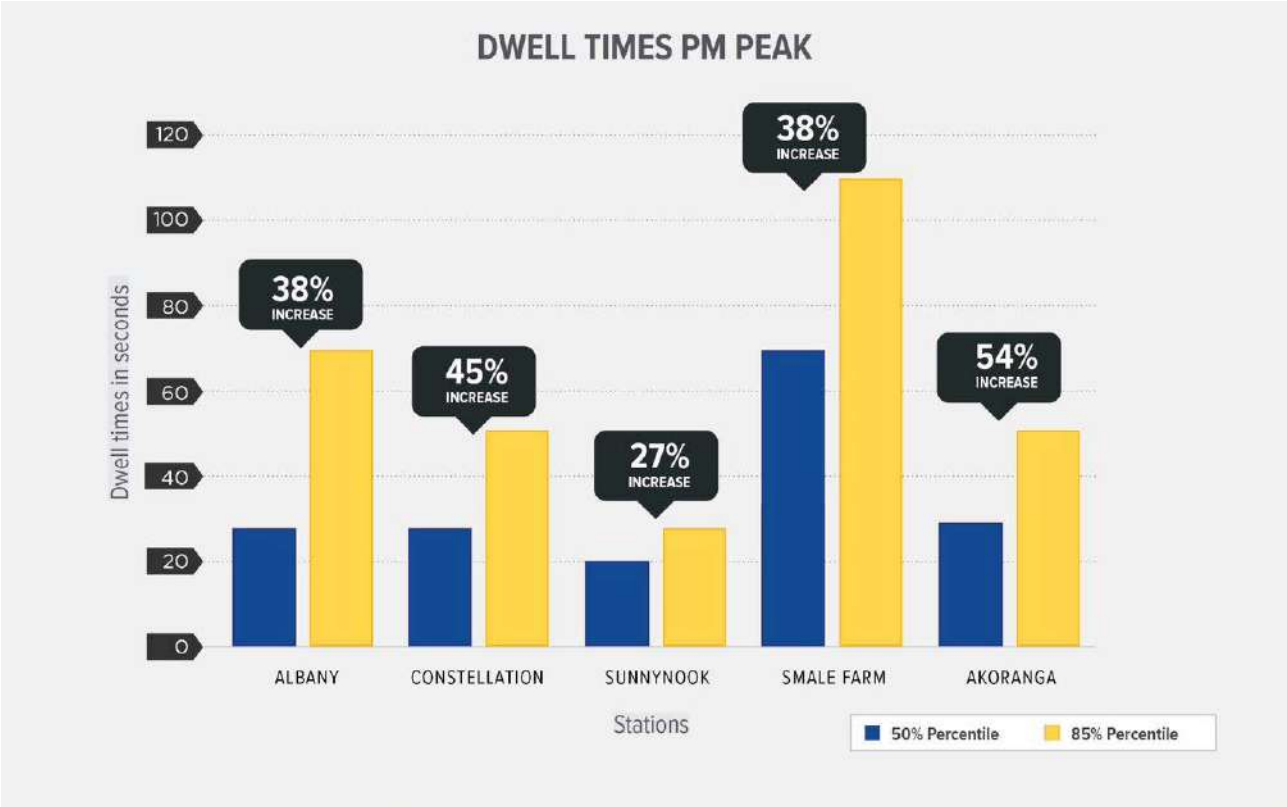


Figure 3-9: Bus Dwell Times PM Peak, Dwell Time Surveys (March, 2019)

The evidence shows the significant variability during morning and evening peaks. Albany Station experienced the longest dwell times and greatest variability in both peaks. Dwell time variability negatively affects the overall predictability and reliability of individual bus services with compounding effects for bus timetables, therefore degrading the level of customer experience. Dwell time variability also further reduces platform capacities by one bus delaying other buses

from entering platforms, as buses are stopped for longer and variable lengths of time at each station or platform. This in turn affects effective bus station capacity.

3.3.5 Operational Issues due to busway station layouts

Trunk and local feeder bus services share platforms at Albany Station, which results in conflict between local and busway services. This issue is also experienced at Constellation, Smales Farm and Akoranga Station, where local buses circulate via the busway to access local platforms and layover bays. The conflict leads to significant delays, safety issues, and further constrains capacity.

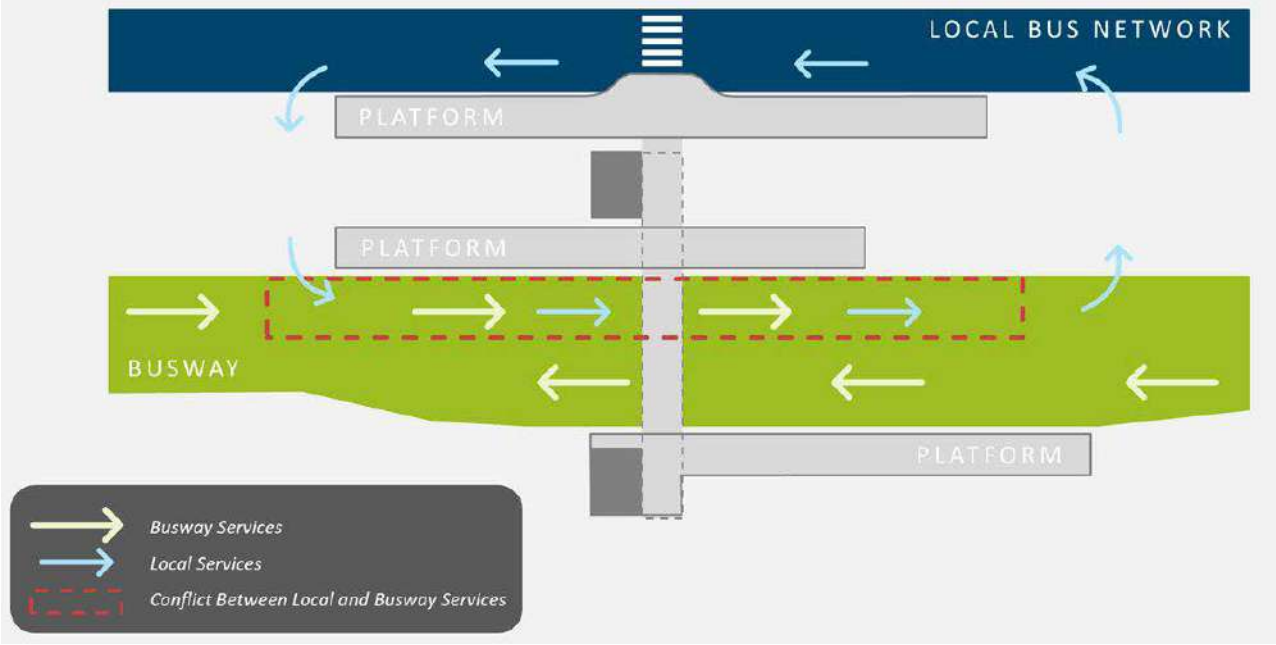


Figure 3-10: Typical Station Layout and Bus Circulation

The flow of pedestrians across the path of circulating buses via the existing at grade pedestrian zebra crossings is also an element impacting busway service operations. These crossings provide priority to pedestrians and introduce delay to all buses. In addition, the crossings increase safety concerns, particularly when buses are queued due to insufficient stop capacity, or when pedestrians rush across the crossing to board a departing service.

Evidence of operational issues – CCTV

CCTV footage supplied by AT provides evidence of significant operational issues experienced at busway stations during both morning and afternoon peaks.

- Specific conflict points between busway and local services
- Specific conflict points between pedestrians and buses
- The delay to buses from pedestrians crossing (crossing duration).

Albany (with two crossings and a third being planned), Constellation, Smales Farm and Akoranga Stations have at-grade pedestrian crossings that give priority to pedestrians to access busway platforms. CCTV footage from 30 June 2020 confirmed the extent of the delays caused by pedestrians.

The maximum delay to buses was surveyed as 1 minute 15 seconds at one of the crossings, with the average delay to buses being between 10 to 20 seconds depending on the length of pedestrian crossing.

The results of the survey are shown in the figure below and illustrate the majority of pedestrians take between 12 and 20 seconds to clear crossings. While apparently short, such impacts are cumulative with this time adding to the variable delay to circulating buses, which compounds to cause bus bunching and unreliability.

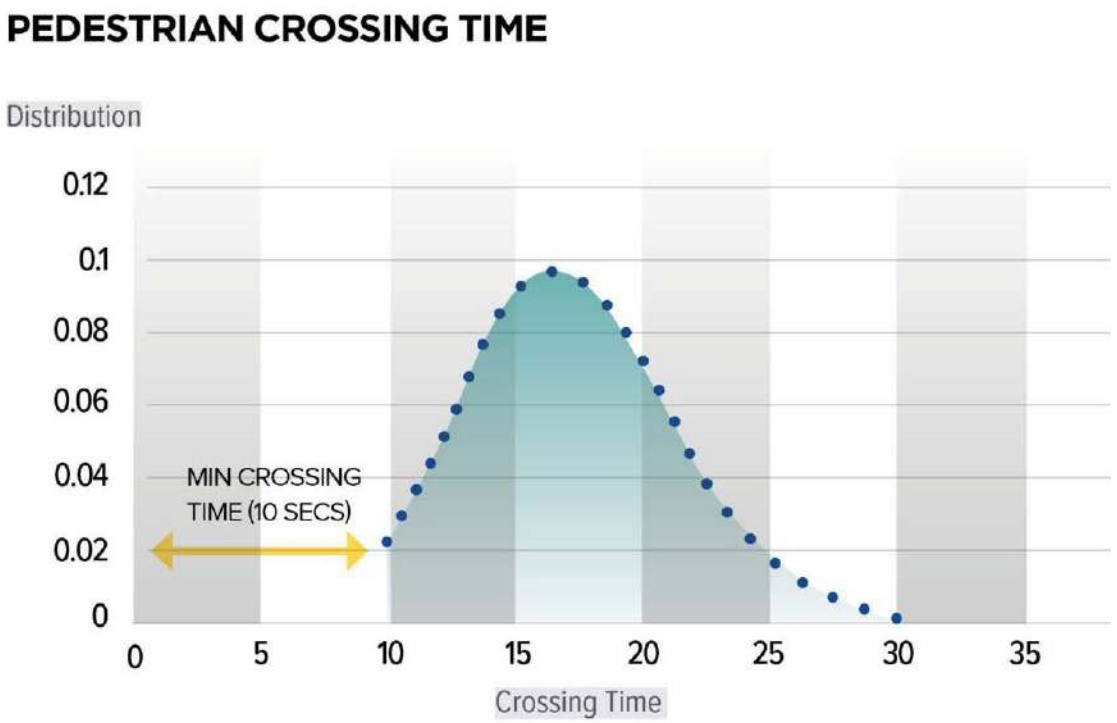


Figure 3-11: Average Pedestrian Crossing Time

This operational problem will worsen in future due to the projected increase in passengers and vehicles at stations.

Figure 3-12: Constellation Station – Operational Issues / Conflict

Figure 3-13: Constellation Station – Operational Issues / Conflict

Figure 3-14: Albany Station – Buses delayed by pedestrian crossing

Figure 3-15: Constellation Station – Buses delayed by pedestrian crossing

Evidence of operational issues - micro-simulation modelling

A micro-simulation model of the Northern Busway between Albany and Akoranga station developed for this business case further provides evidence of the way operational issues at stations are likely to grow. The model, validated and reviewed by AT's Forecasting Centre confirmed that the busway stations will increasingly be susceptible to operational issues related to:

- bus stop capacity caused by the frequency and number of bus services (through routes and local services)
- dwell times associated with ticketing and boarding operation
- station circulation requirements for local bus services, and
- conflicts between at-grade pedestrian facilities and future bus station operation.

Figure 3-16: Albany Station – Example of operational issues in 2028 with no interventions (AM peak)

Figure 3-17: Albany Station – Example of operational issues in 2038 with no interventions (AM peak)

Figure 3-18: Constellation Station – Example of operational issues in 2028 with no interventions (AM peak)

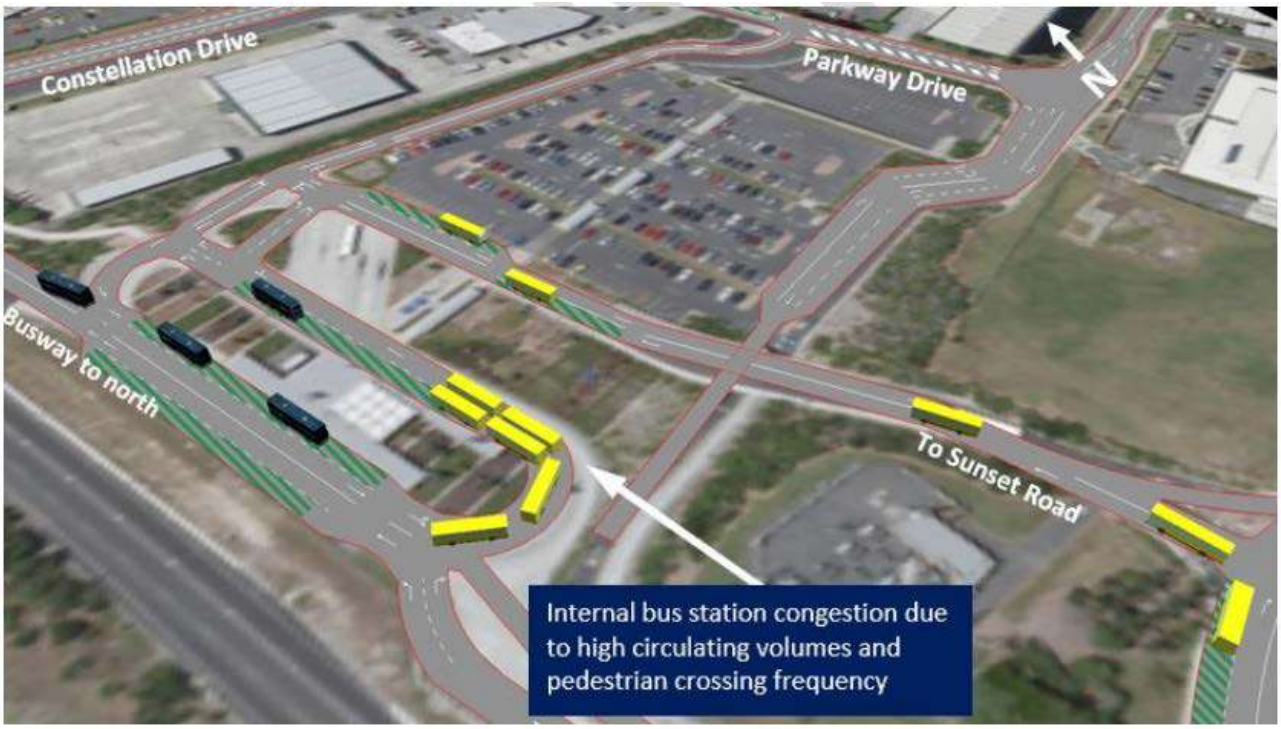


Figure 3-19: Constellation Station – Example of operational issues in 2038 with no intervention (AM peak)

3.3.6 Accessibility

The performance of the current public transport and road network for passenger trips has been assessed using an analysis of travel time and accessibility between Albany, Takapuna and the city centre (Midtown). Isochrones have been calculated based on 2038 AFC MSM model travel times.

While public transport quality has improved in recent years, accessibility levels using private vehicle modes remain higher for most parts of the North Shore.

Accessibility travel time isochrones for travel to Albany (shopping centre) by bus and car are illustrated in Figure 3-20. This shows a far greater number of origins are within 30 minutes travel time by car to Albany compared to travel by public transport. The analysis shows the benefit of the busway in providing pockets of enhanced accessibility by public transport as far south as Akoranga.

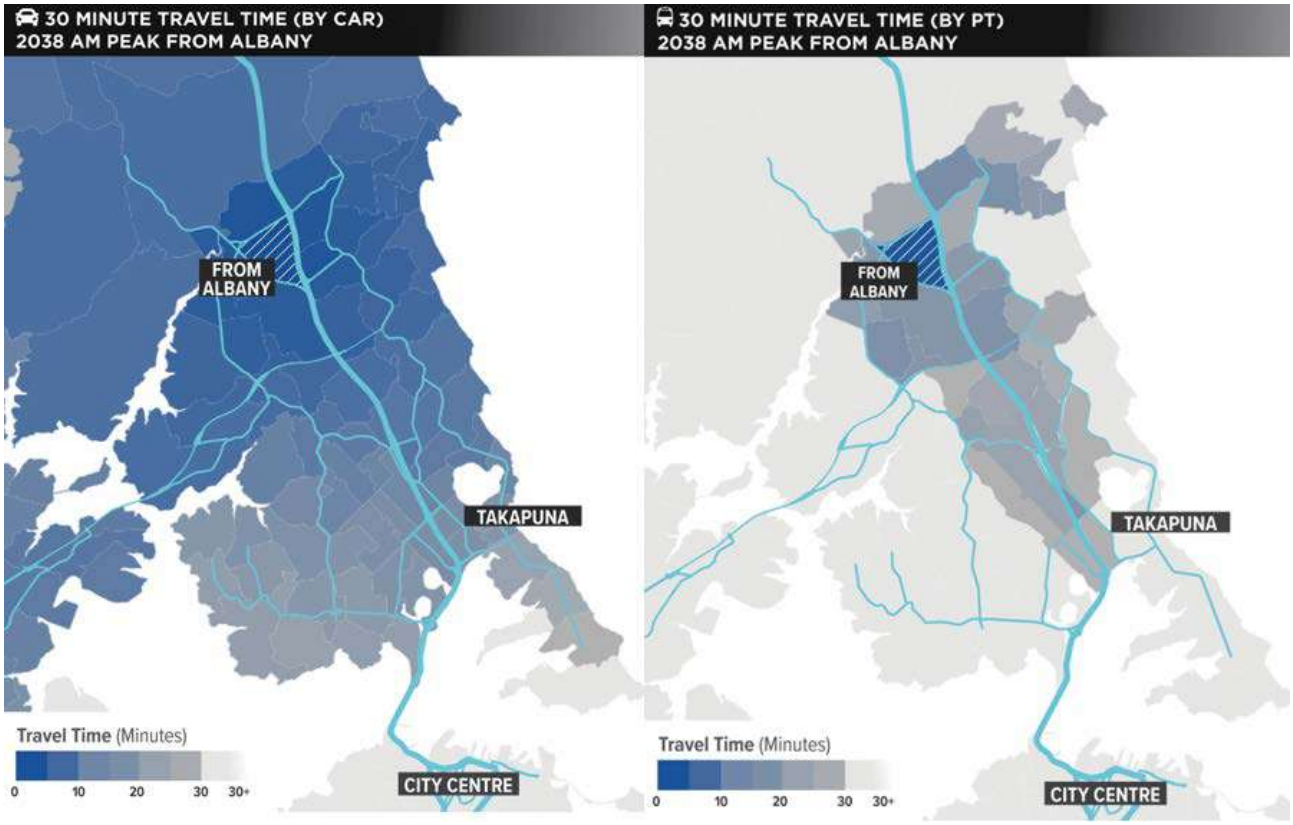


Figure 3-20: Travel Time Isochrones – Albany

Accessibility travel time isochrones for travel to Takapuna by bus and car are illustrated in Figure 3-21. Again, this shows a greater number of origins are within 30 minutes car travel time to Takapuna compared to travel by public transport. However, there is a clear corridor of enhanced accessibility by public transport to the north, corresponding with the busway corridor.

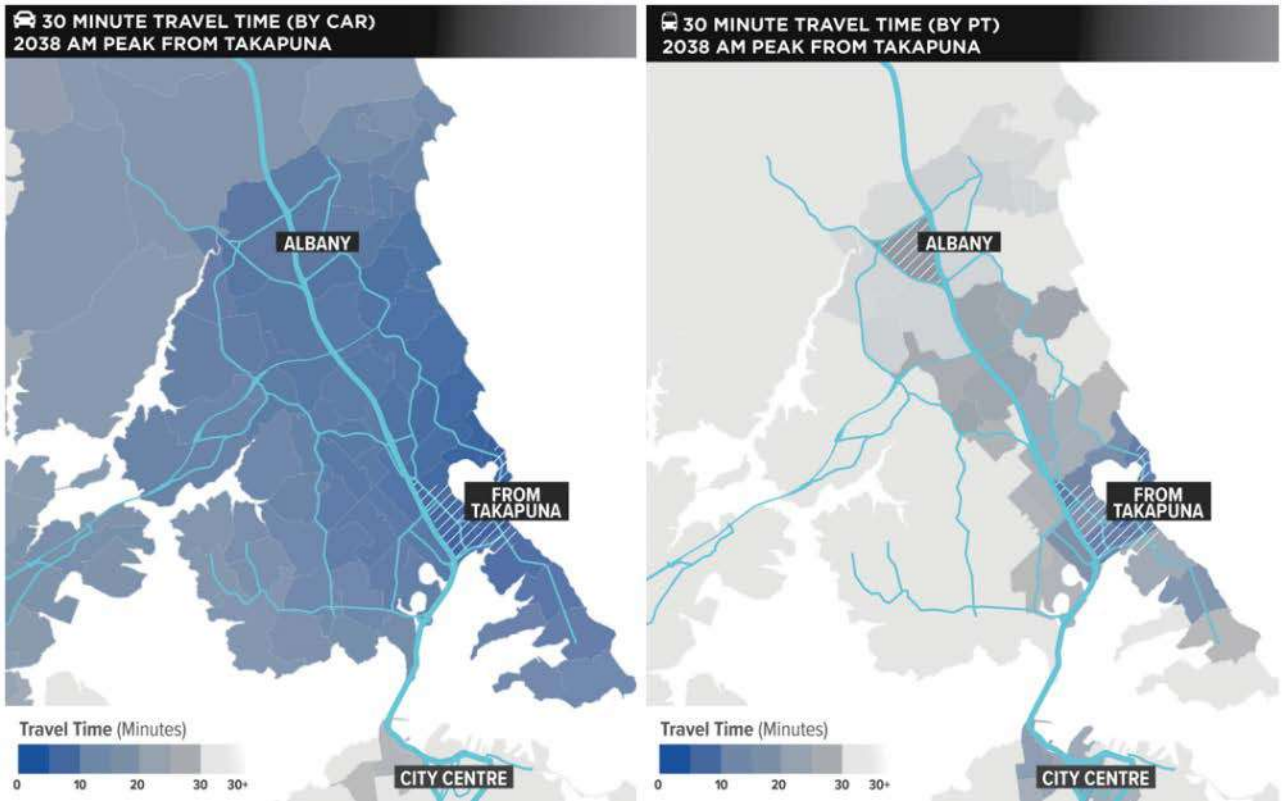


Figure 3-21: Travel Time Isochrones - Takapuna

Accessibility travel time isochrones for travel to Britomart by public transport and car are illustrated in Figure 3-22. In this instance, the isochrones show advantage for public transport accessibility in some areas. The 30-minute travel catchment for public transport extends north to Albany, further than that for cars. Along core public transport corridors (i.e. Busway and Onewa Road) accessibility is higher for public transport than for cars, reflecting peak-period congestion impacting car travel to a greater extent than buses.

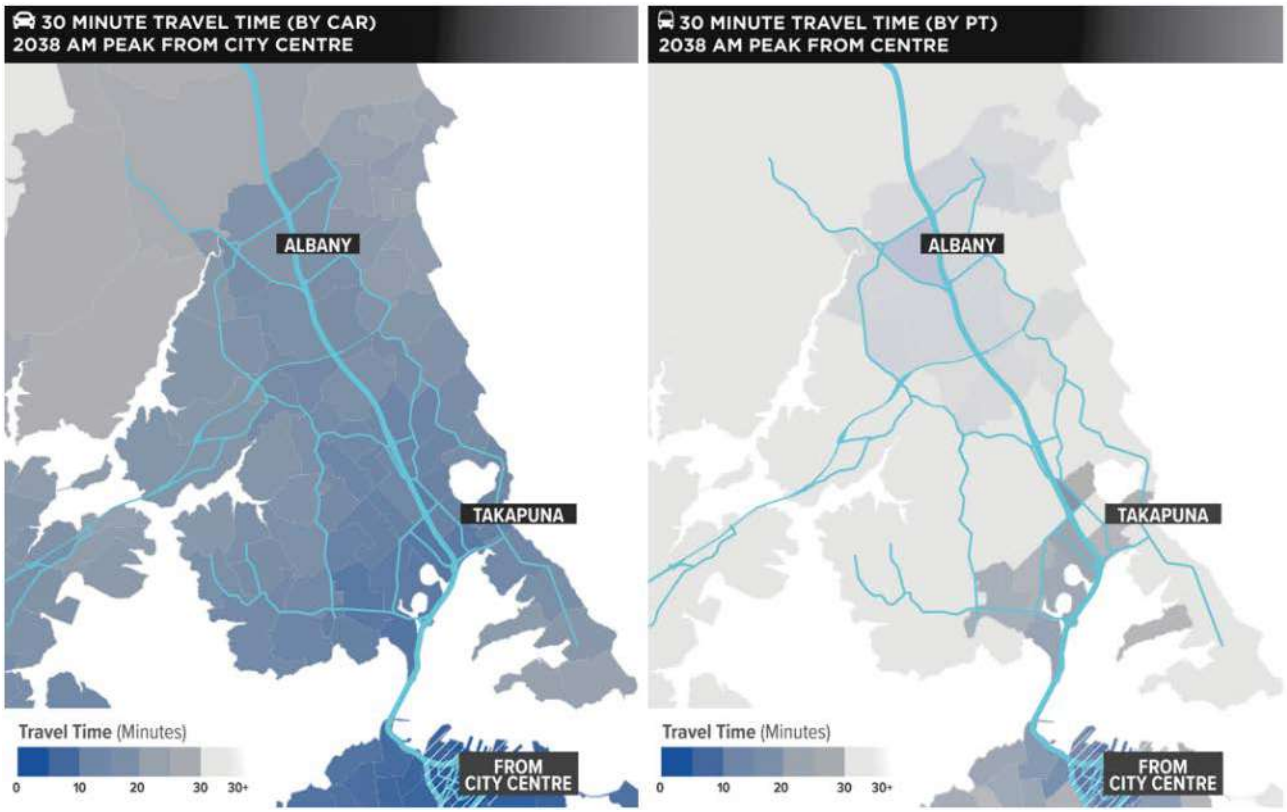


Figure 3-22: Travel Time Isochrones – City Centre (Mid-town)

3.4 Problem Two - Evidence

Inability to effectively serve forecasted demand along the Northern Busway will result in a degradation of service quality, worsen environmental impacts and constrain quality growth.

3.4.1 Forecasted Growth in Demand

The figure below provides mode share forecasts for AM Peak public transport demand from the North Shore (external trips). This provides an indication of the scale of the public transport task across the harbour which increases to around 18,000 passenger trips during the peak two hours by 2038. At present, around one third of all trips on the Waitematā Harbour crossing are public transport trips. By 2028 public transport demand exceeds general traffic and by the mid-2040s public transport is forecast to be strongly dominant on the Waitematā Harbour crossing.

AM Peak PT Demand: External Trips from the North Shore

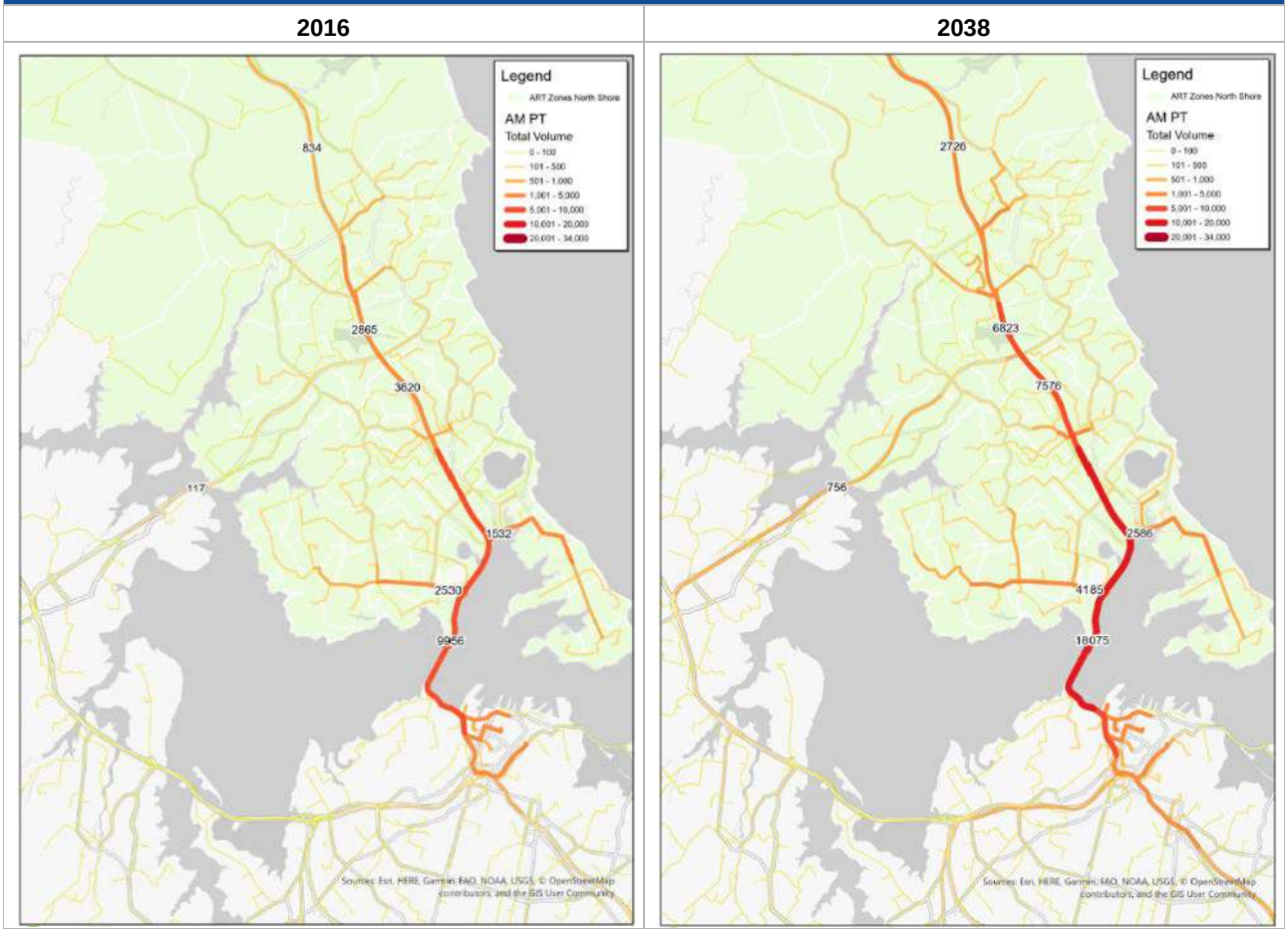


Figure 3-23: AM Peak PT Demand: External Trips from the North Shore (MSM, i11.6)

To serve this growing patronage demand, a significant increase in bus volumes will be required across both busway and local bus services. Figure 3-24 below illustrates the forecast bus volumes between 2020 and 2038 to accommodate this growth. The number of buses cannot increase to fully match demand owing to physical limits across the public transport network including limited terminus locations and existing station and corridor capacity. In order to accommodate the increase in bus volumes a significant capacity increase will be required.

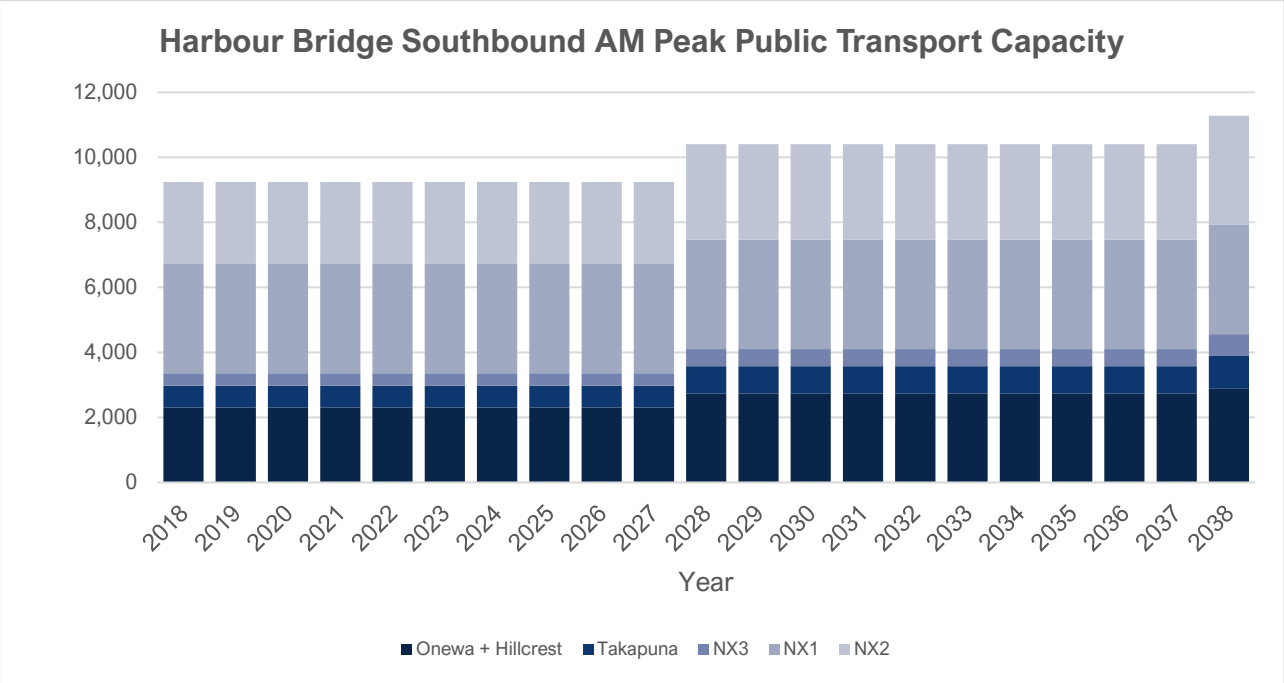


Figure 3-24: Forecasted Public Transport Capacity

With this increase in bus volumes various pieces of busway infrastructure will progressively exceed capacity. This will lead to worsening travel times, travel time reliability and station operations.

Without an additional increase in bus volumes there would be insufficient capacity to serve the additional public transport demand forecasted in Figure 3-23. This would force people to use other transport modes (likely to be private vehicles), leading to worsening congestion, and associated environmental impacts. At stations crowding would worsen and bus occupancy would lead to buses being too full to pick up additional passengers. Overall, this would contribute to a worsening customer experience for both public transport users and outcomes for those travelling in private vehicles.

3.4.2 Degradation of service quality

The RPTP sets objectives for public transport, including objectives for network operation and service quality. They are as follows:

Table 3-3: RPTP Objectives (Network operation and service quality

RPTP Objectives (Network operation and service quality)
Services that meet patronage productivity expectations, considering the primary purpose of the service and the land use pattern
A balanced approach to providing enough capacity with regard to the costs of meeting demand
Attractive, specialised services for special events that help meet the needs of the event and minimise impacts on other parts of the transport system
Dependable levels of service, supported by accurate timetables which meet planned level of service and respect customers' time
Public transport services are safe, reliable, punctual and customer-focused
Safe, comfortable and accessible vehicles, vessels and trains
Excellent operator performance that builds customer confidence in the PT system

The following section covers the expected decline in:

- Travel time reliability, which impacts overall trip quality.
- Station operations, which impacts reliability of services and station quality
- Crowding, which impacts the overall quality of busway stops and stations.

Additional aspects of service quality have been covered under problem statement one but will also worsen if the busway does not effectively serve forecasted demand. Without improvement all of these aspects of service quality on the busway will be in direct conflict with RPTP objectives and will undermine customer confidence.

Travel Times and Reliability

Analysis of AT bus GPS data indicates the current trends regarding bus operation and travel speeds are:

- Northbound bus travel speeds drop to between 10 to 20 kph on approach to the Curran Street on ramp, both in the **morning and evening peak hours**
- Southbound travel speed reduces passing the Onewa Road on-ramp in the **evening peak**, noting that only three lanes are provided in this counter-peak direction
- Southbound in the **morning peak** between Esmonde Road and Fanshawe Street is affected by the southbound vehicle queue extending back from the Esmonde Road on ramp merge towards Albany.

Based on outputs from the Northern Corridor Improvement (NCI) SATURN model and City Centre modelling there is a predicted deterioration in the average busway speeds between Albany and the City Centre between 2020 and 2028/2038 without any interventions. There are several reasons for this:

- An increase in bus volumes, both busway services and local services (which conflict with busway services)
- An increase in bus patronage affecting loading and unloading
- An increase in dwell times on top of loading and unloading
- An increase in pedestrian crossing use.

Average bus travel time between Albany and the City Centre during the peak hour (includes dwell times at stations) – Do Minimum

Table 3-4: Average Bus Travel Time – Albany to City Centre (NCI Model and City Centre Modelling)

	Bus Travel Time AM Southbound (mins)	Bus Travel Time PM Northbound (mins)
2020 Existing/Base model	25 - 31	26 - 31
2028 Do minimum	30 - 32	30 - 32
2038 Do minimum	31 - 33	33 - 35

Station Capacity and Operations

As shown in Sections 3.1.3 to 3.1.5, under Problem 1, station capacity and operations will further degrade as bus volumes and numbers of passengers increase.

Table 3-5: Busway Station Capacity [9]

	2020	2024	2028	2032	2036+
Albany					
	Due to the limited and constrained footprint at Albany Station and the forecasted bus volumes it is expected that Albany will experience overcapacity operations throughout the 15-year timeframe. increased patronage on the busway and busway stations is likely to manifest in over capacity conditions and poor operational performance at Albany Station due to large volumes of commencing services in the AM peak, which use up a lot of station capacity by the mid-2020s.				
Rosedale					
	As the latest constructed station Rosedale is planned to have two double stops for busway services, and double stops for local services. As such, with estimated bus volumes and patronage at Rosedale Station, it is expected that Rosedale station will not exceed capacity within the 15-year timeframe.				
Constellation					
	Current peak-period bus volumes exceed functional capacity already at Constellation Station. NCI works for an additional platform are expected to relieve current capacity issues at Constellation. By the early-mid 2030s it is expected that Constellation will experience overcapacity operations.				
Sunnynook					
	Sunnynook Station has the shortest platforms of all the busway stations. The station currently experiences significant capacity issues. While it is expected NCI works will improve issues with bus bunching along the new busway it is still expected the station will have constrained capacity as projected bus volumes increase.				
Smales Farm					
	By the mid-2030s it is expected that Smales Farm will be experiencing capacity issues – mainly during the busy school peak. As Smales Farm experiences a particularly busy school peak, it is also expected that current issues with layover and active stop availability and crowding will cause operational issues.				
Akoranga					
	Estimated patronage at Akoranga station is low and the footprint of the station is large. As such, with estimated bus volumes and patronage, it is expected that Akoranga station as a whole will not exceed capacity before the mid - late 2030s. However, the northbound busway platforms at Akoranga are smaller than at many other stations. It is expected that this platform will require an expansion within the next two to six years.				

[9] Will refer to appendix

Crowding

Figure 3-25 below shows the forecasted busway station patronage based on MSM forecasts for 2018, 2028 and 2038. All stations are expected to experience growth within the next 15 years. Albany is expected to have a significant amount of growth in both boardings and alightings. This is as Albany employment continues to grow and Albany becomes a new residential hub on the North Shore. Constellation and Akoranga are also expected to grow significantly too. Smales Farm has particularly 'front-loaded' growth with most of the growth happening by 2028, with patronage on par with Constellation. Rosedale and Sunnynook stations are expected to see more conservative growth.

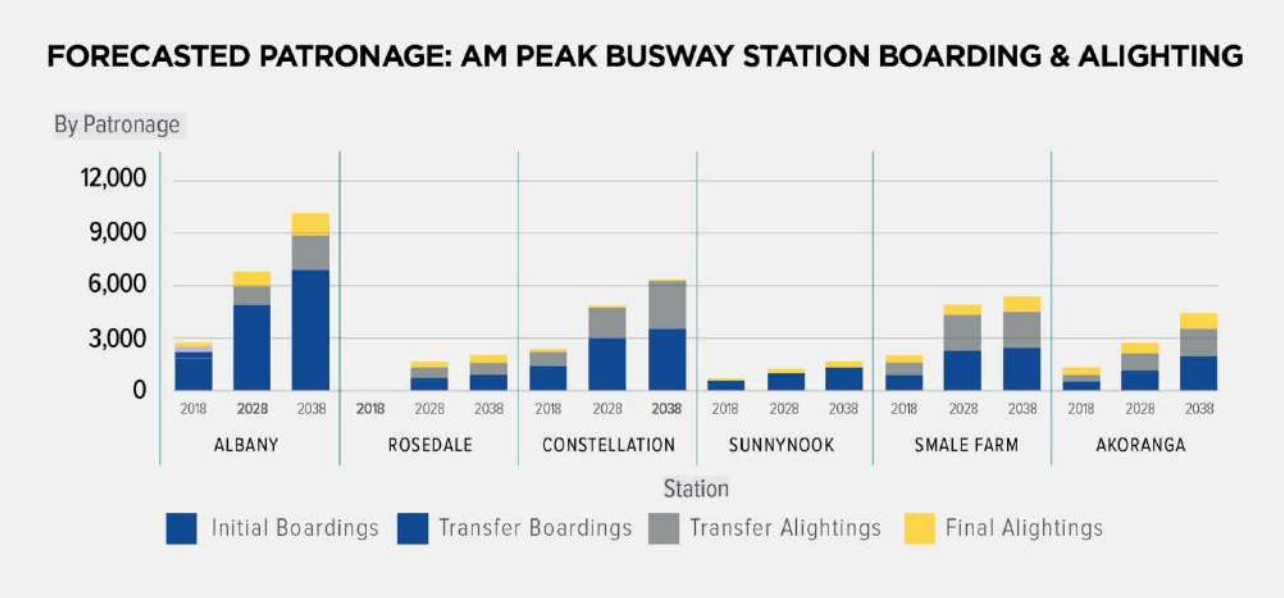


Figure 3-25: Forecasted Station Patronage, AM Peak Period

As demand at these stations continues to grow, issues such as crowding will be exacerbated. Figure 3-26 below shows of current crowding experienced at busway stations and city centre stops. Without improvements at stations, crowding will increase, and more stops and stations will experience these conditions.

Figure 3-26: Current Station Crowing (2020)

3.4.3 Worsening of environmental impacts

Currently, around one third of all trips on the Auckland Harbour Bridge (AHB) are on public transport. While the volume of private vehicles over the Harbour Bridge is expected to remain stable over the next 10 to 15 years, public transport is expected to serve all ongoing growth across the harbour. Figure 3-27 below provides mode share forecasts for North Shore trips across the Waitematā Harbour during the AM peak period.

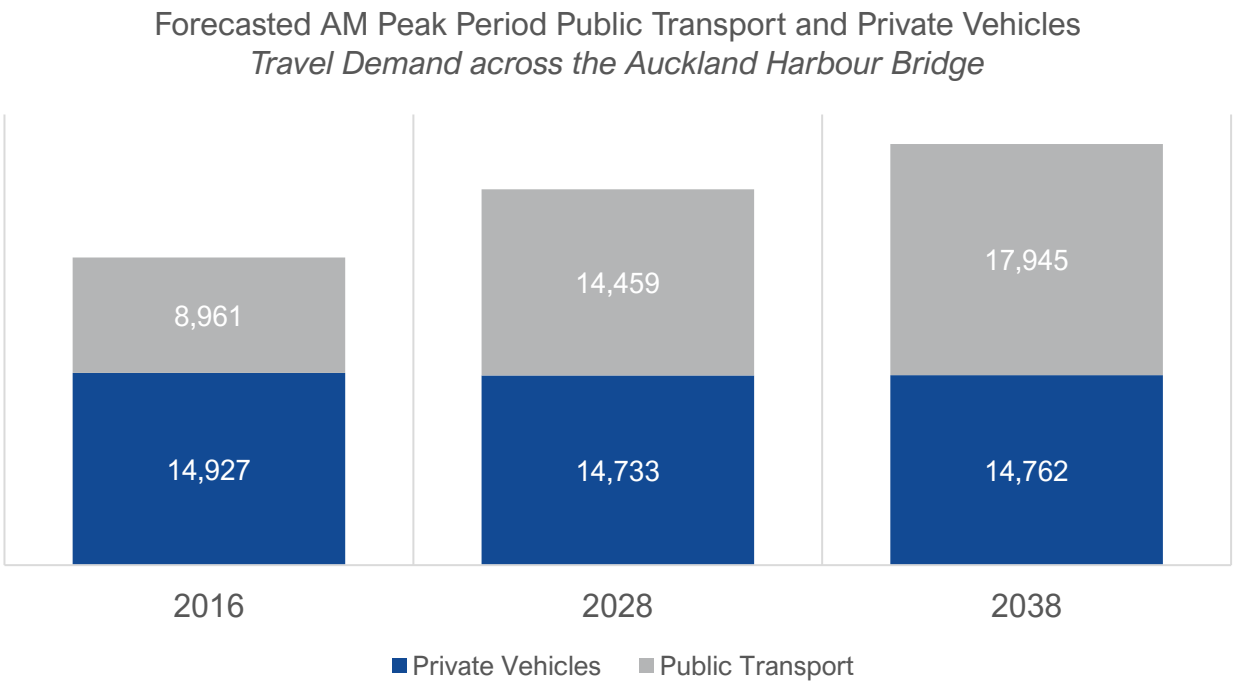


Figure 3-27: Forecast AM Peak Period AHB Travel Demand, MSM i11.6

However, without improvements to the capacity and performance of the Northern Busway, public transport will be unable to support this level of growth. This would lower overall mode share and lead to higher vehicle volumes, increased congestion, emissions, and other environmental impacts.

Particularly in the city centre and other metropolitan centres this increase in vehicle volumes would lead to a decline in urban quality and amenity.

Auckland's Climate Plan

The transport sector is Auckland's largest source of emissions, responsible for 43.6% of Auckland's total emissions, with 86% of this from travel by road (37.6% of Auckland's total emissions)[10]. The Auckland Climate Plan was adopted by Auckland Council in July 2020. To meet envisioned greenhouse gas emission targets the plan would require a significant shift in mode share. Figure 3-28 below shows the targets as set out in the plan.

The plan would require a mode share increase on public transport from 7.8% to 24.5% by 2030. As the northern busway is the only high capacity public transport connection to the whole of the North Shore, the performance of the busway will be key in achieving these targets.

[10] Auckland's greenhouse gas inventory to 2016

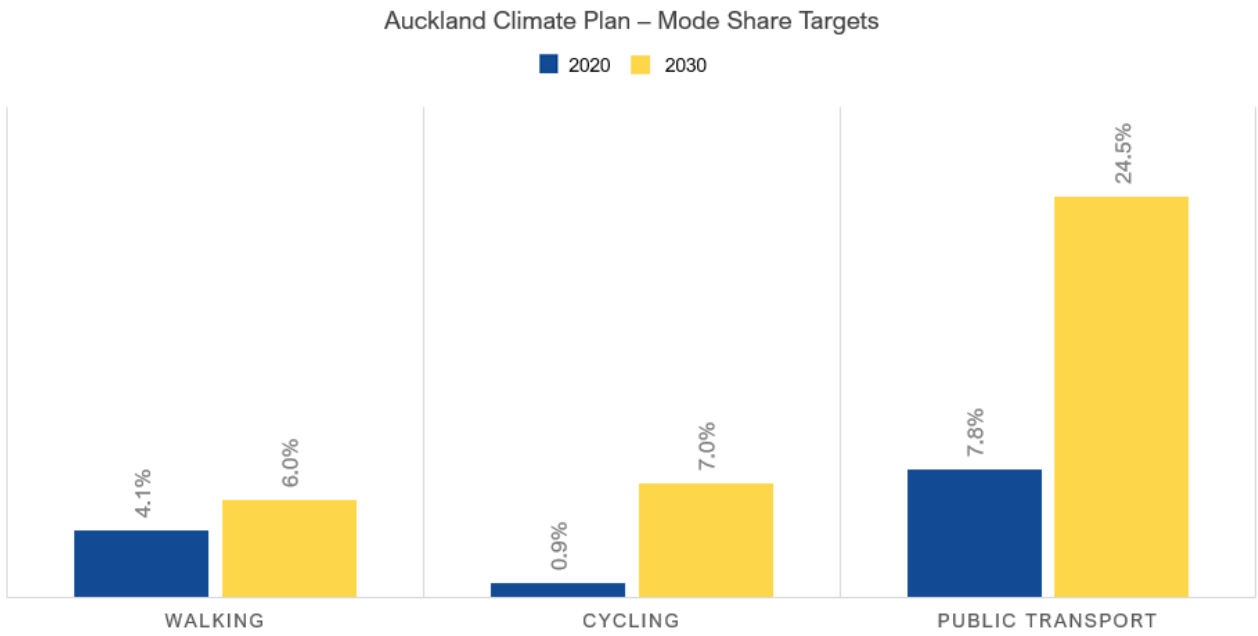


Figure 3-28: Auckland Climate Plan – Mode Share Targets

3.4.4 Constraints on Quality Growth

The Auckland Plan and 'Quality Compact" Growth

The Auckland Plan (2012) encapsulates Auckland Council's vision for Auckland to be the world's most liveable city. This plan includes six "transformational shifts" that are required to achieve the plan's vision. The Auckland Plan's Development Strategy sets out how Auckland will grow and change over the next 30 years. The Auckland Plan specifically takes a "a quality compact approach" to growth and development. The Development strategy directly states that:

"Focusing growth within the existing urban area is key to achieving the quality compact approach, particularly intensifying areas within or close to centres and high-quality transport hubs."

Quality	**The Auckland Plan defines quality growth as growth where development:** • Occurs in areas that are easily accessible by public transport, walking and cycling. • Is within reasonable walking distance of services and facilities. • Maximises efficient use of land. • Is coordinated with the delivery of necessary infrastructure (right place at the right time).
Compact	**The Auckland Plan defines compact growth as growth where:** • Future development is focused within Auckland's urban footprint, particularly existing urban areas. • By 2050, expansion into the rural areas is limited and most growth occurs within this urban footprint.

There is a strong link between Auckland's RTN network and the 'quality compact' growth envisioned in the Auckland Plan. This is also reflected throughout many key strategy documents. This is expanded in the following sections.

The performance of the Northern Busway is critical to making sure 'quality compact' growth is viable and attractive for the growth expected between now and the mid-2030s on the North Shore.

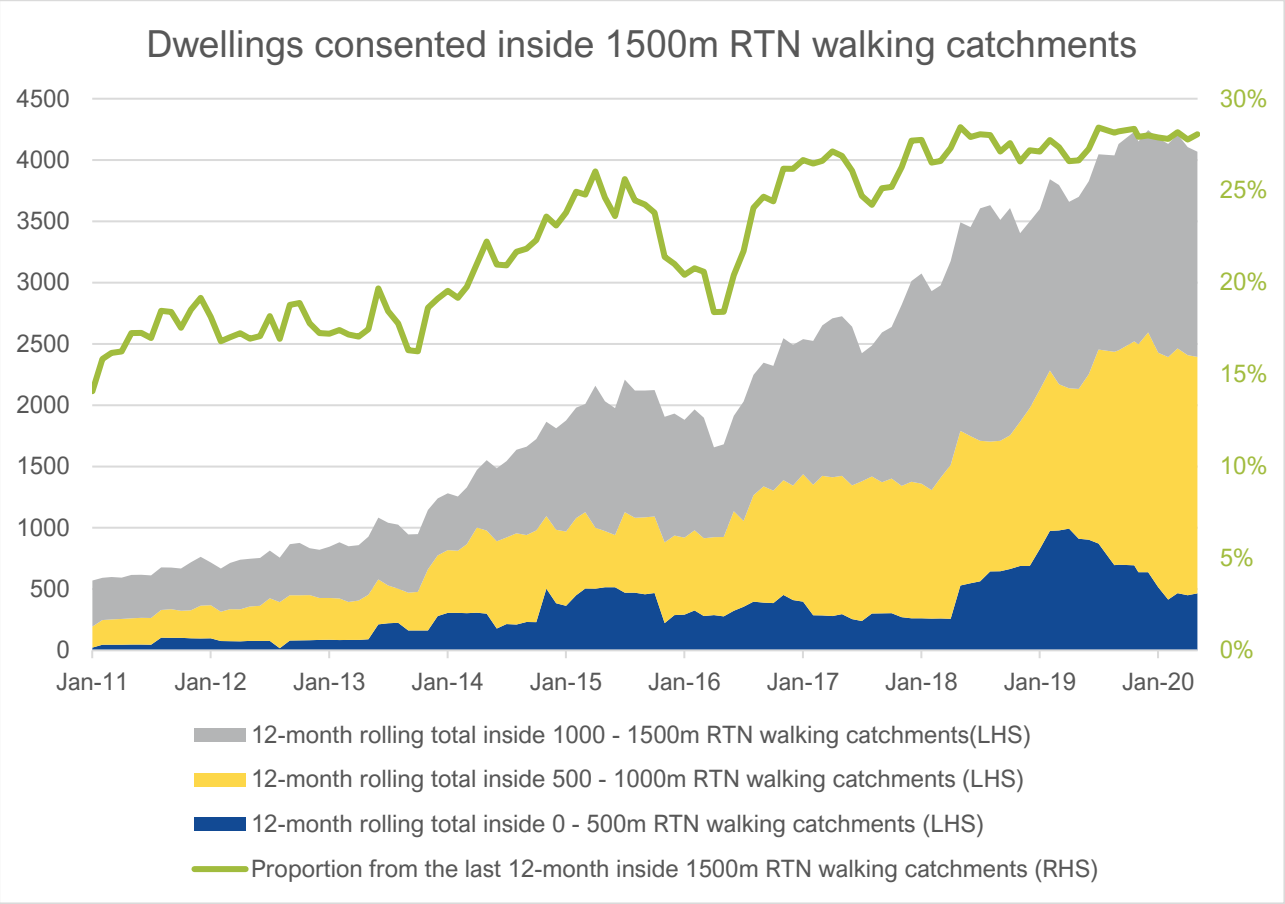
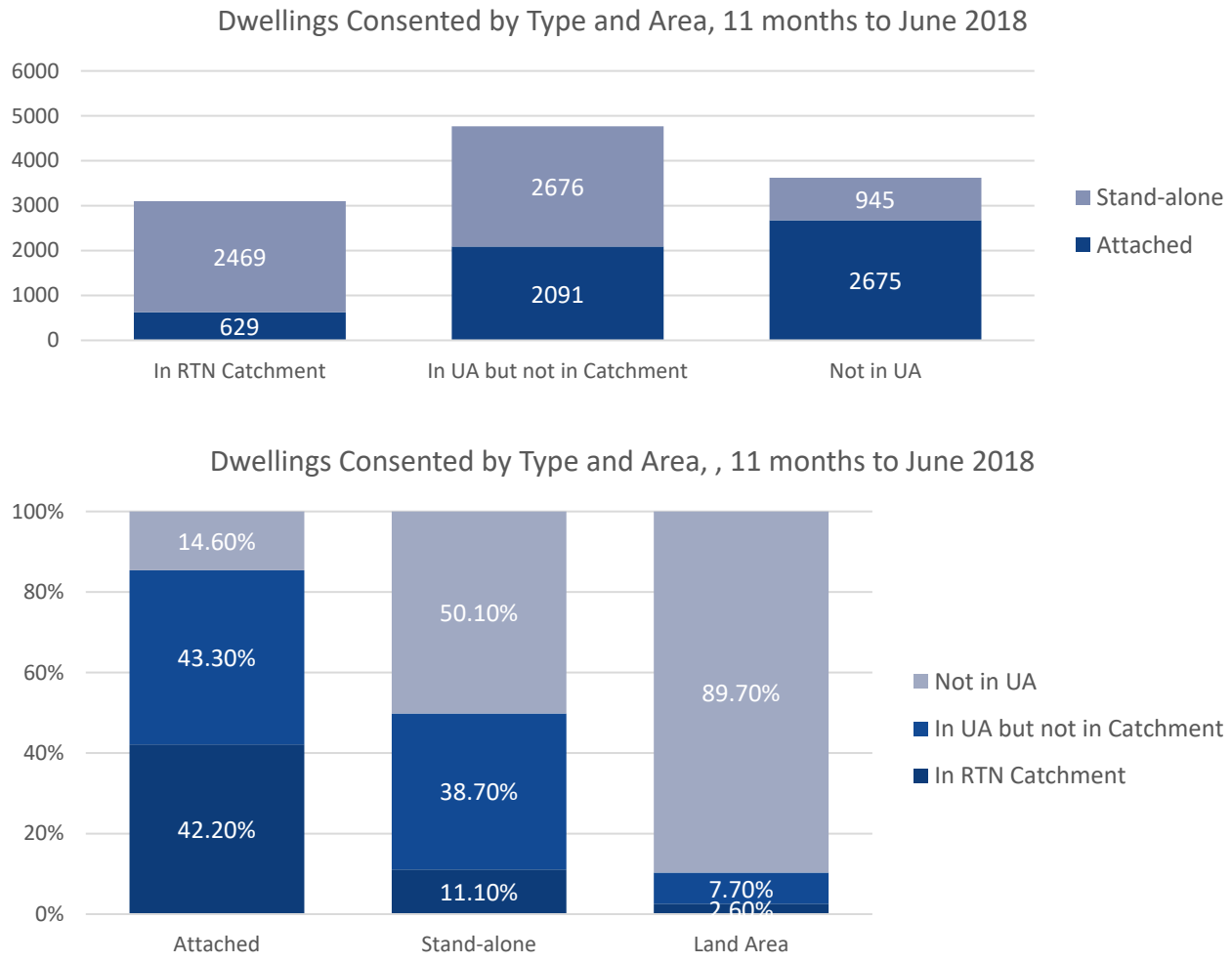


Figure 3-29: Dwelling consented inside 1500m RTN walking catchments (Statistics New Zealand)

'Quality Compact' Growth and Auckland's RTN Network

There is a clear link between Auckland's RTN network and compact growth. Work done by the chief Economist Unit found that there is an increasing preference for new housing in areas close to dedicated public transport routes [11]. Figure 3-30 below shows dwellings consented by type and area for the year up to June 2018.

- A disproportionately large number of dwellings were consented in the catchment areas for rapid transit networks. 42% of all attached dwelling developments consented were in the rapid transit station catchment areas. This is despite the fact that only 2.6% of Auckland's land area falls within a 1.5km walk of a rapid transit station.
- 13% of stand-alone homes were consented in the RTN catchment, which is five times more than the RTN catchments' share of land area.
- Despite the fact that Auckland's RTN catchment only accounts for 25% of the total urban area 40% of all dwellings consented in the 2016- defined urban area (UA) were in RTN catchments.



Source: Chief Economist Unit, Auckland Council

Figure 3-30: Dwellings consented by type and area in relation to the rapid transit network catchment, 11 months to June 2018

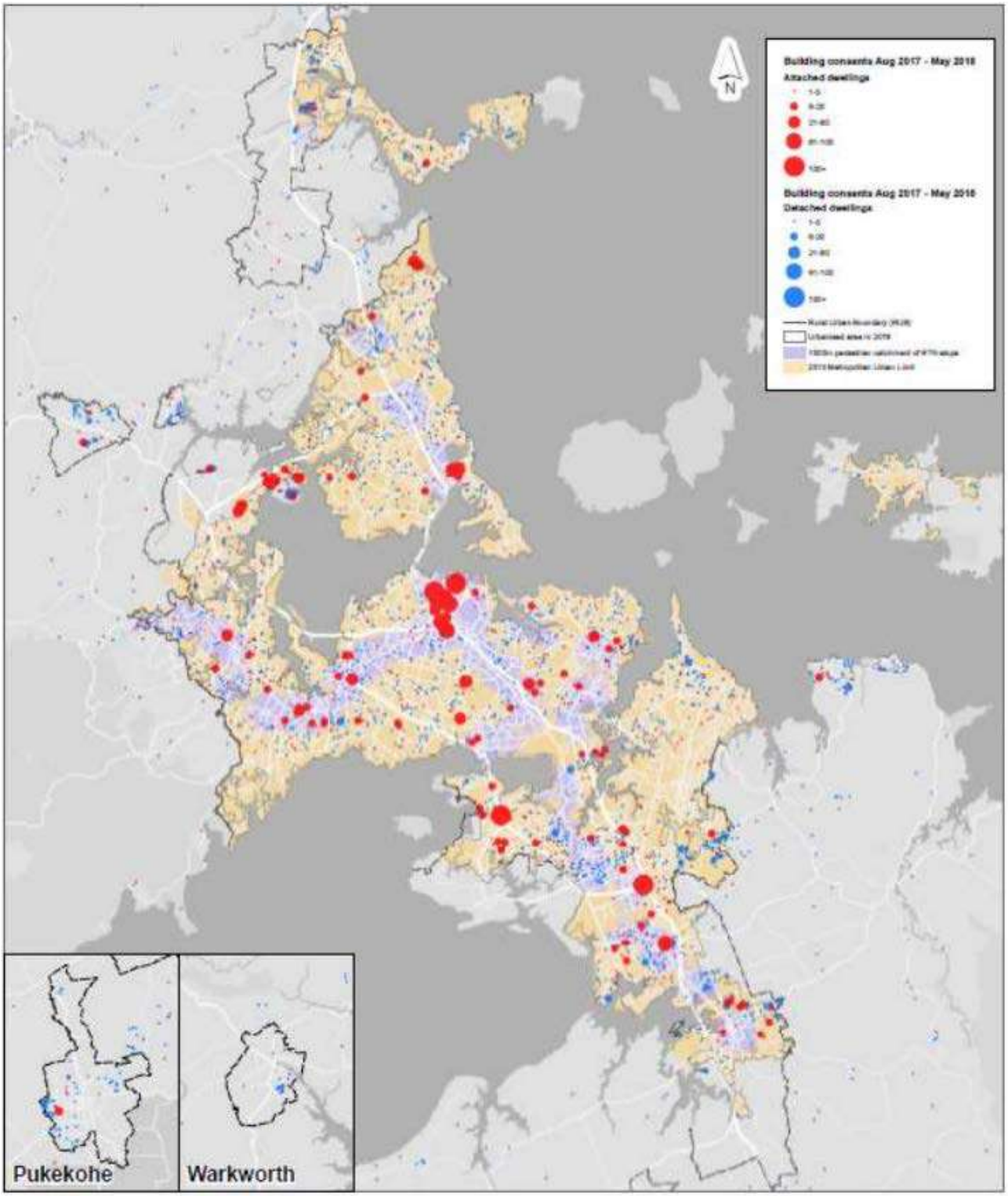


Figure 3-31: New dwellings consented in RTN catchments, the urban area, and beyond

Strategic Support

The evidence that servicing demand along a corridor such as the Northern Busway is critical to achieving the quality growth sought is contained in a variety of documents, which frequently refer to secondary sources for the research evidence. The Table 3-6 below lists documents of note:

Table 3-6: Quality Growth Summary

Document	Description
Auckland Plan 2050	As stated earlier the Auckland plan clearly links 'quality compact' growth and hi-quality public transport, stating that "Focusing growth within the existing urban area is key to achieving the quality compact approach, particularly intensifying areas within or close to centres and high-quality transport hubs." **Evidence Report – Homes and Places –** found that good quality, secure and affordable homes located near good, reliable transport links is a foundation for households and society to function well. **Evidence Report – Transport and Access –** found that the scale and pace of growth in Auckland is placing increased pressure on an already constrained transport networks and that while investment in new infrastructure will increase over time the existing network will need to accommodate much of the growth in travel demand over coming decades. **Evidence Report – Development Strategy-** The evidence report behind the development strategy contains the same evidence of the link between Auckland's RTN Catchment and consented dwellings as explained above. It makes clear that planning that aligns land use and transportation can steer the growth of a city to an urban form that allows it to function more efficiently.
Auckland Transport Alignment Project Report 2018	ATAP states that: *"The role of transport in enabling and shaping the way Auckland grows is also critical to addressing our housing challenges"* ATAP set out key expected outcomes from the recommended investment. This included improved potential for housing growth around rapid transit corridors. It places emphasis on the acceleration of the development of Auckland's rapid transit network to unlock housing and urban development opportunities.
GPS	*"Transport supports urban growth through increasing access to new housing developments and by supporting the redevelopment and regeneration of existing housing. This access should support liveable cities so in addition to local roads it should prioritise modes such as public transport and walking and cycling."* The GPS 2018 supports investment in: • Transport infrastructure to support increasing the supply of serviced land for housing development in high growth urban areas. • Public transport services to support both the redevelopment and regeneration of existing housing areas and new housing areas.

3.5 The Benefits of Investment

As a result of the investment it is expected that:

- Public transport continues to provide and improves competitive options for trips to, from and within the North Shore
- Access to economic and social opportunities is further improved
- The need for additional crossings of the Harbour can be delayed
- High quality growth, improved amenity and reduced environmental impacts are supported

These benefits are used as the basis for developing investment objectives and performance measures used for assessing options and alternatives.

3.6 Key Performance Indicators

To assess options against the Investment Objectives and to determine the level of "benefit" that could be derived, a set of Key Performance Indicators (KPIs) were developed.

Table 3-7: Objectives and KPIs

ILM Benefits	Investment Objectives	Project KPI
Public transport continues to provide and improves competitive options for trips to, from and within the North Shore 35%	Retain and improve public transport competitiveness 35%	Maintain or increase mode share along the busway
		Faster journey times
		More reliable journey times
Further improve access to economic and social opportunities 35%	Improve access to economic and social opportunities 35%	Jobs accessible within a 45 min trip on PT (AM, IP & PM)
		Population accessible within a 45 min trip on PT (AM, IP & PM)
Delay the need for additional crossings of the Harbour 15%	Optimise capacity of the public transport connections to the North Shore 15%	Person throughput across the harbour bridge
Supports high quality growth, improved amenity and reduced environmental impacts 15%	Enable Auckland to achieve quality, compact growth and improved amenity 15%	Reduced impact of transport on Auckland's environment
		Improved amenity for city centre & metropolitan centres
		Reduce CO2 emissions

4 Issues and Constraints

Table 4-1 below lists issues that introduce uncertainties for the programme. There are multiple factors that may influence the long-term travel demand forecasts, some of these factors may significantly change transport supply within the study area and factors that may influence the costs of the programme.

Table 4-1: Issues and Uncertainties Log

Factor	Timing	Uncertainty	Impact	Comments
Factors Affecting Demand				
Land-use change: greenfield growth in future North Shore urban growth areas (eg Silverdale) – scale, location, timing of development	Ongoing	Reasonably foreseeable	High	Significant land areas zoned for future urban growth that will impact-on demand. Considerable uncertainties about the extent and timing of development uptake.
Land-use change: scale of growth within existing North Shore	Ongoing	Reasonably foreseeable	High	Uncertainties about the future geographic distribution of population and employment growth.
Northern Pathway	Ongoing	Reasonably foreseeable	High	Potential increase in demand due to provision of cycling facilities between Westhaven and Esmonde, and potentially Esmonde and Constellation – within the same timeframes as this programme
AWHC – Supplementary RTN	2036+	Reasonably foreseeable	Medium	Uncertainties about the scale, timing and form of a supplementary RTN connection and its impact on demand.
Factors Affecting Supply				
New legislation and policy direction enforce the pace of travel behaviour change	Ongoing	Reasonably foreseeable	High	Central or local government policy may cause changes in infrastructure investment. This may impact assumptions made about the strategic approaches investigated within the options assessment.
AWHC – Supplementary RTN	2036+	Reasonably foreseeable	Medium	Uncertainties about the scale and timing of a supplementary RTN connection and its impact on supply.
Factors Affecting Cost				
Uncertainty of timing / and inter-dependencies with other projects currently planned or underway in Auckland	Ongoing	Reasonably foreseeable	Medium	There is a that the proposed timing and interventions proposed are affected due to designs and proposals developed in other projects. This includes the Northern Pathway
Other Factors				
COVID-19	Ongoing	Reasonably foreseeable	Unknown	The impact of the COVID-19 crisis is as yet unknown and has led to an increased level of uncertainty across all aspects of decision making.

Potential constraints that will impact the programme options include:

- Ecological and landscape values constraining SH1 busway options
- Spatial constraints (eg street width) within the densely built-out city centre
- Planning, feasibility, operational and implementation constraints

The measures likely to be recommended in this DBC are not covered by funding in the RLTP.

5 Options Assessment

This section of the business case describes the option assessment completed. The different components of the enhancement programme were assessed separately using techniques and approaches appropriate for each. In each case, options are described and assessed to determine their ability to contribute to achieving the objectives and the outcomes sought.

5.1 Overall Approach

The development and assessment of options for the Northern Busway Enhancements was completed for the following components of the corridor:

- Northern Busway Stations
- State Highway 1 between Akoranga and Beaumont Street
- Fanshawe Street to Lower Albert Bus Interchange.

The overall approach is detailed in Figure 5-1 below and discussed in further detail in the subsequent sections.

Figure 5-1: Project Overall approach

5.2 AWHC IBC Busway Improvements Programme

A series of improvements were proposed in the Busway Improvements Programme developed as part of the Additional Waitematā Harbour Connections IBC (AWHC IBC). This included:

- Busway Stations and Bus Priority Improvements
  - Busway station upgrades (infrastructure and operational improvements)
  - Bus priority improvements
  - Improvements to priority measures through intersections
- Systemwide Improvements:
  - Ticketing and boarding changes
  - Changes to vehicle fleet

All options developed and assessed for this detailed business case were based on the IBC Busway Improvement Programme, and thus excludes specific sections of the system where improvements or upgrades are being investigated or delivered as part of other projects.

- Improvements to the Northern Busway between Albany and Akoranga Station are focused on busway stations only.
- Opportunities related to potential changes to the current fleet were identified for consideration and further investigation.

As the AWHC IBC had looked extensively at alternatives and a wide set of options, the optioneering in this DBC only related to infrastructure, fleet and management changes to the busway and stations to implement the programme.

The Busway Improvement Programme is illustrated in Figure 5-2 below.

Figure 5-2: Busway Improvements Programme

5.3 Option Development

The project primarily entails a series of improvements to enhance the capacity, and improve bus travel times and reliability for the busway system.

A range of targeted improvements to specific sections of the route were developed and assessed separately using techniques and approaches appropriate for each. In each case, options are described and assessed to determine their ability to contribute to achieving the objectives and the outcomes sought. The options developed and assessed included:

- Northern Busway Stations
  - Changes to Albany, Rosedale, Constellation, Sunnynook, Smales Farm and Akoranga
  - Standardised infrastructure upgrades
  - System-wide interventions
- Bus Priority Optioneering

Options aimed at extending and improving bus priority measures along the corridor. This was broken down into three sections:

- State Highway 1: North of the Harbour Bridge (Akoranga to Auckland Harbour Bridge)
- State Highway 1: South of the Harbour Bridge (Harbour Bridge to Beaumont Street)
- Fanshawe Street from Beaumont Street to Lower Albert Bus Interchange (LABI)

Figure 5-3: Options Developed and Assessed

5.3.1 Assessment Framework

The Assessment Framework is a product of the problem definition. The framework connects problems, benefits, and objectives [12] to a suite of key performance indicators (KPI's) as noted in table below. All options were tested to allow a transparent assessment of the effectiveness of options in solving the problems identified.

The KPIs listed below were included in both the station optioneering and the priority optioneering MCA's. The assessment framework was circulated and agreed with stakeholders from Auckland Transport, Auckland Council and Waka Kotahi NZ Transport Agency in July 2020 and included:

Where required, specific criteria were amended to ensure specific options could be adequately assessed.

Benefits and Investment Objectives

The benefits and investment objectives alongside key performance indicators (the KPIs) and measures are described below.

Table 5-1: Benefits, investments objectives and KPIs

Benefit	Investment Objective	Measure / KPI
Public transport continues to provide and improves competitive options for trips to, from and within the North Shore (**35%**)	Retain and improve public transport competitiveness	Maintain or increase mode share along the busway
		Faster journey times along busway
		More reliable journey times (on busway)
Further improve access to economic and social opportunities (**35%**)	Improve access to economic and social opportunities	Jobs accessible within a 45 min trip on PT (AM, IP & PM)
		Population accessible within a 45 min trip on PT (AM, IP & PM)
Delay the need for additional crossings of the Harbour (**15%**)	Optimise capacity of the public transport connections to the North Shore	Person throughput across the harbour bridge
Supports high quality growth, improved amenity and reduce environmental impacts (**15%**)	Enable Auckland to achieve quality, compact growth and improved amenity	Reduced impact of transport on Auckland's environment
		Improved amenity for City Centre & Metropolitan Centres
		Reduce CO^2 emissions

Technical / Feasibility Criteria

The agreed technical and/or feasibility criteria are described below.

Table 5-2: Technical / Feasibility Criteria

Criteria	Measure	
Engineering Feasibility	Constructability	Assessment of Constructability / complexity of facility
	Utilities	Degree of impacts on utilities
	Stormwater	Degree of impacts on stormwater
Consenting and Property Requirements	Property Requirements	Land Requirements / property impact
	Planning and Consenting	Likelihood of obtaining approval for proposed station development
	Environmental Impacts	Qualitative assessment of key environmental risks including visual impact, noise/air Quality (construction and operations), water quality/ ecological, heritage, contaminated land etc

[12] The Investment Logic Map is included in Appendix A

Criteria	Measure	
Cost	CAPEX	High level $ estimate of capital costs of physical works
	Operating Cost/ Efficiency	Assessment of operational costs including proposed infrastructure maintenance costs and bus network operating cost
	Property	High level $ estimate of property costs (Capex)
Operations		Qualitative assessment of traffic operational risks and issues
		Qualitative assessment of bus operational risks and issues
		Impact on network operations
Safety		Qualitative assessment of traffic safety risks
		Qualitative assessment of bus safety risks
Customer Experience		Qualitative assessment of impact on Customer Experience
Stakeholder / Public		Qualitative assessment of stakeholder / 3rd party approvals. Reputational risks arising from negative feedback from key stakeholders and the public incl. Mana Whenua

5.4 Stakeholder involvement and workshops

Throughout the option development process, a series workshops were held with stakeholder to introduce and discuss the options. The pre-meetings held were with the following stakeholders:

- Waka Kotahi Network Operations and Safety
- Auckland Transport Integrated Network Enablement
- Auckland Transport Metro Services
- Waka Kotahi Northern Pathway Project Team
- Auckland Transport Planning and Consenting Team
- Auckland Transport Property Team.

A series of Options Assessment Workshop were held from August to October 2020 with relevant AT and Waka Kotahi stakeholders to assess each of the options against the investment objectives and MCA framework.

Table 5-3: Workshop attendance register

Name	Organisation	Stations	SH1	Fanshawe
Nalisha Kesha	Auckland Transport	X	X	X
Daniel Newcombe	Auckland Transport		X	X
Luke Elliot	Auckland Transport	X	X	X
Pete Moth	Auckland Transport		X	X
Peng Zhang	Auckland Transport	X	X	X
Debajeet Baruah	Auckland Transport	X	X	X
Steve Wrenn	Auckland Transport	X	X	X
Shashi Lakshminarasimhaiah	Waka Kotahi			X
Kevin Fleckney	Waka Kotahi			X
Jason Malcolm	Waka Kotahi			X

Name	Organisation	Stations	SH1	Fanshawe
Joshua Arbury	Waka Kotahi		X	
James Kaye	Waka Kotahi		X	
Rebekah Pokura-Ward	Waka Kotahi		X	
Kenny See	Waka Kotahi		X	
Philip De Wet	Aurecon	X	X	X
Dean Ingoe	Aurecon	X	X	X
Steve Dudley	Aurecon		X	X
Harry Ormiston	Flow	X	X	X
Terry Church	Flow	X	X	X
Andy Maule	Flow	X	X	X

6 Busway Station Optioneering

This section outlines the results of the infrastructure, operational and micro-simulation assessments carried out for each busway station. The assessment focused initially on the specific requirements and issues identified at each station. Following this process, the impacts of the standardised interventions were tested for appropriateness to address the key issues identified. Detailed optioneering and modelling reports are included in Appendix B.

Concept layout designs were then developed for all stations to enable the development of cost estimates for the business case. Due to the timeframes associated with the improvements (over a 15-year period), the designs for specific elements could be impacted by other future and interfacing projects and surrounding land use development. The final layout will be confirmed during the pre-implementation phase of the proposals.

The approach is illustrated in Figure 6-1 below.

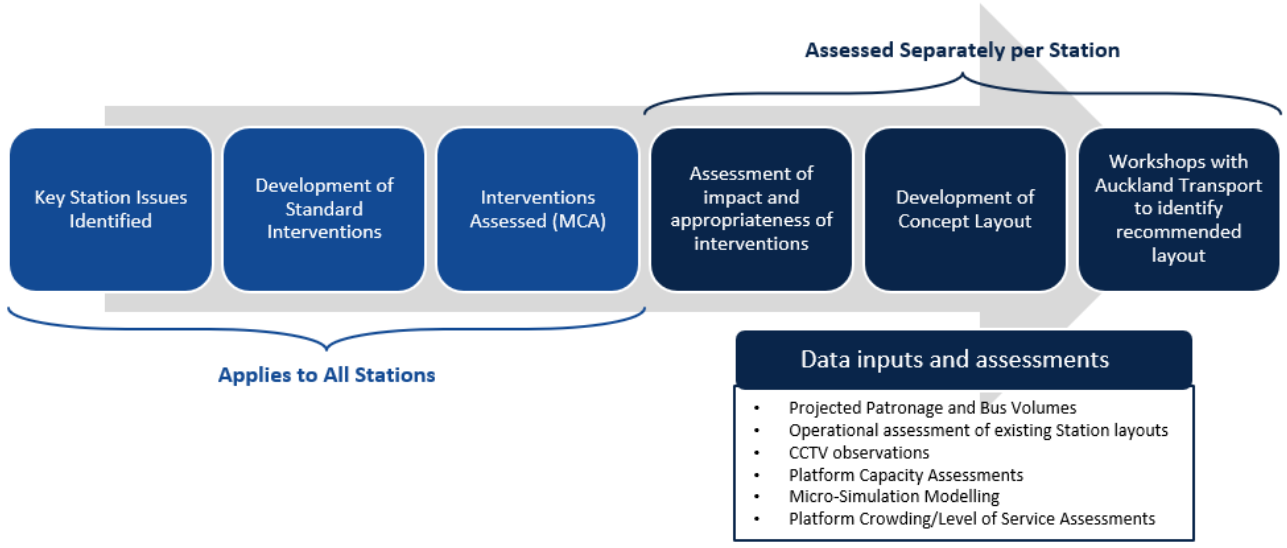


Figure 6-1: Busway Station Methodology

6.1 Key Station Issues Identified

Issue identification entailed the confirmation of evidence for problems identified in Section 3 and as part of the NSRPT PBC and the AWHC IBC, and included a range of infrastructure, operational and safety issues. These included:

- Insufficient platform capacities to serve projected demand:
  - Platform length and stop capacity for projected vehicle volumes
  - Platform length, useable width and circulation space for passengers
  - All stations experience insufficient capacity against future predicted demands because of platform lengths.
- Bus circulation conflicts between busway and local services:
  - Conflict between busway and local services around central station island are contributing to operational deficiencies (delays to local and busway services)
  - High volumes of out of service vehicles accessing layover are all within the same constrained area for Albany, Constellation and Smales Farm.
  - High volumes of school buses at Smales Farm.
- Conflict between pedestrians and buses caused by current station layouts:
  - Albany, Constellation and Smales Farm stations experience conflict between buses and pedestrians due to the location of the at-grade pedestrian crossings.

- This is a safety issue due to the high number of existing and forecasted users and contribute to capacity constraints and delays to local buses.

- Station crowding:
  - Albany and Constellation experience the worst crowding due to the highest passenger numbers and insufficient platform lengths.
  - Crowding at Sunnynook is impacted by existing platform layouts which are narrow. Smales Farm experience the same problem particularly with wide enclosed areas and large waiting volumes in short time frames because of schools in the area.

Additional information for each station is included in the station optioneering and modelling assessment reports included in Appendix B. Standard interventions

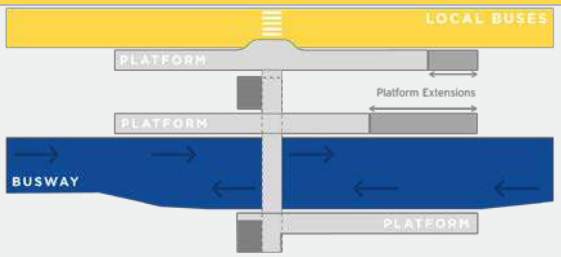
To address the infrastructure and operational deficiencies described in the strategic case, a set of standardised interventions were developed. The interventions potentially provide relief for specific issues and complement each other to provide a significant overall benefit to station operations. The standardised interventions developed and agreed with AT are summarised in the table below. It was agreed to separate the standard interventions into two categories, station specific interventions and interventions that would apply to the whole system to be delivered on a system wide level.

It is noted that for some of the interventions no specific modelling or analysis was completed, and instead these were qualitative assessments that provided rationale for the improvements that may require further analysis at a later stage (if this is deemed necessary).

Table 6-1: Standard interventions

Station specific Improvements	Modelled	System wide Improvements	Modelled
Increased platform length (capacity improvements)	Y	All door boarding (busway only)	Y
Station hub layouts and platform width changes	N (static analysis)	Off board fare collection (busway only)	Y
Bus circulation changes (local services only)	Y	Level boarding (busway only)	N
Additional platforms (local or busway)	Y	Vehicle fleet changes (Minor)	N
Managed pedestrian crossings	Y	Dynamic fleet management (eg vehicle headway and hold points)	N
Grade separated pedestrian crossings	Y	Queuing arrangements for platforms	N

The station specific interventions assessed are briefly unpacked in Figure 6-2 below:

Interventions	Change in station layout / operations	Impact
Increase platform length – Increase capacity of the platforms		Provides for increased capacity without significant changes to station layout.

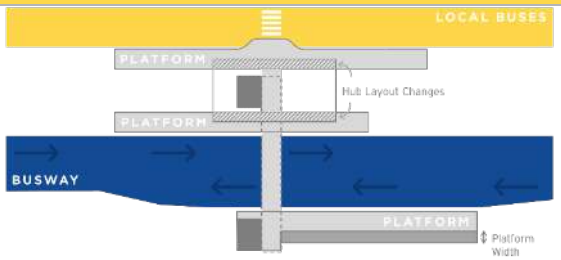
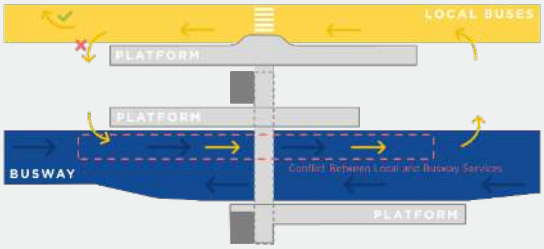
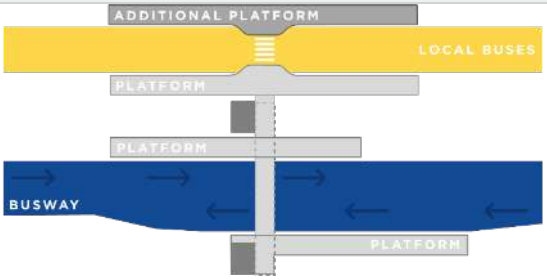
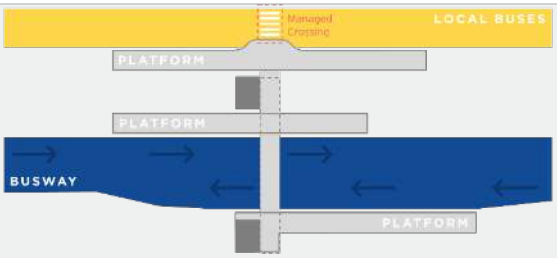
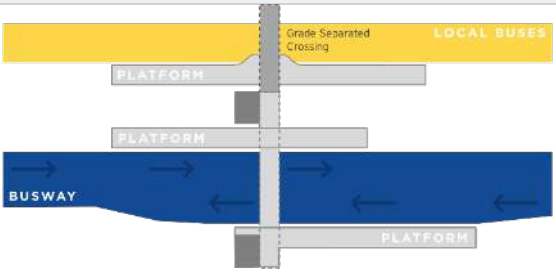
Interventions	Change in station layout / operations	Impact
Hub Layout & Platform Width – Increase capacity of the platform and change the layout of the hub		Allows for greater passenger throughput and reduces crowding. Enables platforms to serve forecasted demand at an acceptable level of service.
Bus Circulation Changes Separating local service circulation from Northern Busway circulation		Minimise delay to busway services and optimise operations of busway service platforms.
Additional platform **Additional local bus platforms**		Provides for increased capacity, and potentially required due due to circulation changes.
Managed Pedestrian Crossings **Controlled or signalised pedestrian crossings**		Reduces the amount of bus and pedestrian conflict at stations. Increased safety and reduces the level of delay to services.
Grade separated crossings **Grade separating pedestrian crossings to minimise delay to busway services**		Removes conflict between pedestrians and vehicles at stations. Improved pedestrian safety

Figure 6-2: Station specific Improvements

The system-wide improvements assessed are briefly unpacked in the Table 6-2 below:

Table 6-2: Systemwide Improvements

Intervention	Description	Impact
All door boarding (busway only)	All door boarding of vehicles	Further reduces crowding and improves the quality of customer experience
Off board fare collection (busway only)	Change to fare collection at stations to allow for off-board fare collection at stations ('train station style' fare collection – no ticket gate line).	Reduced boarding time per passenger and further reduces dwell time and leads to increase in platform capacity.
Level boarding (busway only)	Removing the requirement to step up or down to board buses at busway station platform.	Reduced boarding time per passenger and improved accessibility for wheelchair and pushchair use
Vehicle fleet specification changes	Potential fleet or vehicle specification changes	Reduced boarding time per passenger and potential increased system capacity
Dynamic fleet management	Headway Management	Optimised operations, reduces bunching and unreliable services
Queuing arrangements for platforms	Measures to change the way that customers use station hub and / or platform space to wait for and board buses	Reduces crowding and improves the quality of customer experience

6.2 Multi-Criteria Assessment

The station specific interventions were assessed against the agreed assessment framework. Due to the nature of the issues identified at busway stations, specific technical and feasibility criteria were amended to ensure options can be adequately assessed. Standard interventions were assessed against:

- Benefits and investment objectives
- Overarching technical criteria, "Station operation and efficiency", which included the following measures:
  - Improved access for pedestrians at stations
  - Reduced conflict between pedestrians and buses, disrupting the flow of buses
  - Increased capacity for local and busway services
  - Improved efficiency of bus circulation and reduced conflict between local and busway services.

While the results of the assessment confirmed the appropriateness of the proposed intervention in addressing the problems identified, the impact of the interventions was tested in more detail for each station to enable development of detailed options for each station, and also identify the specific interventions required at each station.

Figure 6-3 summarises the assessment findings of the station specific standard interventions.

Northern Busway Improvement - Station Interventions MCA			Do-Nothing	Standard Interventions										
			Retaining existing station layout, facilities and bus operation	Increase busway service platform length	Increase local service platform length	Increase busway platform width	Local bus circulation changes	Additional local service platform	Introduce managed pedestrian crossings	Introduce grade separated crossings	Local service network changes	All door boarding	Off-board ticketing	Level boarding
Benefit	**Investment Objective**	**Measure/ KPI**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
Public transport continues to provide and improves competitive options for trips to, from and within the North Shore (35%)	Retain and improve public transport competitiveness	Maintain or increase mode share along the busway	○	●	●	●	●	●	●	●	●	●	●	●
		Faster journey times	○	●	●	○	●	●	●	●	○	●	●	○
		More reliable journey times	○	●	●	○	●	●	●	●	○	●	●	○
Further improve access to economic and social opportunities (35%)	Improve access to economic and social opportunities	Jobs accessible within a 45 min trip on PT (AM, IP & PM)	○	○	○	○	○	○	○	○	●	○	○	○
		Population accessible within a 45 min trip on PT (AM, IP & PM)	○	○	○	○	○	○	○	○	●	○	○	○
Delay the need for additional crossings of the Harbour (15%)	Optimise capacity of the public transport connections to the North Shore	Person throughput across the harbour bridge	○	●	○	○	●	●	○	○	○	○	○	○
Supports high quality growth, improved amenity and reduce environmental impacts (15%)	Enable Auckland to achieve quality, compact growth and improved amenity	Reduced impact of transport on Auckland's environment	○	○	○	○	○	○	○	○	○	○	○	○
		Reduce CO2 emissions	○	●	●	○	●	●	○	○	●	○	○	○

Benefit	**Measure**		**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
Station operation and efficiency	Pedestrian Access	Improved access for pedestrians at stations	○	○	○	●	○	○	●	●	○	●	●	●
	Pedestrian and bus conflicts	Reduced conflict between pedestrians and buses, disrupting the flow of buses	○	○	○	○	○	○	●	●	○	○	○	○
	Station capacity	Increased capacity for local and busway services	○	●	●	○	●	●	○	○	○	○	○	○
	Bus circulation	Improved efficiency of local bus circulation and reduced conflict between local and busway services	○	○	○	○	●	○	○	○	○	○	○	○

All assessments made in reference to the 'Do Nothing' options

Rating ● Achieves KPI ○ Does not achieve or impact KPI

Figure 6-3: Standard Interventions MCA (including station operation and efficiency)

6.3 Assessment of impact and appropriateness of interventions

Following the MCA assessment, further analysis was completed to understand the impact of the station-specific and system-wide interventions and to determine the specific requirements for each busway station. The detailed assessments included:

- Operational assessment of existing station layouts
- CCTV observations
- Platform capacity assessments
- Micro-Simulation modelling
- Platform crowding/Level of Service assessments

The following sections provide a brief summary of the analysis undertaken for all stations. Detailed results are included in the Options Assessment Reports for each station in Appendix B.

6.3.1 Operational assessment of existing station layouts

The operational assessment focused on the circulation of all bus services within each station and AT observations provided by AT's Integrated Network Enablement and Metro services teams during a series of workshops between March and October 2020. This includes the assessment of existing in-service and out-of-service vehicles. In-service

vehicles are buses actively transporting customers on route, typically from point A to point B, while out-of-service vehicles are typically when buses are going between two different routes with no customers on board, typically waiting to start a new route or at the end of a route.

Observations were made during site visits to all stations conducted in February, March, and September (2020). The assessment identified:

- Specific conflict points between busway and local services
- Specific conflict points between pedestrians and buses
- Potential options to change bus stop allocation and bus circulation
- Potential locations for additional platforms and potential alternative locations for layovers
- Platform and station crowding observations

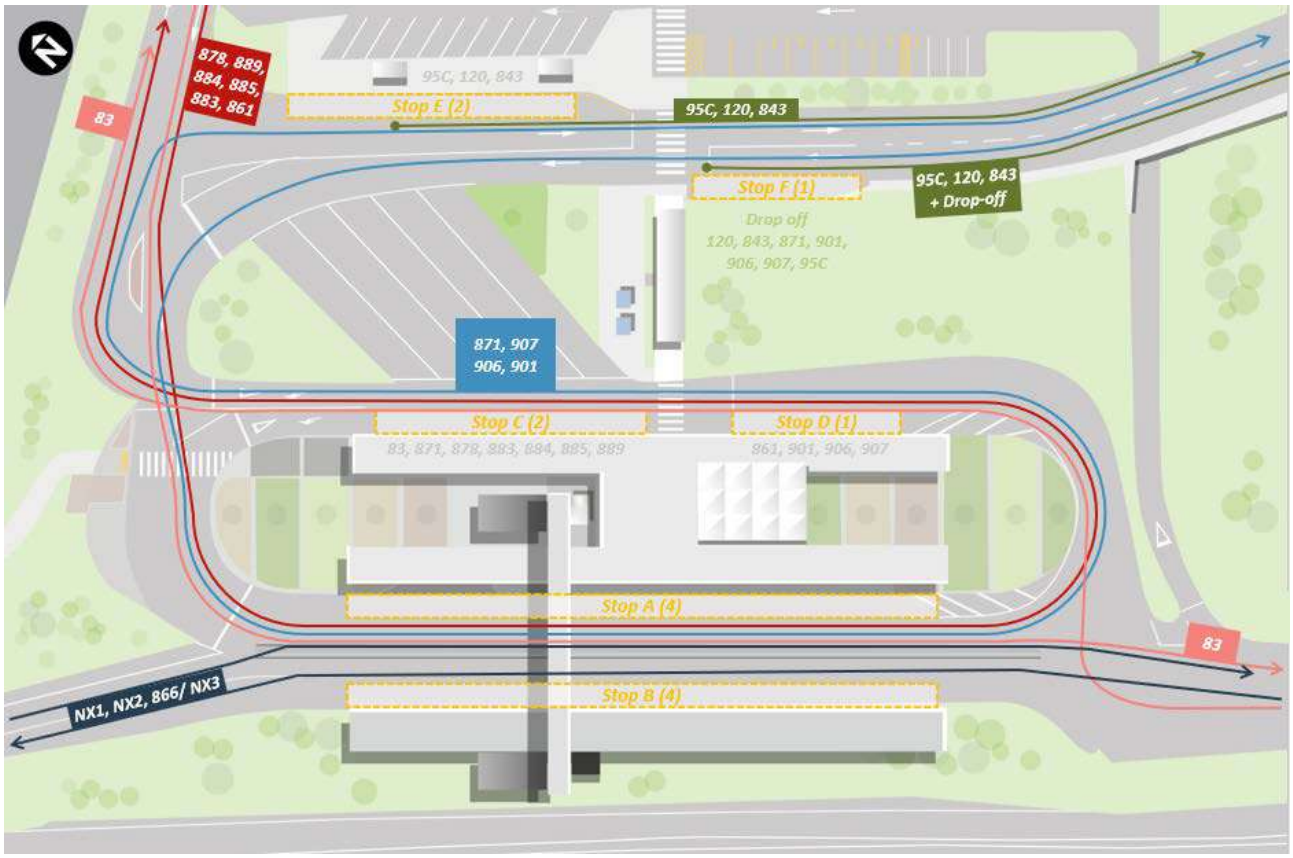


Figure 6-4: Existing in-service circulation of vehicles at Constellation Station

6.3.2 Operation surveys and CCTV observations

The flow of pedestrians across the path of circulating buses via the existing at grade pedestrian zebra crossings is a key element impacting busway service operations. These crossings provide priority to pedestrians but introduce delay to buses. In addition, the way the crossings are used increases safety concerns, particularly when buses are queued due to insufficient stop capacity, or when pedestrians rush across the crossing in order to board a departing service.

To assess the impact of the standard interventions, the existing and forecast pedestrian crossing operation and pedestrian volumes were reviewed via CCTV video footage supplied by AT. The objective of the analysis was to understand:

- The frequency of pedestrians using the current at-grade zebra crossings and affecting buses (i.e. how often are buses stopped)
- The number of pedestrians using the at-grade crossings

- The delay to buses from pedestrians crossing (crossing duration).

From the observations an assessment could be made of future operation and the increasing conflicts between buses and pedestrians at the zebra crossing causing delays for buses due to increased number of users at the station and transfers between local and busway services (which requires using the crossing).

Figure 6-5: Busway Station CCTV (Constellation Station, 30 June 2020)

6.3.3 Platform capacity assessments

The Transit Capacity and Quality of Service Manual (TCQSM) provides guidance on transit capacity, quality of service issues and influencing factors. It provides information on various types of public transportation and a framework for measuring availability, comfort and convenience from the passenger and transit providers points of view.

The TCQSM includes an evaluation tool that calculates the capacity of a bus stop or station based on a number of criteria, including dwell time, road classification, design failure rate (occupied bus stop on bus arrival), coefficient of variation of dwell time (standard dwell time deviation over average dwell time), and time. This information enables the calculation of current capacity and predict impacts of future expected growth rates.

The theoretical capacity of all station platforms was assessed to determine the need for potential bus stop and platform extensions.

The assessment included:

- Southbound busway services
- Northbound busway services
- Local services

Sensitivity tests were carried out for all stations, to test the impact of potential changes to forecasted vehicle volumes or dwell times. The assessment results were compared against previous assessments carried out for the Northern Busway stations by Aurecon as part of the North Shore Rapid Transit Network PBC and Northern Corridor Improvements Project to provide additional technical validation. The detailed results and comparison are included in the options assessment reports in Appendix B.

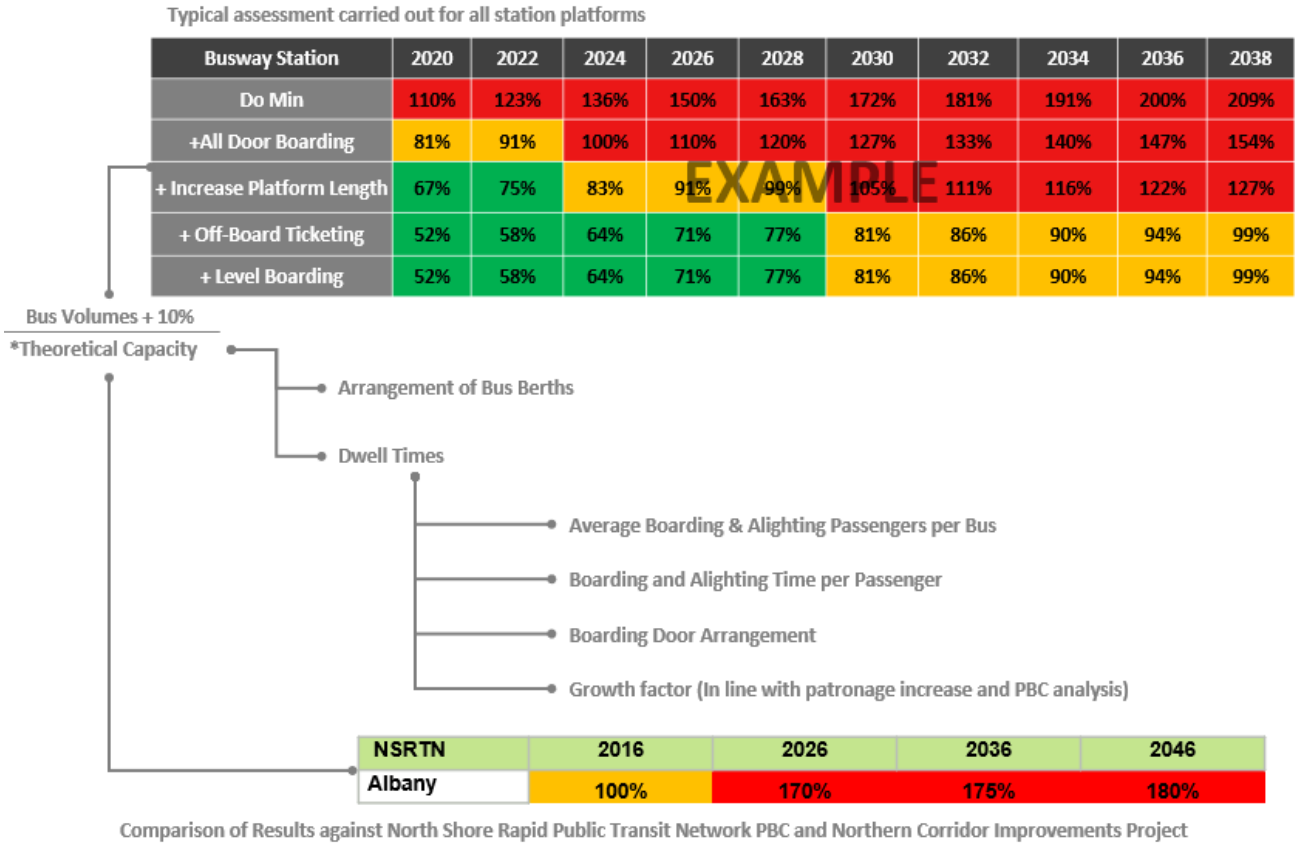


Figure 6-6: Platform capacity assessment example

6.3.4 Micro-simulation modelling

To enable a detailed evaluation of standard interventions, a microsimulation model of the Northern Busway between Albany and Akoranga station was developed. This model provided a tool to assess the proposed operational interventions. The operational and capacity assessments confirmed that the busway stations will be susceptible to operational issues related to:

- Bus stop capacity caused by the frequency and number of bus services (through routes and local services)
- Dwell times associated with ticketing and boarding operation
- Station circulation requirements for local bus services
- Conflicts between at-grade pedestrian facilities and future bus station operation.

The model provides insight into the predicted bus station performance and platform performance, while also showing the operational impacts associated with the existing at-grade pedestrian crossings and local bus routing about the stations. The modelling also provides a visual tool to illustrate the future stations predicted operation when considering interventions.

Two forecast years, 2028 and 2038, were developed for option testing (and to present the issues related to the do minimum base case). The forecast years relate to the MSM forecast years at the time of the study and reflect a short- and medium-term horizon within the DBC assessment. As part of the assessment, four tests were carried out:

- Test 1: Revised local bus circulation and platform extensions.
- Test 2: Boarding and alighting and dwell time improvements
- Test 3: Grade separated pedestrian crossings (2028)
- Test 4: Grade separated pedestrian crossings (2038)

Figure 6-7: Albany Station and Constellation Stations – Example of operational issues in 2028 with no interventions (8:00 am)

6.3.5 Platform Crowding Assessment

In addition to observations based on site visits and CCTV data, patronage and typical boarding data was analysed (using the AT HOP data) in order to identify any specific crowding issues at stations. Passenger boarding data was analysed over three mid-weekdays (Tuesday to Thursday) for a typical week in March 2019.

Figure 6-8 shows the three-day total for boarding's at Constellation Station as an example. This provided insight to the general patronage trends throughout a typical day at stations and allowed for the identification of any issues due to lack of useable platform space.

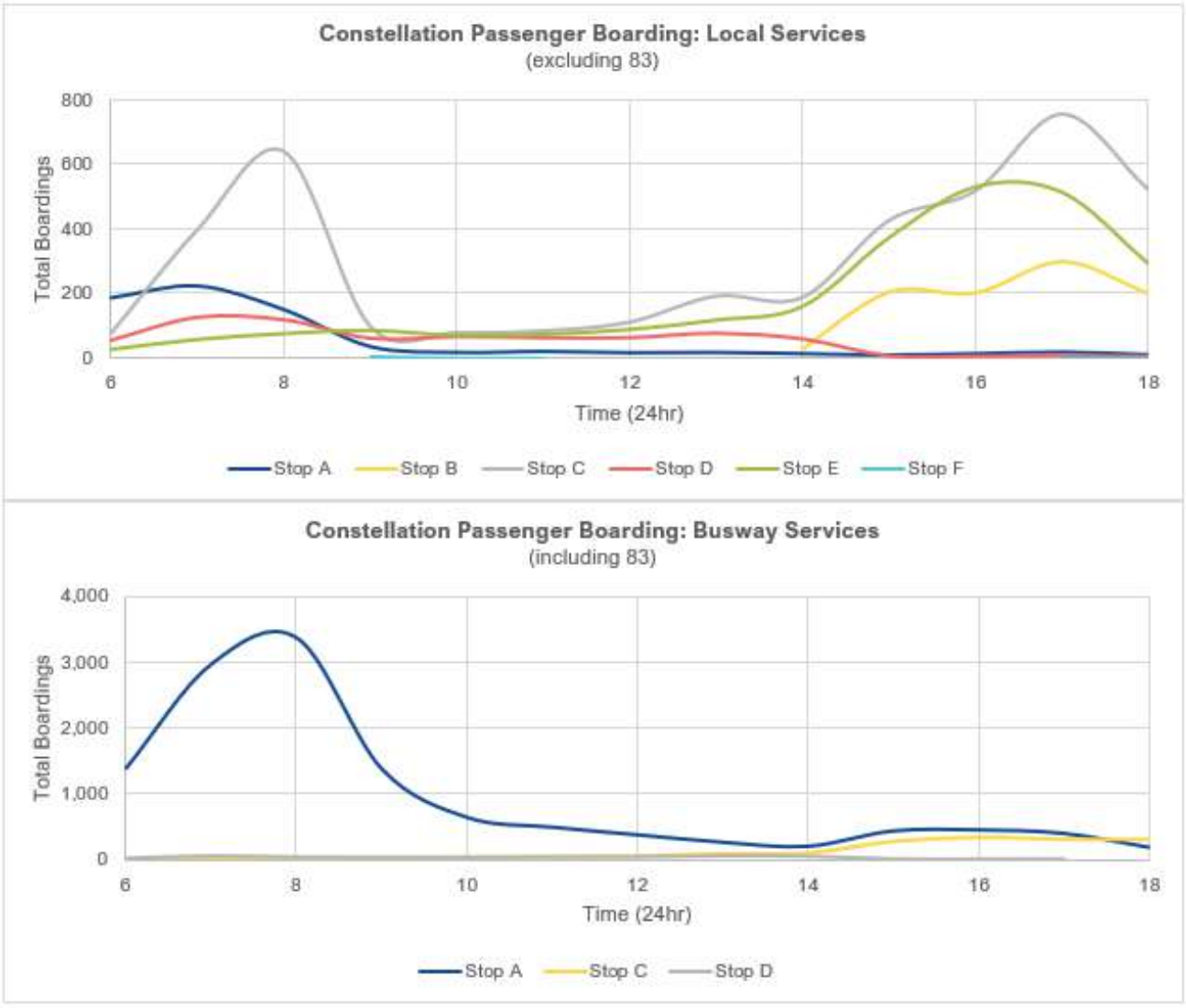


Figure 6-8: Constellation passenger boardings

A high-level assessment for the existing waiting area level of service was undertaken for each platform in their respective peaks, based on the Transit Capacity and Quality of Service Manual, 3rd Edition. As a sensitivity test, missed headway scenarios were also tested for busway platforms to determine the effects on the waiting area level of service.

The need for station platform changes was also based on the current Constellation Station Upgrade. This includes the removal of the central hub protrusion outside the head of stop of Platform A, to enable larger passenger waiting areas at platforms. Similar improvements based on project patronage were identified at Albany and Smales Farm Stations.

Levels of service for pedestrian circulation areas are based on available standing space, perceived comfort and safety, and the ability to manoeuvre from one location to another. LOS letters range from A to F, with A representing an unimpeded condition and F representing an undesirable condition in which pedestrian movement is severely constrained. Pedestrian capacity-the maximum number of pedestrians that can pass a point in a given period of time-is represented by the threshold between LOS E and F. However, station design for typical conditions is usually based on maintaining a desirable (more comfortable) pedestrian LOS, rather than designing for maximum pedestrian capacity.

Table 6-3 below provides an example of the crowding assessment undertaken for stations.

Table 6-3: Future Estimated Waiting Area Level of Service

Constellation Station Waiting Area Level of Service				
Stop	Estimated Waiting Area (m^2)	Average boarding on every service		
		2020	2028	2038
A	90.6	A	C	C
B	90.6	A	A	A
C	73.6	B	D	D
D	76.8	A	B	B
E	73.6	A	A	A

6.4 Busway Station Assessment Results

The assessment results, proposed interventions and potential station layouts were presented to Auckland Transport and Waka Kotahi stakeholders in a series of workshops from May to November 2020. The interventions were refined and updated to incorporate feedback received. Workshop attendees included stakeholders from:

- AT Planning and Consenting
- AT Public Transport Infrastructure
- AT Public Transport Network Planning
- AT Public Transport Maintenance and Operations
- AT Auckland Forecasting Centre (Microsimulation modelling results)
- Waka Kotahi - Northern Pathway Akoranga to Constellation Station DBC (Constellation, Sunnynook, Smales Farm and Akoranga Station)

The recommended concept layouts for all stations are briefly described in the section below. Interventions are numerically ordered and annotated where relevant.

Table 6-4: Station Interventions

Intervention No.	Intervention Type
1.	Platform and canopy extensions
2.	New platforms/ local platforms and canopies
3.	Grade Separated Pedestrian crossings
4.	Set back glass panel walls
5.	New layover bays
6.	New turnaround facilities
7.	New kiss-and-ride drop-off facilities

6.4.1 Albany Station

The proposed interventions for Albany Station are indicated in Figure 6-9 and described below.

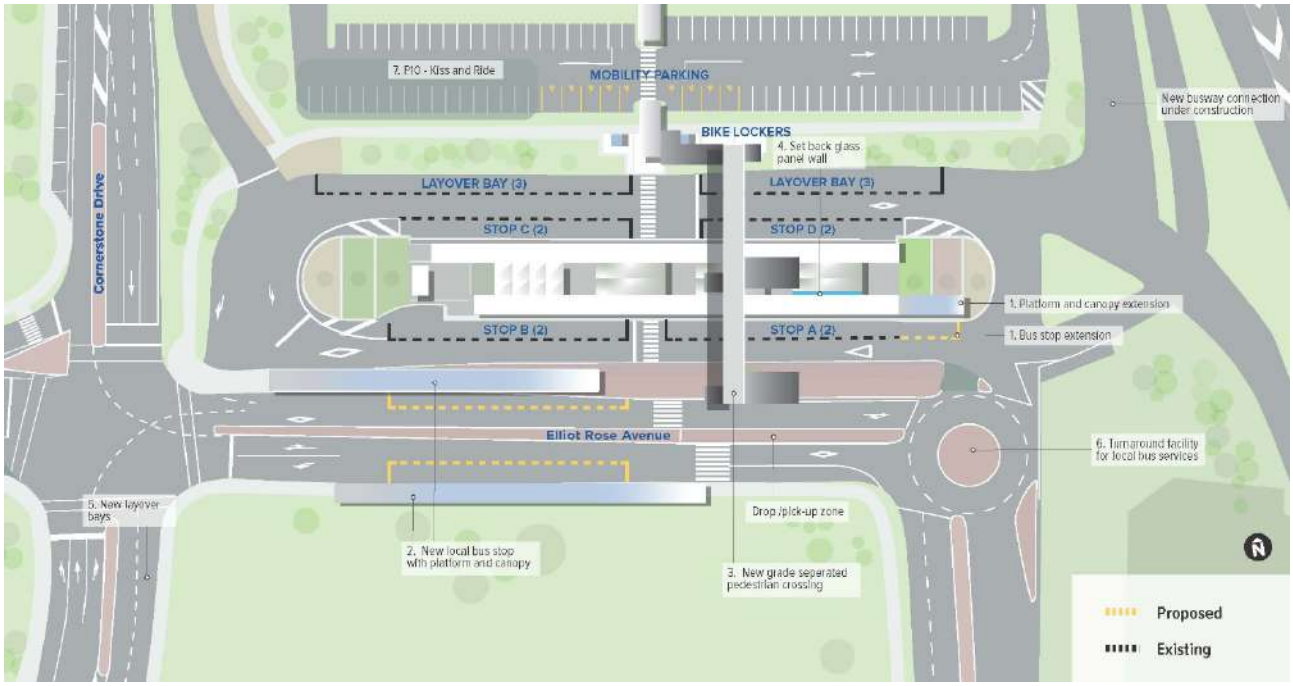


Figure 6-9: Albany Station Recommended Concept Layout

Platform Extensions

Platform length extensions to accommodate additional stops required for busway services. This improvement should be given priority and staged for implementation in the immediate future. This consists of platform and canopy length extensions for Stop A and C to create triple stops [Item 1 on the diagram above].

Additional Platform & Bus Circulation Changes

- Relocation of local bus service platforms onto Elliot Rose Avenue. A double stop would be provided on each side of Elliot Rose Avenue, parallel to the busway stops on Elliot Rose Avenue on both sides of the road. This would further increase the number of local bus platforms to four stops [Item 2 on the diagram above].
- Two double stop layover bays are provided on Cornerstone Drive (south of the Elliot Rose Avenue/Cornerstone Drive intersection) with an additional turnaround facility provided at the Spray Rise / Cornerstone Drive intersection which allows terminating bus services to travel back to Elliot Rose Drive to commence services. [Item 5 on the diagram above]

- Turnaround facility for local buses on Elliot Rose Avenue is provided east of the stops to accommodate bus routes approaching from both east and west directions [Item 6 on the diagram above].
- Busway services to remain within the current layout of Albany Station. This will help increase capacity and alleviate potential bus bunching (especially during peak periods) and improve the overall level of service for customers within the station.

Concourse Arrangement

Sections of Platform A and B (southbound busway stops) have constrained width due to the protruding glass walls separating the internal and external areas, narrowing the useable width of the platform in the boarding area. This restricts the free flow of passengers along the platform and limits room to circulate. This intervention would widen the effective waiting area through relocating (setting back) the glass panel walls [Item 4 on the diagram above].

Grade Separated Crossings

Micro-simulation modelling indicates that grade separated crossings [Item 3 on the diagram above] will be required to replace the existing zebra crossings due to the increased conflict between growing passenger and bus volumes; and hence a grade separation overpass, providing access from Elliot Rose Avenue and the Park and Ride facility is proposed.

6.4.2 Rosedale Station

Based on the projected growth and capacity assessments, Rosedale is not expected to require any additional upgrades or changes within this busway enhancement programme. Given that the Rosedale business case was completed in 2018, the assessments confirmed that the station will have sufficient capacity for all years assessed as part of this business case. Any potential system-wide improvements implemented will however have to be included for Rosedale Station.

6.4.3 Constellation Station

The proposed interventions for Constellation Station are indicated in Figure 6-10 and described below.

Figure 6-10: Future concept layout of Constellation Station

Platform Extension

Platform length extensions to accommodate additional stops required for busway and local services [Item 1 on the diagram above], facilitated by the moving of the pedestrian crossing allows for combining Platform C and D with a slight extension on the northern end to increase platform length, providing two double stops at this local stop i.e. capacity for 4 buses at any one time.

Additional Platform & Bus Circulation Changes

- A new turnaround facility is introduced at the southern end of the station to eliminate the need for local services to circulate via the busway. Local terminating services are able to access the final stops and layover facilities and turn around for new service commencement without interference with the busway [Item 6 on the diagram above].
- A new local bus stops and platform provided opposite of current stops C&D, which involves a new double stop along with an associated platform and canopy. The southern end of this platform would be available for use as layover [Item 2 on the diagram above]. Stop F relocated directly across from Stop E with increased capacity as a double stop. Stop F to be indented to prevent buses bunching behind a stopped bus. A new canopy is proposed at the existing Stop E to provide better shelter as well as greater passenger waiting space.

- Existing layover bay to be relocated to provide additional local stops as described above. As such, new layover bays are provided opposite the southern end of Platform B. Parallel layover bays are also provided on the northern side of the bus accessway connecting into Parkway Drive [Item 5 on the diagram above].

Grade Separated Crossing

A new grade separated crossing would replace the existing zebra crossing between the main station hub and Stop F, to eliminate bus-pedestrian conflicts [Item 3 on the diagram above]. Traffic modelling indicates that this would provide a noticeable improvement in travel time and reliability due to removing the need for buses to stop (particularly during peak hours) and subsequently, a reduced risk of bus bunching issues.

6.4.4 Sunnynook Station

The proposed interventions for Sunnynook Station are indicated in Figure 6-11 and described below.

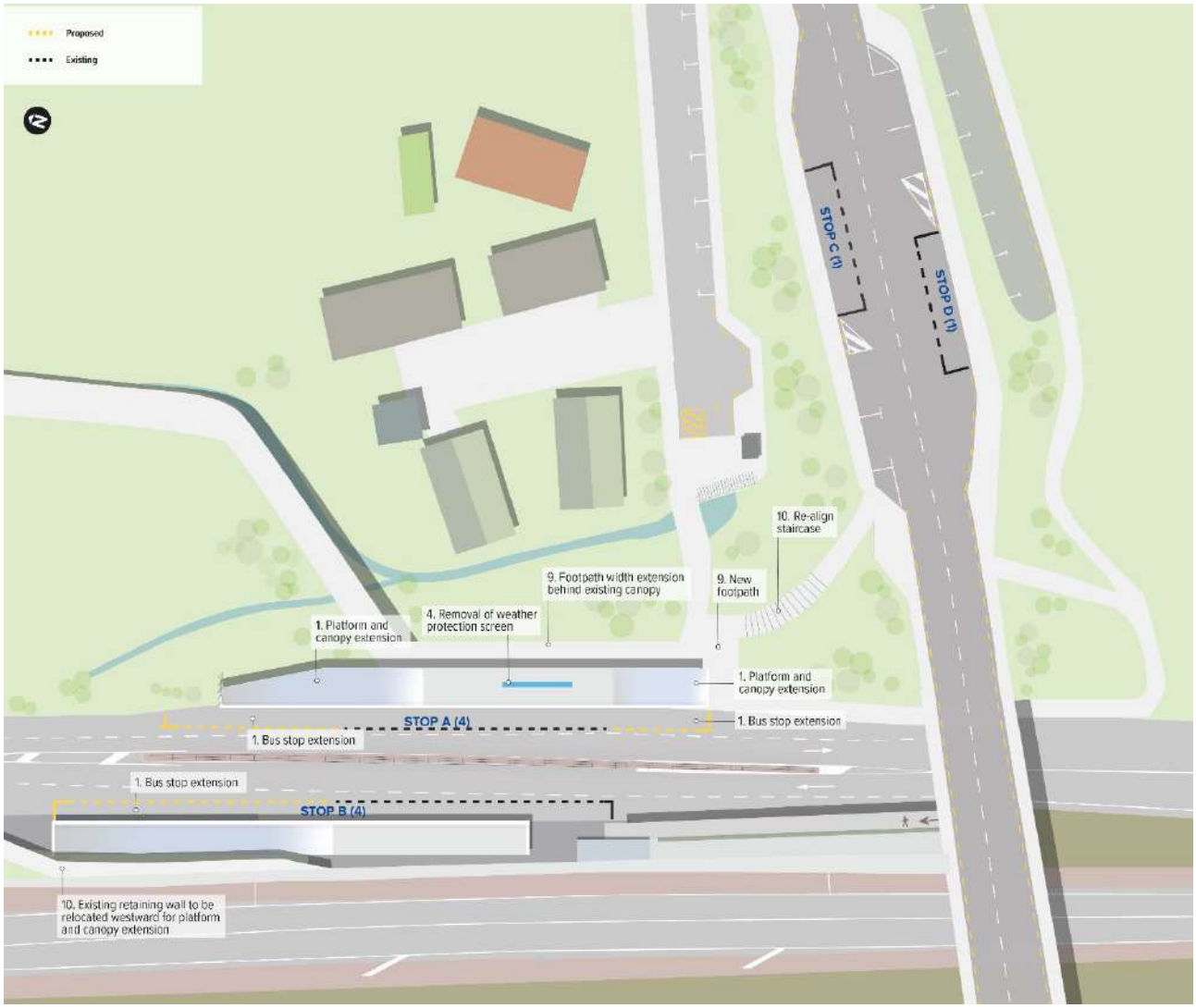


Figure 6-11: Sunnynook Station – Potential Future Layout

Busway Platform Extensions

- Bus stop length extension for each busway platform to provide two double stops i.e. capacity for 4 buses at any one time. The platforms and canopies to be extended accordingly [Item 1 on the diagram above].

- The northbound platform will be extended from 40.0m to 75.0m in length with a canopy extension. This will require the realignment of the existing retaining wall at the northern end of the northbound stop.
- The southbound platform length to be extended to 65.0m. The northern end of the southbound platform is constrained by a retaining wall (which is unlikely to be set back/relocated due to the adjacent stormwater stream) hence only extension of 25.0m. This will however not hinder ability for passengers to alight/board from the northern end of the platform.

Platform Width

- The busway southbound platform (Platform A) has constrained platform widths, restricting the flow of passengers along the platform and limits room to pass. A new 2.0m footpath is proposed behind the existing canopy to help alleviate crowding of passengers. The new footpath can be utilised by those accessing/leaving the bus stops from different ends of the platform whilst avoiding conflict with queued passengers on the main platform [Item 9 on the diagram above].
- In addition to the above, the realignment of the staircase from Sunnynook Road to Platform A (southbound stop) and the relocation of the weather protection screen will help with crowding, separate groups of users, and increase effective waiting space [Items 10 and 4 respectively on the diagram above].

6.4.5 Smales Farm Station

The proposed interventions for Smales Farm Station are indicated in Figure 6-12 and described below.

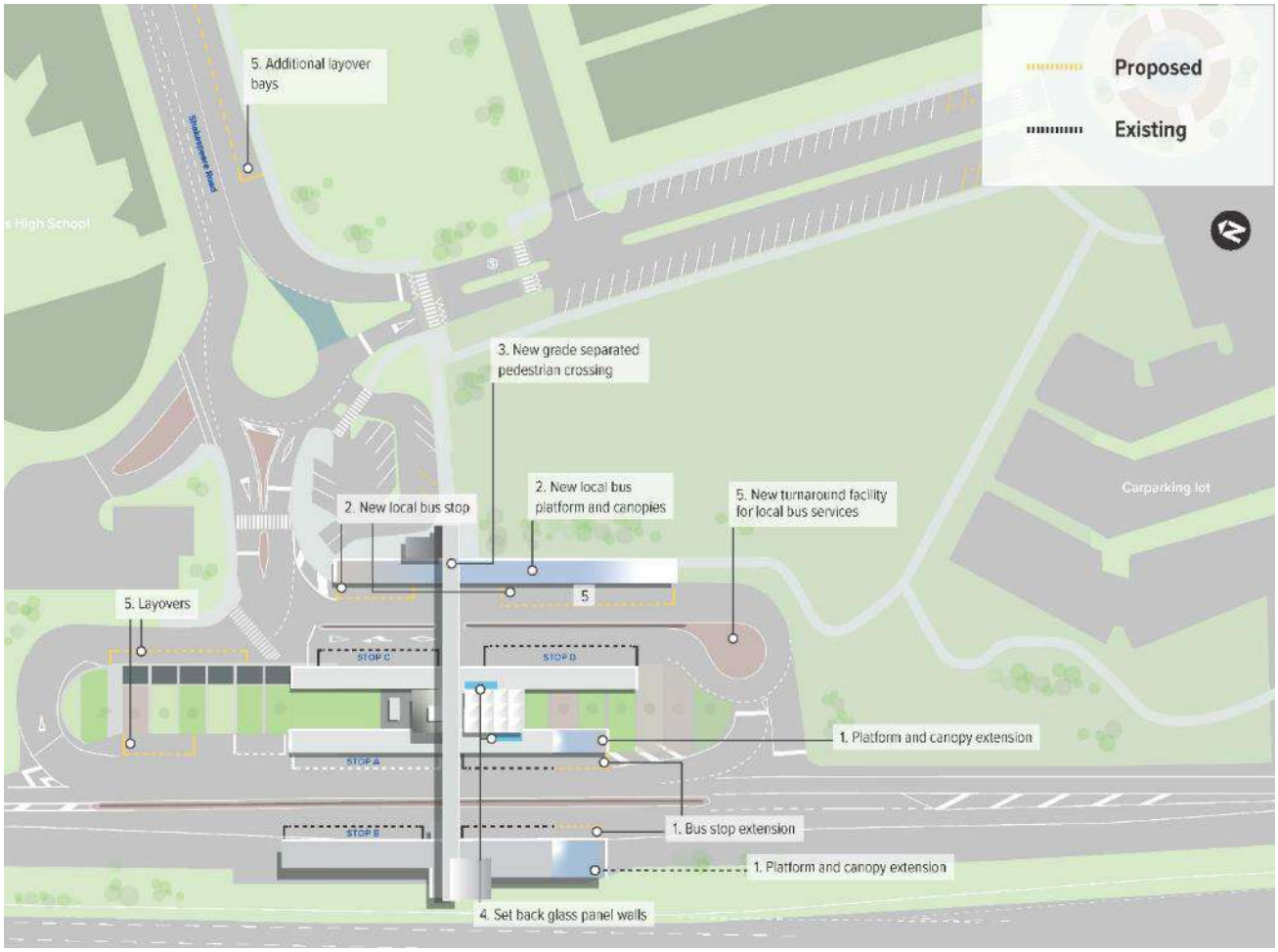


Figure 6-12: Proposed Intervention at Smales Farm Station

Bus Platform Extensions

- Platform length extension for the busway platforms stops in both directions. Increase in platform length (to 75.0m) to provide two double stops i.e. capacity for 4 buses at any one time. This will help to alleviate potential bus bunching

(especially during peak periods) and improves overall level of service for customers within the station [Items 1 on the diagram above].

- Platform length increase of the existing local platform, and a new local platform is proposed to increase capacity for local services.

Additional Platform & Bus Circulation Changes

- Additional single stop opposite Stop C and double stop opposite Stop D. This will help increase capacity and alleviate potential bus bunching (especially during peak periods) and improves overall level of service for customers within the station [Item 2 on the diagram above].
- Separation of local services with busway services will lead to more direct stops for passengers as local services are not required to make the additional loop and therefore reduces travel time. This reduces the conflict between northern busway buses pulling into/out of station and local buses reducing congestion through station. Some buses will still reposition via the busway out of peak to use layover at the northern end of the station.
- A second turnaround facility introduced at southern end of the station to eliminate the need for terminating local bus services to circulate via the Northern Busway apart from when the circulation is at full capacity. The turnaround facility located on the southern end enables terminating services to access last stops and layover facilities and commence in the correct northbound direction at the station [Item 6 on the diagram above].
- Additional layover bays can be provided on Shakespeare Road increasing the layover capacity from 2 layover bays to 4. There is also the possibility to replace a local stop with layover bays opposite Stop C or Stop D. An extra layover bay can also be accommodated on the eastern side of the busway north of the existing service bay that can be utilised by out of service buses. Providing a total of 6 layover bays. [Item 5 on the diagram above]

Platform Width/ Hub Layout Changes

A section of the Northern Busway southbound platform (Stop A) and the local bus northbound platform (Stop D) has constrained platform width due to the protruding glass wall separating the internal and external areas, narrowing the platform where people regularly wait. This restricts the free flow of passengers along the platform and limits room to pass. Widening the effective waiting area through relocating (setting back) the glass panel walls [Item 4 on the diagram above].

Grade Separated Crossing

A new grade separated crossing would replace the existing zebra crossing between the main station hub and the main pedestrian entrance, to eliminate bus-pedestrian conflicts.

Traffic modelling indicates that this would provide a noticeable improvement in travel time and reliability due to removing the need for buses to stop (particularly during peak hours) and subsequently, a reduced risk of bus bunching issues.

6.4.6 Akoranga Station

The proposed interventions for Akoranga Station are indicated in Figure 6-13 and described below.

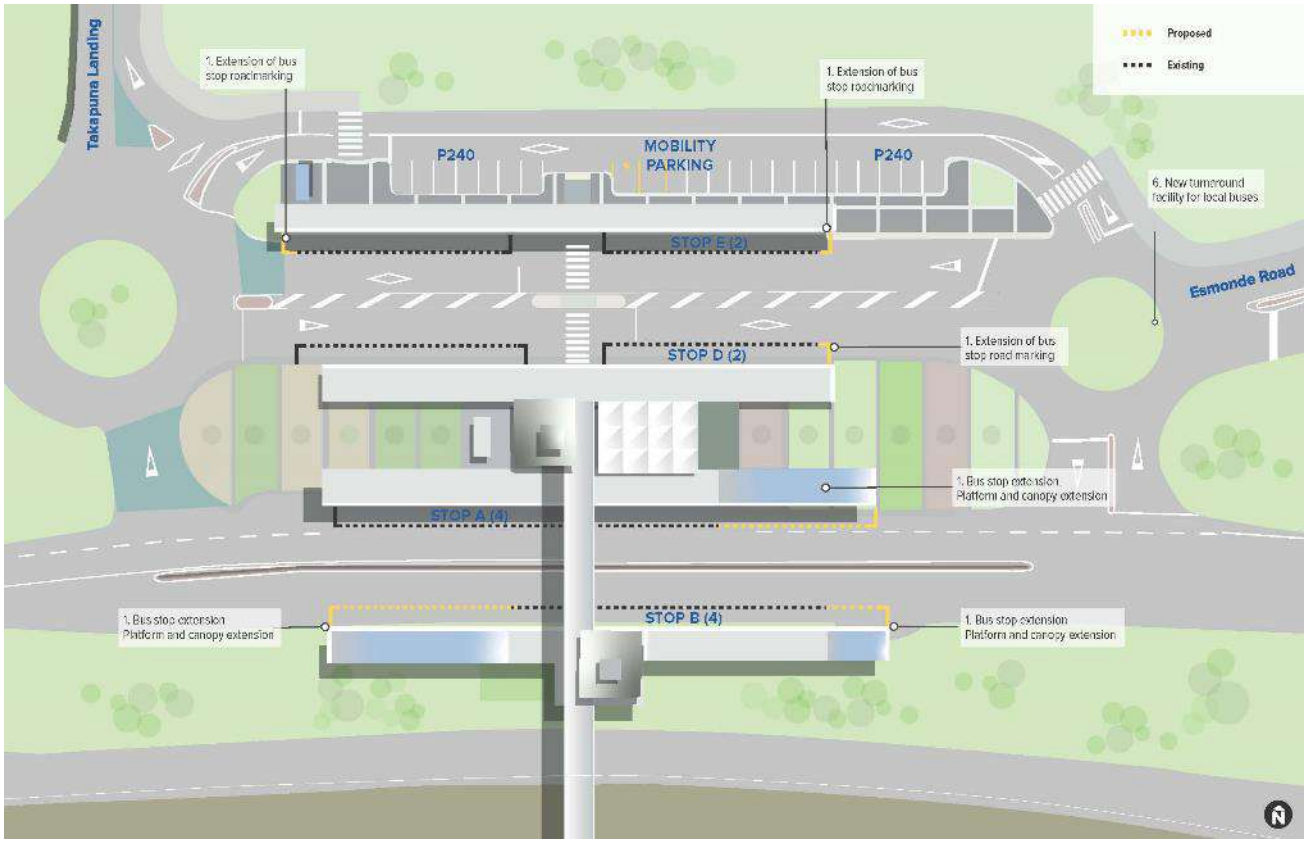


Figure 6-13: Proposed Interventions at Akoranga Station

Platform Extensions

Platform length extension for both the southbound and northbound Northern Busway platforms. This would require an increase in platform length (to 75m) to provide two double stops i.e. capacity for 4 buses at any one time and associated canopy extensions. Slight platform length extensions are also proposed at existing local stops (to 30.0m) to provide better manoeuvrability for buses pulling into and out of stops. This will help to alleviate potential bus bunching (especially during peak periods) and improves the overall level of service for customers within the station [Items 1 on the diagram above].

Bus Circulation

A second turnaround facility introduced at southern end of the station (at intersection with local road from Esmonde Road) to eliminate the need for terminating local bus services to circulate via the Northern Busway. The proposed turnaround enables terminating services approaching from Takapuna Landing to access last stops and layover facilities and commence in the correct northbound direction at the station [Item 6 on the diagram above].

7 State Highway 1 Optioneering

This section documents the identification, development, and assessment of busway options to respond to the problems identified in the strategic case and to deliver the desired benefits. The options assessment process was undertaken in accordance with AT and Waka Kotahi requirements, with the engagement of stakeholders.

The SH1 optioneering process included:

- Analysis of current public transport operations between Akoranga Station and Beaumont Street.
- Modelling assessment
- High-level priority options were developed for the three sections of the busway, aimed at addressing the issues identified (existing and forecasted).
- The draft options were circulated to stakeholders and amended to incorporate initial comments refined to comply with the Costal Marine Area (CMA) and technical requirements
- Options were assessed against an MCA framework
- Recommended options and an indicative programme of works were identified for further development

7.1 Operational Assessment / Evidence

The key issues occurring along this section of busway are related to travel time and reliability. Continuous growing demand is expected to increase travel time and variability issues for busway services along sections of the corridor.

7.1.1 Travel Time/GPS Data (Variability)

As shown in Section 3, the major issues occurring along this section of busway are related to travel time and reliability. Continuous growing demand is expected to increase travel time and variability issues for busway services along sections of the corridor.

- During morning peak hour (8 am to 9 am)
  - Mostly free flow on SH1 in both directions except for northbound on approach to Curran Street on ramp. Northbound bus travel speeds drop to between 10 to 20 kph on approach to the Curran Street on ramp,
  - Lower speeds on the AHB between 40 to 55 kph in both directions.
- During evening peak hour (5 pm to 6 pm)
  - The southbound bus travel speed reduces at the Onewa Road on-ramp in the evening peak. Note only three lanes are provided in this counter peak direction.
  - Northbound bus travel speeds reduce to 10 to 20kph northbound on approach to Curran Street on-ramp.
  - Northbound off-ramp at Esmonde Road indicates reduced bus speeds however, this is mostly associated with the traffic signal delay as bus priority exists on the off-ramp.

In addition to average travel times, gaps in the current bus priority network lead to reduced reliability when significant events occur on the motorway system. Buses cannot bypass general traffic congestion in these locations, for instance northbound between Fanshawe Street and Curran Street.

7.1.2 Traffic Modelling Assessment

The NCI SATURN model has been used to test the proposed options along SH1 route between Akoranga station and Beaumont Street. The NCI model was developed for the NCI project (currently under construction) and the models represent a weekday morning peak, inter peak and evening peak period.

The NCI model has been used as the model covers SH1, SH16 and SH18 and therefore allows traffic to reroute away from the AHB if dictated by option capacity constraints. It is also readily available and has been previously peer reviewed and accepted as the traffic modelling assessment tool for the NCI project.

Figure 7-1 presents the extent of the NCI SATURN model.

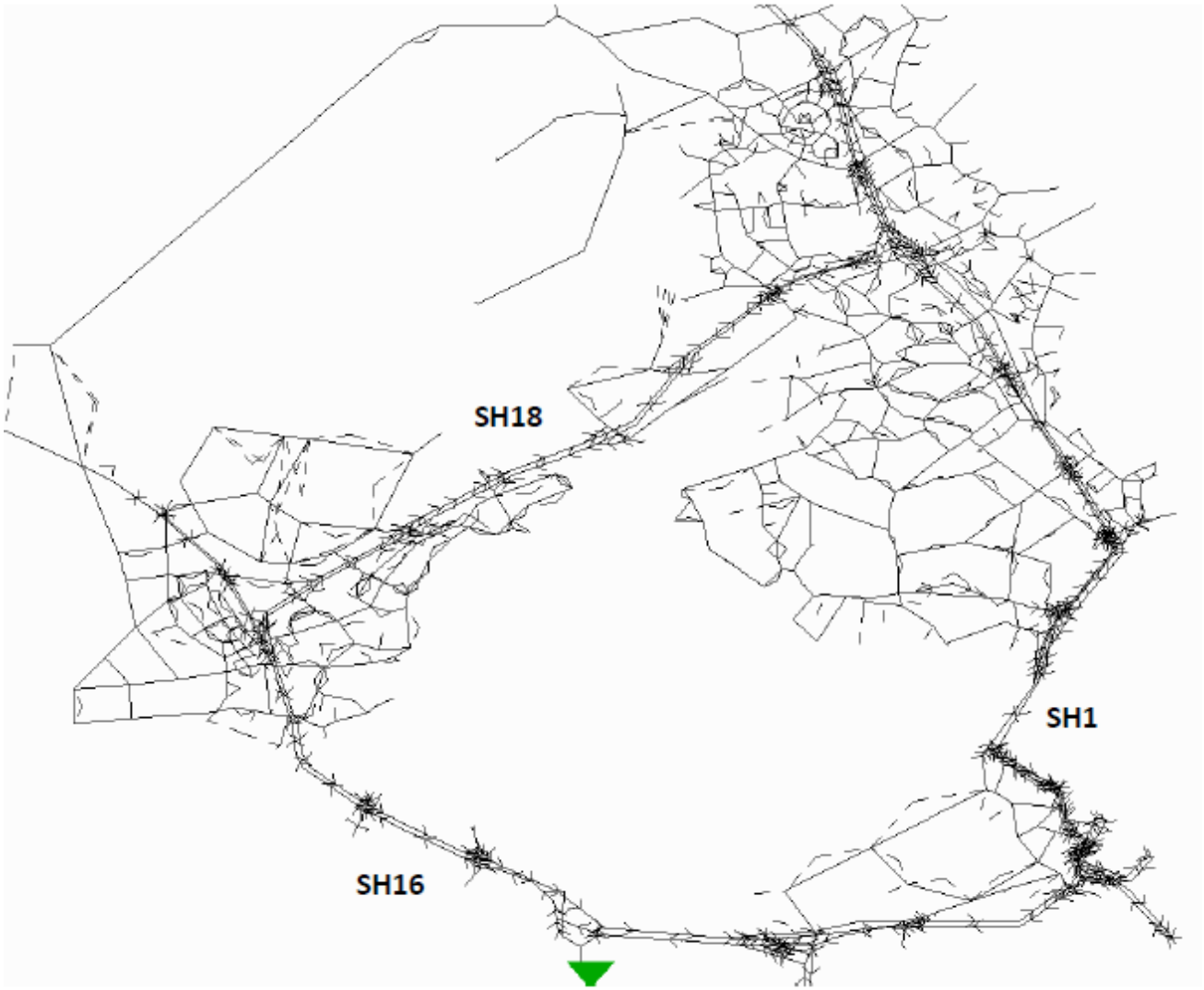


Figure 7-1: SATURN Model showing the western ring route including SH18 and SH16

7.2 Design Considerations impacting Options Development

7.2.1 Northern Pathway Design

While further subsequent work is currently underway to develop and confirm the alignment of the Northern Pathway, for this assessment, all SH1 options between the Auckland Harbour Bridge and Akoranga assumes the Northern Pathway alignment provided by Waka Kotahi. During the time of this report, the Northern Pathway is proposed on the western side of SH1, starting in Westhaven, crossing the Auckland Harbour Bridge and continuing onto Akoranga Drive. Refer to Appendix D for the proposed Northern Pathway alignment provided by Waka Kotahi.

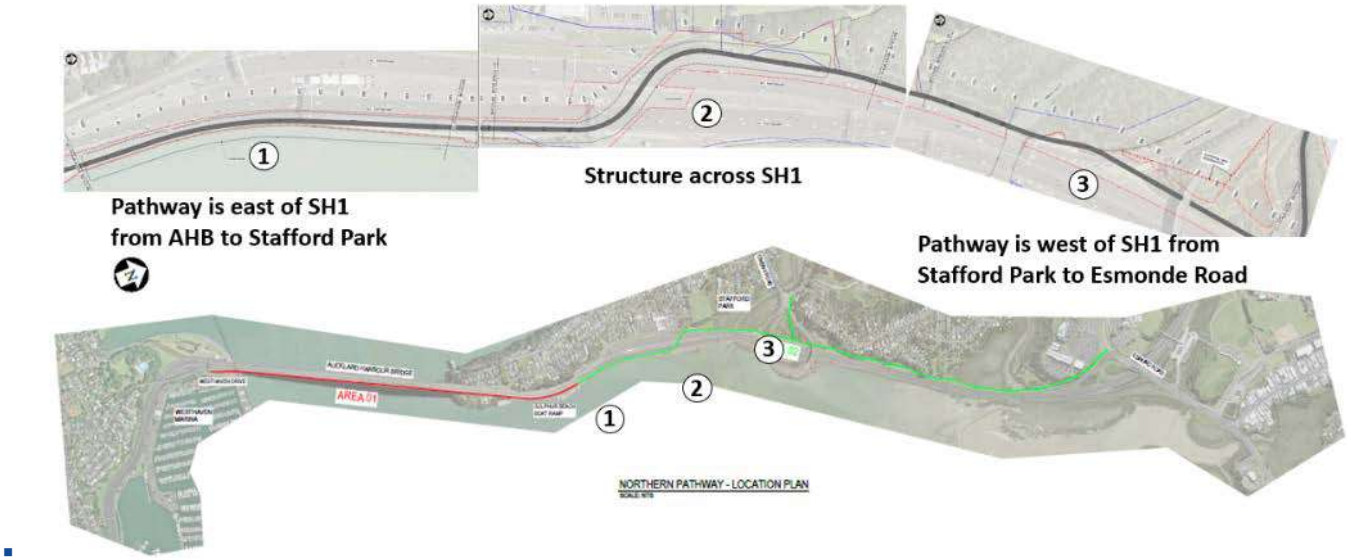


Figure 7-2: Northern Pathway Alignment (provided by Waka Kotahi, 2020)

7.2.2 Planning Context

Coastal Marine Area (CMA) and Significant Ecological Area (SEA)

Shoal Bay is situated to the immediate east of SH1 north of AHB, and forms part of the Coastal Marine Area (CMA). Several marine 'Significant Ecological Area' (SEA) overlays are also present within Shoal Bay and border the CMA boundary for the entire stretch of coastline within the project area.

The New Zealand Coastal Policy Statement (NZCPS) and Unitary Plan both give a strong policy direction towards a careful and precautionary approach in the coastal environment. These documents seek to avoid reclamation within the CMA, unless there are no alternatives, and protect the habitat of nationally significant indigenous species.

Therefore, any works in the CMA presents a significant consenting risk. Any application seeking reclamation or new structures within these areas are likely to be publicly notified and may be refused consent.

Figure 7-3: The extent of the SEA Marine overlays within Shoal Bay, with the M1 areas shown in dark blue and the M2 areas shown in light blue

Volcanic Viewshaft Overlay

Part of SH1 is subject to a 'Regionally Significant Volcanic Viewshaft' Overlay, as shown below in Figure 7-4. These viewshafts seek to protect public views of volcanic cones around the Auckland Region, and impose strict rules for buildings and structures within their 'projections.'

Typically, any new structures that enter these projections are automatically non-complying_activities and must be publicly notified. Typically, a non-complying activity refers to an activity not expected or appropriate within a specific area and the activity will be subject to a greater degree of assessment and scrutiny.

Both Onewa Road on- and -off-ramps already intrude into the E10 viewshaft. However, despite this, design consideration should be given to reducing the extent of structures that enter the viewshaft projection, such as locating any additional overpass structure(s) close to the Onewa Road ramps and/or reducing the required length of such structures where at all possible.

Figure 7-4: The portion of the E10 Volcanic Viewshaft affecting the programme area

Coastal Inundation

Large portions of the existing Northern Motorway/Busway corridor between Akoranga Bus Station and the Auckland Harbour Bridge are within the 'coastal storm inundation 1 percent annual exceedance probability (AEP) plus 1 m sea-level rise' area.

Under Rule E36.4.1 (A54) in the Natural Hazards and Flooding chapter of the Unitary Plan, infrastructure within the Strategic Transport Corridor Zone is a permitted activity. There are no applicable standards to comply with.

Overall, while design consideration should be given to coastal inundation and sea-level rise, the Unitary Plan is enabling infrastructure within hazard areas.

Coastal Cliff Remnants

Coastal cliff remnants are present along the alignment, both to the north and south of the bridge. These cliffs follow the former coastline (before the motorway was constructed) and contain SEA-protected vegetation, including mature Pohutukawa's. Two sites of significance to Mana Whenua are also present adjacent to these cliffs south of the bridge.

The section of motorway to the south of the Harbour Bridge is particularly constrained, both by Westhaven Drive to the north and by the coastal cliffs to the south. Any widening works in this corridor will require works to these trees, regional-level earthworks to modify the cliffs, works within the sites of significance to Mana Whenua and the loss of

some public open space. Such works will result in a range of adverse effects and will be challenging, if not impossible to gain consent approval.

7.3 SH1 Options

7.3.1 Summary

Table 7-1 summarises the interventions for each option against each section of the SH1 study area. Section 7.3.2 to Section 7.3.4 describe each option in detail.

Table 7-1: Options Summary

North of AHB	
Option 1	Minor Bus Shoulder Lane Extension
Option 2	Transit lanes
Option 3	Busway Extension
South of AHB	
Option 1	Minor Bus Shoulder Lane
Option 2	Transit lanes
Option 3	Widen for new bus shoulder lane

7.3.2 Do minimum

The do minimum SH1 option would involve making no improvements to the existing bus priority on SH1. The existing bus and shoulder lanes are retained, and bus priority would remain as existing. Figure 7-5 illustrates the current level of bus priority on SH1 (as well as on Fanshawe Street which is discussed in Section 8).

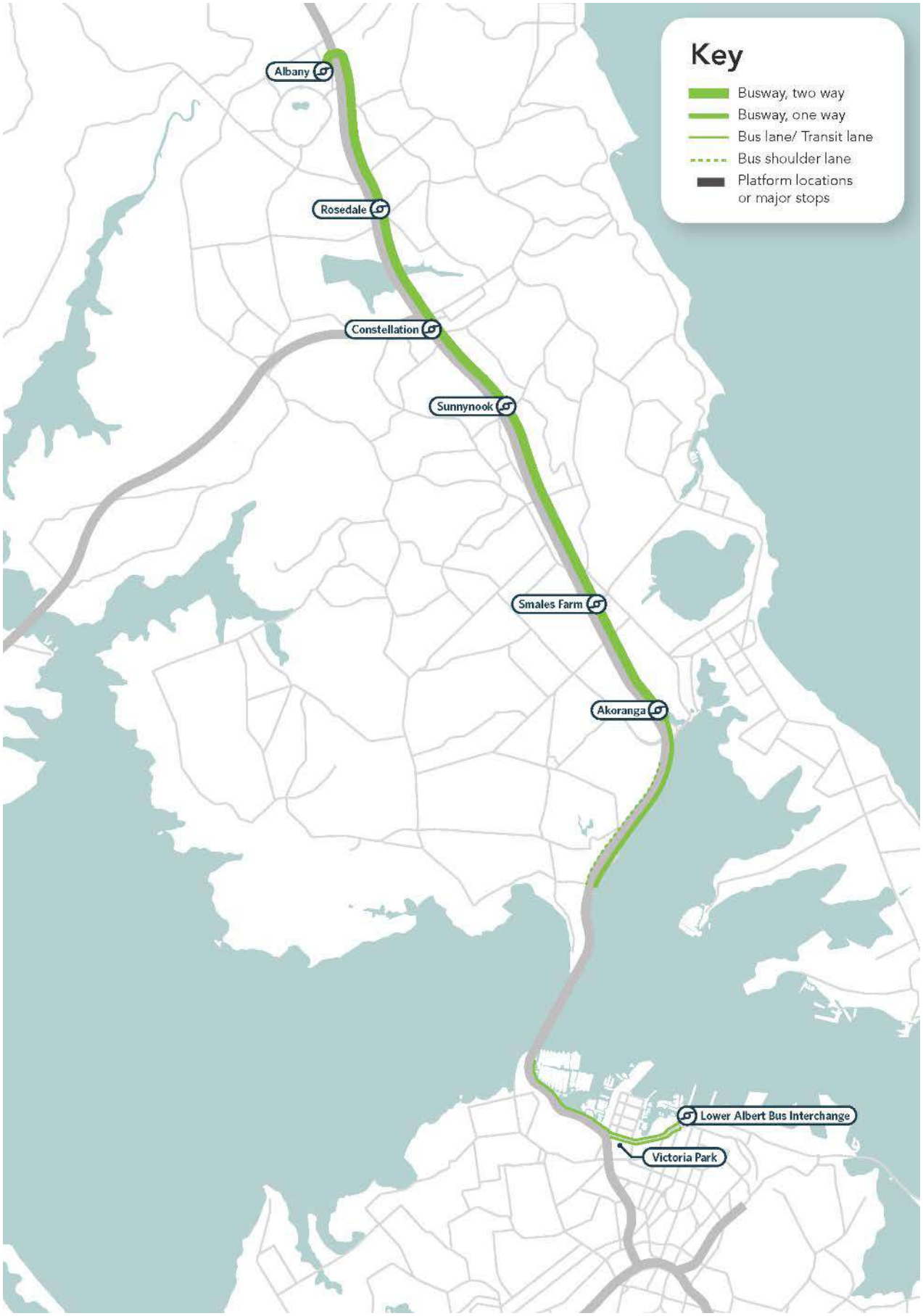


Figure 7-5: Bus priority map, Akoranga Bus Station to Beaumont Street, just west of Victoria Park

7.3.3 North of AHB

Option 1 – Minor Bus Shoulder Lane Extension

Option 1 involves introducing bus priority improvements without major changes to the existing infrastructure on SH1, where possible. For the portion of SH1 north of AHB, extension of the existing southbound bus shoulder lane by 400m is proposed. This provides southbound buses an additional 400m of priority and reduces the impact of general traffic congestion on the approach to the AHB. However, for the northbound direction, no additional bus priority is proposed due to physical constraints. This concept option is illustrated in Figure 7-6 below.

The proposed southbound bus shoulder lane will not impact any existing infrastructure and will only require roadmarking adjustments.

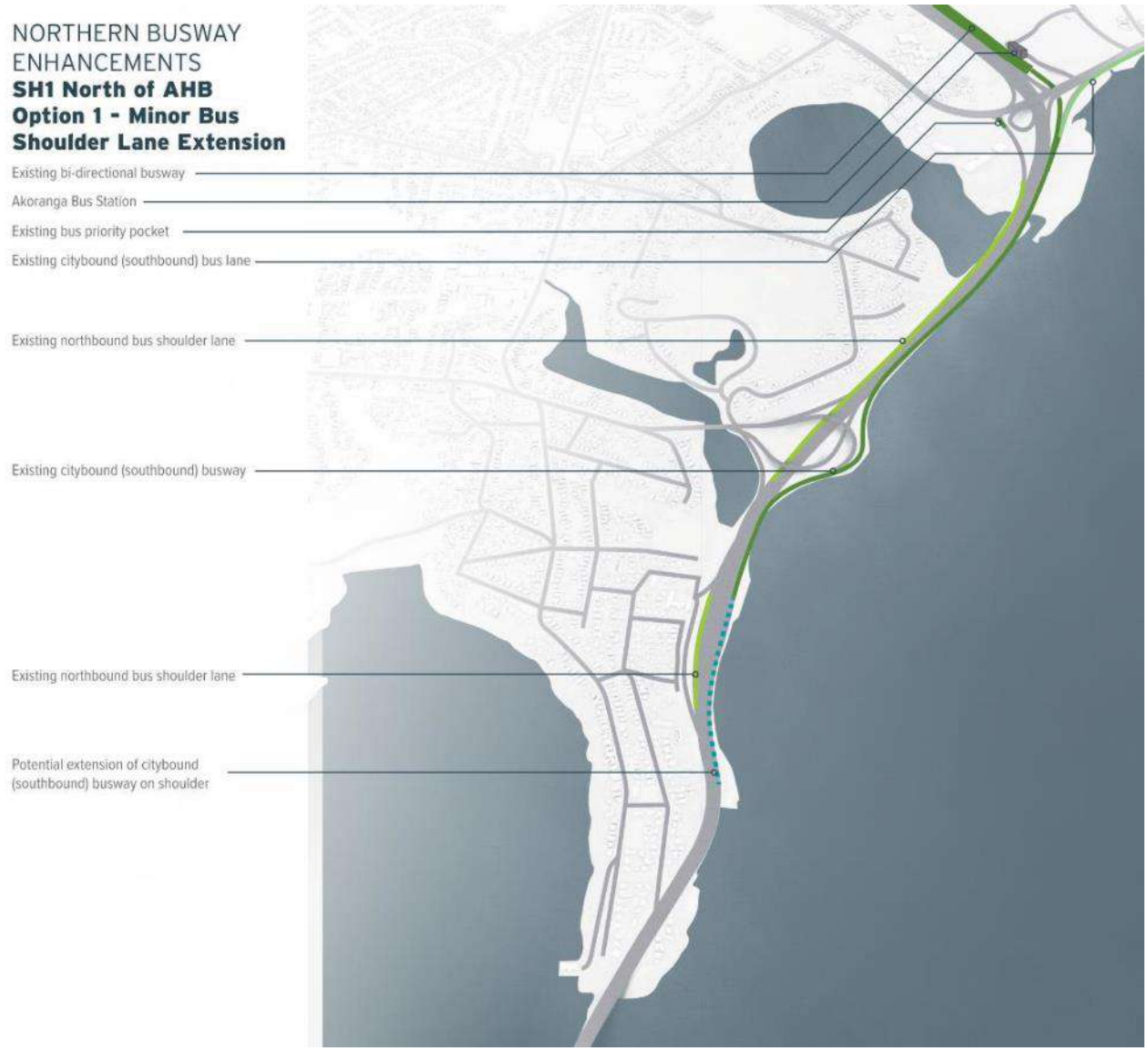


Figure 7-6: Option 1 – Minor Bus Shoulder Lane Extension North of the AHB

Option 2: Transit Lanes

Option 2 involves implementing transit lanes in both directions across AHB. The transit lanes will commence and terminate at either side of the AHB, providing priority to buses and high occupancy vehicles across the AHB. The effectiveness of the transit lanes in reducing impact of general traffic congestion on buses across the AHB is dependent on the operation of the transit lane (such as modal mix and operational hours). The operation of the transit lane is to be determine at a later stage.

The implementation of this option involves the following:

- Allocating the kerbside general traffic lane as a transit lane.
- Suite of transit lane signage to warn motorists of the transit lane operation, extents and crossover points. These are to be implemented on existing gantries where possible.
- New gantries as required to accommodate new transit lane signage.
- Road marking to delineate between transit lane and general vehicle lane.
- New ITS infrastructure to support the daily operation of the transit lanes.

The concept option is illustrated in Figure 7-7 below.

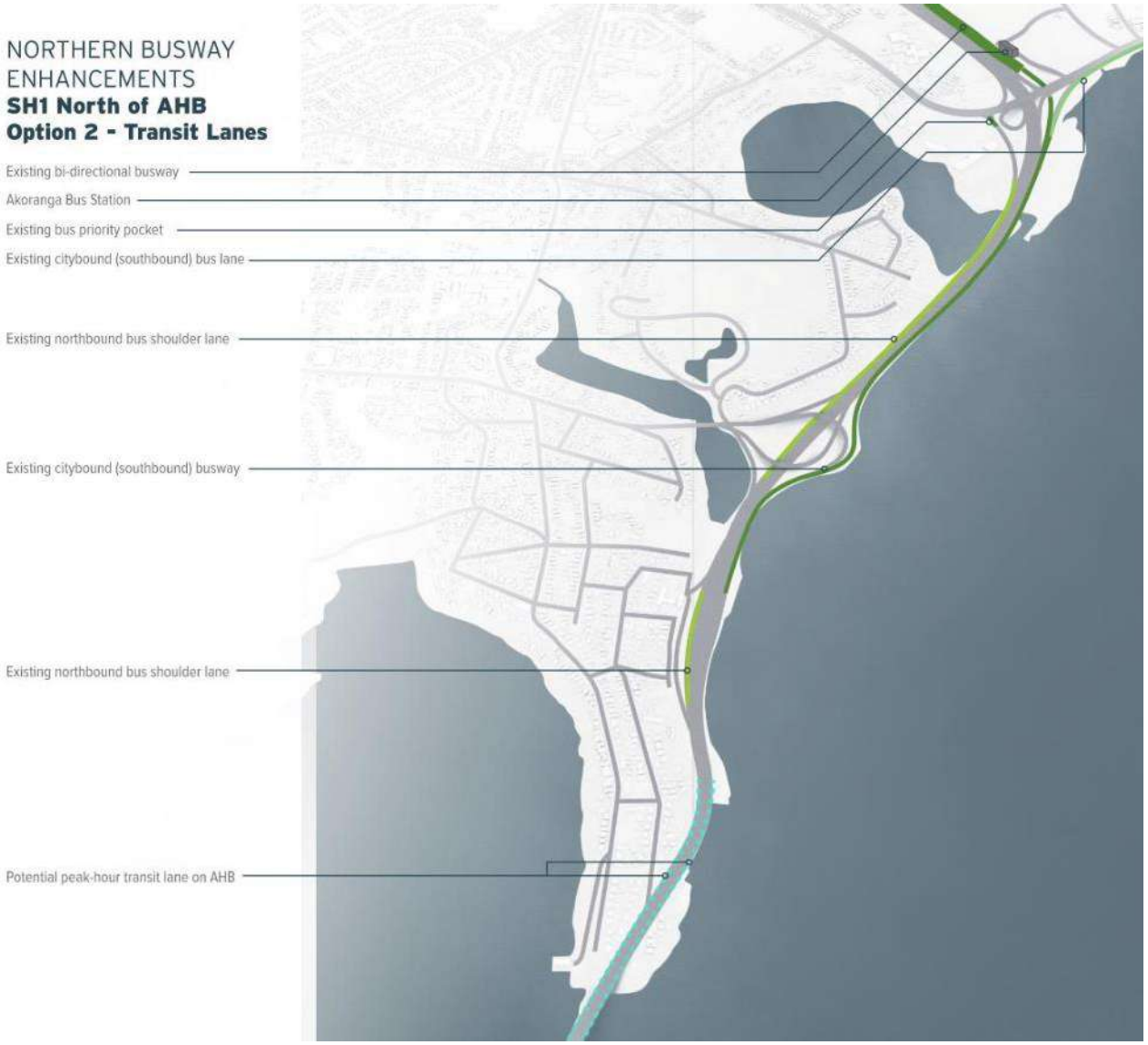


Figure 7-7: Option 2 - Transit Lanes North of AHB

Option 3: Busway Extension

Option 3 involves the extension of the existing bi-directional busway from Akoranga Station towards Onewa Road Interchange, where the busway splits between northbound and southbound. The southbound portion continues onto the existing dedicated bus lane and merges with general traffic south of the Onewa Road Southbound on-ramp. The northbound portion involves a new bus overpass for northbound buses on the kerbside lane to cross over SH1 and join with the proposed bi-directional busway on the eastern side of SH1.

This option provides southbound buses with similar priority to the existing. However, significantly greater priority is provided for northbound buses by providing a more direct connection to Akoranga Station and with over 2km of dedicated busway.

The implementation of this option involves significant civil and structural works and will likely have adverse effects on the coastal marine area (CMA) and significant ecological area (SEA) as well as incurring significantly large costs.

This concept option is illustrated in Figure 7-8 below.

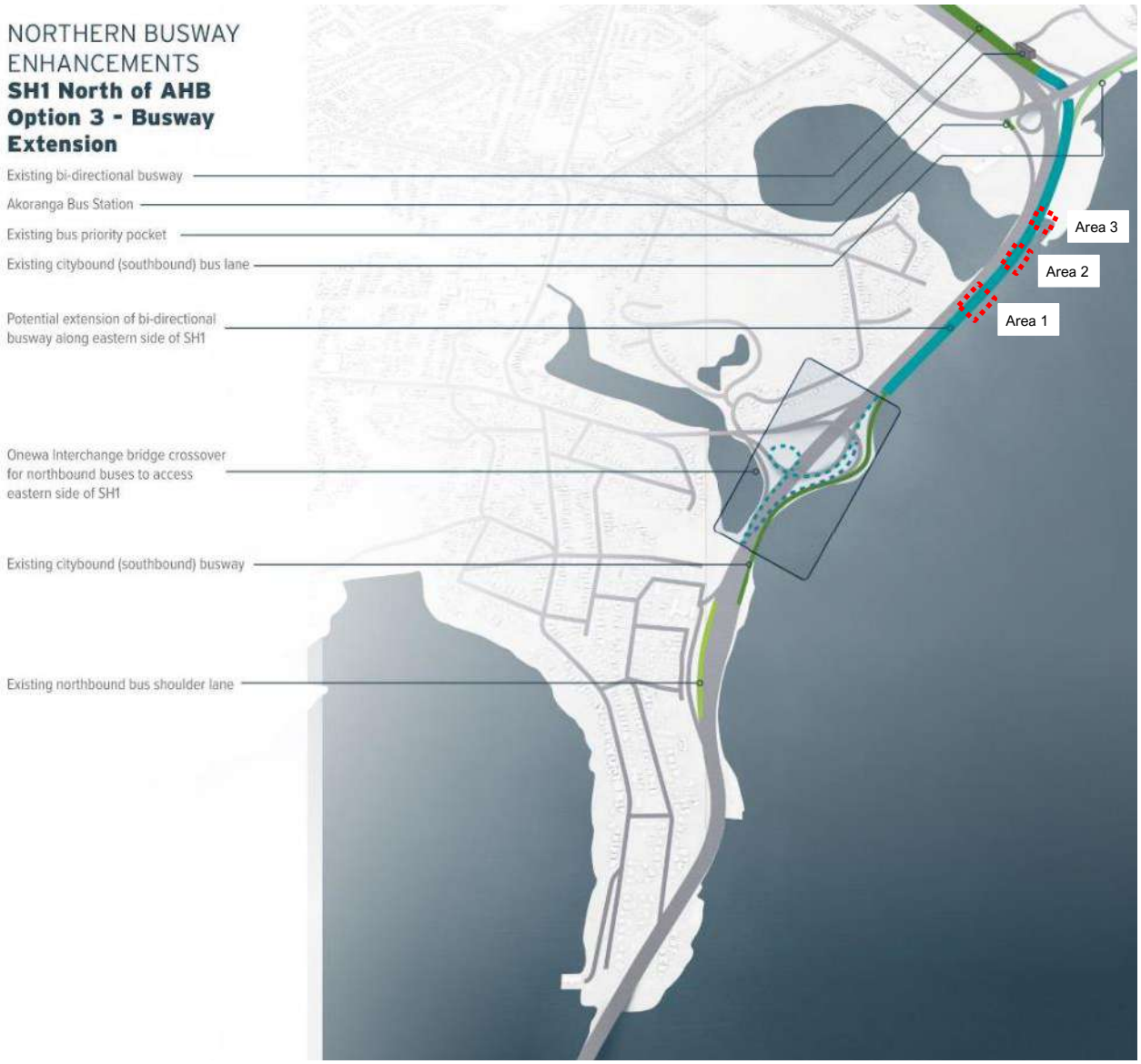
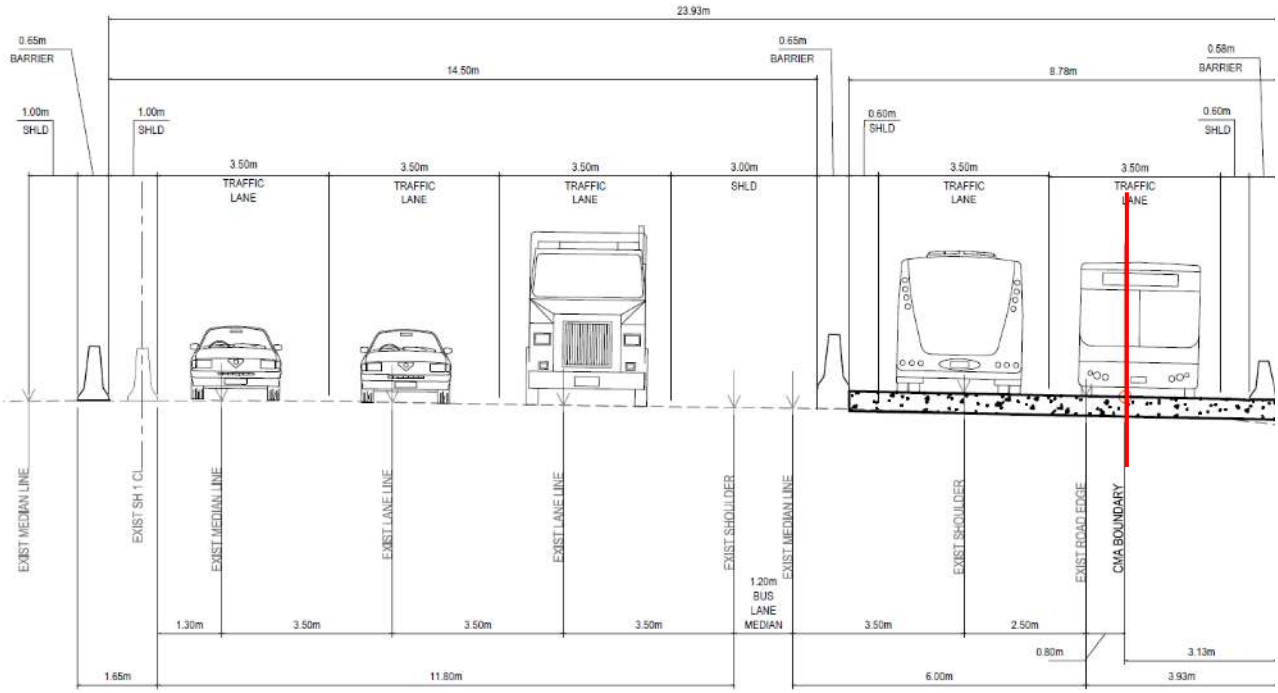


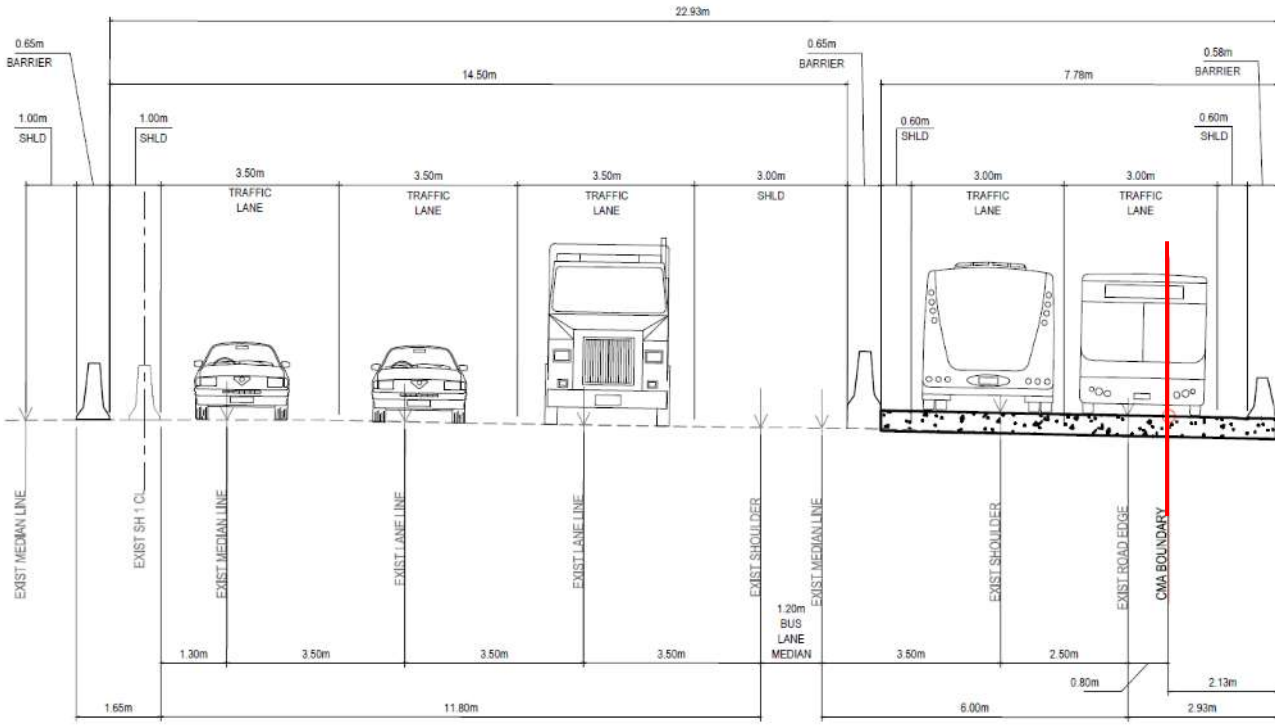
Figure 7-8: Option 3 - Busway Extension North of AHB

Initial investigations have shown that a typical bi-directional busway cross section will conflict with the existing CMA in Areas 1, 2 and 3. These are highlighted in red in Figure 7-8 above. To reduce the impact on the CMA, narrowed cross sections were developed where SH1 southbound lanes and the busway lanes were adjusted. Note that Area 3 is a culvert and will be affected by any busway cross section. The narrowed cross sections are shown in Figure 7-9 below and the CMA boundary is shown in red.

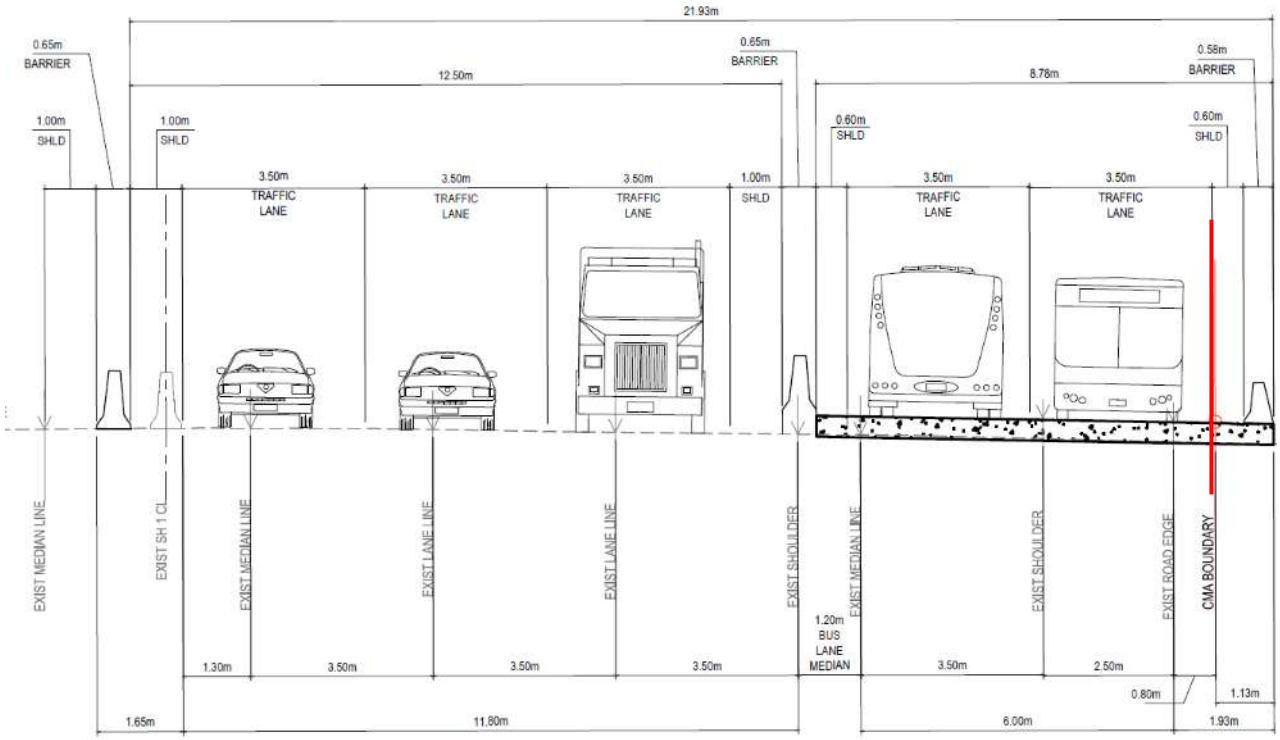
Cross Section 1



Cross Section 2



Cross Section 3



Cross Section 4

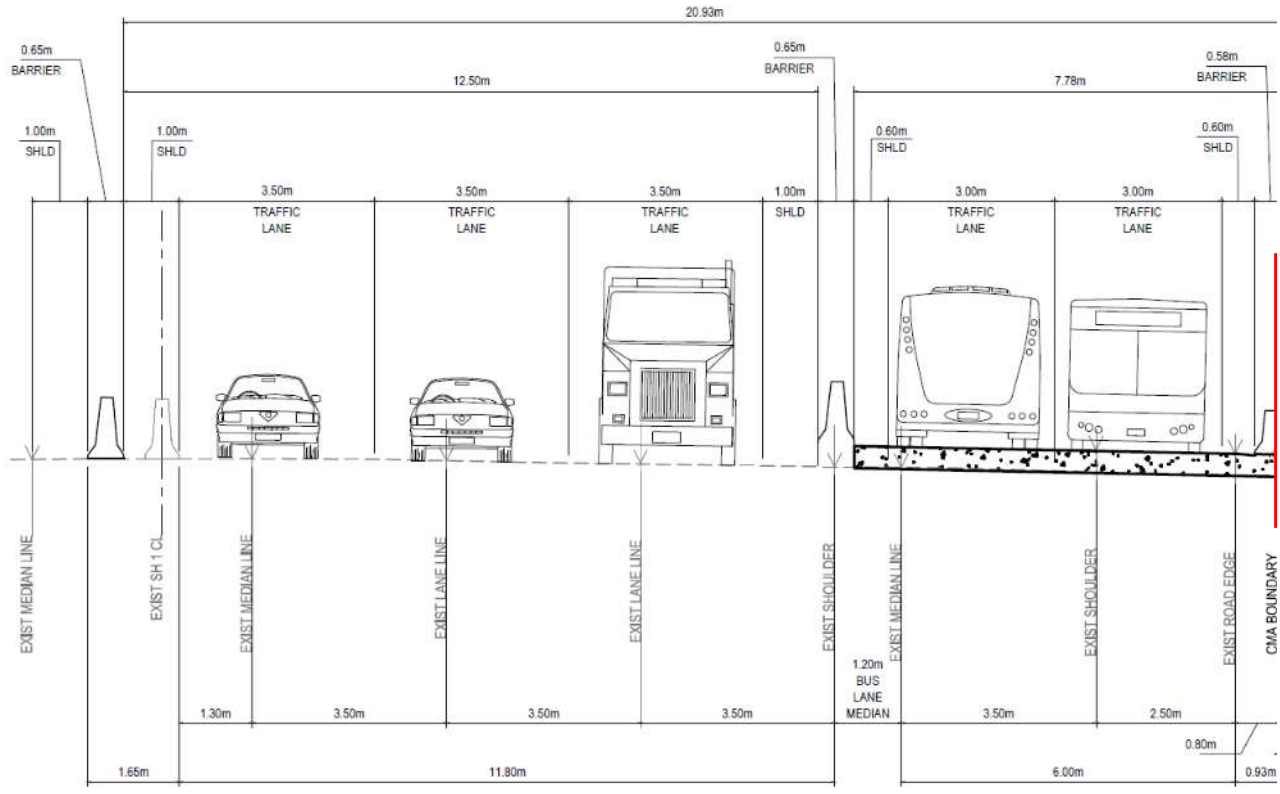


Figure 7-9: Narrowed Cross Sections

These narrowed cross sections had the following impacts on the CMA:

- Cross section 1 has an overall width of 24m and affects all three areas, with 198m of CMA in Area 1, 40m in Area 2 and 20m in Area 3.
- Cross section 2 has an overall width of 23m and affects two areas, with 130m in Area 1 and 20m in Area 3.
- Cross section 3 has an overall width of 22m and affects two areas, with 96m in Area 1 and 20m in Area 3.
- Cross section 4 has an overall width of 21m and affects two areas, with 65m in Area 1 and 20m in Area 3.

It should be noted that these narrowed cross sections exhibit less than desirable shoulder widths and, in some cases, busway lane widths, which have safety and operational implications. Therefore, careful consideration is required to determine a balance between CMA encroachment, and bus and general traffic safety and operational risks.

7.3.4 South of AHB

Option 1: Minor Bus Shoulder Lane

Option 1 involves introducing bus priority improvements without major changes to the existing infrastructure on SH1, where possible. For the portion of SH1 south of AHB, a new northbound bus shoulder lane is proposed between Shelly Beach Road Bridge and the Curran Street On-Ramp. This provides northbound buses an additional 200m of priority and reduces the impact of general traffic congestion on the approach to the AHB. However, for the southbound direction, no additional bus priority is proposed due to physical constraints. This concept option is illustrated in Figure 7-10 below.

The proposed northbound bus shoulder lane will not likely impact any existing infrastructure and will likely only require roadmarking adjustments.

Figure 7-10: Option 1 – Minor Bus Shoulder Lane South of AHB

Option 2: Transit Lane

Option 2 involves implementing transit lanes in both directions across AHB. The transit lanes will commence and terminate at either side of the AHB, providing priority to buses and high occupancy vehicles across the AHB. The effectiveness of the transit lanes in reducing impact of general traffic congestion on buses across the AHB is dependent on the operation of the transit lane (such as modal mix and operational hours). The operation of the transit lane is to be determine at a later stage.

The implementation of this option involves the following:

- Allocating the kerbside general traffic lane as a transit lane.
- Suite of transit lane signage to warn motorists of the transit lane operation, extents and crossover points. These are to be implemented on existing gantries where possible.
- New gantries on SH1 in advance of the AHB to accommodate new transit lane signage.
- Roadmarking to delineate between transit lane and general vehicle lane.
- New ITS infrastructure as well as any software systems required to support the daily operation of the transit lanes.

The southern portion (south of AHB) of this concept option is illustrated in Figure 7-11 below.

Figure 7-11: Option 2 – Transit Lanes South of AHB

Option 3: Widen for New Bus Shoulder Lane

Option 3 involves widening the northbound carriageway between the Fanshawe Street on-ramp and Shelly Beach Road bridge for a new northbound bus shoulder lane. This provides northbound buses an additional 700m of bus priority and reduces the impact of general traffic congestion on the approach to the AHB.

The implementation of this option involves the following:

- Relocation of the existing barrier and noise wall adjacent to the northbound kerbside lane
- Realignment of the existing shared-use path along the southern side of SH1 and provide a new connection to Shelly Beach Road via Amira Street
- Relocation of existing gantry footing
- Narrowing of SH1 general traffic lanes to 3.2m.

This concept option is illustrated in Figure 7-12 below.

Figure 7-12: Option 3 – Widen for New Bus Shoulder Lane South of AHB

7.3.5 Assessment against KPI's

The SH1 Optioneering Report (Appendix B1) details the full options assessment methodology for the SH1 sections of the Busway. Below is a summary of the key findings.

North of the AHB

Figure 7-13 summarises the assessment against KPI's section of the MCA, for SH1 north of the AHB.

Northern Busway Enhancements - MCA Assessment - SH1: North of AHB Akoranga Station to AHB			Do-minimum Retaining existing layout & bus operation	Option 1 Minor bus shoulder lane extension	Option 2 Transit Lanes	Option 3 Busway Extension
Benefit	**Investment Objective**	**Measure/ KPI**	**Score**	**Score**	**Score**	**Score**
Public transport continues to provide and improves competitive options for trips to, from and within the North Shore (35%)	Retain and improve public transport competitiveness	Maintain or increase mode share along the busway	0	1	1	2
		Faster journey times	0	1	1	2
		More reliable journey times	0	1	1	2
Further improve access to economic and social opportunities (35%)	Improve access to economic and social opportunities	Jobs accessible within a 45 min trip on PT (AM, IP & PM)	0	1	1	2
		Population accessible within a 45 min trip on PT (AM, IP & PM)	0	1	1	2
Delay the need for additional crossings of the Harbour (15%)	Optimise capacity of the public transport connections to the North Shore	Person throughput across the harbour bridge	0	1	1	2
Supports high quality growth, improved amenity and reduce environmental impacts (15%)	Enable Auckland to achieve quality, compact growth and improved amenity	Reduced impact of transport on Auckland's environment	0	0	0	-2
		Improved amenity for City Centre & Metropolitan Centres	0	0	0	0
		Reduce CO2 emissions	0	1	1	2

Figure 7-13: MCA Summary – SH1: North of the AHB (assessment against KPI's)

The key outcomes of the MCA were:

- All options scored positively against the journey time and reliability KPIs and hence also scored positively against the job and population accessibility KPIs. In particular, extension of the Northern Busway as part of Option 3 is expected to provide the greatest travel time and reliability improvements and therefore scored the highest.
- Subsequently, the journey time and reliability benefits increase the attractiveness of public transport and hence, all options scored positively for mode share, person throughput and CO2 emission KPIs. In particular, Option 3 provides the greatest journey time and reliability benefits as well as greater customer experience due to the bi-directional busway and therefore, scored the highest.
- Option 3 scored negatively against the KPI *'reduced impact of transport on Auckland's environment',* as the new busway encroaches into the CMA and may affect the Volcanic Viewshaft.

South of the AHB

Figure 7-14 summarises the assessment against KPI's section of the MCA, for SH1 south of the AHB.

Northern Busway Enhancements - MCA Assessment - SH1: South of AHB Fanshawe Street Ramps to AHB			Do-minimum	Option 1	Option 2	Option 3
			Retaining existing layout & bus operation	Minor bus shoulder lane	Transit Lanes	Widen for new bus shoulder lane
Benefit	**Investment Objective**	**Measure/ KPI**	**Score**	**Score**	**Score**	**Score**
Public transport continues to provide and improves competitive options for trips to, from and within the North Shore (35%)	Retain and improve public transport competitiveness	Maintain or increase mode share along the busway	0	1	1	2
		Faster journey times	0	1	1	2
		More reliable journey times	0	1	1	2
Further improve access to economic and social opportunities (35%)	Improve access to economic and social opportunities	Jobs accessible within a 45 min trip on PT (AM, IP & PM)	0	1	1	2
		Population accessible within a 45 min trip on PT (AM, IP & PM)	0	1	1	2
Delay the need for additional crossings of the Harbour (15%)	Optimise capacity of the public transport connections to the North Shore	Person throughput across the harbour bridge	0	1	1	2
Supports high quality growth, improved amenity and reduce environmental impacts (15%)	Enable Auckland to achieve quality, compact growth and improved amenity	Reduced impact of transport on Auckland's environment	0	0	0	-2
		Improved amenity for City Centre & Metropolitan Centres	0	0	0	0
		Reduce CO2 emissions	0	1	1	2

Rating: 2 Significantly positive; 1 Moderate Positive; 0 Neutral; -1 Moderate adverse; -2 Significantly adverse

Figure 7-14: MCA Summary - SH1: South of the AHB (assessment against KPI's)

The key findings were:

- All options scored positively against the journey time and reliability KPIs and hence also scored positively against the job and population accessibility KPIs. In particular, Option 3 is expected to provide the greatest travel time and reliability improvements and therefore scored the highest.
- Subsequently, the journey time and reliability benefits increase the attractiveness of public transport and hence, all options scored positively for mode share, person throughput and CO2 emission KPIs. In particular, Option 3 provides the greatest journey time and reliability benefits and therefore, scored the highest.
- Option 3 scored negatively against the KPI '*reduced impact of transport on Auckland's environment*', as the new shoulder lane requires works along the St Marys Bay cliff face which may impact existing trees, geological formations and regional-level earthworks.

7.3.6 Technical assessment

North of the AHB

Figure 7-15 summarises the technical assessment section of the MCA, for SH1 north of the AHB.

Northern Busway Enhancements - MCA Assessment - SH1: North of AHB Akoranga Station to AHB			Do-minimum	Option 1	Option 2	Option 3
			Retaining existing layout & bus operation	Minor bus shoulder lane extension	Transit Lanes	Busway Extension
Criteria	**Measure**		**Score**	**Score**	**Score**	**Score**
Engineering Feasibility	Constructability	Assessment of Constructability / Complexity of Facility	0	0	-1	-2
	Utilities	Degree of impacts on utilities	0	0	-1	-2
	Stormwater	Degree of impacts on stormwater	0	0	0	-2
Consenting and Property Requirements	Property Requirements	Land Requirements / Property impact	0	0	0	0
	Planning and Consenting	Likelihood of obtaining approval for proposed development	0	0	0	-2
	Environmental Impacts	Qualitative assessment of key environmental risks including: Visual impact, Noise/Air Quality (construction and operations), water quality/ ecological, heritage, contaminated land etc	0	0	0	-2
Cost	CAPEX	High level $ estimate of capital costs of physical works	0	-1	-1	-2
	Operating Cost / Efficiency	Assessment of operational and bus network operating cost	0	1	1	2
		Assessment of Infrastructure maintenance costs	0	-1	-1	-2
	Property	High level $ estimate of property costs (Capex)	0	0	0	0
Operations		Qualitative assessment of traffic operational risks and issues	0	0	-2	0
		Qualitative assessment of bus operational risks and issues	0	1	1	2
Safety		Qualitative assessment of traffic safety risks	0	0	-1	-1
		Qualitative assessment of bus safety risks	0	0	-1	-1
Customer Experience		Qualitative assessment of impact on Customer Experience	0	1	1	2
Stakeholder / Public		Qualitative assessment of stakeholder / 3rd party approvals. Reputational risks arising from negative feedback from key stakeholders and the public incl. Mana Whenua	0	0	0	-2

Rating: 2 Significantly positive; 1 Moderate Positive; 0 Neutral; -1 Moderate adverse; -2 Significantly adverse

Figure 7-15: MCA Summary - SH1: North of the AHB (technical assessment)

The key findings were:

- Against the engineering feasibility criteria, Option 3, including the extension of the Northern Busway and new bus overpass, is the most complex and difficult to construct, and includes potential and certain impacts to utilities and stormwater services.
- Option 3 encroaches the CMA and is likely to have adverse environmental effects, including the bird breeding SEA within Shoal Bay. The bus overpass also has potential adverse visual effects. Therefore, it is unlikely that consent will be given for Option 3.
- With the encroachment of the CMA in Option 3, Mana Whenua support is unlikely. There is also high risk of reputational damage and poor public support given the level of construction disruption.
- The options range from minor to significant capital costs, with Option 3 the most expensive. However, the greater the capital cost options provide the greatest travel time benefits, leading to lower operational costs.
- Option 2 introduce transit lanes across the AHB, which will benefit HOV's, but general traffic will experience delays due to reduced capacity on AHB. There are also safety risks for both buses and general traffic associated with increased lane changing at the beginning of transit lanes, though these risks could be mitigated via appropriate road safety design.

South of the AHB

Figure 7-16 summarises the technical assessment section of the MCA, for SH1 south of the AHB.

Northern Busway Enhancements -
MCA Assessment - SH1: South of AHB
Fanshawe Street Ramps to AHB

Criteria		Measure	Do-minimum Retaining existing layout & bus operation	Option 1 Minor bus shoulder lane	Option 2 Transit Lanes	Option 3 Widen for new bus shoulder lane
Engineering Feasibility	Constructability	Assessment of Constructability / Complexity of Facility	0	0	-1	-2
	Utilities	Degree of impacts on utilities	0	0	-1	-2
	Stormwater	Degree of impacts on stormwater	0	0	0	-1
Consenting and Property Requirements	Property Requirements	Land Requirements / Property impact	0	0	0	-1
	Planning and Consenting	Likelihood of obtaining approval for proposed development	0	0	0	-2
	Environmental Impacts	Qualitative assessment of key environmental risks including: Visual impact, Noise/Air Quality (construction and operations), water quality/ ecological, heritage, contaminated land etc	0	0	0	-1
Cost	CAPEX	High level $ estimate of capital costs of physical works	0	-1	-1	-2
	Operating Cost / Efficiency	Assessment of operational and bus network operating cost	0	1	1	2
		Assessment of Infrastructure maintenance costs	0	-1	-1	-2
	Property	High level $ estimate of property costs (Capex)	0	0	0	-1
Operations		Qualitative assessment of traffic operational risks and issues	0	-1	-2	-1
		Qualitative assessment of bus operational risks and issues	0	1	1	2
Safety		Qualitative assessment of traffic safety risks	0	-1	-1	-1
		Qualitative assessment of bus safety risks	0	-1	-1	-1
Customer Experience		Qualitative assessment of impact on Customer Experience	0	1	1	2
Stakeholder / Public		Qualitative assessment of stakeholder / 3rd party approvals. Reputational risks arising from negative feedback from key stakeholders and the public incl. Mana Whenua	0	0	0	-2

Rating: 2 Significantly positive; 1 Moderate Positive; 0 Neutral; -1 Moderate adverse; -2 Significantly adverse

Figure 7-16: MCA Summary – SH1: South of the AHB (technical assessment)

The key findings were:

- Option 3 is the most complex to implement from a constructability perspective, as the other options only involve reallocation of existing road space. It also scored adversely across a range of the technical criteria, including impacts to utilities and stormwater, property and land requirements, consenting and environmental impacts. It is also the most expensive option.
- Option 2 scored significantly adverse for the qualitative assessment of traffic operational risks and issues, as the transit lanes will reduce the quantity of lanes available to non-HOV general traffic, and lead to longer travel times.
- Although the new northbound bus shoulder lane is predicted to improve customer experience, Option 3 may involve challenging key stakeholders and the public engagement. The works are proposed in the Mana Whenua overlay and may require significant regional earthworks.

7.3.7 Modelling assessment

The State Highway 1 Modelling Assessment is included in Appendix B. It focused on general traffic and bus travel time modelling and compared travel times for each option with the do-minimum to elicit travel time savings. The modelling results fed into several of the MCA criteria and influenced the scoring.

The current gaps in the bus priority network on SH1 reduces travel time reliability when significant events occur on the motorway system as buses cannot bypass general traffic congestion in these locations. 2026 modelled travel times for each option were compared to the do-minimum 2026 forecast travel times. The results can be summarised as follows:

- Option 1 north and south of AHB predicted minimal improvements in travel time for buses and no changes to general traffic travel times as capacity remains like the current situation.
- Option 2 north and south of AHB include transit lanes on the AHB and are predicted to lead to general traffic travel times increasing by approximately 30 seconds per vehicle in the evening peak northbound (based on the current assumptions of T3 lane use). However, bus travel time improvements are in the order of 30 seconds to 1 minute as outlined previously. In the morning peak, there is a predicted 30 second travel time improvement for southbound buses, with minimal disbenefit for general traffic.
- Option 3 north of AHB includes a busway extension and is predicted to provide the most travel time benefits north of AHB, particularly for northbound buses in the evening peak period. Overall, bus travel time improvements are in the order of 1 to 2 minutes. This option does not affect capacity of general traffic lanes and therefore, no change to general traffic travel times.
- Option 3 south of AHB includes a new bus shoulder lane and is predicted to provide the most travel time benefits south of AHB, particularly for northbound buses in the evening peak period. Overall, bus travel time improvements are in the order of 30 seconds to 1 minute. This option does not affect capacity of general traffic lanes and therefore, no change to general traffic travel times.

7.3.8 SH1 recommended option

Based on the modelling results and the MCA assessment, it was recommended the options be implemented as part of a programme of work over the next 2 decades, with Option 1 and Option 2 recommended within the short- to medium-term.

Weaving and merging of vehicles across the transit lanes is considered a potential operational and safety issue. Additionally, there are several operational issues including monitoring, signage, policing, and management of the transit lanes that will need careful consideration.

There is a range of benefits and potential impacts for each of the proposed options being:

- Option 1 (Minor Bus Shoulder Lanes north and south of AHB) provides limited travel time benefits with simple extensions of existing bus priority. This option is a quick-win improvement that can be implemented in the short-term to gain minor travel time benefits and reliability improvements. Monitoring of the bus network travel times following implementation of Option 1 is recommended.
- Option 2 (Transit Lanes across AHB) are predicted to provide moderate improvements in average bus travel time in the peak direction, but there is likely to be a corresponding increase general traffic travel time as capacity is reduced (depending on the utilisation of the transit lane). There is also potential for vehicle queues to extend back through the network, i.e. the Victoria Tunnel. Transit lanes are the best means of providing bus priority across the AHB, however, the AHB is not currently a significant constraint in the route.
- Option 3 north and south of AHB (Busway Extension and Widening for bus shoulder lane) are the highest cost options and the value for money needs to be carefully considered if an AWHC is to be constructed, albeit that the Northern Busway is likely to be supplemented by the AWHC rather than replaced. As part of the programme of works for the DBC a proposed construction timeframe for these options would be from around 2030 onwards if the additional crossing is not progressed.

After the implementation of Option 1, Option 2 can be considered in the medium-term based on the performance of the Northern Busway system to maintain the level of service for customers.

The busway extension and widening of SH1 is significantly dependent on the progress of the AWHC. If this supplementary RTN connection is not provided by the 2030s, further investigation into Option 3 would be required to maintain the current performance of the system.

8 Fanshawe Street Options Assessment

As noted in Appendix B1, the Fanshawe Street Options Assessment Report, there has been extensive planning and redevelopment of the Fanshawe Street corridor over the last decade, which has led to improvements to support public transport operations. The Fanshawe Street corridor has been the subject of many interfacing projects and the following summarises the previous and current projects that interface with the corridor.

These projects have been considered as part of the options assessment but have not been adapted in any way to incorporate these into the design proposals. Any such design amendments to create the interface would be provided for in future stages of the recommended options development.

8.1 Previous and current projects for Fanshawe Street/City Centre

8.1.1 Fanshawe Street Bus Priority and Wynyard Quarter Bus Interchange IBC

The Fanshawe Street Bus Priority and Wynyard Quarter Bus Interchange IBC previously investigated potential infrastructure upgrades to support the principles of the New Network to be implemented in 2018 and the on-going development in Wynyard Quarter. The IBC identified potential options to support these changes whilst maintaining an effective, efficient and high-quality public transport network, within and to Wynyard Quarter and along Fanshawe Street. During the IBC investigation the implementation of light rail transit (LRT) with a proposed alignment along Fanshawe Street and into Wynyard Quarter via Daldy Street was under consideration by Auckland Transport. As the decision (mid to late 2020) has been made to not advance with LRT along the corridor; only the short-list recommended options in the absence of LRT have been progressed for further investigation as part of this options assessment.

The short-list recommended options identified for Fanshawe Street in the absence of LRT were a:

- Northern alignment busway along the whole corridor.
- Northern alignment urban busway east of Halsey Street and Kerbside bus priority west of Halsey Street.
- Northern busway east of Nelson and kerbside bus priority west of Nelson Street.

8.1.2 Lower Albert Bus Interchange

As part of the Downtown Auckland Transformation programme the Lower Albert Street Bus Interchange (LABI) has been upgraded. The interchange is being delivered in partnership with the City Rail Link (CRL) project and Auckland Council's streetscape programme. Construction was completed in April 2021 and the interchange is not operational. The interchange caters for North shore bus services and Western bus services.

For the purpose of the assessment, it is assumed that all bus services from the North Shore travelling currently terminating at Lower Albert will continue to terminate at Lower Albert Bus Interchange. Similar to other capacity enhancements potentially identified as part of this Detailed Business Case, potential changes to Lower Albert will only be identified if the interchange requires further enhancements before potentially being replaced by a new terminus in Quay Park.

8.1.3 Downtown Public Transport Infrastructure Improvements

Changes to the Fanshawe Street corridor have been proposed as part of the Downtown Public Transport Infrastructure Improvements that aim to improve city centre bus operation and performance. These improvements are ongoing and include the implementation of additional bus priority (eastbound bus priority on Sturdee Street between Nelson Street and Lower Albert Street, northbound bus priority on the western side of Lower Hobson Street, westbound bus lane on the southern kerb side of Quay Street and eastbound right turn bus lane for buses turning into Lower Albert Street from Quay Street), upgrades of existing bus stop facilities and additional consideration for layover and circulation of buses within the downtown precinct.

8.1.4 City Centre Safety Engineering Projects

As part of Auckland Transport and Waka Kotahi's commitment to Vision Zero, speed limits within the city centre have been reduced. The new Speed Limits Bylaw came into force on 30 June 2020 and means that the speed limit along the Fanshawe Street corridor between Beaumont Street and Lower Albert Street has been reduced to 40km/h and 30km/h along Sturdee Street.

Cycling facilities along Fanshawe Street have been an on-going consideration for Auckland Transport and the recently completed (November 2019) City Centre and Fringe, Central Isthmus and Sandringham Cycle Single Stage Business Case as part of the Connected Communities suite of works, proposes dedicated cycling facilities along the corridor.

The City Centre Safety Engineering Projects are also investigating the potential implementation of cycle facilities along the corridor to compliment further safety improvements. As such, no consideration for cycling facilities have been included during this options assessment.

8.2 Proposed Fanshawe Street Options

Based on the design considerations and assumptions discussed in detailed in Appendix B, Fanshawe Street Options Assessment Report, proposed concept options were developed. The draft options were circulated to stakeholders and amended to incorporate initial comments. The options include a do-minimum scenario as a reference case against which all options were assessed.

8.2.1 Do Minimum

The do minimum option would involve making no improvements to the existing bus stop facilities and bus priority on Fanshawe Street. The existing bus stop locations would be retained, and bus priority would remain as existing.

8.2.2 Option 1: Optimisation of Existing

Option 1 involves the optimisation of the existing layout and corridor operation along Fanshawe Street. This involves the following changes:

- Traffic signal optimisation (at the intersections of Fanshawe Street with Beaumont Street, Daldy Street (including Daldy Street bus gate), Halsey Street, the signalised pedestrian crossing on Fanshawe Street east of Bouzaid Way and the intersection of Nelson Street, Sturdee Street and Market Place with Fanshawe Street)
- Extension of the existing Victoria Park stop (by 30m) to create clear demarcation for separate route group services by stop as opposed to the existing head of stop operations
- Additional footpath widening to accommodate increased passenger levels and floating platforms, upgraded canopies and a new footpath behind the canopy structure to enable pedestrian movement behind the platform waiting area for users not waiting for bus services, thereby creating a pedestrian bypass that will further reduce crowding
- All bus priority and stop upgrades currently being delivered east of Halsey Street as part of the Downtown Public Transport Infrastructure Improvements project (the existing inbound stop on Sturdee Street will be closed and used as layovers. In addition, the existing stop at Bouzaid Way outside AT is proposed to be replaced by layover bays and two new double stops further down Fanshawe Street. The new stops will be located to the east of the signalised pedestrian crossing, west of Customs Street West and between Market Place and Nelson Street).

No additional bus lane priority is proposed as part of the Option 1 and the existing priority measures along the corridor will be retained; however the additional priority along Sturdee Street, Hobson Street and Quay Street proposed as part of the Downtown Public Transport Infrastructure Improvements have been included in the assessment of the modelling outcomes.

Figure 8-1 below illustrates the previous and current project improvements as well as the Option 1 proposals.

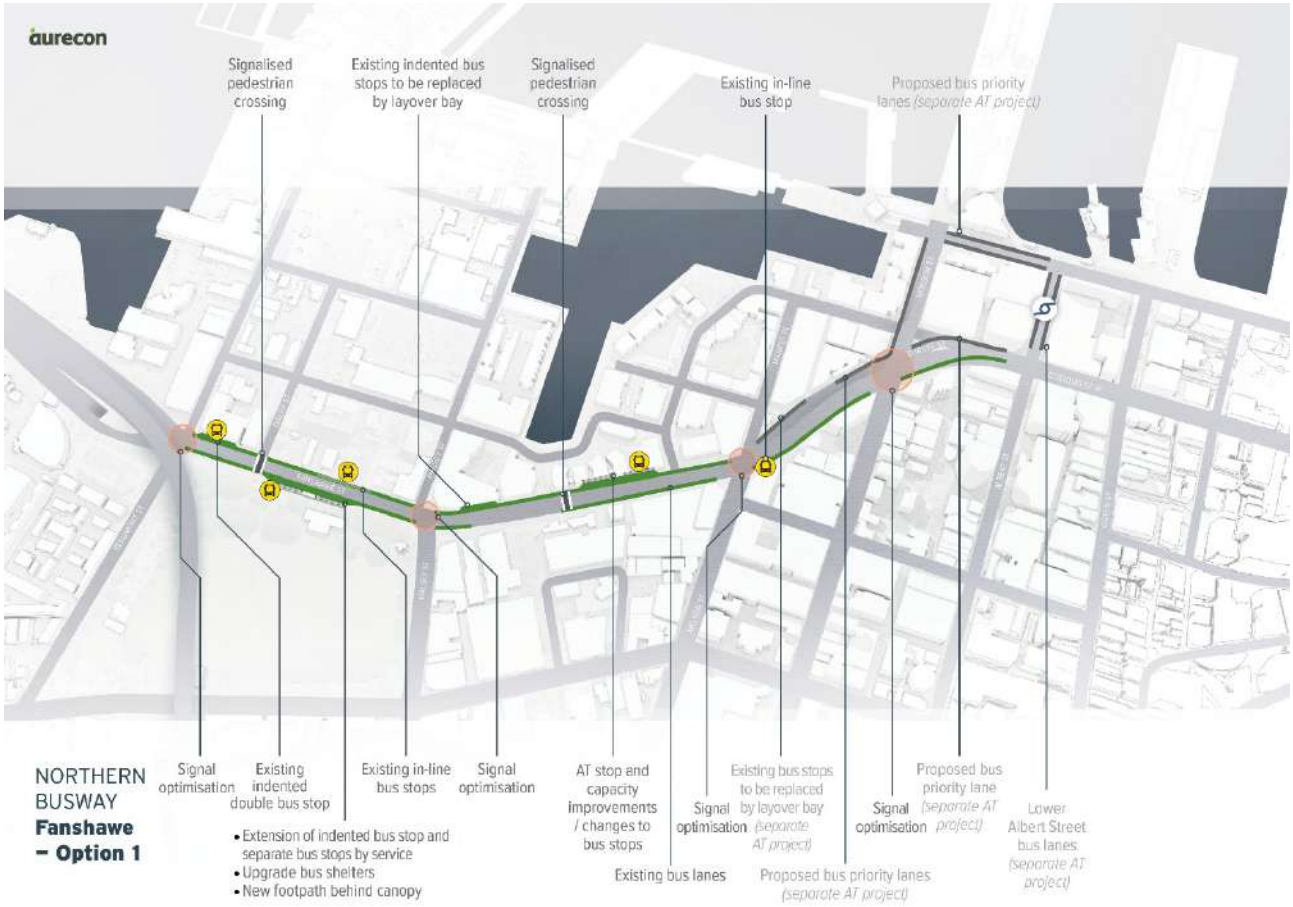


Figure 8-1: Option 1 – Optimisation of Existing

8.2.3 Option 2: Urban Busway

Option 2 is proposed as a fully separated bi-directional urban busway positioned on the northern side of Fanshawe Street between Beaumont Street and Nelson Street (approximately 700m) with optimised traffic signals and midblock signalised pedestrian crossings. It is noted that cycling facilities have been excluded from the proposed options, as this is subject to an additional commission through Auckland Transport and has not yet been sufficiently completed for inclusion.

This option is based on the Urban Busway option identified and developed as part of the Fanshawe Street Bus Priority and Wynyard Quarter Bus Interchange IBC. The proposed urban busway will connect the Northern Busway and Wynyard Quarter with the city centre. The urban busway will have four indented bus stops with platforms on the northern side of Fanshawe Street for incoming bus services and two indented bus stops with platforms on the southern side for North Shore bound services.

Inbound bus services operating on the busway will join the busway from SH1 at the Beaumont Street intersection with Fanshawe Street. Buses will then continue onto Sturdee Street at Nelson Street and continue to LABI via new bus lanes being implemented as part of the downtown improvements project. In the outbound direction buses will join the busway at the Nelson Street intersection and continue onto SH1 from the Beaumont Street intersection.

Figure 8-2 below illustrates the previous and current project improvements as well as the Option 2 proposals.

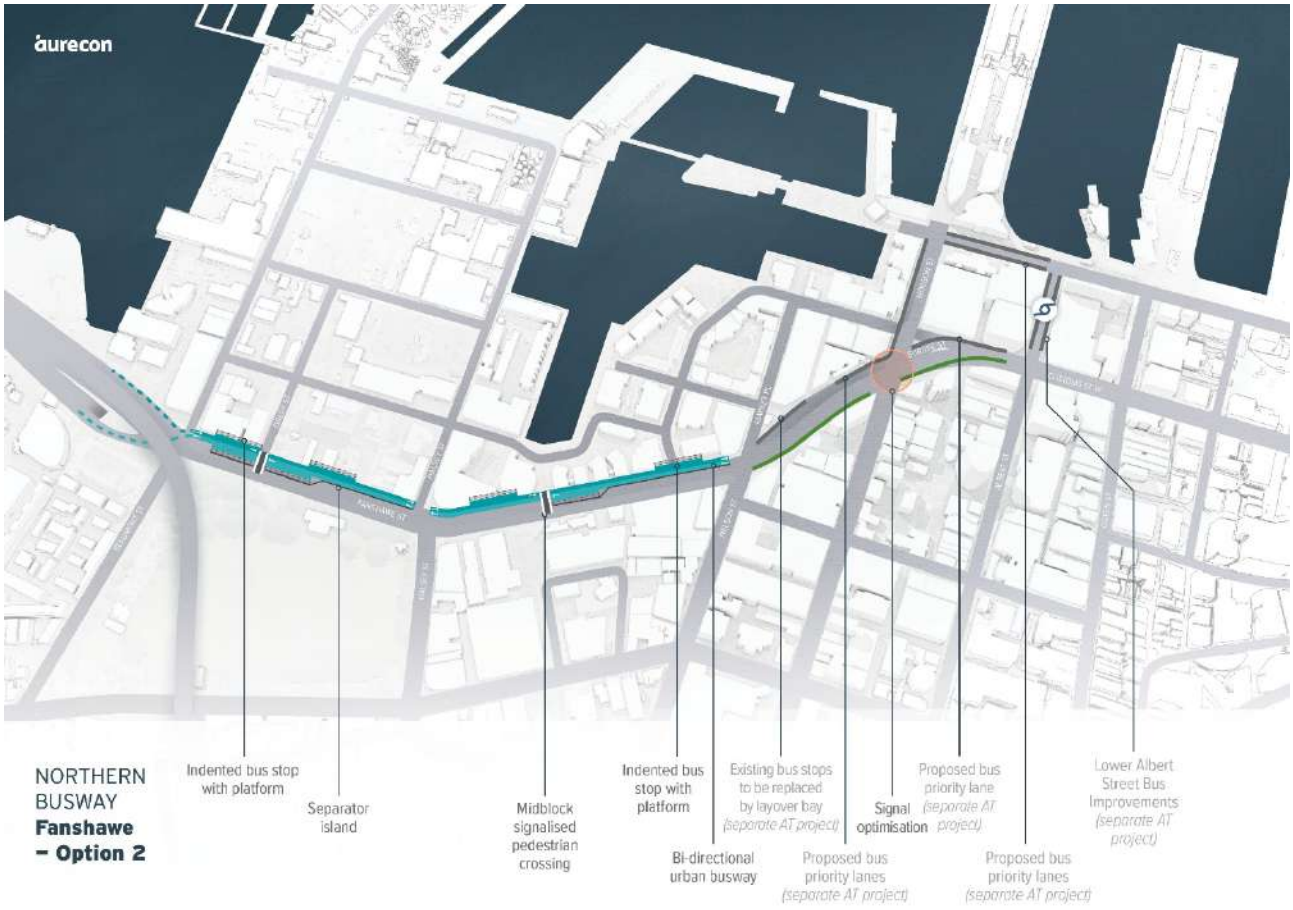


Figure 8-2: Option 2 – Urban Busway

8.3 Modelling Assessment

A comprehensive modelling assessment was completed for all proposed options. A base model was developed to represent the existing operation of the key intersections along Fanshawe Street between Beaumont Street and Nelson Street. The proposed options have been modelled with predicted travel times findings detailed in the following sections.

The following was considered in the development of the model:

- Existing environment, aerial photography, and site visits
- Bus timetables and route maps
- Existing and forecast bus frequencies
- SCATS traffic counts and signal phasing and timing (pre-COVID19 lockdown)
- Vehicle travel time (Snitch data supplied by Auckland Transport)

Figure 8-3: Fanshawe Street base model Layout

The model was calibrated to existing count data and validated against travel time data. The model is therefore deemed suitable for the purpose of option assessment and providing inputs into the economic assessment.

The Fanshawe Street Modelling Report is included in the Appendix B, and provides detailed information on the approach, methodology and outcomes of the operational assessment of all options.

8.3.1 Do Minimum Results

The key elements to note for the do minimum model outputs relate to the difference in the travel time and performance on Fanshawe Street between 2020 and 2028.

Fanshawe Street has several conflicting modes (buses, pedestrians, general vehicles) and conflicting directions of travel (east-west, north-south). All modes compete for the green time at the key intersections.

The existing peak direction bus lanes are already operating with delays particularly at the bus stops and bus travel times are predicted to deteriorate by ~15 seconds in the peak commuter direction (approximately a 5% increase in travel time as compared to the existing corridor conditions)

Table 8-1: Do Minimum 2020 vs 2028 (AM peak hour)

Fanshawe Street		AM Peak Hour			
		2020 Existing Layout	2028 Existing Layout	Difference	% Difference
Eastbound	Bus	04:35	04:52	00:16	6%
	All Vehicles	05:05	05:04	00:01	0%
Westbound	Bus	04:18	04:19	00:01	0%
	All Vehicles	04:36	04:36	00:00	0%

Table 8-2: Do Minimum 2020 vs 2028 (PM peak hour)

Fanshawe Street		PM Peak Hour			
		2020 Existing Layout	2028 Existing Layout	Difference	% Difference
Eastbound	Bus	03:59	03:59	00:00	0%
	All Vehicles	04:30	04:30	00:00	0%
Westbound	Bus	04:05	04:19	00:13	5%
	All Vehicles	05:50	05:38	00:12	4%

8.3.2 Option 1: Optimisation of Existing

The outcomes are noted from the modelling results as a result of the proposed changes as part of Option 1 Optimisation of Existing. In summary, there are moderate benefits to bus travel times in the peak direction along Fanshawe Street as a result of Option 1. The benefits are mostly attributed to the improvement in bus stop capacity and the addition of the bus gate facility westbound at Daldy Street. There are limited opportunities to further optimise traffic signal times along Fanshawe Street.

- Average eastbound bus travel times are predicted to improve by approximately 55 seconds in the morning peak and relatively small (approximately 10 seconds) in the evening peak hour
- Average westbound bus travel times are predicted to improve by approximately 50 seconds in the evening peak hour, and approximately 20 seconds in the morning peak hour (westbound is the contra-peak direction in the morning)
- In the evening peak hour, there is a noticeable increase in westbound general traffic delay predicted as a result of the proposed bus gate with approximately 1-minute additional travel time

The improved capacity of bus stops is predicted to lead to an improvement in travel times in the peak direction (AM inbound and PM outbound on the links with bus stops) on Fanshawe Street. This has been incorporated in the travel

time assessment on the basis of an improved dwell time related to the increased accessibility to the bus stops for services along Fanshawe Street due to the increased stop capacity and allocation for route groups at the stop. It has been assumed that with additional bus stop capacity (length, service splitting) Option 1 and 2 will remove the 15 sec average delay, i.e. with the options buses will be able to enter the new bus stops rather than wait behind other services.

The above assumptions have been applied outside of the SIDRA models as SIDRA excludes bus stops.

8.3.3 Option 2: Urban Busway

The following are noted for the Urban Busway option. In summary, there are moderate benefits to bus travel times in the peak direction along Fanshawe Street as a result of Option 2 Urban Busway. The crossover points to the segregated busway introduce significant delay to general traffic and/or buses along Fanshawe Street due to the requirement for an additional traffic signal phase for exit and entry to the separated busway at Beaumont Street and Nelson Street respectively.

- Bus travel time savings are predicted to improve in the peak directions, approximately 1 minute and 30 seconds eastbound in the morning peak and 50 seconds westbound in the evening peak compared to the do minimum. This benefit applies to approximately 165 buses per hour in the peak direction in 2028.
- The travel time savings for buses in the contra-peak direction are predicted to improve by 35 seconds in the morning peak and 15 seconds in the evening peak.
- There will be some improved travel time reliability, however buses will still be suspectable to network operation as they will still cross through all at-grade intersections on Fanshawe Street (as with Option 1)
- The travel times of general vehicles are largely unaffected in both directions in the morning peak. There is significant impact to eastbound general traffic in the evening peak with a travel time increase of more than 3 minutes predicted. It is noted that general traffic capacity has been reduced by 1 full lane eastbound.
- Extra traffic signal phases are needed to separate bus movements from general traffic at both ends of Fanshawe Street busway. To maintain a similar cycle time as existing (thereby not disadvantaging pedestrians), less green time is given to the general traffic.
- As a result of a bi-directional busway on the northern kerbside, buses need to cross over to external bus facility at both ends, i.e. Beaumont Street intersection and Nelson Street intersection. These crossover points introduce significant delay to general traffic and/or buses due to the additional phasing at the intersections noted.
- It is noted that as part of the development for the Option 2 urban busway, operating on the northern side of Fanshawe Street, that the Victoria Park outbound stops will be deleted and catered for at medial stops on the urban busway. This has been included in the MCA under operations as a qualitative assessment but has not been included in the modelling as a quantitative outcome.

8.4 Multi-Criteria Analysis (MCA) Assessment

The Options MCA Assessment Workshop was held on the 28th October 2020 with relevant AT (AT Metro services and AT Property & Planning) and Waka Kotahi stakeholders to assess each of the options against the investment objectives and MCA framework. The following comments were documented during the MCA assessment workshop:

- Many of the identified issues along the corridor are a result of upstream issues resulting from long dwell times at busway stations, a lack of priority and overall reliability issues of the busway system.
- Optimising the existing facilities and making small changes to improve what is already there allows an opportunity to monitor the benefits of upstream improvements and the proposed improvements along the corridor delivered by other interfacing projects (Appendix B: the Fanshawe Street Options Assessment Report Section 8.1.3)
- Option 1 provides similar travel time savings to Option 2 however can be delivered for a significantly lower cost in comparison

- The uncertainty surrounding the delivery of a supplementary RTN connection to the North Shore, presents both an opportunity and a risk
- Implementing improvements proposed in Option 1 presents an opportunity to make a short-term investment and monitor the impact of other system improvements before significant capital investment is made

Northern Busway Enhancements
MCA Assessment - Fanshawe Street

Benefit	Investment Objective	Measure/ KPI	Do Minimum Score	Option 1 Optimisation of Existing Score	Option 2 Urban Busway Score
Public transport continues to provide and improves competitive options for trips to, from and within the North Shore (35%)	Retain and improve public transport competitiveness	Maintain or increase mode share along the busway	0	1	2
		Faster journey times	0	1	1
		More reliable journey times	0	1	2
Further improve access to economic and social opportunities (35%)	Improve access to economic and social opportunities	Jobs accessible within a 45 min trip on PT (AM, IP & PM)	0	1	1
		Population accessible within a 45 min trip on PT (AM, IP & PM)	0	1	1
Delay the need for additional crossings of the Harbour (15%)	Optimise capacity of the public transport connections to the North Shore	Person throughput across the harbour bridge	0	1	1
Supports high quality growth, improved amenity and reduce environmental impacts (15%)	Enable Auckland to achieve quality, compact growth and improved amenity	Reduced impact of transport on Auckland's environment	0	0	0
		Improved amenity for City Centre & Metropolitan Centres	0	1	1
		Reduce CO2 emissions	0	1	1

Criteria	Measure		Do Minimum Score	Option 1 Score	Option 2 Score
Engineering Feasibility	Constructability	Assessment of Constructability / Complexity of Facility	0	0	-2
	Utilities	Degree of impacts on utilities	0	-1	-2
	Stormwater	Degree of impacts on stormwater	0	-1	-1
Consenting and Property Requirements	Property Requirements	Land Requirements / Property impact	0	0	0
	Planning and Consenting	Likelihood of obtaining approval for proposed station development	0	-1	-1
	Environmental Impacts	Qualitative assessment of key environmental risks including: Visual impact, Noise/Air Quality (construction and operations), water quality/ ecological, heritage, contaminated land etc	0	0	-1
Cost	CAPEX	High level $ estimate of capital costs of physical works	0	-1	-2
	Operating Cost / Efficiency	Assessment of operational and bus network operating cost	0	0	1
		Assessment of infrastructure maintenance costs	0	0	-1
	Property	High level $ estimate of property costs (Capex)	0	0	0
Operations		Qualitative assessment of traffic operational risks and issues	0	-1	-2
		Qualitative assessment of bus operational risks and issues	0	1	1
Safety		Qualitative assessment of traffic safety risks	0	0	1
		Qualitative assessment of bus safety risks	0	0	1
Customer Experience		Qualitative assessment of impact on Customer Experience	0	1	2
Stakeholder / Public		Qualitative assessment of stakeholder / 3rd party approvals. Reputational risks arising from negative feedback from key stakeholders and the public incl. Mana Whenua	0	0	-1

Rating: 2 Significantly positive; 1 Moderate Positive; 0 Neutral; -1 Moderate adverse; -2 Significantly adverse

Figure 8-4: Fanshawe Street MCA Summary

8.4.1 Fanshawe Street Recommended Option

Based on the outcomes of the MCA assessment and Options Assessment Workshop, **Option 1 was identified as the recommended option for the Fanshawe Street corridor**. Option 1 proposes improvements to optimise the existing operation and layout of the Fanshawe Street corridor.

As referenced in Appendix B: the Fanshawe Street Options Assessment Report, there are several projects competing for space on Fanshawe Street and this DBC is not the only project proposing improvements along the corridor. Consequently, there are several components that require further consideration to ensure Fanshawe Street functions effectively as a multimodal corridor. A dynamic programme approach therefore allows flexibility to balance the demands for space along the corridor while managing the uncertainties around the delivery of a supplementary RTN connection and other changes within the city centre.

However, should a supplementary RTN connection to the North Shore not be progressed for construction in the mid-2030s, improvements associated with Option 1 will likely not be able to sustain the growing travel demands into the late 2030's and 2040's. Option 2 (or a similar option providing increased or fully segregated priority) will then likely be required.

The further development of Option 2 should include additional option investigation as the corridor environment will likely be significantly different to the planned City Centre changes. As a result, the recommended option along the Fanshawe Street corridor involves a dynamic programming approach to implementation.

8.5 Options Assessment Summary – Recommended Options Identified

The recommended options and indicative timeframes identified in the options assessment workshops are illustrated below in Figure 8-5, and entails a suite of initiatives to progressively invest in the northern busway infrastructure to provide a consistent high-quality level of service. This includes:

- Busway Stations
  - Busway station capacity improvements and upgrades
- State Highway 1
  - Minor bus shoulder lane extensions north and south of the harbour bridge on SH1
  - Transit lanes
  - Extension of fully segregated busway
- Fanshawe Street
  - Optimisation of the existing infrastructure and facilities
  - Urban Busway

The recommended options and staging strategy are unpacked in more detail in Section 9.

Figure 8-5: Recommended Options - MCA Workshop Outcomes

9 Recommended Option

9.1 Recommended Option Description

A series of improvements are proposed to enhance the capacity and improve the reliability of the Northern Busway. It is envisaged the full suite of improvements will collectively enable the busway to meet projected demand and provide a high-quality service that meets customer expectations up to 2038.

The recommended option is shown below in Figure 9-1. The improvements programme has been packaged for staged delivery. The recommended option consists of the following:

- Focused infrastructure improvements that can be implemented within a short timeframe. This includes:
  - Minor platform length and width extensions at Albany, Constellation, Sunnynook, Smales Farm and Akoranga Stations.
  - Signal phasing optimisation in Fanshawe Street
- Busway Station Upgrades aimed at significantly improving safety and reliability of all public transport services.
  - New pedestrian overpasses at selected stations
  - Additional local bus platforms and bus circulation changes.

Due the uncertainties around the delivery of a supplementary RTN connection and other interfacing projects, a dynamic programme approach is recommended. Depending on the timing of an additional RTN cross-harbour connection the following may be required:

- Extensions to bus shoulder lanes on SH1. These extensions are to be confirmed once the alignment, design and implementation timeframes of the Northern Pathway is finalised.
- Potential managed lanes on SH1 as an option to add additional public transport priority without significant investment in infrastructure
- Busway infrastructure extensions to provide fully segregated infrastructure on SH1 and Fanshawe Street.

Figure 9-1: Recommended Option

9.2 Infrastructure Components – Costs

A construction cost estimate has been prepared by TrueCost for the recommended option in accordance with Waka Kotahi's 'Cost Estimation Manual' (SM014). Auckland Transport administration costs have been applied based on 5.7% of Auckland Transport cost estimates.

The P50 total costs for pre-implementation and delivery of the Northern Busway Enhancements are:

- $275.5M, excluding AT funding admin cost
- $291M, including 5.7% AT funding admin cost.

Delivery cost risk was estimated, utilising a risk-based assessment based on the project risk register, and provided an estimated P50 and P95 cost estimate for the programme. These costs were updated after the completion of parallel estimates arranged by Auckland Transport.

9.3 Staged Delivery Approach

A staging strategy has been developed for the recommended option. The intention of a staged delivery is to demonstrate the potential strategic benefits of staging the proposed enhancements. The following staging methodology does not intend to prescribe the exact timing and method of delivery for all proposed improvements, and recognises that specific Horizons and delivery methods may change depending on various interactions with other projects (e.g. AWHC/Supplementary RTN connection to the North Shore, Northern Pathway etc.), capital and operating budgets.

The recommended programme further develops the programme proposed in the AWHC business case (2019), which means the improvements to the busway will need to be effective until at least the mid-2030s. The staged delivery approach includes a decision gate linked to the progress of the AWHC. The Horizon 3 and 4 interventions are the highest cost and risk options, and the value for money needs to be carefully considered if an AWHC is to be constructed, given that the Northern Busway is likely to be supplemented by the AWHC rather than replaced.

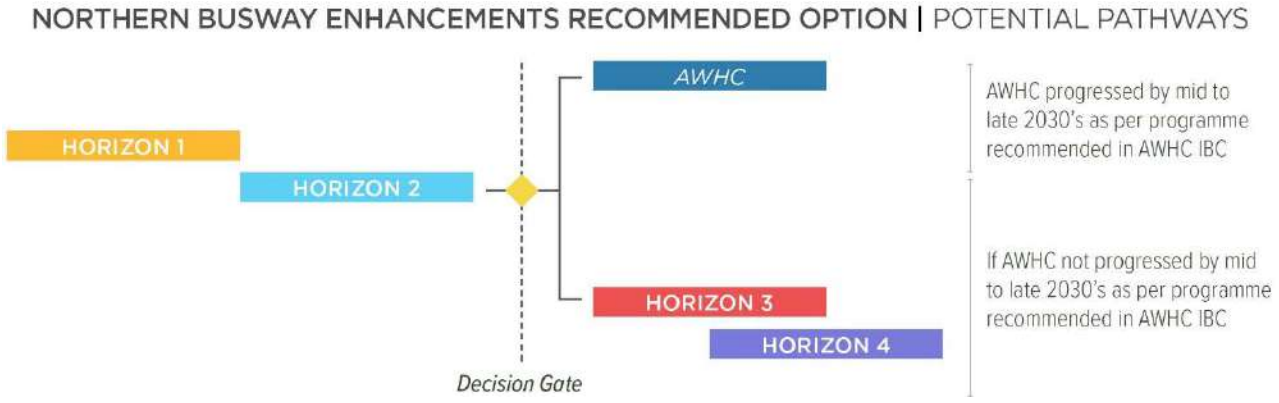


Figure 9-2: Recommended option pathways

The following section describe the proposed programme of delivery of the Northern Busway Enhancements DBC. Each horizon is characterised by:

- The strategic and practical purpose of the horizon,
- The specific elements to be delivered in the horizon (i.e. infrastructure, service), and
- Details on the overall capital costs, operating costs and risks for the Horizon.
- Trigger points identified that outline both practical delivery dependencies and operational requirements that should be achieved prior to implementation of each element of the project.

The staging approach can be characterised as follows:

- Dynamic integration with related infrastructure investments
- Aim to stage improvements to deliver greatest value for money
- Allowing investment to be aligned with growth in demand to optimise the investment profile, while increasing capacity and maintaining a high-quality service.

While time horizons have been assumed in this strategy to inform economic analysis and financial planning, the exact timing of delivery will require a dynamic approach to determine the timing of each stage of the investment.

- **Horizon 1 –** Station and stop capacity upgrades, signal-phasing optimisation
- **Horizon 2 –** Station Upgrades and circulation changes
- **Horizon 3 –** SH1 Improvements – Bus shoulder lanes, Managed Lanes / Transit Lanes
- **Horizon 4 –** Extended / Segregated Busway

System wide improvements are also proposed during all horizons aimed at increasing the capacity and efficiency of the Northern Busway through potential system changes or upgrades. The proposed horizons are described in the sections below.

9.3.1 Physical project extents and asset owners within the programme

The Northern Busway Enhancements DBC Programme includes improvement works across the whole Northern Busway corridor from Albany in the north to the city centre (Fanshawe Street). The extent of which are described below, with the asset owner noted in Italics:

- *Auckland Transport Asset* - Stations: Albany, Rosedale (under construction), Constellation, Sunnynook, Smales Farm and Akoranga Bus Stations.
- *Waka Kotahi NZ Transport Agency Asset* - SH1 (Northern Motorway) corridor: SH1 between the Akoranga Drive interchange in the north and the northern end of the Auckland Harbour Bridge (AHB) in the south.
- *Waka Kotahi NZ Transport Agency Asset* - SH1 corridor: SH1 between the southern landing of AHB in the north and the intersection of Beaumont Street and Fanshawe Street, including the Fanshawe Street on and off ramps, in the south.
- *Auckland Transport Asset* - Local road corridor: Fanshawe Street in Auckland City Centre between the intersection with Beaumont Street and the intersection with Nelson Street.

9.3.2 Staging approach

The Programme is to be sequentially delivered over the next 10-15 years in four stages (Horizons 1 to 4), with a rail connection anticipated to be constructed by the mid-2030s.

Staged delivery of the programme is considered to have several strategic benefits, including:

- Allows existing problems to be addressed and benefits to be realised in the shorter-term with less costly interventions (compared to a full-investment non-staged approach which is less attractive under current funding constraints)
- Allows for more informed decision making at each stage, assessing the effectiveness of interventions and better targeting future interventions under the programme. Noting that a number of the more complex interventions are dependent on outcomes on adjacent projects.
- Provides the opportunity to increase value for money outcomes by targeting investment for greatest benefit, while also spreading the quantum of funding requirements over a longer period.

In addition to the above, a staged approach provides further alignment to government strategies and priorities.

As such the Commercial Case is focussed on the pre-implementation and implementation works for Horizon 1 and 2 which include:

- Station Inventions – Minor platform extensions, Busway station upgrades and circulation changes
- Fanshawe Street – Signal optimisation and minor stop upgrades

Later horizons are addressed in lower levels of detail and focus on options to retain flexibility to adapt as adjacent projects confirm their scope and programme timeframes. Pre-implementation is typically defined as everything from the business case to a spade in the ground.

9.4 The commercial strategy responds to the complexity in the programme

The approach to delivering the programme is affected by its multiparty complexity:

- Although the programme can in some senses be separated into the distinct project components, the delivery approach must also view them as a connected whole.
- Programme Partners: There are two Programme Partners to the Northern Busway enhancements Project – Auckland Transport (AT) and Waka Kotahi NZ Transport Agency leading to the need for strong governance and co-ordination.
- Multiple infrastructure asset owners: The programme extent covers two asset owners being AT (local roads) and Waka Kotahi (state highways). This, combined with the network interrelatedness, necessitates a focus on coordination among the parties.
- Multiple designation holders: Each of the two infrastructure owners is also a Requiring Authority and either holds or is enabled to apply for designation over or along its infrastructure corridors. This is likely to require dual leads or supporting roles in seeking approvals where infrastructure overlaps.
- Multi-year (decade) programme: The current programme staging plan spans up to two decades beyond 2035. This long horizon requires prioritisation of near-term activities that can be planned now, and deliberate flexibility and option retention for medium- and long-term programme components, particularly because of the potential uncertainty generated by COVID-19 and the number of interfacing projects, many of which have higher priority, that are also planned but whose scope and programme has not yet been confirmed. An adaptive approach to investment management over time to manage uncertainty is set out in the Management Case.
- Dual funding sources: The programme's shared components will require agreements on cost sharing among between Waka Kotahi and Auckland Transport.
- Several of these aspects relate to and influence the governance arrangements (asset ownership, legal rights, funding), covered in the Management Case. Funding issues also relate to the Financial Case.
- The multiparty nature of the programme has underpinned the consenting and procurement approaches. These are described below.

9.5 Timing and staging of programme delivery

The staging strategy has been developed for the preferred programme. The intention of the proposed strategy is to demonstrate the potential approach to and strategic benefits of staging the proposed enhancements. The staging methodology does not intend to prescribe the exact timing and method of delivery for all proposed improvements, and recognises that specific Horizons and delivery methods may change depending on various interactions with other projects (e.g. AWHC/Supplementary RTN connection to the North Shore, Northern Pathway etc.), capital and operating budgets.

9.5.1 Strategic Alignment

The Northern Busway Enhancements recommended programme aims to increase the capacity of the existing busway system and improve reliability to meet the projected demand. Staged delivery of these interventions has several strategic benefits, including:

- Allows existing problems to be addressed and benefits to be realised in the shorter-term with less costly interventions (compared to a full-investment non-staged approach which is less attractive under current funding constraints)
- Allows for more informed decision making at each stage, assessing the effectiveness of interventions and better targeting future interventions under the programme
- Provides the opportunity to increase value for money outcomes by targeting investment for greatest benefit, while also spreading the quantum of funding requirements over a longer period.

In addition to the above, a staged approach provides further alignment to government strategies and priorities.

9.5.2 Horizon 1: Station and stop capacity upgrades, signal-phasing optimisation

Horizon 1 depicts the quick win improvements that can be delivered in the short term while providing immediate relief for the problems identified at stations/stops across the busway system.

Table 9-1: Summary of Horizon 1 Components and Delivery

Component	Details
Time Horizon	2021-2023
Capital Cost	$14-$20m
Description	These quick-win interventions are targeted improvements to specific sections across the busway system as below. Platform extensions to increase capacity of busway station platforms (such as Sunnynook Station as shown in Figure 9-3) and Victoria Park stops on Fanshawe Street (Figure 9-4). This will help to alleviate bus bunching (especially during peak periods) improving overall level of service for customers. Platform widening of busway station platforms and Victoria Park stops on Fanshawe Street. Widening of platforms will increase the effective waiting area at the stops, reducing conflict between boarding, alighting and through passengers. Optimisation of Fanshawe Street traffic signals to increase reliability of public transport services.
Purpose	This stage provides immediate benefit to maintain/improve customer experience at relatively low capital cost by reducing dwell times, passenger crowding and passenger circulation at stations.
Focused Infrastructure Improvements	Albany Station: Bus stop length extensions to accommodate an additional bus stop for busway services. The platforms and canopies to be extended accordingly. Constellation Station: Bus stop length extensions to accommodate additional stops required for busway and local services, facilitated by a slight extension of busway platforms and canopies. New local bus stops are also proposed, which involves a new double stop along with associated platform and canopy. Sunnynook Station, Smales Farm Station, Akoranga Station: Bus stop length extensions to provide an additional stop for busway services in each direction. The platforms and canopies to be extended accordingly. Sections of platforms have constrained width due to the protruding glass walls separating the internal and external areas, narrowing the useable width of the platform in the boarding area. This restricts the free flow of passengers along the platform and limits room to circulate. Relocating (setting back) the glass panel walls is proposed to increase the effective waiting space for passengers. Fanshawe Street:

Component	Details
	Improvements to the Victoria Park stop on Fanshawe Street through extension of the existing Victoria Park stop (by 30m) to create clear demarcation for separate route group services by stop as opposed to the existing head of stop operations. Additional footpath widening is proposed to accommodate increased passenger levels, upgraded canopies and a new footpath behind the canopy structure Traffic signal optimisation (at the intersections of Fanshawe Street with Beaumont Street, Daldy Street, Halsey Street, the signalised pedestrian crossing on Fanshawe Street east of Bouzaid Way and the intersection of Nelson Street, Sturdee Street and Market Place with Fanshawe Street).
System Wide Improvements	Additional system-wide improvements to be considered for implementation include: All door boarding Active queue management System wide improvements are discussed further in the Northern Busway Additional Enhancements technical note, refer to Appendix B

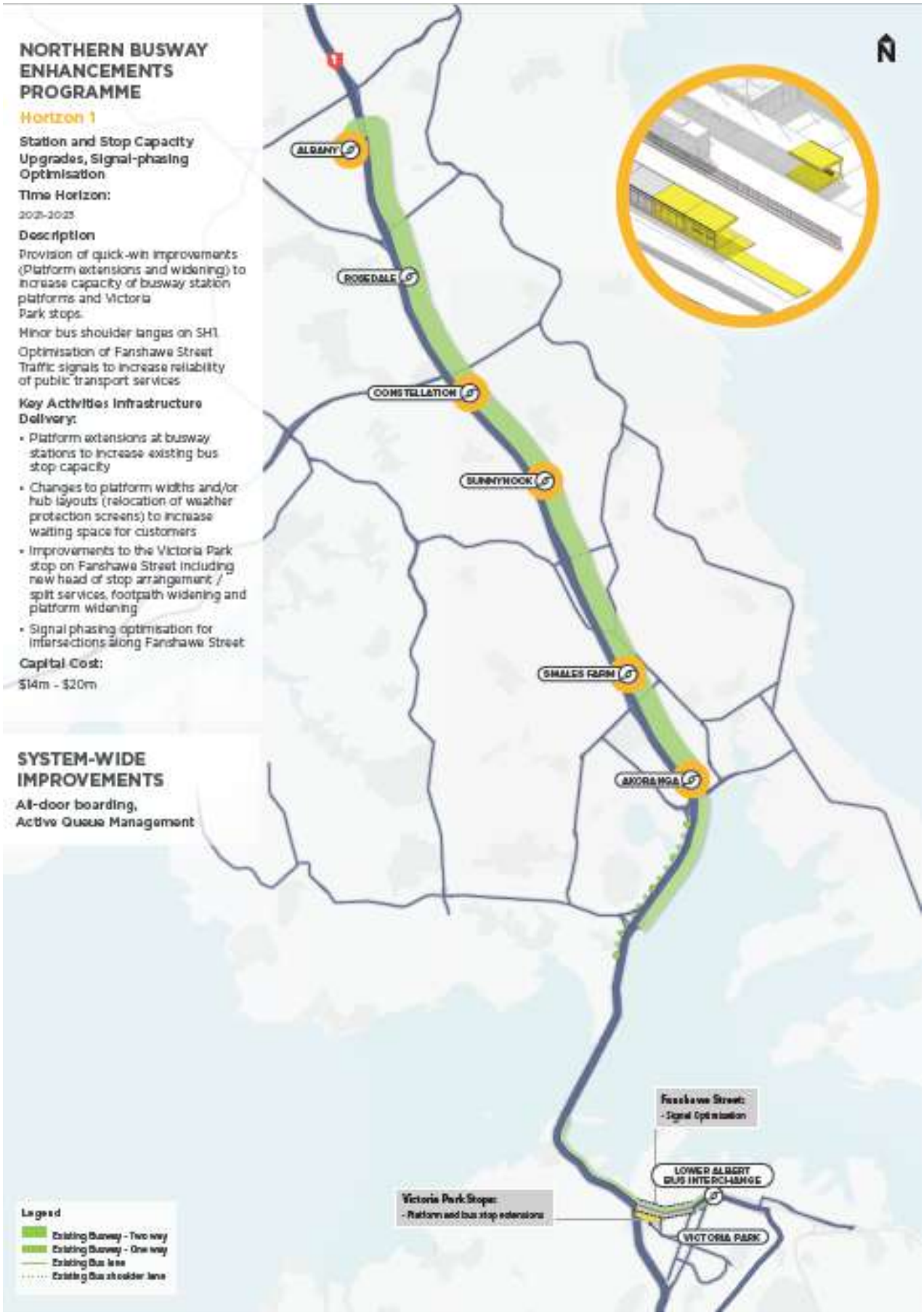


Figure 9-3: Horizon 1

Figure 9-4: Sunnynook Station Rendering – extended platform

Figure 9-5: Victoria Park Stops Rendering – extended platform

9.5.3 Horizon 2: Station Upgrades and Circulation Changes

Horizon 2 depicts the station upgrades and infrastructure required to enable circulation changes at the busway stations.

Table 9-2: Summary of Horizon 2 Components and Delivery

Component	Details
Time Horizon	2023-2027
Capital Cost	$80-$90m
Description	Station infrastructure upgrades to enable complete separation between busway and local services, to remove the need for any local services to circulate via the busway. This includes pedestrian overpasses and new lift and stairwell towers.
Purpose	This stage enables bus circulation changes to manage the increased volume of buses and eliminate any conflict impacts dwell time and reliability of busway services. Pedestrian overpasses improved safety, by removing all pedestrian conflict with the increasing number of circulating buses, while also enabling additional system-wide improvements such as electronic ticketing gates.

Component	Details
Focused Infrastructure Improvements	Albany Station, Constellation Station, Smales Farm Station, Akoranga Station: New turnaround facilities at the stations to eliminate the need for local services to circulate via the busway (Figure 9-7). Local terminating services are able to access the final stops and layover facilities and turn around for new service commencement without interference with the busway Albany Station, Constellation Station, Smales Farm Station: New grade separated crossings would replace the existing zebra crossings between the main station hub and local stops, to eliminate bus-pedestrian conflicts (Figure 9-8). Other than safety benefits, traffic modelling also indicates that this would provide a noticeable improvement in travel time and reliability due to removing the need for buses to stop (particularly during peak hours) and subsequently, a reduced risk of bus bunching issues. Additional layover bays to meet growing demand (Figure 9-9). The station layouts allow local terminating services to access the final stops and layover facilities before accessing commencement stops without interference with the busway. Infrastructure components at the bus stations are covered in more detail earlier in Section 6.4.
System Wide Improvements	Additional system-wide improvements to be considered for implementation include: • Off-board fare collection • Level boarding System wide improvements are discussed further in the Northern Busway Additional Enhancements technical note, included in Appendix B

Figure 9-6: Horizon 2

Figure 9-7: Akoranga Station Rendering – new turnaround facility

Figure 9-8: Constellation Station Rendering – new pedestrian overpass

Figure 9-9: Constellation Station Rendering – new bus entrance and layovers

9.5.4 Horizon 3: SH1 improvements - Managed Lanes / Transit Lanes

Horizon 3 entails the potential provision of managed/transit lanes across the Harbour Bridge in sections where widening and new infrastructure are not considered feasible.

However, several operational issues including monitoring, signage, policing, and management require careful consideration before the managed/transit lanes are potentially implemented.

Table 9-3: Summary of Horizon 3 Components and Delivery

Component	Details
Time Horizon	2027-2029
Capital Cost	$9-$12m
Description	Potential managed/transit lanes on SH1 to provide additional priority for rapid transit services between Onewa Interchange and Beaumont Street. Additional investigation required, and ultimately potential for, and timing of interventions linked to wider AWHC progress.
Purpose	There is opportunity to increase reliability of specific sections with no current priority as significant capital expenditure is required to potentially provide dedicated priority
Focused Infrastructure Improvements	Bus shoulder lanes and transit lanes on SH1: This involves minor bus priority improvements without major changes to the existing infrastructure on SH1. For the portion of SH1 north of AHB, extension of the existing southbound bus shoulder lane by 400m is proposed. This provides southbound buses an additional 400m of priority and reduces the impact of general traffic congestion on the approach to the AHB. For the portion of SH1 south of AHB, a new northbound bus shoulder lane is proposed between Shelly Beach Road Bridge and the Curran Street On-Ramp. This provides northbound buses an additional 200m of priority and reduces the impact of general traffic congestion on the approach to the AHB. The proposed bus shoulder lanes will unlikely impact any existing infrastructure and will likely only require roadmarking adjustments.

Component	Details
	Transit lanes commencing and terminating at either side of the AHB can provide priority to buses and high occupancy vehicles across the AHB. The effectiveness of the transit lanes in reducing impact of general traffic congestion on buses across the AHB is dependent on the operation of the transit lane (such as modal mix and operational hours). The implementation of this option involves the following: • Allocating the kerbside general traffic lane as a transit lane. • Suite of transit lane signage to warn motorists of the transit lane operation, extents and crossover points. These are to be implemented on existing gantries where possible. • New gantries as required to accommodate new transit lane signage. • New ITS infrastructure to support the daily operation of the transit lanes

Figure 9-10: Horizon 3

9.5.5 Horizon 4: Extended / Dedicated Busway

Horizon 4 entails the busway extension and widening of SH1 and an urban busway (bi-directional busway) on Fanshawe Street to provide a significant increase in dedicated priority for bus services. The busway extension, widening of SH1 and urban busway is highly dependent on the progress of the AWHC

Table 9-4: Summary of Horizon 4 Components and Delivery

Component	Details
Time Horizon	2025-2034 (timing linked to AWHC progress)
Capital Cost	$170-$230m.
Description	Significant infrastructure investment to increase public transport priority by extending the existing busway, widening SH1 to increase priority and delivery of an urban busway on Fanshawe Street.
Purpose	To provide increased reliability for specific sections of the system with limited or no current priority.
Focused Infrastructure Improvements	**Extension of the busway south of Akoranga Station to Onewa Road:** This involves the extension of the existing bi-directional busway from Akoranga Station towards Onewa Road Interchange, where the busway splits between northbound and southbound. The southbound portion continues onto the existing dedicated bus lane and merges with general traffic south of the Onewa Road Southbound on-ramp. The northbound portion involves a new bus overpass for northbound buses on the kerbside lane to cross over SH1 and join with the proposed bi-directional busway on the eastern side of SH1. This option provides southbound buses with similar priority to the existing. However, significantly greater priority is provided for northbound buses by providing a more direct connection to Akoranga Station and with over 2km of dedicated busway. **Widening of SH1 between Beaumont Street and Curran Street:** This involves widening the northbound carriageway on SH1 between the Fanshawe Street on-ramp and Shelly Beach Road bridge for a new northbound bus shoulder lane. This provides northbound buses an additional 700m of bus priority and reduces the impact of general traffic congestion on the approach to the AHB. **Urban Busway on Fanshawe Street between Beaumont Street and Nelson Street:** This option is based on the Urban Busway option identified and developed as part of the Fanshawe Street Bus Priority and Wynyard Quarter Bus Interchange IBC This involves a separated bi-directional urban busway positioned on the northern side of Fanshawe Street between Beaumont Street and Nelson Street (approximately 700m) with optimised traffic signals and midblock signalised pedestrian crossings. The proposed urban busway will connect the Northern Busway and Wynyard Quarter with the city centre. Inbound bus services operating on the busway will join the busway from SH1 at the Beaumont Street intersection with Fanshawe Street. Buses will then continue onto Sturdee Street at Nelson Street and continue to LABI via new bus lanes being implemented as part of the downtown improvements project. In the North Shore bound direction buses will join the busway at the Nelson Street intersection and continue onto SH1 from the Beaumont Street intersection.
System Wide Improvements	Additional system-wide improvements to be considered for implementation include: • Potential fleet opportunities • Headway management systems System wide improvements are discussed further in the Northern Busway Additional Enhancements technical note, included in Appendix B.

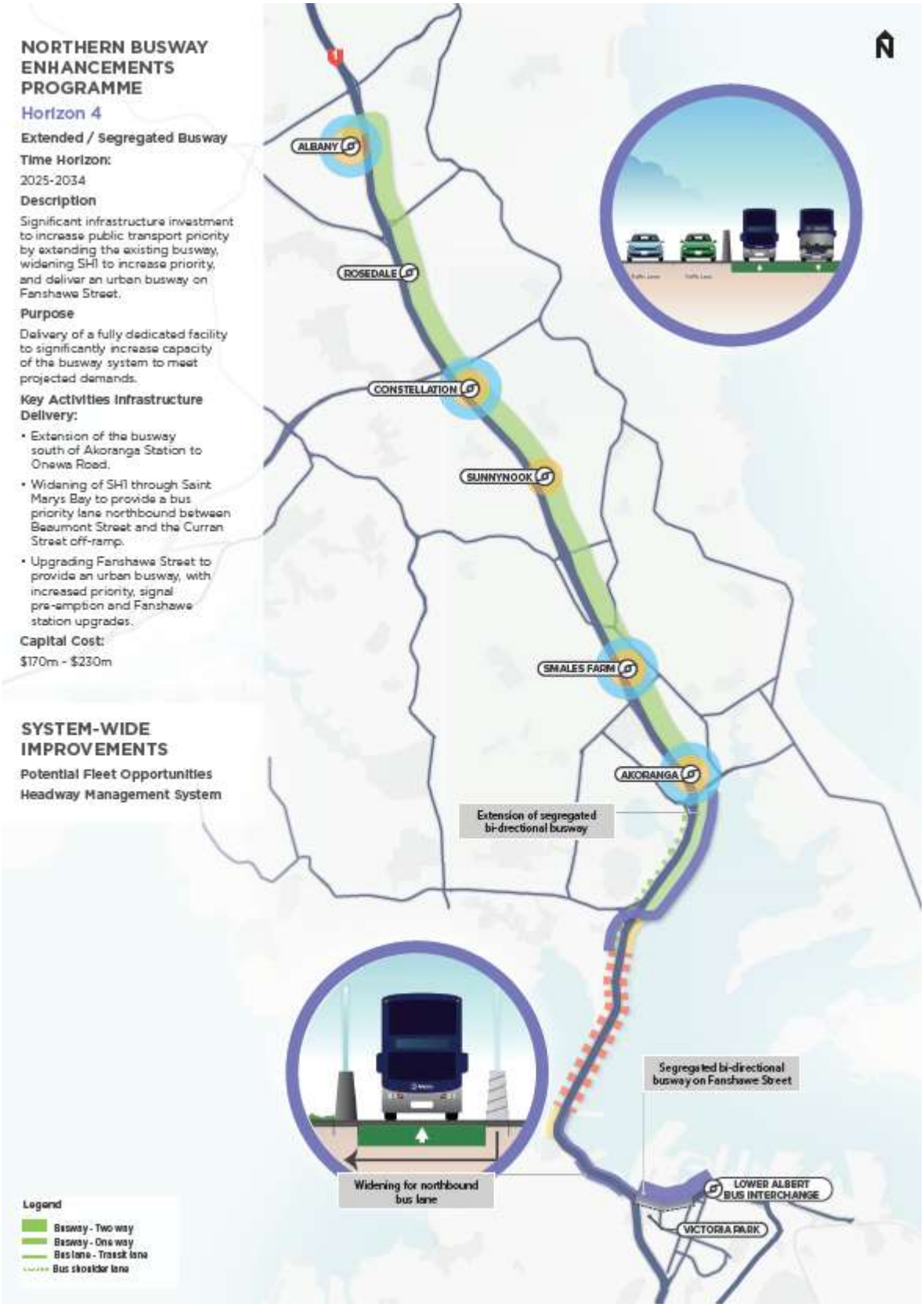


Figure 9-11: Horizon 4

9.6 Assessment Against Objectives and KPI's

The overall DBC adopted objectives are:

- Retain and improve public transport competitiveness
- Improve access to economic and social opportunities
- Optimised capacity of the public transport connections to the North Shore
- Enable Auckland to achieve quality, compact growth and improved amenity.

The table below notes the specific elements of evidence that demonstrate achievement of the intended outcomes. Each element is then expanded upon below.

It should be noted, that some KPIs are required for the purpose of post implementation monitoring, while others can be used to assess likely achievement of the objectives through implementing the recommended option.

Table 9-5: Project objectives and evidence of achievement

Investment Objective	Measure/ KPI
Retain and improve public transport competitiveness	Maintain or increase mode share along the busway Faster journey times More reliable journey times
Improve access to economic and social opportunities	Jobs accessible within a 45 min trip on PT Population accessible within a 45 min trip on PT
Optimise capacity of the public transport connections to the North Shore	Person throughput across the harbour bridge
Enable Auckland to achieve quality, compact growth and improved amenity	Reduced impact of transport on Auckland's environment (emissions reductions, VKT and fuel use reduction) Improved amenity for City Centre & Metropolitan Centres (Mode shift to City Centre) Reduce CO2 emissions

9.6.1 Retain and improve public transport competitiveness

The figure below shows the expected increase in public transport mode share between the North Shore and the city centre. In both AM and PM peaks and interpeak there is a forecasted increase in PT mode share. The recommended option maintains and improves the public transport in all modelled decades.

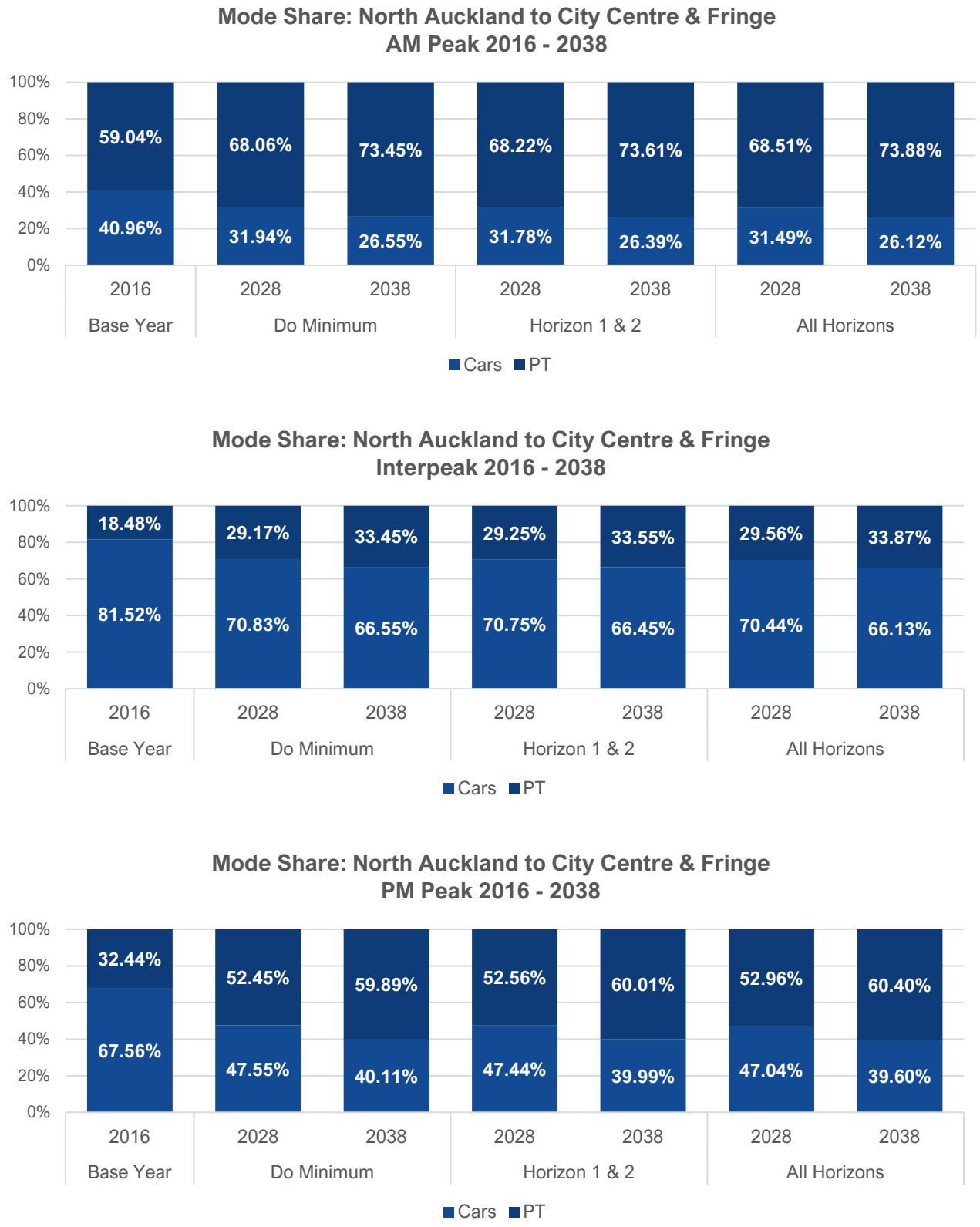


Figure 9-12: PT mode share between the North Shore and the city centre and fringe

Table 9-6 and Table 9-7 below show the travel times between Albany and the city centre for the do-minimum and the recommended option for 2020 (current), 2026 and 2036 based on MSM outputs.

- AM peak southbound travel times are expected to improve by approximately 6 minutes in 2026 and 5 minutes in 2036.
- PM peak northbound travel times are expected to improve by approximately 5 minutes in 2026 and 7 minutes in 2036.

Table 9-6: AM peak southbound travel times (Albany to city centre)

AM Peak Southbound Travel Times (Albany to City Centre)	2020	2028	2038
2038 Do-Minimum (Minutes)	25 - 31	30 - 32	31 - 33
2038 Recommended Option (Minutes)		24 - 26	26 - 28

Table 9-7: PM peak northbound travel times (city centre to Albany)

PM Peak Northbound Travel Times (City Centre to Albany)	2020	2028	2038
2038 Do-Minimum (Minutes)	26 - 31	30 - 32	33 – 35
2038 Recommended Option (Minutes)		25 - 27	26 - 28

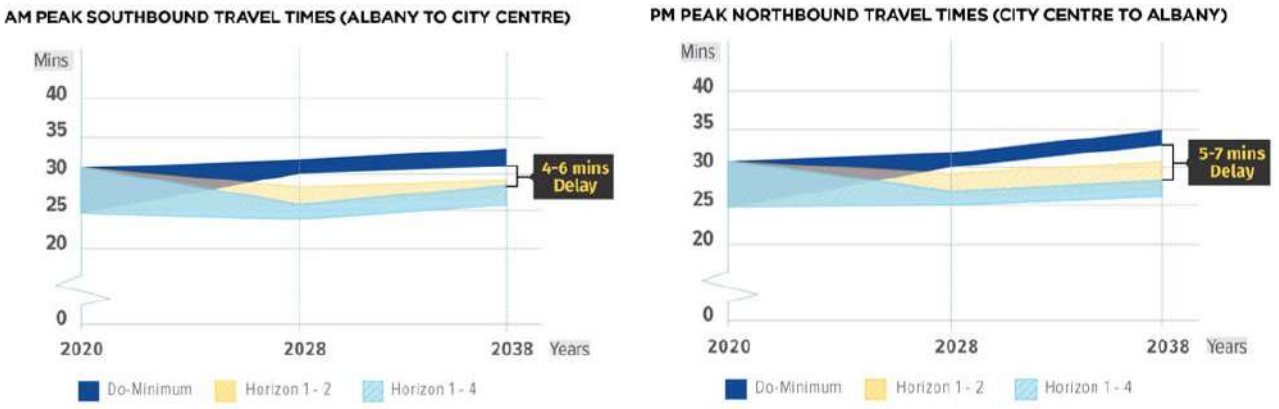


Figure 9-13: Impact of Recommended Option on AM and PM travel times

The reliability of public transport on the corridor with the preferred option is expected to increase. Table 9-8 below shows the % of PKT by bus in severe congestion. This acts as a measure of the reduction of bus congestion experienced in the recommended option in comparison to the do-minimum and is indicative of wider travel time reliability improvements.

Table 9-8: % of PKT by bus in severe congestion (LOS EF)

% of PKT by Bus in severe congestion (LOS EF)			
Peak	**2038 Do-Minimum**	**2038 Recommended Option (Horizon 1 & 2)**	**2038 Recommended Option (All Horizons)**
AM	4.42	4.41	4.37
IP	1.19	1.19	1.18
PM	5.35	5.52	5.14

9.6.2 Improve access to economic and social opportunities

The project increases the number of jobs and population falling within the 45-minute public transport catchment.

Table 9-9: Recommended option employment catchments

Employment Catchments				
Peak	Origin	2038 Do-Minimum	2038 Recommended Option (Horizon 1 & 2)	2038 Recommended Option (All Horizons)
AM	Albany	274,900	280,600	280,600
	City Centre	541,200	543,200	544,200
IP	Albany	264,100	286,600	286,600
	City Centre	543,500	543,500	545,900
PM	Albany	139,900	142,400	142,400
	City Centre	542,700	542,700	543,000

Table 9-10: Recommended option population catchments

Population Catchments				
Peak	**Origin**	**2038 Do-Minimum**	**2038 Recommended Option (Horizon 1 & 2)**	**2038 Recommended Option (All Horizons)**
AM	Albany	320,400	331,900	331,900
	CBD	971,900	975,100	981,400
IP	Albany	325,700	337,500	337,500
	CBD	982,000	982,000	995,900
PM	Albany	247,600	257,000	257,000
	CBD	970,100	970,100	975,300

9.6.3 Optimise capacity of the public transport connections to the North Shore

Table 9-11, Table 9-12 and Table 9-13 below illustrate the expected increase in throughout across the Auckland Harbour Bridge southbound in the AM peak, northbound in the AM peak (counter-peak) and northbound in the PM peak respectively. Across each peak period and direction shown below, there is an increase in person throughout on public transport for the recommended option.

Table 9-11: AM peak southbound – Auckland Harbour Bridge

Mode	2038 Do-Minimum	2038 Recommended Option (Horizon 1 & 2)	2038 Recommended Option (All Horizons)
Public Transport	17,798	17,948	18,191
Private Vehicle	14,733	14,729	14,724
Total	32,531	32,677	32,915

Table 9-12: AM peak northbound – Auckland Harbour Bridge (counter-peak)

Mode	2038 Do-Minimum	2038 Recommended Option (Horizon 1 & 2)	2038 Recommended Option (All Horizons)
Public Transport	7,380	7,424	7,608
Private Vehicle	11,015	11,018	11,026
Total	18,395	18,442	18,634

Table 9-13: PM peak northbound – Auckland Harbour Bridge

Mode	2038 Do-Minimum	2038 Recommended Option (Horizon 1 & 2)	2038 Recommended Option (All Horizons)
Public Transport	14,640	14,745	15,142
Private Vehicle	16,428	16,423	16,443
Total	31,068	31,168	31,585

9.6.4 Enable Auckland to achieve quality, compact growth and improved amenity

The environmental impacts of the project options are local. They were included in the MCAs of the individual components and therefore contributed to option selection. The project is expected to provide environmental benefits from reducing car use and increasing public transport use and therefore emission of pollutants, including greenhouse gases.Table 9-14 and Table 9-15 demonstrates the emissions reductions expected in the recommend option in 2038. Not only do these emissions reduce but also fuel consumption and total network VKT. Table 9-16 shows the percentage of person trips to the city centre by mode in 2038. Not only does public transport patronage improve but traffic volumes are expected to reduce.

Table 9-14: Recommended option emissions

Emission Type	2038 Do-Minimum	2038 Recommended Option (Horizon 1 & 2)	2038 Recommended Option (All Horizons)
CO Emissions (kg/24hr)	15,178	15,176	15,171
CO2 (kg/24hr)	6,843,317	6,842,740	6,840,650
NOX Emissions (kg/24hr)	10,313	10,312	10,308
NO2 Emissions (kg/24hr)	2,138.00	2,138.00	2,137.00
PM10 Emissions (kg/24hr)	184.50	184.50	184.40

Table 9-15: Recommended fuel consumption and VKT

Measure	2038 Do-Minimum	2038 Recommended Option (Horizon 1 & 2)	2038 Recommended Option (All Horizons)
Fuel Consumption (l/24hr)	2,813,874	2,813,636	2,812,768
VKT Total (/24hr)	44,977,112	44,971,960	44,962,132

Table 9-16: % of person trips to city centre by mode - AM peak

% of Person Trips to CBD by Mode - AM 2hr	2038 Do-Minimum	2038 Recommended Option (Horizon 1 & 2)	2038 Recommended Option (All Horizons)
Car	32.26	32.23	32.17
PT	67.74	67.77	67.83

9.7 Impact of Recommended Programme on Customer Experience

As identified in the strategic case and options assessments, there is an array of operational issues that impact the overall customer experience on the Northern Busway. Customer decisions and travel behaviour are driven by high quality transport options that provide comfort, ease, and reliability. The recommended programme provides relief for these issues by making improvements to the following:

- Journey time
- Journey reliability
- Crowding
- Safety
- Legibility and wayfinding

The recommended programme delivers benefits to improve customer experience across all horizons. In Horizon 1 and 2, some of the greatest benefits for customers are realised. Changes to station layouts, available waiting area space and clear stop allocations enhance the overall customer experience by improving customer comfort and their ability to navigate the public transport system with ease. In the longer term, larger infrastructure improvements to provide additional priority and dedicated facilities for bus services strengthens and builds upon the perception of the Northern Busway as a premium RTN service.

Figure 9-14 below provides a summary highlighting when the benefits of the recommended improvements can be expected for customers during each horizon.

Customer experience improvements	EXPECTED IMPROVEMENTS TO CUSTOMER EXPERIENCE REALISED PER HORIZON			
	Horizon 1	Horizon 2	Horizon 3	Horizon 4
Reliability	✓	✓✓	✓	✓✓
Journey Time	✓	✓	✓	✓
Crowding	✓✓	✓		
Safety	✓	✓✓		✓
Legibility	✓✓	✓✓		✓

✓✓ Significant positive ✓ Positive

Figure 9-14: Customer Experience Improvements by Horizon

10 GPS Alignment, Scheduling and Efficiency

10.1 Prioritisation of the Proposed Investment

The priority for the potential investment has been assessed in accordance with the Waka Kotahi method for the 2021-24 National Land Transport Programme [13].

This Investment Prioritisation Method requires the assessment of three factors – GPS alignment, Scheduling and Efficiency. The assessment against each factor is outlined below.

10.1.1 GPS Alignment

GPS alignment indicates the alignment of the proposed project with a GPS strategic priority and identifies the potential contribution to achieving it. A rating of Very High/High/Medium/Low alignment is applied. It is noted that where a project contributes to more than one GPS strategic priority, the rating is assigned based on the highest expected contribution to a single strategic priority [14].

The nature of the project and investment objectives, which are aimed at retaining the competitiveness of this regionally significant public transport system, coupled with the limitations of Auckland Forecasting Centre's regional public transport model to capture all operational deficiencies identified as part of the business case in detail, necessitates the use of various project specific benefits that will contribute to the strategic priorities of the GPS.

The impacts of no investment on the travel time and efficiency of the busway system has been determined through detailed modelling conducted for all components of the busway (busway stations, SH1 and Fanshawe Street), which provided evidence of the forecasted level of degradation across the busway, and the impact of the recommended programme.

The programme ensures that the Northern Busway maintains its current level of service across the next two decades, and while it does not add public transport services or stops, it ensures that this crucial system, which has no public transport alternatives, efficiently operates at an acceptable level.

The highest GPS metric relates to the *'**Better Travel Options**;* strategic priority which focuses on the impact on mode choice.

The recommended programme Improves public transport travel times by 20% when compared to the do-minimum. AM peak southbound travel times are expected to improve by approximately 6 minutes in 2026 and 5 minutes in 2036, while PM peak northbound travel times are expected to improve by approximately 5 minutes in 2026 and 7 minutes in 2036. The rating of the corresponding metric would be **Very High**, as a 20% increase in travel time exceeds the % listed in the for a Very High rating in all prescribed measures.

Without investment, the increase in passenger minutes delay experienced from a 2020 baseline would be 29% higher than what it would be if Horizon 1 and 2 were implemented, and 50% higher than what it would be if all horizons are implemented.

A **Very High** rating indicates that both the extent of alignment and scale of the expected contribution are well aligned with the GPS strategic priority.

10.1.2 Scheduling

Scheduling in the Method relates to either of two factors: *criticality* and *interdependency*. Criticality is the significance of the project's role as part of the network, and the degree of impact to users, particularly due to availability (or not) of alternatives. Interdependency refers to the degree to which the project is necessary to unlock the benefits of another related or integrated investment. The other investment may be part of the same transport programme or package, or a major housing or industrial development or international event.

[13] Investment prioritisation Method for the 2021-24 National Land Transport Programme, Waka Kotahi December 2020
[14] Ibid, p.11

In this case the dominant factor is interdependency as this project is intrinsically linked to the wider programme recommendations Additional Waitemata Harbour Connections IBC. Not investing in the improvements included in this DBC, will drastically influence the realisation of benefits associated with the wider programme.

Similar to the rating of GPS alignment, a rating of High/Medium/Low is applied. Considering the high interdependency with other projects, this project meets the **High** criterion of interdependency as it is "part of a programme, package or another investment, and its delivery in the 2021 NLTP period is required to enable further implementation of that programme, package, or investment" and "one or more benefits will not be achieved or will be delayed for more than 3 years" [15].

10.1.3 Efficiency

Efficiency indicates the expected return on investment and considers the whole of life costs and benefits. BCR is generally used for looking at monetised impacts of the investment.

For this business case, the BCR for Horizon 1 and 2 (which is currently confirmed) is 4, which gives a **medium** rating.

The BCR for Horizon 1 to 4 (which is currently unconfirmed) is 1.8, which will result in a **low** rating.

10.1.4 Overall Priority

The recommended project has been assessed against the NLTP Investment Prioritisation Method. The assessment indicates that the recommended option has:

- **Very high** GPS alignment
- **High** scheduling
- **Medium** efficiency (Horizon 1 and 2)

Applying the Investment Prioritisation 3-factor matrix to the above ratings, the priority order for the project would be **1** (for the initial Horizon and 2) or **2** (for Horizon 1 – 4, due to the lower BCR).

10.2 Appraisal Summary Table

Appraisal Summary tables are included in Table 10-1**.** and Table 10-2, and have been prepared in accordance with Waka Kotahi requirements.

[15] Ibid, p.17

Table 10-1: Northern Busway Enhancements – Appraisal Summary

Appraisal Summary Preferred Option			
Date: June 2021	**Evaluation Period: (baseline and forecast year)** 2016 - 2038	**Northern Busway Enhancements – Recommended Option**	• Minor platform length and width extensions at Albany, Constellation, Sunnynook, Smales Farm and Akoranga Stations. • Signal phasing optimisation in Fanshawe Street • Busway Station Upgrades aimed at significantly improving safety and reliability of all public transport services. • Extensions to bus shoulder lanes on SH1. These extensions are to be confirmed once the alignment, design and implementation timeframes of the Northern Pathway is finalised. • Potential managed lanes on SH1 as an option to add additional public transport priority without significant investment in infrastructure • Busway infrastructure extensions to provide fully segregated infrastructure on SH1 and Fanshawe Street.
Problem/opportunity statement: Problem 1: An existing lack of priority and infrastructure means that the busway is unable to perform optimally and not all journeys to, from and within the North Shore are well-served. Problem 2: Inability to effectively serve forecasted demand along the Northern Busway will result in a degradation of service quality, worsen environmental impacts and constrain quality growth. In the case of the two problem statements, it is realised that the system is beginning to reach capacity and become less efficient, and consequently will start to fail in delivering the patronage goals of the busway and Auckland's RTN as set out in the AT RPTP. Without the planned improvements, stations and the busway system are likely to be under sustained pressure in peak times. This will lead to degraded performance.	**Investment objectives:** The overall DBC adopted objectives are: • Retain and improve public transport competitiveness • Improve access to economic and social opportunities • Optimised capacity of the public transport connections to the North Shore • Enable Auckland to achieve quality, compact growth and improved amenity.	**How project gives effect to GPS:** The GPS 2021 sets out the Government's priorities for expenditure from the NLTF over the decade from 2020/21 – 2029-30. In the Statement of Performance Expectations published by Waka Kotahi, the provision and improvement of public transport networks contributes to road safety, providing access to social and economic opportunities, and reducing the impacts of the transport sector on the environment. The enhancements will improve the ability of a large population of people to get where they want to go safely and efficiently by improving the efficiency of the busway system. It will provide more reliable access and higher quality choice of access to jobs, education and social opportunities that will have an impact on economic opportunities, e.g. the ability to provide housing on the North Shore and access for people to the places and opportunities they require. It will also provide a more sustainable alternative mode to driving, hence reducing the impact on the environment and public health. In summary, it is considered that the Northern Busway Enhancements DBC is fully aligned with the GPS 2021.	**How project gives effect to local community outcomes:** Growth rates on the Northern Busway have consistently outpaced growth on the rest of the Auckland RTN. The Northern Busway Enhancements recommended programme aims to increase the capacity of the existing busway system and improve reliability to meet the projected demand. The ATAP identifies that improvements to the Northern Busway will be required. This project aligns with ATAP and will provide 'Better Travel Choices' by making public transport more attractive. The RLTP also lists the Northern Busway enhancements within its 'Capital Programme', although it is listed as an unfunded status. This DBC will also give effect to local community outcomes stated in: • RPTP, by creating additional bus interchanges and additional bus lanes to support the 'frequent network' as being a high priority for investment. • Auckland Plan, by improving PT services on the North Shore and encouraging more Aucklanders to choose PT over private vehicles • Auckland Unitary Plan, by providing more PT services to accommodate the expected intensification around Birkenhead, Northcote, Takapuna, and Sunnynook. • CCMP, by potentially reducing the reliance on using private vehicles to get to city centre and being supportive of achieving the objectives of 'Access 4 Everyone' project proposed in the CCMP Refresh.

Table 10-2: NBE – Investment Prioritisation Method

Transport Outcomes	Non-Monetised Impact:					Monetised Impact:	
Name of Benefit	Name of Measure:	Baseline:	Do Minimum Impact:	Recommended Option Impact Horizon 1 -2	Preferred Option Impact Horizon 1 -4	Do Minimum Impact:	Option Impact:
Healthy and safe people							
3.1 Impact of mode on physical and mental health	3.2.1 Ambient air quality - NO2	N/A	2138 kg/24h	2138 kg/24hr	2137 kg/24hr, reduced by 1 kg/24hr	N/A	N/A
3.1 Impact of mode on physical and mental health	3.2.2 Ambient air quality - PM10	N/A	184.5 kg/24hr	184.5 kg/24hr	184.4 kg/24hr, reduced by 0.1 kg/24hr	N/A	N/A
Resilience and security							
4.1 Impact on system vulnerabilities and redundancies	10.1.9 Travel time	AM peak southbound: 25 - 31 mins (in 2020)	Improve by approximately 6 minutes in 2026	Improve by approximately 6 minutes in 2026 (20%)	Improve by approximately 5 minutes in 2036 (20%)	N/A	N/A
		PM peak northbound: 26 - 31 mins (in 2020)	33 to 35 minutes	Improve by approximately 5 minutes in 2026 (20%)	Improve by approximately 7 minutes in 2036 (20%)	N/A	N/A
Economic prosperity							
5.1 Impact on system reliability	5.1.1 Punctuality - public transport	N/A	4.42% of PKT by bus in AM peak severe conditions	4.41% of PKT by bus in PM peak severe conditions	4.37% of PKT by bus in AM peak severe conditions	N/A	N/A
		N/A	5.35% of PKT by bus in PM peak severe conditions	5.52% of PKT by bus in PM peak severe conditions	5.14% of PKT by bus in PM peak severe conditions	N/A	N/A
Environmental sustainability							
8.1 Impact on greenhouse gas emissions	8.1.1 CO2 emissions	N/A	6,843,317 kg/24hr	6842740 kg/24hr	6,840,650 kg/24hr, reduced by 2,667 kg/24hr	N/A	N/A
Inclusive access							
12.1 Impact on Te Ao Māori	12.1.1 Te Ao Māori	N/A	N/A	Addressing transport connections between the North Shore and the city will improve access to social and cultural opportunities, which will contribute to improved wellbeing and prosperity for Māori.	Addressing transport connections between the North Shore and the city will improve access to social and cultural opportunities, which will contribute to improved wellbeing and prosperity for Māori.	N/A	N/A
10.1 Impact on user experience of the transport system	10.1.6 People - throughput	N/A	17,798-person throughput via PT (AM peak southbound)	17,984 person throughput via PT (AM peak southbound)	18,191-person throughput via PT (AM peak southbound)	N/A	N/A
		N/A	14,640 person-throughout via PT (PM peak northbound)	12,745 person throughput via PT (AM peak southbound)	15,142 person throughout via PT (PM peak northbound)	N/A	N/A

Transport Outcomes	Non-Monetised Impact:					Monetised Impact:	
Name of Benefit	Name of Measure:	Baseline:	Do Minimum Impact:	Recommended Option Impact Horizon 1 -2	Preferred Option Impact Horizon 1 -4	Do Minimum Impact:	Option Impact:
10.2 Impact on mode choice	10.2.1 People - mode share	N/A	AM peak PT mode share 67,74% in 2038	AM peak PT mode share 67,77% in 2038	AM peak PT mode share 67,83% in 2038	N/A	N/A
10.3 Impact on access to opportunities	10.2.5 Spatial coverage - public transport - employees	N/A	274,900 jobs accessible within 45-minute PT trip (AM peak, originating from Albany)	280,600 jobs accessible within 45-minute PT trip (AM Peak, originating from Albany)	280,600 jobs accessible within 45-minute PT trip (AM Peak, originating from Albany)	N/A	N/A
		N/A	139,900 jobs accessible within 45-minute PT trip (PM peak, originating from Albany)	142,400 jobs accessible within 45-minute PT trip (PM peak, originating from Albany)	142,400 jobs accessible within 45-minute PT trip (PM peak, originating from Albany)	N/A	N/A
10.3 Impact on access to opportunities	10.2.6 Spatial coverage - public transport - resident population	N/A	320,400 population (AM peak, Albany)	331,900 population (AM peak, Albany)	331,900 population (AM peak, Albany)	N/A	N/A
		N/A	247,600 population (AM peak, Albany)	257,000 population (AM peak, Albany)	257,000 population (AM peak, Albany)	N/A	N/A

1. Summary of Non-Monetised Impacts (Description)	2. Summary of Financial Impacts		3. Summary of Monetised Option Impacts	
The series of improvements proposed in the recommended option is anticipated to enhance the capacity and improve the reliability of the Northern Busway. The full suite of improvements will collectively enable the busway to meet projected demand and provide a high-quality service that effectively serve the growing demand up to 2038. • Retains and improves the competitiveness of public transport and increases the modelled person throughput. • Increases the number of jobs and population falling within the 45-minute public transport catchment by between 2 and 8% depending of the direction and time of travel. • Improves travel times by 20% when compared to the do-minimum: - AM peak southbound travel times are expected to improve by approximately 6 minutes in 2026 and 5 minutes in 2036. - PM peak northbound travel times are expected to improve by approximately 5 minutes in 2026 and 7 minutes in 2036. • In addition, the model estimates significant savings in greenhouse gas emissions.	Capital Costs	P50 of $275.3M P95 of $317.7M	Total Monetised Benefits, excluding Wider Economic Benefits (WEBs)	$360m ($314m for horizon 1 and 2)
			Total Monetised Benefits, including Wider Economic Benefits (WEBs)	$360m ($314m for horizon 1 and 2)
	Operating Costs	$304,000	Total Monetised Benefits (costs)	$197.9m ($79.5m for horizon 1 and 2)
			BCR (excluding WEBs)	1.8 for Horizon 1 to 4 4 for Horizon 1 and 2
	Total Financial Costs		BCR (including WEBs)	

Rationale for selecting preferred option
The recommended option is a suite of interventions aimed at increasing the capacity of the busway. A range of options were developed, and the recommended option was identified during a series of workshops with Auckland Transport and Waka Kotahi stakeholders. The recommended programme was selected as it: • Allows existing problems to be addressed and benefits to be realised in the shorter-term with less costly interventions (compared to a full-investment non-staged approach which is less attractive under current funding constraints). • Allows for more informed decision making at each stage, assessing the effectiveness of interventions and better targeting future interventions under the programme. • Provides the opportunity to increase value for money outcomes by targeting investment for greatest benefit, while also spreading the quantum of funding requirements over a longer period. The recommended programme further develops the programme proposed in the AWHC business case (2019), which means the interim improvements to the busway will need to be effective until at least the mid-2030s. The staged delivery approach includes a decision gate linked to the progress of the AWHC. The Horizon 3 and 4 interventions are the highest cost and risk options, and the value for money needs to be carefully considered if an AWHC is to be constructed, given that the Northern Busway is likely to be supplemented by the AWHC rather than replaced.

11 Preferred Option – Assessment

11.1 Outcomes

This chapter provides a detailed assessment of expected achievement of the desired project outcomes. Many of the calculated expected benefits are derived from the well-established Auckland Forecasting Centre (AFC) MSM model, giving confidence in the assessment. Given the nature of the interventions, there is a reasonable level of confidence that the intended project outcomes will be achieved. The aims of improving mode share, journey times, reliability, accessibility, and amenity along the Northern Busway system as well as providing overall environmental benefits should be expected.

11.2 Assessment of Preferred Option

11.2.1 Travel Behaviour Change

Travel behaviour change is expected as the project aims to enhance the existing Northern Busway system by improving the travel time and reliability of existing services. This will further increase the attractiveness of the Northern Busway and encourages behaviour change towards public transport on the North Shore.

11.2.2 Public Engagement

No public engagement has been undertaken as part of the development of the detailed business case. This will be included in the next stages as workstreams are developed.

11.2.3 Environmental Impacts

There are a number of potential impacts of the preferred option on the surrounding environment. The project area is within/adjacent to the CMA along SH1 between Akoranga and the AHB. In addition, within Shoal Bay there are several protected SEA overlay areas.

The project area south of the AHB is adjacent to coastal cliffs, which are remnants of the former coastline. These cliffs have geological and cultural significance and contain protected Pohutukawas and other native flora. Widening the motorway corridor to accommodate a busway extension or bus lanes is likely to require tree removal and significant earthworks, which is likely to generate adverse visual, cultural and ecological effects.

11.2.4 Design Development

The recommended option was progressed to concept design to inform the preparation of the construction cost estimates for the DBC. The design development included geometric, utilities, stormwater, traffic and operational investigations and designs. This can be split into three geographical areas:

- Northern Busway Stations – Albany, Constellation, Sunnynook, Smales Farm and Akoranga Station
- SH1 – between Akoranga Station and Fanshawe Street Off-Ramp
- Fanshawe Street

The station concept designs incorporated all improvements that have been proposed, under construction or recently implemented by other projects. This includes Smales Farm Platform Extension and improvements implemented as part of Northern Corridor Improvements project for Rosedale and Constellation Bus Stations.

The SH1 recommended options were developed to consider the Northern Pathway Project and the concepts were designed for DBC-purposes only to minimise the likelihood of conflict with the Northern Pathway alignment. Given the high risk of this corridor, the utilities assessment was used to inform the construction cost estimates.

The Fanshawe Street options included a short- and long-term improvement, where the long-term improvement incorporated the design used as part of an IBC undertaken by Jacobs.

11.2.5 Peer Review

A peer review of the draft business case and proposals has been undertaken by Tonkin & Taylor Limited. Comments have been addressed in the detailed business case.

11.2.6 Safety Audits

Potential safety risks were identified during a workshop attended by project team members and stakeholders from Auckland Transport. The workshop focused on the various components of Horizon 1 and 2, and as agreed with Auckland Transport, will be used to inform the scoping of Road Safety Audits to be conducted during the pre-implementation phase of the project. This decision was informed by the nature of the improvements proposed, which are focused primarily on the busway stations and Victoria Park stops. The main outcomes of the safety workshop are summarised below.

Table 11-1: Road Safety Workshops outcomes

Component	Road Safety Risk and considerations for pre-implementation
Station platform extensions and new pedestrian overpasses	• The planned improvements are business as usual for Auckland Transport, and similar to recent improvements implemented at Smales Farm Station, and at Constellation as part of the Northern Corridor Improvements. It is important to consider construction impact on passenger circulation and ensure current circulation space is maintained throughout. • Pedestrian and median barriers should be provided to reduce risks of passengers accessing platforms via the busway.
New platforms and turnaround facility	• There is potential conflict between buses, general vehicles and pedestrians • Clear signage, and barriers will be required to guide passengers in the revised station layouts. There might a need to consider the implementation of bus-only sections should local bus stops be provided outside busway stations (as proposed at Albany). This will reduce conflict between general vehicles and buses. • There is a need to ensure that any new median islands are sufficiently sized. The sizing should be informed by pedestrian modelling to confirm sufficient stacking space.
General considerations	• The implementation of the Akoranga to Constellation section of the Northern Pathway could increase conflict between Shared Use Path users and station users. This potential conflict was identified and addressed at Rosedale as part of NCI. The design of Constellation should be coordinated with the design of the SUP (currently planned for delivery as part of a separate project) to ensure conflict is minimised. This includes potential grade-separation of the SUP as recommended by WK's A2C DBC. • Potential conflict between buses and pedestrians needs to be reduced through clear signage, median barriers and fencing where required. • Station layouts will change the circulation of buses, and potentially lead to vehicles accessing areas not intended for vehicles. Auckland Transport will work with bus operators to ensure drivers are aware of all changes. If required, driver training should be provided before operational changes are implemented.

11.2.7 Traffic Modelling

The AFC MSM model was used to estimate the effect of the intervention for economic evaluation and to assess performance against the objectives and KPIs. Additional traffic analysis was undertaken to assess travel time and reliability benefits of the recommended option. All components of the recommended option contribute to an overall enhancement of the Northern Busway by improving the operational efficiency, journey time, reliability and safety of the busway system.

11.2.8 Joint Working

AT and Waka Kotahi are working together on the project. Though it is intended that Horizons 1 and 2 of the Project are delivered by AT it is intended to have representation from Waka Kotahi in the Governance structure from inception as a key stakeholder. The joint governance structure may be scaled up as the project moves into Horizon 3 and 4 works which are more significant in size and complex in nature, and specially involves Waka Kotahi as Road Controlling Authority for the relevant sections on SH1. This joint governance structure is expanded upon in Section 15 below.

11.2.9 Key Risks

The risks, controls and ratings have been assessed. The completed risk register is included as Appendix I. The top risks are presented in Table 10-2. They are at a very high (red) or high (orange) level. None are considered as requiring additional management or mitigation over the existing controls which are currently in place.

Table 10-2: Identified Risks

Description	Current Control	Risk Level
Scope: There is a threat that we may not be able to achieve a consent for the proposed works that impact on the CMA including the coastal escarpment at St. Mary's Bay and / or they are not achieved within the proposed programme; noting this predominately relates to SH1.	Consenting Strategy - A staged consenting approach is proposed as the Station Works are considered to have a lower consenting risk profile that the SH1 / Fanshawe works which are likely to involve more prolonged consenting processes.	Very high
Scope: There is a threat that the preferred options cannot be delivered on SH / Fanshaw Street.	Governance Group: A joint project Governance Group with representatives of Waka Kotahi and AT has been established which can be used to highlight the importance of these works/ risks associated with no undertaking them.	Very High
Funding: There is a threat that the funding allocated to the Project is not to the level required and / or is not allocated as per the proposed delivery programme.	Governance Group: A joint project Governance Group with representatives of Waka Kotahi and AT has been established which can be used to highlight the importance of these works/ risks associated with no undertaking them.	High
Scope: There is a threat that the proposed option (scope) for later stages of the project (e.g. SH1 / Fanshawe) cannot be delivered as anticipated as the project moves into later stages of the programme.	Governance Group: A joint project Governance Group with representatives of Waka Kotahi and AT has been established which can be used to highlight the importance of these works/ risks associated with no undertaking them.	High
Consenting: Ecological Impact - There is a threat that the project will encroach on/ into the Shoal Bay SEA Marine 1 and Marine 2 environment, if the busway extension is pursued (i.e. reclamation and / or structures located within).	Designing to minimise impact: Current preferred option / design philosophy is to design for least impact on the nationally significant birdlife, whilst still achieving the projects primary objectives is presented.	High

12 Economic Case

This section describes the economic assessment of the recommended option. The full details are included in Appendix G.

The economic appraisal utilises the procedures contained in the **Waka Kotahi Monetised Benefits and Costs Manual** (MBCM) to assess the economic benefits and costs of the proposed interventions. These procedures are performed using data produced by four separate traffic models (listed below) which capture changes different geographic zones and aspects of the corridor. Wider Economic Benefits, in the form of productivity gains, are also assessed using MBCM procedures and data from traffic models.

12.1 Benefits Assessed

The options are designed primarily to increase the capacity and reliability of the Northern Busway and reduce travel times between the North Shore and the Auckland City Centre. This design intention has guided the selection of benefits the economic appraisal is assessing.

- Journey reliability
- Travel time cost reduction
- Vehicle operating cost reduction
- Reduction in air emissions
- Reduction in greenhouse gas emissions

These benefits are all direct benefits of the interventions. An additional assessment was conducted to investigate the potential productivity impact of the interventions. All direct benefits are assessed using MS Excel. Due to the quantum of data produced by the MSM model, RStudio is used in the initial phases of the productivity analysis, while later stages revert to MS Excel.

12.2 Transport Modelling

The economic appraisal utilises four models. When modelling at the direct impact of the proposed interventions, the project is divided into three sections: Northern Busway, SH1 over AHB, and Fanshawe Street. This decision is driven by the traffic modelling methodology used for the three different sections.

The traffic models used differ between these three sections. The reason for this is that the road environment between these sections is distinctly different and so alternative models were required.

- The Northern Busway section is a segregated, bi-directional busway. To assist in the evaluation of the Northern Busway stations, Flow developed a microsimulation model of the Northern Busway between Albany and Akoranga station, which provided a tool to assess the operational interventions considered. The model provided insight into the predicted bus station performance and platform performance, while also providing insight to the operational impacts associated with the existing at-grade pedestrian crossings and local bus routing about the stations
- The SH1 section, over AHB, is an expressway with comingled traffic and a high-speed environment. This is modelled using SATURN. The Northern Corridor Improvement (NCI) SATURN model has been used to test the proposed options along SH1 route between Akoranga station and Fanshawe Street. The NCI model was developed for the NCI project (currently under construction) and the models represent a weekday morning peak, inter peak and evening peak period. The NCI model covers SH1, SH16 and SH18 and therefore allows traffic to reroute away from the AHB if dictated by option capacity constraints.
- The Fanshawe Street section is an urban road with comingled traffic, lower speeds, and multiple intersections. This is modelled using SIDRA.

A fourth model, an MSM macrosimulation model run by the Auckland Forecasting Centre, has also been used in the calculation of benefits. This model produces results for the entire network, not for individual sections of the network. Mode shift estimates produced by this model was used to estimate benefits to private vehicles of reduced traffic as people switch to using public transport.

The transport models have produced results for two sample years each. The years produced differ between models. In addition, for the SATURN Model, 2038 results have only been produced for Option 3.

Table 12-1: Sample years by model

Model	Sample Years
Paramics	2028, 2038
SATURN	2026, 2036
SIDRA	2020, 2028
MSM	2028, 2038

The transport models produced results for the AM and PM peak periods. Interpeak periods were investigated but no benefits were identified at the transport modelling stage. As a result, the economic appraisal has only looked at these two peak periods.

12.3 Options Modelled

The indicative programme of works has been grouped into four horizons based on their expected completion date. The timeframe for each is as follows:

- Horizon 1: 2021 - 2023
- Horizon 2: 2023 – 2027
- Horizon 3: 2026 - 2029
- Horizon 4: 2024 - 2034

The nature of the transport modelling segregations meant that the most straightforward approach was to assess discretely the economic impact of options as they were produced in the transport modelling, and then post hoc combine the results into the four horizons. The changes assessed in the transport modelling are additive, meaning they can be summed together without issue.

The options assessed discretely are grouped into three sections in line with the transport model outputs used to assess each option. These are:

- the Northern Busway from Albany to Akoranga and associated projects.
- SH1 From Akoranga to the Fanshawe Street on/off-ramps.
- Fanshawe Street from the SH1 Fanshawe Street on/off-ramps offramp to the Lower Albert Street Bus Interchange

Within these groupings, the discrete options modelled are shown in the table below.

Table 12-2: Discrete options assessed

Busway: Paramics
Option 1: Removal of local services and minor platform extensions
Option 2: All door boarding, and off board ticketing
Option 3: Grade separated pedestrian crossings

SH1: SATURN
Option 1: Minor bus shoulder lane extensions on both the north and south approaches of the bridge.
Option 2: A transit lane over the bridge.
Option 3: Extension of the Northern Busway to Onewa and widening of the westbound section of SH1 south of the bridge.
Fanshawe Street: SIDRA
Option 1: Signal optimisation and bus stop upgrades
Option 2: Urban busway

12.4 Scenarios Assessed

The options in Horizon 4 will only be progressed in the event AWHC is not progressed. These options are mutually exclusive to the components included in Horizon 3, meaning that when they are completed, they will effectively replace these earlier options and thus nullify the later benefits of these options.

To address this, the economic appraisal has assessed two scenarios:

- Scenario 1: AWHC is progressed.
  - A -13% impact on public transport demand on the busway system was applied, based on AFC modelling outputs from the AWHC IBC.
  - Benefits assessed as sum of Horizons 1, 2, and 3
- Scenario 2: AWHC is *not* progressed
  - A 0% demand impact is assumed
  - Benefits assessed as sum of Horizon 1 and 3 benefits up to completion of Horizon 4 options, and all Horizon 2 and Horizon 4 benefits.

12.5 Do Minimum Specification

The base network for this project uses ATAP 2 Update (August 2019, i11.5) for its land use and transport system. All options in this business case are compared to a "do minimum" case, which is detailed in Appendix G. Generally, only committed, and funded projects have been included within the do minimum, and the focus area of this business case otherwise operates in the same manner as present day.

The do-minimum for options in Horizons 1, 2, and 3 includes an assumed one-off demand shock related to the opening of an Additional Waitemata Harbour Crossing (AWHC). Options contained in Horizon 4 are assessed against a separate do minimum with no demand shock, though identical in all other respects. See 12.6.4 for further detail.

12.6 Assumptions

12.6.1 Discounting

A discount rate of 4% and a discount period of 40 years has been used in line with the latest guidance from the MBCM and **Waka Kotahi**. All values are discounted to July 2021, using financial years beginning in July.

12.6.2 Annualisation

Transport modelling found benefits for the AM and PM weekday peak periods. These were done for 1-hour periods at each point, and a daily total has been taken as the sum of benefits in these two periods. Annualization is done using a 245-day year.

12.6.3 Extrapolation and Interpolation

Where model outputs are available for two different years, values for the intervening years are interpolated linearly between the two values. For values beyond or prior to model runs, or where only one model year is available, extrapolation is used. Different assumed rates have been used for different values when extrapolating.

Table 12-3: Rates used for extrapolation of inputs

Volumes	Assumed Change (Per Annum)
PT Passenger Volume	1.8%
General Traffic Volume	-0.5%
Bus Volume	0%
Travel Times	
General Traffic	0%
Bus	0%
Average Minutes Late (Reliability)	0%

12.6.4 Additional Waitemata Harbour Crossing

Public transport patronage along the Northern Busway, as well as general traffic patterns in the assessment zone, could be impacted by the existence of a second crossing of the Waitemata Harbour. An additional Waitemata Harbour crossing (AWHC) could be road, road and a form of rail, or rail alone. The exact form and alignment of the AWHC has not yet been determined as the work has not yet been completed in sufficient detail. Whichever form it does take, it is likely to have an impact on the BCR of the options assessed.

The AWHC IBC recommended that a public transport AWHC would likely commence construction in the 2030s. Given the City Rail Link will take over 15 years from commitment of funding to being operational it is prudent to assume the more complex AWHC would take over 20 years. An assumed date of opening for AWHC is set at 2045.

To incorporate this into the analysis, we have assessed options in Horizons 1, 2, and 3 with an assumed, one-time negative demand impact to public transport passenger volumes, bus volumes, general traffic volumes, and flow on effects to travel time for both public transport and general traffic.

Table 12-4: AWHC modelled demand impact

Volumes	Assumed Demand Shock
PT Passenger Volume	-13%
General Traffic Volume	-13%
Bus Volume	0%
Travel Times	
General Traffic	-2.0%
Bus	-2.0%

Horizon 4 interventions are anticipated to be executed only if the AWHC is not progressed. As a result, no assumed demand shock has been incorporated into modelling for these projects.

12.6.5 PT Vehicle Capacity and Speed

Public transport passenger volumes are calculated within the model using forecast bus volumes and an assumed bus capacity and utilisation rate. The bus utilisation rate has been set to generate passenger volumes which reflect peak demand projections contained in the NSRTN PBC.

A maximum speed has also been assumed for the purposes of calculating changes in emissions. This is primarily intended as a failsafe to ensure unrealistic speeds are not calculated when reductions in travel time are extrapolated.

Table 12-5: PT vehicle capacity and speed assumptions used

Component	Assumption
Bus Capacity (Passengers)	120
Bus Utilisation	90%
Passengers per Bus	108
Bus Max Speed	80

12.6.6 Adjustment Factors

Values for travel time, vehicle operations cost, and so on, are given in the MBCM. These values require adjustment to the assessment year to ensure they account for inflation and other factors. Adjustment factors are available to bring these values up to July 2019, and further adjustment factors have been assumed to bring these values to July 2021 based on actual inflation in the year to July 2020 and RBNZ surveys of inflation expectations for the year from June 2020 [16].

Table 12-6: Adjustment factors used

Variable	Base Date	July 2019	July 2021
Travel Time	July 2002	1.54	1.04
Vehicle Operating Cost	July 2015	1.1	1.04
Passenger Transport User Benefits	July 2008	1.24	1.04
Emission Reduction Benefits	July 2015	1.1	1.04

12.6.7 Productivity Assessment

When assessing for Wider Economic Benefits (WEBs), the outputs of the MSM Model have been used to estimate a productivity impact of the entire programme of works. These outputs include origin-destination matrices of demand and generalised cost for the Auckland region, with a do-minimum and an option assessed, and model runs produced for 2028 and 2038. The MBCM sets out seven steps when conducting an assessment for productivity gain. These are set out below, with associated commentary as relevant to this reproduction of the process.

Step A: Define Spatial Zoning System

The MSM model includes its own spatial zoning system based on aggregations of mesh blocks produced by Statistics NZ.

Step B: Gather Economic Data

Data on employment and population by zone is included in the MSM outputs. GDP data has been obtained from Statistics NZ at the regional level for Auckland for 2019. This has been extrapolated to 2028 and 2038 using the average GDP growth rate for Auckland for the period 2000-2019, calculated from the same dataset. GDP per zone has been calculated using the population figure for each zone, assuming a constant GDP per capita through each zone. For the agglomeration elasticity, the All Industries figure from table 38 of the MBCM has been used.

[16] https://www.rbnz.govt.nz/statistics/m14

Step C: Calculate Weighted Average Costs

Origin-destination matrices of demand and general cost by mode and trip purpose are used to calculate corresponding matrices of weighted average cost. Due to the quantum of data being manipulated, RStudio has been used to run the calculations in this stage.

Generalised Cost is measured in minutes and this is adjusted to a dollar ($) cost using the travel time values in Table 15 of the MBCM (depicted below).

Table 15: Values of time by trip purpose ($/h/person – July 2002)

Trip purpose	Base value of time ($/h/person)	Maximum increments for congestion (CRV $/h/person)
Work travel purpose	23.85	3.15
Commuting to/from work	7.80	3.15
Other non-work travel purpose	6.90	2.75

Figure 12-1: Copy of table 15 from MBCM

Two Modes (Car, PT) and two purposes (Home Based Work – HBW, and Employer Business – EB) are used in the productivity gain calculations. For HBW, the value for commuting is used, while for EB the value for work travel purpose is used. These values, adjusted to 2021 using the adjustment factors in section 12.6.6, are shown below.

Table 12-7: Value of travel time by trip purpose, adjusted to 221 NZD

Trip Purpose	Value
Work Travel Purpose	$38.20
Commuting to/from work	$12.49

Step D: Calculate Effective Density

Matrices of employment data from the MSM outputs and the weighted average cost calculated above are used to calculate effective density. Due to the quantum of data being manipulated, RStudio has been used to run the calculations in this stage.

Step E: Calculate Productivity Gains by Zone

GDP Per zone data is used along with the effective density calculated above to estimate an absolute ($) change in productivity for each zone. By this stage the data has been condensed down into just four matrices, and so MS Excel is used to carry out this and following steps.

Step F: Total Productivity Gains

This is a simple sum of the absolute productivity gains by zone to give an aggregate for the whole region.

Step G: Extrapolation and Present Value

Values are interpolated between 2028 and 2038 using the method described in Section 12.6.3. An assumed rate of productivity growth of 0.5% is used to extrapolate values prior to 2028 and beyond 2038. The benefit is discounted at 4% over a 60-year timeframe, as per all other elements of the economic appraisal.

12.7 Costs

P50 and P95 Costs were estimated by True-Cost Construction Cost Consultants. The P50 costs were discounted within the economic appraisal according to the programme to generate a suitable denominator for the BCR analysis. The P95 values were used for the purposes of sensitivity testing.

The programme split works along three task groupings for each horizon. These were:

- Design/Consenting
- Procurement
- Delivery

The cost estimates are provided in the following breakdown:

- Project Development
- Pre-implementation
- Implementation
- Physical Works
- Contingency

These factors are summed to provide a total cost. In addition, a P95 risk value is provided which is made up of the total cost plus an additional contingency value. The following table shows how cost estimates were matched to programme elements to discount costs.

Table 12-8: Programme Element and Cost Component

Programme Element	Cost Component
Design/Consenting	Project Development
Procurement	Pre-implementation
Delivery	Implementation
Delivery	Physical Works
Delivery	Contingency

Costs were estimated for projects along the Northern Busway by station. This contrasts to the transport modelling, which was common to all stations but split by the intervention proposed. This means that a BCR cannot be produced for each option modelled discretely in the economic appraisal. Instead, costs are aggregated to the horizon level, and BCRs are reported at that level.

12.8 Results by horizon

The two scenarios produce different results. This is because the options in Horizon 4 have a high price tag for a comparatively low level of benefit, and they replace a number of earlier Horizons options with relatively high benefits. Note: All figures are in NZD discounted to 2021, using 4% discount rate over 40-year evaluation period.

Table 12-9: Direct BCR (Excluding WEBS) for each of the Assessed Horizons

Package	Scenario 1 – Direct BCR	Scenario 2 - Direct BCR
Horizon 1	3.8	0.9
Horizon 2	4.0	4.0
Horizon 3	2.3	0.3
Horizon 4	N/A	0.7

Table 12-10: Breakdown of Direct Benefits by Horizon and Scenario. All figures 2021 NZD

Package	Scenario 1 – Benefits	Scenario 2 – Benefits
Horizon 1	$48.8m	$12.3m
Horizon 2	$265.7m	$265.7m
Horizon 3	$15.0m	$2.0m
Horizon 4	N/A	$80.9m

Table 12-11: Breakdown of P50 Costs by Horizon and Scenario. All figures 2021 NZD

Package	Costs (P50)
Horizon 1	$12.9m
Horizon 2	$66.6m
Horizon 3	$6.5m
Horizon 4	$111.9m

Table 12-12: Direct and Indirect BCR for all Projects Combined

Package	Scenario 1 – BCR	Scenario 2 - BCR
Combined Direct BCR	3.8	1.8
Combined Direct and Indirect BCR	4.1	1.9

Table 12-13: Breakdown of Benefits by Direct and Indirect. All figures 2021 NZD

Benefits	Scenario 1	Scenario 2
Direct	$329.5m	$360.9m
Indirect	$22.1m	$22.1m

12.9 Results by modelled option

Table 12-14: Direct Benefits for Horizon 1 by Modelled Option and Scenario. All figures 2021 NZD

Horizon 1	Scenario 1	Scenario 2
City - Option 1	$48.8m	$12.3m

Table 12-15: Direct Benefits for Horizon 2 by Modelled Option and Scenario. All figures 2021 NZD

Horizon 2	Scenario 1	Scenario 2
North – Option 1	$124.0m	$124.0m
North – Option 2	$86.9m	$86.9m
North – Option 3	$54.8m	$54.8m

Table 12-16: Direct Benefits for Horizon 3 by Modelled Option and Scenario. All figures 2021 NZD

Horizon 3	Scenario 1	Scenario 2
Bridge – Option 1	$5.5m	$1.6m
Bridge – Option 2	$9.5m	$0.4m

Table 12-17: Direct Benefits for Horizon 4 by Modelled Option and Scenario. All figures 2021 NZD

Horizon 4	Scenario 1	Scenario 2
Bridge – Option 3	N/A	$10.4m
City – Option 1	N/A	$12.5m
City – Option 2	N/A	$58.0m

Table 11-18: BCR for Horizon 1 & 2 combined

Package	Scenario 1	Scenario 2
Horizon 1 & 2 Combined	4	3.5

12.10 Sensitivity Testing

Sensitivity testing has been conducted on several key variables to assess their impact on each of the four Horizons. The variables being tested, and the results are shown below. For Horizons 1, 2, and 3, AWHC scenario 1 is used. For Horizon 4, AWHC scenario 2 is used.

Table 12-19: Sensitivity Testing. All figures 2021 NZD

Variable	BCR H1	BCR H2	BCR H3	BCR H4
3% Discount Rate	4.6	4.6	2.6	0.82
6% Discount Rate	2.7	3.1	1.8	0.59
60-year discount	5.5	5.1	3.1	1.06
1% Patronage Growth	3.1	3.6	2.1	0.58
3% Patronage Growth	5.4	4.6	2.6	1.04
-1% General Traffic Growth	3.8	4.0	2.3	0.72
1% General Traffic Growth	3.8	4.0	2.2	0.72
30% AWHC Demand impact	3.8	4.0	2.1	0.72
10% AWHC Demand impact	3.8	4.0	2.3	0.72
0% AWHC Demand impact	3.8	4.0	2.4	0.72
2050 AWHC Open Date	3.8	4.0	2.3	0.72
2066 AWHC Open Date	3.8	4.0	2.4	0.72
P95 Costs	3.5	1.9	2.0	0.63

The greatest sources of variability in the sensitivity testing are the discount rates used, and the discount period and the patronage growth percentage. Given the focus of these interventions is on improving bus services, it is little surprise that the results are quite sensitive to changes in public transport patronage growth, and relatively un-responsive to changes in general traffic growth. The sensitivity testing reveals the AWHC demand shock to have little impact on the results.

Horizons 1 through 3 are consistently reporting BCRs of greater than 1 throughout the sensitivity testing. Horizon 4, which under standard assumptions is reporting a BCR of 0.7, primarily retains a sub-1 BCR throughout sensitivity testing with only two exceptions. A 3% patronage growth and 60-year discount period bring the BCR up to 1.04 and 1.06 respectively – unconvincingly clearing the breakeven point. This shows that the overall impact of the Horizon 4 projects is considerably dependent on actual patronage levels going forward, which cannot be predicted reliably.

13 Financial Case

This section describes the Financial Case for the Northern Busway Enhancements Programme. Refer to the Commercial and Management cases for governance arrangements related to management of delivery of scope of the programme.

The analysis described in this Financial Case assumes interventions will be delivered in line with the staged approach as per the Economic Case. Costs have been assigned to assumed future years however these dates may change as trigger points are reviewed as outlined in the Management Case which would result in changes to the cashflow profile. All costs reported in this financial case as undiscounted and exclude inflation and escalation.

13.1 Programme delivery costs

The following sections describe the capital costs of the Northern Busway Enhancements Programme.

13.1.1 Capital Costs

Cost related assumptions and base values used in the analysis are summarised per the Economic Case. Delivery capital cost estimates were developed by TrueCost, in accordance with Waka Kotahi's 'Cost Estimation Manual' (SM014). The delivery cost estimates included a risk-based assessment based on the project risk register, which provided the estimated P50 and P95 cost estimate for the programme.

The costs have been split into project horizons, using the plans of the recommended option and in alignment with the scope of the Staging Strategy. Total estimated P50 capital costs of $275.5M. Parallel cost estimates were developed for Horizon 1 and 2 estimates.

Maintenance and renewal costs have been calculated based on costs developed as part of the Northern Corridor Improvements programme and the Airport to Botany SSBC. Refer to Appendix F for the full breakdown of maintenance costs and assumptions.

13.1.2 Cash flow

Table 13-1, Table 13-2 and Figure 13-3 summarise the capital requirements to deliver the outcomes under each staging horizon. Capital costs are shown by the components within each horizon necessary to deliver the infrastructure improvements required.

The P50 total costs for pre-implementation and delivery of the Northern Busway Enhancements are:

- $275.3M for AT, excluding AT funding admin cost
- $291.0M for AT, including 5.7% AT funding admin cost

Table 13-1: Northern Busway Enhancements costs by horizon, P50 Estimate ($M, undiscounted)

Phase / Horizon	Costs, P50 Estimate ($M undiscounted)	
	Sub Total (excluding AT 5.7% admin)	Total (including AT 5.7% admin)
Horizon 1	13.9	14.7
Horizon 2	80.6	85.2
Horizon 3	8.9	9.4
Horizon 4	171.9	181.7
Total	**275.3**	**291.0**

The assumed construction duration and delivery of each horizon is as follows:

- Horizon 1 delivery 2023 – 6-month construction period (mid 2022 – early 2023)
- Horizon 2 delivery 2026 – 2-year construction period (2025 – 2027)
- Horizon 3 delivery mid 2029 – 2-3-year investigation/implementation and construction period (2027 – 2029)
- Horizon 4 delivery mid 2034 – 4-year construction period (2030 – 2034)

Table 13-1 provides a breakdown of P50 cash flow by activity, horizon.

Table 13-2: Cost and cash flow by activity and horizon ($M p.a., undiscounted, P50)

Horizon / Phase	Activity	Cashflow ($M p.a., Undiscounted, P50)													
		21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	Activity
Horizon 1	Design / Consenting	0.3	0.1												0.4
	Pre-implementation		0.8												0.8
	Construction		12.8												12.8
Horizon 2	Design / Consenting			3.1	1.3										4.5
	Pre-implementation				8.3										8.3
	Construction				13.6	33.9	20.4								67.9
Horizon 3	Design / Consenting						0.2	0.2							0.46
	Pre-implementation							0.8							0.8
	Construction								7.6						7.6
Horizon 4	Package 1 Design / Consenting				0.7	1.5	1.5	1.5	1.5	0.7					7.4
	Package 1 Pre-implementation									13.8					13.8
	Package 1 Construction: Akoranga to Onewa										33.6	33.6	33.6	11.2	111.9
	Package 1 Construction: St Marys Bay										3.2	3.2	3.2	1.1	10.8
	Package 2 Design / Consenting									0.4	1.0				1.4
	Package 2 Pre-implementation											0.3	1.3	1.1	2.7
	Package 2 Construction: Fanshawe Street											2.4	11.9	9.5	23.9
AT Total Per Year		0.3	13.6	3.1	23.9	35.4	22.1	2.6	9.0	14.9	37.8	39.5	50.1	22.9	275.3
Accumulative Total			13.9	17.1	41.0	76.4	98.5	101.1	110.1	125.0	162.9	202.3	252.4	275.3	
AT Sub-Total (excl. AT 5.7% admin)		**275.3**													
AT 5.7% admin		15.7													
AT Total (incl. AT 5.7% admin)		**291.0**													

Table 13-3 below shows the P50 cashflow over the 2021 – 2034 period.

Table 13-3: P50 Cash Flow

Horizon 1	Station and Stop Capacity Upgrades, Signal-phasing Optimisation	Cost ($)	Colour Key
	Pre-implementation; Design Procurement; Design, Consenting, Engagement; Procurement	**1.2M**	
	Construction	**12.8M**	
Horizon 2	**Station Upgrades and Circulation Changes**		
	Pre-implementation; Design Procurement; Design, Consenting, Engagement; Procurement	**12.7M**	
	Construction	**67.9M**	
Horizon 3	**SH1 Improvements: Managed Lanes / Transit Lanes**		
	Pre-implementation; Design Procurement; Design, Consenting, Engagement; Procurement	**1.3M**	
	Construction	**7.6M**	
Horizon 4	**Extended/ Segregated Busway**		
	Package 1 Pre-implementation; Design Procurement; Design, Consenting, Engagement; Procurement	**21.2M**	
	Package 1 Construction: Akoranga to Onewa	**111.9M**	
	Package 1 Construction: St Marys Bay	**10.8M**	
	Package 2 Pre-implementation; Design Procurement; Design, Consenting, Engagement; Procurement	**4.1M**	
	Package 2 Construction: Fanshawe Street	**23.9M**	

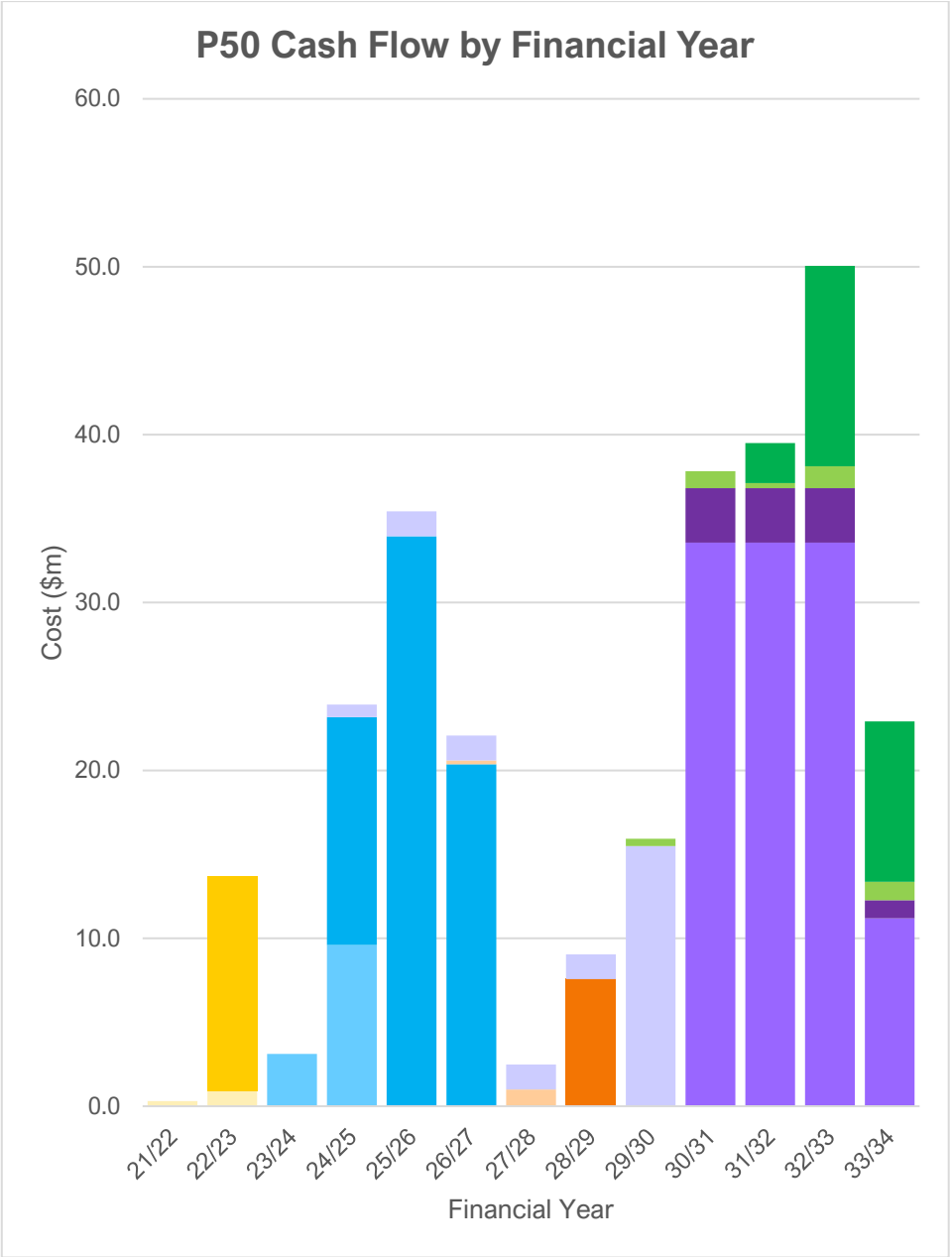


Figure 13-1 below shows the P50 cashflow per year against the accumulative cost over the period from 2021 to 2034.

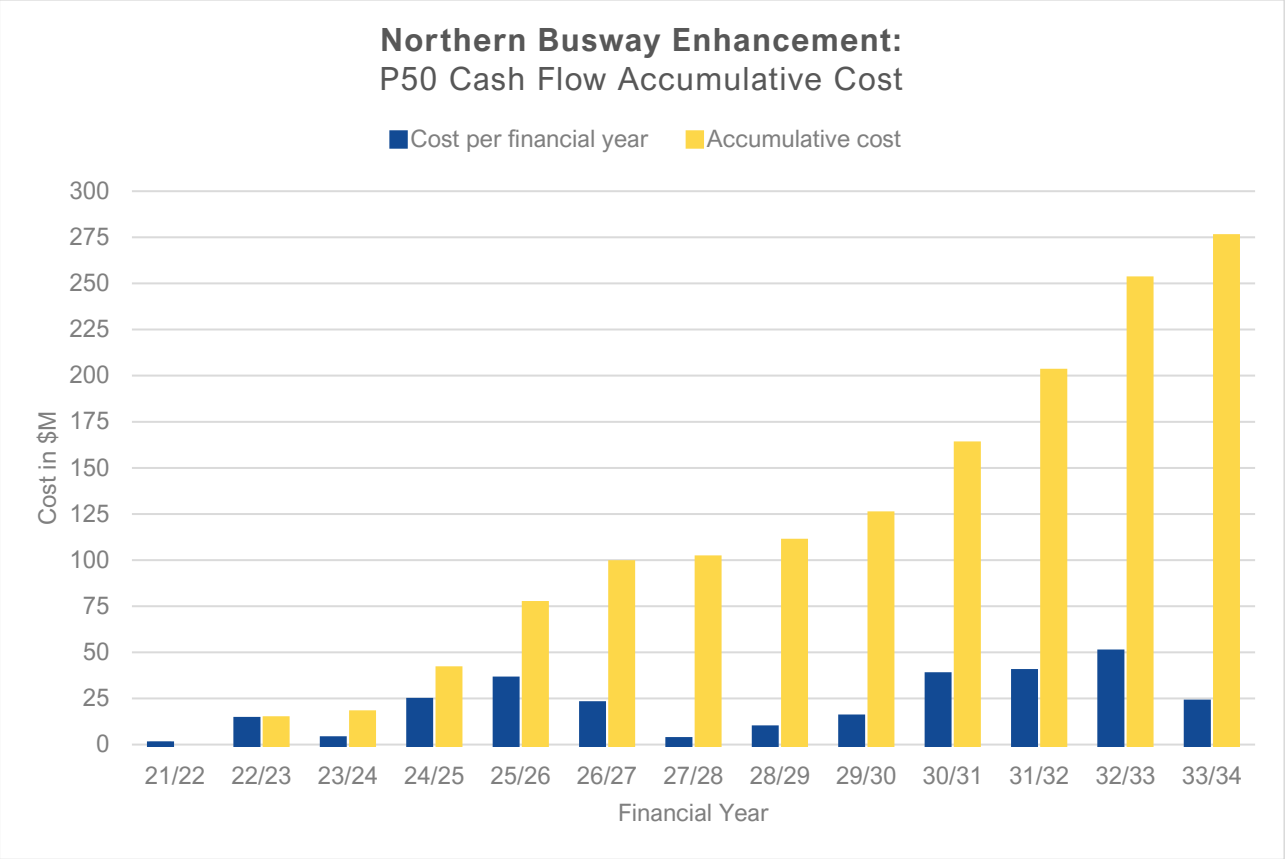


Figure 13-1: Cost per financial year and cumulative cost.

The P95 total costs for pre-implementation and delivery of the Northern Busway Enhancements are:

- $317.7M for AT, excluding AT funding admin cost
- $335.8M for AT, including 5.7% AT funding admin cost

Table 13-4: Northern Busway Enhancements costs by horizon, P95 Estimate ($M, undiscounted)

Phase / Horizon	Costs, P95 Estimate ($M undiscounted)	
	Sub Total (excluding AT 5.7% admin)	Total (including AT 5.7% admin)
Horizon 1	15.2	16.0
Horizon 2	94.0	99.3
Horizon 3	10.2	10.8
Horizon 4	198.3	209.6
Total	**317.7**	**335.8**

13.1.3 Funding Availability

As of June 2021, no local budget has been allocated for the project. Both AT and Waka Kotahi have, however, indicated their support for it. The draft RLTP 2021 - 2031 contains an item:

Northern Busway Enhancements - Improvements to the existing Northern Busway to extend the lifespan and capacity; Priority 2; Cost $62m (2027/28 - 2030/31). In the RLTP Priority 2 means prioritised.

Funding availability poses a significant risk to project delivery. This DBC will assist in the prioritisation of additional funding going forward.

13.1.4 Project Revenues

There are no explicit project revenues. Increased fare revenue should be expected from the increased patronage. This revenue has not yet been quantified.

13.1.5 Asset Management

SH1 and Fanshawe Streets

The implementation of the project will result in additional assets requiring ongoing maintenance on SH1 and Fanshawe Street. Waka Kotahi will take responsibility for the operation and maintenance of improvements on SH1 and Auckland Transport will take the responsibility for the operation and maintenance of Fanshawe Street.

Annual maintenance costs have been assessed at $40,000 lane km / year (2019 estimates) based on recent records available from the ASM. The estimated periodic maintenance costs cover pavement, bridges, lighting, shared use paths, retaining, structures, traffic signals and stormwater ponds/wetlands.

Periodic maintenance costs are primarily pavement and surfacing replacements and occur approximately every 8 years for traditional surfacing and 25+ years for Epoxy modified OGPA. Cost estimates developed for SH1 and Fanshawe Street include pavement milling and resurfacing. The cost estimate includes EMOGPA surfacing for the improvements resulting in significantly lower periodic maintenance requirements. Resurfacing has been assumed at a cost of $40 per m² of additional pavement (over above existing only) following 25 years.

Northern Busway Stations

Auckland Transport will take the responsibility for the operation and maintenance of the busway stations, public transport facilities and areas within the station perimeter. All public transport stations require regular and preventative maintenance.

General station maintenance includes Building Warrant of Fitness, trial evacuations, security, cleaning, landscaping as well as maintenance of facilities (painting, seat refurbishment and line-markings). Security and cleaning are generally the highest cost. All systems and technical components of stations also require regular preventative maintenance. This includes aspects such as CCTV, customer help-points, HVAC and plumbing, electrical components and Passenger Information Displays.

As the recommended option includes new assets at the stations; additional platforms, widening of existing platforms and new pedestrian overpasses, this will have an impact on the maintenance and renewal budgets of Auckland Transport. Below are the annual maintenance costs of the new assets only (proposed as part of this project) which are additional to the existing annual maintenance costs at the stations.

Refer to Appendix F for the full breakdown of maintenance costs and assumptions.

14 Commercial Case

14.1 Introduction

The purpose of the Northern Busway Enhancements (NBE) DBC is to develop a programme of improvement works to enhance the capacity of the busway system to address current deficiencies and enable it to meet projected demand to the mid-2030s. These improvements will enable the busway system to meet projected demand and provide a high-quality service that meets customer expectations.

The NBE DBC has identified a preferred programme of works ('the Programme') that aligns to Government strategy, stakeholder requirements and the Programme's investment objectives. The proposed improvements can be summarised into two main types: Focused infrastructure improvements and System Wide Improvements.

This Commercial Case addresses the commercial deliverability of the preferred programme with an emphasis on Horizons 1 and 2. The Commercial Case has been written jointly for the project at a programme level due to the interrelatedness for delivery.

The Commercial Case covers the deliverability of the programme and is made up of the following parts:

- Delivery risks
- Consenting strategy
- Procurement strategy.

The staging methodology for the preferred options is discussed below while the consenting strategy is detailed in Appendix J.

The procurement strategy is kept very high level at this stage with a focus on Horizon 1 and 2 pre-implementation and implementation phases.

The Commercial Case relates closely to the Management Case, which is being prepared jointly at the programme level. The governance and project management structures set out in the Management Case provide a framework for managing the risks and uncertainties described here.

14.2 Staging Methodology

The following sections describe the four staging horizons of the Northern Busway Enhancement programme:

- Horizon 1 – Station and stop capacity upgrades, signal-phasing optimisation (quick wins)
- Horizon 2 – Station Upgrades and circulation changes
- Horizon 3 – SH1 Improvements – bus shoulder lanes, Managed Lanes / Transit Lanes
- Horizon 4 – Extended / Segregated Busway

Each horizon is characterised by:

- The strategic and practical purpose of the horizon,
- The specific elements to be delivered in the horizon (i.e. infrastructure, service), and
- Details on the overall capital costs, operating costs and risks for the Horizon.
- Trigger points identified that outline both practical delivery dependencies and operational requirements that should be achieved prior to implementation of each element of the project.

The staging approach can be characterised as follows:

- Dynamic integration with related infrastructure investments
- Allowing investment to be aligned with growth in demand to optimise the investment profile, while increasing capacity and maintaining a high-quality service.

While time horizons have been assumed in this strategy to inform economic analysis and financial planning, the exact timing of delivery will require a dynamic approach to determine the timing of each stage of the investment.

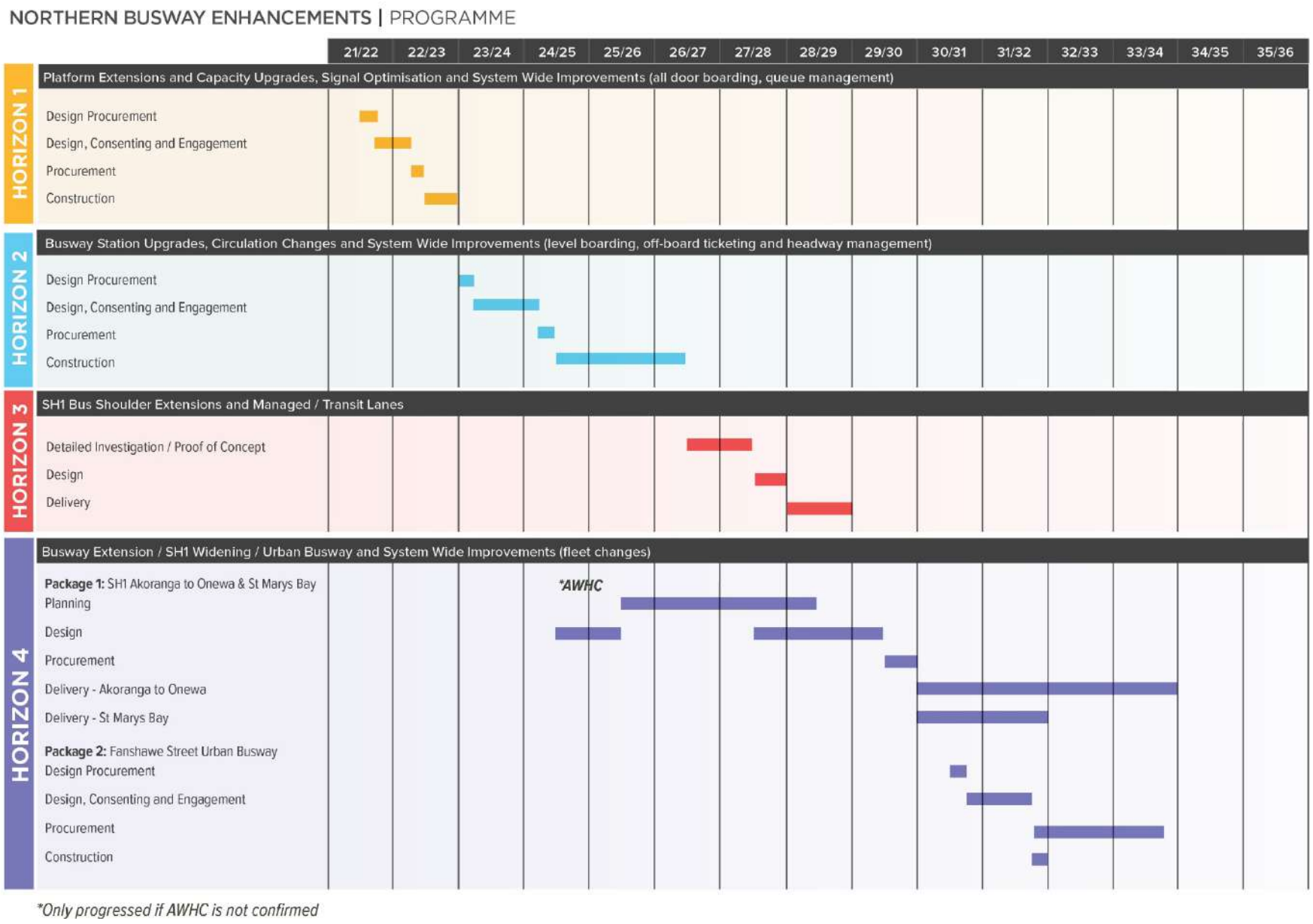


Figure 14-1: Proposed Northern Busway Enhancements Programme

14.3 Delivery risks

14.3.1 Risk and opportunities register

A risk register (Appendix I) has been produced for Northern Busway Enhancements Project through a strategic risk workshop involving staff from both Waka Kotahi and AT and a series of one-on-one sessions with the project team. The register is a live document and should be maintained and updated throughout the life of the projects.

The register identifies risks and opportunities at the programme level (strategic risks) and project level; outlines cause and impact (consequence); notes current controls and proposed treatments; and assesses probability, qualitative threat and opportunity level, and potential cost impact.

The key strategic risks identified in the risk register are:

- Funding: There is a threat that the funding allocated to the Project is not to the level required and / or is not allocated as per the proposed delivery programme.
- SH1 Work: There is a threat that the proposed works on SH1 will not be supported or be impacted by current interfacing projects proposing changes in the same sections of SH1.
- Scope: There is a threat that the proposed option (scope) for later stages of the project (e.g. SH1 / Fanshawe) cannot be delivered as anticipated as the project moves into later stages of the programme due to constraints from / decisions made on adjacent projects.
- Assumptions: There is a threat that the project assumptions related to interfacing projects may be incorrect (particularly with respect to Northern Pathway/AWHC) e.g. cross-sections, extents, programme.
- Consenting: There is a threat that Auckland Transport might not be able to achieve a consent for the proposed works that impact on the CMA including the coastal escarpment at St. Mary's Bay and / or they are not achieved within the proposed programme; noting this predominately relates to SH1. This relates to risks associated with Reserve Land, Areas of Cultural Significance and Ecological importance in this area.

The key design risks relate to:

- Utilities: including location, condition, and cost/ time impact of relocation
- Existing asset: condition
- Consenting: approval timeframes, stakeholder support or otherwise

Third party utilities and interface risks are expanded on below, and specific risks are touched on in the consenting and property sections.

The approach to risk management is described in the Management Case, which contains a suite of processes and governance arrangements to mitigate these risks.

14.3.2 Third party utilities

An initial assessment of utilities has been undertaken for the project which indicates there are several utility providers within the corridor these include:

- Transpower (HV electricity)
- Vector (Electrical)
- Chorus (Communications)
- Vodafone (Communications)
- Watercare (Stormwater)

The initial assessment has been carried out on available GIS data which has not yet been verified by as-builts or field survey; thus, the location of the utilities may not be accurate.

The assessment indicates low risk due to utilities with the horizon 1 and 2 enhancements. However, there are several significant utility assets that may be impacted by the long term (Horizon 4) enhancement works on SH1 between Akoranga to Stafford extent, these are discussed in detail below.

To date no engagement has been undertaken with utility and network operators. A lack of engagement does present a risk to the approvals process and to delivery. Further engagement with these utility and network operators will be critical to project delivery. Processes and procedures for engagement are set out in the National Code of Practice for Utility Operators' Access to Transport Corridors and the Government Roading Powers Act (GRPA, 1989). Cost sharing arrangements and approaches to reaching agreements are provided in the Code of Practice and under the GRPA.

Works affecting utilities, particularly lifeline utilities, require long lead times to allow agreement to be reached with the utility owners and to settle cost share arrangements. There is sufficient time within the delivery programme to reach these agreements if this is well planned for. The full assessment is provided in Appendix C.

14.3.3 Management of Utilities

The utility assessment notes that existing utilities which are affected by the proposed works along the public roads and interchanges will be protected and diverted if necessary. Any utilities crossing the carriageways or under the existing carriageways will be required to be protected from construction works. If affected by works resulting in level changes, the utilities are will need to be relocated to maintain existing minimum cover levels in accordance with the standards.

Where possible, minimum covers and minimum clearance to the utility assets are to be provided. However, where this cannot be achieved, diversion of services or installation of protective slabs are to be considered as part of the future design process. These needs to be coordinated with the relevant NUO's.

Network utility diversion/relocation works are to be managed so that the installation, design, operation, maintenance and upgrade will be in compliance with the relevant standards, code of practice or guidelines in order to reduce or remove potential adverse effects on the health and safety of people and on the surrounding environment.

Stations

Within the station footway utilities are limited to those providing local connections to the station infrastructure. The initial utility assessment indicates no major utilities will be impacted by the proposed short terms enhancement works.

SH1 Akoranga to Stafford extent (Auckland Harbour Bridge)

Within SH1 between Akoranga to Stafford (Auckland Harbour Bridge) there are several utilities that intersect with the project area that have the potential to be impacted by the proposed works.

Table 14-1: Utilities identified – Highest Risk

Existing Utility	Description	Impact/Risk
Transpower	2 x existing high-voltage (220kV) underground ducts along the eastern side of the existing highway corridor and the existing Northern Busway.	Onewa Road Interchange: The proposed busway on-ramp is located above the Transpower ducts at the Onewa Road Interchange. There is no impact on the ducts from the above-ground busway, however the ducts may be impacted by the bridge piles supporting the proposed busway on-ramp bridge. Onewa Road Interchange to Esmonde Road off-ramp: Based on the available GIS data, the widening for the upgraded busway is proposed in close proximity to, but not directly above the Transpower ducts; therefore, there is low impact. However, the close proximity still poses a risk of impact from construction works (i.e. heavy machinery).
Vector	23 x lighting poles located at approximately 45m intervals along the eastern boundary of the highway corridor	Onewa Road Interchange: The proposed busway on-ramp is located above the Transpower lighting poles at the Onewa Road Interchange, thus there is no impact. Onewa Road Interchange to Esmonde Road off-ramp: Existing lighting poles impacted by the proposed highway redevelopments.
Chorus	Existing Chorus cable located across the existing busway and highway south of the Esmonde Road off-ramp.	Onewa Road Interchange to Esmonde Road off-ramp: The Chorus cable is located beneath the existing roading, thus there is a low impact from the proposed redevelopment works.
Vodafone	Existing Vodafone cable located next to the proposed busway on-ramp at the Onewa Road Interchange.	Onewa Road Interchange: The proposed busway on-ramp is located above the Vodafone cable at the Onewa Road Interchange. There is no impact on the cable from the above-ground busway, however the cable may be impacted by the bridge piles supporting the proposed busway on-ramp bridge.
Stormwater	11 x existing stormwater culverts and 2 x outlet pipes crossing the highway. 1 x existing stormwater swale located along the western side of the highway corridor.	Onewa Road Interchange: Existing stormwater swale along the western end of the highway corridor, impacted by the busway on-ramp construction. Onewa Road Interchange to Esmonde Road off-ramp: Existing stormwater culverts and outlet pipes cross the proposed busway alignment, thus there is a risk of impact from construction works.

14.3.4 Interfaces with adjoining projects

There are a number of project that interface with Northern Busway project corridor. These are detailed below as well as the current status and potential impact on the Northern Busway Enhancement Project. It is noted that these interfacing projects are at different stages of the project cycle and are working to different to timeframes to that of the NBE programme.

- Stations
  - Northern Pathway Constellation to Akoranga (**https://www.nzta.govt.nz/assets/projects/northern-pathway/docs/northern-pathway-akoranga-to-constellation-drive-preferred-route-september-2020.pdf**)
    - Current Phase: Detailed Business Case
    - Noting DBC has been completed, however programme not confirmed / endorsed. Pathway also goes through Constellation Station so coordination will be required with NBE.
- SH1
  - Northern Pathway Westhaven to Akoranga
  - Current Phase: Detailed Design
  - Optioneering of alignment underway. The proposed alignment may impact on the proposed NBE busway alignment.
- Fanshawe Street
  - Connected Communities City Centre and Fringe Cycling Business Case
    - Current phase: Detailed Business Case
    - DBC identifies Fanshawe Street as potential cycling link (current DBC phase).
  - City Centre Public Transport Infrastructure Improvements Programme
    - Programme includes bus stop capacity and priority lanes along Fanshawe (programmed for 2021 and delivered by AT) which is included for in NBE DBC programme.
  - Fanshawe Street Safety Engineering Measures
    - Proposed to align NBE DBC Horizon 1 with this project. Will also align with Horizon 4 and busway works on Fanshawe.

Decisions made on the above projects may influence the scope, funding and delivery programme of the NBC programme particularly at later stages of the programme (Horizons 3 and 4). They will need to be carefully monitored and managed. This should be a focus of the governance processes and connections should be made with governance in the interfacing projects and at delivery level (refer to the Management Case for further details). Decision to proceed with later stages of the programme should not be made without consideration of these interfacing projects.

14.4 Consenting Strategy

14.4.1 Purpose

A Consenting Strategy has been prepared for the project the purpose of which is to outline the RMA approvals and other necessary approvals (which may be required under different legislation) for the Programme.

This Consenting Strategy considers the available pathways to achieve the approvals associated with each section of the Programme, being the existing Northern Busway stations (excluding Rosedale), the State Highway 1 (SH1) corridor between Akoranga Drive and AHB and AHB and Beaumont Street, and Fanshawe Street in the Auckland City Centre.

The focus of the Consenting Strategy is on Horizon 1 and 2 works identified in the DBC, although some commentary has been dedicated to the potential medium- to long term works (Horizons 3-4, 5 – 15 years).

The Consenting Strategy is a living document that has been developed at the DBC phase and it will be revisited, reviewed and updated (as required) by the Programme Partners once each phase of the programme progresses to the pre-implementation phase (i.e. detailed design, property acquisition (if required) and RMA consenting).

14.4.2 Recommended Strategy

The recommended Consenting Strategy is:

- Rely on the existing AT designations for Horizon 1 works within Albany, Constellation and Smales Farm and Horizon 1 and 2 works within Akoranga Station;
- Lodge a regional resource consent for tree removal works at Sunnynook Station, while relying on the existing AT designation for the remainder of the Horizon 1 works;
- Rely on the existing Waka Kotahi designations for Horizon 1 works within the SH1 corridor;
- Lodge resource consents for Horizon 1 works within the Fanshawe Street corridor;
- Lodge NoR's for Horizon 2 works within Albany, Constellation and Smales Farm Stations (when funding is confirmed);
- Continue planning for potential Horizon 3 and 4 improvements, such as transit/managed lanes on the AHB and busway extensions.

14.4.3 Key Planning and Environmental Risks

Given the reliance upon the existing designations for the majority of the short-term improvements, there is considered to be little to no risk for the majority of these works. The key planning and environmental risks for the Horizon 1 and 2 works largely relate to the Fanshawe Street corridor, given the wider range of complicating factors including contaminated land, potential archaeological sites, street tree removal, construction effects (including noise, vibration and traffic effects) and a large number of potentially affected residents, workers and property owners. These aspects mean that the Resource Management Act approvals and environmental effects may be moderately complex.

The works at Sunnynook Station are a comparatively lower risk consenting package, however, further assessment will likely be required to confirm the likely ecological effects of the proposed tree works.

There is significant consenting risk for the Horizon 4 improvements, particularly the proposed busway extensions on the Akoranga to AHB and Fanshawe Street sections, and the motorway widening works between the AHB and Beaumont Street. Further investigations and environmental baseline testing for these works should be undertaken now by AT and Waka Kotahi to reduce uncertainty and risk, as these works may not be consentable under the current statutory framework.

As noted above the Consenting Strategy is a live document and it is intended that it will identify issues arising through the course of the design process and enable timely resolution. This resolution process will be key to ensuring the Project remains on the identified programme.

14.5 Property acquisition strategy

To date a property acquisition strategy has not been prepared for the project.

As noted in the Consenting Strategy it is intended that the Horizons 1 and 2works be undertaken within existing designations / corridors and therefore unlikely that property acquisition will be required. The following are however noted with respect to the Horizon 1 works:

- Smales Farm Station: Part of the land at this station is controlled by the Ministry of Education (Westlake Girls High School). However, its unlikely further land will be required.

- Fanshawe Street and surrounding local network: Improvement works largely lie within the existing road corridor, with the exception of a path within Victoria Park. This is not expected to require property acquisition however, as it is within the general purpose of the park.

The proposed enhancements for the medium to long term works have been developed to minimise impacts on private land particularly; however, there may be a requirement for private land take for SH1 between AHB and Beaumont Street. Should horizon 3 and 4 be implemented, a property acquisition strategy will be developed by Auckland Transport.

14.5.1 Process for property acquisition

The Public Works Act (PWA) provides local authorities and the Crown (and their delegates) with the statutory authority to acquire land either by negotiation or compulsorily for a public work. The PWA acquisition powers are closely connected with the Resource Management Act consenting processes. The compulsory property acquisition process typically takes place after all required consents for the use of the land have been granted, or a designation has been confirmed by a Requiring Authority. The designation provides a basis for the subsequent acquisition of land needed for the works and may warrant partial land acquisition, or full property acquisition. However, property negotiations can commence earlier, in particular in the case where there is a willing seller.

As noted above, the proposed enhancements for the medium to long term works have been developed to minimise impacts on private land particularly; however, there may be a requirement for private land take for SH1 between AHB and Beaumont Street. If land this land is required o the Consenting Strategy indicates that there is a high risk associated with the acquisition of this land given the owners and impact of the project. Therefore, it is unlikely properties will be secured on an advanced willing buyer willing seller basis; and may require securing via the compulsory acquisition process (section 23 of the PWA) and appeal process. Properties whose acquisition progresses through the appeal process will incur longer time frames (circa. 12 – 18 months) and this will need to be allowed for in the project delivery programming.

14.5.2 Property acquisition strategy

As noted above a Property Acquisition Strategy has not been developed for the Programme to date.

As the medium to long term improvements (Horizon 3 to 4) are developed a property acquisition strategy will need to be developed in conjunction with AT's Property Team who are likely to lead any property acquisition process. This shall be developed early, as a property acquisition may take significant time if the property acquisition process needs to be followed.

14.5.3 Approach to property costs

The proposed enhancements have been developed to minimise the impact on private land and the requirement for land acquisition. Therefore, no property costs have been allowed for within the cost estimate.

14.6 Approach to procurement

The focus of this commercial case is on the pre-implementation and implementation for Horizons 1 and 2 while preserving optionality for procurement of the later delivery stages.

The approach to procurement for the NBE programme was discussed with AT and Waka Kotahi in a workshop. The outcome of this a proposal to undertake the design of Horizon 1 and 2 (pre-implementation phase) as one. Noting that it is still proposed to undertake the construction (implementation phase) in two stages.

Later stages are subject to future Implementation Business Cases as set out in the Gateway Funding Approach outlined in the Management Case. However, some initial indications of procurement options are provided below.

14.6.1 Risk allocation

The following risk allocation table shows how the main risks are expected to be apportioned between the client and contractor during delivery.

Table 14-2: Risk allocation

Risk	Horizon 1		Horizon 2		Horizon 3		Horizon 4	
	Client	Contractor	Client	Contractor	Client	Contractor	Client	Contractor
Design	✓		✓		✓		✓	
Consenting	✓		✓		✓		✓	
Consent compliance		✓		✓		✓		✓
Property	✓		Unlikely / NA		Unlikely / NA		✓	
Utilities		✓		✓		✓		✓
Construction		✓		✓		✓		✓
TTM		✓		✓		✓		✓
Cost		✓		✓		✓		✓
Delay		✓		✓		✓		✓
Health and Safety		✓		✓		✓		✓

Noting for Horizon 1 and 2 the Client will be Auckland Transport. For Horizon 3 and 4 if will be the asset owner.

14.6.2 Procurement (sourcing) options and key considerations

The procurement options for the NBE programme were discussed with AT and Waka Kotahi through a workshop a summary of key considerations for procurement is provided below.

AT and Waka Kotahi internal staffing will be established as part of the approvals process for the programme.

The lead delivery agency for each stage has been recommended based on the affected asset ownership and delivery focus. It is expected that the Short Term (Horizon 1 and 2) works will be delivered by an Auckland Transport Team with a focus on expertise in pre-implementation and implementation of station and PT works. It is recommended that AT, as the lead agency, retains experienced project management staff on the project.

For Horizon 3 and 4, Waka Kotahi involvement is recommended for infrastructure works that affect the state highway assets. This includes direct works on the assets (improvements), traffic management requirements and working in live traffic environments on state highways, and where the activity poses risk to the state highway operation and asset condition.

Table 14-3: Summary of works requirements affecting sourcing decision

Role	Horizon 1	Horizon 2	Horizon 3	Horizon 4
Lead Agency	AT	AT	AT/ WK	AT/WK
Focus of DBC	Yes	Yes	No	No
Funding Agency	AT	AT	AT/WK (to be confirmed	AT/ WK (to be confirmed)

Role	Horizon 1	Horizon 2	Horizon 3	Horizon 4
Risks / challenges	Scope well defined and understood No interfacing projects Low risk area i.e no works in CMA but need to confirm ecological in design	Works focused around stations Interfaces with Northern Pathway at Constellation Station (consider where the pathway goes through station). Low risk area i.e. no works in CMA	Scope still not defined; scope and timing linked to adjacent project. Includes works on existing SH	High risk area with widening into the CMA Works on and tying into existing SH Interfacing projects
Consenting risks / challenges	Minor changes within the planning context. May be a requirement for consents at Sunnynook due to work near waterways. Combining H1 and H2 from a planning perspective appears reasonable. Assume will be done under the existing planning regime (RMA)	Minor changes within the planning context. Combining H1 and H2 from a planning perspective appears reasonable. Assume will be done under the existing planning regime (RMA)	Within the existing corridor, low risk for planning. May be impacted by changes to the RMA.	Very difficult, and very complex. No point considering until changes in the RMA are understood and interfacing projects are understood.
Property	Minor - Land required in Victoria Park for a pathway.	Minor	Minor	Current design avoids requirement for land but may be required. Will be problematic.

14.6.3 Pre-implementation services

As per above the procurement (sourcing) options for the NBE programme was discussed with AT and Waka Kotahi in a workshop. Through this discussion it was proposed that the design (pre-implementation phase) of Horizons 1 and 2 should be undertaken as one. Noting that they are likely to be constructed (implementation phase) in two (or more) stages.

Given the scope of Horizons 3 and 4 they are likely to be procured independently.

Scope of Horizons 1 and 2 Pre-Implementation phase

AT will take responsibility for the procurement of the pre-implementation services by external professional services providers (consultants).

The scope of the pre-implementation phase shall include for the consenting, property and design phases of the works including

- Engineering Design: Project development (scheme refinement/project-level optioneering etc.) and detailed design,
- RMA planning: Development of the strategy and submission of the consents including specialists' technical assessments (ecological, cultural and archaeological) and legal to support the approvals applications as per the consenting strategy

- Property planning and acquisition processes: Confirmation of property requirements, strategy and support to Auckland Transport's Property Team with the acquisition process.
- Stakeholder engagement and communications support (with organisational ownership of consultation and communications remaining with AT).
- Interface management: Including engagement with adjacent projects and Waka Kotahi.
- Implementation Procurement: Including development of the procurement plan, documentation (for sign off by AT) and management of the process.
- MSQA
- Programme and project management.

The specific scope of work will be developed as part of the procurement process. The professional services will be engaged under an AT contract.

Procurement options for Horizons 1 and 2

It is expected that scope of pre-implementation works for Horizons 1 and 2 would attract interest from tier 1 suppliers. However, the market may be resource constrained given other major infrastructure planning activities underway.

Horizon 1 and 2 professional services may be procured via:

- AT Technical Panel – AT have an existing panel for provision of professional services. This provides for contracts up to $1M in fees, with all projects with fees over $300K requiring an RFQ be issued to all panellists. Given the pre-implementation phases of Horizon 1 and 2 are to be delivered as one it is unlikely this panel can be utilised.
- Competitive tender - A market sounding, and communication exercise should be conducted early to gauge interest and capability, to generate interest in bidding to provide the services, to determine the best timing to bring the procurement to market, and to allow suppliers time to prepare and plan. Procurement should proceed through a short-listing and interactive process.

Timeframes for Horizon 1 and 2

Scoping of procurement of professional services is expected to begin following endorsement of the business case by the AT and Waka Kotahi boards.

As noted above if the pre-implementation phase of Horizon 1 and 2 is delivered together it expected that AT will have to go to an open competitive tender for the professional services over their AT Technical Panel.

A competitive tender would commence early 2022 (Q3 2021/2022) and take around 3 to 4 months, including approvals. The Design Consultant is expected to be engaged by Q2 2022/2023.

The pre-implementation phase activities (including development and submission of resource consents activities) are expected to take six months in total. An additional three months is allowed for consents to be granted, running in parallel with the procurement of the Implementation Phase.

Based on this programme Construction is set to commence Q3 2022/2023 (July 2022).with a six-month construction programme allowed for.

Funding and governance approvals present a potential delay risk to these timeframes noting no funding is currently allowed. Delays will have potential knock-on effects throughout the programme, with potential to delay the service delivery as far out as 2030 and loss of benefits to customers.

Procurement options for Horizons 3 and 4

It is expected that like Horizons 1 and 2 the scope of pre-implementation works for Horizons 3 and 4 would attract interest from tier 1 suppliers. However, the market may be resource constrained given other major infrastructure planning activities underway.

Horizon 3 and 4 professional services may be procured via:

- AT Technical Panel – AT have an existing panel for provision of professional services. This provides for contracts up to $1M in fees, with all projects with fees over $300K requiring an RFQ be issued to all panellists. Given the likely size of the pre-implementation phases of Horizon 3 and 4, it is unlikely this panel can be utilised.
- Competitive tender - A market sounding, and communication exercise should be conducted early to gauge interest and capability, to generate interest in bidding to provide the services, to determine the best timing to bring the procurement to market, and to allow suppliers time to prepare and plan. Procurement should proceed through a short-listing and interactive process.
- Early Contractor Involvement – Given the constraints associated with later stages including spatial limits, working / tying into the SH (for H3 and H4 respectively) and working in the CMA (H4) it may be appropriate to include Contractor input into the design for H3 and H4. The level involvement will be dependent on the scope and subject to decisions made on adjacent projects.

14.6.4 Delivery model options

Several delivery model options are available for each horizon stage and should be selected based on their suitability to the particulars of each stage. The options range across the traditional delivery options with increasing complexity and scale and variation in the nature of risk allocation between client and contractor:

- AT Physical Works Supplier Panels
- Measure and value
- Lump Sum
- Design and construct
- Early Contractor Involvement (for Horizon 3 and 4 works which will be significant complex projects with high risk)
- Alliance (for Horizon 3 and 4 works which will be significant complex projects with high risk)

The horizons under the current staging strategy are each different in their works requirements, complexity and scale. It is likely that a mix of the above options would be appropriate. For example:

- Horizons 1 and 2 are relatively simple and could be procured and delivered under a lump sum or measure and value type arrangement.
- Horizons 3 and 4 contain more complex and larger scale infrastructure improvements which may be better suited to an integrated design and construct approach or alliance approach, which can provide benefits such as better certainty in cost, and/or a high level of knowledge transfer between participants.

It is expected that AT would procure the physical works contract via an Open Competitive Tender. Auckland Transport has a physical works supplier panel that can be used for works up to $50m. It is likely that if the works within each horizon are procured as one the packages will be larger than this and therefore the panel can't be utilised. However, all Contractor submitting to the open tender would be required to be pre-qualified. Given the scope and size of the works it is expected that Contractors would have to be pre-qualified with AT for Panel 1

Within horizons, in particular Horizons 1 and 2, some of the works may be delivered in smaller packages using a mix of models or could be packaged together to achieve scale and to reduce interfaces and to reduce the project management burden on the delivering agency. In this case the panel could be utilised. As per discussion at the procurement workshop with AT it was recommended that this be decided once the design is progressed further.

The model should be considered based on careful assessment of the outcomes sought and the added complexity and cost. Detailed procurement strategies should be developed for each delivery stage as part of future Implementation Business Cases. These should take account of the particular characteristics and needs of the stage, including complexity, risk, interfaces, and client capability and preferences. Flexibility should be retained to manage changes to delivery staging.

14.7 Flexibility should be retained to manage changes to delivery staging

As discussed above, the proposed improvements and associated staging strategy has been developed to programme of improvement works to enhance the capacity of the busway system to address current deficiencies and enable it to meet projected demand to the mid-2030s and funding constraints.

Other constraints include:

- Governance agreement among Programme Partners.
- Interfaces with other projects and land use developments
- Stakeholder and partner agreements, including with third party utilities
- Property acquisition – full acquisition would take 2 – 5 years (if required)

If funding can be removed and delivery is accelerated it can be programmed around some of the other constraints, such as property and utilities. It is important to note that an acceleration strategy that relies on programming is likely to require the procuring agency to accept some additional long-stop risk in relation to relieving the particular constraints (e.g., achieving final property purchases).

The focal points for retaining flexibility are:

- Interfaces with other projects, in particular continuing to liaise with projects along the corridors to understand their delivery programmes and the implications on the scope and staging of the NBE Enhancements Projects.
- Stakeholder and partner agreements; including partners internal priorities and support (and associated funding) for the programme or components of.
- Governance, in particular ensuring that the Programme Partners are able to respond and adapt to changing circumstances, and that the risk and opportunity management processes are robust, and support informed strategic decision making.

14.8 Payment Mechanisms

The contract(s) for the NBE programme of works should include provisions to recognise the importance of completing the works quickly and planning and managing works (and Traffic Management) so as to minimise disruption.

Penalty clauses should be considered to incentivise performance to meet these goals.

14.9 Pricing Framework and Charging Mechanisms

As per discussion above, the delivery contract for Horizons 1 and 2 would most likely be let on a lump-sum basis.

14.10 Contract Length

The contracts would require completion in accordance with this, and subsequent, business cases and include standard defects liability periods.

14.11 Other market and contracting considerations

The contracting will need to include provisions to allocate risk related to COVID-19 alert levels and working restrictions. Both AT and Waka Kotahi have previously issued guidance on this matter.

Standard contract conditions should be used to enable speed and clarity.

AT have preferred suppliers for items such as CCTV, PA systems etc. These will need to be incorporated into the design specification and delivery contracts.

14.12 Contract Management

The Management Case sets out the proposed approach to managing the project during implementation and delivery. This includes a programme.

15 Management Case

15.1 Introduction

This Management Case addresses the delivery roles and governance approach for Northern Busway Enhancements Project. As with the Commercial Case, the Management Case has been written for the full NBE with a focus on Horizon 1 and 2.

The Management Case is made up of the following parts:

- Delivery roles
- Governance arrangements, including supporting agreements and risk management and assurance framework
- Horizon 1 and 2 Phase delivery structure and programme
- Staging, project development and Investment Management
- Benefits realisation plan

15.1.1 Timeframes and focus of the Management Case

The Staging Strategy has been developed to reflect the needs for the enhancements, the constraints of Government funding and to provide a practical and efficient implementation pathway. The staging strategy does not intend to prescribe the exact delivery method for the NBE and recognises that specific stages and delivery methods may change depending on various factors and decisions made within other projects (e.g. Northern Pathway, additional Waitemata Harbour Crossing etc).

The conditions under which investment would be made (similar to triggers) could include interface projects decisions, capital and operating budgets and organisational responsibilities and priorities. To manage uncertainties, constraints and interdependencies over the lifecycle of the programme and associated investment risks, an Investment Gateway Approach has been developed and is discussed further in Section 15.5.1.

Though it is intended that Horizons 1 and 2 of the Project are funded and delivered by AT it is intended to have representation from Waka Kotahi in the Governance structure from inception as a key stakeholder. The Governance structure may be scaled up as the project moves into H3 and H4 works which are more significant in size and complex in nature. Given these are some time away detailed governance arrangements for the later stages are not described at this time. This Management Case largely focuses on the short term works to be progressed. It also sets out a proposed Investment Management Approach to monitor and manage investment timing and risk over the course of the programme.

The governance and risk management arrangements need to be able to respond flexibly to changes in the staging if and when they occur. These arrangements will also need to evolve over time to suit the differing needs of each stage.

15.1.2 The complexity in the programme affects the management approach

The Northern Busway is complex in relation to its scale, involvement of two parties, the programme duration and the number of interfacing projects many of which are still in option development, including specifically:

- Two infrastructure asset owners
- Two Requiring Authorities (designation holders)
- Multi-year (decade) programme
- Potential multiple funding sources with funding yet to be committed.
- Interfacing projects with higher priority

These aspects relate to and influence the governance arrangements (asset ownership, legal rights, funding) and the proposed dynamic approach to managing the programme.

15.2 Project Plan and Schedule

The following sections provide a summary of the sequence of all key activities required to complete the pre-implementation and implementation phases of the project.

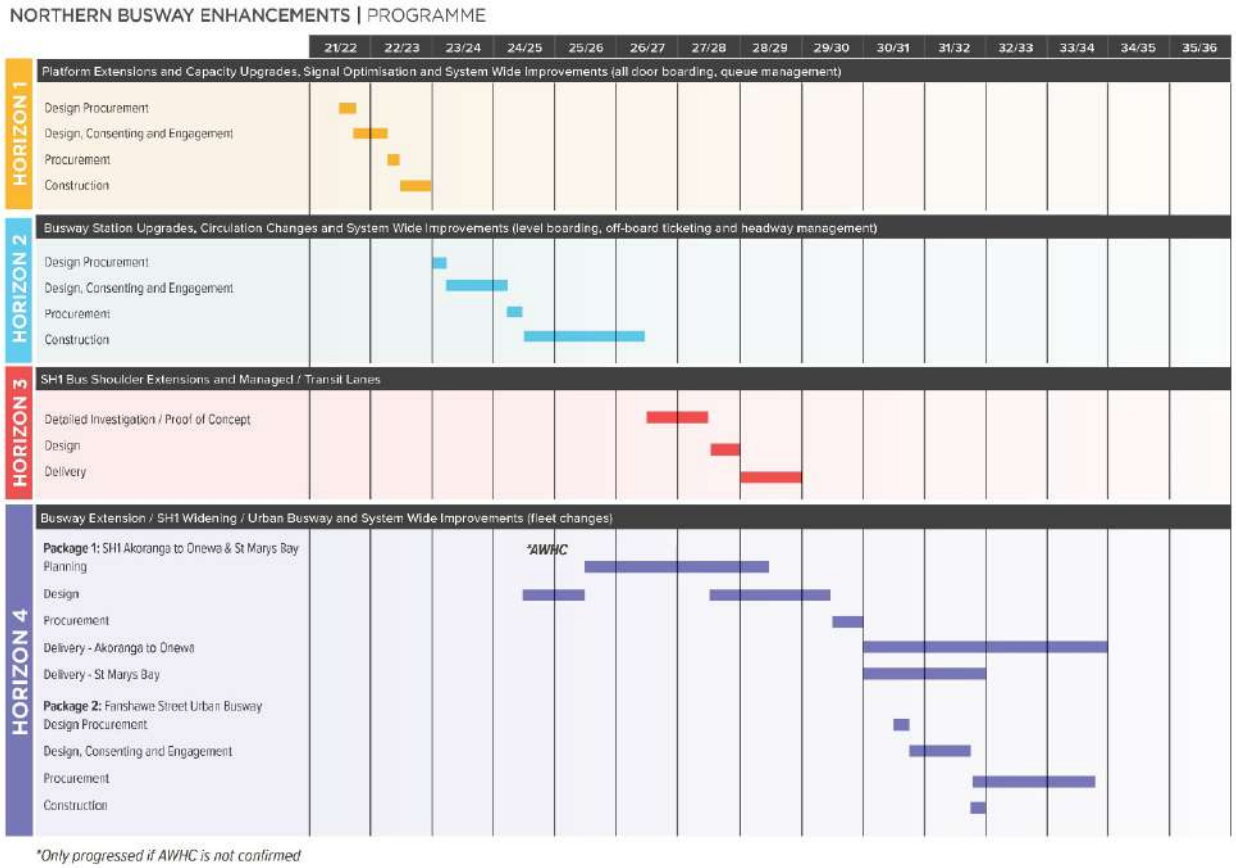


Figure 15-1: Summary of Key Activities – Pre-Implementation and Implementation Phase

15.3 Project Roles and Governance

At a strategic level there are two programme partners to the NBE being AT and Waka Kotahi. Their project roles and the importance of coordination between the partners is a key consideration in designing the governance arrangements which are discussed below.

The governance arrangements for the NBE must support the following:

- Enable coordination and joint decision-making on common interests among the Project Partners, particularly for the critical path consenting activities
- Provide governance-level coordination with interfacing projects.
- Provide a point of escalation for risk that cannot be managed or mitigated at the component level
- Provide efficient and engaged oversight on behalf of each organisation's corporate governance
- Provide an approval pathway where Project Partners' Board approvals are required (ie decisions above delegations)
- Provide an assurance pathway to the Project Partners' Boards

The partners project roles in Horizon 1 and 2 are discussed below. These will be reviewed as the programme develops and moves through each Horizon and may develop further following input from specialist advisors, the requirements of each Horizon, and as the programme progresses.

To date no funding agreements have been agreed between the partners.

As outlined above the business case is being managed by Auckland Transport (AT) on behalf of itself and Waka Kotahi NZ Transport Agency (Waka Kotahi).

It is proposed that Auckland Transport are the lead agency for the delivery of Horizons 1 and 2. It is anticipated that they also be the sole funding agency given the works are primarily associated with their assets.

For Horizons 3 and 4 it anticipated that Auckland Transport will take the role of lead agency but with the support of Waka Kotahi with both parties contributing to the funding of these works.

15.3.1 Responsibilities

As outlined above the business case is being managed by Auckland Transport (AT) on behalf of itself and Waka Kotahi NZ Transport Agency (Waka Kotahi). The responsibilities of AT and Waka Kotahi in the delivery of the programme is described below.

The specific responsibilities of the partners in the delivery of Horizons 3 and 4 are not covered in detail in this document and will be subject to agreement at the time.

Waka Kotahi Responsibilities

Waka Kotahi is the RCA for the Northern Busway, State Highway Network including the Auckland Harbour Bridge and will be the requiring authority and resource consent holder for any state highway infrastructure within the project.

For Horizons 1 and 2 it is recognised that Waka Kotahi are a key stakeholder and have representation in the Governance of these projects. They will not have a delivery responsibility.

For Horizons 3 and 4 it is anticipated that Waka Kotahi will be a funding partner (with AT) and support AT with the delivery of these works. As such they are likely to have a more significant role in the Governance of these phases than Horizons 1 and 2.

Auckland Transport Responsibilities

AT is the RCA for the Busway Stations and Fanshawe Street will be the requiring authority and resource consent holder for any infrastructure within these areas.

It is proposed that AT are the lead agency for the delivery of Horizons 1 and 2. It is anticipated that they also be the sole funding agency given the works are primarily associated with their assets.

For Horizons 3 and 4 it anticipated that AT would take the role of lead agency but with the support of Waka Kotahi in the delivery. AT will also be a funding partner.

15.3.2 Horizons 1 and 2 Proposed Governance Structure

The governance structure recognises that coordination is essential to the success of the programme, especially given the number of the interfacing projects and their developing scopes and programmes. The proposed governance structure is summarised in Figure 15-2 below.

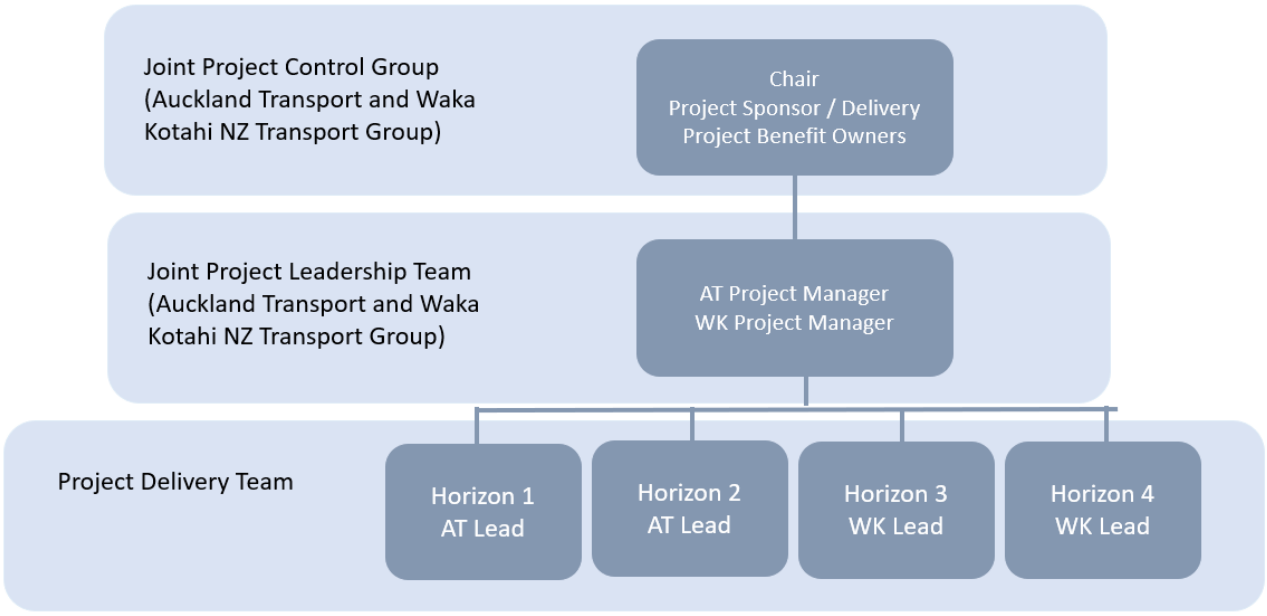


Figure 15-2: Governance Structure

15.3.3 Framework Agreements and Funding Agreements

To date no framework or funding agreements have been signed between the Programme Partners.

It is anticipated that a series of framework agreements will be required to support the governance arrangements and delivery of the programme through delivery of the programme, these are likely to include

- Heads of Agreement (HoA) between AT and Waka Kotahi
  - Sets out governance, coordination, dispute resolution, escalation and engagement arrangements.
  - Details future funding processes
  - Details how the partners will engage and agree on future stages
- Horizon 1 and 2 Agreement / Memorandum of Understanding (MOU) between AT and Waka Kotahi
  - Documents how Waka Kotahi support AT in the delivery of Horizon 1 and 2.
  - Details the project level governance arrangements, decision-making processes, and dispute resolution and escalation procedures
  - Details any cost sharing arrangements (noting it is anticipated there will be none for these phases with the works being solely funded by AT).
  - Documents joint 'best for programme' decision-making principles
  - Confirms that Auckland Transport retains decision-making for scope, standards and conditions related to elements of the transport infrastructure and operations that they will own and maintain.

Note that the above list is not exhaustive. other governance agreements may be required as the programme develops.

15.3.4 Project Delivery Team

AT will provide the Project Delivery Team for Horizons 1 and 2 as the lead agency. This team will be supported by professional service providers (the consultant team) and specialists from across AT.

It is anticipated the AT project delivery team members will be nominated and confirmed at the commencement of the pre-implementation phase, following approval of the DBC. The team may expand as the project progresses through to Horizons 3 and 4.

The AT Project Manager will be responsible, with the support of AT procurement, for the engagement of the consultant team and manage the professional services contract(s) for this stage. They will also be responsible for internal reporting and interfacing with Waka Kotahi's representative (as the Project Partner and key stakeholder).

15.3.5 Resources

The indicative major discipline areas required for Horizon 1 are provided below, those disciplines that will be provided by professional service providers are noted:

- Project and Programme Management (overall responsibility would be retained by AT however consultant teams still have a responsibility for this).
- Engineering Design (professional service provider)
- Independent Road Safety Auditors (professional service provider)
- Cost Estimation (professional service provider)
- RMA Planning (professional service provider)
- Stakeholder Management and Communications (professional service provider, however responsibility and overall leadership of stakeholder management communications would be retained by AT).
- Environmental Specialists (professional service provider)
- Cultural and Archaeological Specialist (professional service provider)

Specialists from across AT will provide expert advice over the course of the project, it is anticipated this will include:

- Procurement and Contract Management
- Risk Management
- Planning and Consenting
- Property and Land acquisition.
- Funding and RLTP
- Stakeholder Management and Communications (*refer to note above re. responsibility*)
- Māori Engagement
- Road Safety
- Design Standards.
- Health and Safety
- Public Transport
- Facilities
- ATOC
- Maintenance
- Road Operations

Key AT project team members and their responsibilities are defined below:

- AT Project Manager

  In accordance with Section 3.3.1 of the PMF15

- Project Sponsor –

  In accordance with Section 3.3.2 of the PMF15, with the following exceptions:

  - Endorses/ Approve PID
  - Endorses the Project plans
  - Endorses the project Business Case.
  - Endorses gateway approval Request
  - Review PHR

- Project Control Group

  The Project Control Group is the decision-making body that ensures the right activities are taking place, undertaken correctly and are in alignment with strategic goals. The PCG provides a forum for senior management to better understand the scope, benefits and financial and contractual status of projects, enabling informed decisions to be made and ensuring a high level of communication with stakeholders.

  The PCG will discuss any key issues, project overlaps and potential delivery risks that may have adverse implications for the project, Auckland Council, Auckland Transport or Waka Kotahi in terms of time and cost; or being of high public profile/politically sensitive nature whilst ensuring a zero-harm focus on project delivery is maintained. Any approvals or endorsements required that are outside of the PCG's delegated financial authority will be referred to upwards as appropriate.

  The PCG are not involved in the day to day management of the projects but rather set the broad direction to be implemented by the project team responsible for the delivery and administration of the project.

15.3.6 Project Assumptions

The programme's core assumptions shall include

- Zero harm during design and construction
- Quality outcomes consistent with AT and Waka Kotahi's customer experience, including incorporating Crime Prevention Through Environmental Design (CPTED) and Safety in Design (SID) principles
- Efficient whole-of-life maintenance and renewal costs consistent with other facilities across the AT public transport and state highway corridor network
- Addressing and minimising effects on adjacent property owners and occupiers, road corridor and public transport patrons, as well as freight services and local traffic operations
- Avoid, remedy or mitigate actual and potential effects on the environment where necessary during construction
- Consideration of integration of future planned infrastructure.
- Delivery within the approved project budget
- Positive sustainability and social outcomes that align with the AT and Waka Kotahi's requirements.

15.3.7 Constraints

The known project constraints are described in Section 4 above, noting key known constraints include:

- The project is currently not funded in the RLTP and there is no funding agreement (on framework agreement) with Waka Kotahi.

- Uncertainty of timing / and inter-dependencies with other projects currently planned or underway in Auckland including the Northern Pathway and the AWHC.
- Spatial constraints within the densely built-out city centre (e.g. street width) and along the existing SH1 corridor.
- Planning, feasibility, operational and implementation constraints.
- Covid-19 continues to develop and the long-term impact of the crisis is as yet unknown. This continues to lead to increased level of uncertainty across all aspects of decision making.

15.3.8 Dependencies

Project dependencies, for Horizon 1 and 2, include:

- Project funding: Delay to the project and when benefits can be realised
- Adjacent projects (scope and programme): May impact scope of later phases and the timing of delivery
- Planning and regulatory: Particularly given the proposed changes in the regulatory framework and the planning requirements for Horizons 3 and 4.
- Property acquisition – if required for Horizon 4 noting acquisition through the Public Works Act may be likely.

15.3.9 Issue Management

In order to identify and address issues that emerge during the delivery of the project, a project issues register will be established and maintained throughout the life of the project. This will be reviewed monthly and key issues included in the monthly Project Highlight Reports. Refer to Section 4 for current issues and constraints.

Issues will be managed to ensure they are resolved and in order to avoid potential negative impacts on the project. Issues will be identified, logged, periodically reviewed and evaluated, escalated where necessary, and reported. Issues will be discussed at various levels of the project governance as required.

15.4 Project Controls

The following Project Controls shall be put in place for the delivery of Horizon 1 and 2.

15.4.1 Project Meetings

- Monthly meetings with the Project Control Group
- Monthly Project Highlight Reports (PHR) submitted to the Project Sponsor for review and other PCG members.
- Weekly progress meeting with external design consultant
- Regular (weekly-monthly as required) meetings with interdependent projects.
- Monthly PACE meetings with external consultants/suppliers or as per the contract.
- Additional special meetings with stakeholders and external design consultants to facilitate any unusual design requirements or discuss design decisions/reports.

15.4.2 Risk Management

The Commercial Case sets out the key strategic delivery risks for the programme as identified in the risk register (see Appendix I), and these documents should be referred to for detail of the risks and dependencies. Most of the strategic risks are matters that need to be addressed via the governance arrangements. In particular (but not limited to):

- Funding and cost sharing arrangements
- Addressing future uncertainty, particularly in relation to COVID-19

- Managing interfaces and alternative decisions being made with other major projects and programmes, the transport network and land development
- Coordinated consenting in relation to works on SH1 where Waka Kotahi is the requiring authority and designation holder.
- Coordinated stakeholder engagement.

A disciplined, structured and documented risk management framework will be established. This will enable identification, documentation and reporting of risk consistently and comparably.

The risk management framework will:

- Establish a purpose-driven risk identification process focussed on the programme's critical success factors and targeting those risks that can impede the realisation of success
- Establish ongoing risk monitoring and reporting processes at the project level, beginning with the Route Protection and Resource Consent phase
- Establish requirements for reporting project risk up to the programme-level governance
- Design in cultural enablement within operational teams to ensure risks are elevated early
- Establish thresholds and reporting requirements for programme-level risk reporting to Project Partners' Boards.

The outcome of the risk framework should be that risks are actively identified and managed throughout the programme lifecycle. The risks identified in the business case (current risk register) will be carried and managed through Horizon 1 works and then into the future project stages.

AT's internal Risk Management Process (as outlined in the Project Risk Management Handbook) and Programme Management Framework (2015) processes, or any subsequent revisions will be applied.

15.4.3 Project Tolerances

The Project Manager will notify the Project Sponsor via the monthly project status report of any changes that sit outside accepted tolerances. Any change to the project scope and deliverables, or departure from the project requirements will require a formal Project Change Request which must be authorised by the Project Control Group. Guidelines for criteria that would be specifically addressed are as follows. (It should be noted that the following criteria are specifically recommended for this project and they will take precedence over the recommendation of Section 5.3 PMF2015).

As the current project time/cost estimates are based on preliminary drawings, there is a degree of uncertainty surrounding the estimation of the cost and timeframes. In the event of a variation to the agreed scope / time / cost, the following criteria will be applied.

- Scope
- Budget
- Programme
- Risk / Issues

15.4.4 Quality Management

Any and all business case related documents shall generally be in accordance with best practice and with the principles that have been established by AT and Waka Kotahi.

The project will be designed in accordance with best practice and with the principles that have been established by AT and Waka Kotahi.

A specific quality management plan for the design phase will not be developed as the following is sufficient to maintain the quality controls.

The project shall maintain standard quality standards appropriate for AT and Waka Kotahi, specifically:

- AT Transport Design Manual).
- Safe Systems approach
- Urban Design Framework
- Standard Engineering Detail (S.E.D)
- Development Code NZ & Auckland
- CPTED (Crime Prevention Through Environmental Design)
- Accessibility Standards
- Any deviation from the standards would require sign-off by the Policy & AMP Specialist (Robert McSpadden) and the project manager will be responsible for initiating and close-off of the standard AT quality deviation/departure process.

The following reviews of the documentation will be undertaken at suitable stages of the design phase to maintain the quality.

- External Traffic Safety audits at each project stage;
- Technical peer review by the AT and Waka Kotahi specialist staff;
- Technical peer reviews (PS2- design Review) of the design documentation by an external consultant;
- Non-Motorised User Audit at design stage;
- Peer review of the cost estimates;
- Parallel Cost Estimate; and
- Economics peer review.

15.5 Project Development and Investment Management

15.5.1 Investment Management Approach Overview

The NBE proposes to deliver a programme of investment over a period of approximately 15 years, which together form the recommended option within this DBC. While the entire programme is required to deliver the full investment benefits and resolve the problems identified in the ILM, a staged delivery programme is recommended as the appropriate implementation method given the inter-relationship of the programme with WK's Additional Waitemata Harbour Crossing work.

To manage uncertainties, constraints and interdependencies over the lifecycle of the programme and associated investment risks, an Investment Gateway Approach unique to the NBE has been developed. This establishes an adaptive and responsive framework to manage and monitor the timing of investment decision-making over the course of the NBE. This dynamic approach to investment risk management recognises the uncertainties generated by a large and complex programme that has short, medium- and long-term stages of investment. It also provides flexibility to consider changes in underlying conditions, interdependencies, constraints and forecasts, including uncertainties related to COVID-19 and adjacent projects. This will ensure robust decision-making closer to the time of investment for future programme phases.

In summary, this process:

- Identifies how the agencies progress to the ultimate outcome over time
- Is a method to manage uncertainty into the future, particularly in light of uncertainties generated by adjacent projects
- Is a flexible approach to moving horizon timings and components between horizons

- Provides appropriate checks and balances to ensure there is an optimised right-sized investment made at the right time
- Is managed through a series of Gateway Reviews
- Provides a framework for development of future phases.

The Investment Gateway Approach includes the following elements:

- Investment Gateway Approach Principles
- Programme Staging Intent and Proposed Outcomes
- Gateway Reviews – overall timing and process
- Investment Drivers - to be managed and monitored
- Investment Gateway Reporting and Monitoring – timing and process.

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