
North Shore Rapid Transit Programme Business Case Addendum

Aurecon NZ Ltd for Auckland Transport

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VERSION 1

Programme business case



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INTRODUCTION

Since the completion of the North Shore Rapid Transit Network PBC (NSRTN PBC) in December 2017, several changes have occurred that are relevant to the case for investment. These include the most recent update to the Auckland Transport Alignment Project (ATAP), the implementation of the New Network bus services on the North Shore, and the indicated preference for light rail as the preferred mode for the Northwest and City Centre to Mangere sections of Auckland's rapid transit network (RTN).

These updates reinforce the case for investigation into the development of the rapid transit network north of the Waitemata Harbour. In particular, they highlight the urgent need for further investigation of Northern Busway enhancement options outlined in stage one of the PBC's recommended programme and further support the recommendation to introduce light rail as patronage volumes increase and the operational capacity of the busway is exceeded.

The purpose of this addendum is to provide an update on current and forecast demands, given a year has passed since the completion of the PBC, and a summary of how other changes might impact the findings of the PBC.

Major changes since the PBC include:

- Light Rail
 - Preferred option for Northwest and City Centre to Mangere rapid transit
- ATAP 2018 recommendations for
 - Bus shoulder lanes to Orewa and possible extension of RTN to Grand Drive
 - Road Pricing
 - Bus priority improvements on Fanshawe St
 - Additional general vehicle harbour crossing by 2048
 - Light rail between the City Centre and North Shore (by the mid-2030s)
- New Network bus service implementation

Summary

- **Strategic Context** – the policies and projects highlighted in the Government Policy Statement on Transport (GPS), ATAP 2018 and planned light rail projects indicate a strengthened strategic alignment with the recommended programme in the PBC.
- **Light Rail** – light rail has become the preferred mode for additions or upgrades to some parts of the RTN, which strengthens the case in the NSRTN PBC for LRT being selected as the preferred higher-capacity mode for the Northern Busway corridor to provide a connected network across the region (though the RTN mode selection for the North Shore still needs to be confirmed through next steps).
- **Forecast demand** – no changes have been made to the land-use growth assumptions underpinning demand forecasts in the NSRTN PBC report, so these modelled demands for travel remain unchanged.
- **Patronage growth** – continued growth in patronage on buses from the North Shore increases the urgency for investment to improve or upgrade the existing busway and plan for a future step change in capacity.
- **The New Network** – the implementation of the bus services as part of the New Network highlighted the urgency for improvements to the busway, as capacity constraints are

increasingly evident.

Strategic Context

Government Policy Statement on Land Transport (GPS)

A new Government Policy Statement on Land Transport (GPS) for 2018/19–2027/28 was released in June 2018. The recommended programme outlined in the PBC is strongly aligned with the priorities of the GPS, which demonstrated a clear commitment to public transport. Alignment with Government policy is stronger now than it was in 2017.

Ensuring that the RTN network on the North Shore continues to meet demand over the next two decades means that the travelling public have meaningful transport choice to access social and economic opportunities. Development of the network in conjunction with planning for an alternative Waitemata harbour crossing also ensures the resiliency of the network. The GPS signals the need for mode shift towards lower emissions forms of transport including public transport. Finally, the incremental, staged approach of the recommended programme meets the GPS goal of representing good value for money by delivering the appropriate infrastructure at the appropriate level with flexibility to respond to changes in demand and interaction with other major projects over the next two decades.

ATAP 2018

The ATAP update completed in April 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. The original PBC indicates the RTN ending at Albany with limited or no bus priority further north and therefore the next stages of the I/DBC process would need to incorporate an anticipated extension.

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 St components will need to be monitored in relation to how much of this is delivered by the City Centre to Mangere LRT project, and any gaps.

The ATAP package also indicates future priorities to be completed over the medium to longer term as funding becomes available, consisting of an upgrade of the Northern Busway, extension of the RTN north to Orewa and south to the city centre (including a new crossing of the harbour, though not specifying any form or alignment) and a Takapuna connection. The upgrade of the Busway, a connection to Takapuna and a new harbour crossing are included in the PBC recommended programme, but extension of the RTN further north would need to be added to be considered at the next stages of the business case process.

ATAP points out the need to upgrade the Northern Busway to (or supplement it with) a higher capacity mode over the medium to longer term. The urgency of selecting this higher capacity mode and confirming how it integrates with the City to Māngere light rail corridor and a potential future road crossing of the harbour is highlighted.

ATAP identified congestion pricing as having significant potential to manage travel demand and reduce congestion, in conjunction with implementing the wider strategic approach. The Congestion Question project has carried out Phase 1 of its work and has reaffirmed this potential. Of relevance to the NSRTN PBC, the Phase 1 report acknowledges that *“core to successful schemes internationally has been the availability of sufficient high quality public transport to support modal shift where this has been a viable alternative.”*

Preferred pricing options and their resulting impacts and timing of implementation have not been determined at this stage, so it is difficult to predict the impacts of pricing on the recommended direction with any specificity. It is likely, however, that any pricing of road congestion in the northern corridor would have an upward effect on demands for rapid transit services, potentially bringing forward the timing improvements are required and/or increasing the design capacity. The potential for, and ongoing investigation into congestion pricing does not undermine the PBC’s recommended direction. If there is any effect, it is one of further supporting the need to investigate enhancing the RTN north of the Waitemata Harbour.

City Centre Masterplan

Auckland Council is underway with refreshing the City Centre Masterplan, particularly in view of the transformational change expected with LRT planned for Queen Street. The updated Masterplan is expected to recommend continuing provision for greater public transport capacity and a reduction in city centre traffic volumes, compared to current plans to maintain existing volumes. Given that AT is responsible for following and delivering components of the Masterplan, this strategic context is significant in terms of supporting NSRTN investigations and reducing traffic volumes into the city centre.

Light Rail

Since the North Shore RTN PBC was prepared, the following changes have occurred regarding light rail in Auckland:

- ATAP recommendation to providing light rail between the City Centre and Māngere in the next 10 years (2018–2028)
- ATAP recommendation to providing light rail to Auckland’s northwest within the next 10 years (2018–2028)
- According to the NZ Transport Agency business case for City Centre to Mangere Line, this route is expected to run along Queen Street
- The Mt Roskill to City section of the route will progress as quickly as possible

The ATAP preference for light rail points to a change in strategic direction, with light rail being favoured over other modal options across Auckland on new or upgraded rapid transit corridors. In particular, light rail has been considered more suitable than heavy rail to the airport and Māngere, and light rail has been considered more favourable than a busway to the northwest.

Such decisions suggest light rail is likely to be a favoured strategic approach to the next phase of RTN network expansion in Auckland over the next decade at least. The PBC’s recommended direction to investigate light rail as a next higher capacity RTN mode for the North Shore is more aligned with wider network planning and strategic direction than it was in 2017.

Recent and committed changes to the North Shore bus network

New Network

Implementation of the New Network on the North Shore in September 2018 has highlighted the capacity constraints of the existing busway. Constellation Station in particular, experienced major operational issues with the network update, with up to 120 buses per hour scheduled to arrive at the existing two platforms. The long dwell times (Northern Busway dwell times range between 50 to 100 seconds per vehicle during AM and PM peaks) result in platooning of vehicles, which has a negative impact on the reliability of services, and customer experience.

Figure 1: Constellation Station – Afternoon Peak 1 October 2018



Customer Feedback on Northern Express Services undertaken by AT's Customer Experience team between 2016 and September 2018 indicate a higher number of passenger complaints citing capacity issues and overcrowding than anywhere else on the network.

Current improvement to the station including the extension of the citybound platform, and the construction of a northbound platform will mitigate some of this congestion. However, the current failure of the station to accommodate the increased frequency and volume of buses with the New Network changes is a preview to future capacity constraints on the busway as patronage continues to increase. This reinforces the need to start investigations into the enhanced busway options recommended in the PBC.

Due to the high number of vehicles circulating around the existing two platforms, AT have been forced to change a number of routes to maintain movement through the station. As a short-term measure, changes to the existing parking area have provided space to provide new active stops and layover bays for all Sunset Road services, which have reduced the pressure on the busway platform. The high number of buses circulating through the station have also increased the conflict with pedestrians accessing the station via Constellation Drive and the Park and Ride facility.

Figure 2: Constellation Station – Conflict between bus and pedestrian movements



Similar operational deficiencies at other busway stations have been highlighted by recent investigations. Site observations carried out during October 2018 at Sunnynook and Smales Farm Stations confirmed capacity constraints and bus platooning due to insufficient platform length.

The evaluation of dwell time data in terms of variability in customer experiences while waiting for bus services, identification of platform capacity constraints, in conjunction with growing demand and patronage growth on the Northern Busway highlights the current and future operational and service deficiencies experienced by customers at existing stations. As a result of these operational and service deficiencies, customer experience will deteriorate, alongside the risk that the uptake and retention of passengers utilising the Northern Busway will decrease. AT's desired patronage targets may not be achieved due to declining levels of service.

Northern Corridor Improvements

Improvements to the Northern Busway as part of the NZ Transport Agency's Northern Corridor Improvements Projects will increase the capacity of Constellation Station. The Constellation station upgrade involves converting it from a terminus station to a through station. This includes the lengthening of the existing busway platform, as well as a new northbound platform with lifts and overpass.

The new Rosedale Station will also reduce pressure on existing stations as it creates the opportunity to divert more local services away from Constellation Station. While this will provide additional capacity in the short term, forecasted patronage growth, and the need for resulting need for additional services will result in stations exceeding capacity within the next decade.

Passenger demands

Updated transport modelling

The demand forecasts on which the North Shore RTN PBC were based came from the ART strategic transport model using the ATAP Common Elements Enhanced version 4 (CEE4) infrastructure scenario and the i11 land-use scenario. Modelling is now available for a newer infrastructure scenario more closely aligned with the updated ATAP programme. A new version of the strategic transport model, known as MSM, has also been developed in 2018. Nevertheless, the primary determinant of forecast transport demand is land use, which remains unchanged.

Modelling of the 2018 ATAP update has only been completed for 2028, and this addendum has analysed updated modelling from the previous iteration, ATAP 1.1. Like ATAP 2018, the ATAP 1.1 scenario includes new harbour crossings in the 2040s, which provide additional capacity for private vehicles and a grade-separated light rail crossing. Despite these changes, there is negligible change in the forecast total public transport demand across the harbour compared to the ATAP CEE4 scenario documented in the North Shore RTN PBC report.

Any additional changes to the transport project assumptions included in the transport modelling – such as updates to the projects included in ATAP – will impact the forecast demand for the North Shore RTN. However, the fundamental land use and transport demands captured in the i11 scenario remain the same as when the North Shore RTN PBC was prepared.

Continued growth in North Shore bus patronage

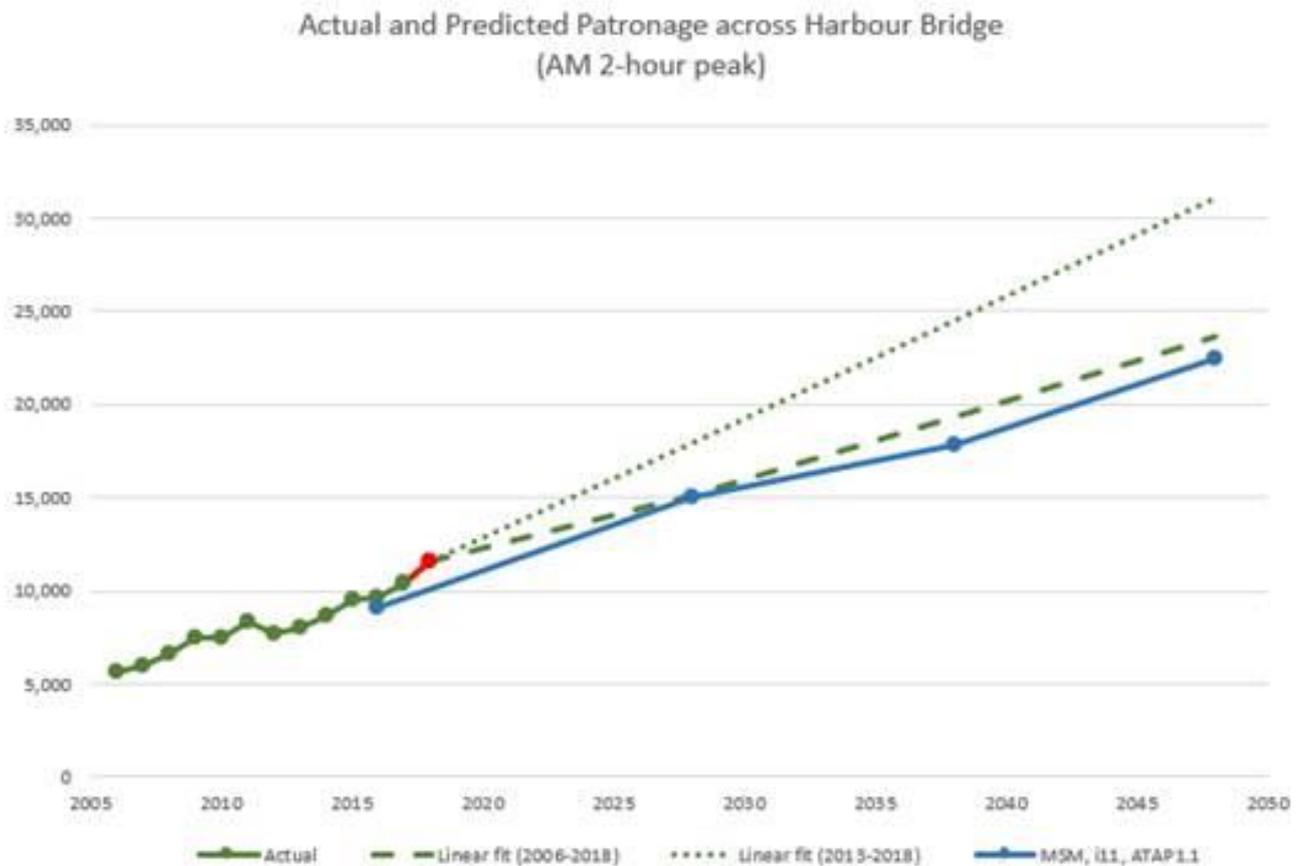
Currently, patronage on buses travelling across the Auckland Harbour Bridge is currently exceeding forecast demands. Passenger numbers has continued to grow strongly throughout 2018, increasing the likelihood that actual demands will continue to exceed forecast demands in the 2020s. Figure 3 shows an update of Figure 20 from the original North Shore RTN PBC report, with the actual demands for 2018 now included in red. The growth in morning peak patronage in 2018 was 1200 (12%) more passengers than in 2017. This shifts the linear projections of demands that might be expected if future growth continues as it has in recent years. If the observed growth rates from the last 6 to 13 years continue, demand for public transport across the Auckland Harbour Bridge could increase to between 24,000 (taking the 13-year trend) and 31,000 (taking the 6-year trend) passengers by 2048.

The MSM modelled demands for 2028 are about the same as is expected based on the average growth rate since 2006, but the modelled demands for 2038 and 2048 are lower than would be expected based on the growth rates since 2006 (see Table 1 below). For example, a linear fit based on the trend since 2006 would result in 1,200 (5%) more trips over the Harbour Bridge in the 2-hour AM peak in 2048 than is predicted in the transport model forecasts (MSM model, i11, ATAP 1.1). This indicates that if the growth rates from the last 13 years continue, the modelled demands would be underestimating the actual demands in future decades.

Table 1: Difference between linear forecasts and MSM, i11, ATAP 1.1 forecasts.

	2028	2038	2048
Linear fit (long term trend, 2006-2018)	50 (0.3%)	1,500 (9%)	1,200 (5%)
Linear fit (short term trend, 2013-2018)	2,800 (19%)	6,700 (38%)	8,600 (38%)

Figure 3: Comparison of trends and projections for public transport patronage across the Auckland Harbour Bridge from MSM model outputs (i11 scenario) and actual screenline counts (AM 2-hour peak) – Updated year shown in red



Comparing North Shore bus patronage and facilities with rail patronage and facilities

The two major components of the rapid transit network (RTN) serving the city centre are the rail lines terminating at Britomart and the Northern Busway. Ticketing data from March 2018¹ estimates that busway services delivers approximately 8,000 people to the city in the AM peak (7am–9am) on a network that is partially shared roadway with limited kerbside facilities. This is more than double the passengers on the Southern Line, which delivers approximately 4,000 people to the city during AM peak on dedicated transit lines to a major interchange station.

In the AM peak, all the train lines terminating at Britomart carry approximately 10,000 passengers to the city. This can be compared to buses southbound over the harbour bridge, which carry an estimated 11,000 passengers during the AM peak in a mix of partially prioritised and shared traffic lanes².

Continued strong growth in patronage on the Northern Express and all North Shore bus services is evident following the PBC’s completion, reinforcing the initial conclusions that significant improvements to operational reliability, capacity and customer experience are required.

¹ Source: MRCagney Transit Stops

² Source: MRCagney Transit Flows

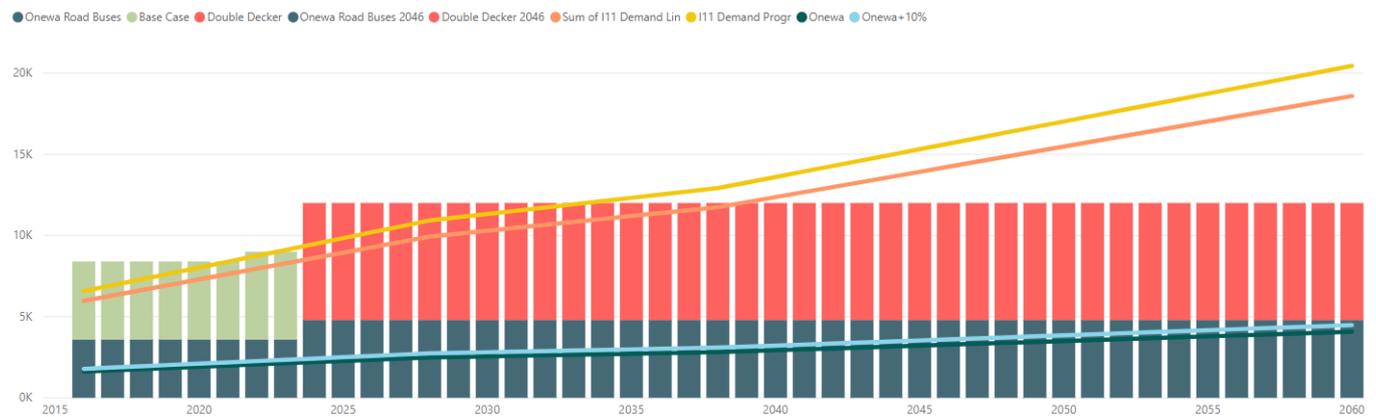
Capacity Assessment

The total demands for public transport across the harbour do not change significantly with ATAP 1.1 compared to the demands that were previously modelled using the ATAP CEE4 scenario.

The demand-capacity charts from the PBC report have been updated here to show the forecast AM peak hour demand from the ATAP 1.1 model (MSM model, i11 land-use scenario). The updated charts show little difference in the timing of required investments and still indicate that the busway will run out of capacity by the mid-2030s.

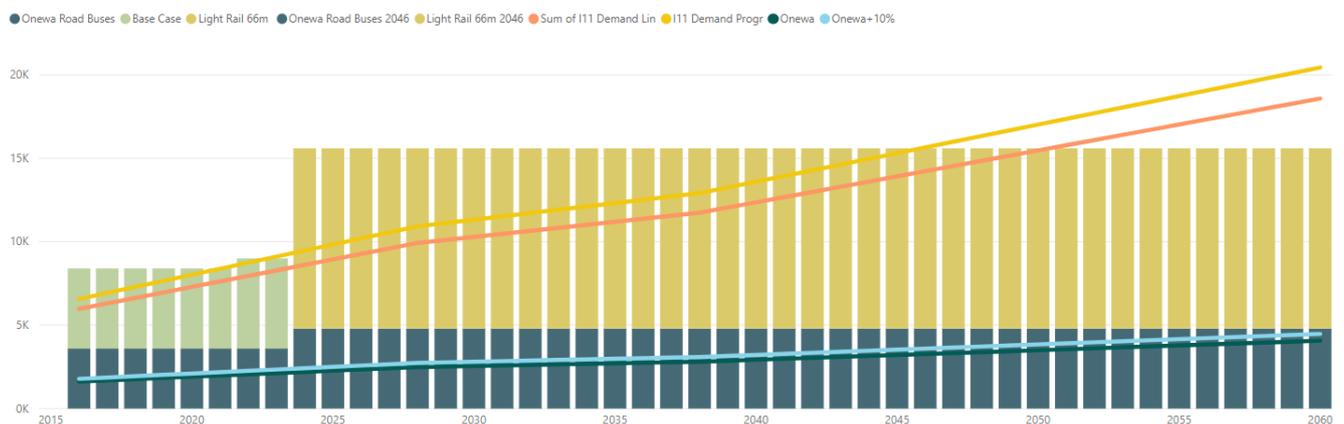
These charts show the total demand and capacity across the harbour from the North Shore to the city centre, made up of the demand and capacity from two corridors: Onewa Road and the RTN corridor (currently the Northern Busway). As in the 2017 PBC, the charts show the i11 demands and an additional, higher “forecast” which is i11 + 10% to reflect the observed pattern of actual patronage exceeding forecast demands outlined in Figure 3 above. The potential capacities of various improvement options are shown in vertical columns. This indicates the time at which forecast demand growth exceeds the capacity of the various improvement options.

Figure 4: Enhanced busway (double decker or advanced bus) demand v capacity (MSM, i11 demands)



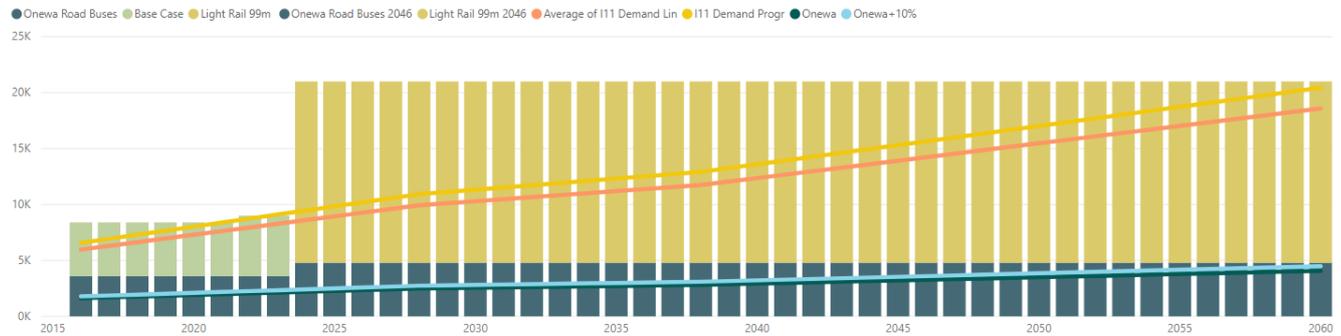
In terms of capacity, an enhanced busway is expected to provide enough capacity until the early to mid-2030s. For context, the enhanced busway can be implemented using double deckers or advanced buses and assumes station upgrades and additional dedicated right of way south of Akoranga, including the Fanshawe Street bus corridor. The two options have a similar capacity outcome but provide different outcomes from a customer experience, reliability and urban environment perspective due to the different City Centre terminal operation and arrangement.

Figure 5: Light rail 66m trams @ 2 min headway demand v capacity (MSM, i11 demands)



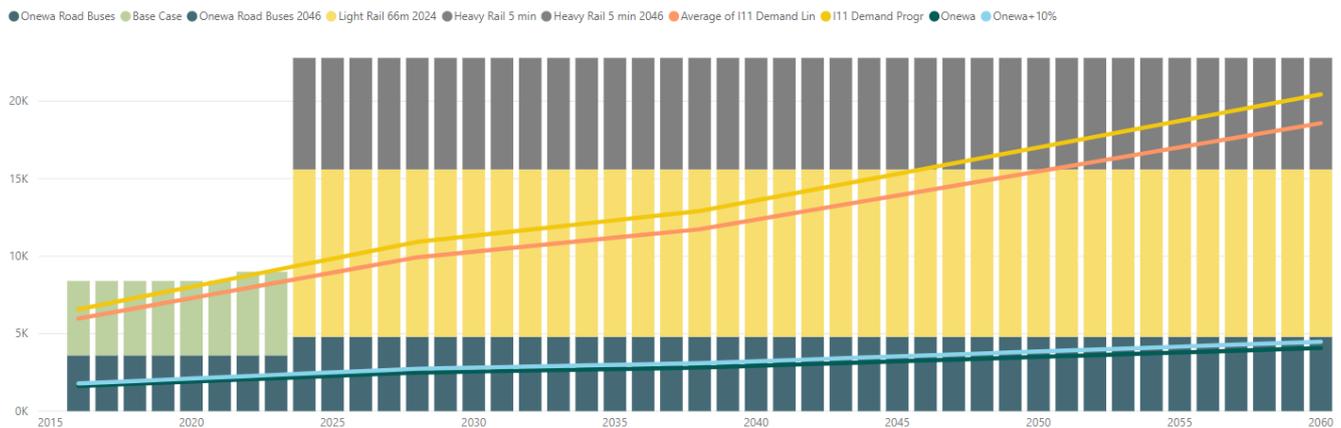
Light rail on its own harbour crossing, using 66m trams at a 2-minute headway, is likely to provide enough capacity for the current demand forecasts, which end at 2048, although by 2048 there is likely to be no additional headroom remaining in this system for growth in demand beyond this time or higher than expected growth rates. However, if demand growth is stronger or occurs earlier than predicted, additional network capacity would be required before 2048.

Figure 6: Light rail 99m trams @ 2 min headway demand v capacity (MSM, i11 demands)



Light rail has also been assessed using a 99m vehicle operating at a 2-minute headway. This option has headroom beyond the forecast period, through to the 2060s based on extrapolated growth forecasts. However, this has some risks in terms of its acceptability in a dense urban on-street context, and there may be operational challenges with integrating this system with current plans for 66m light rail vehicles on the City to Mangere and Northwestern lines.

Figure 7: Heavy rail from north of Albany and light rail demand v capacity (MSM, i11 demands)



Heavy rail has been assessed as an augmentation to the light rail option, assuming 6-car trains at 5-minute headways. Heavy rail can operate at greater lengths and high frequencies enabling significantly greater capacity than the capacity shown, which is aligned with extrapolated forecast growth. This provides significant additional headroom for growth beyond the demand forecast period to 2048. This option would require the consideration of a new harbour crossing (or crossings) that could accommodate both light rail and heavy rail, with the understanding that light rail will be required earlier. Early delivery of heavy rail together with light rail would provide considerably excess capacity relative to currently projected demands and land use patterns, but heavy rail creates significant room for further growth beyond that currently forecast. Heavy rail also opens up opportunities for inter-regional operations and travel patterns that do not exist in the current or planned network.

Figure 8: Recommended Programme - Capacity and Demand Profiles (Light Rail Strategy)

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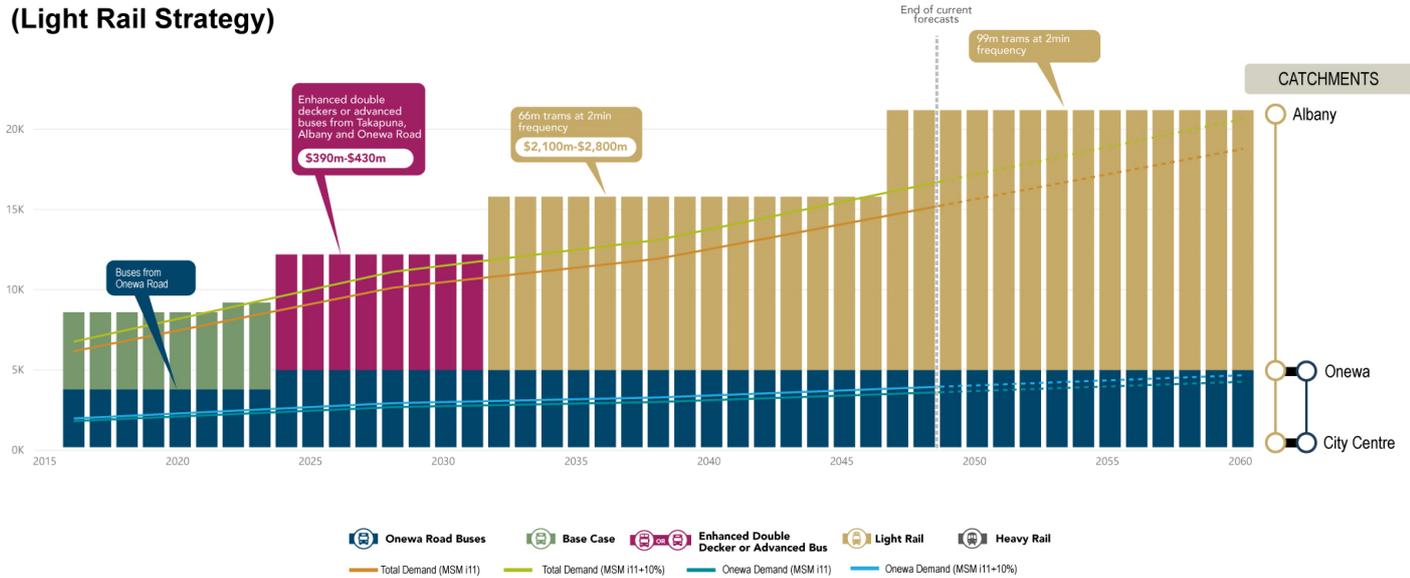
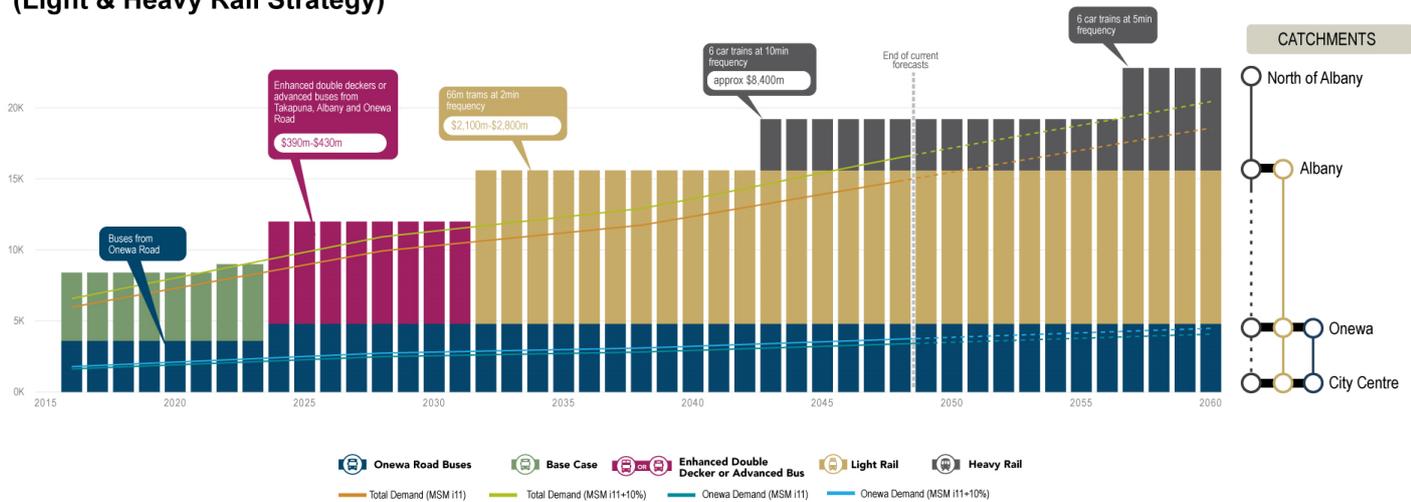


Figure 8 shows a programme of successive busway and LRT improvements as one approach to meeting the growth in passenger demands (noting no change in customer volumes from additional capacity improvements, when the reality is that the implementation of LRT is expected to result in an increase in patronage). The overall patronage demands appear to indicate the need for higher capacity LRT vehicles, additional heavy rail or some other additional RTN capacity in the longer term (or increasingly early if accelerated growth continues). In terms of catchments and future demands, it is important to recognise the relationship of a future North Shore light rail line with the City to Mangere and Northwest light rail corridors, which may influence demands and service patterns.

At, or toward the end of the current forecast period, a decision is likely to be required as to whether longer light rail vehicles are implemented (Figure 8, above), or a heavy rail connection is added (Figure 9, below) to service any additional urban growth beyond that currently envisaged. The approach will be affected by the respective growth of each North Shore catchment and the relative merits and combinations of RTN modes and configurations. The connection to the existing heavy rail network is also a consideration. These issues should be examined in more detail in the I/DBC process.

Figure 9: Recommended Programme - Capacity and Demand Profiles (Light and Heavy Rail Strategy)

Recommended Programme - Capacity and Demand Profiles (Light & Heavy Rail Strategy)



The updated charts reaffirm the PBC’s original conclusions that significant enhancements to the busway are required in the early-mid 2020s to meet forecast demands. By the mid-2030s, a higher capacity mode such as light or heavy rail will be required to meet forecast demands. As indicated in the PBC, the optimal interventions, in mode, alignment and timing therefore need to be investigated further.

Implications of an Onewa Road RTN connection

The PBC indicates that the Onewa Rd catchment appears likely to be best operated as a bus-based system into the future, regardless of other changes to the RTN network on the North Shore. Providing an interchange at Onewa allows for connection with the existing busway and any future higher capacity modes on the RTN corridor, allowing direct local access to the RTN and to destinations within the North Shore, to the City Centre and potentially beyond. It also provides direct walk-up RTN access to Northcote Point and the Onewa Road area.

This interchange would enable more efficient utilisation of routes and vehicles. This can provide operating efficiencies and cost savings, especially for intra-North Shore travel. For example, an Onewa connection has the ability to be a useful anchor point for the smaller routes from Northcote Point/Sylvan Avenue, allowing them to act as feeder routes to the RTN and thus achieving a better use of infrastructure. The Onewa interchange could also provide efficiencies for city-bound buses and potentially reduce congestion on the Harbour Bridge. Buses are currently originating in both Albany and Northcote/Birkenhead to provide parallel service to the City Centre/Ponsonby. Establishing a connection to the Northern Busway at Onewa Road would allow buses to operate at high frequencies at peak times from an Onewa interchange serving both these catchments while improving fleet utilisation efficiencies.

It is anticipated that the provision of an interchange would allow for the option of transfers both to the city and to the wider North Shore, without requiring a transfer.

Review of Recommended Programme timing

The figure below (Figure 41 from the North Shore RTN PBC report) shows the anticipated business case timing for next steps. Based on this timeline, it is clear that work must commence on the I/DBC

process (or equivalent work) as soon as possible to ensure that planning is in place to meet the trigger points highlighted in the PBC where demand on the network will exceed capacity.

Stage 1: The PBC recommended that the DBC for the enhanced busway options be completed in 2018 with implementation anticipated in late 2020's. New data indicates that these enhancements may be even more urgent which means that progression of the business case process is critical

Stage 2: The PBC recommended that the DBC for light rail/heavy rail investigations commence in 2020 with a view to implementation in the mid-2030s.

No changes or new information since 2017 has changed the underlying programme phases and need, however the process for investigation may require some update with a view to integration with the AWHC project, given the refreshed direction provided within the latest ATAP.

Figure 10: Recommended Programme Timing

