Auckland Central Access Plan

Auckland Transport

22 March 2016

VERSION V6

Programme Business Case

NZ TRANSPORT AGENCY WAKA KOTAHI

New Zealand Government

Contents

Auckland Central Access Programme Business Case

Executive summary

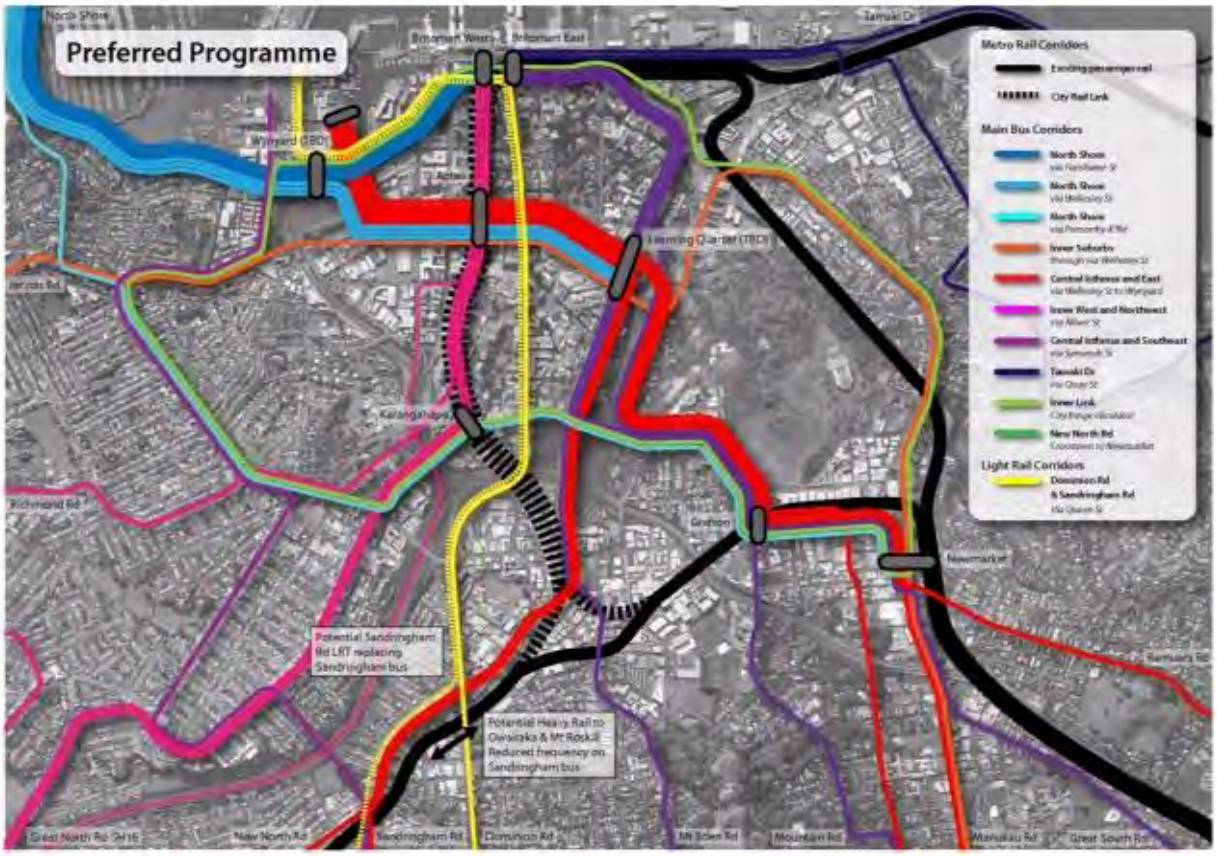
Recommendations

a) That this *Auckland Central Access Programme Business Case* (PBC) be supported with a preferred programme described as the Integrated Programme (IP), comprising:

1. Optimisation of the current plans for the New Network[1] of central Auckland public transport services including maximum introduction of higher capacity buses and reallocation of bus services to make better use of available capacity
2. Taking all possible measures to improve the efficiency of the bus network – for example off-board ticket checking and further commitment to bus priority measures
3. Commitment to fast tracking/bringing forward existing public transport (PT) programme
4. Further support to enable active modes (walking and cycling) within and accessing the Auckland City Centre, as well as investigation and use of further practical demand management tools (eg parking management)
5. Refine/develop higher capacity rapid transit programme that can use can use Queen Street and Dominion Road while enhancing the urban amenity – expected to be light rail
6. Assessing and as appropriate including a possible second high capacity line on Sandringham Road and / or a metro rail spur from the Western Line to Mt Roskill.

b) It is proposed that linked Indicative Business Cases (IBC) are developed for principal components of the IP:
   - Demand management – walking and cycling, parking management
   - PT infrastructure / asset investment – high capacity PT modes

[1] The New Network was designed to provide a clear hierarchy of routes with frequent, all-day services providing access to as much of the city as possible, connector services providing additional passenger links, and coverage services ensuring the maximum number of Auckland residents have access to the network.



The Problems

The PBC has confirmed the problems as identified in the Strategic Case as being valid, critical and urgent:

- Problem one: Inability to meet current and projected transport demand on key corridors will sustain unreliable travel and poor access to productive central city jobs
- Problem two: Blockages and delays in central bus services worsen travel times and customer experience for those using public transport
- Problem three: High and increasing traffic volumes on residential and inner city streets create adverse urban amenity and environmental effects.

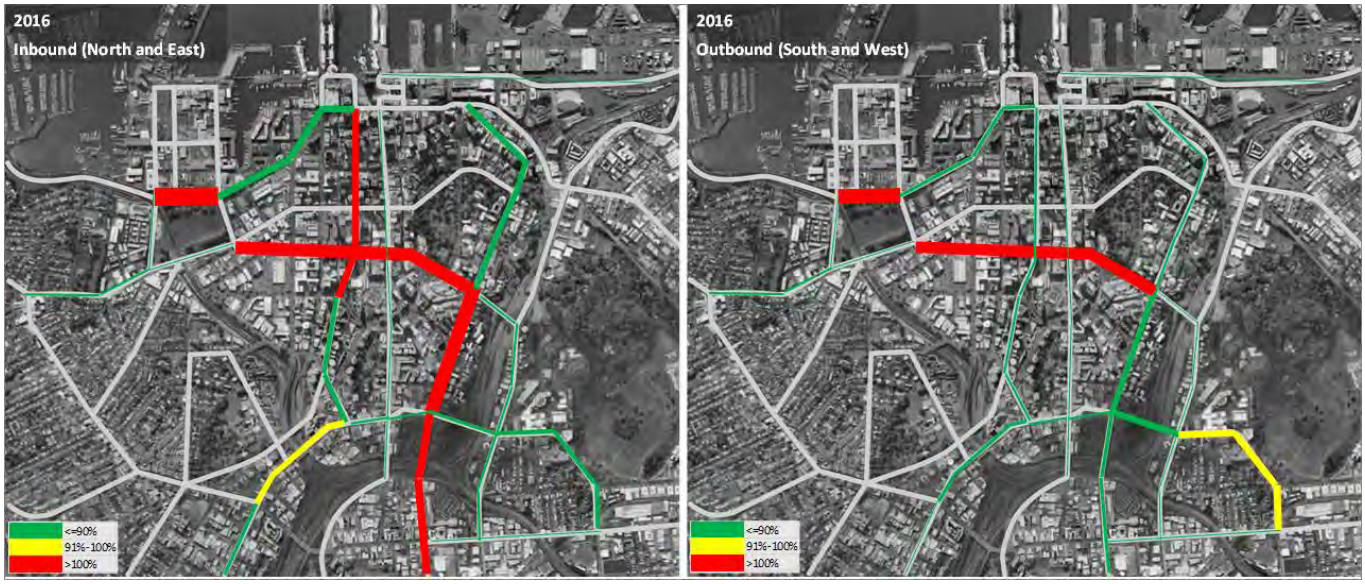
The further evidence from detailed analysis for the PBC has shown that access to Auckland's City Centre in the next few years, is reaching a critical point where recent and committed actions will not be sufficient to provide the necessary capacity for effective access to New Zealand's most important economic location. The high level of population growth is driving rapidly mounting demand that has for 15 years been accommodated on public transport and must continue to be, as there is no realistic way to expand road capacity. Without investment, the proportion of Auckland's workers able to access the City Centre within acceptable time frames will reduce as congestion grows.[2]

There is already a substantial problem now with buses frequently late and full, resulting in passengers being left behind. Projects and initiatives such as the City Rail Link (CRL) and the New Network, largely with double-decker buses, will provide substantial additional capacity, but the underlying growth in projected demand is so great that most bus routes and the associated terminals and bus stops will have reached capacity by the early 2020s. The stress on the system at that time will be such that only the introduction of a mode that can move more people in fewer vehicles and that can use the sole under-used City Centre corridor – Queen Street – will provide more than very marginal relief. While measures to optimise the use of the bus services and reduce demand through promoting active travel are integral components of the proposed programme, they only 'buy time' before the extra corridor must be brought into use with a higher capacity mode. They will help to make conditions more tolerable as demand continues to grow and before a step-change can be introduced.

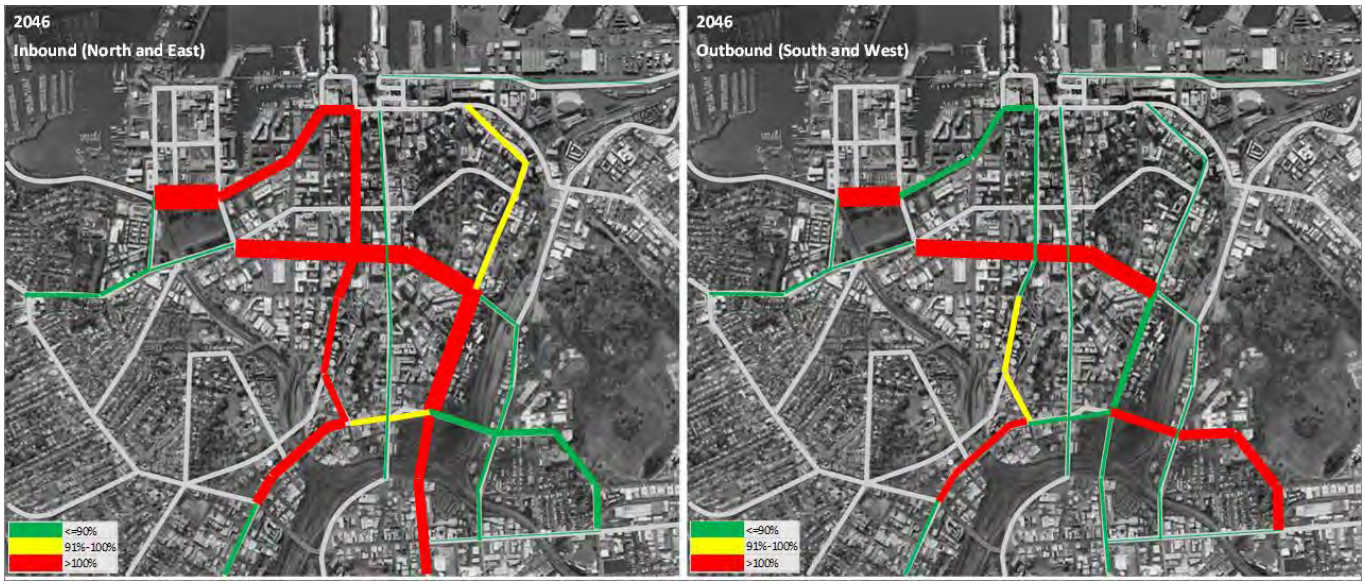
[2] Sections 5 and 7 provide the supporting evidence in relation to the problems

The problems are demonstrated in the graphs below. They use capacity on two critical links – Symonds Street and Wellesley Street - as a direct representation of Problem 1, inability to meet demand on a key corridor, and as a proxy for Problems 2 and 3 relating to poor customer service and the additional traffic that there will be as public transport fails to keep pace with demand. The source analysis – the AT Stage Timing Model – is explained in Section 5.3.

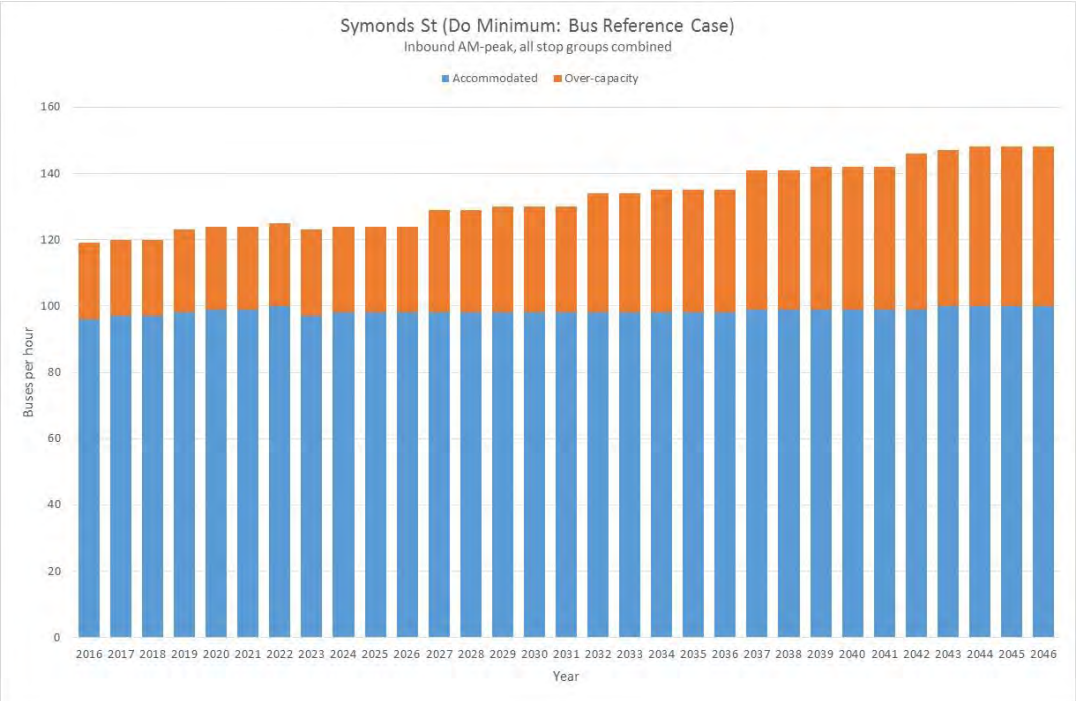
The diagrams below show how under-capacity on Auckland's City Centre public transport corridors is likely to increase in the absence of significant interventions. As can be seen there is significant under-capacity of provision against demand in 2016, particularly on Wellesley and Symonds streets.



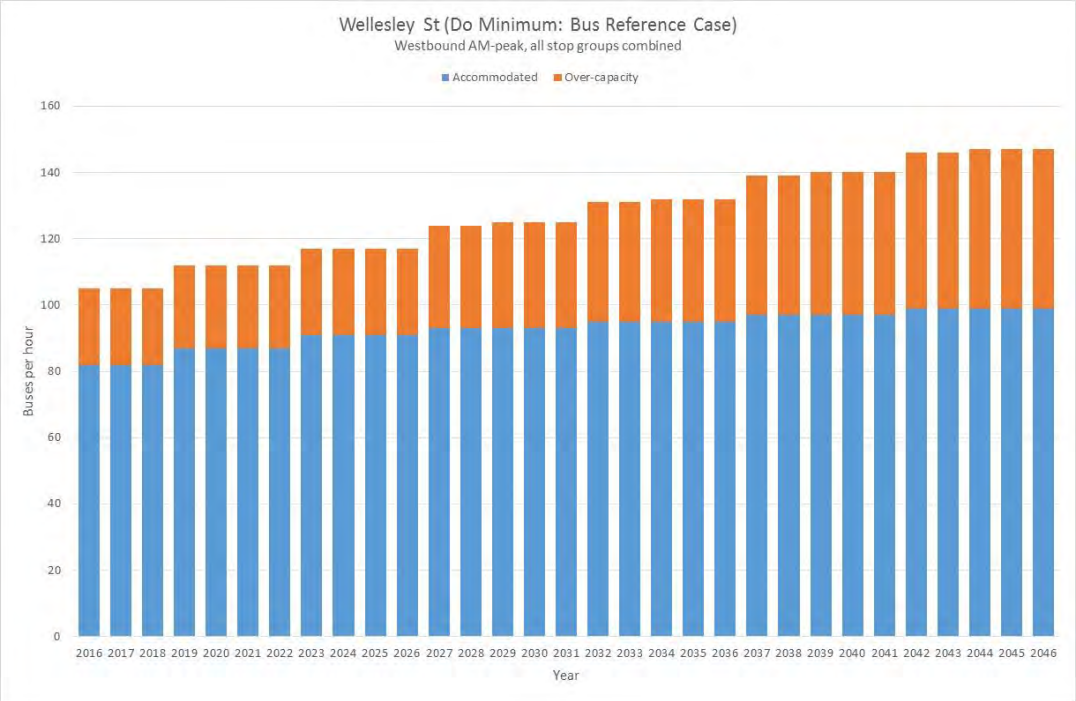
By 2046 the problem is expected to be extreme:



An alternative way to envisage the issue is shown in the next graphs which show Symonds Street inbound and Wellesley Street westbound. Over time the shortfall in bus capacity rises from 23 buses per hour to 48.



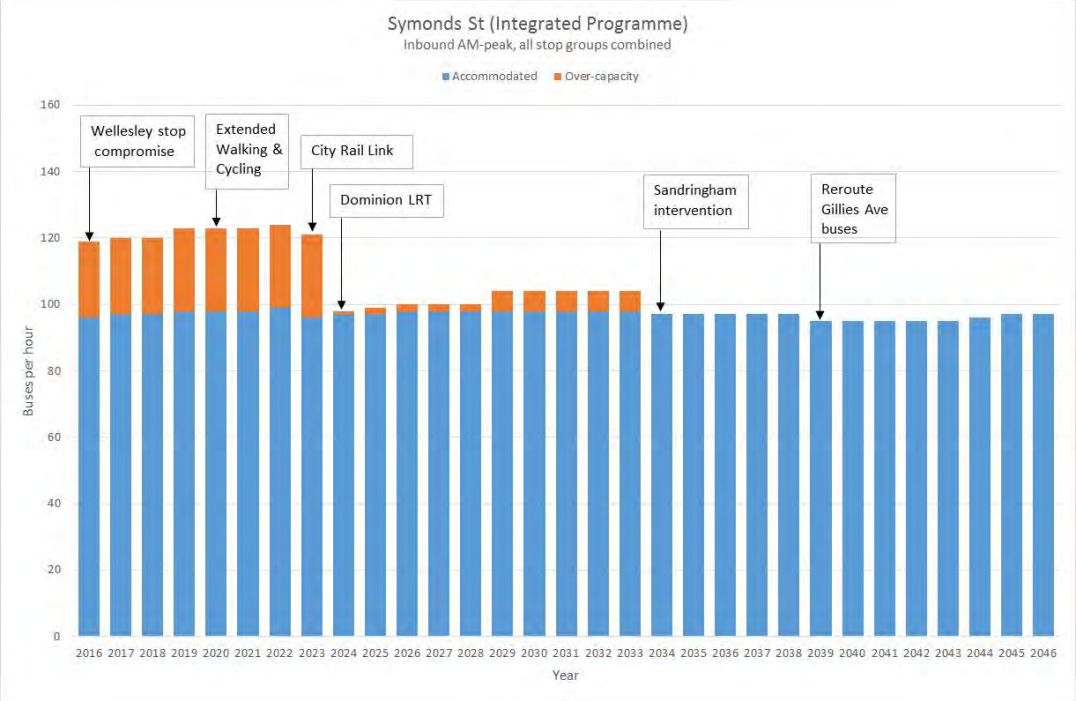
This represents about 3000 passengers per hour who cannot be accommodated, just on these services.

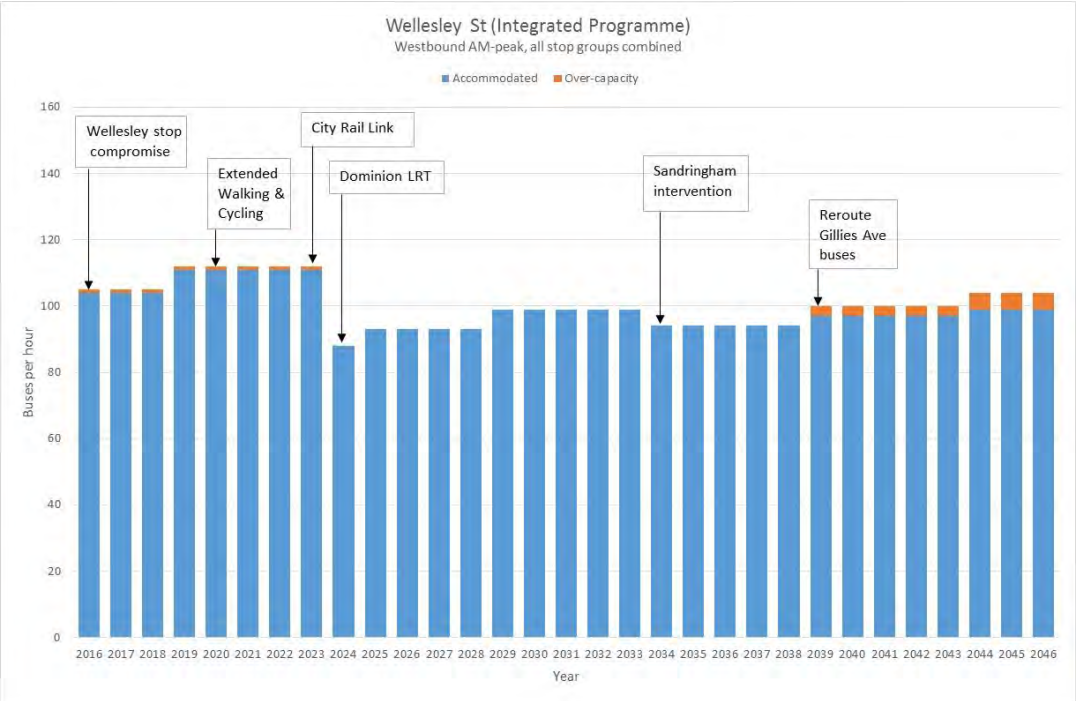


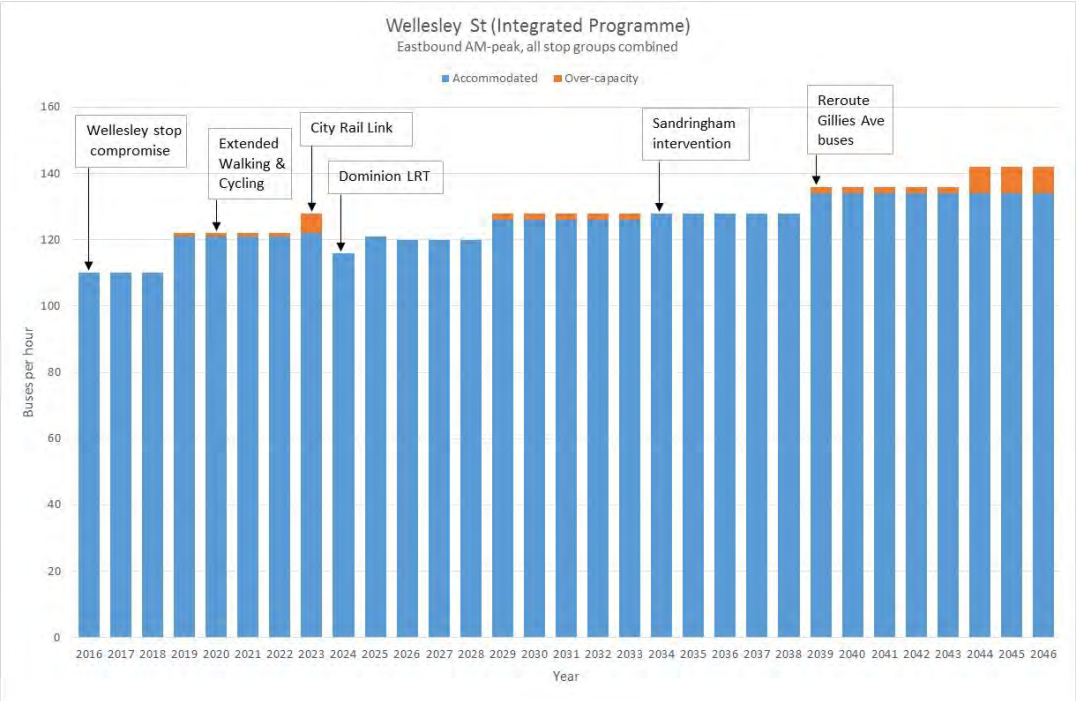
The graphs show the scale of unmet demand – largely workers who will be unable to reach City Centre jobs - without an investment such as the IP. The full IP includes the light rail service on Queen Street and Dominion Road, where the capacity can be increased over time and which allows more buses to use Symonds Street from Manukau Road and Mt Eden Road as other services have been replaced by light rail.

On the same basis the next diagrams show the effect of the IP at the same locations. It can be seen that there is significant over-capacity in the early 2020s which is prevented from rising by pragmatic measures initially then the active modes programme and CRL. It is only after the Dominion Road LRT service is introduced, assumed in 2024 that there is again a reasonable balance between capacity and demand. Moderate under-capacity returns in the 2030s until a further intervention – in this case assumed to be the Sandringham LRT is introduced. Only in the final years does the IP again show signs of needing a further intervention (to address Wellesley Street).

As discussed, given forecasting uncertainties it is not considered appropriate for the IP to include specific plans to address this shortfall – but they should not be precluded.







It can be seen that even the full IP does not quite meet the demand level in 2046, but because of the uncertainties associated with forecasting for 30 years no measures are included in the IP to address that shortfall. The ATAP Foundation Report at pp. 17 and 23 reinforces the uncertainty relating to longer-term forecasting.

Benefits

The recommended IP was established against a set of measures that represent the benefits sought in the Strategic Case:

- Benefit one: Auckland's prosperity and growth are enabled
- Benefit two: City Centre is attractive, vibrant, healthy and safe
- Benefit three: More efficient and cost effective network and services.

The IP has been identified as the combination of interventions most likely to generate the benefits while being affordable and representing value-for-money. Multiple options with different combinations of public transport operations, demand management and investment in new infrastructure were assessed with an integrated programme combining elements of the options emerging as the preferred option to take forward. Benefit one is achieved by ensuring access to New Zealand's most important economic hub – the Auckland City Centre. It opens up an additional public transport corridor and therefore provides sufficient capacity for the growing transport demand. Benefit two similarly requires the efficient access but also a transport system that enhances rather than detracts from the urban amenity. The recommended programme does so with better links for cyclists and pedestrians to and within the City Centre as well as allowing sufficient capacity on the public transport system. It also does not require large areas of highly valuable City Centre land to be devoted to additional public transport terminals, nor very high costs for underground facilities. Benefit three will be delivered through better use of the available transport corridors, further optimising the bus network and, potentially taking advantage of the extra metro rail capacity offered following the CRL.[3]

Implementation

The recommendations noted above (1 and 2) to optimise the public transport network should be established as part of Auckland Transport's 'business-as-usual' with the support of the Transport Agency. Changes to double-decker buses can be achieved through the PTOM contracts. Stronger enforcement of bus lanes and preventing loading/unloading should be part of AT's standard operations.

[3] Section 12 provide the supporting evidence in relation to the benefits of the IP

Separate but linked business cases will be needed for the active modes / demand management programme and for the infrastructure investments.

The IBC for the main infrastructure elements of the IP should confirm the extent and timing of the first light rail corridor – though the analysis suggests it should be in use as soon as possible – and the need and timing of the complementary elements of the IP – either the rail spur or a Sandringham Road LRT line. It should also reconfirm that there is no alternative technology or mode that can use the available Queen Street corridor providing the capacity required, that is compatible with the urban amenity imperatives, has acceptable terminal requirements and is affordable. Both AT and the Transport Agency have independent reviews underway that should deal with this aspect of the IBC.

The indicative capital costs range of these investments over and above those recommended to be part of AT's business-as-usual, is $1.9b - $2.2b in 2016 dollars over a 30 year period, the large majority to be incurred in the next decade and the balance for the rail spur or Sandringham Road LRT line to follow. More detailed modelling using more granular models will need to be used to confirm the timings.

The linked IBCs will need to confirm that the proposed programme is robust, provides sufficient flexibility against different scenarios, for example land use patterns, or proven and emerging technologies, and also needs to further develop the economic, commercial and financial cases.

AT is likely to seek financial support from the Transport Agency for the linked IBCs. Based on recent experience their direct costs are likely to be of the order of $500,000 - $600,000 each.

Options unlikely to be worth pursuing immediately

This PBC shows that a second light rail service pattern using Symonds Street, Manukau Road and Mt Eden Road may be required towards the very end of the 30 year period. Allowance has not been made for this service pattern in the IP owing to the level of uncertainty in forecasting so far out as noted in ATAP. The PBC has also shown that there is no known bus-based option that resolves the identified problems, provides the required benefits and is affordable.

Stakeholders

The PBC has been produced in partnership by Auckland Transport, Auckland Council and the New Zealand Transport Agency using standard Transport Agency methodologies. The IP is well-aligned with the adopted strategies of each. It also supports the Government Policy Statement aim: "to drive improved performance from the land transport system by focusing on economic growth and productivity" including: "targeted infrastructure improvements that improve transfers across the network and address emerging bus capacity constraints in central Auckland, Wellington and Christchurch".

The IP is likely to support the ATAP[4] objectives given the alignment between the objectives and the benefits sought from the IP:

(i) To support economic growth and increased productivity by ensuring access to employment/labour improves [relative to current levels] as Auckland's population grows

(ii) To improve congestion results [relative to predicted results], in particular travel time and reliability, in the peak period and to ensure congestion does not become widespread during working hours

(iii) To improve public transport's mode share [relative to predicted results], where it will address congestion

(iv) To ensure any increases in the financial costs of using the transport system deliver net benefits to users of the system.

[4] Auckland Transport Alignment Project - The joint project involving Auckland Council, the Ministry of Transport, Auckland Transport, the NZ Transport Agency, the Treasury and the State Services Commission, to identify a preferred approach for developing Auckland's transport system over the next 30 years.

PART 1 – THE STRATEGIC CASE

1 Introduction

This Auckland Central Access Plan (CAP) programme business case (PBC) recommends further investigation of a series of linked interventions that together should address the problems identified in the Strategic Case and, in combination, improve access to the Auckland City Centre over the next 30 years. Improved access is vital for ensuring economic prosperity through enabling more workers to be employed in New Zealand's most productive location and by having a level of amenity that underpins economic success.

The CAP has been developed jointly by Auckland Transport (AT), the New Zealand Transport Agency (the Transport Agency) and Auckland Council (Council).

The recommended intervention programme follows the Transport Agency hierarchy of:

- Identifying opportunities to manage traffic growth to utilise the network more efficiently and provide appropriate mode choice
- Then optimising the use of the existing network through road marking, signage, phasing of signals, ramp metering, etc.
- And finally, considering investment in new infrastructure, matching the levels of service provided against affordability and realistic need.

The IP comprises:

1. Optimisation of the current plans for the New Network of central Auckland public transport services including maximum introduction of higher capacity buses and reallocation of bus services to make better use of available capacity
2. Taking all possible measures to improve the efficiency of the bus network – for example off-board ticket checking and further commitment to bus priority measures
3. Commitment to fast tracking/bringing forward existing public transport (PT) programme
4. Further support to enable active modes (walking and cycling) within and accessing the Auckland City Centre, as well as investigation and use of further practical demand management tools (eg parking management)
5. Refine/develop higher capacity rapid transit programme that can use can use Queen Street and Dominion Road while enhancing the urban amenity – expected to be light rail
6. Assessing and as appropriate including a possible second high capacity line on Sandringham Road and / or a metro rail spur from the Western Line to Mt Roskill.

1.1 Purpose

This CAP PBC further develops the strategic context presented in the CAP Strategic Case for the investment proposal and the case for change.

In doing so the PBC:

- Revisits the strategic context and indicative assessment profile for the proposed investment
- Re-examines the evidence base for the problems and the rationale for investing
- Demonstrates how the potential benefits of investing have been assessed against SMART transport KPIs (which would then be used to monitor the achievement of the benefits)
- Presents the range of interventions tested, their grouping into potential programmes and the recommended composite programme to achieve the outcomes and benefits identified in the Strategic Case.

2 The Strategic Context

2.1 The Problems

The problems identified in the Investment Logic Map (ILM) as set out in the Strategic Case are:

- Problem one: Inability to meet current and projected transport demand on key corridors will sustain unreliable travel and poor access to productive central city jobs.
- Problem two: Blockages and delays in central bus services worsen travel times and customer experience for those using public transport
- Problem three: High & increasing traffic volumes on residential and inner city streets create adverse urban amenity and environmental effects.

Resolving issues of blockages and delay into the City Centre is important to both central and local government. The current value of the Auckland economy to the national economy is $81.2billion (2014). This amounts to 35.3% of the national GDP. 17% of the Auckland's GDP is generated from the City Centre. This amounts to $13.8billion. By 2041 it is estimated that Auckland City Centre could account for 25% - 30% of Auckland's GDP. Auckland is New Zealand's commercial capital; home to more than 60% of the top 200 companies.

This economic imperative is further compounded by a projected inability to meet current and future transport demand on key corridors. Statistics' projections indicate that 60% of national population growth over the next 30 years will occur in Auckland. 40% of New Zealand's population will reside in Auckland by 2046. Of this growth 54,000 of people will live within the City Centre and 135,000 will live within the central area including the City Centre, fringe and Newmarket. The City Centre is an employment hub for 84,000 people with likely growth taking it to 156,000 in 2046 (226,000 in the wider central area). It is an education centre with 68,000 students and the potential to grow to 83,000 by 2046. Auckland is New Zealand's largest tourist destination with 2.9m international guest nights in 2013, most of which would have been spent in the City Centre. An increase of 50% just by 2021 is expected. Enabling all these people to easily access employment, education, cultural and recreational opportunities is both an existing and future problem that merits further attention. As shown in **Figure 1** from the ATAP Foundation Report, there will be a growing imbalance between the location of jobs and people – adding to the pressure on the transport system, especially to the City Centre

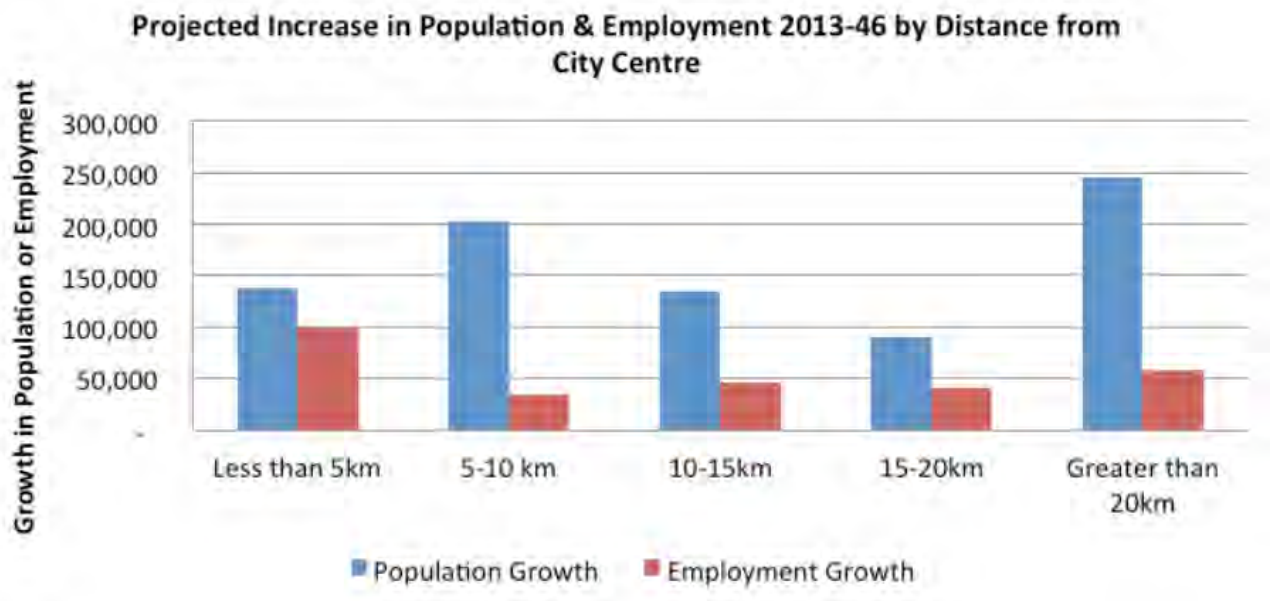


Figure 1 Population and employment increase

The third problem is amenity focused, which might be perceived as being most strongly aligned to Council aspirations for liveability, quality urban form, and transformational change. Council wants to ensure the look and feel of the City Centre is not undermined by increasing traffic volumes on residential and inner city streets. Addressing this problem, however, is also strongly in the interests of Government as well. The future economic success and vibrancy of the City Centre is integrally connected to the way in which the City Centre functions and

feels. It is not possible to achieve economic success without the city being an attractive place to work, live and play. This problem is interdependent with the efficiency and quality problems.

Additionally, addressing issues of safety, health and environmental opportunities is of relevance to key stakeholders due to the fact that improvements in air quality, $C0_2$ emissions, and safety will contribute to better health outcomes, and also reduced costs.

There is limited realistic ability to increase access to the City Centre by private vehicle with statistics over the last fifteen years showing that all additional movement in and out of the City Centre has been by public transport and active modes. The Auckland bus network is already under pressure as it approaches and passes through the City Centre, shown through an inability to meet scheduled arrival times and significant variability in travel times. Routes are experiencing over-crowding with crush loadings occurring resulting in passengers being passed by as is being increasingly commented on in the press[5].

There is some limited ability to provide additional services but they will soon also be at capacity themselves. The rail network too has been experiencing very rapid patronage increases averaging 18% year-on-year since the opening of the Britomart Transport Centre. There is a strong likelihood that capacity at Britomart will be exceeded before the City Rail Link (CRL) will be opened in 2023.

The existing problems will be compounded by Auckland's very rapid population growth with a likelihood that the population will increase from around 1.5 million people to 2.2 - 2.5 million over the next 30 years.

An Auckland CAP is required to address the significant existing and future deficiencies in Auckland's central transport network. It is needed to address the multiple transport challenges and to prevent an unnecessary and potentially damaging limitation of Auckland's economic productivity. The CAP will need to build on recent projects and investment commitments such as Britomart Transport Centre and the CRL.

The CAP is deliberately focused on the Auckland City Centre and corridors that directly feed into it, mainly from the central isthmus, as analysis has shown that the most critical corridors are those from the south converging on Symonds Street. Other major corridors accessing the City Centre from the North and Northwest and the rail network are being addressed by AT and the Transport Agency through separate planning processes and current projects including the CRL.

2.1.1 The Auckland Transport context

To understand fully the problems and the need for the CAP, it is essential to comprehend the scale of change in public transport demand against the change in provision over the last 25 years.

Following the deregulation of public transport in 1991, Auckland's public transport patronage hit its nadir with just 32 million trips recorded in 1994. In the mid-1990s, the City Centre was characterised by declining employment numbers, increasing office vacancy rates and a surfeit of cheap surface parking lots with all day parking costing $4 or less. The flood of Japanese second-hand imported cars was underway and the City Centre was considered to be in decline.

In 2016, the situation is completely different. The City Centre has strongly growing employee, resident and student numbers, low office vacancy rates, a dynamic resurgent retail and hospitality sector, triple the public transport patronage of 1994, and all-day parking costing $24 per day in Auckland Transport parking buildings. Surface parking lots have largely disappeared with the few remaining slated for redevelopment in the next few years.

The triplication of public transport patronage can be split up into several time periods:

- *1994 - 1996* – the first post-deregulation public transport network review starting the long process of simplifying an extremely complex bus network.
- *1997 - 2002* – the first strong signs of revival in public transport with the launch of the Link bus in 1997 and peak period bus lanes in Dominion Road and Mt Eden Road in 1998 and Sandringham Road in 1999. By way of example, bus patronage on Dominion Road increased by 20% year-on-year for the four years after the implementation of peak-period bus lanes. Ferry services were introduced to Bayswater, Birkenhead, Northcote Point and Half Moon Bay.
- *2003 - 2005* – The return of passenger rail to Auckland City Centre in 2003, after an absence of 73 years, set the stage for the revival of urban rail which had been surviving with ex-Perth DMUs keeping the system going in the meantime. Peak alighting at Britomart was 9,660 in 2016 compared to just 340 at the former

[5] http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11598301, http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11606776

Auckland Station in 1994, an increase of 2,700%. This was followed by a range of service improvements including an expanded span of rail operation, station upgrades and evening and Sunday train service. The Northern Express spine service was introduced in 2005 with the opening of Constellation and Albany stations. New bus lanes were provided on Albert Street.

- *2006 - 2010* – The bulk of the core rail network upgrade projects were delivered during this period including double-tracking the Western Line, the New Lynn rail trench, the reopening of the Onehunga Branch Line, Newmarket Station and junction upgrade and numerous other station upgrades and relocations. Rail service frequency, capacity and span of service were further expanded. The full Northern Busway was opened in 2008 including a complete redesign of North Shore bus services and the Central Connector project, providing extensive bus priority between Britomart and Grafton Station, opened in 2010.
- *2011 - 2015* – The final stage of the core rail network was delivered with the opening of the Manukau Branch Line and station in 2012. Integrated ticketing was implemented in 2014 and electric trains were rolled out on the rail network during 2014 and 2015. The year following the electric train roll-out saw over a 20% increase in rail patronage. The bus priority network was progressively expanded, the Northern Express was extended to Silverdale and a redesigned bus network in Green Bay/ Titirangi achieved 35% year-on-year patronage growth. New ferry service introduced to Hobsonville Point and Beach Haven and ferry services to Gulf Harbour, Pine Harbour and other locations were improved.
- *2016 - 2018* – 2016 will see 56 double-decker buses in service on high-patronage City Centre routes. Integrated fares will be implemented in July 2016. The first major implementation of the completely transformed New Network for buses, tightly integrated with rail, will be delivered in October 2016 with the remainder of the network implemented during 2017 and early 2018. 75% of public transport journeys now use the pre-pay AT HOP card. Seniors will be fully migrated on to the AT HOP card mid-2016 and integrated fares will increase the pre-pay discount to 33% to further encourage pre-pay. This significantly reduces bus dwell times and increases bus operating speeds which improves the attractiveness of bus as a mode and hence patronage.

All of these improvements have delivered improved access to the City Centre without any increase in peak car trips over the last 15 years. However, they are hitting a wall of simple geometry - the amount of kerbside space available for bus stops, staging areas and lay-up together with the presence of short blocks, particularly in the east west direction, and traffic signals up to every 50 metres in the City Centre which limits the length and capacity of bus stops and the throughput of buses. While there is an extensive network of largely 24-hour bus lanes in the City Centre, kerbside bus stop capacity is less than what existed up to 2001 when the Britomart Bus Terminal was demolished to create the Britomart Transport Centre.

3 Organisational Context

3.1 Organisational Overview

Central Government, Auckland Council, Auckland Transport and the Transport Agency are mandated by the Land Transport Management Act with its "purpose to contribute to an effective, efficient, and safe land transport system in the public interest."

Government provides direction by way of a Government Policy Statement on Transport to the Transport Agency, Council and AT. The 2015-2018 GPS[6] sets out an overall strategic direction and direction for the National Land Transport Fund, which is to drive improved performance from the land transport system by focusing on economic growth and productivity, road safety and value for money. The Government's aspirations for Auckland City Centre are made explicit as the GPS identifies that it wants to invest in:

"A land transport system that addresses current and future demand for access to economic and social opportunities:

Well used and configured public transport can increase network productivity on key corridors at peak periods when they are under the most pressure. For example, while constraints on Auckland rail capacity are not expected in the next decade, as a result of the significant additional capacity on new electric trains[7], bus congestion in the Auckland central business district is expected to emerge as patronage grows and additional services are provided[8]."

The Transport Agency is the Crown Entity which is responsible for fulfilling the expectations of government as expressed in the GPS. It allocates the NLTF to activities which will give effect to the GPS. It expresses how it will do this by way of a 2015 Statement of Performance Expectations and has a number of goals of relevance to CAP, namely the need to:

- Integrate land uses and transport networks to shape demand at national, regional and local levels
- Integrate national and local transport networks to support strategic connections and travel choice

An Investment Assessment Framework is where the Transport Agency prioritises those activities which make a significant contribution to the aspirations of Government. The scale of central Auckland issues are such that the Transport Agency is highly motivated to address them given their national significance as set out in the GPS and participates as a critical stakeholder.

Auckland Council is the statutory planning authority for Auckland. It is responsible for the statutory Auckland Plan 2012, which outlines overall objectives and funds Auckland Transport to give effect to it. The following statements are particularly relevant to the City Centre**:**

- Quality Compact Auckland Goal: focussing growth around town centres, corridors and suburban areas contiguous to town centres. The development areas have good transport access leveraging off past and future investment in Auckland's rapid transport network (RTN) and around metro rail stations
- Development Strategy (urban core): the development strategy is designed to focus new development around the current and planned future RTN and horizontal infrastructure provision, with urban intensification around metropolitan centres, town centres and corridors.
- Key structural Shapers and Enablers: Critical infrastructure, integration of land use and transport, blue and green networks and the principal economic gateways of the ports and airport.
- Two Big Initiatives: transformational change to the City Centre to create a global city and destination of international significance; and the southern initiative that concentrates on addressing social needs.
- Working and Delivering with Others: achieving the objectives of the Plan through collaboration and commitment to transformational shifts and strategic directions. These goals are given life in a Long Term Plan produced under the local government act 2003 which identifies policies and investment plans for the next 10 year plans as well as the Unitary Plan (the PAUP9 at present) under the Resource Management Act 1991, which outlines the rules by which it will give effect to these aspirations. It collects rates and

[6] Government Policy Statement on Land Transport 2015/16 – 2024/25, December 2014
[7] Recent very rapid patronage growth on the rail network would test this comment
[8] Emphasis added
[9] Proposed Auckland Unitary Plan

user charges which are used to fund local government services including roads and public transport services.

The City Centre Masterplan[10] (CCMP) is a non-statutory document that expands on the Auckland Plan. It sets out the Council's goals for the City Centre as a globally significant centre for business, the Engine Room of the Auckland economy with a vibrant and vital retail and commercial core. It specifies targets relating to commercial occupancy rates and an increase in the number of top 200 business head offices.

The CCMP also includes policies relating to increasing urban living and ensuring that major cultural institutions of quality are located in the City Centre to provide professional and international cultural events. The City Centre is seen as becoming the hub of an integrated regional transport system with a range of public transport options.

Enhanced public transport is specified as a vital enabler of the CCMP's aspirations for the City Centre to enable easy access to its employment opportunities and other offerings.

The Waterfront Plan[11] envisages that over the next 30 years Auckland's waterfront redevelopment will directly and indirectly contribute to a total of 40,000 jobs for Auckland. A goal for the waterfront is to be a place that is "highly accessible, easy to get to and to move around in, where people feel connected to the wider city and beyond by improved pedestrian and cycling linkages, fast, frequent and low-impact passenger transport".

The CCMP and Waterfront Plan help drive the process to transform the City Centre.

AT is the strategic transport planning authority for Auckland. AT is responsible for giving effect to the Auckland Plan. It does so in two key statutory documents. The first of which is the Regional Land Transport Plan (RLTP)[12] which identifies AT's approach to investment and lists all future transport investments in the Auckland region. This includes State Highway activities, local roads, public transport services and infrastructure, maintenance and renewals, walking and cycling and investment management activities over a ten year period.

The second significant strategic document is the Regional Passenger Transport Plan which outlines an approach to public transport over a three year period. This includes policies that relate to fare box recovery and concessions.

AT has multiple initiatives underway with the support of its partners as shown below in **Figure 2**. This CAP is focussed on the City Centre and its connections from the isthmus.

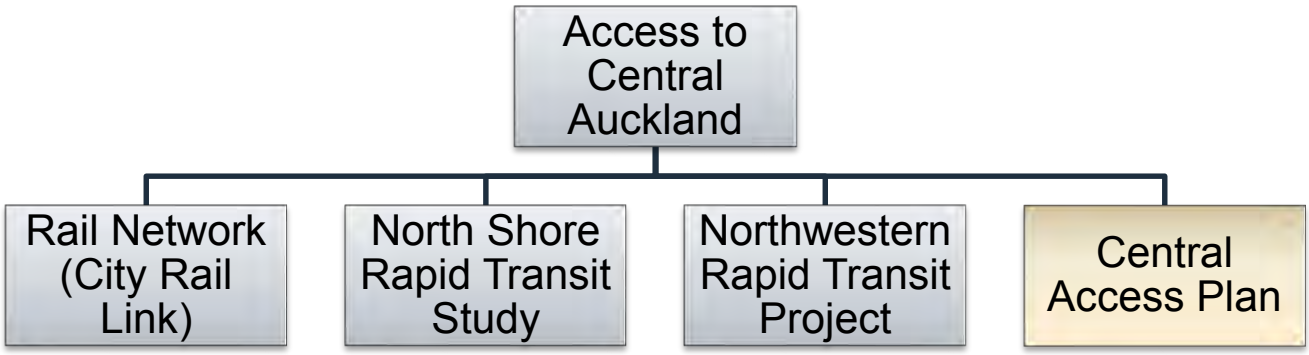


Figure 2 Central Auckland access initiatives

[10] City Centre Masterplan, Auckland Council, 2012
[11] The Waterfront Plan, Waterfront Auckland, June 2012
[12] Auckland RLTP 2015-25, Auckland Transport, July 2015

4 Organisational Outcomes, Impacts and Objectives

Whilst the three partnering organisations have differing statutory roles and functions their objectives in terms of access to central Auckland are broadly aligned. Naturally, Council has an emphasis on outcomes to be gained in terms of the economic and environmental health of the City Centre whilst the Transport Agency and AT are more focused on the immediate outcomes for customers.

4.1 The Transport Agency

The 2015 Statement of Performance Expectations for the Transport Agency[13] gives its overall function as *Planning and Investing in the Land Transport Network.* Its Services and Investment are defined as:

- Investment management
- Public transport
- Road safety promotion
- Local road improvements
- Walking and cycling

The Transport Agency has the Goal:

- Integrate one effective and resilient network for customers

It has two objectives that are particularly relevant for the CAP:

- Integrate land uses and transport networks to shape demand at national, regional and local levels
- Integrate national and local transport networks to support strategic connections and travel choice

Similarly, the CAP will relate strongly to two priorities for the Transport Agency: *predictable journeys for urban customers* by making PT trips more reliable with greater likelihood of being able to board a particular vehicle and with travel times that are less affected by traffic; *and making urban cycling a safer and more attractive transport choice* through the proposed investment of some $200m as a further tranche of Auckland's commitment to improving cycling facilities within about 5 km of the City Centre.

The Agency thus is also focused on resolving the direct transport issues but also recognises the importance of the land use components.

4.2 Council

Given the emphasis in the Auckland Plan on a well-functioning City Centre that is economically highly productive and which supports a high growth in employment, educational places and residences, developing a successful CAP is clearly important to Council and consistent with its priorities.

4.3 AT

The Board of AT has adopted the following set of strategic themes which relate to the Auckland Plan directions:

- Prioritise rapid, high frequency public transport
- Transform and elevate customer focus and experience
- Build network optimisation and resilience
- Ensure a sustainable funding model
- Implement accelerated, adaptive, innovative solutions

The strategic themes are strongly correlated to the direct transport benefits identified in the ILM.

[13] NZ Transport Agency Statement of Performance Expectations 2015/16

5 Status of the Evidence Base

5.1 The Evidence for the Strategic Case

Considerable evidence of the problems was compiled for the Strategic Case as presented in Section 7.1.1. Since then further evidence has been assembled in AT's Bus Reference Case and Stage Timing Model.

5.2 The Bus Reference Case

In order to ensure a clear understanding of the Do Minimum or business-as-usual scenario relating to bus services in central Auckland, a Bus Reference Case (BRC) has been used, included as Appendix F. It documents AT's planned bus network to 2036 in terms of the actual routes, frequencies, stop groupings and corridors that are to be operated with the implementation of the New Network. This reference case was developed to be a common benchmark for all public transport planning projects in the Auckland City Centre.

The BRC brings together all relevant information on the infrastructure needed for the New Network to operate in the City Centre. This includes a review of the maximum theoretical bus stop capacity of the major corridors and termini, taking into account frequencies and service groupings, the required bus stop design geometry and the specifics of block lengths, available kerb space and operational requirements at each stop location. It identifies notable deficiencies relating to the planned terminal and route capacity, and shows the need for the greater use of higher capacity buses and operational management measures such as off-board fare collection.

It does not, however, propose significant network or infrastructure changes to relieve stop capacity which is a key constraint on many corridors. This requirement was tested in the Stage Timing Model, discussed next.

5.3 The Stage Timing Model

Additional evidence of the growing difficulties associated with operating an effective bus network for central Auckland has been developed using a "Stage Timing Model" further developing the work of the BRC. The model has been used for this PBC to test when possible interventions as part of the overall optimisation of the bus network reach their limit. Further information on the STM is included in Appendix F.

5.4 Development areas for the evidence base

In order to fully understand the impact of the IP detailed traffic and patronage modelling will be required, which was not available for the PBC. At the IBC stage such modelling should be used to understand better the timing of the elements of the Programme in both proposed IBCs and to optimise the extent of the high capacity LRT route.

Initial modelling using the JMAC[14] Auckland Regional Transport model (ART) and the Auckland Passenger Transport model (APT models (see Section 11.2) provided useful information on the limitations of the Do Minimum or base case which was used to assess different options.

The additional modelling will also allow the refining of the economic analysis.

[14] Joint Modelling Advisory Centre – a collaboration between AT, Council and the Transport Agency

6 Changes/updates since the Strategic Case was undertaken

There have no substantive changes since the strategic case was approved in October 2015 that affect the problems or required benefits. Similarly the economic and transport context has not changed.

As widely reported in February 2016 Council resolved not to pursue certain changes to the PAUP that might have supported more intensification. The independent panel, has, however, the “responsibility to deliver a Unitary Plan that can meet agreed growth requirements for consideration by Council.

7 Confirming the need for investment

7.1 Defining the problem/opportunity

A facilitated investment logic mapping workshop for the CAP Strategic Case was held in two stages on 04/09/2015 and 10/09/15 with the principal stakeholders, as listed in Section 3, to gain a better understanding of current issues and business needs.

The stakeholder group identified and agreed the following problems:

- Problem one: Inability to meet current and projected transport demand on critical corridors will result in unreliable travel and limit access to actual and potential productive central area jobs
- Problem two: blockages and delays in central bus services reduce effectiveness of the public transport network and worsen customer experience
- Problem three: high and increasing traffic volumes on inner city streets create adverse urban amenity, health and environmental effects

The investment logic map is attached as Appendix A.

7.1.1 Evidence for the problem statements at CAS stage

Inadequate corridor performance reducing City Centre accessibility

Analysis for AT has shown that reductions in peak-hour bus speeds and the corresponding increase in commuter journey times to access City Centre employment will significantly impact the labour pool available to City Centre businesses. While rail and busway services are expected to be largely unaffected, the remainder of street running bus routes are susceptible to delays from traffic, crowding and bus stop congestion. A particular problem area is the central isthmus.

In 2016, an estimated 461,000 people will live within a 45 minute commute of the City Centre by public transport. Under a business-as-usual scenario, however, bus journey times to the City Centre at peak hours are projected to increase by approximately 15% per decade. Rising ridership and overcrowding will slow bus operations while rising traffic congestion reduces bus speeds. By 2026, the number of people living within a 45 minute public transport commute of the City Centre will have declined by 18%, representing a reduction in the commuter labour pool of 84,000 people.

By 2046, on-street bus travel speeds will have declined to 77% of the 2016 baseline, resulting in the number of people within a 45 minute PT commute of the City Centre being reduced by 37%, a loss in catchment of 172,000 people from the City Centre labour pool, compared to the present.

Figure 3 demonstrates the expected catchment loss over time.

Overall, the analysis suggests that a business-as-usual approach will lead to a rapid decline in accessibility to the City Centre by public transport as street-running buses become increasingly affected in future decades. This reduction in bus speeds will result in a significant drop in the number of people within a reasonably public transport commute time of the City Centre, reducing the effectiveness of the Auckland labour market.

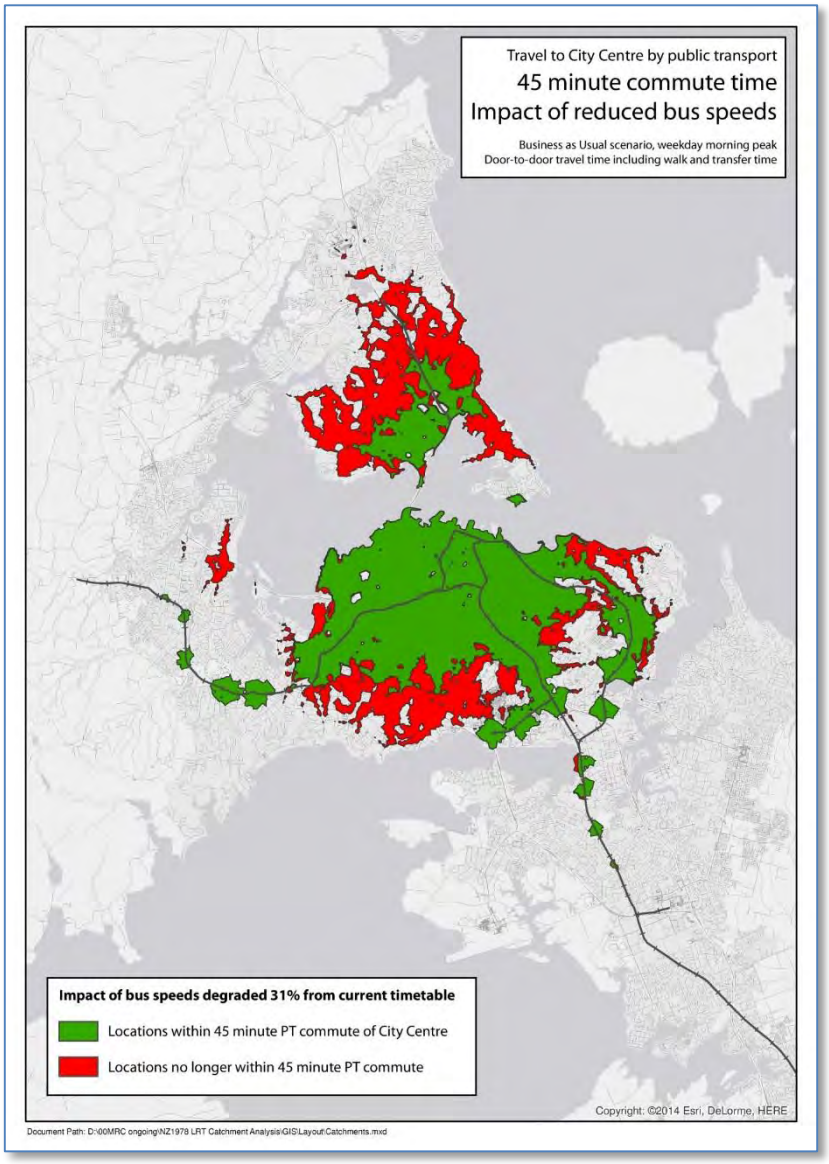


Figure 3 Expected catchment loss over time

Limited effectiveness of the bus network and poor customer experience

The City Centre forms the heart of Auckland's public transport network, with 60% of all public transport trips having a destination in the City Centre. While the new public transport network creates more cross-town and feeder bus services, a large proportion of bus routes still travel to and through the City Centre. This means the performance of the whole public transport network is highly dependent on how efficiently and effectively it operates within the City Centre.

As of mid-2015, the Auckland bus network carried 59.8 million passenger trips per year, with 507.1 million passenger-kilometres travelled. Bus patronage has increased from 43 million trips in 2005; an increase of some 40% over ten years.

While in the future metro rail is forecast to carry many more trips than it does today (partly as a result of having the CRL), with the growth of Auckland, buses are still expected to be the largest public transport mode to the City Centre.

The bus network experiences substantial variability in service travel time which results in a poor experience for customers. They are often delayed when services are late, or left standing at stops when services are full. The performance of the bus network presents significant issues in terms of the scale of variability that is currently being experienced. A compounding factor for Auckland is the closely spaced intersections in the City Centre and short block lengths which lead to practical difficulties as multiple bus bays are required at each bus stop.

HOP tag-on and tag-off data for March 2015 were analysed to compare the actual arrival time at the final stop and the scheduled arrival time, for all buses across one weekday. These results, shown in Table 2 below, indicate consistent delays at peak times, particularly in the morning peak. There is significant variability in travel time across all times of day but especially in the peaks. Schedules already allow for increased journey time in the peaks, so the level of deviation from the scheduled time is a more useful understanding of the variability of bus travel times than journey times themselves.

Table 1 Bus travel time variability, March 2015

	Average of Minutes deviation	Std Dev of Minutes deviation
Regular bus routes		
Inbound		
AM Peak	7.5	11.3
Interpeak	5.6	9.3
PM Peak	6.2	13.9
Evening	6.4	13.3
Outbound		
AM Peak	6.6	10.9
Interpeak	5.1	7.8
PM Peak	5.4	6.8
Evening	4.1	5.8

Source: AT HOP data, March 2015

While travel time variability is shown to be one of the issues affecting the bus network, the other major issue is the high level of patronage and bus volumes as services reach the City Centre.

The busiest corridor to the City Centre is central Symonds St, in the section where the routes from Upper Symonds Street and Grafton Bridge combine to run through to the University and City Centre. This corridor averages 130 buses and 4,619 passengers per hour in the morning peak, representing one bus and 41 passengers every 27 seconds, with slightly lower levels outbound in the evening peak. These levels should be compared with the internationally accepted level for reasonable operation of 80 buses per hour and an absolute limit of 140 buses per hour.

Adverse City Centre amenity

Successful cities have strong and attractive centres, highlighting their role as major visitor destinations and centres of commerce, finance, education and culture. These centres need great amenity to encourage high concentrations of activity, successful business and high skilled, but mobile, international labour.

The current transport system generates significant adverse impacts on the amenity value of the City Centre, potentially undermining its current and future success. These impacts include the effects of harmful pollutants and noise from vehicles.

Furthermore, having significant numbers of people and vehicles in the City Centre also creates safety problems, particularly for those walking and cycling. The current form of many streets in the City Centre is detrimental to achieving high quality place-making by encouraging higher traffic speeds, providing low-standard pedestrian and cycling facilities and making it difficult and unsafe to cross streets.

As the main on-road public transport mode serving the City Centre core, buses contribute disproportionately to poor amenity in critical locations such as around the University, Britomart and midtown areas. The overall volume of traffic is a major adverse factor on roads that are designated for general traffic, such as Customs, Fanshawe, Nelson and Hobson streets and which are widely accepted as having low amenity values.

As shown in the analysis above, buses currently experience significant congestion levels in the heart of the City Centre. At peak times in particular, bus throughput volumes exceed the capacity of corridors, intersections and stops which results in queuing of buses along city streets. As these queues can often number six or seven buses they can create a ‘wall of buses’ effect over a hundred metres long in places. In addition to the noise and emissions of queuing buses adjacent to the footpath, with their potential health effects, this creates a physical and visual blockage of the corridor limiting the ability to cross the street or view the far side. This results in considerable negative impacts being reported on retailing and ground floor environments, in particular.

Through the City East West Transport (CEWT) Reference Study and subsequent investigations, several major stakeholders expressed significant concerns at the impacts of increasing and planned future bus volumes on urban amenity including visual impact. This was particularly the case where those stakeholders were investing tens of millions in developments and were concerned that the uptake or benefits of this investment would be inhibited by the noise, fumes and visual impacts of large volumes of buses. The stakeholders who expressed these concerns included the University of Auckland, Waterfront Auckland, Cooper & Co., Heart of the City and various individual landowners.

A benchmarking exercise identified that above 140 buses per hour, very poor visual amenity is experienced. Roads such as Symonds Street and Fanshawe Street are at or very close to these levels.

The degree to which Symonds Street already exceeds acceptable levels for visual amenity is illustrated in the photograph in **Figure 4**.

Figure 4 Bus related amenity levels on Symonds St

7.2 Re-confirming the Problem

In order to confirm the problems, the Stage Timing Model (see Section 5.3) has been used by AT to identify the year in which City Centre bus stops exceed capacity within the study period of 2016–2046. Inputs to the STM were taken from the Bus Reference Case (BRC), including bus stop operational capacities, bus volumes and routing.

The base scenario includes all the current projects that are programmed or underway in the City Centre:

- New Network redesign and efficiency improvements
- City Rail Link (CRL)
- Double-deckers on major corridors
- New bus terminals at Wynyard Quarter and the Learning Quarter
- Reconfiguration of Britomart terminals
- A new “street busway” corridor on Wellesley St.

The bus volumes and stop capacities anticipated in the City Centre with these projects were documented in the Bus Reference Case (BRC).

The STM assumes that the New Network is in place for the duration of the modelled period from 2016 to 2046. Bus routing in the City Centre follow the alignments proposed in the New Network Central Suburbs consultation. In addition, as part of a business-as-usual scenario, several bus infrastructure improvements are proposed for the City Centre in order to accommodate the anticipated bus volumes using the principal corridors and termini.

Having taken account of these changes, the STM calculated the first-occurring corridor capacity constraints as identified with the business-as-usual case using the STM.

Table 2Year that bus stop capacity is exceeded - business as usual

Corridor	Stop(s)/group(s) exceeding capacity	Year capacity exceeded	Option to prolong corridor life	Outcome
Wellesley Street	Isthmus to Wynyard Crosstown/Birkenhead	2016 (2023)*	Reconfigure stop groupings	Extends corridor life to 2023
Symonds Street	Isthmus to Wynyard	2016	No options	Vehicle numbers exceed aggregate stop capacity
Albert Street	All routes (one stop group)	2016	No options	Capacity limited by road width and in-line stops
K Road	All routes (one stop group)	2019	No options	Capacity limited by road width and in-line stops

* Note: one stop group on Wellesley Street exceeds capacity by one bus from 2016 to 2022.

It can be seen that on multiple corridors the options available to run additional services and meet demand using conventional buses and infrastructure are quickly being used up with no further opportunities then available. As noted in Section 2.1 we are “hitting a wall of simple geometry” – due to the amount of kerbside space available for bus stops, staging areas and lay-up.

The STM was further run to test the shortfall on two major links: Wellesley Street and Symonds Street.

The diagrams below show how under-capacity on Auckland’s City Centre public transport corridors is likely to increase. As can be seen there is significant under-capacity of provision against demand in 2016, particularly on Fanshawe, Wellesley and Symonds streets.

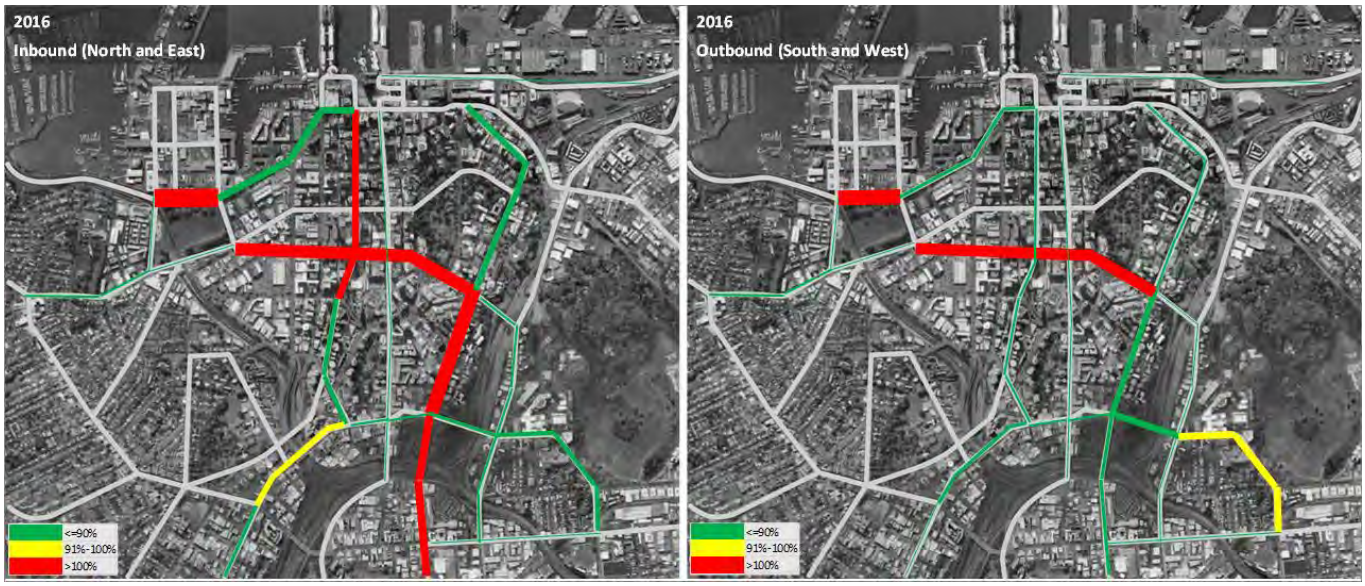


Figure 5 2016 bus capacity vs demand

By 2046 the problem is expected to be extreme as shown in **Figure 6**.

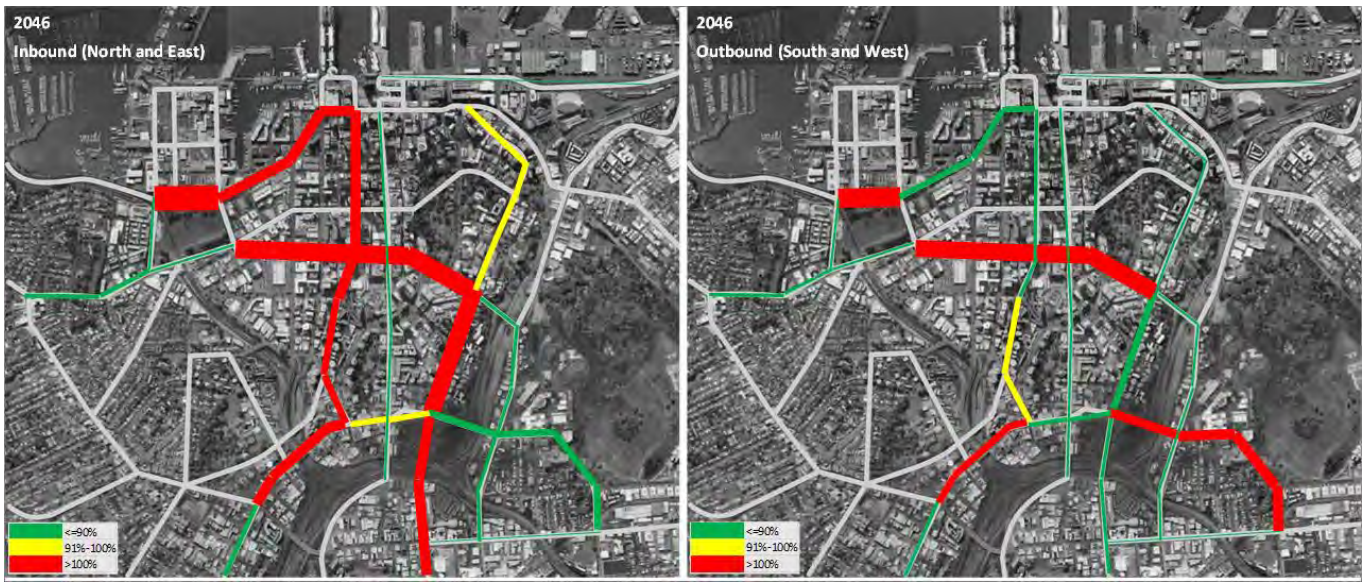


Figure 6 2046 bus capacity vs demand

An alternative way to understand the issue is shown in the next graph which shows Symonds Street inbound and Wellesley Street westbound. Over time the shortfall in bus capacity rises from 23 buses per hour to 48. **Figure 7** and **Figure 8** show the over capacity bus volumes on these corridors over time.

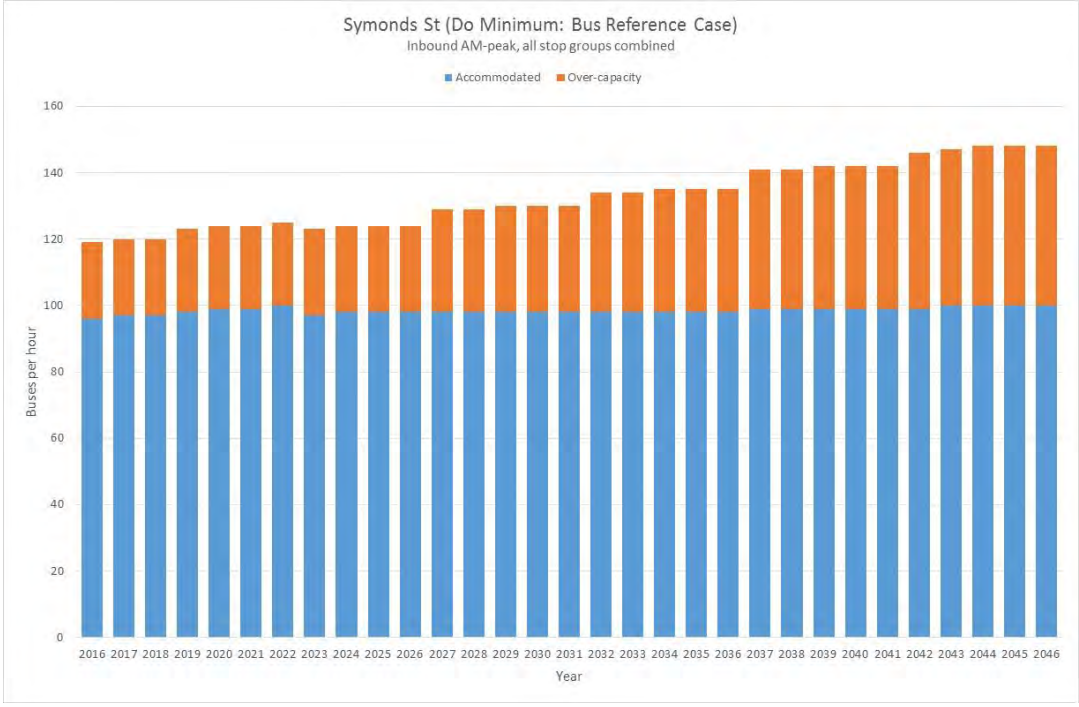


Figure 7 Symonds Street

This represents about 3000 passengers per hour who cannot be accommodated, just on these services.

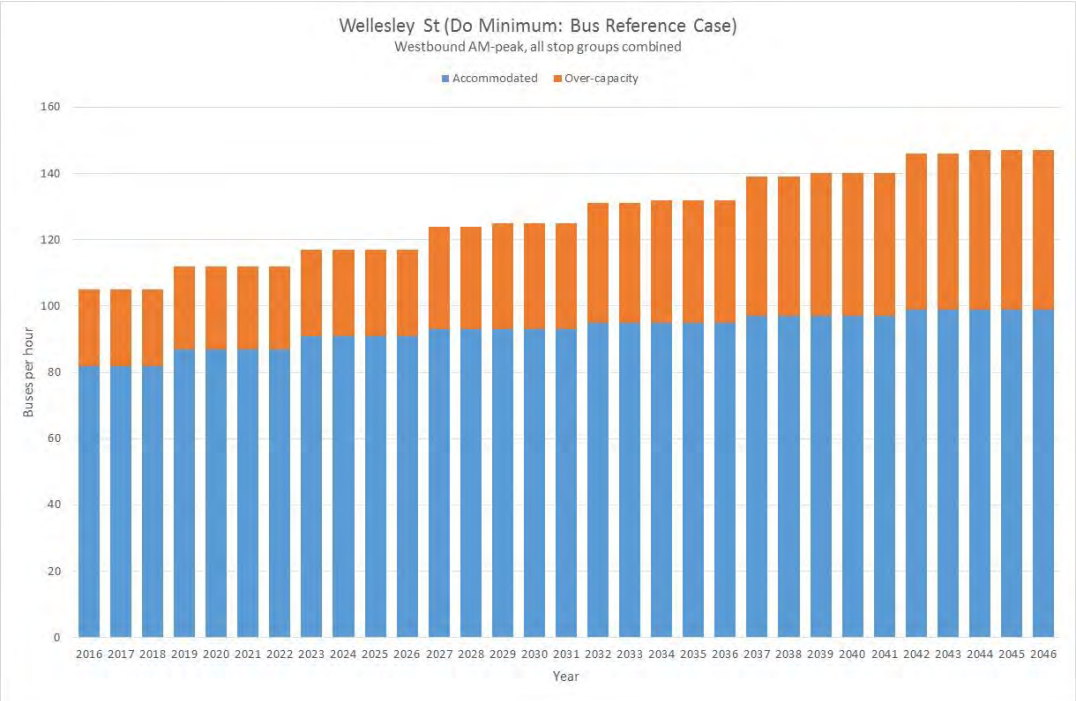


Figure 8 Wellesley Street

7.3 The Benefits of Investment

The potential benefits of successfully investing to address these problems in a CAP were identified as part of the second facilitated investment logic mapping held on 10 September 2015 with a benefits workshop on 19 October 2015. The stakeholder panel identified and agreed the following potential benefits for the proposal:

- Benefit one: Auckland's prosperity and growth are enabled
- Benefit two: City Centre is attractive, vibrant, healthy and safe
- Benefit three: More efficient and cost effective network and services

The benefits as identified by the representatives of the three partner organisations therefore covered two broad outcomes to be delivered. The first relates to the first and second benefits and is concerned with supporting growth – economic and population – and the quality of the City Centre.

The third (intermediate) outcome represented by the third benefit is more directly related to improvements in the transport system. The intermediate outcome is required to enable the economic and amenity outcomes to be achieved.

The benefit map is attached as Appendix B.

8 Stakeholder Agreement

The three principal stakeholders agreed the strategic case with it being signed-off by senior managers from the three organisations. For the Transport Agency the NLTP Advisory Group accepted the Strategic Case in November 2015.

Whilst AT carried out earlier investigations into the way to address the issue of the limits for bus service numbers being reached on critical corridors and proposed a possible solution, this PBC has been prepared in partnership using Transport Agency disciplines to ensure the problems are well-defined, the benefits sought are clear and that together they drive the process to determine solutions.

PART 2 –DEVELOPING THE PROGRAMME

9 Programme Context

This section of the PBC provides the context for the location of the proposed investment. It does not seek to describe the problems or opportunities.

9.1 Geographical and Environmental Context[15]

Auckland's geography presents a number of major transport challenges and opportunities. Infrastructure and demand are focused into a small number of narrow corridors leading to congested pinch points across the transport network. Auckland's relatively dispersed employment creates challenges for the efficient provision of public transport.

Over the past decade there has been a very significant increase in transport investment by Government and Auckland Council. Large parts of Auckland's motorway network have been expanded or improved and other major projects are nearing completion. Significant investment in public transport has also taken place, including electrification of the rail network supported by a new fleet of electric trains, substantial bus service improvements and the introduction of a single electronic ticketing system across the public transport network.

These investments have yielded positive results. Although Auckland's population has grown by nearly 300,000 since 2003 traffic surveys indicate that overall peak period congestion has not increased over that period although inter-peak congestion has become a more serious issue. Public transport use has also increased substantially over the past decade growing from 50 million to over 80 million annual boardings.

On some metrics, such as the level of inter-peak congestion and the use of walking and cycling, Auckland's transport performance compares well against major Australian cities. However, in other areas Auckland lags behind; particularly its travel time reliability, public transport mode share and overall labour pool access.

Recent transport investments have helped to avoid some of the negative transport consequences of Auckland's recent growth. Continuing on this path will not be easy, as many of the most obvious investments in Auckland's transport system are now complete. The next generation of transport investments will be more challenging as they will need to be integrated with established uses and generally do not have available corridors set aside.

The scale and location of population and employment growth is a critical factor influencing Auckland's future travel demand. Two key growth trends are at the heart of Auckland's future transport challenges:

- Population growth is spread throughout Auckland's urban area and extends into major future urban growth areas to the north, northwest and south. Nearly a third of population growth is projected to occur in areas beyond 20km of the city centre.
- Employment growth is highly concentrated in a few locations, particularly the city centre, the airport and other regional metropolitan centres. Over a third of employment growth is projected to occur within 5km of the City Centre. The growth in service sector jobs, which tend to locate in major centres to benefit from agglomeration, is a key factor behind the projected concentration of employment growth.

9.2 Social Context

The social make-up of the City Centre and parts of the isthmus is informed by the 2013 census; more employed, younger, better qualified, higher paid, with faster growth than the Auckland average.

At the time of the 2013 census, the usually resident population of the Waitematā local board area, which includes the City Centre, was 77,000. Waitematā's population increased by 14,000 (23%) between the 2006 and 2013 censuses. This compares with the neighbouring Albert-Eden through which the main public transport services of interest run, where there was an increase of four per cent (3,700 residents)[16]. Since the 2013 census, population growth in central Auckland has been particularly strong with the Waitematā local board area's population increasing by 16% to 94,500 in only two years[17].

[15] Section 9 is largely drawn from the Auckland Transport Alignment Project Foundation Report, February 2016

[16] http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/reports/Pages/censusinaucklandhome.aspx#lbprofile accessed 2 March 2016

[17] http://nzdotstat.stats.govt.nz/wbos/index.aspx?DataSetCode=TABLECODE7502

Over half of the City Centre population identified with an Asian ethnic identity. The median age for residents was 27.4 years (against the median age for Auckland as a whole of 35.1 years).

The proportion of adult residents in Waitematā who were employed was 66.6 per cent compared with 61.5 per cent in Auckland as a whole. Residents of the two board areas are typically better paid than the average in Auckland with the median personal income for adults in Waitematā at $34,700 and in Albert-Eden $32,800 per annum. These compare with Auckland as a whole at $29,600.

The proportion of Waitematā and Albert-Eden adults with a formal qualification was high at 94.3 per cent and 90.2 per cent respectively. This is higher than the Auckland average of 83.2 per cent. One-person households in the City Centre constituted 36.0 per cent of households in 2013.

Home ownership was considerably lower in Waitematā (39.1%) and in the City Centre (19.4%) compared to 61.5 per cent for Auckland. In line with long-term trends the home ownership rate in Waitematā declined from 44.2 per cent in 2006. Home ownership was also low in Albert-Eden at 55.5 per cent compared with 61.5 per cent for Auckland.

Attached dwellings, i.e. two or more flats/ units/ townhouses/ apartments/ houses joined together, were more prevalent in Albert-Eden at 38.5 per cent, than in Auckland as a whole at 24.8 per cent. In the City Centre they constitute 95.6 per cent of occupied dwellings and 70.6 per cent in Waitematā as a whole.

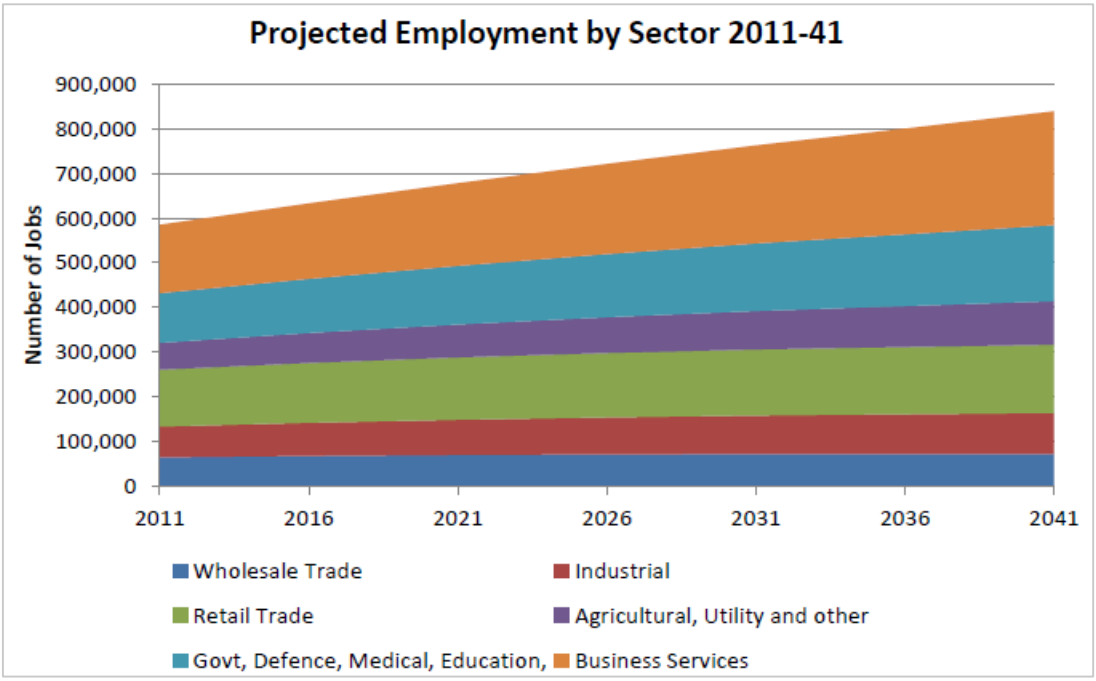
9.3 Economic Context

Over the next 30 years 60% of New Zealand's population growth is expected to occur in Auckland. However, a lower average age means that the vast majority (over 80%) of the growth in New Zealand's working age population is projected to occur in Auckland.

The number of jobs in Auckland is projected to increase from just under 600,000 to more than 850,000 over the next 30 years. Changes to the structure of Auckland's economy in the future also drive changing transport demands. Auckland is New Zealand's dominant commercial centre, leading the finance, insurance, transport and logistics and business services industries. The productivity of highly skilled service sector jobs that cluster in Auckland is highly dependent upon agglomeration (the clustering of economic activity) and large labour markets.

The pattern of economic growth in Auckland is continuing to compound its structural differences with the rest of the New Zealand economy. The service sector has dominated the city's employment growth over the past decade[18] and this trend is projected to continue with business services being the largest driver of employment growth, as shown below in **Figure 9**.[19]

[18] Infometrics and Auckland Council http://ecoprofile.infometrics.co.nz/Auckland
[19] Source: Auckland Council land-use projections



Source: Auckland Council land-use projections

Figure 9 Employment projections

Auckland has most of NZ's working age population growth owing to its younger population. Statistics NZ estimates overall population growth for NZ between 2013 and 2043 of approximately 427,000. Auckland's working age population growth over the next 30 years is projected to be approximately 400,000. This means that over 90% of NZ's working age population growth is expected to be in Auckland – most likely meaning that Auckland will drive the vast majority of NZ's economic growth in the future, as shown in **Figure 10**.

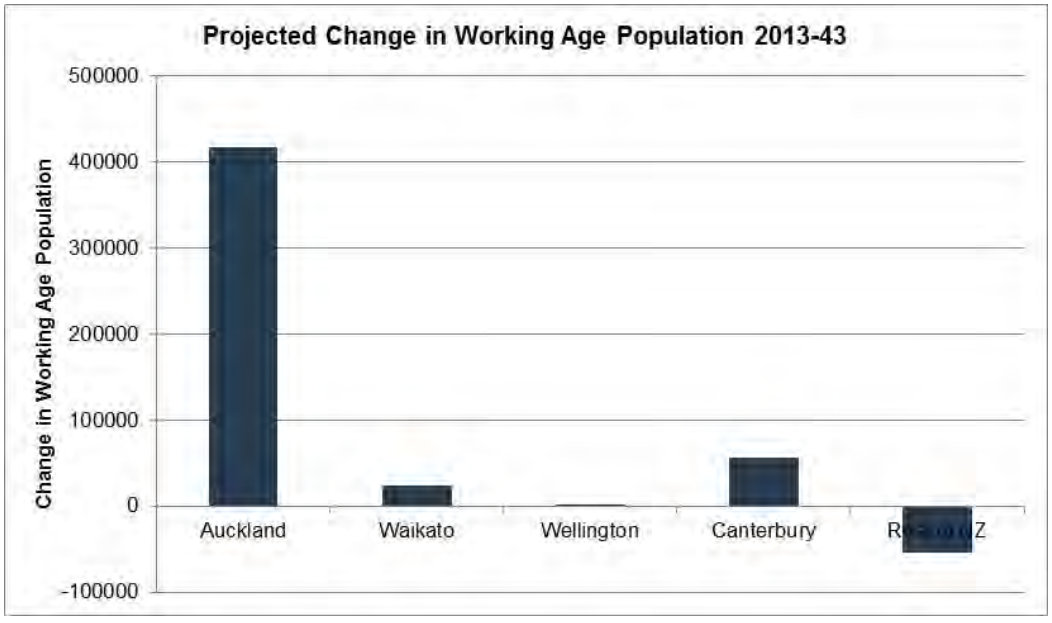


Figure 10 Working age population

These projections assume that population and employment growth occurs at a reasonably steady rate. In practice short term population growth can fluctuate significantly based on trends in net-migration. For example, Auckland's population growth rate between 2006 and 2013 was lower than between previous censuses while over the past

two years a significant increase in net migration has boosted population growth to near-record levels, with Auckland's population increasing by over 75,000 since 2013.[20]

Longer-term population growth could occur at a lower or higher rate than projected by Statistics New Zealand. Past population projections for Auckland have tended to under-estimate the rate of growth; for example, projections in 1996 expected Auckland's population to reach two million around 2060 whereas most recent projections expect that to occur 30 years earlier.

[20] Auckland Profile – initial results from the 2013 census (page 6), available online at: http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/reports/Documents/aucklandprofileinitialresults2013census201405.pdf
In the June 2014 year Auckland's population grew by 34,000 (2.3 percent), in the June 2015 year population grew by 43,500 (2.9 percent), to reach 1.57 million - Subnational Population Estimates: At 30 June 2015, available online at: http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/SubnationalPopulationEstimates_HOTPAt30Jun15/Commentary.aspx

10 Stakeholder Engagement

10.1 RLTP Consultation

No specific stakeholder engagement has been undertaken on the CAP as the overall views on transport in Auckland have been well-canvassed. For example, the draft 2015-2025 Regional Land Transport Plan (RLTP) was issued for public comment on 23 January 2015, in parallel with Auckland Council's (AC's) Long Term Plan (LTP), resulting in high levels of response.

Key themes coming through in consultation were that submitters:

a) Want better public transport, but it has to be convenient, reliable and quicker;

b) Want to walk and cycle but it has to be safe;

c) Want funding to be reallocated towards public transport, walking and cycling;

d) Want better transport but have mixed views on how to raise the additional investment required.

Public Transport

The major themes were a strong focus on public transport being a top priority for Council / AT and that public transport should be 'more frequent, more reliable and cheaper'.

A large number of submitters supported more bus lanes as part of this integrated public transport network, along with another group who recognised that the speed of the journey, however this was achieved, is an important part of the public transport offering. Park & Rides also featured strongly in the feedback, with many wanting more Park & Ride spaces at both bus and rail stations.

A number of submissions featured using congestion charging to incentivise public transport. Many submitters thought that AT allocated too much to roads and that this should be redistributed to public transport.

Walking, Cycling and Travel Demand Management

The vast majority of submissions regarding cycling were calls to improve the quality of cycling infrastructure and increase the proportion of AT's spend in comparison to other modes on cycling. There was a perception amongst the submissions that the current cycling infrastructure was inadequate, disjointed and needs an overhaul.

Some considered cycling to not be a serious transport option but a sport and therefore funded through appropriate Government sport funding (as other sports such as rugby, soccer, netball, cricket, etc.). A few submitters wanted more concentration on alternatives to the motor vehicle other than mass transit, such as electric bikes and scooters. A general theme was that of prioritising non-personal motor vehicle travel, including walking, cycling, cycle hire, bike share, town car hire, buses, car-pooling and ride-sharing.

10.2 RPTP 2015 variation

In 2015 AT produced a variation to its RPTP which included the possibility of light rail. The majority of submissions received were supportive of light rail but some stakeholders, including the Transport Agency, considered that including light rail in the RPTP at that stage was premature given the lack of detail available on the investigations undertaken, costs, timing and impacts on local communities and the transport system.

The main issues were:

- Some key stakeholders wanted more information on the light rail proposal (e.g. option assessments) before supporting its implementation. Also more detail on how routes were being determined (e.g. possibly to Wynyard Quarter).
- Some concern about the costs of light rail and the potential for light rail to divert funds away from other public transport projects. No provision for light rail in funding documents.
- Light rail is not included in the Auckland Plan and the Proposed Auckland Unitary Plan (PAUP) does not support the land use intensification that would be required alongside the proposed light rail corridors to maximise their patronage potential.

10.3 Professional Engagement Process

The professional engagement process has related to the development of this PBC with technical advice provided by a range of consultants who are familiar with contemporary projects in Auckland including CRL and Waterview. This knowledge has, for example, enabled cost estimates to be generated (at a level appropriate for a PBC) that take account of local conditions.

Appropriately qualified specialists assessed the amenity impacts of the project options, again drawing on their local experience.

11 Alternatives and Options Assessment.

This section records how the long-list and short-list of programme options were developed through a robust analysis of the alternatives and options. It is supported by additional information in Appendix C.

11.1 Preliminary interventions considered

At a facilitated workshop on 15 December 2015 involving representatives of the three partner organisations and technical advisers a wide range of possible interventions was generated that might be able to address at least one of the problems. The brief for the workshop was that ideas should initially be put forward without pre-judgment on their merits as what was important was the breadth of possibilities. Later stages of the process would group, assess and trim the possibilities.

Interventions were sought which might change demand (reduce or slow the problem), increase productivity (make better use of existing system), and/or increase supply (provide extra capacity to treat or fix the problem).

Participants were invited to add to the original list after the workshop, again to ensure that the widest possible set of potential interventions was created for consideration.

The long list of possible interventions generated is given in Appendix C

At the workshop the potential interventions were grouped into common themes which allowed programme options to be developed with internal consistency. The themes are also in Appendix C.

11.2 The Do Minimum

Land use scenario

The spatial land use scenario containing population, employment and education distributions is a key input into the transport models. The scenario used for the CAP PBC is consistent with the scenario being used in the ATAP Scenario I9, which represents a medium growth forecast.

A single land use is used for evaluation of the programme options against the Do Minimum.

Transport network

The transport network in the Do Minimum is a critical element. The ATAP process has developed the 'ATAP Common Elements' network, which was therefore adopted for consistency and as it represents a realistic set of projects and schemes with agreement and commitment.

Major projects

The major projects that are included in the Common Elements are summarised in **Table 3** along with the assumed timing associated with their inclusion. The major exclusions are Airport Rail and the Additional Waitematā Harbour Crossing (AWHC). The other projects all have commitment and are expected to be in place by 2026.

Table 3 Timing of major projects in the Do Minimum

Project	2026	2036	2046
CRL	✓	✓	✓
AMETI	✓	✓	✓
Airport Rail	X	X	X
Northern Busway extension to Albany	✓	✓	✓
AWHC	X	X	X
East West Connections	✓	✓	✓
Northern Corridor (SH1 – SH18 Interchange upgrade)	✓	✓	✓
Southern Corridor (SH1 upgrade Manukau – Papakura)	✓	✓	✓
Puhoi to Warkworth RoNS	✓	✓	✓

Public transport service plan

A crucial component of the overall transport network is the public transport (PT) network and associated service plans for rail, bus and ferry. As the CRL is included in the Do Minimum (from 2026) the associated pre- and post-CRL opening rail operating plans are used. The ferry network is not expected to change over time, though service frequencies and vehicle types may change over time as part of the overall PT offering.

The bus network is currently undergoing changes and the Bus Reference Case (BRC) – see Section 5.2 - details the latest thinking around routing, services and operational characteristics and constraints. Capacities identified through the BRC for corridors and termini/interchanges are adopted as constraints on the individual service provisions.

Further Optimising the Do Minimum

One of the requirements for the public transport network for the PBC, particularly for the bus network, is the further optimisation of the network to allow the most efficient use of 'resources' (buses and bus space in the City Centre). This required use of the transport model with outputs assessed in conjunction with the input assumptions as to vehicle capacities and frequencies. This work then informed a small number of minor changes to the service plans so that the whole network was better optimised and considered to be a realistic network in terms of provision.

Modelling suite

The analysis for the CAP PBC used the Auckland Regional Transport model (ART) and the Auckland Passenger Transport model (APT). The Do Minimum was tested in both models and the outputs used to determine the timing and scale of problems and assist in option development and evaluation.

A single ART model run was used as a base and then each option was subsequently modelled in APT to test the impacts on public transport patronage. The APT model runs were run without the 'crowding' module (effective capacity constraints) initially so that the level of total demand could be established. Capacity constraints were incorporated outside the model through the analysis of the outputs. Key model outputs used in the analysis were patronage demands along the corridors, and the peak passenger loadings. The crowding module was eventually used for the Do Minimum and Preferred Programme to test the impacts of the additional capacity that the programme interventions enable.

More detailed modelling tools for the isthmus and city centre are under development and will be ready for use at the IBC level. These are more focused on the impacts on general traffic, rather than the public transport modes and are:

- The City Centre SATURN model – a mesoscopic simulation and assignment model which covers the city centre and can be used to quickly test the implications of changes to specific corridors in the city centre.
- The City Centre PARAMICS model - a detailed micro-simulation model to assess the impacts on traffic operations (all modes) in the city centre and can be used to fine tune any options that are modelled.
- The Isthmus AIMSUN model – a meso/micro simulation model that provides a much higher degree of network coverage within the modelled area (bounded by New North Rd, SH20 and Mt Eden Rd). This will be able to test the implications of any turning restrictions or lane changes that are proposed as part of improving the provision for public transport on any of the main corridors.
- The opportunity to intorudce a feedback loop from the STM and more detailed models into APT and ART will also be pursued.

11.3 Programme options assessed

This section of the business case describes the initial programme options that were generated from the long list interventions. Six variations were developed around different principles. These principles related to different approaches:

- maximising use of existing assets
- bias towards new or enhanced infrastructure
- demand management

A fourth principle relaxed the existing philosophy for central Auckland public transport, extending the number of roads available to public transport, in contrast to the present thinking of concentrating public transport and prioritising other roads for different modes, including for pedestrians.

The initial strategic interventions were grouped by participants in the workshop on 22 December 2015 to provide consistent programmes. The percentages indicate the weighting of effort to be directed to each intervention within the programme. The programme options themselves illustrate the application of the Staged Intervention Hierarchy which emphasises reducing demand and optimising use of existing capacity before expanding the infrastructure.

Within the programme options the hierarchy would still apply. For example, within programme 2, earlier stages would concentrate on those aspects that would make better use of the existing network with the new infrastructure (the bus tunnel) following.

Some of the initial interventions generated were not pursued further as they were identified at the workshop as being unlikely to contribute to resolving the problems, and/or unlikely to generate the intended benefits, and/or beyond the scope and control/influence of the current business case.

11.4 Programme options grouped by Principle

As discussed above, the possible interventions were grouped by the principle they represented to generate programme options for assessment and consideration at the IP workshop.

Principle	Maximise Use of Existing Assets	Demand Management	Alternative Approach to use of Transport Assets	Infrastructure Investment Biased Programmes		
	Programme Option 1	Programme Option 2	Programme Option 3	Programme Option 4	Programme Option 5	Programme Option 6
Strategic Interventions	**Do Regardless**	**Non-financial demand management**	**Extended bus network**	**Heavy Rail Spur to Mt Roskill**	**Light Rail Transit**	**High investment in buses/Bus Rapid Transit**
1.Bus network optimisation • Elimination of low productivity services • More express services • More bus lanes/extended times • Micro-moves e.g. traffic signal pre-emption • Maximum use of higher capacity buses	**95%**	**10%**	**10%**	**10%**	**10%**	**10%**
2.Use more roads for buses (i.e. change New Network principle)			**70%**	**10%**		
3.Heavy investment in bus network						**33%**
4.Introduce new higher capacity mode					**72%**	**40%**
5.Extend metro rail				**65%**		
6.Traffic management changes: • One way systems (City centre 'rooms') • Reverse ramp metering (limiting exit from motorways) • Reduce number of motorway exits • Dynamic operations • Create more City Centre edge car parking		**10%**	**10%**	**4%**	**5%**	**5%**
7.Heavy private vehicle demand management • drastically reduce City Centre car parking • Change road lanes to more efficient modes • Multiple City Centre road closures • Time shift, mode shift		**70%**	**5%**	**4%**	**4%**	**4%**
8.Enhance pedestrian& cycling facilities: • higher quality pedestrian environments • more cycling and pedestrian priority • use of more minor City Centre roads as 'laneways' and active mode routes • extended linkages for cyclists, in particular, to the City Centre	**5%**	**10%**	**5%**	**8%**	**9%**	**8%**
		100%	**100%**	**100%**	**100%**	**100%**

Appendix C provides further description of each programme option that was analysed in developing the IP.

11.5 Interventions not considered further

Reliance on technology

- Personal rapid transit
- Driverless cars

Workshop participants recognised that it is possible that over time developments in technology may change demand for conventional transport or provide new ways to travel. These possibilities were, however, assessed as being both beyond the control of the partners and outside the scope of the business case. Nevertheless it was acknowledged that technological change is likely to happen within the planning horizon of 2046 and that it was appropriate that monitoring should take place as any programme is rolled-out. As noted in ATAP technological change is one contributor to forecasting uncertainty.

Some technology developments might be integral to the programme options being assessed further, such as the adoption of new and more advanced forms of buses or light rail vehicles (LRVs).

Land-Use change

- Decentralisation
- De-agglomeration

The land-use change ideas generated initially centred on the thinking that moving activity away from the City Centre would reduce public transport demand and therefore some of the identified service issues. The concept was assessed, however, as being outside the scope of the business case as well as contrary to adopted Council policy, would weaken Auckland's economy and would ultimately be more expensive to service with effective transport.

The particular concept suggested was unlikely to generate the required benefits. It is appropriate, however, that the IP should be robust against different land-use outcomes. Such testing and refinement might be part of the two IBCs.

Road expansion

- Widening arterials
- Multi-deck motorways
- Additional car parking buildings
- Take over public transport routes

The workshop considered a programme theme that would comprise a series of interventions to expand road capacity. This programme was not pursued as the participants acknowledged that such a strategy would be unlikely to address the identified problems as the required road capacity in lieu of public transport could not realistically be provided without seriously harming the city's character, would be extremely expensive and environmentally damaging and would be contrary to adopted and well-established policy.

The City Centre Future Access strategy (CCFAS) had come to a similar conclusion, that the number of people accessing the City Centre who might realistically be accommodated through road expansion would make only a small difference to the public transport demand.

Financial-based demand management

The partners recognised that it was possible that demand management based on some form of direct charging for road use might significantly change the Auckland transport landscape, if introduced. It was agreed, however, that such a change was outside the parameters of the CAP business case and the control of the partner organisations. If such a scheme emerged from ATAP its impact would need to be considered. The possibility of financial demand management, presumably in the medium to longer term, is therefore included in the Programme Risk discussion in Section 12.5.

The potential use of higher City Centre car parking charges as a financial tool was not precluded and might form part of Option 5, for example or of the chosen IP.

11.6 Option Evaluation

The options that were taken forward to the workshop were evaluated based on the benefits and measures. A cardinal scale was used with each measure normalised to values between 1 and 5. The combined total for each benefit was then weighted in accordance with the percentages allocated by the stakeholders at their benefits workshop.

This approach avoided the issue that sometimes applies to multi-criteria analysis of arbitrary weightings.

11.6.1 Overall evaluation

Figure 11 - **Figure 13** below show the results of the assessment against the benefits and measures. As can be seen, the only options that score well and therefore provide the benefits sought, are the two higher investment - Options 5 and 6.

While Options 2 and 3 provide moderately valuable travel related benefits each scores negatively on the amenity criterion.

			Do Minimum		Option 1: Do Regardless		Option 2: Non-price demand management		Option 3: New Bus Network		Option 4: Heavy rail spur		Option 5: LRT Network		Option 6: BRT w/ Tunnel	
Benefit	**Investment KPI**	**Measure**	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*
1. Auckland's prosperity and growth are enabled	Increased access to city centre (business to business)	No of job places within 45 mins by PT & walk /cycle & 30 mins by car to City Centre at peak		0	No significant difference from the Do Min	0	Improvement in bus travel in the city centre should increase the PT catchment slightly, thoguh car access will likely decline through reduction in accessibility	1	Little change from Do Min in terms of catchment/accessibility. Slight improvement on Dominion/Sandringham routes throguh more direct access and additional capacity provided	2	Potential slight improvement, though likely slightly worse than Do Min due to transfer requirements for bus-rail, but additional capacity provided enabling more people overall	1	Offers travel time improvements for PT, so catchment increases. Crucially provides significant additional capacity to allow the larger catchment to be realised.	5	Offers travel time improvements for PT, so catchment increases. Crucially provides significant additional capacity to allow the larger catchment to be realised.	5
	Increased access to city centre (labour pool - workers to business)	No. of residents within 45 mins by PT & walk /cycle & 30 mins by car to City Centre at peak		0	No significant difference from the Do Min	0	As above	1	As above	2	As above	1	As above	5	As above	5
	Increased match between volume to capacity-City Centre routes over time	No of people per hour by major corridor at LoS E or better in peak periods		0	Slight improvement on the Do Min due to reallocation of bus resource to better match demand	1	Provides ability to better meet demand, though bus terminal capacity still restrictive as time goes on	2	Additional terminal space allows further increases in city bus volumes so demand can be met further into the future	3	Provides ability to better meet demand, though bus terminal capacity still restrictive as time goes on	2	Demand can be met and LoS likely to improve through less crowding and congestion	5	Demand can be met and LoS likely to improve through less crowding and congestion	5

Figure 11 Option evaluation - Benefit one

			Do Minimum		Option 1: Do Regardless		Option 2: Non-price demand management		Option 3: New Bus Network		Option 4: Heavy rail spur		Option 5: LRT Network		Option 6: BRT w/ Tunnel	
Benefit	**Investment KPI**	**Measure**	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*
2. City centre is attractive, vibrant, healthy and safe	Reduction in environmental impacts of transport in Centre City	Volume of pollution from vehicles entering the City Centre		0	No significant difference from the Do Min	0	Noticeable reduction in general traffic volumes entering the City Centre through adjusting levers (parking, road allocation, accessability by general traffic)	3	Higher bus volumes than Do Minimum, but reduction of general traffic in the Queen St corridor - on balance probably marginal comparison to the Do Min	0	Some reduction in bus volumes as an improvement over the Do Min. Unlikely to impact general traffic	1	Removal of significant bus volumes crossing the City Centre and much reduced traffic volumes on Queen St	3	Removal of significant bus volumes crossing the City Centre by utilising the tunnel	2
		No.of pedestrians & cyclists exposed to transport-related pollution over specified levels		0	No significant difference from the Do Min	0	Noticeable reduction in general traffic volumes entering the City Centre through adjusting levers (parking, road allocation, accessability by general traffic)	3	Higher bus volumes than Do Minimum, but reduction of general traffic in the Queen St corridor - on balance probably marginal comparison to the Do Min	0	Some reduction in bus volumes as an improvement over the Do Min. Unlikely to impact general traffic	1	Less buses and less traffic on Queen St so higher volumes of peds/cyclists are exposed to lower pollution levels	2	Less buses on surface in the core of the City Centre. Positive compared to Do Min, but not a drastic reduction. Unlikely to impact general traffic volumes	2
	Increased safety for all road users	No of deaths and serious injuries in road crashes within the City Centre		0	No significant difference from the Do Min	0	Noticeable reduction in general traffic volumes entering the City Centre through adjusting levers (parking, road allocation, accessability by general traffic)	3	Higher bus volumes than Do Minimum, but reduction of general traffic in the Queen St corridor - on balance probably marginal comparison to the Do Min	0	Some reduction in bus volumes as an improvement over the Do Min. Unlikely to impact general traffic	1	Less buses and less traffic on Queen St, while other City Centre roads will likley increase. Positive compared to Do Min	2	Less buses on surface in the core of the City Centre. Positive compared to Do Min, but not a drastic reduction. Unlikely to impact general traffic volumes	2
	Increase in City Centre amenity	Rating against key amenity criteria		0	No significant difference from the Do Min	0	Reduction in general traffic in the city centre is positive, but increasd bus volumes negatively impact, reducing the overall positive effect	-1	Turns Queen St into major bus corridor, having significant urban amenity impacts	-2	Some reduction in bus volumes as an improvement over the Do Min. Unlikely to impact general traffic	2	Increase in public space and walkable environment	5	Impact of portals are significant in the vicinity, but considerable positive impacts in the central city (ie Queen St area). Higher volumes on the CBD outskirts (donut effect)	1

Figure 12 Option evaluation - Benefit two

			Do Minimum		Option 1: Do Regardless		Option 2: Non-price demand management		Option 3: New Bus Network		Option 4: Heavy rail spur		Option 5: LRT Network		Option 6: BRT w/ Tunnel	
Benefit	**Investment KPI**	**Measure**	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*	*Comment*	*Score*
3. More efficient & costeffective transport network & services	Increased travel efficiency in City Centre	Peak and off-peak travel time, by mode, between selected origins &destinations		0	No significant difference from the Do Min	0	Negatively impacts general traffic through reduced accessibility, but positive for bus operations through allocated dedicated space	3	Additional corridors for bus usage reduces bus-bus congestion so improves flow overall.	2	Some reduction in bus volumes as an improvement over the Do Min in terms of bus operating efficency in the shorter term. Unlikely to impact general traffic	2	Increased level of segregation for PT, less turning movements to improve ped and general traffic movement. Lower bus volumes.	4	Removal of vast bus volumes improves surface travel and buses operate in segregated facility	5
		% fare box recovery on public transport		0	Slight improvement on the Do Min due to reallocation of bus resource to better match demand	1	Slight improvement on Do Min through improved operating efficiency, but relationship between service provision / patronage remains very similar	2	Slight improvement on Do Min through improved operating efficiency, but relationship between service provision / patronage remains very similar	2	Slight improvement on Do Min through improved operating efficiency, but relationship between service provision / patronage remains very similar. Additional rail opex likely to be negigible as expected to replace short running inner western services so this is beneficial overall	3	Improved efficiency in operations and higher passenger numbers	4	Improved efficiency in operations and higher passenger numbers	4
	Increased travel reliability	Travel time variability by mode- peak & off-peak		0	No significant difference from the Do Min	0	City Centre sections improve noticeably through additional space allocation	2	City Centre sections improve noticeably through additional space allocation and additional improvements on approach corridors further improve	3	Rail pax enjoy high levels of reliability. Negligible impact on bus pax through reduced bus volumes compared to Do Min	1	Segregated facility for PT	5	Segregated facility for PT, but inability to achieve any signal priority on approach corridors due to vehicle volumes	4
		Travel time variability by major corridor - peak & off-peak		0	No significant difference from the Do Min	0	City Centre sections improve noticeably through additional space allocation	2	City Centre sections improve noticeably through additional space allocation and additional improvements on approach corridors further improve	3	Rail pax enjoy high levels of reliability. Negligible impact on bus pax through reduced bus volumes compared to Do Min	1	Segregated facility for PT on major corridors	5	Segregated facility for PT, but inability to achieve any signal priority on approach corridors due to vehicle volumes	4
	Increased public transport user customer experience	Customer satisfaction rating		0	No significant difference from the Do Min	0	Better city centre tavel efficiency, otherwise little improvements	2	Improvement in reliability through additonal improvements on corridor approaches and priority on more corridors in city centre	3	Pax who transfer to rail will benefit as long as transfer experience is done well. Limited impact on bus pax.	2	Higher speeds, reliability should lead to much improved customer satisfaction	5	Higher speeds, reliability should lead to much improved customer satisfaction	5
		No. of bus passengers left behind		0	No significant difference from the Do Min	0	Better ability to meet demand through additional corridor and terminal capacity. This will still be constrained in the medium - long term.	2	Increases overall capacity to cater for demand compared to Do Min through more servcie, enabled by additional corridor and terminal capacity in the city centre	3	Increases overall capacity to cater for demand compared to Do Min. Ability to add service from other corridors due to redcued bus vols from two corridors	2	Provides sufficient capacity to meet demand with capacity for further growth	5	Provides sufficient capacity to meet demand with capacity for further growth	5
		Weighted Score		**0.0**		**0.2**		**1.5**		**1.4**		**1.5**		**4.4**		**3.7**

Figure 13 Option evaluation - Benefit three

11.6.2 Travel Related Evaluation

The travel and traffic related benefits and measures such as increased access to the City Centre, reduced travel time variability and so on, largely score consistently with substantial benefits from the heavier investment options, 5 and 6. Option 3 performs reasonably well on these measures as it allows additional capacity to be provided – for a limited period. Demand management – Option 2 – also provides some benefits for public transport users. The Do Regardless Option contains essential first steps that must be taken. Its impact is however limited. The gains from the lower cost investments are illustrated in Section 12.4.

11.6.3 Environmental and Amenity Evaluation

The Environmental impact reductions – relating to pollution and exposure – improve most for Option 2 as it deliberately aims to reduce overall private vehicle levels. The heavy investment options provide benefits both from attracting travellers from cars and from reducing bus numbers in the City Centre.

The assessment of the amenity impacts of the options (and subsequently of the IP) was carried out by professional consultants Jasmax and Land Lab using a methodology developed by specialists within Council. The methodology and results are included in Appendix D. The accompanying assumptions and notes are also in Appendix D. The results of the evaluation were normalised and included in the overall appraisal.

Option 3, extended bus network, scores particularly badly owing to the use of Queen Street for buses and no relief for the town centres or road corridors. By contrast, Option 5, Light Rail Transit has a very positive affect on amenity in the City Centre and through the suburban town centres. Option 2, Demand management is assessed as being worse than the base case as it results in more buses which are seen as more detrimental in terms of amenity than the general car traffic removed. The other options lie between the Do Regardless and the LRT options.

11.6.4 Road Safety

As part of the second benefit -"*City centre is attractive, vibrant, healthy and safe"* - a measure was included that sought to increase safety for all road users, focused on reducing the number of deaths and serious injuries within the City Centre.

Using AT's Collective Risk Mapping Tool, there are a number of corridors within the City Centre that are identified as being 'high risk'. This is because of high traffic and pedestrian volumes. Interrogating the data further showed that in terms of recent crash history, there were no fatal or serious injury crashes; all reported crashes were minor or non-injury. This suggests that while the City Centre may be viewed as high risk, there does not appear to be a current safety problem that any of the programmes or options would affect. The non-price demand management option was considered to have the most impact as it may reduce the collective risk by lowering traffic volumes. All the other options were considered to perform similarly in terms of the safety measure.

Crashes on the four main isthmus arterials (Sandringham, Dominion, Mt Eden and Manukau roads) from the five year period from 2010 – 2014 were also assessed to determine any significant safety concerns. All corridors had a number of minor and non-injury crashes which is not unexpected for the volumes of traffic that they carry. Only Dominion Road had a single fatal crash and Dominion and Mt Eden roads had a small number of serious crashes.

None of the options was considered to represent any negative change to the safety environment of the outer area, though the AT road safety team would welcome any restriction in allowable turning movements or improved visibility, particularly at identified black spots, as they would likely be a safety improvement.

11.6.5 Workshop conclusions

The evaluation demonstrated to the satisfaction of all the workshop participants from the three partner organisations that none of the options in themselves should go forward to the IBC. Only Options 5 – with LRT – and 6 – with BRT - produced solutions to the problem. Each of those options was recognised as very expensive, while Option 1, Do Regardless, was seen as being appropriate to its name and was an essential first step. Aspects of Options 2 and 4 were also seen at the workshop as having potential. It was therefore agreed at the workshop that the Preferred Programme would be an integrated combination of the Do Regardless, bus optimisation, active modes programme and demand management with at least one high capacity LRT line that could use the available Queen Street corridor and improve amenity. It was suggested at the workshop that the metro rail spur to Mt Roskill might provide sufficient capacity at a lower cost to avoid the need for the Sandringham Road LRT line. Subsequent analysis using the STM suggested that there would be benefit in comparing the rail spur option with a Sandringham Road LRT line as the latter offered more benefits - though at a higher cost.

On the evidence at the time it seemed that an additional LRT corridor connecting to Symonds Street from Manukau and Mt Eden Roads as included in Option 5 might not be needed until around the planning horizon of the mid-2040s. Again further analysis suggested that these additional interventions might be required in the early 2040s and therefore theoretically within the planning horizon of 2046.

The BRT option was identified as being more costly than the LRT option, was far more uncertain as to its constructability, required significant property purchase and could not be staged. While subsequent AT initiated peer review of the BRT option suggests that the costs may be at the higher end of a likely range (see Section 12.12), it would still be far more expensive than the alternatives, would be unattractive to customers with deep stations and would not generate the full range of benefits sought.

The composite IP was therefore taken forward for more analysis, largely using the STM as discussed in the next section.

12 The Integrated Programme (IP)

12.1 Programme Overview

The principle of the IP is to address capacity issues on City Centre and feeder corridors with a combined programme that comprises:

1. Optimisation of the current plans for the New Network of central Auckland public transport services including maximum introduction of higher capacity buses and reallocation of bus services to make better use of available capacity
2. Taking all possible measures to improve the efficiency of the bus network – for example off-board ticket checking and further commitment to bus priority measures
3. Commitment to fast tracking/bringing forward existing public transport (PT) programme
4. Further support to enable active modes (walking and cycling) within and accessing the Auckland City Centre, as well as investigation and use of further practical demand management tools (eg parking management)
5. Refine/develop higher capacity rapid transit programme that can use can use Queen Street and Dominion Road while enhancing the urban amenity – expected to be light rail
6. Assessing and as appropriate including a possible second high capacity line on Sandringham Road and / or a metro rail spur from the Western Line to Mt Roskill.

The LRT element replaces all buses operating on Dominion Road from Mt Roskill to the City Centre removing them from congested city centre bus corridors (i.e. Symonds Street and Wellesley Street) and transferring the demands to a new LRT corridor on Queen Street. The Sandringham Road LRT line, if justified, would similarly replace the equivalent bus services.

The possible metro rail element would involve a Mt Roskill rail spur from the western line and reductions to the bus services from the Sandringham Road group of bus routes, which intersect the rail line, reducing the demand for bus travel along Isthmus bus corridors. This heavy rail branch therefore presents an alternative to a Sandringham Road LRT line. A reservation exists for the rail route. Post-CRL train service plans have been developed that could accommodate the service.

Together these elements would reduce the numbers of buses that will reach the City Centre by removing all Dominion Road buses and reducing the number of Sandringham Road buses. This relieves congestion and allows space through the city centre for more buses from other corridors. Alternatively, the Sandringham Road LRT line could provide greater benefits than the metro rail spur. The two should be assessed and compared in the infrastructure IBC.

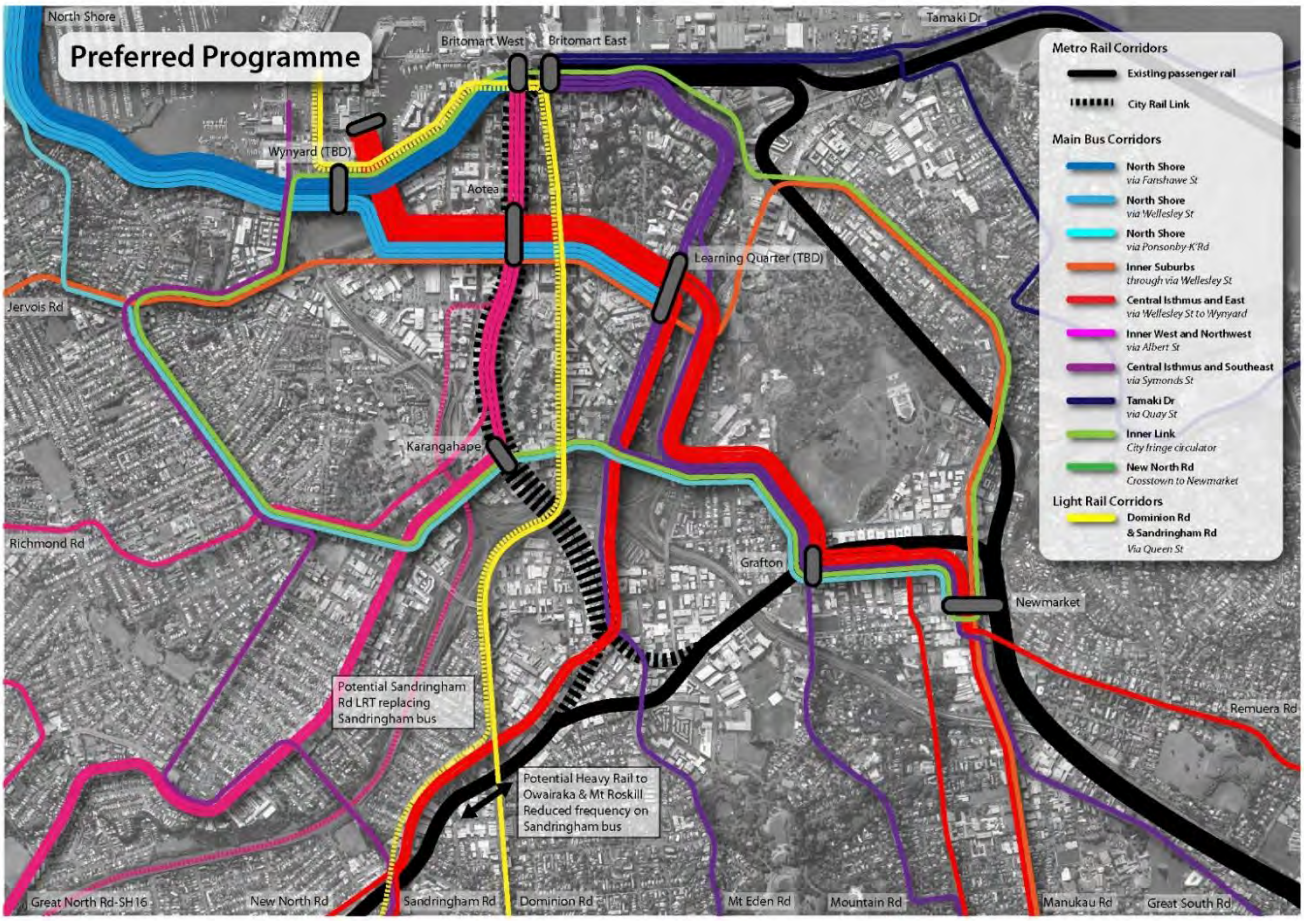


Figure 14 Conceptual IP

12.2 IP discussion

For the IP the first priority is to implement all the Bus Reference Case and Stage Timing Model possible actions to maximise the carrying capacity of the New Network buses as discussed in Section 5. The full programme of actions to support and promote active modes is also included as the best way to reduce demand for motorised travel in a very constrained area – and where the local population is young and growing as noted in Section 9 – in the City Centre itself and within about a five kilometre radius.

The proposed further extensive investment in walking and cycling builds on the significant success of individual projects delivered to date. For example, the first stage of the Nelson Street separated cycleway has 900 riders per day whereas the pre-implementation figures were close to zero. This effect will be significantly enhanced when the City Centre minimum grid of three east - west and two north - south separated cycleways is delivered between now and mid-2018 which, based on international experience, will significantly further boost cycling numbers.

Cycling and walking investment complements public transport. Investing in improving walking and cycling *to* and *from* rapid transit – something that AT is piloting at New Lynn and Glen Innes stations – is far more cost efficient than park and ride, for example.

Importantly for the City Centre, is that the fact that peak bus costs are around three times that of non-peak operation. This cost is driven by the fact that the bus network only requires around a third of the fleet to operate non-peak service. The fleet size is determined by the peak level of demand which is driven by the peak load point for a service. So the peak load point of a peak service, carrying the last boarding passengers a relatively short distance, drives a lot of the cost of providing peak public transport.

This peak load is nearly always within easy walking and cycling distance of the City Centre. Migrating short distance public transport customers to walking and cycling not only drives better health outcomes for those people, it also avoids some of the peak-of-the-peak cost of operating public transport and enables sustainable modes to work optimally for the optimal journey length for each mode. It also potentially reduces bus volumes entering the City Centre and helps buy time until a higher-capacity public transport solution can be delivered. Based on

experience with recent programmes the active mode component of the IP may delay the need for need for additional investment by one to two years as they are likely to reduce demand by up to 2%.

Therefore, while these actions – and commitments such as CRL (which largely serves different catchments in the south and west) – are integral to the programme the rate at which demand is growing in Auckland means that a step change in public transport provision is still required. That step change is achieved in the IP by bringing into use the City Centre's only route that is relatively underutilised by public transport: Queen Street.

Moving a significant service group off Symonds Street allows that corridor to remain within capacity for about 20 years with relatively minor challenges on Wellesley Street, even though the capacity released will at least partially be used to allow more bus services to operate on the Manukau Road and Mt Eden road corridors.

Moving significant numbers of bus services on to Queen Street, however, will not function operationally or in terms of the urban amenity – as discussed in terms of programme option 3. There would remain the major question of terminal capacity that is one of the fatal flaws of that option. A different mode is therefore required that does not have those challenges but can move more people in fewer vehicles without the high urban amenity impact. The only mode identified with those characteristics is light rail as in programme Option 5. The IP includes a further LRT line on Sandringham Road as a possible requirement subject to incremental cost-benefit analysis compared to the metro rail spur to Mt Roskill. The modelling indicates that a further service pattern via Symonds Street may be needed towards the end of the thirty year evaluation period. Given the uncertainty associated with forecasting so far out, it has not been included in the IP.

In the IP, Queen Street becomes effectively pedestrianised (north of the Town Hall) except for the LRT services (with three stations) and limited servicing (e.g. at night). Dominion Road would be subject to strong controls on on-street parking along much of its full length (compared to the intermittent bus lanes currently in place), with centre road running of the LRT and widely spaced 67m long stations rather than the present frequent stops. Vehicles would be 33m long capable of being coupled to form 66m trains.

Full traffic signal prioritisation would be implemented along with limiting right turning options on the arterial roads which accommodate the LRT routes.

The IP may include the Mt Roskill rail spur extension from programme Option 4 as previously identified in the Auckland Plan. Two stations would be included, a Mt Roskill station (at the Dominion Road LRT-bus interchange) and an Owairaka station (near the Richardson Road overbridge over SH20). The approximate alignment is shown below in **Figure 15**. As noted, a Sandringham Road LRT line might still be required as an alternative or an addition.

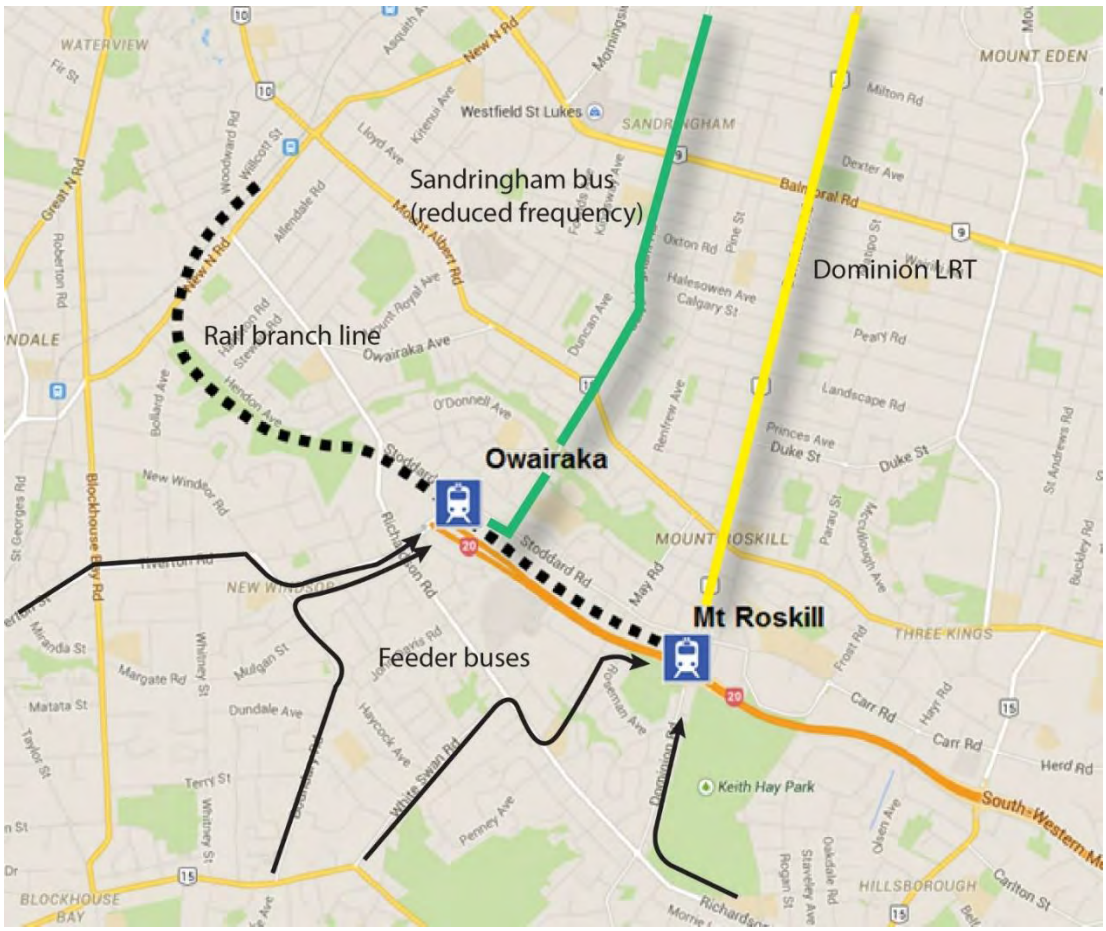


Figure 15 The IP and suburban interchanges

Primary service implications would include:

- All Queen Street and Dominion Road buses would be replaced by LRT north of Mt Roskill station. A sub-stage would likely be an extension from Queen Street to the Wynyard Quarter.
- South of Mt Roskill the tails of existing Dominion Road bus routes would be reconfigured as feeder routes to an interchange located at the heavy rail and LRT stations at Mt Roskill Junction (Dominion Road and Denbigh Ave)
- All Sandringham Road buses would likewise be stopped at the Owairaka Station as feeder services. A new reduced frequency Sandringham Road service from the Owairaka Station to the City Centre would be added so that there is no reduction in network coverage.
- The bus-rail interchanges at the stations would be provided in a way to minimise disruption (in terms of layout etc.), and timed where possible to reduce wait time (and therefore overall journey times) for passengers interchanging.
- Additional services would be added to other bus routes using the released capacity within the City Centre to cater for terminating buses.
- It is expected that double decker buses would be used as appropriate especially on the other trunk routes that need to take up the capacity released (e.g. Manukau Road).
- Rail operating plans will need to be modified on the network to accommodate this service. There should be a minimum of four trains per hour at peak (ideally six).
- Planning for the CRL has shown that additional metro rail capacity will be required on the inner sections of the western line over time. The IP would provide that capacity.

This option also allows for an extension of the Dominion Road line to the airport and/or the addition of other parallel LRT lines in the future.

12.3 Programme Timing

The IP was assessed using the STM, which modelled the bus optimisation. It is anticipated that the reduction in demand and further management measures with the active modes will equate to up to a two year delay, in the timing for the major investment. Earlier active mode programmes have reduced demand by about 1%. This equates to a year's growth on the constrained Frequent Transit Network, much less if the pent up demand related to the Rapid Transit Network is the comparator.

Similarly, when the CRL opens in 2023 it will allow some re-working of bus routes and will itself provide a large jump in capacity but largely for outlying catchments, especially in the west.

The component of the IP that provides the step change needed is the use of Queen Street as an additional high capacity public transport corridor, which requires careful consideration of amenity impacts. It is therefore apparent that this element of the IP needs to be delivered in the first decade.

The STM was used to model the Base Case and the IP, shown below for the key corridors of Symonds Street (**Figure 16** - **Figure 17**) and Wellesley Street (**Figure 18** - **Figure 21**). The problems with the base case not catering for the demand is vividly shown. The requirement to bring in the major elements of the IP are also apparent. Appendix E shows a time series of the base case and the IP at five yearly intervals for their impacts on City Centre corridors.

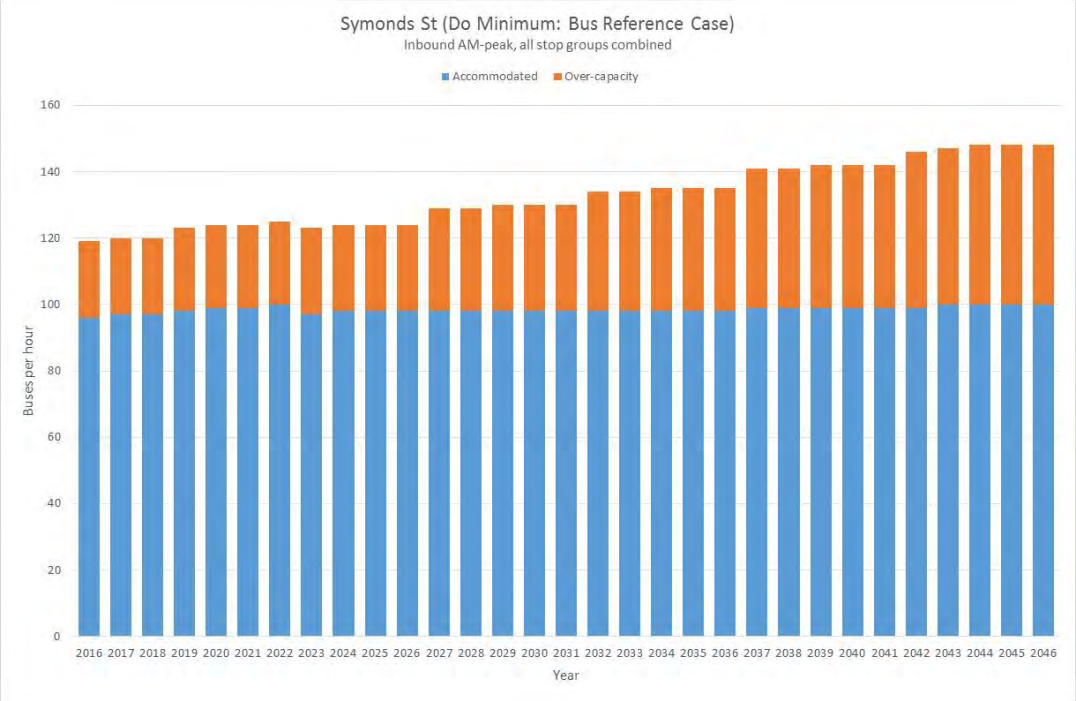


Figure 16 Symonds St – do minimum

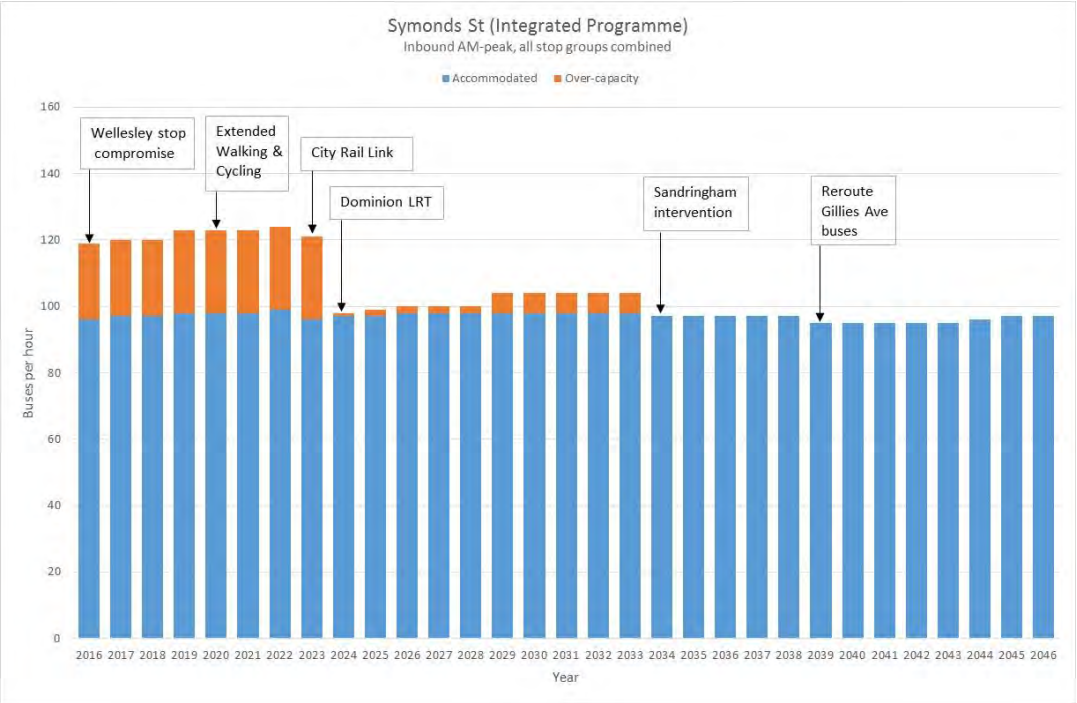


Figure 17 Symonds St - IP

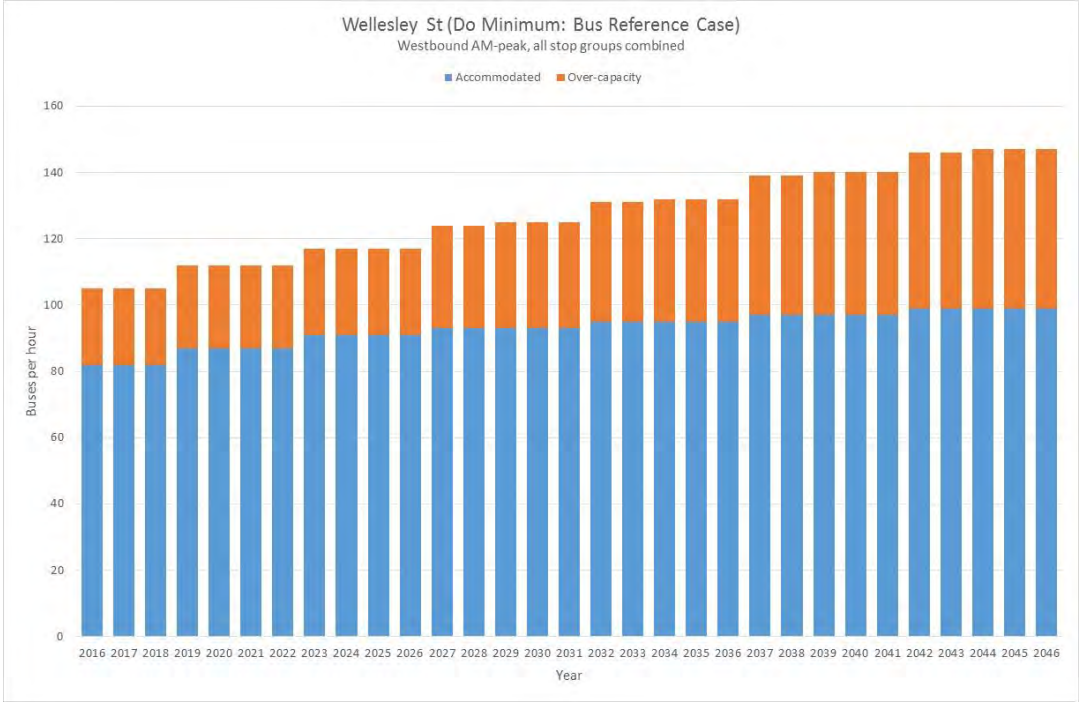


Figure 18 Wellesley Street, westbound – do minimum

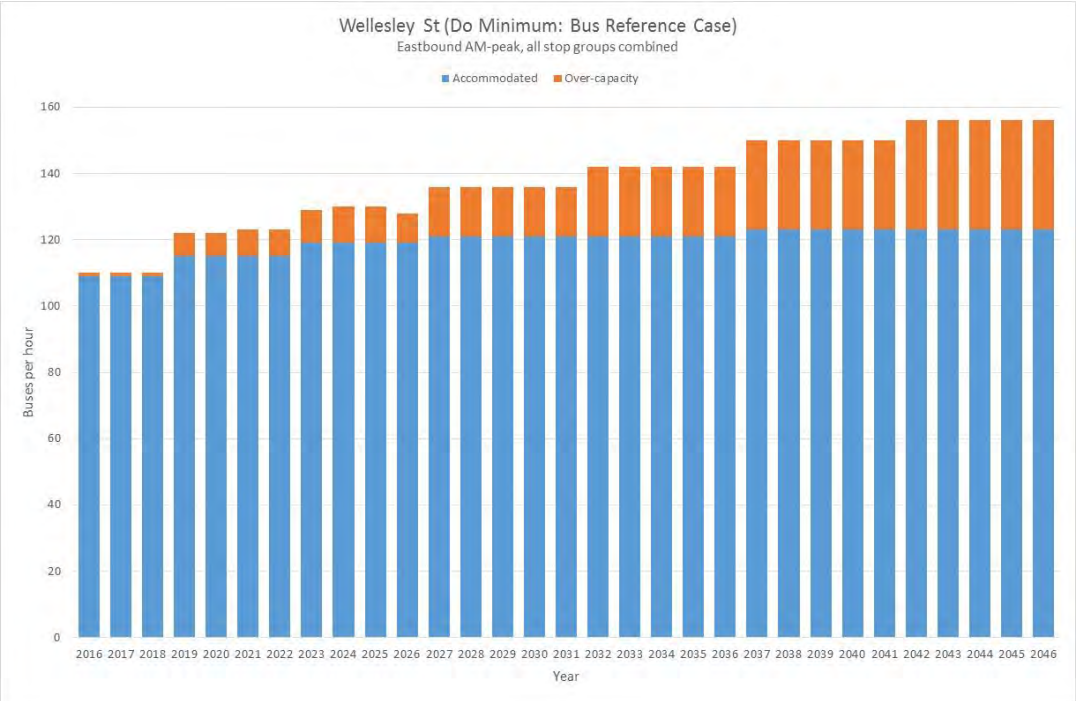


Figure 19 Wellesley Street, eastbound – do minimum

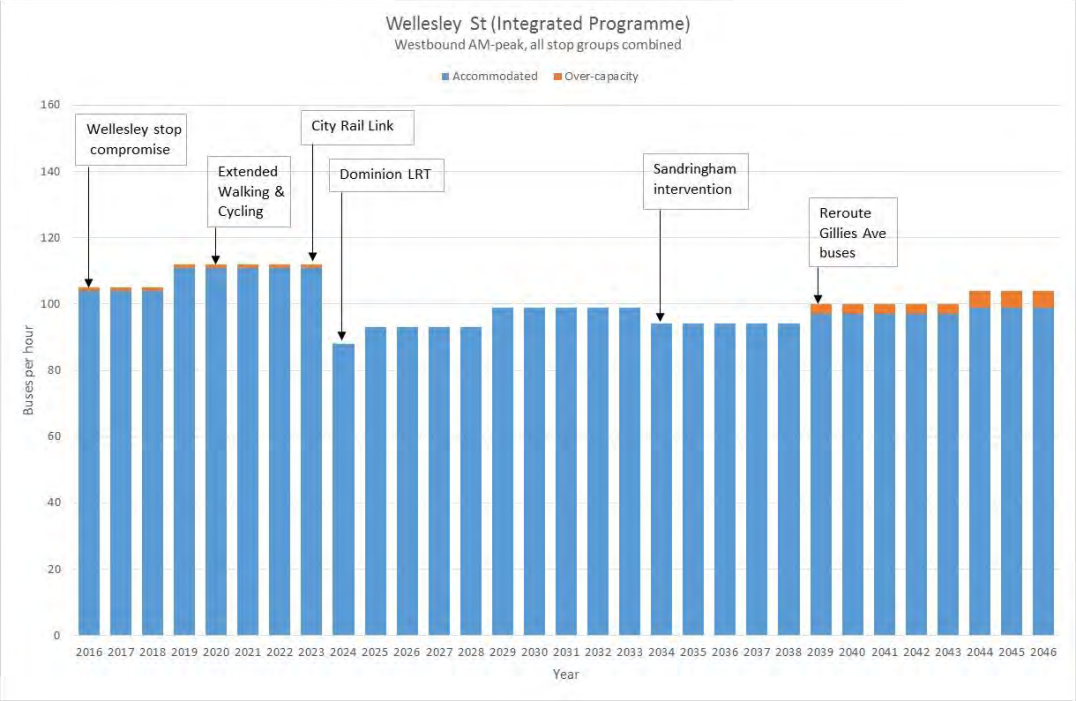


Figure 20 Wellesley Street, westbound - IP

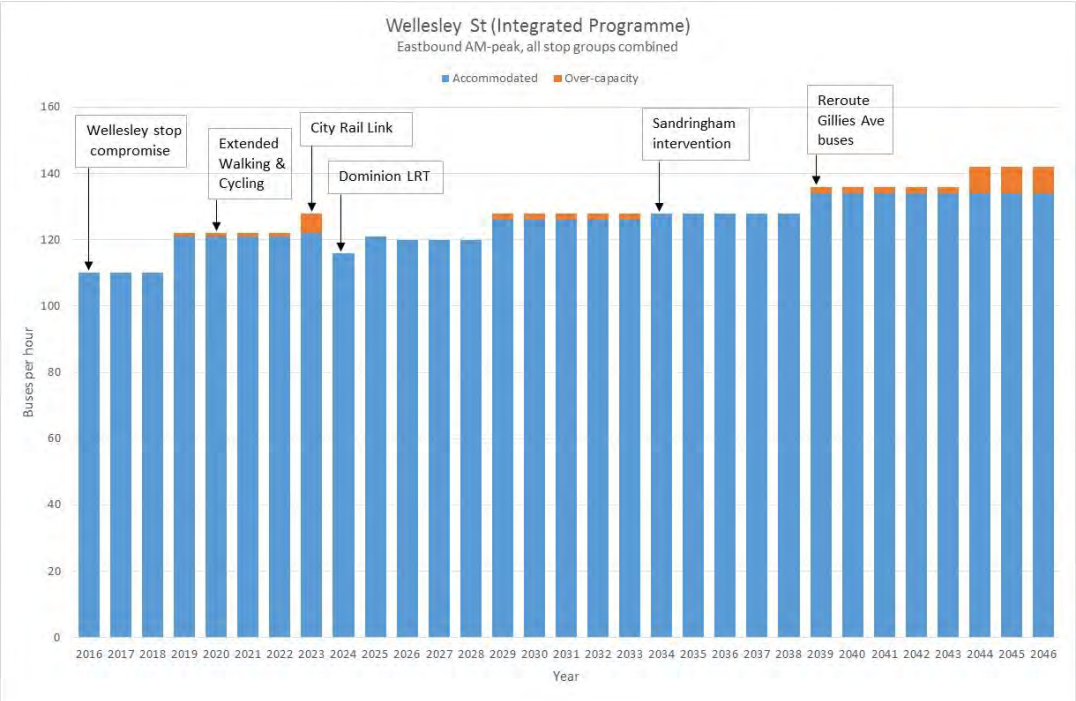


Figure 21 Wellesley Street, eastbound - IP

The IBCs should confirm this timing and that for the other programme elements. The more detailed modelling that is appropriate at the IBC stage will allow the refining to take place.

12.4 Programme Benefits

The performance of the IP against the benefits as represented by the investment KPIs is shown in **Table 4**.

Table 4 IP benefit assessment

Benefit	Investment KPI	Evaluation
Auckland's prosperity and growth are enabled	*Increased access to City Centre (business to business)*	The walking component of the IP will be particularly important for the business to business connectivity and its impact on economic productivity. Targeting fine grain routes (eg laneways and arcades) with high amenity should appreciably contribute to the agglomeration benefits of the total programme[21]. The LRT element will provide an effective transport spine linking-up the commercial centre.
	Increased access to City Centre (labour pool – workers to business)	The active modes element of the IP will improve access to the City Centre for residents within typically 5 km. Improved travel time and capacity on Dominion Road extend catchment. The bus space released can accommodate higher demand from elsewhere. 6,000 more potential public transport users in each peak period can be accommodated just on the principal corridor. The impact on the overall catchment will be significantly greater as the ability to accommodate more users on public transport will substantially reduce congestion that would otherwise occur.

[21] http://www.sgsep.com.au/publications/valuing-city-melbournes-walking-economy

Benefit	Investment KPI	Evaluation
	Increased match between volume to capacity – City Centre routes over time	The IP leads to a better match between demand and capacity. In the early years the bus optimisation and active modes/demand management components contribute. The infrastructure investments add capacity sufficient to meet demand until the 2040s.
City Centre is attractive, vibrant, healthy and safe	*Reduction in environmental impacts of transport in City Centre*	Moderate impact as the IP will allow at least 6000 more travellers to use active modes and public transport rather than needing to use private transport. Removing buses and general traffic from Lower Queen Street will substantially reduce the number of pedestrians exposed to transport-related pollution. Similarly provision of pedestrian routes away from major roads will provide a significant benefit. Elsewhere there will be no benefit as the IP allows capacity on the roads released by removing some bus services to be taken up by others.
	Increased safety for all road users	A moderate benefit likely as overall traffic levels should be reduced. Taking general traffic out of Lower Queen Street will reduce the potential for pedestrian/vehicle conflicts as will having more dedicated pedestrian routes. The cycle programme will benefit these vulnerable road users.
	Increase in City Centre amenity	There will be an appreciable amenity benefit both from the partial pedestrianisation of Queen Street and from the increase in laneways/shared streets in the walking programme.
More efficient and cost effective transport network and services	*Increased travel efficiency in City Centre*	Increases in segregated corridors for cyclists, pedestrians and some public transport will provide moderate benefit. Some private vehicle travel will be less efficient through being less direct, though with lower overall traffic levels.
	Increased Travel Reliability	Significant improvement through having segregated facilities.
	Increased public transport user customer experience	Significant improvement through having sufficient capacity in most years, with higher speeds and a service that may be considered ‘premium’.

The benefits identified above would be realised immediately once the changes are implemented.

Based on the outputs from the STM, there is a need to implement changes in the early 2020s so that the performance of the City Centre bus network does not start to undermine the operation of the city.

Prior to that, the progressive implementation of the walking and cycling network can alleviate a small portion of the demand and if delivered in its entirety may be able to accommodate up to two years’ worth of growth. This would be through attracting existing public transport passengers and those travelling by car to travel by active mode and new travellers choosing bicycle or foot as their main travel choice.

The benefits from the minor bus network changes are minor and again are really suited to buying some time. Once the required infrastructure was in place, these could be implemented, easing the pressure on the Symonds St corridor, albeit for a short time.

The assumed implementation of the major programme elements occurs progressively until 2023 when the large infrastructure items are completed. The removal of buses in the city centre from Sandringham Rd through the heavy rail component of the programme is reliant on the CRL being open and operational so that additional trains from the western line can be accommodated on the network. The LRT line on Dominion Rd could be delivered at

any stage, though there will be a reasonably long lead time for the full line. It can potentially be delivered in two stages (city centre stage and Dominion Rd stage) so that some benefits in the city centre could be realised prior to the full line being operational. Temporary stabling and maintenance requirements may affect the ability to stage the implementation.

By 2023, it is expected that the full range of benefits will begin to be being realised and they will increase over time as demand for travel to the City Centre grows.

12.5 Programme Risk

As with any investment programme, particularly over a longer time period, there are risks and uncertainties that need to be considered. Some of the risks can be reduced during the later stages of the business case process, others are inherent and will need to be managed right through programme implementation.

The specific risks and uncertainties identified for the CAP IP are:

- **Technical**: it is possible that before all elements of the Programme have been commissioned new technologies may be available that either change the demand for travel to the Auckland City Centre or provide different solutions. ATAP is specifically considering technological opportunities that may be relevant. In any case it is suggested that as an input to the IBC there should be a check that no viable alternative to LRT exists that that can use the available Queen Street corridor providing the capacity required that is compatible with the urban amenity imperatives, has acceptable terminal requirements and is affordable.
- **Operational**: the timing of the IP and its ability to provide sufficient capacity for the demand until the mid-2040s has been assessed through the STM with its detailed analysis of operational characteristics. Although the product of informed expert work by consultants working with AT's own specialists it is possible that the analysis will be shown not quite to represent accurately actual conditions. It is suggested that the analysis may be 'optimistic' and that operational performance may not be as good as modelled.
- **Financial**: the availability of funding for the IP is likely to be influenced by the outcomes of ATAP and its wider prioritisation of transport requirements across Auckland.
- **Stakeholder/public**: both the measures to optimise the New Network bus operations and the introduction of LRT will require displacement of car parking, loading and unloading, higher levels of enforcement etc. Historically the level of resistance to such measure, for example by concerned shopkeepers, has been high. It will be important that the community engagement is effective in describing the wider benefits of the Programme.
- **Economy**: the Programme is strongly geared to achieving Government and local aims for Auckland's economy. If it continues to grow strongly there may be pressure to extend the Programme or bring forward additional elements. Alternatively, if the economy weakens and with it some of Auckland's population pressures there may be some opportunity for delay although conversely any weakening of the economy might put greater pressure for infrastructure measures that can boost productivity.
- **Land use**: Land-use risk exists as many future decisions will impact upon the level of growth in both population and employment within and outside the study area. One approach will be to tie the timing of the interventions to population/employment levels rather than particular years.
- **Other corridors**: AT is currently studying preferred ways to improve public transport services both to the North Shore and to the Airport. It is possible that these studies may recommend an option that complements the IP or interacts with it in some way. Such effects need to be understood in later stages of the business case cycle.

12.6 Value for Money

A significant step change, beyond what is planned with the CRL and New Network, is needed for public transport to the City Centre and that step change involves a large cost. The IP allows the majority of the benefits of the other high performing options to be realised, but at a much smaller cost than other options that could also achieve an appropriate level of benefits. So whilst the IP is still a large investment, the interventions are better sized and it represents a better value for money solution.

12.6.1 Benefits

There are numerous traditional transport benefits (consistent with the Economic Evaluation Manual) that the integrated programme achieves which have been estimated as part of the value for money assessment. These include:

- **Travel time benefits:**

  Achieved through providing the capacity for people to travel on public transport. For those people on Dominion Rd, this includes the benefits of reduced travel time from introducing LRT in a segregated facility compared to the buses they were previously travelling on which were affected by congestion to some degree. The additional capacity enabled by the IP can mean that the drivers who wish to use public transport can get out of their cars and onto fast, reliable services with sufficient capacity. This is especially important as the congestion on these routes will worsen over time making the benefits achieved by utilising public transport grow in the future.

  A smaller, but equally important improvement is generated for people who can now use the light rail as a means of getting round the City Centre compared to the City Link bus that is slowed by congestion. Another element of the travel time benefit that is enabled through the removal of general traffic in Queen St is for the City Centre pedestrians. Currently they are typically restricted to crossing at signalised crossing points which are subject to traffic signal phase and cycle times. When general traffic is removed, turning movements reduced and cycle times reduced the ability to cross roads in the City Centre is improved. Though the improvement per person is small, the sheer number of pedestrians in the city centre means this comes to noticeable total overall.

- **Travel reliability improvements:**

  Achieved through reducing the variability of travel time on public transport, specifically on the Dominion Rd corridor. With bus-bus interactions causing congestion and still having to navigate parts of the route with congested general traffic, the introduction of segregated light rail provides real improvements in the ability to travel to schedule. This reduces customer frustration and means that people can arrive on time, and not have to attempt to build in an allowance for that variance. A smaller, but equally important improvement is generated for people who can now use the light rail as a means of getting round the City Centre compared to the City Link bus that operates in heavily congested conditions.

- **Public transport user benefits:**

  The customer experience aboard light rail vehicles will be superior to the bus experience and the EEM provides values to capture these improvements. They occur both whilst in the vehicle and at the stations which will be much higher quality than a typical bus shelter.

- **Benefits associated with reduced emissions (both air pollutants and noise):**

  Whilst these benefits are modest, there will be a reduction in air pollutants and noise emissions due to the switch from bus to light rail as the public transport mode on the Dominion Rd corridor. There will be some slight increases on other corridors as additional bus services are enabled by the freed up space in the City Centre.

- **Health benefits from walking:**

  In the Dominion Rd corridor, the light rail stations will be further apart than bus stops, so existing public transport customers will now walk slightly further and the health benefits of that extra walk can be captured. In the other corridors, where more bus services are enabled, the passengers on those buses are now walking to their bus stop (as they were previously part of the underlying demand that could not be met). This daily walk improves their health and the benefits to those groups of customers are also captured.

- **Residual value:**

  The long life of the investment in the light rail infrastructure is not adequately captured in a 40 year evaluation period, so the residual value of the project has been estimated. This can either be the residual value of the infrastructure which remains (i.e. it does not need to be built again) or the residual value of the potential benefits that occur beyond the end of the 40 year evaluation period.

- **Wider Economic Benefits:**

  The Wider Economic Benefits largely due to agglomeration effects within the City Centre have been estimated at the programme level based on the proportion of total benefits that other large public transport

projects have estimated. One of the main benefits of the integrated programme is the ability to deliver sufficient capacity for travel to the City Centre, enabling the growth and agglomeration effects to occur.

12.6.2 Costs

The capital and operating costs of the IP have been estimated, along with an estimated cashflow for the capital costs.

The NPV of the high level cost estimate of the IP are shown below by programme element:

- Series of minor improvements - $270m
- Heavy rail spur (to reduce bus demands from Sandringham Rd) - $148m
- Dominion Rd to Wynyard LRT – $1,030m
- Operating costs - $119m - $236m

12.6.3 Economic Analysis

An initial economic analysis consistent with the Transport Agency's Economic Evaluation Manual has been carried out using the available model outputs and has attempted to quantify the benefits described in the earlier section. For a number of benefit categories, a range has been used to give an estimated upper and lower value. The standard 6% discount rate and 40 year evaluation period have been adopted.

The benefits from the series of minor improvements have not been included in the analysis as many of the elements are not suitable for EEM based calculations (such as laneway improvements)[22] and parts being included in other expected programmes (such as NW Busway stations being brought forward).

The NPV of the estimated benefits based on this initial analysis are:

- Traditional transport appraisal benefits: $679m - $1,051m
- Wider Economic Benefits - $102m - $452m
- Total benefits (sum of above) - $781m - $1,503m

For calculating an indicative benefit – cost ratio (BCR) the cost range, excluding the minor improvements costs, is $1,298m - $1,414m.

An alternative approach including an increase in property value uplift in vicinity of LRT stations would create additional benefits in the range of $250m - $1b. This would give the potential BCR in the range **0.7 – 1.9** allowing for the metro rail spur**.**

At this stage the relatively low BCR is not entirely unexpected for a number of reasons:

- The constraint of requiring a fixed land use for the evaluation is a flawed assumption, as without additional capacity for travel to the City Centre, the ability to deliver the land use is compromised.
- Similarly, for the people that are 'crowded off' the public transport services, there is likely to be a second order effect on general traffic as some of them would be forced back to car travel, making it even less efficient in the process. The performance of the road network would also be expected to degrade over time so potential benefits further in the future are likely to be under represented.
- Large public transport projects where a step change is being made represent a significant investment up front, but offer comparatively modest benefits in the early years. However, for a number of reasons there is a need to make that investment at that point in as there are no feasible options to allow continued functionality without the investment.
- The reliability improvements that come with almost completely segregated travel need to be explored further, particularly as the EEM currently caps them at the same value as the travel time savings.
- The non-transport benefits, such as increased tourism activity in the City Centre would further contribute to the overall economic benefit of the IP.
- Land use value uplift has not been estimated in detail but based on overseas examples is potentially large. Further assessment will confirm the magnitude of these benefits.

[22] The SGS research quoted in Section 12.4 demonstrates that there are significant quantifiable benefits

- Further optimisation around the timing of intervention will be required to endorse the best mix of investment over time. While it is evident that there is a need for intervention in the early 2020s, there may be further steps that could delay the timing of the added components of the IP – the rail spur or Sandringham Road LRT line - by maximising the use of the investment in LRT on Dominion Road.

It is expected that the BCR for the IP would increase with additional analysis and refining of the programme.

The alternative scenario was tested, with LRT also being introduced on Sandringham Rd (instead of the heavy rail spur). This would allow more buses to be removed from the City Centre, freeing up further space that could be utilised to cater for growth from other areas in the isthmus. This scenario would be expected to enable demand to be met out to (and beyond) the planning horizon of 2046. The optimal timing for the Sandringham Rd LRT line has not been assessed and for the purpose of this scenario, it is assumed to open with the Dominion Rd LRT line in 2023.

This scenario has increased estimated costs of $1,611m - $1,724m (NPV) due to the cost difference between the LRT and heavy rail spur.

There are also additional benefits with this scenario and the NPV of the benefits is estimated as $938m - $1,764m.

This gives an indicative BCR for this scenario of 0.5 - 1.1, slightly lower than the IP, but optimising the introduction of LRT on Sandringham Rd would likely increase this indicative BCR by delaying the costs.

12.7 Assessment Profile

The programme was assessed using the latest NZTA Assessment Framework criteria. An assessment profile of **H/H/L** has been determined for the programme using the NZTA's funding allocation process as detailed below:

Strategic fit of the problem, issue or opportunity that is being addressed: ***H***

The IP aligns very well with the strategies and priorities of the three partner organisations. It also addresses Government concerns re the economy as it enables more workers to access New Zealand's most productive area – Auckland's City Centre.

Effectiveness of the proposed solution: ***H***

The IP with its multiple components is an effective solution to the identified problems as it addresses all elements with a balanced programme that initially optimises the bus network and reduces demand for motorised travel with an extended active modes programme. The step change with the high capacity mode – LRT- on one (or two) corridors – and possibly use of metro rail capacity released by the CRL- ensures that the necessary capacity is provided. It does so in a way that also enhances amenity in the City Centre and along the corridors – addressing the third problem very successfully.

Economic efficiency of the proposed solution: ***L***

The preliminary economic analysis suggests that the calculated BCR is likely to be a little over 1.0. Once there is the ability to properly assess the disbenefits of the counter-factual that value is likely to increase.

12.8 Programme cost

The IP is made up of four major elements. The estimated costs of each of those elements is discussed below. Costs are noted in FY2016 dollars.

1) A series of minor improvements and major expansion of the Auckland Cycling Network

   The total estimated cost of this element is $337 million which is made up of:

   - Expansion of the Auckland Cycle Network - $200m
   - Further bus fleet expansion with more double-deckers - $80m
   - City Centre laneway and minor side street improvements - $30m
   - Footpath improvements (targeted across the region) - $15m
   - Bringing forward Te Atatu and Lincoln Rd stations - $10m
   - Implementing off board collections, traffic signal changes, more cycle parking and bus shelter improvements - $2m

2) LRT line from Wynyard Quarter to Mt Roskill via Queen St and Dominion Road

   The total estimated cost of this element is $1,367 million which is made up of the following:

- LRT infrastructure including rolling stock, stations and depot facilities - $1,352m
- Footpath improvements along the corridor (outside the City Centre)- $15m

3) Possible heavy rail spur to Mt Roskill and two new stations

   The total estimated cost of this element is $204 million which is made up of the following:

   - New rail infrastructure - $81m
   - Two new rail stations and interchange facilities - $15m
   - Additional rolling stock required to operate the services - $108m

4) Possible Sandringham Road LRT line: $500m

The operating cost of the preferred programme is estimated be cost an additional $13m - $25m annually in relation to the do minimum. This accounts for reductions associated with operating fewer buses, and increases in the costs to operate the LRT line and minor increase in heavy rail operating costs associated with the Mt Roskill metro rail spur.

The Net Present Value (NPV) of the costs associated with the preferred programme have been calculated using the NZ Transport Agency discount rate of 6% and an evaluation period of 40 years, consistent with the Economic Evaluation Manual (EEM).

Cost	NPV ($m)
Capital	$1,400
Operating	$120 - $240
Total	**$1,600 - $1,700**

12.9 Funding and procurement arrangements

It is expected that the elements of the IP will be funded under standard arrangements between the Transport Agency and Council. The exception may be the metro rail spur if included following the IBC, as special arrangements apply to 'below track' for metro rail.

The opportunity exists for Government to contribute directly to other elements of the IP, given the importance to New Zealand's economy of Auckland City Centre.

A range of procurement and financing options should be considered including public private partnerships and traditional procurement.

12.10 Affordability

The affordability of the Programme cannot be confirmed until ATAP has considered all the needs of Auckland, and the GPS has determined the size of future output classes. It also depends on the future RLTP and Council's LTP.

12.11 Programme Governance and Reporting

The IBC and programme governance and reporting arrangements will be reviewed between the three current partners.

12.12 Peer Review

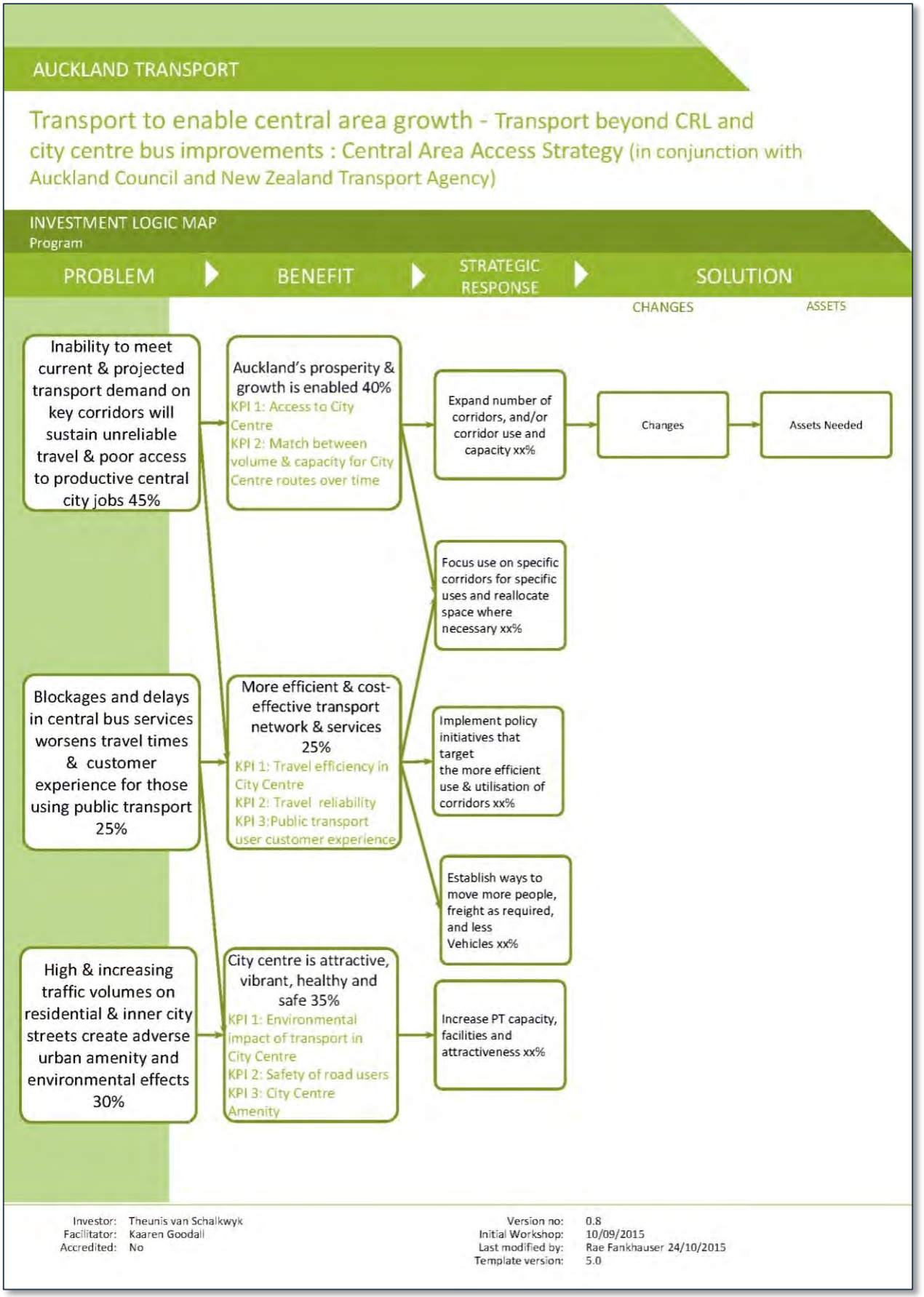
A peer review of the business case has been carried out by Aurecon NZ Ltd. The findings are included in Appendix G.

The initial assessment confirmed that the NZTA procedures for a Programme Business Case were being correctly followed.

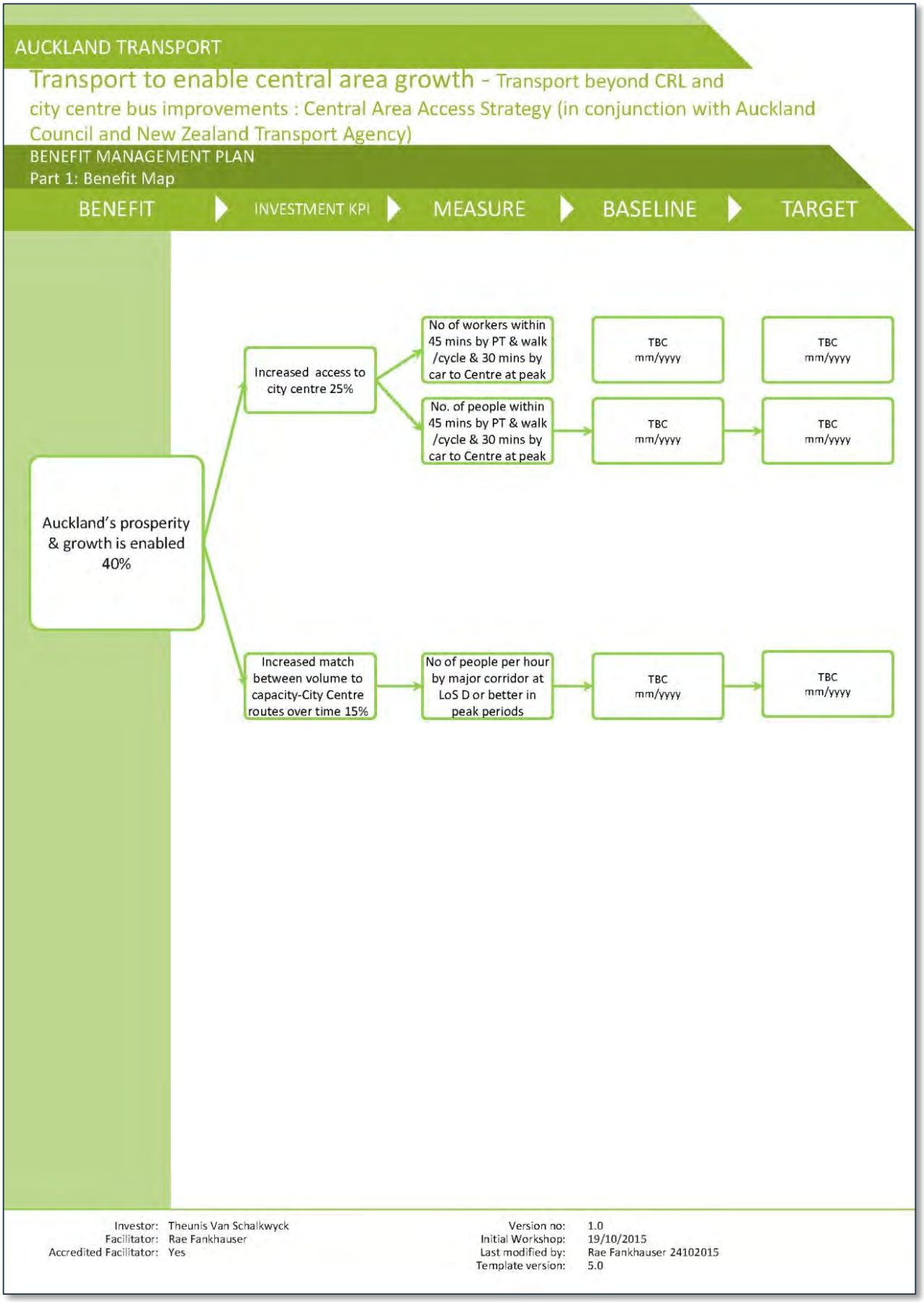
The peer reviewers were further asked by AT to review the BRT option and its costs as AT was conscious that the question of BRT compared with LRT would be subject to some debate, and hence appointed the independent peer reviewer to look deeply into scope and costs, and effectively carry out an initial value-engineering exercise to confirm that the most appropriate comparison was available. This has been done and the outputs confirm that the option evaluated was appropriate, without any obvious superior alternative. The peer review found that the

costs as used are possibly at the higher end, but the BRT option remains even at a low end cost of $5.4b still considerably more expensive than any other option, as well as having other disbenefits as discussed in Section 11.6.

Appendix A Investment Logic Map



Appendix B Benefits Map



Appendix C Strategic Alternatives and IP supporting information

Workshop Ideas			
City Centre rates decrease, other areas increase to promote land-use centralisation	Limit road capacity for general traffic, but available at all times for buses	New heavy rail line	Different uses at different times e.g. amend university timetables, hours of work
Do minimum only and gauge effect	Introduce mega-buses	Build interchanges at outer points of central area e.g. Wynyard, Mt Eden	Restrictions on hours for deliveries/freight in City Centre
Create “amazing cycling”	Re-route buses, 24 hour bus lanes, more bus lanes over more corridors	Parking buildings at outer points then change mode	Pedestrian friendly routes with all-weather shelter and amenity
Shift attractors	Create new transport spaces	Carless days by number plate	Uber, Chariot, other use of technology/ride-sharing apps
30 small things, micro moves e.g. at signals, lights always green for buses	Introduce light rail (LRT)	Introduce bus rapid transit (BRT)	No cash payments on buses to speed boarding
Reduce car park numbers in CITY CENTRE	Impose a car parking levy	Increase parking prices	Cheap or free off-peak public transport
Cordon charge, City Centre entry toll, congestion charging on key routes	Driverless cars	Create more road space	Make better use of air-space e.g. above transport routes/termini
Remove parking on arterials	Intensify City Centre, more live-work	Decentralise businesses	Close City Centre to certain transport at certain times
Ban one person occupied cars	Use dynamic lanes	Elevated trains	Higher capacity vehicles for all modes
Subsidise taxi fares	Build a cross-city bus tunnel	Make more use of water transport	De-agglomerate
HOT lanes	Ride share, informal car pooling	High Occupancy Vehicle lanes on motorways	More heavily subsidised PT
Huge off street bus terminal(s)	Build tunnels, double stack roads	Queen Street becomes a major public transport corridor	Queen Street pedestrianised
Post Workshop Additions			
Off-board fare collection/touch-on and all-door boarding	Network solutions to remove low-productivity bus routes from the City Centre	More express bus services on the motorway that come off the motorway rather than current entry points	

Theme	Interventions
Lifting productivity of what we already have	Promote more cycling and walking
	Bus network optimisation
	Reallocating road space
	Re-route buses within but also beyond City Centre
	Higher capacity vehicles to move more people in same space
	30 micro-moves – small things which add up
	More heavily subsidised PT
	Queen St re-designed as new bus corridor
	No cash handling on buses
	Switch modes on corridors e.g. road to rail and vice versa
	Use the water more
	Driverless cars
	HOT lanes/HOV lanes,
	Remove parking on arterials
	More one-way systems
	Bus signal pre-emption, signal optimisation
	Higher capacity vehicles – triple-deckers
	More trains on existing lines
	Create more transport space
	Limit roadway parking
	24 hour bus lanes
	Uber vehicles
	Ride share and car pooling
	Reverse ramp meters/lights
	Dynamic use of road space

Theme	Interventions
Reduce or slow the access problem	Look beyond the City Centre to change use of roads entering or beyond
	Land-use changes
	Pricing for demand – City Centre tolls, entry charges or cordon
	City Centre rates decrease, outer rates increase
	Shift attractors
	Time-shift – e.g. university timetable, hours of work
	Bus fare structures – off peak pricing, free periods
	City Centre edge parking, interchanges (see Oxford UK)
	Close parts of the city to transport/for transport
	Decentralise business/de-agglomerate
	Work from home, more live-work
	Reduce City Centre freight deliveries or re-schedule
	More ferries and water-based transport
	Reduce City centre parking supply
	Taxis as solution
Treat the problem, add capacity	Better quality buses, hybrid vehicles and alternative fuels
	Build tunnels or double stack
	Huge off-street bus terminals
	Elevated trains, new heavy rail line
	Cross city bus tunnel
	Create more road space, add new roads, widen existing roads
	Higher capacity vehicles e.g. BRT, LRT, sky trains, elevated trains, Personal rapid transit (PRT), new technologies
	Queen Street becomes major public transport corridor
	Improve quality of amenity, environment
	Reduce road space, reduce demand, increase green space
	Increase transport corridor space

C.1 Detailed programme options descriptions and assessments as used for 22 February Workshop

C.1.1 Programme Option 1: Do Regardless

Description

The Do Regardless programme comprises three elements: maximising operability of the Do Minimum public transport network, investment in walking and cycling infrastructure and enhanced management to limit general traffic. This programme is focussed on maximising utilisation of available capacity without major infrastructure or policy interventions.

Maximising operability of the Do Minimum public transport scenario includes the following possible changes to the bus network:

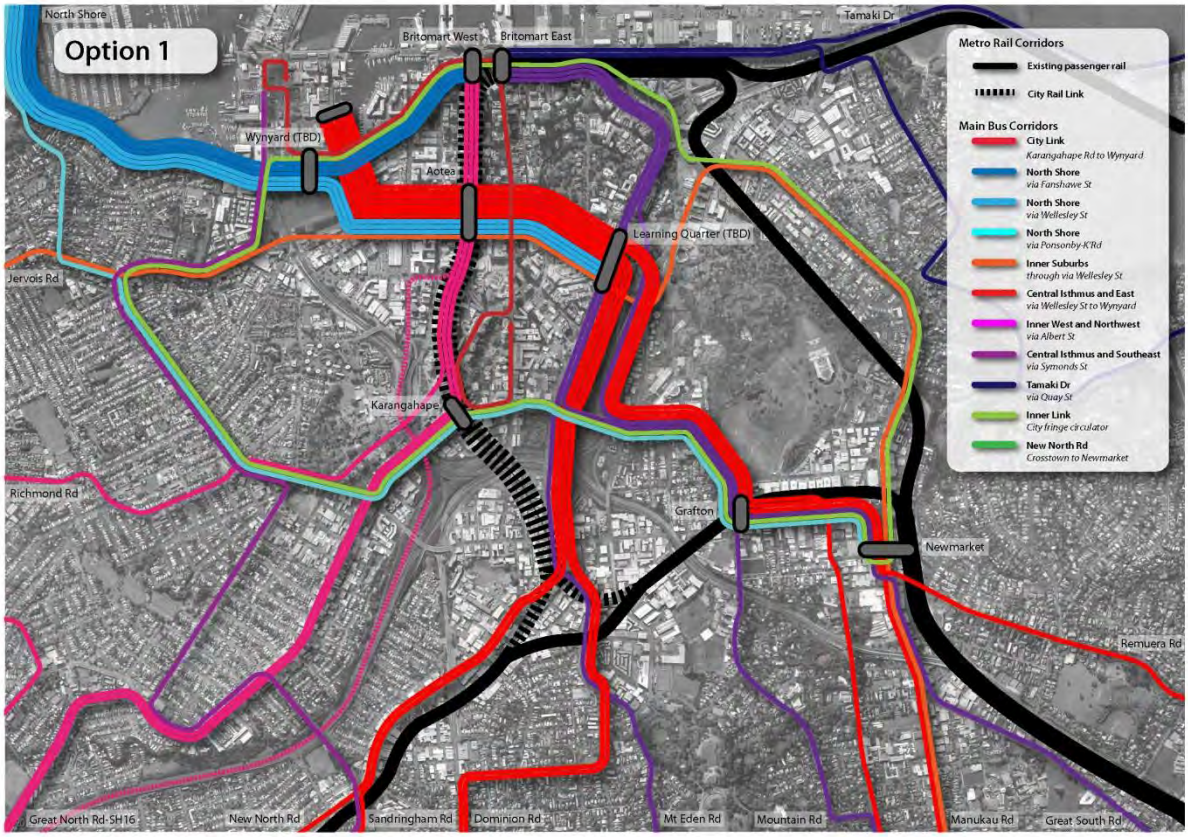
- Reduction of bus volumes on routes entering the City Centre where capacity exceeds demand, either through changing bus types or reallocation of routes to other roads
- Replacement of smaller vehicles with a lesser number of larger, 3-axle and double-decker vehicles, where possible, on all routes entering the City Centre
- Further rationalisation of routes to reduce total number of patterns and thus vehicles
- Truncation of minor or peak-only services at interchanges outside the City Centre
- Realignment of routes to different public transport corridors where more capacity may be available
- Moving routes around between stop groups where possible
- Introduction of off-board fare collection and/or all-door boarding at key stops and/or increase tolerance for bus stop congestion where buses wait to enter stops
- Changes to the fare structure to move demand towards the shoulders of the peak, rather than the peak of the peak.

Walking and cycling infrastructure would be upgraded beyond current plans to include (potentially):

- Improving footway quality and width
- changing traffic signal phasing to take account of pedestrians as transport users
- implementation of more of the laneway circuit
- upgrading side streets (e.g. Wolfe Street, Mills Lane) to be attractive pedestrian/cycling routes
- investigating a southern extension of the “Little Queen Street” N/S route planned for the Commercial Bay development by joining Mills Lane, Durham Lane and Elliott Street from the waterfront to Wellesley Street in conjunction with building redevelopments as pedestrian route
- introducing shelter on busier routes (cf Featherstone Street, Wellington)
- extending cycle facilities to ~ 5 km from City Centre
- creating more cycle parks

Traffic management would be focused on reducing ease of general traffic movement through the City Centre and deterring access by single occupant car (such as by introducing more High Occupancy Vehicle lanes – restricted to cars with two or more occupants (also known as T2 lanes)).

The “Do regardless” interventions are largely assumed as a base for the other options, but represent a level of investment and commitment beyond the base Do Minimum.



***Option 1** City Centre service changes*

Option 1: discussion

The principle of the Do Regardless programme is to carry out a range of often relatively low cost measures that collectively would be expected to better accommodate the demand for public transport in conjunction with interventions to reduce the demand, especially in the peak of the peak when the highest number of public transport vehicles are required to operate. Promotion of active modes would complement the public transport changes serving intra-City Centre demand and providing an attractive alternative for shorter trips into the City Centre.

This option assumes the following:

- Full implementation of the New Network
- Completion of the Northern Busway to Albany or Silverdale, AMETI Busway between Panmure and Botany, and the Northwest Busway to Westgate
- Delivery of the CRL
- Construction of terminal facilities at Wynyard Quarter and the Learning Quarter
- Re-design of the bus terminal facilities at Britomart

Assessment

Cost Estimate: $340m

Benefits

- Provides minor increase in overall capacity
- Likely to buy a few years before additional intervention is required

Drawbacks

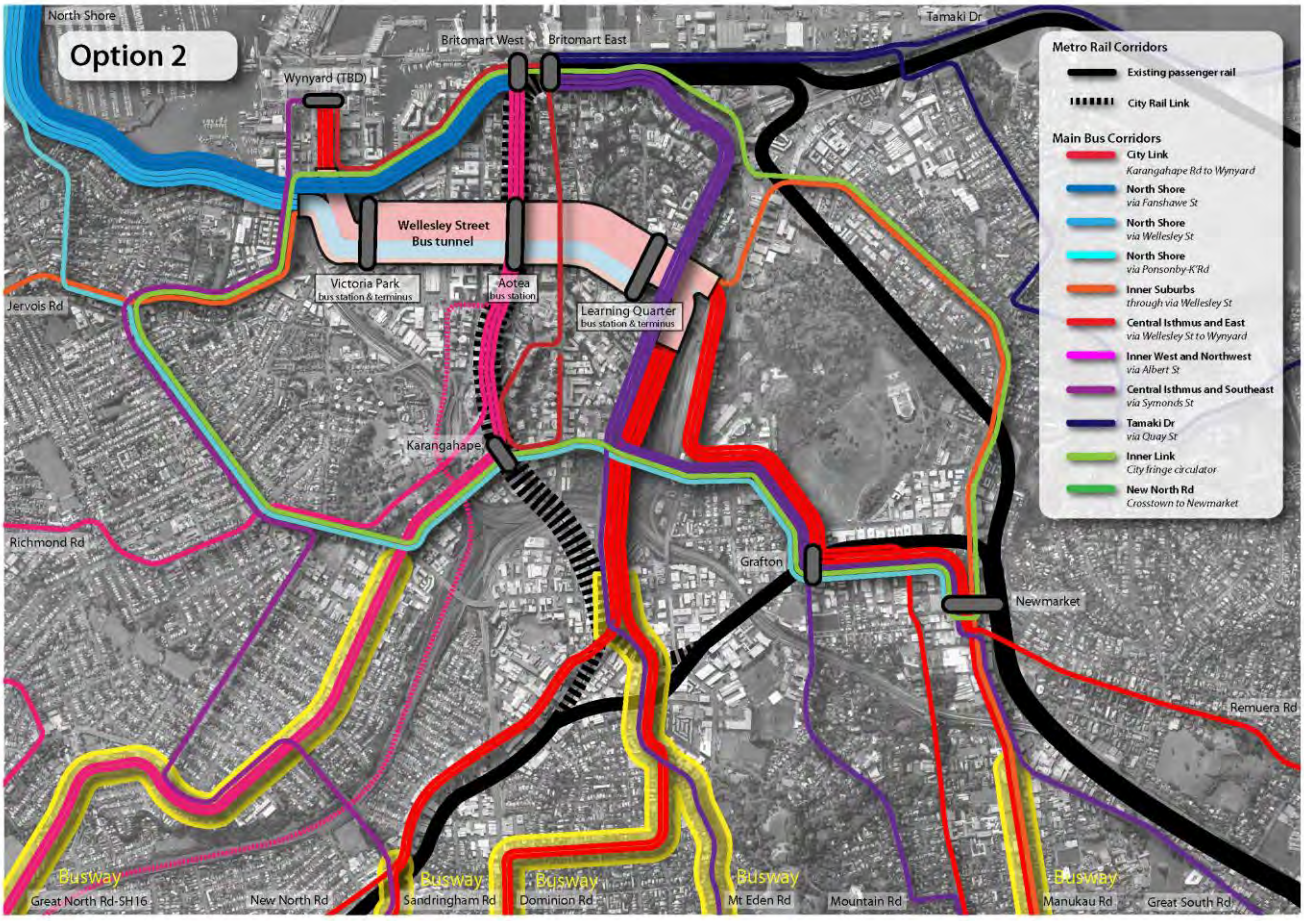
- Does not affect/preclude subsequent interventions
- Does not offer significant improvement over do minimum
- Effectiveness is very short lived

C.1.2 Programme Option 2: High Investment in Buses / Bus Rapid Transit

Description

The High Investment in Buses/Bus Rapid Transit (BRT) programme is an extension of Auckland's existing bus strategy with greater priority being introduced with a higher capacity mode, BRT, and with enhanced services on City Centre approach corridors. In the longer term the identified problems within the City Centre can be addressed by a major infrastructure investment that takes the services below ground, both providing capacity and significantly reducing disamenity.

The programme continues the New Network philosophy of concentrating services on selected corridors, ultimately addressing capacity issues on critical central city corridors by establishing a grade separated high-capacity bus alignment through the City Centre, most likely in a tunnel beneath Wellesley Street. This scenario also includes completion of currently planned busways, a new terminal facility in the City Centre and very high capacity buses (e.g. double-articulated vehicles).



***Option 2** City Centre service changes*

Option 2: discussion

Primary service implications would mainly relate to the introduction of the bus tunnel and would include:

- All services planned for Wellesley Street would operate along the Wellesley Street tunnel including isthmus, cross-town and North Shore services
- Grafton Bridge services (Remuera Road, Abbots Way, Gillies Avenue and Mangere) would be realigned to operate via Grafton Road and Wellesley Street in order to reduce bus volumes on Symonds Street
- Northwestern Busway (WEX) services operating express along the Motorway would continue onto SH16 and exit at Wellesley Street to access the new facility

In order to support these services, the following infrastructure would be required:

- Upgrades on Isthmus arterials to BRT including Great North Road, Sandringham Road, Dominion Road, Mt Eden Road and Manukau Road including removal of on-street parking, all-day bus lanes, and strong signal priority (conditional, as absolute would not be appropriate for the expected high bus frequencies). Fewer but higher quality bus stops.
- A major east-west underground bus facility would be constructed along Wellesley Street between Symonds Street and Victoria Park. This facility would need to be two or four lanes wide and include at least three underground stations (University, Aotea Square, Victoria Quarter). It would use the designation for a North Shore rail line including the reservation beneath the CRL Aotea Station.
- Connections would need to be provided between this underground facility and the SH-16 motorway, Grafton Road, Symonds Street and the Learning Quarter interchange on the eastern end, as well as with College Hill, Wynyard Quarter and the Harbour Bridge/SH-1 on the western end.
- Expanded terminus at Wynyard Quarter to handle the addition of WEX services, as well as additional Isthmus services.
- Expanded terminus at the Learning Quarter to handle increases in North Shore service volumes.
- Expanded terminus at Britomart East to handle volume increases on Howick, Tamaki and Mt Eden Road services.

This option also assumes completion of the Northwestern Busway between Westgate and the City Centre; completion of the AMETI Busway between Panmure and Botany; and completion of the Northern Busway to Albany (or Silverdale).

A first stage of this programme could be to implement the lower cost elements initially with the expensive tunnel introduced subsequently. The tunnel would be expected to allow significant upgrading to the streetscape and more capacity for active modes on the streets relieved of bus traffic, although there can be significant severance effects at tunnel entrances. If this programme is shown to be preferred, staging and the mix of interventions should be addressed in an IBC.

Pedestrian facility upgrades in addition to those in Option 1 would be targeted at providing better linkages to the bus facilities.

Assessment

Cost Estimate: $9,540m

Benefits

- Provides sufficient capacity to cater for demand and ability to cope with further growth
- Significant travel time reliability improvements through segregation and priority
- Removes a high number of buses from the city centre surface, leading to amenity improvements
- Reduction in safety risk through removal of buses from city centre core
- Increase in public space in the city centre
- Takes North Shore buses underground as well

Drawbacks

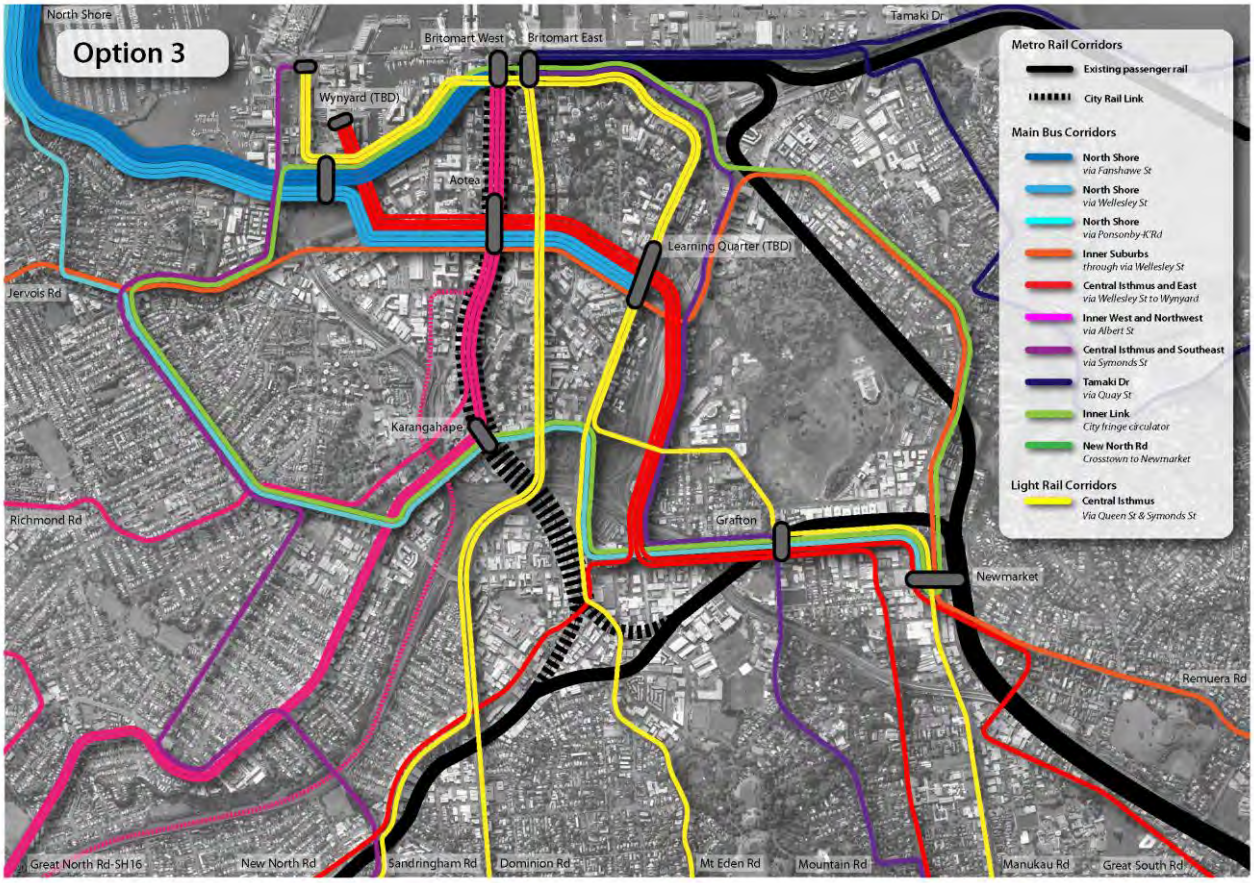
- Extremely high cost, driven largely by complex and large tunnel and cavern stations
- Potentially considerable impacts on general traffic, particularly on isthmus arterials (not particularly well understood currently)
- Large tunnel portals in the city centre would be safety concerns and Symonds St in particular could act as major severance due to gradient challenges (going underground on a downhill).

C.1.3 Programme Option 3: Light Rail Transit

Description

The Light Rail Transit LRT) programme option would address capacity issues on City Centre and feeder corridors by introducing a high-capacity public transport mode (LRT) to and through the City Centre, via Queen Street, taking advantage of its current relatively low use for public transport. This scenario has western and eastern corridors – one feeding Queen Street and the second linked to Symonds Street.

The timing of interventions would need to address critical demand / capacity constraints. The staging of implementation would be driven by constructability and operational constraints, including the requirement to maintain public transport accessibility to the City Centre by buses until services would be replaced by LRT. To achieve this, early work indicates that the first stage of LRT construction would include Queen Street / Dominion Road (possibly followed by Sandringham Road), while maintaining current bus services on Symonds and Wellesley Streets. On completion, bus services on Symonds Street would be replaced by LRT via Queen Street. This would then then free up Symonds Street for construction of further stages of LRT.



Option 3 *City Centre service changes*

Option 3: discussion

Primary service implications would include:

- All Queen Street, Dominion Road and Sandringham Road bus services would be replaced by LRT.
- A sub-stage would likely be an extension from Queen Street to the Wynyard Quarter.
- Manukau Road and Mt Eden Road services would also be replaced by LRT feeding into the City Centre via Symonds Street.

This option allows for a possible extension of the Dominion Road and/or Manukau Road line to the airport.

In this option Queen Street becomes effectively pedestrianised (north of the Town Hall) except for the LRT services (with three stations) and limited servicing (e.g. at night). Dominion Road and then the other corridors would be subject to strong controls on on-street parking along their full lengths (compared to the intermittent bus lanes currently in place), with centre road running of the LRT and widely spaced '67m long stations' rather than the present frequent 'stops'. Vehicles are assumed to be 33m long, capable of being coupled to form 66m trains.

Pedestrian facility upgrades in addition to those in Option 1 would be targeted at providing better linkages to the LRT stations. Cycle parking would be expected to be introduced at the suburban LRT stations.

Full traffic signal prioritisation would be implemented along with limiting right turning options on the arterial roads which accommodate the LRT routes.

Variations of the option might see fewer routes converted to LRT within the planning horizon (of 2046).

Assessment

Cost Estimate: $3,740m

Benefits

- Provides sufficient capacity to cater for demand and ability to cope with further growth
- Significant travel time reliability improvements through segregation and priority
- Removes a high number of buses from the city centre, leading to amenity improvements
- Reduction in safety risk through general traffic removal from Queen St
- Increase in public space in the city centre

Drawbacks

- Very high cost
- Potentially considerable impacts on general traffic, particularly on isthmus arterials (not particularly well understood currently)

C.1.4 Programme Option 4: Heavy Rail Spur to Mt Roskill

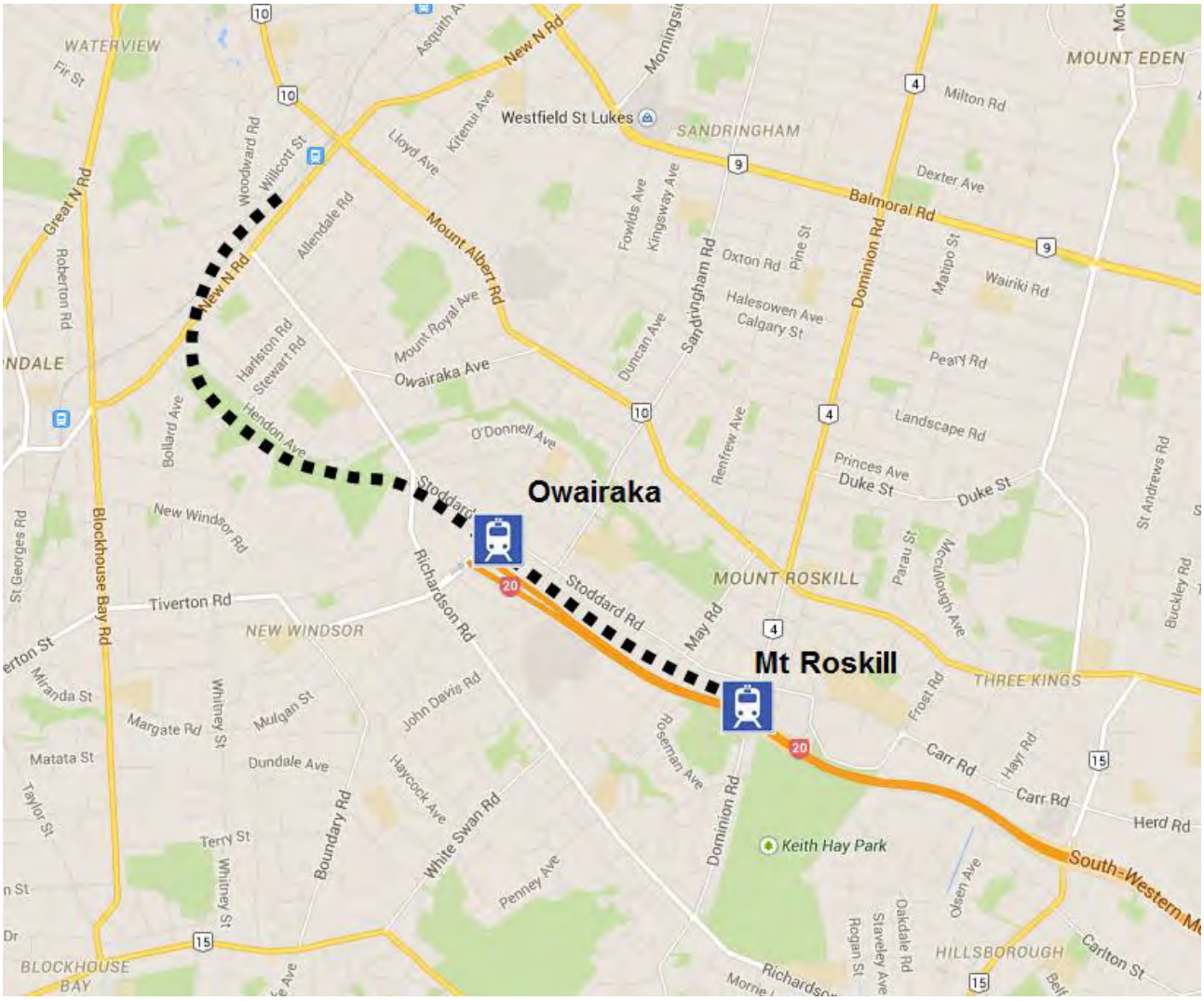
Description

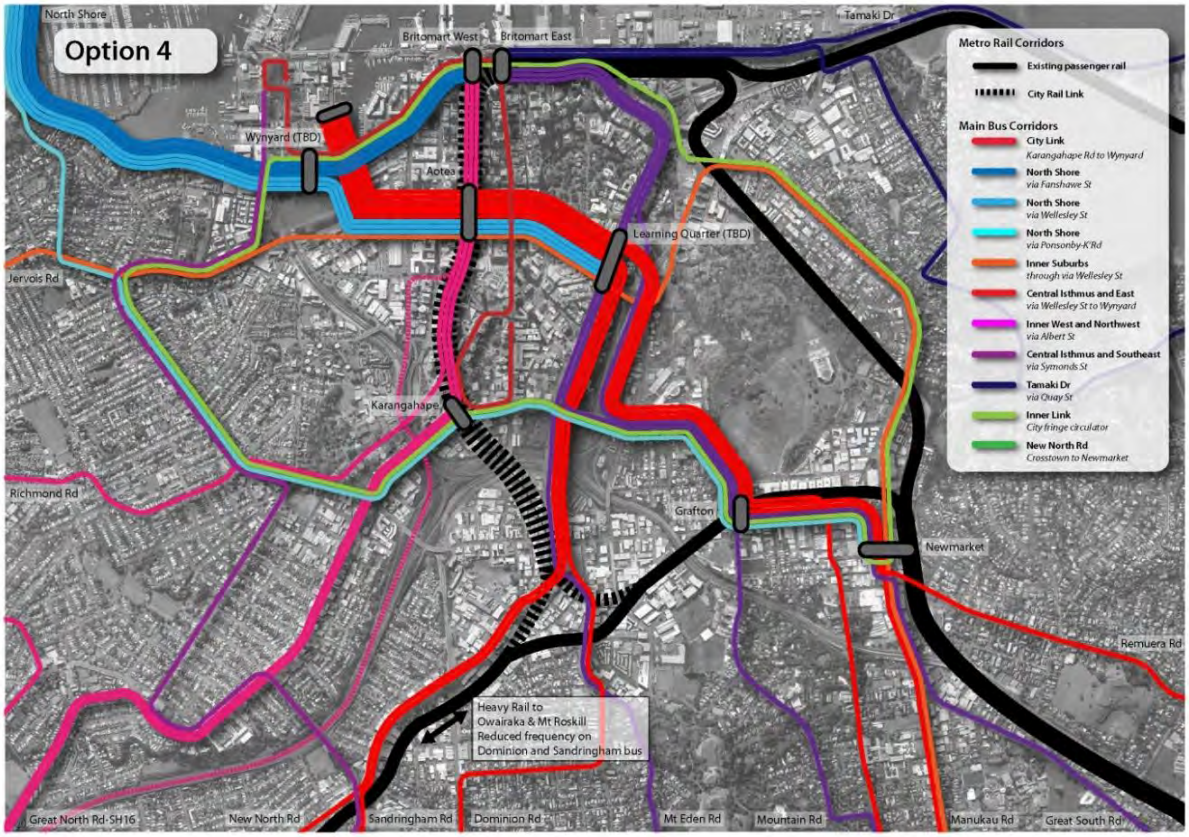
The principle of Programme Option 4 is to address the problem statements by maximising use of the metro rail capacity that will exist once CRL is in place and therefore reducing the number of on-road public transport services otherwise required.

The Heavy Rail Spur programme incorporates the Mt Roskill rail link to the western line and reductions to the bus services which intersect the rail line, limiting the demand for bus travel along western Isthmus bus corridors. It therefore reduces the numbers of buses that will reach the City Centre on those corridors and releases space for more buses on other eastern, routes.

A reservation exists for the rail route. Post-CRL train service plans have been developed that could accommodate the service.

The approximate alignment is shown below, followed by the indicative City Centre service pattern.





***Option 4** City Centre service changes*

Option 4: discussion

This programme is based around the Mt Roskill rail spur extension identified in the Auckland Plan. Two stations would be included; a Mt Roskill station (at the Dominion Road interchange) and an Owairaka station (near the Richardson Road overbridge over SH20).

- Rail operating plans would need to be modified on the network to accommodate this service
- There should be a minimum of 4 trains per hour (ideally 6)
- All bus services that use Sandringham Road would be stopped at the Owairaka Station and a new Sandringham Road service from the Owairaka Station to the City Centre would be added so that there is no reduction in network coverage. The frequency of the new service would be based on the patronage differential between the station location and City Centre
- The same logic would be applied for Dominion Road bus services but using the Mt Roskill station as the interchange
- It is expected that double-decker buses would be used as appropriate especially on routes that are able to take up the City Centre route capacity released (e.g. Manukau Road)
- The bus-rail interchanges at the stations would be provided in a way to minimise disruption (in terms of layout etc.) and timed where possible to reduce wait time (and therefore overall journey times) for passengers interchanging
- Additional services would be added to other bus routes using the released capacity within the City Centre to cater for terminating buses
- Planning for the CRL has shown that additional metro rail capacity will be required on the inner sections of the western line, over time. This option could provide that capacity

Additional pedestrian and cycle routes and facilities would focus on the two new stations to maximise their catchments.

Assessment

Cost Estimate: $540m

Benefits

- Provides increase in overall capacity and ability to cater for demand
- Modest reduction in bus volumes in the city centre upon implementation
- Likely to buy a few years before additional intervention is required
- Does not affect/preclude subsequent interventions
- Provides ability to have additional rail capacity on the inner western line without additional investment
- Low impact as it utilises an existing rail designation

Drawbacks

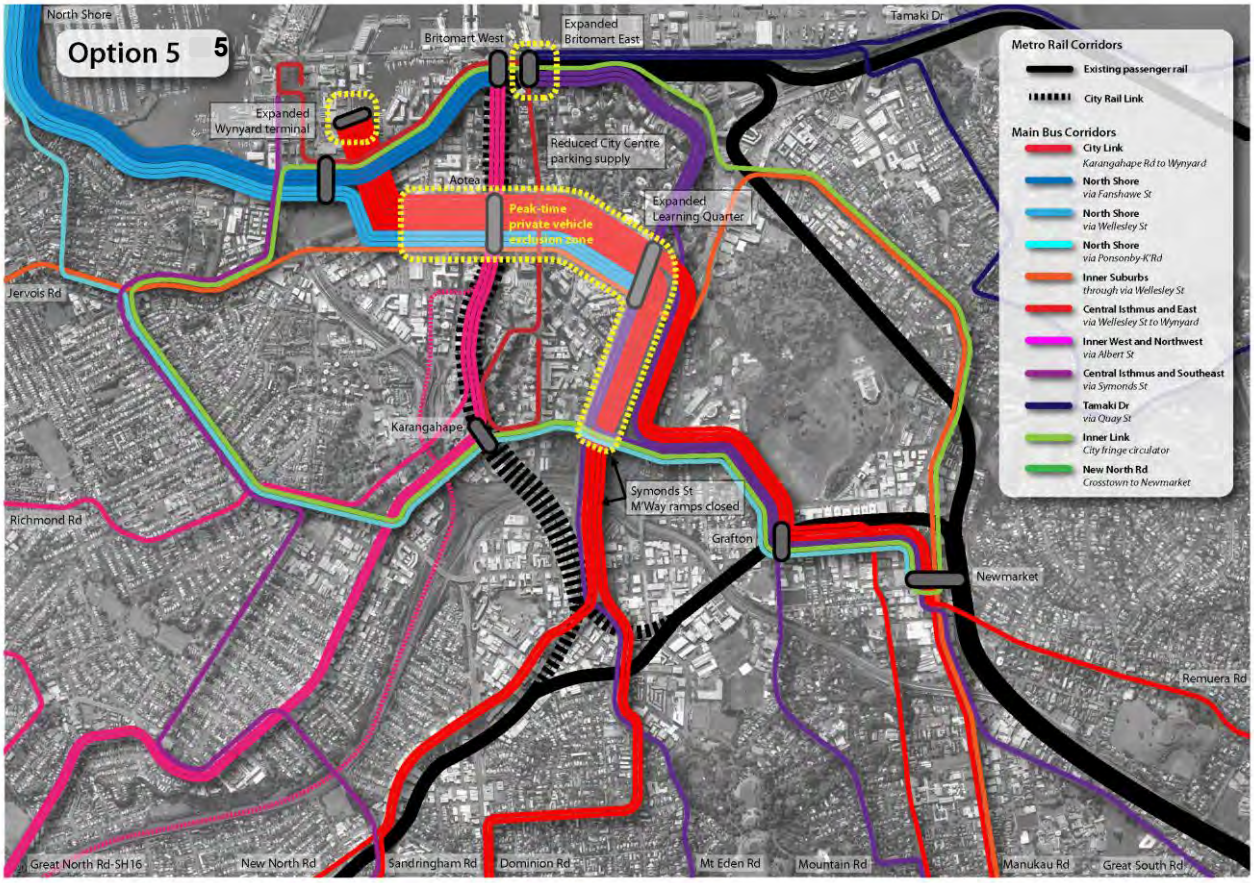
- Effectiveness is relatively short lived and constrained by bus terminal capacity in the city centre. This option essentially delays the problem by providing short term relief
- Train frequency will constrain overall travel time
- Longer distance trips for Dominion Rd passengers

C.1.5 Programme Option 5 Non-financial demand management

Description

Managing demand through non-financial means aims to reduce the desire and need for private car travel by changing priorities within the City Centre. The results of these changes would mean that some road space could potentially be reallocated for use by more efficient travel modes. It would be expected to increase public transport and active mode travel demand, which would amplify the need for changes to the road network in the City Centre. The prioritised corridors would facilitate bus movement along the existing bus routes adding capacity to cope with increasing demands without spreading the load to more roads.

Compared with the other programme options there would also be more commitment to enhancing active modes - walking and cycling.



Option 5 *City Centre service changes*

Option 5: discussion

There are a number of policy type interventions that would be proposed under this option to reduce need for and attractiveness of private car travel:

- Reduction to car parking supply within the City Centre through:
  - Reallocating current car parking land use (including to terminating bus where possible)
  - Changing controls on development to reduce parking provision
  - Parking charges
- For the critical transit corridors of Symonds Street (from Karangahape Road) and Wellesley Street ensuring that two lanes in each direction become bus corridors during peak periods (6:30-9:30am, 3:30-6:30pm) with off-line stops where space permits. This allows a stopping lane and circulation lane
- The Symonds Street motorway ramps would be closed to assist with reducing demand through this corridor
- Additional space would be allocated to active modes wherever possible
- Private vehicles (including commercial) would redistribute across other corridors in the network

- Access to property and side streets off these corridors would be restricted during peak periods. This would be enforced through monitoring (expected to be via technology)
- Emergency vehicles would still be permitted to use any public transport corridors at all times
- The public transport networks are not intended to change under this option, rather they are able to use the additional capacity that is provided through the reallocation of road space
- Greater attention would be paid to actively managing all vehicles (e.g. inappropriate loading and unloading, both freight and passengers on tourist services) to reduce interruptions to essential public transport services and active modes
- By allowing increased volumes of buses, the termini would also require expansion:
  - Expanded terminus at Wynyard Quarter to handle the additional Isthmus services
  - Expanded terminus at the Learning Quarter to handle increases in North Shore service volumes
  - Expanded terminus at Britomart East to handle volume increases on Howick, Tamaki and Mt Eden Road services (potentially delivered on Queens Wharf)
  - Possible use of kerb space/car park land released by reduction in on- and off- street car parking.

The Option 1 pedestrian and cycle programme would be supplemented by more aggressive changing of vehicle lanes to pedestrian and cycle lanes. Some car parking spaces would be reallocated to cycle parking.

Assessment

Cost Estimate: $540m

Benefits

- Provides increase in overall capacity and ability to cater for demand
- Reduction in city centre pollution through general traffic removal/restriction
- Less safety risk exposure for pedestrians/cyclists
- Some amenity improvements through general traffic reduction, but higher bus flows
- Improved bus efficiency on the key city centre corridors through ‘exclusive’ use
- Does not significantly affect/preclude subsequent interventions.

Drawbacks

- Restriction of general traffic access
- Additional pressure on other city centre motorway access points
- Fuels the problem as people are forced to change to PT, adding to already growing demand and will bring forward need for additional intervention
- Effectiveness is relatively short lived and constrained by bus terminal capacity.

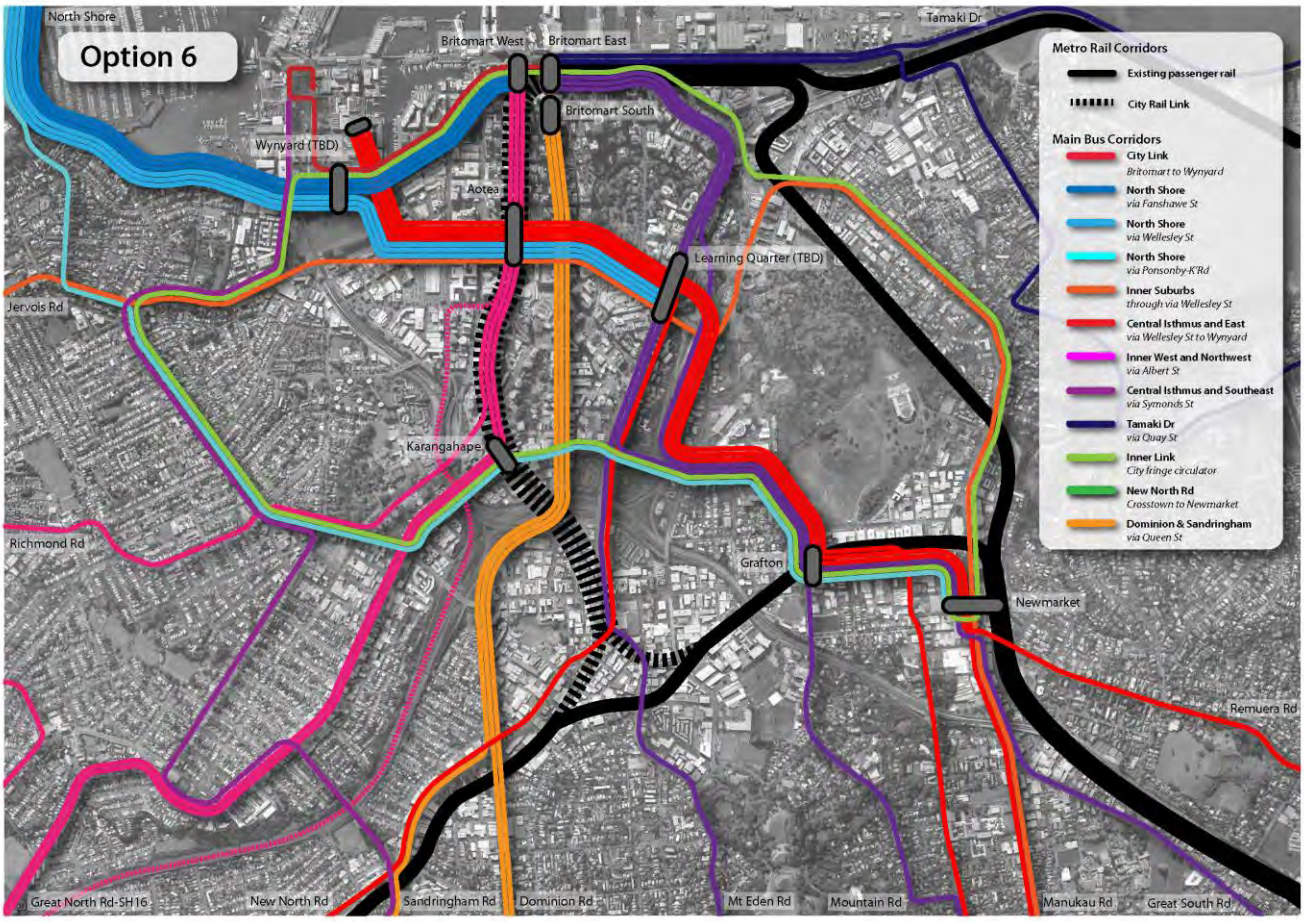
C.1.6 Programme Option 6 Extended bus network

Description

The principle behind Programme Option 6 is to change the Auckland approach that precludes certain roads, notably Queen Street, from being major bus corridors. It therefore represents a departure from the New Network philosophy.

The extended bus network scenario therefore addresses capacity issues on existing City Centre bus corridors by establishing a new high-capacity public transport (bus) spine along Queen Street and redirecting several services to use this new facility. In the long term it also includes the option of shifting bus volumes to other new or underutilised corridors as existing corridors reach capacity.

While this option includes a busway along Queen Street it uses only surface streets (with the potential for an underground terminal) and does not include any grade separated running ways as they are seen as more appropriately part of a concentrated bus route scenario, as in option 2.



***Option 6** City Centre service changes*

Option 6: discussion

Primary service changes would include:

- Dominion and Sandringham Road services would be removed from Symonds and Wellesley Streets and instead operate via Ian McKinnon Drive and Queen Street (Mt Eden Road and Hospitals services would continue to operate on Symonds Street).

In order to support these services the following infrastructure would be required:

- Bus lanes or a busway along Queen Street with sets of indented stops for City Link/SkyBus and for Dominion/Sandringham Road services, as well as bus lanes along Ian McKinnon Drive. Queen Street, north of the Town Hall at least, would have general traffic removed
- A new underground terminal facility at Britomart or an aboveground facility on Queens Wharf to anchor the Queen Street corridor (Dominion and Sandringham Road buses)

- Upgrades on Isthmus arterials including Great North Road, Sandringham Road, Dominion Road, Mt Eden Road and Manukau Road including removal of on-street parking, all-day, geographically continuous bus lanes, with higher signal priority (conditional, as absolute would not be appropriate for the expected high bus frequencies).

Additional service changes could include the following:

- Grafton Bridge services (Remuera Road, Abbots Way, Gillies Avenue and Mangere) would operate via Victoria Street and Waterloo Quadrant instead of Wellesley Street (Cross-town 4 and North Shore services would continue to operate on Wellesley Street)
- Northwestern Busway (WEX) services would operate via the motorway to Hobson/Nelson Streets (Great North Road and Richmond Road services would continue to use Albert Street and Karangahape Road). If Queen Street were completely closed to traffic (other than buses) then another option would be to feed the WEX services into Queen Street.

To support these additional services changes, the following infrastructure would be required:

- Bus lanes on Hobson/Nelson Streets with in-line stops
- Bus lanes on Victoria Street with in-line stops and removal of linear park
- Reconfiguration of Britomart West to accommodate higher volumes of buses entering from the North Shore and Northwest.

This option also assumes completion of the Northwestern Busway between Westgate and the City Centre; completion of the AMETI Busway between Panmure and Botany; and completion of the Northern Busway to Albany (or Silverdale).

This option is less supportive of active modes than are those which concentrate public transport services as at-grade transport corridor space is necessarily allocated to bus services.

Assessment

Cost Estimate: $920m

Benefits

- Provides increase in overall capacity and ability to cater for demand (new terminal and additional corridors)
- Improved bus efficiency on the key city centre corridors by using additional corridors, reducing bus-bus congestion
- Reduction in general traffic on Queen St
- Likely to buy a number of years before additional intervention is required.

Drawbacks

- Effectiveness is relatively short lived and constrained by bus terminal capacity
- Creates a major bus corridor through Auckland's 'premier' street
- High vehicle (bus) volumes means signal priority is unachievable, limiting the efficiency gains
- Introduces tunnel portals in the downtown area
- Restricts the range of possible subsequent interventions
- Increases bus movements through the city centre – adverse amenity and safety impacts
- High cost.

Appendix D Amenity Evaluation

D.1 CAP Programme Options - Background and methodology for Urban Amenity

RMA references amenity value as:

The qualities and characteristics of an urban place or area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.

In the New Zealand context, there is no standard methodology for determining the amenity or character of a place. On this basis the CAP Programme Business Case options, utilise overseas assessment methodologies to enable both a quantitative and qualitative assessment. This includes a simplified version of the UK Department of Transport Web TAG guidance to assess 'Sense of Place' qualities and Project for Public Spaces in USA for assessing 'Public Space'.

Urban amenity is divided into two key areas namely, 'sense of place' and 'pubic space/street quality'.

Sense of Place KPI's include:

- **Urban Form –** The extent to which the urban form can accept/adapt to change
- **Urban character and culture values -** The extent to which the proposed options respond positively to the local character and culture
- **Heritage buildings or structures and context setting -** The extent of impacts on heritage buildings and structures
- **Visual amenity in relation to traffic -** The extent to which vehicular traffic in City Centre streets are reduced
- **Visual obstruction -** The extent of the view blocked by transport mode from pedestrian/street view perspective
- **Visual intrusion -** The extent of impact on the streetscape corridor in terms of infrastructure requirements

Public Space/Street Quality KPI's include:

- **Access and connectivity -** The extent of effects on localised pedestrian movement access and connectivity
- **Comfort & Image -** The extent of effects on perception of safety and positive image of a place to sit or pass through as a pedestrian
- **Use & Activity -** The extent of uses and activities promoted within the street corridors
- **Sociability -** The extent people have the ability to socialise, meet or interact

The Table below identifies the relevant amenity issues, description indicators, measures, most appropriate methodology and desired outcomes

KPI Urban Amenity Value Increase in City Centre/Local Centre and corridor streetscape amenity	Description of indicator Issues	Measure Metrics/Indicators Quantitative	Measure Metrics/Indicators Qualitative	Comments/Questions	Method of assessment Source	Desired outcome
SENSE OF PLACE Realised through the City Centre Masterplan aspirations and Downtown Framework study and Waterfront Plan to develop high quality urban amenity	URBAN FORM	The extent to which the urban form can accept/adapt to change			Assess on a scale of 1-10 major/ minor effects etc.	• Protection of amenity values from adverse effects from transport mode/alignment • A vibrant, attractive and high quality pedestrian focussed city centre 'CCMP aspirations' retail hub etc. • A city centre and local centres that express community and cultural development
	URBAN CHARACTER AND CULTURE VALUES	The extent to which the proposed options respond positively to the local character and culture	Utilise a four stage measure to establish the baseline and appraise at nominated points 1) Describe urban character and locally distinctive features 2) What matters and why it is important, local significance. 3) Appraise proposal's impact 4) Provide an overall	CCMP and Maori cultural commitments	Use PAUP Character overlays as a base. Then apply 4 stage process uses the Web TAG approach to provide a score for character and culture. Assess on a scale of 1-10 major/ minor effects etc. (This process helps to understand how well, or not, an option fits into the existing townscape and then how it can be mitigated to retain, improve and protect character and cultural features).	

			assessment score			• Peoples health and safety is not adversely affected by inappropriate design/siting of infrastructure, buildings or structures.
	HERITAGE BUILDINGS OR STRUCTURES AND CONTEXT SETTING	The extent of impacts on heritage buildings and structures			PAUP Heritage overlays Assess on a scale of 1-10 major/ minor effects etc.	
	VISUAL AMENITY IN RELATION TO TRAFFIC	The extent to which vehicular traffic in City Centre streets are reduced			Transport model data	
	VISUAL AMENITY IN RELATION TO TRAFFIC – Visual obstruction	The extent of the view blocked by transport mode from pedestrian/street view perspective.		m^2 rating measured at identified locations (to be agreed)	Transport model data Measured by m2 blocked over a typical peak period at specified locations	
	VISUAL AMENITY IN RELATION TO TRAFFIC – Visual intrusion	The extent of impact on the streetscape corridor in terms of infrastructure requirements			Define measure - Scale 1-10	
PUBLIC SPACE **Street Quality**	PUBLIC SPACE (four assessment categories) including: 1) Access and Connectivity	The extent of effects on localised pedestrian movement access and connectivity	Sample questions to ask regarding the proposed effects	Establish a scoring system	PPS (Project for Public Spaces) 'What makes a great space'. The value of good design for public realm evaluation and metrics developed further by Auckland Design Office. (See attached). The UK web TAG form of assessment can be adapted to provide ratings / overall scores Assess on a scale of 1-10.	
	2) Comfort and Image	The extent of effects on perception of safety and positive image of a place to			Qualitative assessment with a rating Assess on a scale of 1-10	

		sit or pass through as a pedestrian.				
	3) Use & Activity	The extent of uses and activities promoted within the street corridors.			Qualitative assessment with a rating Assess on a scale of 1-10	
	4) Sociability	The extent people have the ability to socialise, meet or interact.			Qualitative assessment with a rating Assess on a scale of 1-10	

Sample assessment form completed per option (followed by an option summary table)

Option 1 - Amenity Analysis

Description of mode and alignment: **Uses same roads as now for buses, though buses increase in quantity and may be bigger.**

Assessment process along the alignments does not provide a comparative analysis as each option uses different routes.

Location points	KPI's								
	Urban Form	Character and Culture	Heritage structures or buildings and context	Visual amenity in relation to traffic Visual obstruction	Visual amenity in relation to traffic Visual intrusion	Public Space Street Quality Access and Connectivity	Comfort and Image	Use and Activity	Sociability
City centre									
Local centres									
Road Corridor/alignment									

OPTION 1 overall rating score:

D.2 Amenity Evaluation

Option / Location	KPIs								
	Sense of Place					Public space – Street quality			
	Urban Form	Character and Culture	Heritage Structures or buildings and context	Visual amenity in relation to traffic	Visual amenity in relation to infrastructure Visual Obstruction	Access and connectivity	Comfort and Image	Use and Activity	Sociability
Option 1: Do Regardless									
City Centre	3	3	3	3	5	3	3	3	3
Town Centres	3	3	3	3	5	3	3	3	3
Road Corridors	3	3	3	3	5	3	3	3	3
Sub-totals	**9**	**9**	**9**	**9**	**15**	**9**	**9**	**9**	**9**
Overall score	**87**								
Option 2: Non-financial demand management									
City Centre	1	1	1	1	5	3	3	3	3
Town Centres	1	1	1	1	5	1	1	1	1
Road Corridors	1	1	1	1	5	1	1	1	1
Sub-totals	**3**	**3**	**3**	**3**	**15**	**5**	**5**	**5**	**5**
Overall score	**47**								

Option / Location	KPIs								
	Sense of Place					Public space – Street quality			
	Urban Form	Character and Culture	Heritage Structures or buildings and context	Visual amenity in relation to traffic	Visual amenity in relation to infrastructure Visual Obstruction	Access and connectivity	Comfort and Image	Use and Activity	Sociability
Option 3 Extended bus network									
City Centre	1	1	1	1	1	1	1	1	1
Town Centres	1	1	1	1	1	1	1	1	1
Road Corridors	1	1	1	1	1	1	1	1	1
Sub-totals	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Overall score	**27**								
Option 4 Heavy rail extension									
City Centre	5	5	5	5	5	5	5	5	5
Town Centres	7	7	7	7	7	5	5	5	5
Road Corridors	5	5	5	5	5	5	5	5	5
Sub-totals	**17**	**17**	**17**	**17**	**17**	**15**	**15**	**15**	**15**
Overall score	**145**								
Option 5 Light Rail Transit									
City Centre	10	10	10	10	10	10	10	10	10
Town Centres	10	10	10	10	10	10	10	10	10
Road Corridors	5	8	8	5	3	5	5	5	5
Sub-totals	**25**	**28**	**28**	**25**	**23**	**25**	**25**	**25**	**25**
Overall score	**229**								

Option / Location	KPIs								
	Sense of Place					Public space – Street quality			
	Urban Form	Character and Culture	Heritage Structures or buildings and context	Visual amenity in relation to traffic	Visual amenity in relation to infrastructure Visual Obstruction	Access and connectivity	Comfort and Image	Use and Activity	Sociability
Option 6 Bus Rapid Transit									
City Centre	8	5	5	10	3	10	5	10	8
Town Centres	1	1	1	1	3	3	3	3	3
Road Corridors	1	1	1	1	5	3	3	3	3
Sub-totals	**10**	**7**	**7**	**12**	**11**	**16**	**11**	**16**	**14**
Overall score	**104**								

D.3 Assessment Notes

D.3.1 Option 1 – Do Regardless

- Assume that the existing urban form of the city is at/near capacity in terms of ability to support increased bus infrastructure without having significant negative outcomes for the City Centre, villages and corridors.

Summary

No significant improvement or change to current situation. Most of the walking and cycling interventions 'beyond current plans' will be difficult to achieve in most places (i.e. widen footpaths, signal phase changes) as there is no space to achieve these.

D.3.2 Option 2 – BRT (Wellesley Street bus tunnel)

- Assume this results in more buses in village centres and along key corridors as a consequence of additional services
- Assumes that the bus infrastructure on corridors results in impacts such as higher frequency, more stop/lane infrastructure, little ability to improve the public realm
- Assumes proposed tunnel goes under Queen Street and has minimal impact on the amenity of the City Centre (well-designed portals etc.)

Summary

Has positive impacts on the amenity of the City Centre but little ability to enhance the public realm elsewhere.

D.3.3 Option 3 – LRT

- Assumes wire free in Queen Street and village centres, 66m long vehicles and proposed public realm enhancements etc.
- Assumes a good outcome can be achieved with integration of LRT stops/terminus and buses downtown
- Keeping passengers at-grade in the city centre seen as a significant benefit
- Improves public realm of City Centres and village centres significantly

Summary

LRT enables enhancement of the public realm in City Centre and village centres.

D.3.4 Option 4 – Metro Rail Spur

- Assumes significant impacts on existing public realm and open space between Mt Albert and Stoddard Road
- Assume additional capacity in the city is replaced with other routes so is neutral in terms of change to current City Centre
- Removes buses from some existing village centres so enables public realm improvements

Summary

Benefits of fewer buses limited to adjacent corridors and some village centres only.

D.3.5 Option 5 – Non-Financial Demand Management

- Assumes additional buses integrated/distributed at-grade in the City Centre
- Buses have a greater impact on the quality of City Centre, villages and corridors therefore will not improve the current situation

Summary

Buses have a greater impact on the quality of City Centre, villages and corridors.

D.3.6 Option 6 – Extend Bus Network (use Queen Street corridor)

- Assumes additional buses integrated/distributed at-grade in the City Centre

- Has the most significant impact on the amenity of the City Centre as contributes to the greatest change to Queen Street

Summary

Buses have a high impact on the quality of City Centre, villages and corridors.

D.4 IP Amenity Assessment

The IP was assessed in accordance with the same methodology as the options. With a score of 172 it was rated between the LRT option 5, which scores highest at 229 and Do Regardless at 87 as it has a less beneficial effect on the Manukau Road and Mt Eden Road corridors.

The assessment assumed the Rail Spur was included and not the Sandringham Road LRT line. With the latter the score would have been a little higher.

Option / Location	KPIs								
	Sense of Place					Public space – Street quality			
	Urban Form	Character and Culture	Heritage Structures or buildings and context	Visual amenity in relation to traffic	Visual amenity in relation to infrastructure Visual Obstruction	Access and connectivity	Comfort and Image	Use and Activity	Sociability
Integrated Programme									
City Centre	7	7	7	7	7	7	7	7	7
Town Centres	7	7	7	7	7	7	7	7	7
Road Corridors	5	6	6	5	4	5	5	5	5
Sub-totals	**19**	**20**	**20**	**19**	**18**	**19**	**19**	**19**	**19**
Overall score									

Appendix E STM Analysis

These series of plots at five yearly intervals show how the capacity problem in the City Centre get progressively worse as assessed through the Stage Timing Model (STM).

The plots show the weekday morning peak period from 2016 to 2046. Two plots are used to show the situation for both directions of each corridor, particularly as the peak directional flow from the North Shore and the Isthmus and southeast operate simultaneously in the opposing directions on Wellesley St. The “inbound” plot on the left shows the northbound or eastbound sides of the corridor while the “outbound plot on the right shows the southbound or westbound sides of the corridors.

Green corridors are those that are fully functional, yellow indicates corridors with stop groups that are approaching capacity (90%+) and red indicates corridors with stop groups that are overcapacity (100%+).

In the Base Case, both directions of Wellesley St begin overcapacity in 2016 and remain that way through to beyond 2046. Likewise the inbound direction of Symonds St is overcapacity in the first year and remains that way across the evaluation period.

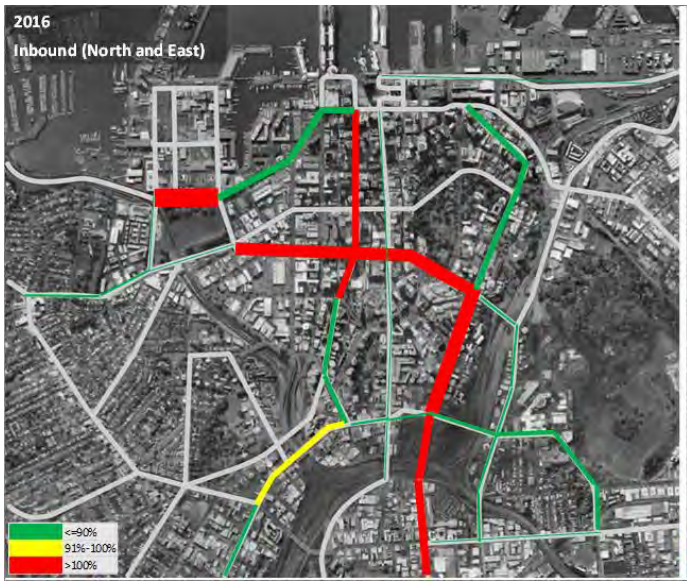
In the Integrated Programme (IP) Wellesley St and Symonds St likewise begin in a state of being overcapacity, or approaching capacity in the case of Wellesley St eastbound. However due to the staged intervention of the IP in the 2020s, Wellesley St and Symonds St return to an uncongested state from approximately 2024 onwards once the major intervention in the Dominion Rd corridor is operational. This state lasts on Wellesley St through until approximately 2041, while Symonds St remains uncongested until beyond the final evaluation year.

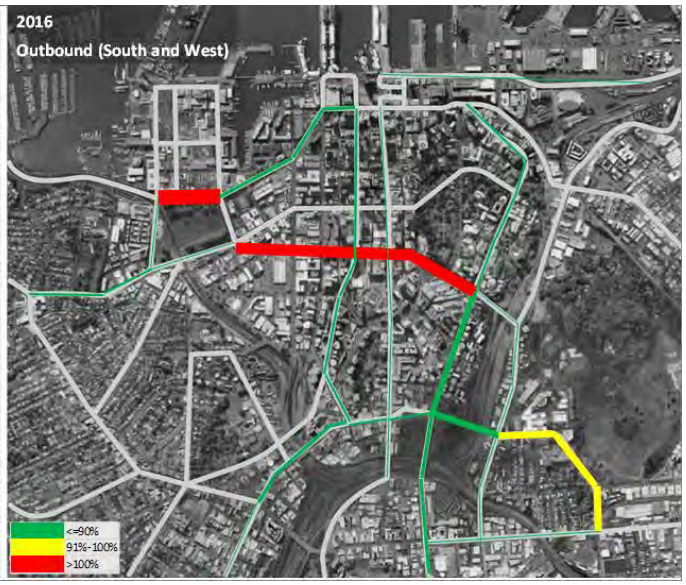
It should be noted that in both scenarios, the section of corridor on Fanshawe St between Beaumont St and Halsey St begins overcapacity and remains that way across all years. This is due to the overlap of the Fanshawe St and Wellesley St corridors in this location, intended to serve the Wynyard area from both the North Shore and the Isthmus. Similarly, in both scenarios the section of Fanshawe St from Halsey St to Britomart begins in a state of approaching capacity and goes overcapacity by 2036. An Indicative Business Case is currently underway for the Wynyard-Fanshawe area which will determine corridor capacity/configuration options to solve these known issues.

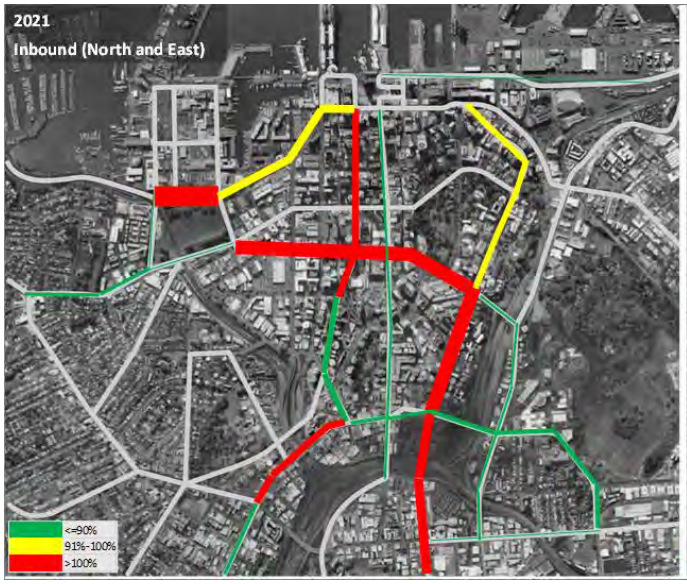
Likewise, in the northbound (inbound) direction parts of Albert St and Karangahape Rd remain overcapacity in all years, in both the Base Case and the Integrated Programme. Investigations have begun to evaluate options for expanding capacity and/or reducing bus volumes on these corridors.

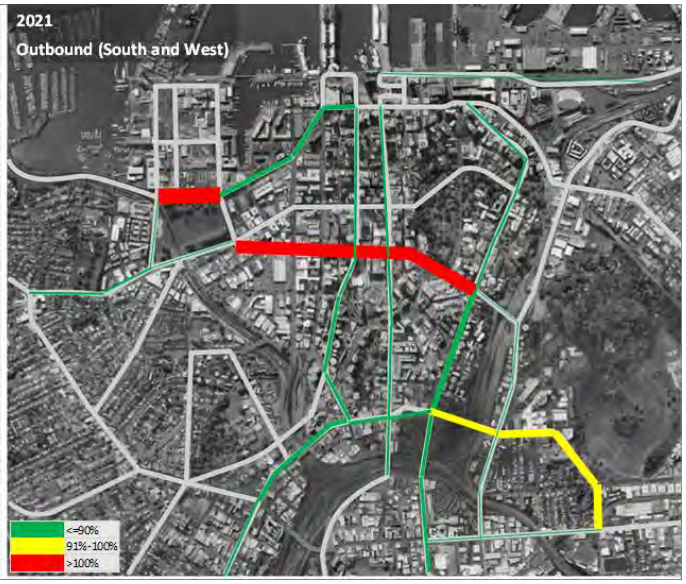
At this broad level (and the exceptions above notwithstanding), the STM indicates that the IP ‘fixes’ bus capacity issues in the City Centre for a period of approximately two decades from the time the major interventions of the programme are deployed.

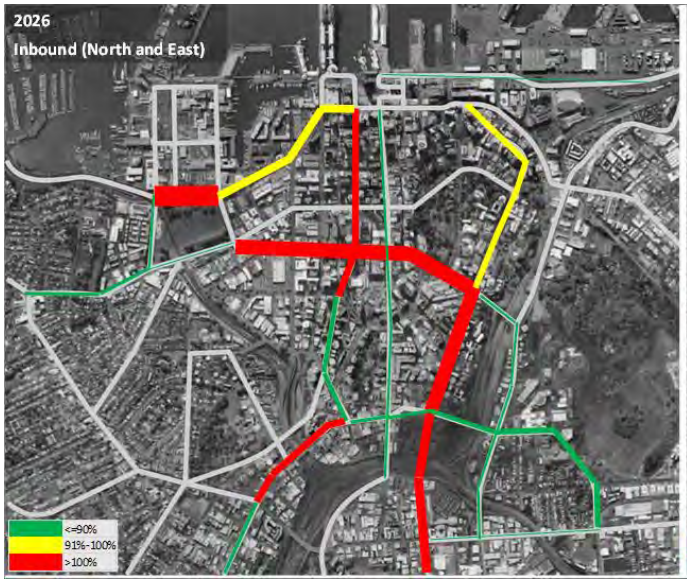
E.1 Base Case

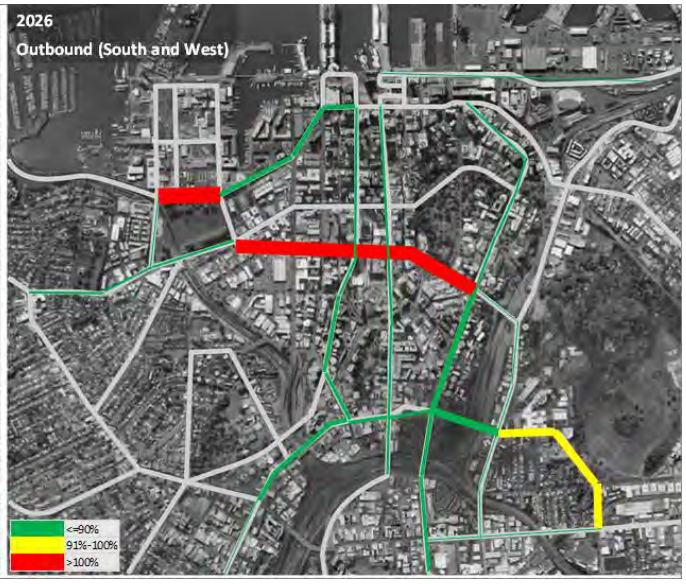

2016
Inbound (North and East)
<=90%
91%-100%
>100%

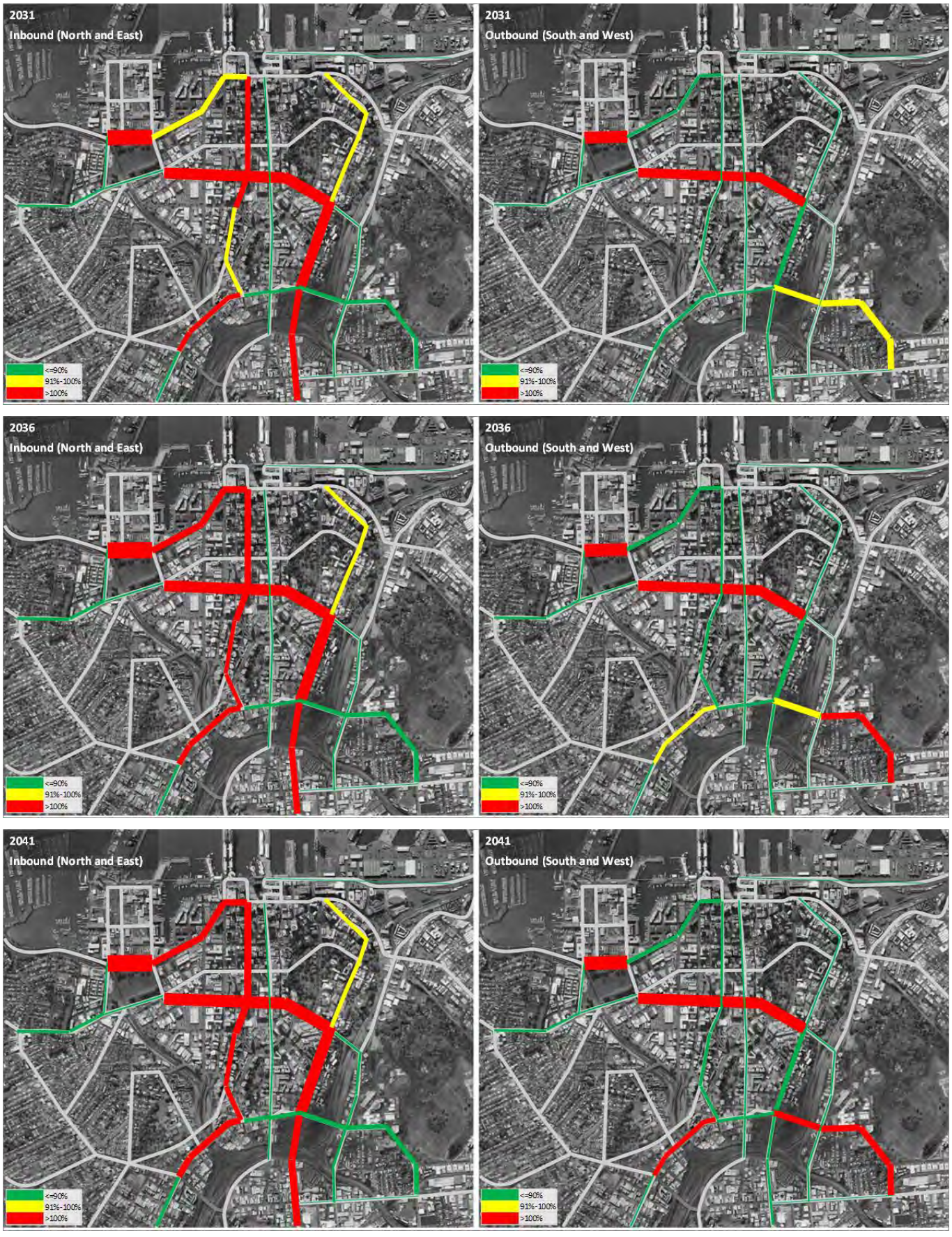

2016
Outbound (South and West)
<=90%
91%-100%
>100%

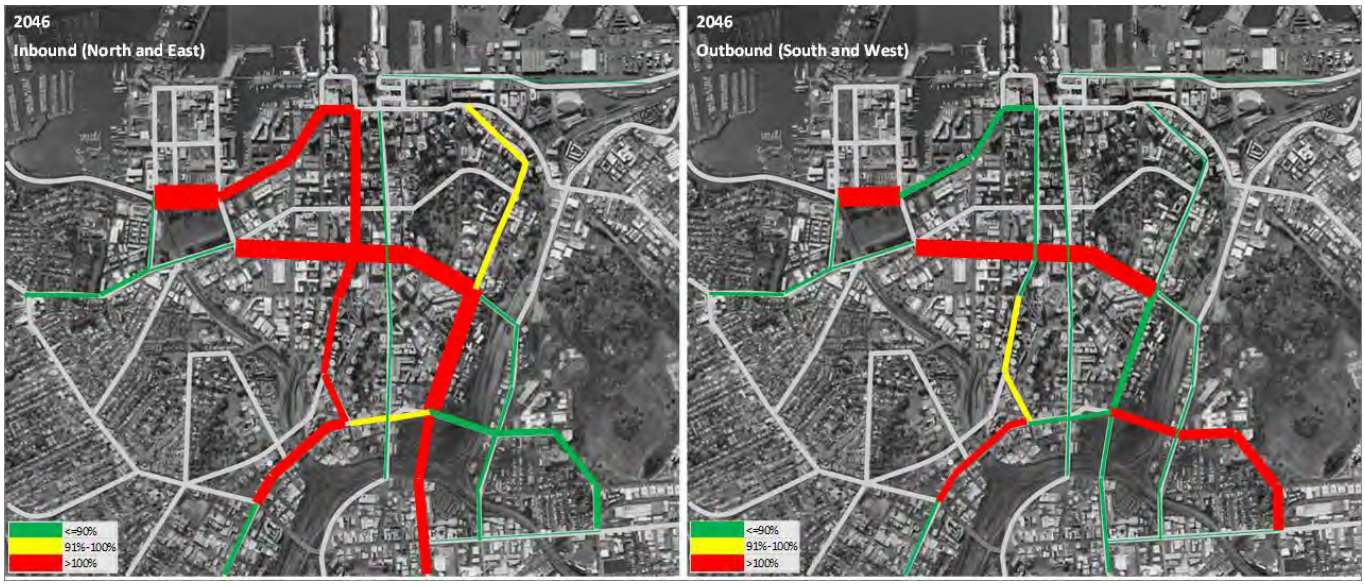

2021
Inbound (North and East)
<=90%
91%-100%
>100%


2021
Outbound (South and West)
<=90%
91%-100%
>100%

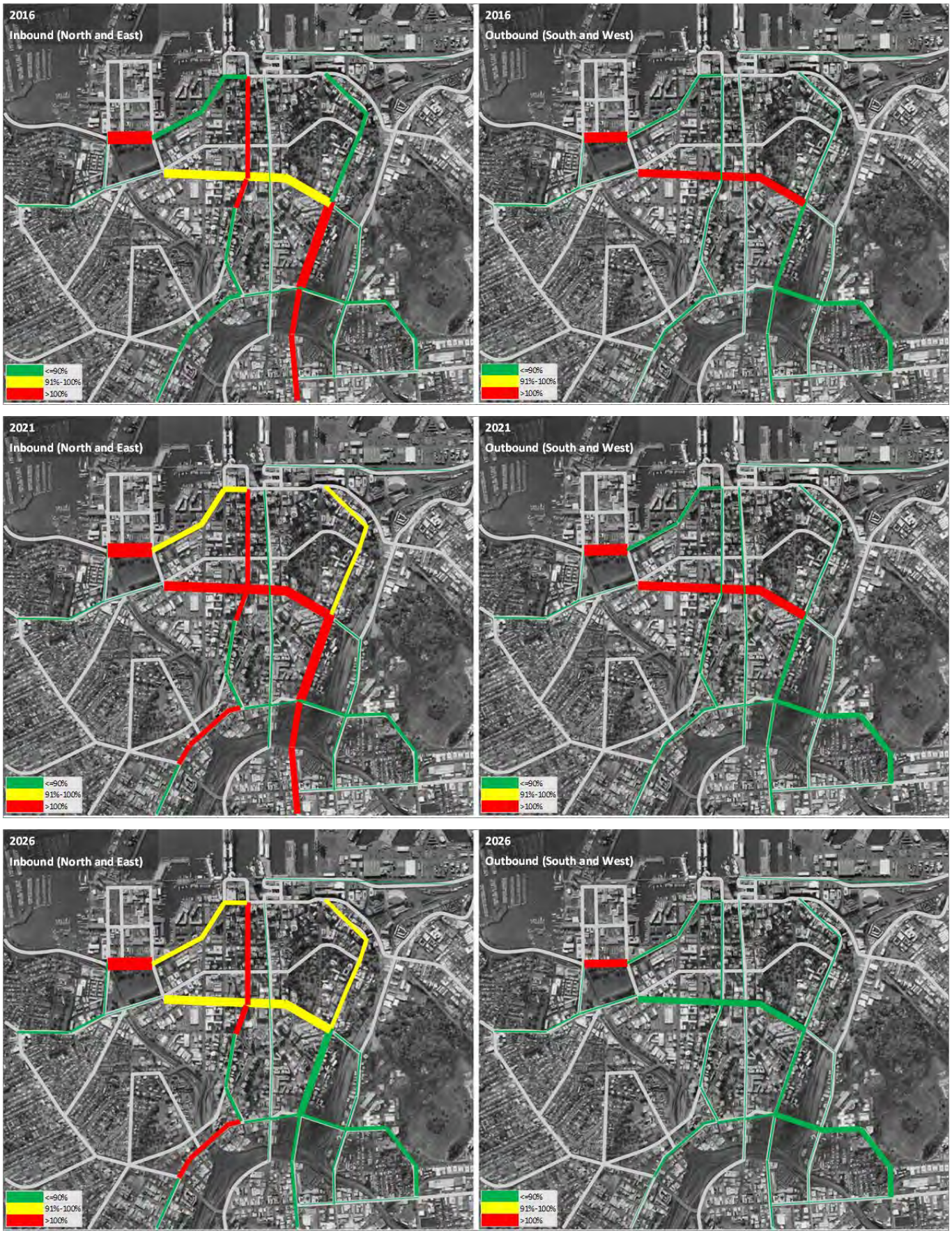

2026
Inbound (North and East)
<=90%
91%-100%
>100%

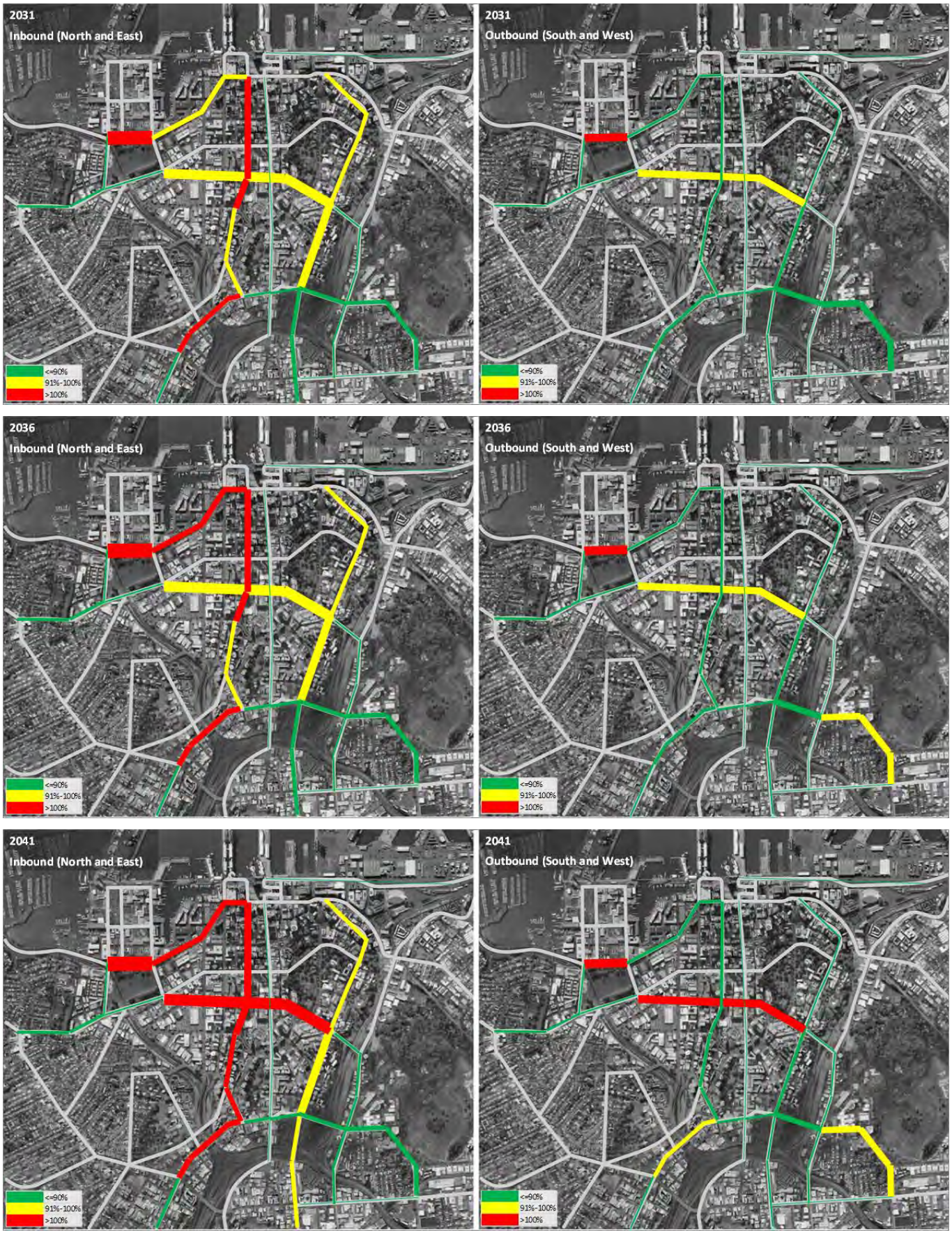

2026
Outbound (South and West)
<=90%
91%-100%
>100%

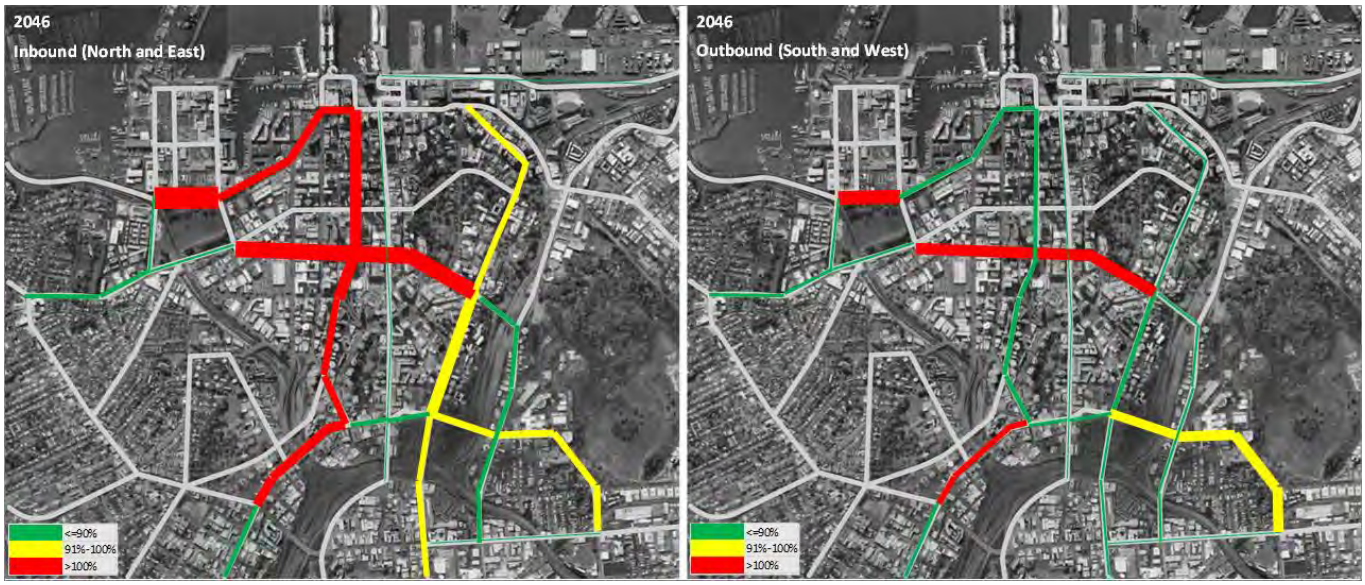

2031
Inbound (North and East)
<=90%
91%-100%
>100%
2031
Outbound (South and West)
<=90%
91%-100%
>100%
2036
Inbound (North and East)
<=90%
91%-100%
>100%
2036
Outbound (South and West)
<=90%
91%-100%
>100%
2041
Inbound (North and East)
<=90%
91%-100%
>100%
2041
Outbound (South and West)
<=90%
91%-100%
>100%


2046
Inbound (North and East)
<=90%
91%-100%
>100%
2046
Outbound (South and West)
<=90%
91%-100%
>100%

E.2 With the IP




2031
Inbound (North and East)
<=90%
91%-100%
>100%
2031
Outbound (South and West)
<=90%
91%-100%
>100%
2036
Inbound (North and East)
<=90%
91%-100%
>100%
2036
Outbound (South and West)
<=90%
91%-100%
>100%
2041
Inbound (North and East)
<=90%
91%-100%
>100%
2041
Outbound (South and West)
<=90%
91%-100%
>100%


2046
Inbound (North and East)
<=90%
91%-100%
>100%
2046
Outbound (South and West)
<=90%
91%-100%
>100%

Appendix F BRC and STM documentation

Appendix G Peer Review Comments