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LGWM Programme

Preferred Option Report

MRT and SHI team

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Glossary of Abbreviations

Items	Descriptions
BAU	Business As Usual
BCR	Benefit Cost Ratio
BRT	Bus Rapid Transit
CBD	Central Business District
DBC	Detailed Business Case
GWRC	Greater Wellington Regional Council
HLU	High Land Use
IBC	Indicative Business Case
IP	Indicative Package
LGWM	Let's Get Wellington Moving
LIHP	Low Impact High Probability
LoS	Level of Service
LRT	Light Rail Transit
MCA	Multi-Criteria Analysis
MRT	Mass Rapid Transit
NPS UD	National Policy Statement Urban Development
PASLO	Programme Affordability Threshold Short List Options
PBC	Programme Business Case
PT	Public Transport
RLTP	Regional Land Transport Plan
RMA	Resource Management Act
RPI	Recommended Programme of Investment
SDP	Specified Development Project
SHI	Strategic Highway Improvements
TDM	Travel Demand Management

UDA	Urban Development Act
UDS	Urban Development Summary Report
VKT	Vehicle Kilometres Travelled
WCC	Wellington City Council
WRGF	Wellington Regional Growth Framework

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Executive Summary

Background

Let's Get Wellington Moving (LGWM) is working with the people of Wellington to develop a transport system that supports aspirations for how the city looks, feels, and functions.

A review of the programme of activities to achieve this vision was initiated to reflect policy changes, refreshed programme objectives, new regional and city plans, and the outcomes of some of the detailed investigations into the programme's elements.

Four short listed options have been identified that seek to achieve the objectives at a cost that is within the affordability threshold of the partners. All the programme options have common elements in terms of short-term projects, corridor treatments and travel behaviour change opportunities, but differ in the form and placement of Mass Rapid Transit (MRT) and larger enabling infrastructure at the Basin Reserve and Mt Victoria.

These options were presented to the public for their feedback at the end of 2021. This report takes that feedback, plus further technical assessments that have been undertaken in relation to an intensified land use scenario, transport modelling, carbon analysis and economic analysis to inform the selection of a preferred programme option.

The options were considered against the project objectives and weightings that were developed by Councillors and decision makers to ensure that the recommended option delivers meaningful changes in liveability, access, carbon and mode shift, safety and resilience.

A key aspect of this assessment, and indeed transformational programmes of this nature, is how the options respond to, and catalyse, changes in land use. Accordingly, the options were assessed in relation to both a "core" land use scenario, and an "intensified" land use scenario, which anticipates significant number of new homes along the MRT corridors.

Investigations have identified that:

- there is a good investment case for MRT in Wellington City, subject to realising the intensified land use scenario;
- focusing our highest quality MRT along the southern corridor has the greatest potential to both drive and support intensification;
- the priority to the east is fast and reliable public transport journeys to drive mode shift, urban development and access, including for trips to the Airport by public transport. This does not require MRT, but does require new infrastructure through Mount Victoria and grade separating the Basin Reserve to provide additional public transport lanes;
- a solution at the Basin Reserve has been identified that can deliver transport benefits by separating and prioritising MRT and enhanced public transport to both the south and the east, whilst also delivering urban development and urban amenity benefits; and
- there is strong public support for change and for investment in MRT, a new Mt Victoria Tunnel and for grade separated improvements at the Basin Reserve. There is also a strong appetite to make it happen sooner, deliver the best value and get public transport right.

The preferred option that should be progressed to detailed business case is a high quality, high capacity MRT solution along the southern corridor from Wellington Station to Island Bay with a new tunnel

through Mt Victoria to improve facilities for active modes and public transport, and a grade separated solution at the Basin Reserve. This is the same as Option 1 but it is recognised that Bus Rapid Transit (BRT) could provide similar outcomes to Light Rail Transit (LRT) if appropriately specified and designed. Option 1 has an estimated cost of \$7.4B and yields a BCR of up to 1.2 if delivered alongside an intensified land use scenario.

But there is a lot that needs to be considered during the next phase of planning, including:

- agreeing intensified land use distributions that should be used in the assessment of the programme and how best to assist in delivering urban intensification;
- ensuring that urban amenity enhancements are recognised and provided for in the public realm and the way in which urban development is delivered;
- identifying how embodied carbon can be reduced as much as possible during construction;
- assessing different MRT vehicle types and enabling infrastructure to deliver high quality, high capacity MRT to the south in a resilient way that is scalable to address different growth scenarios and strong the growth to the north;
- more detail in regard to the infrastructure required to enable MRT to the south and east including road space allocation, stabling and power supply;
- developing more detail in regard to the layout and form of the Basin Reserve solution;
- determining the alignment and configuration of existing and new tunnels through Mt Victoria to provide better facilities for walking and cycling and two new public transport lanes;
- integrating the preferred option with the wider transport network (across the city and region);
- identifying further opportunities to reduce costs and limit environmental effects; and
- how to further support giving life to Mana Whenua values and aspirations

These elements will be progressed during the Detailed Business Case and once further certainty is available, the programme team will undertake a re-check of the programme to ensure that optimal outcomes, in relation to the programme objectives and value-for-money, are being achieved.

While this next phase of planning work continues, the programme will continue to deliver the 3-year programme elements of Golden Mile, Thorndon Quay and Aotea Quay and will be looking for opportunities to accelerate elements of the MRT/SHI Transformational Programme, such as a second public transport 'spine' down the waterfront in preparation for MRT.

In addition, the wider programme will be delivering important bus priority walking, cycling and urban amenity improvements to lock in early benefits and minimise disruption once construction begins on the larger elements of the programme.

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1 Introduction

1.1 Overview

Let's Get Wellington Moving (LGWM) is a joint initiative between Wellington City Council (WCC), Greater Wellington Regional Council (GWRC), and Waka Kotahi NZ Transport Agency (Waka Kotahi), with support from Mana Whenua, to develop a transport system that supports the city's aspirations for how the city looks, feels and functions.

A draft Programme Business Case (PBC) was released in 2019 which identified a preferred way forward for Wellington's transport network and since that time LGWM has been developing several Indicative Business Cases and Single-Stage Business Cases for elements of the programme.

Recently, the need for a refreshed programme-level view has become apparent to reflect policy changes, new regional and city plans, and the outcomes of some of the detailed investigations into the programme's elements.

1.2 Purpose

The purpose of this report is to recommend a preferred programme option that best aligns with the outcomes sought for the LGWM programme. The identification of the preferred programme option is based on assessments undertaken prior to stakeholder and public engagement as well as more recent updates that are documented within this report. These aspects are shown in Figure 1.



Figure 1: Key inputs used in the programme assessment process

Following stakeholder and public engagement, technical updates have been undertaken to urban development forecasts, transport modelling, carbon analysis and the economic analysis. The outcome of this work is intended to help answer some key remaining questions and is presented alongside the outcomes of the Multi Criteria Analysis (MCA) assessment and public engagement feedback to identify a preferred programme option.

Whilst this report recommends a preferred programme option, the case for investment in the Mass Rapid Transport (MRT) and Strategic Highway Improvement (SHI) elements of the programme will be provided

in an Indicative Business Case (IBC), which is due to be completed this year. The MRT and SHI IBC will fully document the case for investment and detail the assessment process.

The MRT and SHI IBC will also outline the next steps to be completed through the Detailed Business Case (DBC) phase. Wider elements of the LGWM preferred programme option will be reflected in parallel business cases, which continue to be developed and finalised¹.

The remainder of this report is structured as follows:

- Section 2 outlines the problems, objectives and regional context of LGWM
- Sections 3 and 4 provide a summary of the work completed to date and the work undertaken to develop the programme options
- Section 5 outlines the four programme options that were consulted on through the stakeholder and public engagement phase
- Section 6 provides a summary of the stakeholder and public engagement feedback
- Section 7, 8 and 9 documents the additional analysis that has been undertaken on the four options following the community engagement, including new work on land use scenarios, transport modelling, carbon analysis, cost and economics
- Section 10 addresses key questions
- Section 11 presents the current uncertainties and risks
- The identification of the preferred programme option, how it will be delivered and next steps (Sections 12 to 15).

This report focusses primarily on the transport solutions in the context of a still developing case for investment in urban development rather than combined urban development and transport solution investment. It is recommended that a combined urban development and transport solution is taken through (or alongside) the Detailed Business Case phase.

¹ See section 2.1 for wider programme elements

2 Strategic Context

2.1 Partner Environment

LGWM is a joint initiative between, Wellington City Council (WCC), Greater Wellington Regional Council (GWRC), and Waka Kotahi NZ Transport Agency (Waka Kotahi). These organisations are supported by Mana Whenua partners Taranaki Whānui and Ngāti Toa.

LGWM's role is to provide a way to work together, so that decisions are balanced and consider what else is going on in the city and region. As a group, LGWM discuss each project, agree the best way forward and make sure it is delivered.

To make sure Mana Whenua perspectives, rights and interests shape this work, local representatives participate in the governance of the LGWM programme and are consulted through a Governance Reference Group and an Iwi Partnership Advisory Group.

A set of Mana Whenua values have been developed by Mana Whenua representatives, with the authority of the Iwi partner organisations Taranaki Whānui and Ngāti Toa, with the expectation that LGWM will give life to these values and Mana Whenua aspirations. These values are:

- Whakapapa - A sense of place
- Wai-ora - Respect the role of water
- Pūngao-ora – Energy
- Hau-ora – Optimising health and wellbeing
- Whakamahitanga - Use of materials
- Manaakitanga – Support a just and equitable society
- Whakāhuatanga - Celebrate beauty in design
- Arotutuki – Ongoing monitoring of design and outcomes.

2.2 Why Transformational Change is Needed

Wellington is New Zealand's vibrant, compact, fast-growing capital city. It is the country's centre of Government and a hub for high-skilled jobs and creative industries. Wellington has experienced strong economic and population growth in recent years, as more people have been drawn to the high quality of life the city can offer². However, the city and region are facing several challenges including infrastructure deficiencies, evidenced by:

- Increasingly limited housing supply, choice and affordability
- A series of burst water and sewage pipes
- Declining levels of service on the region's transport network
- A climate crisis which requires an urgent response to both mitigate and adapt.

Buses, cyclists, pedestrians, freight, service vehicles and private vehicles all compete for limited space and priority on Wellington's constrained transport corridors. Resulting transport network issues include:

- Traffic congestion and unreliable journey times

² Let's Get Wellington Moving | Draft Programme Report for Public Engagement, 2021

- Poor and declining levels of service for all users
- Safety issues, especially when cycling and walking
- Vulnerability to disruption from unplanned events.

These issues mean it is becoming harder for Wellingtonians to access key employment, community, and recreation destinations reliably and safely. Easing pressure on the transport system and moving more people in fewer vehicles is critical, but mode shift is constrained by several factors:

- Buses (often full during peak times) caught up in congestion can result in slow, unreliable journeys for public transport users in Wellington City. This makes public transport a less attractive choice than the private car for many people when a door-to-door trip is considered.
- Lack of safe, connected cycle networks and facilities significantly constrains the potential uptake of more trips by bike.
- Limited footpath space, busy roads, and long wait times at crossings can disincentivise walking trips.

Transport is the biggest source of carbon emissions in the Wellington region, accounting for 40% of all emissions in the region, and 48% of emissions in Wellington City. Total transport emissions have risen by around 14% over the past two decades. The need to curb emissions will only continue to grow given the need to meet national, regional, and local climate change targets and obligations, and due to the region's vulnerability to the effects of climate change.

Within the context of population growth and limited housing supply, choice and declining affordability, there is a need to accommodate growth and enable greater housing capacity in Wellington, to meet current and future community needs, including for Māori. The opportunity to provide for a significant share of that growth focussed close to the central city, and along key public transport corridors with good travel choice and access is a key move identified in the regional growth plan.

Investment through the LGWM programme aims to provide a step change in the level of service of public transport and active modes within Wellington, giving people safe and easy options to move around. It will be a catalyst for more intensive urban development enabling more housing, improving liveability, enabling the movement of more people with fewer vehicles, and helping reach city, regional and national carbon emission reduction goals.

2.3 LGWM Vision

LGWM has developed a vision for Wellington, based on transport and city goals and urban design principles identified through stakeholder and community consultation in 2016, and the programme partners' priorities for the region's future. LGWM's vision is:

"A great harbour city, accessible to all, with attractive places, shared streets, and efficient local and regional journeys."

To realise this vision, the Programme needs to move more people with fewer vehicles.

2.4 Programme Objectives

In early 2021, the programme partners reviewed and updated the programme objectives. This was undertaken in response to a number of factors including:

- The need for greater emphasis on climate change commitments

- The need for increased focus on addressing housing and development challenges for the city and the wider region. There was also an update to the population projections including increased levels of intensification of land use and residents related to LGWM investment
- COVID-19.

The updated objectives, and associated weightings is shown in Figure 2.

Our objectives		Weightings
A transport system that...		
	Enhances urban amenity and enables urban development outcomes	20%
	Provides more efficient and reliable access for users	15%
	Reduces carbon emissions and increases mode shift by reducing reliance on private vehicles	40%
	Improves safety for all users	15%
	Is adaptable to disruption and future uncertainty	10%

Figure 2: LGWM Objectives

2.5 Policy Context

Wellington, like the rest of New Zealand, is grappling with a number of challenges. House prices have risen sharply since 2019, with housing becoming unaffordable for many. The potential impacts of climate change are well documented and there is a need to act now.

Central and Local Government policy has developed within, and is responding to, this context. Commitments to address these issues include:

- Recent amendments to the Climate Change Response Act 2002
- Introduction of the National Policy Statement on Urban Development in 2020
- Government Policy Statement for Land Transport 2021-24
- Finalisation of the Wellington Regional Growth Framework 2021
- The Wellington Regional Land Transport Plan 2021.

This means the wider policy and planning environment LGWM sits within has evolved since the Programme began in 2016. LGWM has not remained static in response, instead its direction and focus has shifted to reflect New Zealand's current priorities. This collective shift means that LGWM is closely aligned with the major regional policy and strategy documents including:

- Regional Land Transport Plan (GWRC, 2021)

Contains a vision of “A connected region, with safe, accessible, and liveable places – where people can easily, safely, and sustainably access the things that matter to them – and where goods are moved efficiently, sustainably, and reliably.” It also has strong carbon, safety and mode share targets.

- Regional Public Transport Plan (GWRC, 2021)

Focuses on mode shift and decarbonisation as well as improving customer experience.

- Regional Mode Shift Plan (Waka Kotahi, 2020)

Focuses on increasing development density near public transport, making active modes more attractive and influencing travel demand and transport choices.

- Regional Climate Emergency Action Plan (GWRC, 2019)

Confirms the need for key projects and programmes to meet emission reduction targets.

- Wellington Regional Growth Framework (WRGF, 2021)

Includes objectives to improve access utilising multi-modal transport and encouraging sustainable, resilient and affordable settlement patterns/urban form. It identifies rapid transit as a key enabler of regional growth that enables a high degree of transport and land use integration through intensification around stations. The framework also includes the 'key move' of fully unlocking the urban development of current and future rapid transit orientated corridors particularly those proposed by the LGWM programme.

- Regional Housing Action Plan 2022-2027 (WRGF, 2022)

Focuses on housing related interventions to 2027. It is focused on taking action to support the WRGF objectives noted above, focusing on non-District Plan mechanisms that can increase housing supply and improve housing affordability and choice, improving regional access to data, driving regional collaboration, and encouraging new technologies and smarter ways of building.

- Our City Tomorrow: Spatial Plan for Wellington City (WCC, 2021)

Outlines what Wellington might look in the future. It aims to maintain areas of special significance while enabling greater capacity for new housing for the growing Wellington City community. The Spatial Plan addresses affordability, accessibility, resilience, and effects from climate change. Regarding infrastructure, it highlights a staged approach that links investment with growth area priorities. The overarching goals for the city are compact, resilient, vibrant and prosperous, inclusive and connected, greener, and in partnership with Mana Whenua.

- Green Network Plan (WCC, 2022)

Outlines the direction and goals for a greener Wellington central over the next 30 years to address the current deficit of green space, enable growth and to respond to the climate and ecological emergency declared in 2019. The key objectives include treasure and protect what is important, celebrate the value of green with partners, grow the number of trees and public green, and manage what we create and what we already have.

- Te Atakura First to Zero (WCC, 2019)

Outlines how to make Wellington City a zero-carbon capital by 2050. It includes key initiatives that can help lower emissions in four target areas: transport, building energy and urban form, advocacy, and the Council.

In terms of the strategies detailed above, it is vital that the preferred programme option for LGWM contributes to the success of the region to the fullest extent possible. LGWM is one of the flagship investments in the region and has the ability to make a step change towards climate change and mode shift goals.

2.6 Why LGWM Matters in the Regional Context

The Wellington region is growing, with around 200,000 to 250,000³ more people expected to live here over the next 30 years. WCC is planning for 50,000 to 80,000 more people to live in the city over than same timeframe. The fastest growing areas will be in and around the central city.

Approximately 60% of the region's jobs are concentrated in Wellington City and the majority of those are in the Wellington City Centre. The COVID-19 pandemic has been a major disruptor event and may lead to sustained changes to travel patterns, behaviours and where people work and live. However, Wellington City is expected to remain the primary economic hub for the region. Enabling a high functioning Wellington City Centre that is accessible, vibrant, and liveable will be important to attract new investment, jobs, talent and visitors to the city and the wider region and continue to drive regional economic development by building local capability and capacity and a regional pipeline of activity.

Shaping urban growth is critical to delivering on transport outcomes. Meeting the housing needs of a growing regional population in a way that reduces carbon emissions and improves travel choice and liveability will require a response both within Wellington City and across the region. The WRGF identifies LGWM as a key part of the regional growth picture. It expects approximately two-thirds of the housing growth over the next 30 years to occur in existing urban areas through infill, urban renewal, and intensification. With approximately one-third of the growth in greenfield areas, extending the current urban footprint of the region.

The LGWM Programme will provide the foundations for a fundamental change to the way urban form develops within Wellington City over the medium to long term. LGWM provides an opportunity for a more compact and sustainable growth pattern for the region, requiring less greenfield development than what is currently envisaged. A new MRT system and associated infrastructure provides the important city shaping catalyst for this change.

The more new housing that can be provided in Wellington City's central, southern, and eastern suburbs along a future MRT corridor, the higher the number of trips that can easily be made by walking and cycling and public transport given the proximity and access to the region's largest employment hub, Wellington City centre. There are established rail services to the two main growth corridors in the north and therefore a high mode share, but mode share for trips from the south and east could be improved.

Wellington's Regional Land Transport Plan (RLTP) 2021 includes ambitious ten-year headline targets including:

- 40 percent increase in active travel and public transport mode share
- 35 percent reduction in transport-generated carbon emissions
- 40 percent reduction in deaths and serious injuries.

LGWM is a central part of the RLTP activity, that connects to other key programmes/projects such as:

- Regional Rail Plan improvement package that will link LGWM's MRT with the wider rapid transit (regional rail) network and like LGWM facilitate and drive mode shift with associated opportunities for more intensive transit-orientated development (TOD) around railway stations. This focusses on the rail network from Wellington to the north, whereas LGWM focusses to the south and east.

³ Wellington Regional Growth Framework Report JULY 2021 (wrgf.co.nz). This is lower than the [Population forecast 2020 to 2051](#), completed in April 2022 by Sense Partners, which has up to 300,000 people in the region (75%ile) and 110,000 in WCC (75%ile).

- Te Ara Tupua that will connect to the extensive walking and cycling networks including Thorndon Quay/Hutt Road and Golden Mile, planned as part of LGWM's Three-Year Programme as well as the 10-Year City Streets Programme and WCC's Bike Network programme
- Other significant activities in the RLTP including Riverlink, Access Kenepuru, Eastern Porirua Regeneration Programme

Together LGWM and these programmes/projects are expected to positively affect access, housing, carbon, safety, resilience and liveability outcomes for the region and enable the region to achieve its ambitious targets for mode shift, carbon emissions reduction and safety as set out in the RLTP 2021.

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3 Work Completed to Date

Figure 3 below provides an overview of the work completed to date and a detailed summary is provided within this section. A number of investigations as part of the LGWM programme were progressed in 2020 and 2021, including:

- Mass Rapid Transit
- Strategic Highway Improvements
- City Streets
- Travel Demand Management
- Golden Mile Improvements
- Central City Pedestrian Improvements
- Thorndon Quay / Hutt Road Improvements.

These investigations also identified that some of the elements of the PBC programme may not be optimal in terms of delivering the desired benefits, and the expected cost, due to rising escalation in construction and property acquisition costs, is likely to be greater than previously estimated at the time of the PBC in 2019.

In parallel, WCC finalised its Spatial Plan, and released a draft District Plan for engagement in December 2021, with a Proposed District Plan to be notified in July 2022.

Furthermore, since the completion of the PBC, other significant factors have arisen, each with potential to reshape the LGWM programme:

- Greater emphasis on climate change commitments
- Increased focus on addressing housing and development challenges for the city and the wider region. There was also additional analysis to understand the implications of different population projections on the outcomes sought from the LGWM investment.
- COVID-19.

In light of these factors, programme partners reviewed and updated the programme objectives. As a result of the updated objectives, the changes in the individual elements and the new external factors, the programme team was instructed by the LGWM Board to check that the Indicative Package still represented the best way forward for Wellington.

Work was undertaken to test the Indicative Package against a number of alternative programmes. The LGWM Programme Long List and Short List reports (July 2021) presented the process for evaluating the programme options and identified a technically best performing programme of investment, whilst also noting that this was subject to affordability, public acceptance, and value for money considerations.

Following the Programme Long List and Short List reports, an affordability threshold was identified, and the short list options were further refined to align with the affordability threshold. As noted in the Programme Affordability Threshold Report (2021), four programme options were presented to the public for their input in November 2021. The community engagement and feedback, along with some technical updates detailed in this report will now be used to help select a preferred programme option.

Once selected, the preferred programme option will form the basis for finalising the MRT and SHI IBC elements of the programme. Further detailed investigation and assessment will then be undertaken for the MRT and SHI elements through the DBC phase.

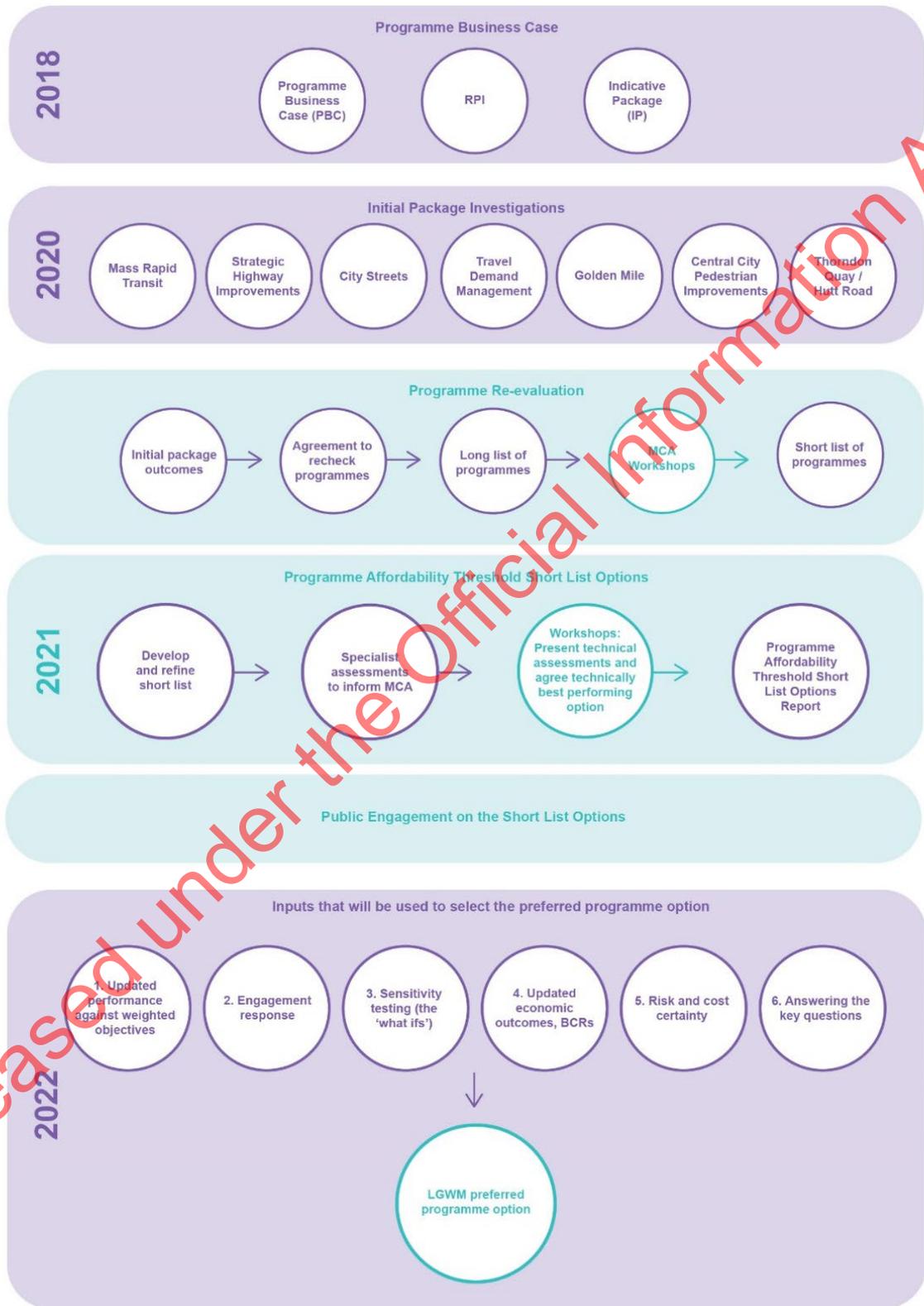


Figure 3: Indicative Programme option development and assessment process

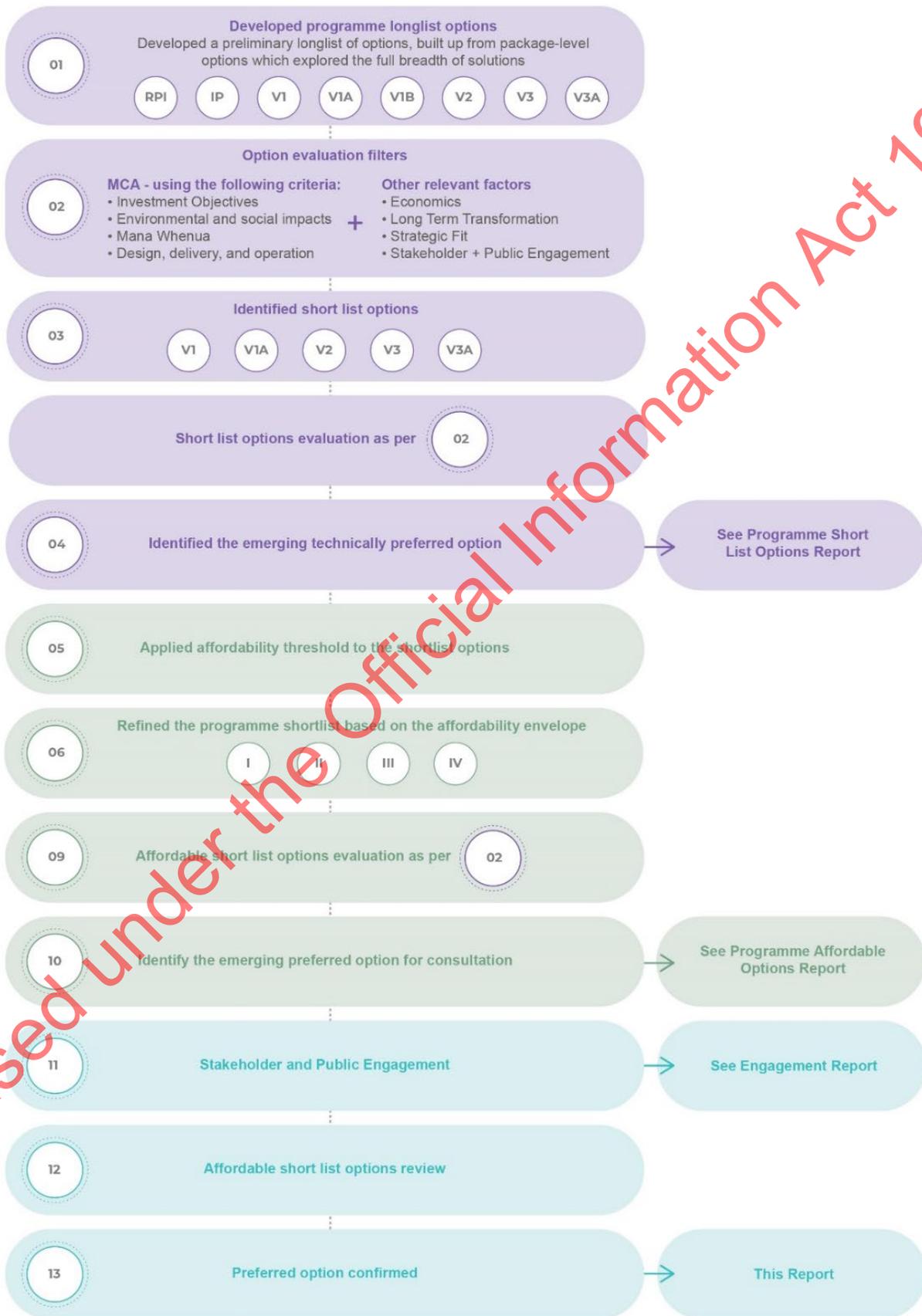
4 Development and Assessment of Programme Options

The programme option development process has been undertaken over several months and options have been assessed at different levels to enable a robust and transparent outcome. A summary of the filtering process is presented in the diagram below. Further information on the process can be found in each of the programme option reports referenced in the diagram.

Key preceding reports include:

- LGWM Programme Report draft (October 2021): [Draft Programme Report.pdf](#)
- Programme Short List Options Report (October 2021): [PSLO Report.pdf](#)
- Programme Affordability Options Report (October 2021): [PASLO Report.pdf](#)
- Engagement Report (March 2022): [Mass Rapid Transit Engagement Report.pdf](#)

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Figure 4: Assessment process

This report discusses and analyses the Programme Affordable Short List options which were presented to stakeholders and the public at the end of 2021. As presented earlier in this report, the decision on a preferred programme option will be undertaken by considering a range of different inputs as shown below:

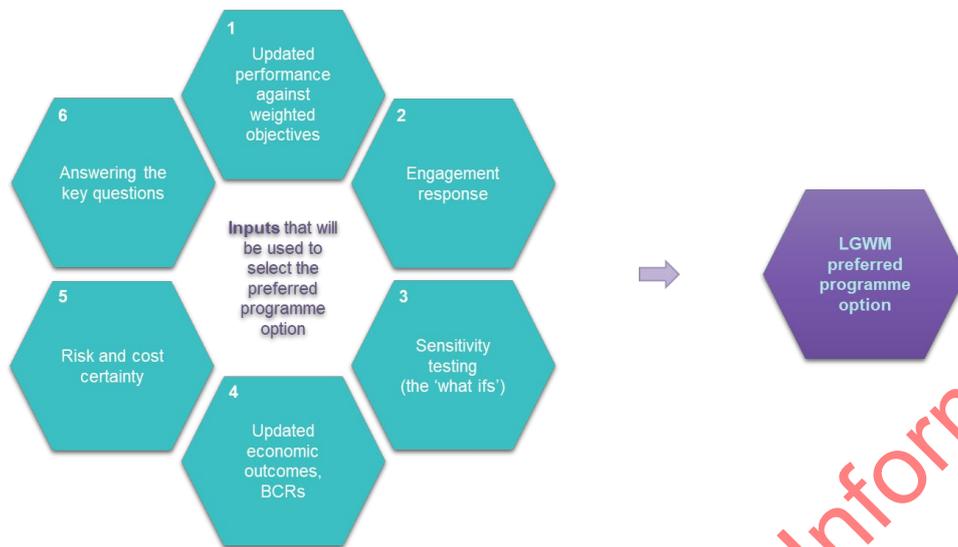


Figure 5: Preferred Programme inputs

The performance against the objectives (see Figure 2), and their likely effects, was assessed through an MCA process to understand how the programme options perform for the different land use scenarios. However, it is not the MCA alone that will be used to decide on a preferred programme option. This is because there are only a few significant differentiators and as they are inter-related, they also need to be discussed and debated holistically rather than through a structured, sometimes mathematical, process.

The preferred programme option will be the one that best achieves the vision for Wellington, whilst providing value for money. It will be the option where any outstanding risks (such as uncertainties, costs, environmental effects) can be minimised.

As part of the process, and to help inform decision makers, several key questions have been considered. These questions have come from within the LGWM team, the programme partners, stakeholders and the public and have been the focus of the most recent investigations, as they need to be understood to make a choice on a preferred option. These questions are outlined below and are discussed and answered later in this document.

- What form of MRT is preferred?
 - If light rail, why would this not go to the Airport?
- Are large-scale or less effective minor improvements preferred at the Basin Reserve?
 - If large-scale, why does it have such a large footprint?
- Is a new Mt Victoria tunnel needed?
- How can urban intensification be achieved?
- How will the options integrate with the wider transport system?
- Are parking levies or congestion charging proposed?

5 Programme Options

Four programme options have been identified to achieve the objectives of LGWM at a cost that is within the affordability envelope of the PBC. These were initially reported in the PASLO report and have been the subject of stakeholder and public engagement. All the Programme Affordable Short List options have common elements including:

- Short term programme:
 - Golden Mile improvements
 - Thorndon Quay & Hutt Road improvements
 - Central City pedestrian improvements
 - Cobham Drive crossing and safer speeds
- City Streets – improving connections for people on buses, bike or walking on 19 key routes between the central city and suburban centres (will slightly vary by programme depending on extent of MRT)
- Travel Demand Management including travel behaviour change initiatives

The major differences in the programme options are around the type of MRT, the proposed routes, and the level of investment in the Basin Reserve and Mt Victoria Tunnel. The short-listed options are outlined in the table and images below.

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Table 1: Programme option summary

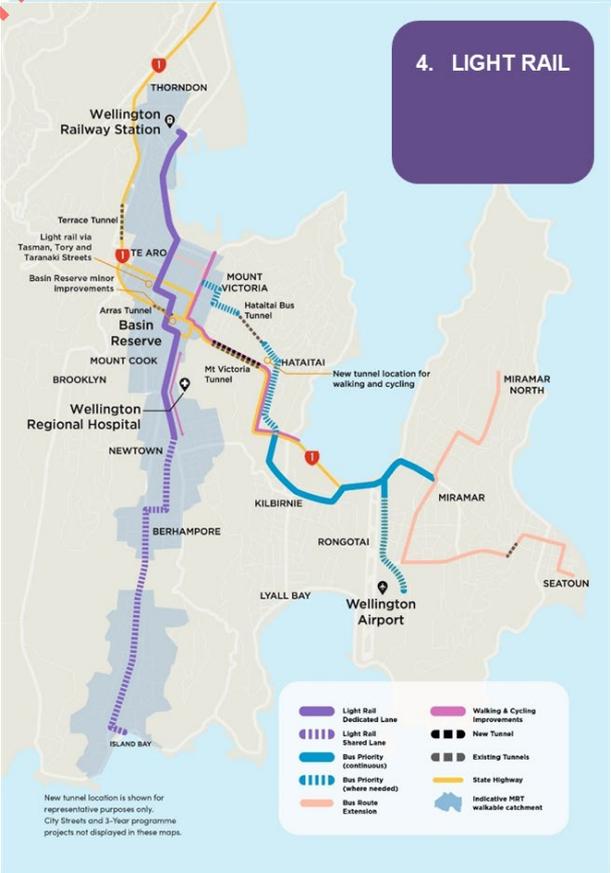
	Option 1	Option 2	Option 3	Option 4
Basin Reserve	Movements grade separated with extended Arras tunnel and opportunity for better amenity	Movements grade separated with extended Arras tunnel and opportunity for better amenity	Movements grade separated with extended Arras tunnel and opportunity for better amenity	At-grade (stays a roundabout with minor improvements)
Mt Victoria Tunnel⁴	New tunnel (diagonal or parallel) for public transport and general traffic. Existing Mt Victoria Tunnel re-purposed for active modes	New tunnel (diagonal or parallel) for public transport and general traffic. Existing Mt Victoria Tunnel re-purposed for active modes	New tunnel constructed for walking and cycling. Traffic stays in current Mt Victoria Tunnel and public transport stays in Hataitai bus tunnel	New tunnel constructed for walking and cycling. Traffic stays in current Mt Victoria Tunnel and public transport stays in Hataitai bus tunnel
MRT city to south	Light rail, via Cambridge Tce	Bus rapid transit, via Cambridge Tce	Light rail, via Cambridge Tce	Light rail, via Taranaki St ⁵
MRT east	Continuous Bus Priority ⁶ , via new tunnel to be used by most eastern suburbs' buses. Remaining eastern suburbs' buses continue to use existing Hataitai bus tunnel	Bus rapid transit, via new tunnel. Remaining eastern suburbs' buses continue to use existing Hataitai bus tunnel	Continuous Bus Priority from Kilbirnie to Miramar. Targeted local priority treatments between Kilbirnie and Mt Victoria via Hataitai bus tunnel	Continuous Bus Priority from Kilbirnie to Miramar. Targeted local priority treatments between Kilbirnie and Mt Victoria via Hataitai bus tunnel
Other	Short Term Programme, City Streets and Travel Demand Management common across all programme options			
Cost⁷	\$7.4 billion	\$7 billion	\$6.6 billion	\$5.8 billion
Construction timeframe	10 to 15 years	10 to 15 years	8 to 12 years	8 to 12 years

⁴ The Hataitai Bus Tunnel will remain in its current configuration in all options, but will have significantly fewer services in Options 1 and 2.

⁵ This route is needed if the Basin Reserve is not upgraded.

⁶ Continuous Bus Priority comprises extensive bus priority improvements including long continuous sections of kerbside bus lanes and signal priority. It represents a solution that has lower ride quality and customer experience without pavement upgrades, level boarding stations and other associated infrastructure.

⁷ Total LGWM programme cost calculated on the whole of life cost (WoLC) over a 30-year period to 2049/50. This includes investigations, design, construction, and on-going operational and financing charges for the entire LGWM programme.



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Figure 6: Programme option summary

6 Outcomes from Stakeholder and Public Engagement

This section presents the feedback and findings of the stakeholder and public engagement process conducted over six weeks from early November to mid-December 2021, during which time the four programme options were presented. The full engagement report is available online⁸.

Understanding community views will help the LGWM partners gauge appetite for change, what changes the community would like to see and provides direction for future engagement. A total of 5,692 submissions were received from the public engagement process and 41 detailed submissions from stakeholder groups and organisations. Despite the diversity of feedback, six key themes emerged:

- Quality urban growth and development
- Better environmental, carbon, social and liveability outcomes
- Quality public transport
- Timeframe, cost and construction disruption
- Cyclist/scooter-friendly and walkable city
- Access for private vehicles and parking.

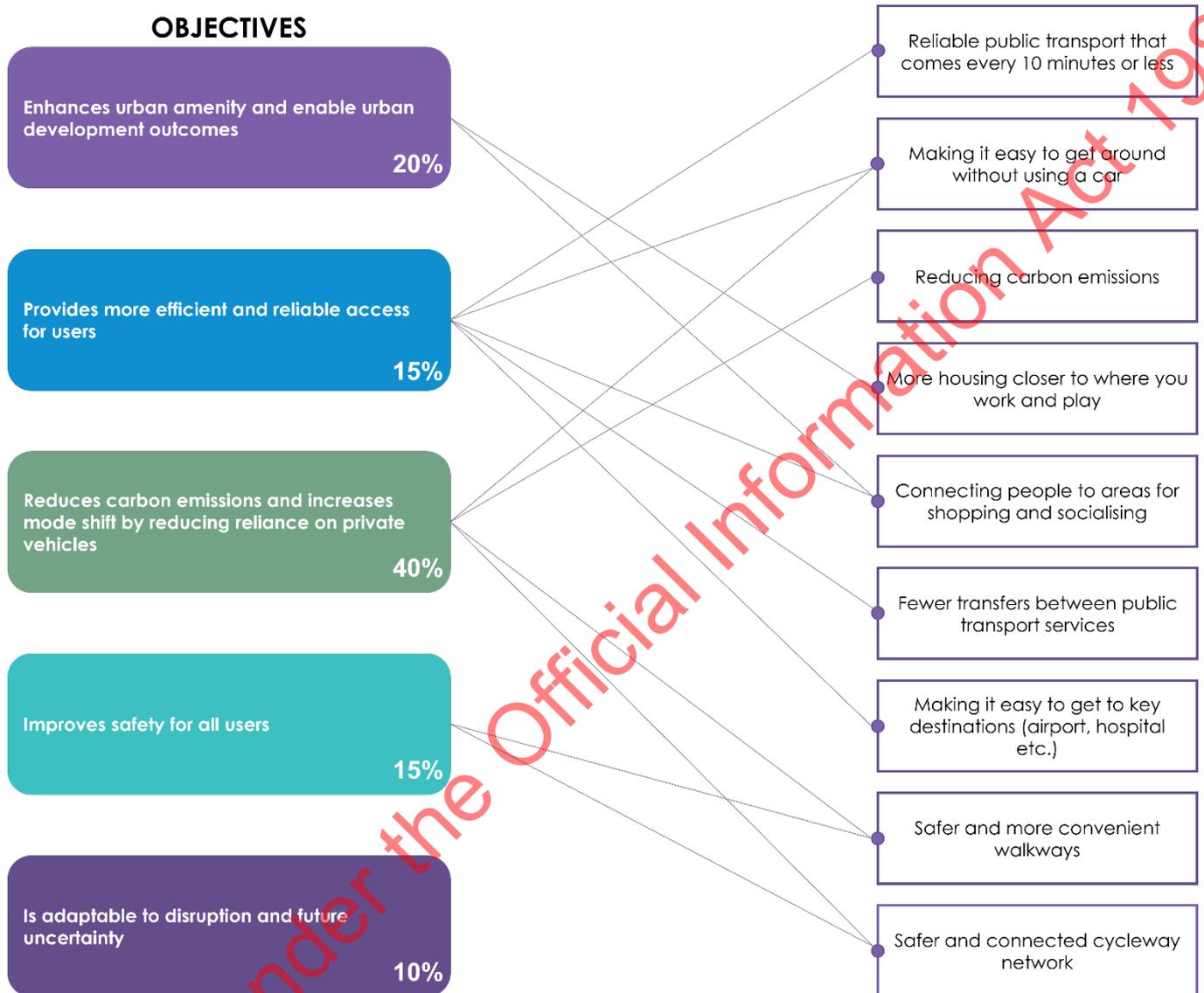
One of the questions asked during engagement was 'What do you think is most important to the future of Wellington?'. People were asked to rank a series of statements in level of importance, one being most important and nine being the least. The top two responses for the most important was reliable public transport with a frequency of at least every 10 minutes and making it easy to get around without using a car. The lowest rated factors were connecting people to areas of shopping and socialising and fewer transfers between public transport services.



Figure 7: Number of responses to "What do you think is most important to the future of Wellington?"

⁸ <https://lgwm-prod-public.s3.ap-southeast-2.amazonaws.com/public/Projects/Mass-Transit/Mass-Rapid-Transit-Engagement-Report.pdf>

The most important elements relate well to the programme objectives as can be seen from the image below:



The engagement was very useful in terms of helping to answer the key outstanding questions and provided the following key insights.

The engagement process sought to understand the preferences of the general public in terms of public transport mode options. A total of 53% of the respondents supported LRT, with the primary reasons being:

- High capacity (over 300 people per trip)
- Reliability and frequency
- Improved carbon performance.

There was a perception that LRT will be quiet to operate despite information supplied (and the specialist assessment undertaken for the PASLO MCA). When asked about BRT, 23% were in support for the following reasons:

- Flexibility and ability to be extended to more suburbs in the future
- Less investment and is faster to implement
- Quicker recovery time from a natural disaster.

24% of the respondents did not indicate a preference for LRT or BRT. Of these, most respondents commented that they do not support any type of MRT as a suitable public transport solution for Wellington. Others suggested that Wellington needs both BRT and LRT to create a well-connected quality public transport service.

Overall, 69% of the 1,616 comments received in relation to the new tunnel were supportive of the proposed new Mount Victoria tunnel due to the focus on MRT and active mode safety, as well as improved connections between the City and Airport. People would like more information about the entry and exit points on either ends of the tunnel.

Respondents who are concerned about better access for cars and other vehicles questioned why only a two-lane tunnel is proposed and would like to see four lanes for general traffic (two in each direction) because they believe this would future-proof the investment and support population growth and intensification.

Those who support the aim of reducing car reliance felt a new tunnel would be counter-productive to that goal, as it would encourage car use. In addition, people were concerned about the level of disruption from the construction of a new tunnel and the carbon impacts.

A total of 61% of the 980 comments on the Basin Reserve supported the changes to the Basin, however, there were concerns about whether the changes would delay investment elsewhere. The reasons for the support of the Basin Reserve were:

- People want reduced congestion and improved traffic flow around the Basin Reserve
- Enhanced, people-centred, open space
- Those living in the wider region think changes are needed to make it easier for them to get to the Hospital and the Airport.

Those who were less supportive of changes at the Basin Reserve highlighted the following issues:

- Question if changes will fix congestion, since traffic merges and bottle necks continue elsewhere in the network
- Extension of Arras Tunnel too carbon costly
- Arras Tunnel also perceived as incentivising driving over public transport or active modes.

During the public engagement process LGWM also received written feedback from over 40 different stakeholders with a range of different perspectives and insights. These specific comments have been considered alongside the public feedback in the preferred programme option assessment.

6.1 Online Panel Survey

To supplement feedback from public consultation, LGWM commissioned a parallel study to determine a representative view of the Wellington public through an online panel. This comprised a 10-minute survey amongst a sample of approximately 1,230 Wellingtonians.

The panel had very similar thoughts to the public in terms of what they considered was most important for Wellington.

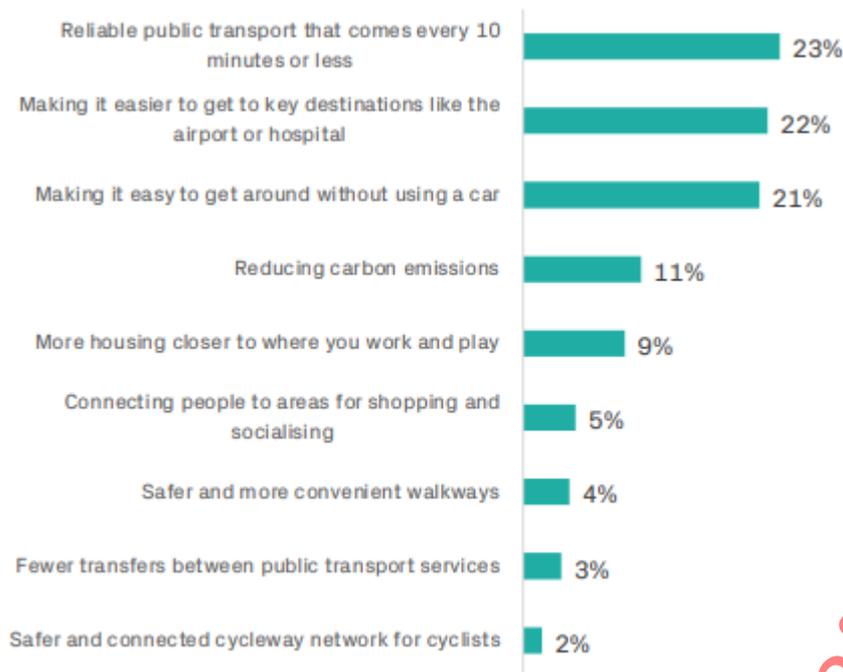


Figure 8: General public survey results - most important for Wellington

The research⁹ determined that the programme options are well liked as they link closely to what people want to see from the region, particularly improved public transport, better access to the Airport and Hospital and freeing up the city of traffic, using reliable public transport as a substitute to cars.

One area where the online research gave a slightly different result to the public engagement was in relation to the form of MRT. LRT was preferred by 59% of respondents, compared to 41% for BRT, which is closer than that identified through the public engagement. When considering the responses from only Wellington City residents, the preferences are even closer with 52% preferring LRT and 48% preferring BRT.

Further engagement will be undertaken during the DBC phase to help inform the development of the preferred option.

⁹ [LGWM TRA Engagement Study](#)

7 Technical Assessments

A number of additional technical assessments have been undertaken to help provide a more detailed understanding of the relative advantages and disadvantages of each of the options. The assessments have focussed on:

- Transport modelling: which forecasts changes in demand for different transport modes as well as changes in travel time
- Economic analysis: which provides an indication as to whether the programme options deliver value for money
- Carbon analysis: which forecasts both embodied and enabled carbon emissions.

The technical assessments have been used to inform an MCA which will be discussed in the next section of this document. This technical assessments will feed into updated MCA assessments of the options, but as presented above, it is not the MCA alone that will be used to decide on a preferred programme option.

7.1 Land use scenarios

A key consideration of a transformational programme of the scale envisaged by this programme is how it catalyses and responds to changes in land use. A successful programme will enable changes in land use patterns, urban form and urban amenity relative to a situation where no programme is implemented (described below as a “do minimum” scenario).

MRT will support new forms of denser housing within the walkable catchments of rapid transit stops along the MRT corridor. Enabling greater intensification can help the region and city address critical challenges such as increasing housing supply, affordability and choice, and reducing emissions; and deliver on city and regional objectives including those in the WRGF.

All options, regardless of either LRT or BRT mode support intensification in line with (or in excess of) the WCC Spatial Plan estimates and with additional Transit-Orientated Development around MRT stations. A range of land use scenarios have been developed by LGWM that consider the nature and location of future growth. For the purposes of the analysis, all future year scenarios have assumed the same total quantum of growth across the Wellington region but have adjusted the distribution of future growth using a sliding scale between dispersed growth across the region and intensified growth along the MRT corridor. This is shown in the following diagram.

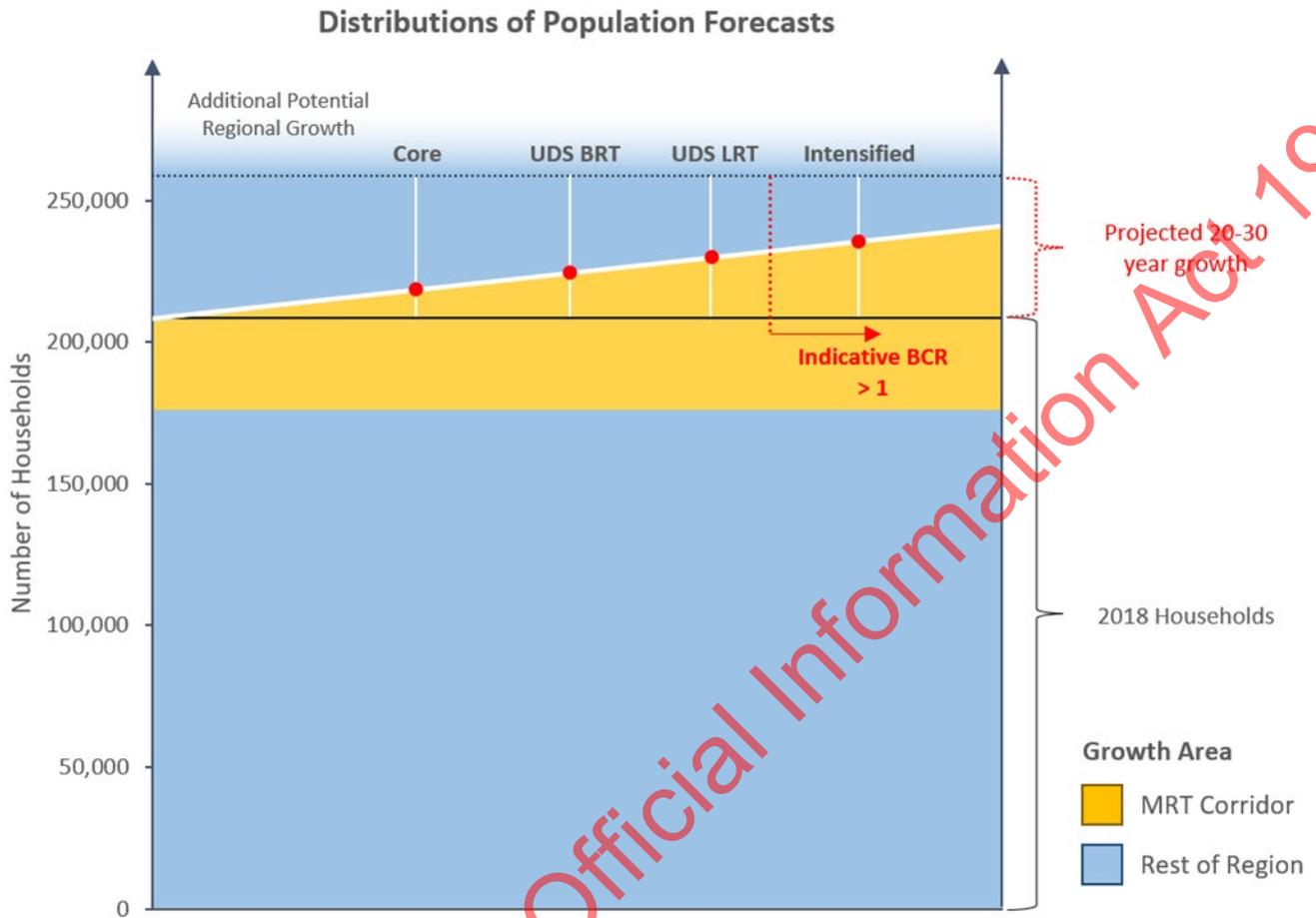


Figure 9: Land use scenarios: Distribution of Population Forecasts

The diagram indicates a total increase of approximately 50,000 households between 2018 and 2046 across the Wellington region. This is based on levels of growth agreed between GWRC, WCC and the other Territorial Local Authorities across the region in November 2019. It also highlights the two “bookend” scenarios that have been used in the technical analysis (namely, ‘core’ and ‘intensified’).

The land use scenarios are:

- Core – this reflects business as usual growth and was the level of development distribution that was agreed in November 2019. This scenario has assumed 10,000 new dwellings within an indicative MRT walkable catchment. It was developed in advance of the publication of the draft WCC Spatial Plan however it is reflective of the level and distribution of growth indicated in the Spatial Plan. This represents the do minimum assumption.
- Urban Development Summary Report: Bus Rapid Transit option (UDS BRT) – this assumes up to 16,000 new households across the indicative walkable catchments associated with the BRT option (13,000 plus an additional 3,000 facilitated and/or delivered via additional investment in urban development). The number of dwellings for BRT is slightly less reflective of a lower Land Value Uplift (4.9% for BRT compared to 11.5% for LRT).
- Urban Development Summary Report: Light Rail options (UDS LRT) – this assumes up to 21,000 new households along the LRT option corridors (16,000 plus an additional 5,000 facilitated and/or delivered via additional investment in urban development).

- Intensified – this reflects a level of intensification that might be commercially feasible under a MRT based programme, where intensification is focused close to the assumed MRT station locations. This is a more intensive scenario than those identified in the Urban Development Summary Report and can be considered a ‘what if’ scenario that would likely require a very intensive urban form and significant investment in urban development to facilitate and/or deliver high density along the corridor¹⁰. Intensification has been assumed to result in an additional 26,000 households along the MRT corridor and a consequent reduction in growth in the wider region.

In both core and intensified land use scenarios, a relatively high-level assumption has been made regarding the distribution of development across the region. This is not intended to be a forecast of the level of development that will occur, instead it provides a representation of what could occur, should differing levels of intensification be realised. It is recognised in the programme investment objectives that alongside urban development, there is an imperative to deliver enhanced urban amenity (that will in itself be a critical factor to attracting more people to live in the area). It is also assumed that development would proceed in tandem with delivery of the LGWM programme.

Table 2 provides a summary of the land use changes assumed in these scenarios.

Table 2: Land use changes and growth scenarios

	2018 Estimate Households	Modelled	UDSR Scenario	UDSR Scenario	Modelled
		2046 – Core Households	2046 – UDS BRT	2046 – UDS LRT	2046 - Intensified
CBD / Te Aro	8,000	12,500	15,000	18,000	21,500
Southern corridor¹¹	11,000	15,000	17,500	19,500	21,500
Eastern corridor	12,000	13,500	14,500	14,500	14,500
Sub-total additional to 2018	0	+10,000	+16,000	+21,000	+26,500
Western suburbs	11,000	12,000	12,000	12,000	11,500
Northern suburbs	27,000	33,500	32,500	31,000	30,000
WCC other	15,500	17,000	17,000	16,500	16,500
Rest of Region	124,000	154,500	150,000	147,000	142,000
Region	209,000	257,500	257,500	257,500	257,500

¹⁰<https://lgwm-prod-public.s3.ap-southeast-2.amazonaws.com/public/Documents/Nov-1-MRT/2021-10-29-LGWM-Urban-Development-Summary-Report.pdf>

¹¹ Less than 20% of growth in the southern corridor is assumed to be located in Berhampore or Island Bay with the majority assumed to occur between the Basin Reserve and Newtown (inclusive)

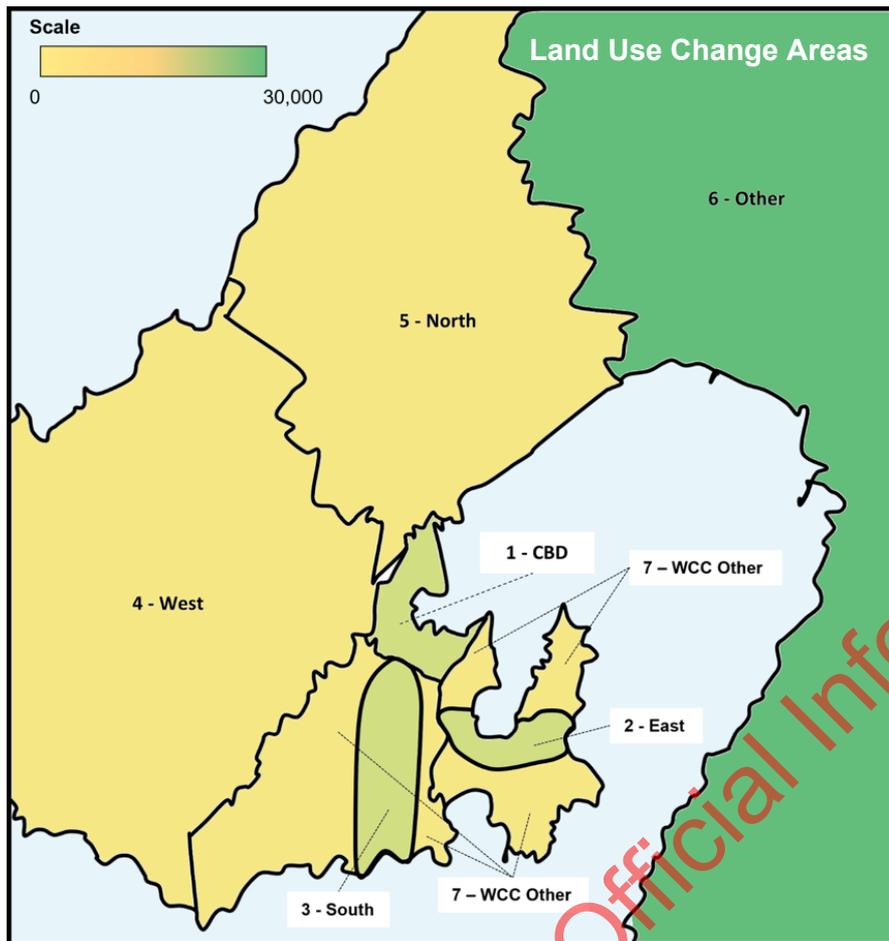


Figure 10: Land use change areas

It is noted that not all the options enable this development to the same extent. Options 3 and 4 in particular do not provide additional infrastructure to the east to enable high quality public transport services to support new development, this could affect both the 'East' and 'WCC other' areas.

It is also noted that the assumption regarding total growth across the region is a simplification using a 2019 estimate.

The Wellington Regional Growth Framework is planning for up to 90,000 new households over 30 years in the Wellington Region (+ Horowhenua District), compared to the 48,000 new regional households used in the table above.¹² Population projections have very wide ranges, depending on future immigration rates, positive effects from new housing supply, and the transformational programme. This will be investigated further at the DBC stage, aligning with ongoing work through the Wellington Regional Leadership Committee and input from the WCC housing capacity model.

7.2 Transport Modelling

This section presents the key finding of the transport modelling work undertaken between September 2021 and April 2022 to support the identification of a preferred option. It is important to note that revisions to the modelling scenarios occurred during this period. Model outputs and results have consequently been updated over time. Following the completion of the engagement period, further modelling was undertaken to provide a more granular understanding of the differences between the

¹² Ref WRGF [Wellington Regional Growth Framework Report JULY 2021 \(wrgf.co.nz\)](http://wrgf.co.nz)

options in a couple of key areas (mode share and accessibility) as well as to provide input to other workstreams (carbon and economics) and understand the performance of the network should higher levels of intensification occur.

Where relevant, modelling results are presented for the core and intensified land use scenarios to demonstrate the range of potential outcomes.

The full modelling report can be found in Appendix A.

7.2.1 Mode Share

The transformational programme provides a step change in public transport provision to the south and east. Figure 11 shows the performance of the options in terms of car and non-car mode share for the southern and eastern suburbs. This demonstrates that Options 1 and 2 deliver a 42% increase in non-car mode share relative to the do minimum under the core land use scenario and Options 3 and 4 deliver a 38% increase in non-car mode share.

Analysis of the difference between the two pairs of options indicates a lower level of public transport uptake from the eastern suburbs under Options 3 and 4 (a 17% increase in public transport patronage compared to a 34% increase under Option 1 and 2). Options 1 and 2 provide faster and more reliable travel times due to the increased capacity under Mt Victoria and this encourages a greater amount of mode shift away from private cars.

More detailed analysis of the modelled public transport travel times between Miramar and the railway station indicate that the infrastructure provided in Options 1 and 2 would reduce the travel time by three minutes (or 13%) during peak periods.

The graph also shows the potential increase in non-car mode share attributable to the intensified land use scenario. As this scenario is intended to be reflective of what could be achieved under Option 1, only results for Option 1 have been presented. It is noted that in addition to the change shown to the south and east on the figure below, this scenario also reduces private vehicles travel from the north and west (due to lower levels of growth in these locations).

This analysis indicates an increase in public transport ridership of 110% compared to the do minimum. Most of the increase is attributable to the assumed growth in residential development in the CBD, Te Aro and to the south, however intensification also results in increased ridership from the east as an assumed increased concentration of employment in the CBD will encourage more people to take public transport.

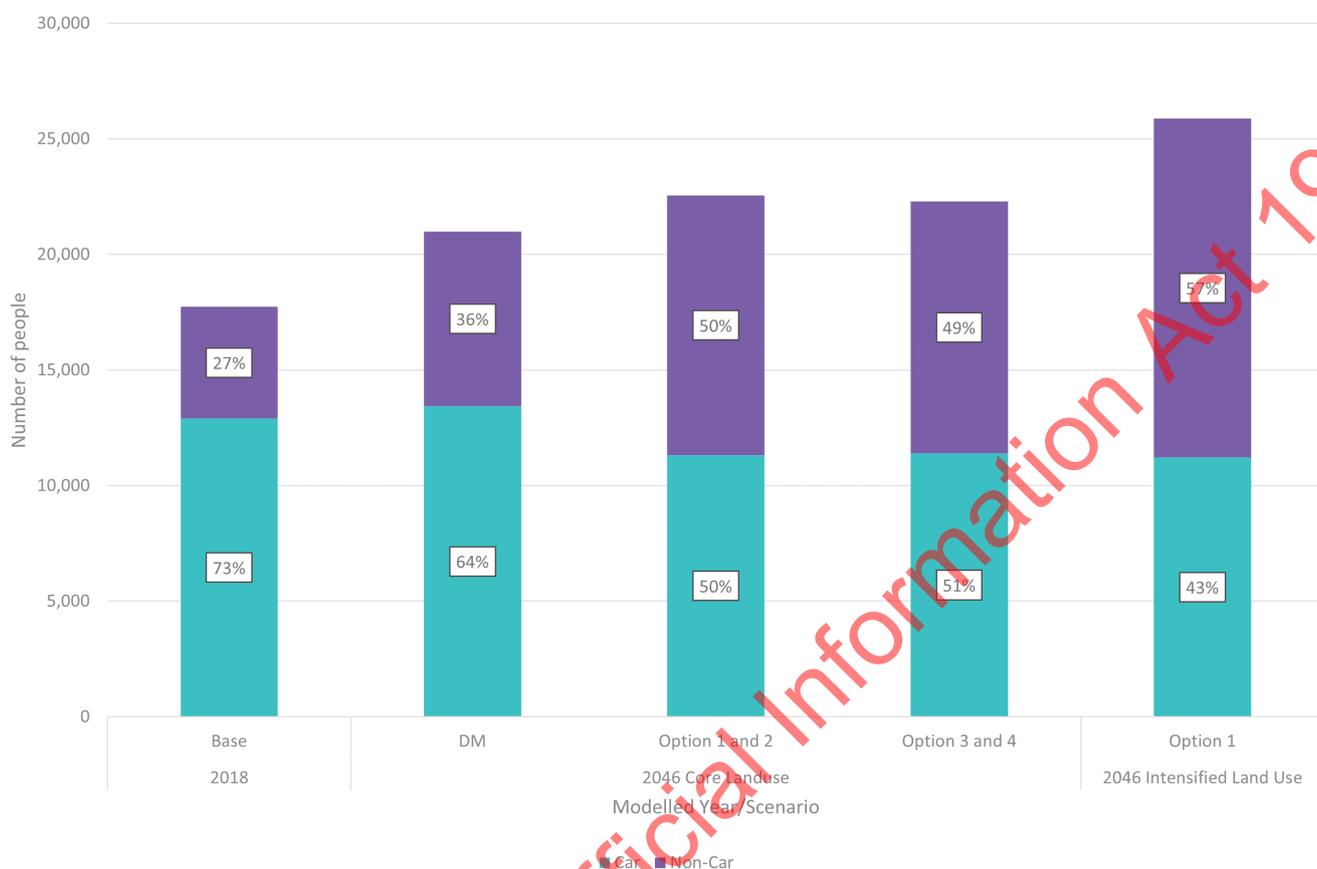


Figure 11: Car and non-car mode share, AM peak, traveling to CBD from south and east suburbs (WTSM April 2022 preferred option modelling)

7.2.2 Public Transport Demand and Capacity

Uplift in public transport demand is a key measure of the successfulness of the programme. Outputs from the Wellington public transport model have been used to understand public transport ridership on the southern (Newtown – Island Bay) and eastern (Mt Victoria – Miramar/Airport) corridors. Ridership is presented as a range (determined through running a number of model tests using different variables – levels of working from home, active travel uptake and degree of travel demand management) and covers bus and MRT services.

Figure 12 shows the projected public transport demand for the southern corridor (on the approach to the Basin Reserve) in the morning peak hour in 2046. The lighter coloured bar provides an indication of the range. This demonstrates how investment in PT infrastructure, coupled with intensification delivers a step change in use of the PT network. Ridership is forecast to increase by up to 72% following the introduction of MRT services under the core land use scenario with minimal differences in patronage between programme options. This increase rises to 200% if the MRT service is accompanied by the intensified land-use scenario

Figure 13 shows the equivalent projected public transport demand for the eastern corridor (passing under Mt Victoria, through the Hataitai bus tunnel and/or through the new Mt Victoria tunnel, depending on the option). This shows there is a stronger demand, in the order of 500 passengers, under Option 1 and 2 where there is a new Mt Victoria Tunnel compared to Options 3 and 4 where buses use the existing Hataitai bus tunnel. Under the Intensified land use scenario, public transport demand increases further with total patronage forecast to be around 35% higher than under the equivalent core land use scenario.

Although the assumed residential intensification to the east is not as significant as it is to the south, there is an increase in patronage in the intensified scenario due to the assumed increase in employment density in the CBD. This means that the CBD becomes a more attractive destination for jobs and as such stimulates an increase in PT ridership.

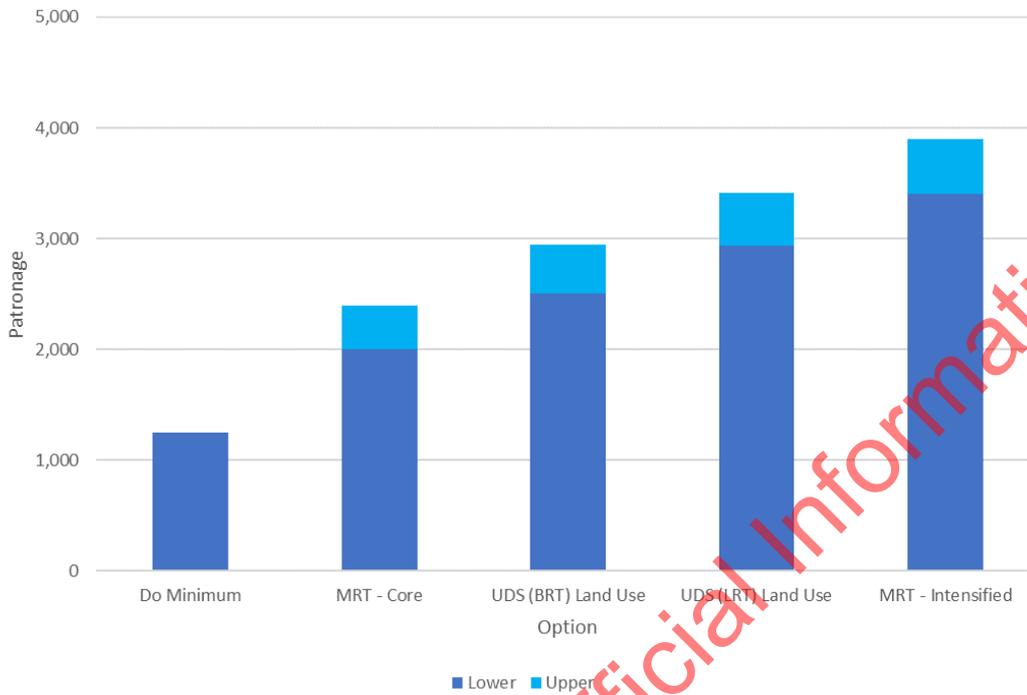


Figure 12: Southern corridor PT line loading 2046, inbound AM peak (preferred option modelling WTSM, 1-hr volumes at peak loading point – approaching BR)

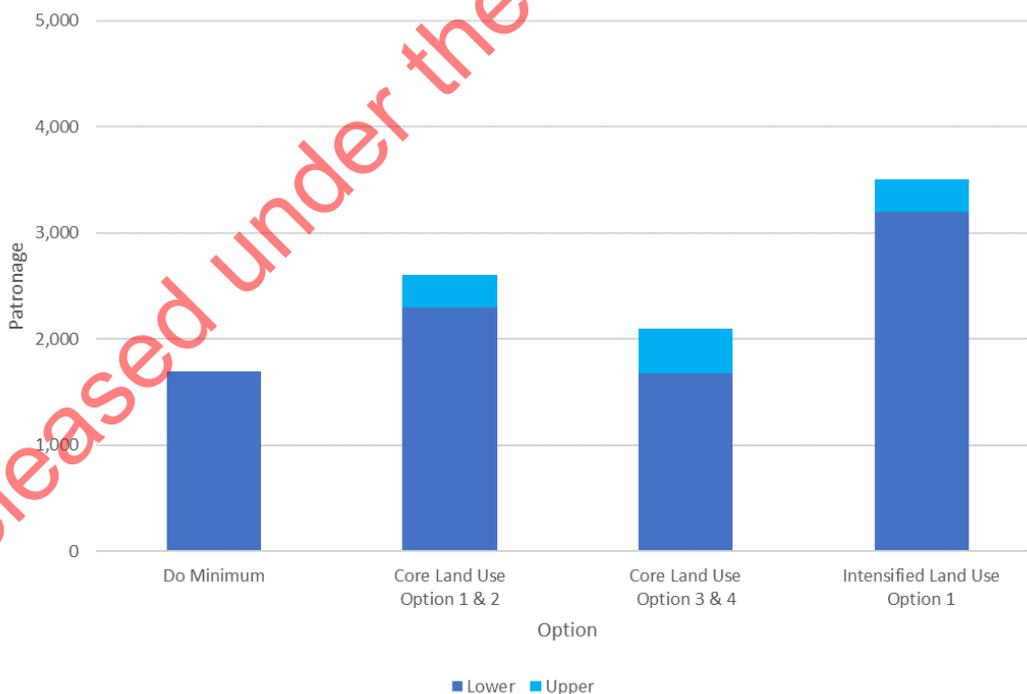


Figure 13: Eastern corridor PT line loading 2046, inbound AM peak (preferred option modelling WTSM, 1-hr volumes at peak loading point - approaching BR)

In order to cater for these demands, particularly under the Intensified land use scenario, a substantial increase in the frequency of buses is required. In total the demand forecast under the Option 1 or 2 intensified land use scenario in 2046 equates to almost 60 standard rigid buses an hour or around 40 articulated buses per hour. Compared to the southern corridor however, the demands to/ from the east are more diverse and cover a range of specific sub-geographies and markets which would be catered for by different service patterns and vehicle types. As such a mixed bus fleet is assumed to serve the eastern corridor in all programme options with higher capacity buses (either double deckers or articulated buses) used on the busier trunk routes resulting in a total of around 50 buses per hour in the highest demand 2046 scenario.

Further assessment has been undertaken to understand the degree to which additional capacity can be provided to cater for growth beyond the 2046 forecasts in a way which is reliable and attractive. Analysis into mode options undertaken for the business case suggests that up to 60 vehicles per hour is an acceptable upper limit for high quality street-based mass rapid transit corridors with exclusive lanes. This limit however is at a whole of corridor level, where multiple sub-corridors each with multiple services, converge. In order to deliver a high quality MRT product with a high level of signal pre-emption to minimise bunching of services and maximise travel time reliability, an upper target of an MRT service about every 3 minutes is considered reasonable.

- To the south, under Options 1, 3 and 4, 33m LRT vehicles could be operating up to every 3 minutes (20 vehicles per hour) or a 44m LRT up to every 4 minutes (15 vehicles per hour) to cater for 2046 modelled forecast demands under the intensified land use scenarios. Additional capacity to cater for growth post 2046 could be achieved through a combination of increased frequency or longer vehicles and still operate at good levels of reliability.
- To the south under Option 2, 18m BRT vehicles would need to be operating up to every 1.5 minutes (40 vehicles per hour) to cater for 2046 modelled forecast under the intensified land use scenario. Whilst feasible, a single MRT service operating at this high level of frequency is likely to experience some bunching and delays with reduced travel time reliability compared to Options 1,2 and 4. Capacity for growth beyond these 2046 forecasts will be limited with the need to consider larger BRT vehicles combined with different network solutions which retain a larger number of supplementary bus services on the corridor. This could result in the southern corridor rapidly approaching or exceeding 60 vehicles for hour which could result in sub-optimal network outcomes both on this corridor itself and within the two central city spines.
- To the east, a bus every 1 to 1.5 minutes (around 50 buses per hour) is required to cater for 2046 modelled forecast under the intensified land use scenario. Under Options 1 and 2, buses are able to use two parallel corridors through Mt Victoria (including a new tunnel with dedicated bus lanes) ensuring volumes on each discrete corridor are well below the desirable 60 vehicle threshold at the corridor level. This provides significant additional capacity to cater for growth in population and resulting bus volumes with good service reliability. However, under Options 3 and 4, all buses must use the Hataitai Bus Tunnel which does not enjoy exclusive lanes on its approaches as well as having significant side friction, and therefore will be less likely to be able to reliably cater for even 60 buses per hour. As such, capacity for growth on the eastern corridor beyond 2046 under Option 3 and 4 will be more constrained. Additional public transport capacity under Mount Victoria to accommodate future growth in public transport passengers in a fast, attractive and reliable manner, is therefore likely to be essential in achieving desired future mode shift targets. Without this link, the level of growth assumed for the east may not be achievable.

North of Basin Reserve where both the southern and eastern corridors converge, the mix of vehicle types (bus, BRT, LRT) and allocation to inner city corridor (Golden Mile versus Waterfront) becomes a critical consideration in overall network capacity for growth. However, there are multiple potential

network options which will need to be investigated to get the optimal mix of services across the two corridors.

7.2.3 Accessibility

The modelling indicates that the new Mt Victoria Tunnel delivers significant accessibility improvements, particularly for PT and active modes, through improving capacity and reliability for the eastern suburbs and Airport. Accessibility analysis has been undertaken using the modelling suite and this indicates that public transport accessibility is significantly improved for Option 1/2 relative to Option 3/4 to the east, driven by the Mt Victoria tunnel duplication and the Basin Reserve grade separation. The airport has been chosen as a reference point because it is a key regional destination (along with a significant attractor and generator of trips). Over 230,000 people live within one hour of the Airport by PT under Options 1 or 2 in the core scenario. This drops to around 190,000 under Options 3 or 4 and just over 160,000 in the do minimum. In the intensified scenario, over 270,000 people live within one hour of the Airport by PT under Option 1. This is shown in Figure 14 below.



Figure 14: Population catchment analysis for the Airport by PT in 2046

7.2.4 Network Assessment

More detailed analysis of the network has been undertaken to show changes in travel times and any - wider network effects caused by the changes. Table 3 below provides a summary of the key travel time changes for public transport and general traffic for key routes.

Table 3: Sample travel time routes (travel times in minutes)

Route	Do Minimum	Option 1	Option 4
PT Miramar – Station (AM)	30	21.7	25
PT Station – Newtown (PM)	23.3	15	15
Traffic Miramar – CBD (AM)	11.7	8.3	11.7
Traffic SH1 – CBD (AM)	13.3	16.7	16.7
Traffic CBD – Karori (PM)	10	10	12.5

The implications of the network changes can be seen in the modelling density maps shown in Figure 15 below – areas of red and orange indicate where congestion is predicted. For the purposes of illustration, model outputs for Option 1 (left image) and Option 4 (right image) are presented side by side. As shown in the image on the right, if MRT runs along Taranaki St, it becomes a more constrained corridor for public transport and general traffic compared to Kent / Cambridge. This is predicted to result in greater congestion at intersections along Taranaki St and in the environs in Option 4, compared to Option 1.

The modelling indicates that this will have a knock-on effect across the network and would influence wider public transport (as well as general traffic) reliability. This results in increased travel time of up to 2 minutes 30 seconds (25% increase) for trips between Karori and Te Aro. This indicates that grade separation at the Basin Reserve delivers some wider network benefits by allowing MRT to operate on the preferred Kent/Cambridge corridor, reducing multi-modal conflict on Taranaki Street and enabling the public transport benefits provided by the Mt Victoria Tunnel.

It is worth noting that the Option 1 model indicates some increased congestion for traffic leaving the Mt Victoria suburb. This reflects the amount of priority provided to public transport along Kent/Cambridge Terraces and will need to be investigated further to minimise potential delay of buses from Hataitai.

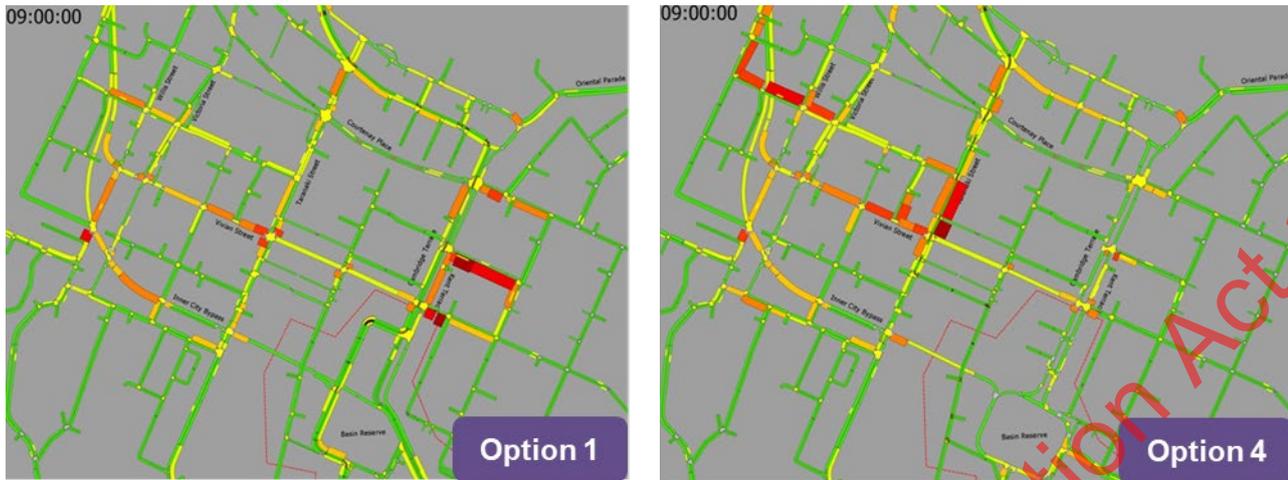


Figure 15: Aimsum models (2046) of the Kent/Cambridge area AM Peak (hotter colours are more congested)

7.3 Cost

The 95%ile cost of each option is summarised below in Table 4. The cost summary is composed of investment costs which includes all costs up to the end of construction, including inflation but excluding the impact of financing and operating costs. These are assumed to be paid as they occur and includes infrastructure operations and maintenance, costs of new MRT service net of revenue, and an estimate of the lost revenue from WCC for items such as on-street car parking revenue for Wellington City Council.

Table 4: Option cost estimates

Options	Option 1	Option 2	Option 3	Option 4
Mass Rapid Transit -South	\$2,044m	\$1,215m	\$2,057m	\$2,139m
Mass Rapid Transit / PT Improvements - East	\$388m	\$902m	\$697m	\$703m
SHI - Mt Vic Tunnel	\$1,408m	\$1,412m	\$398m	\$401m
SHI - Basin Reserve	\$774m	\$775m	\$779m	\$27m
TDM - Travel Behaviour	\$66m	\$66m	\$66m	\$66m
TDM - Parking Levy	\$10m	\$10m	\$10m	\$10m
City Streets	\$531m	\$532m	\$534m	\$539m
3-year prog - Golden Mile	\$93m	\$93m	\$93m	\$94m
3-year prog - Thorndon Quay & Hutt Road	\$55m	\$55m	\$55m	\$56m
3-year prog - Central City Walking Imp.	\$6m	\$6m	\$6m	\$6m
3-year prog - Cobham Crossing	\$5m	\$5m	\$5m	\$5m
Total Capital Cost	\$5,379m	\$5,072m	\$4,700m	\$4,047m

Options	Option 1	Option 2	Option 3	Option 4
Whole of Life Costs	\$7,370m	\$6,984m	\$6,603m	\$5,815m

It is noted that there is still uncertainty of costs due to a range of factors, including, but not limited to:

1. Costs are based on IBC/SSBC level designs
2. Cost escalation and inflation, in general, has recently increased materially
3. Increased scope (as further design work is completed) would increase build requirements and overall costs
4. On-going costs (O&M and renewals) were based on capex spend and do not have as well-developed benchmarks
5. The estimated property costs are a material element (16-19% of capital costs). Land values can be volatile and transaction costs will differ based on the purchase approach (for example market sale vs compulsory acquisition).

The following mitigations have therefore been used in the above estimates:

1. The higher cost estimates (P95) were used for funding requirements (Economic analysis uses expected (P50) estimates)
2. Cost estimates followed Waka Kotahi cost estimate processes (SMO 14) and were priced by quantity surveyors using available design detail
3. Parallel cost estimates were sought for most project capital cost estimates
4. On-going costs were benchmarked to available information from council asset management registers
5. Interest costs were agreed, and are different, for each funding partner to align with their LTPs for councils for the first 10 years and using Waka Kotahi provided information
6. Property cost estimates at the P95 level were used and provided by 3rd party experts.

There is different affordability threshold "headroom" between programme options. That is the difference between programme cost and the affordability threshold (\$7.4b). No decision has been made if this affordability threshold (\$7.4b) could be increased.

If this threshold represents a cap for funders, then the lower cost programmes will have an additional buffer. Funders have a range of choices to address breaching the affordability threshold, including providing more funding or reducing the scope of delivery.

7.4 Economics

Updated economic analysis has been undertaken and this is reported in the economics technical report (Appendix B).

Figure 16 shows the monetised benefits for the options. The first four columns show the results for Options 1 to 4 using the core land use scenario. This is also summarised for Options 1 and 4 in tabular form in Table 5. The analysis shows that Option 2 delivers similar benefits to Option 1 under the core land use scenario, and Option 3 delivers similar benefits to Option 4. The cost benefit analysis for the core scenarios indicates that all options deliver very similar BCRs in the range of 0.5 to 0.7. In other words, costs outweigh the benefits. As all BCRs are very similar, this indicates that increased levels of investment will result in proportional increases in benefits.

The economic analysis has been re-run for an alternative growth scenario using the output from the modelling of the intensified land use scenario. This shows that the intensified land-use scenario has a significantly positive effect on the benefits for all options. The benefits for Option 1 increase by 80% under the intensified scenario and this will increase the BCR range to 0.9-1.2.

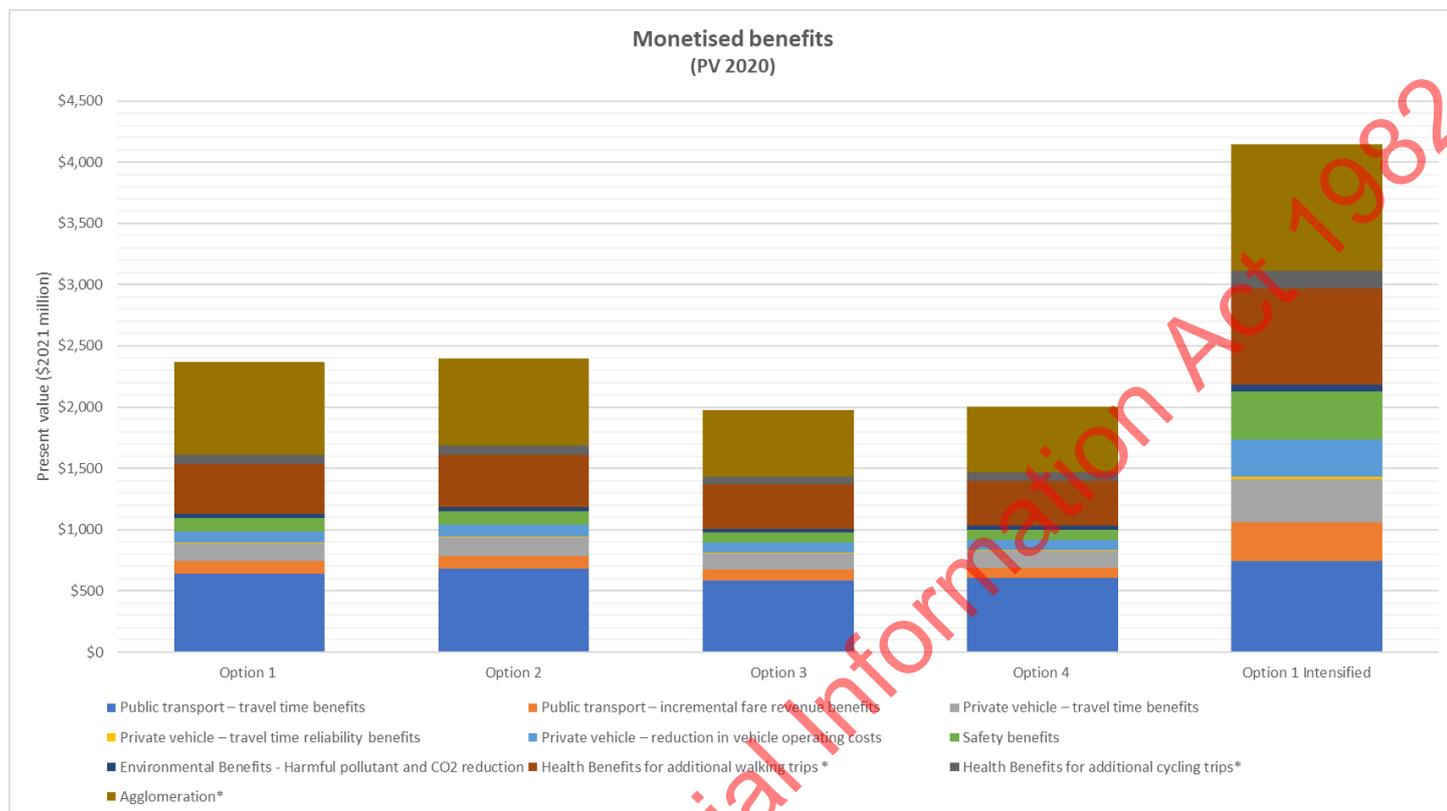


Figure 16: Monetised benefits

Table 5: Summary breakdown of economic benefits (present values, 2021)

	Option 1 Core	Option 4 Core	Option 1 Intensified
Public transport	\$741m	\$690m	\$1059m
Private Vehicles	\$245m	\$225m	\$676m
Active Travel	\$478m	\$435m	\$943m
Safety	\$109m	\$85m	\$391m
Environmental	\$31m	\$27m	\$97m
Agglomeration	\$759m	\$537m	\$1,031m
Total	\$2,363m	\$2,001m	\$4,197m

Sensitivity tests have also been run for intensified versions of Options 2 and 4. These show that Option 1 delivers significantly more benefits than Options 2 and 4 under the intensified land use scenario. In the case of Option 4 this is due to increased PT travel time benefits resulting from the diagonal tunnel and grade separated Basin Reserve. In the case of Option 2, it is due to assumed reductions in development capacity attributable to the version of BRT assumed under Option 2.

In summary, the BCR ranges for the intensified options are as follows:

- Option 1 intensified land use – 0.9 to 1.2
- Option 2 intensified land use – 0.8 to 1.0
- Option 4 intensified land use – 0.9 to 1.1.

It should be noted, however, that the Options 2 and 4 assessments are not directly comparable to the Option 1 assessment. The Option 2 analysis reported here has been developed based on an assumption that the assumed BRT option has less capacity to stimulate growth than the LRT based options – 20% less intensification has been assumed (this assumption has been developed based on a study of comparable cities globally that have implemented MRT). Although international literature supports the assumption that on average, BRT stimulates lower levels of growth, further analysis will be required at the DBC to quantify this in the Wellington context. Nevertheless, it does highlight the importance of the intensified land-use scenario to achieve a BCR above one.

The assessment undertaken for Option 4 has assumed that the level of intensification assumed for Option 1 to the south is achievable in this option. As outlined above, capacity constraints on the network mean that the level of intensification assumed for the east will not be achievable under Option 4 and therefore the BCR range has reflected this through reduced benefits to the east. Further work is required to determine the realistic total quantum and location of intensification along the corridor, however this analysis provides an indication as to the level of development required to achieve a BCR above 1. Should lower levels of intensification be delivered, the economic performance of the programme will be more muted.

A high-level incremental analysis of the difference between Option 1 and Option 4 has been undertaken. Depending on the level of intensification achievable to the east, the incremental BCR is in the range of 1.1 to 1.4 (under the intensified land use scenario). Under the core land use scenario, the incremental BCR reduces to 0.5 further emphasising that intensification is required to maximise the benefits of the transformational programme.

A preliminary analysis of wider economic benefits has indicated that it may be possible to claim additional benefits under the intensified land use scenario as the project develops. These have not been quantified and will be considered further at the DBC stage.

7.5 Carbon

The carbon analysis was undertaken to understand the potential impact of investment on emissions at both a programme level and comparatively across the four options compared to the do minimum (as reported in the Carbon technical report, Appendix C). Transport modelling was central in the estimation of carbon emissions.

There is comparatively little difference between the programme options when considering levels of enabled carbon emissions reduced under the core land use scenario. Detailed examination of the transport modelling illustrates the following key points:

- All options have a positive impact in terms of reducing daily vehicle emissions within Wellington City and across the Region relative to the Do Minimum
- Option 1 results in a marginally greater reduction in daily emissions compared to Option 4, primarily due to higher modal shift from the east.
- All options reduce daily traffic volumes (expressed as vehicle kilometres travelled, VKT) across the Region (2%) and Wellington City (up to 5%) in the core scenario. Option 1 will result in a slightly greater reduction in VKT, compared to the other options, due to the greater level of PT improvements to the east delivering mode shift.

- In the intensified scenario, the region as a whole would see a reduction in VKT of 7% as a result of shifting growth from outside of Wellington City to the CBD, Te Aro and Newtown with relatively low levels of car dependency and high PT / active mode trip rates. If the intensified scenario is achieved, there is a greater amount of development in Wellington city. Although this results in greater uptake of sustainable modes on a per capita basis, additional development will result in more car travel (albeit at a lower rate). Therefore the VKT change for Wellington city changes to a 1.5% reduction in the intensified scenario.

The options with larger amounts of infrastructure will have higher levels of embodied carbon, although in all cases enabled carbon savings exceed embodied emissions over the analysis period. This is shown in Figure 17 below for Options 1 and 4. This diagram also shows the potential range of enabled carbon savings under the intensified scenario.

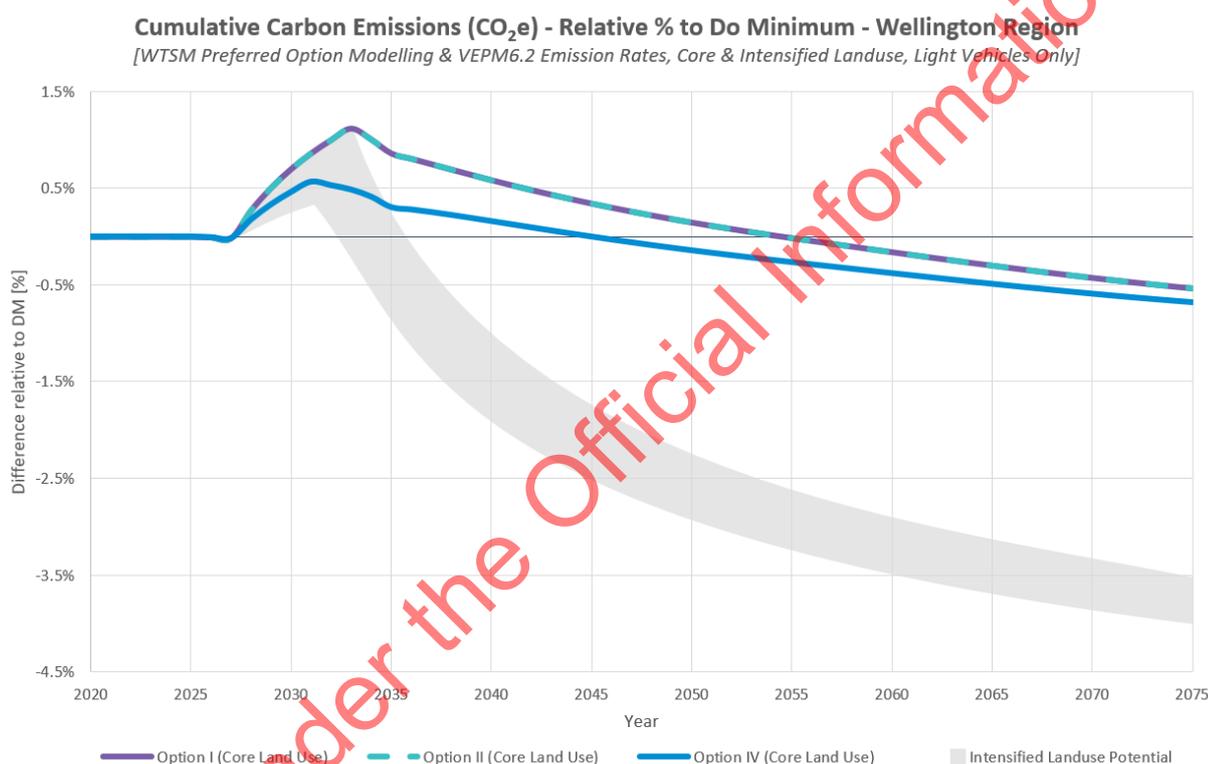


Figure 17: Construction and vehicle emissions

The LGWM 3-year programme will make travel by public transport and active modes much more attractive, supporting mode shift to low or no-carbon modes. The LGWM investment in MRT, however, will provide the foundations for a fundamental change to the way urban form develops in Wellington City, with associated significant and sustained reduction in carbon emissions. The level of carbon reduction and mode shift enabled is, however, not sufficient to meet the City’s and the Region’s immediate carbon reduction goals: other investments and initiatives to reduce travel by private vehicles and facilitate mode shift to zero-carbon options will still be required.

In the long run, embodied carbon emissions are less important than enabled emissions. Furthermore the level of land use intensification each option enables is likely to have a greater effect on carbon savings than the option itself - greater urban density produces significantly greater carbon emissions savings than the carbon produced in construction. This aligns with the LGWM objectives, which seek both carbon reductions and mode shift away from private vehicles. Mode shift to public transport and active modes also has wider benefits, such as liveability enhancement, journey time reliability, travel choice, etc.

Option 1 is likely to enable the highest levels of urban intensification. The high quality MRT corridor to the south will support very high levels of intensification, especially in the sections with dedicated running. Furthermore, improved public transport journeys and increased capacity to the east will support mode shift, growth and intensification, and this isn't available in Options 3 and 4.

The capacity and vehicle type assumptions for the bus-based form of MRT currently included in Option 2 will be able to accommodate less growth and enable less urban development than the assumed light rail-based MRT assumed in Options 1, 3 and 4¹³. It is important to note that Option 2 includes bus-based MRT both south and east and is likely to support intensification across both these areas, however not to the level forecast for Option 1. The lower public transport level of service and capacity limits to the east under Options 3 and 4 are likely to constrain the degree of mode shift and intensification in the east. These 'secondary' benefits are an important component of the analysis – as can be seen from the substantially better performance of the intensified land use scenario. The DBC will need to explore what actions will be required to deliver these potential benefits.

Intensification is the most important contributor to carbon emissions savings compared to the do minimum. More growth occurring along the MRT route concentrates people and trips around infrastructure supporting non-car modes, and consequently makes car-based transport less attractive. This is seen from the significant drop in VKT in the region compared to the VKT drop in Wellington City: More people living in Wellington City compared to the Do Minimum concentrates trips in Wellington City; the corollary is that there will be less people living further out of Wellington city compared to the Do Minimum¹⁴.

Further analysis has indicated that timing of construction is important – reductions in carbon can be realised more quickly (and to a greater extent overall) if the infrastructure is constructed more quickly. Delivering an option earlier or later can be more significant than the difference between Option 1 and Option 4, therefore the DBC needs to focus on opportunities for faster delivery

It is noted that even under the Intensified Land Use scenario assessment, the total carbon payback date is not expected until around 2035, and so other investment and initiatives (for example, travel demand management, pricing, bike network improvements) will also be needed to address the more immediate climate targets.

¹³ It is important to draw a distinction between Option 2 and BRT. A higher capacity form of BRT could be delivered using larger vehicles, however this is not part of Option 2.

¹⁴ the total population is the same under the do minimum, core and intensified land use scenarios – the difference comes from where we assume those people live

8 Programme Options Analysis

MCA has been used to inform the option comparison throughout the programme development process as it provides a legible summary of performance against the objectives as well as identified effects. The criteria used in the MCA were agreed during the PBC stage by LGWM and have been kept as consistent as possible whilst incorporating changes in objectives and items of importance.

The PASLO MCA assessment was undertaken towards the end of 2021 assessed all four programme options against the core land use scenario. As further work has progressed on potential urban development outcomes, an additional assessment was undertaken to determine if these scores would change with an intensified land use scenario. Both of these scenarios are reported in this section.

The programme options were assessed against the full set of criteria including the revised programme objectives, environmental and social impacts, mana whenua values, and design, delivery, and operations. This is documented in The LGWM Programme Affordable Short List Options Report¹⁵. The results for the programme objectives are shown in Table 5 below. The programme objective scores have been produced based on technical analysis that has informed a series of sub-criteria and key performance indicators. Further detail on these is provided in the Programme Affordable Short List Options Report.

In addition to the four programme options, a “do minimum” option has been assessed. In this case, the “do minimum” assumes no network changes in Wellington, other than those committed and funded through other projects. It assumes growth in line with the “core” land use scenario described above. The results for the do minimum therefore provide an indication as to the outcomes if LGWM is not implemented.

The key points of differentiation for the programme objectives analysis can be summarised as follows:

PO1: Liveability

- All programme options perform well against the investment objectives and significantly better than the do minimum (which received neutral or negative scores against all investment objectives).
- Option 3 was awarded a slightly higher score for liveability on the basis that it doesn't feature the road/PT tunnels under Mt Victoria. The additional portals were considered to have an impact on urban amenity in a relatively sensitive area close to the town belt. Although Option 4 also has this characteristic, it wasn't awarded the same score as Option 3 as it doesn't include the same degree of urban amenity improvements at the Basin Reserve.
- The intensified land use scenario results in improved development potential, particularly along the southern corridor. Therefore, the urban development component of the liveability score has been increased to reflect this.

- There is also an opportunity to enhance urban amenity through urban change in the public realm. Where urban development is being enabled by MRT it too can result in enhanced urban amenity where its enablement comes with a process that requires buildings, open space, heritage and street space allocation to work together to make the city more liveable. At this time, and with the level of planning for this phase of programme development, the ability to deliver greater urban development GFA potential is the primary motivator of the increase in scores for the intensified land use scenario. There remains a need for urban amenity outcomes to be amplified and provided for in the Detailed Business Case when more concepts can be

¹⁵ [2021-10-22-LGWM-PASLO-Report.-Final_Redacted.pdf \(amazonaws.com\)](#)

developed for how preferred options will provide the desired enhancement.

- The opportunity remains throughout the affected corridors and at key points such as the Basin Reserve for urban amenity enhancements too, but the detail needed to confirm the quality of outcomes for urban amenity will be generated in subsequent phases of the design/Business Case process. The urban amenity scores remain relatively modest to reflect the stage of design the project is at.
- The Liveability MCA score is the combination of urban development and urban amenity factors (as per the Investment Objective). In the intensified scenario, the overall Liveability score increased two points for Options 1 and 4 and 1 point each for Options 2 and 3. The reasons for the change are that all options will contribute to greater urban development in the central to southern corridor. The score reflects that MRT together with the other tools needed to enable intensified development will result in much more intensification than either one alone¹⁶.
- No urban amenity score changed as no new information was to hand, so they remained conservatively low. Option 2 remained relatively lower due to less urban development enablement of BRT.

PO2: Access

- Options 1 and 2 scored better than Options 3 and 4 for the access investment objective due to the multi modal improvements to the east. As indicated above, modelling indicates sizeable improvements in accessibility attributable to the Mt Victoria Tunnel and Basin Reserve improvements.
- Overall, the access investment objective scores didn't change under the intensified land use scenario, although there were some changes to the sub criteria. The scores for all options improved for the "access to key destinations" and "journey time variability" sub criteria, however the difference wasn't sufficient to change the overall scores.

PO3: Carbon and Mode Shift

- This objective considered mode share to central city, regional mode share, carbon emissions and embodied carbon. For the core land use scenario, Options 1, 2 and 4 received the highest scores, albeit for slightly different reasons. Options 1 and 2 achieve the highest levels of mode shift due to the combined improvements to the south and the east. Option 4 has the lowest level of embodied carbon (a direct reflection of the level of investment in physical infrastructure). Option 3 does not achieve the same mode shift and has increased embodied carbon compared to Option 4.
- The intensified land-use scenario results in improvements to the scores for three of the four sub criteria for the carbon emissions and mode shift investment objective (mode share to the central city, regional mode share, and carbon emissions). This has resulted in the score for this investment objective for Option 1 increasing from 3 to 4 as this is the only option that is the best for both mode shift and enabled carbon emissions. All other options achieve a score of 3 overall.

¹⁶ Whilst this score may reflect more than just enablement, it was considered vital to reflect the significant impact of MRT in contributing to high levels of intensification, and that these could only be realised in the high intensity land use scenario.

PO4: Safety

- All options score the same for safety as there are no differentiators between options that were sufficient enough to change scoring. All project elements have good safety outcomes.

PO5: Resilience

- Option 2 received the highest score for resilience as it is more flexible to respond to day-to-day disruption on the network. Furthermore, it is also more resilient to higher impact lower probability events. Although LRT track can be engineered to respond well in seismic events, it will be more influenced by falling masonry and ground movement, or day to day network disruption than a rubber tyred mode (which can take an alternative route to bypass obstacles).
- The scores for the resilience investment objective do not change.

Table 6: Programme objective MCA scores (+5 = good performance, -5 = poor performance)

	Core Land Use					Intensified Land Use				
	Liveability	Access	Carbon emissions and mode shift	Safety	Resilience	Liveability	Access	Carbon emissions and mode shift	Safety	Resilience
Do Min	0	-1	-1	-1	-2	0	-1	-1	-1	-2
1	2	3	3	2	1	4	3	4	2	1
2	2	3	3	2	2	3	3	3	2	2
3	3	2	2	2	0	4	2	3	2	0
4	2	2	3	2	-1	4	2	3	2	-1

As shown in section 2.4, the programme objectives have been weighted using the criteria weightings agreed by Waka Kotahi and WCC and GWRC elected members. A summary of the weighted scores is provided in Table 8.

Table 7: Programme objective MCA summary

	Core Land Use	Intensified Land Use
DoMin	-0.90	-0.90
1	2.45	3.25
2	2.55	2.75
3	2.00	2.60
4	2.10	2.50

The key change in this MCA summary between the two land use scenarios is for Option 1 which sees a significant increase in score for the intensified scenario compared to the core scenario. This is a reflection of the assumed characteristics of the MRT mode in Option 1 which has the highest level of capacity and quality (LRT) to the south and a significant public transport improvement to the east.

The results of the effects assessment are shown in Table 8. Overall, although all options have some significant impacts reflecting the scale of the transformational programme, none were deemed to be fatally flawed by the specialists and mitigation measures for the selected option will be considered as part of the DBC. High levels of effects should be expected given the transformational nature of the programme. The key points of differentiation from the effects assessment are:

- mana whenua gave Option 2 the highest score on the basis that scores well in respect of Whakapapa (place), Hau-ora (wellbeing) and Manaakitanga (just society). It was considered beneficial to provide a broader spread of urban uplift benefits and the prospect of expansion of BRT to the north and west was considered advantageous. There were significant positives associated with Options 1, 2 and 3 in relation to keeping MRT away from the Te Aro Pā site at the northern end of Taranaki Street. mana whenua awarded Option 1 an additional point under the intensified scenario as it was deemed to be the option likely to catalyse the most development.
- Option 4 has a slightly less negative score for heritage and archaeology on the basis that it has reduced impacts at the Basin Reserve.
- Options 3 and 4 have the least social impact as they have reduced Town Belt and property acquisition requirements, but Option 3 has benefits associated with the Basin Reserve upgrade.
- Options 1 and 2 received a positive score for business disruption and outcomes on the basis that they deliver the highest levels of accessibility improvement, offsetting the construction effects. Options 3 and 4 received a neutral score.
- The intensified land-use scenario results in a change to the “Business Disruption and Outcomes” score. Options 2, 3 and 4 were all awarded an extra point reflecting the benefits of intensification on businesses (increased demand for services, better access for employees, increased footfall etc). Option 1 was awarded two extra points as it is the option that facilitates the most development across the network.
- Options 1 and 2 were awarded a more negative score for landscape and visual on the basis of the impacts at the Mt Victoria tunnel portals.
- Option 2 received the highest noise and vibration score as it features BRT – the specialist assessment noted that LRT can experience “wheel squeal”, which can be avoided with a rubber tyred based option.
- Option 4 was given slightly less negative scores for engineering difficulty and property difficulty, mainly due to the lower impact at the Basin Reserve and Mt Victoria Tunnel.
- Option 2 was awarded the highest positive score for scalability of network and services reflecting the flexibility of a rubber tyred mode. BRT services could be extended to the north and west at a later date without forcing a change of mode.

Table 8: Effects Assessment MCA scores

	Mana whenua	Heritage and archaeology	Social ¹⁷	Business Disruption and Outcomes	Landscape and visual	Noise and Vibration	Contaminated Land	Engineering Difficulty	Property Difficulty	Scalability of network and services
Core Scenario										
DoMin	-2	0	1	-1	0	0	0	0	0	0
1	2	-5	-3	1	-3	2	-3	-4	-5	3
2	3	-5	-3	1	-3	3	-2	-4	-5	5
3	2	-5	-2	0	-2	1	-3	-4	-5	3
4	1	-5	-3	0	-1	0	-2	-3	-4	3
Intensified Scenario										
1	3	-5	-3	3	-3	2	-3	-4	-5	3
2	3	-5	-3	2	-3	3	-2	-4	-5	5
3	2	-5	-2	1	-2	1	-3	-4	-5	3
4	1	-5	-3	1	-1	0	-2	-3	-4	3

Overall, Options 1 and 2 scored similarly to each other and better than Options 3 and 4. In terms of the differences, Option 2 provides slightly greater flexibility and scalability compared to Option 1. This is an important consideration as it provides opportunities to extend MRT services to the north and west at a later date. Furthermore, because the BRT is assumed to be able to divert around or along a different route in operational and Low Impact High Probable (LIHP) events, it is deemed to be a more resilient mode. Option 1, however provides greater capacity than Option 2 (noting that an alternative version of BRT could deliver higher capacities) – it is therefore better able to respond to growth under the high land use scenario, maximising mode shift and decarbonisation benefits. Although Options 3 and 4 generally received lower negative scores against some of the effects criteria, they also received lower positive scores against the investment objectives. On balance, therefore, Option 2 was identified as the technically preferred option through this assessment.

As outlined in the PASLO report, a number of sensitivity tests were undertaken with a key focus on the impact of congestion charging/forms of travel demand management. These sensitivity tests show that interventions that serve to reduce the traffic demand entering the central city have a positive impact on the performance of the options against the investment objectives. The conclusion in the previous PBC report was that a combination of infrastructure investment, service improvement and travel demand management was required to deliver on the overall investment objectives. That conclusion remains the same.

¹⁷ Primarily considered negative impacts such as noise, dust, community amenity effects and property acquisition during construction.

8.1 Updated Analysis - Summary

Whilst MCA analysis is a very helpful tool, should not be used alone to decide a preferred option. In this case it has been used to identify areas of differentiation and help decision makers weight these against the objective weightings. Consideration needs to be given to all of the analysis undertaken to understand the relative performance of the options. These include transport modelling, economic analysis, an assessment of emissions and a MCA. Overall, the analysis indicates that Options 1 and 2 outperform Options 3 and 4 reflecting the benefits of improving the transport network to the east. The most significant finding, however, is that the intensified land-use scenario is a key part of the investment story:

- Intensification along the MRT corridor better delivers on the carbon and mode share objectives
- Intensification along the MRT corridor is required to maximise BCR (and achieve a BCR above 1)
- The degree of intensification along the corridor influences specifications/characteristics of MRT mode
- Based on the limited information provided in the consultation documentation, the public have responded positively to the concept of intensification.

Without a high degree of intensification, none of the transformational programme options have a BCR above 1. While achieving a BCR above 1 isn't the only element in decision making, it does indicate that a transformational programme will need more than the infrastructure investment outlined in this document to deliver value for money. If a high degree of intensification is not palatable, there may be better ways to invest in the transport network.

However, high levels of intensification maximise the ability of the programme to deliver on the programme objectives. On the assumption that development intensification is desirable, and based on modelling results that show that increasing levels of intensification result in increasing levels of performance against the investment objectives, the MRT service with the highest capacity and quality will both support and cater for this. Of the four options, Option 1 delivers on this best. The analysis indicates that, once intensification is taken into account, a higher capacity service is required for the southern corridor in the long term than has been assumed for Option 2.

LRT, if planned appropriately, can serve much higher patronage growth in the long-term as it is easier to add services and carriages to LRT¹⁸, whereas BRT is unlikely to support the same level of intensification. A specialist literature review of comparable land value uplift from MRT systems globally indicated that a general land value uplift of 11.5% could be achieved for LRT, and 4.9% for BRT. This is relevant to the key strategic question of whether a more intensive urban development scenario is pursued around MRT stations (building on requirements under the National Policy Statement on Urban Development).

¹⁸ As long as there is planned capacity at the depot, terminals and stops

9 Key Questions

To help inform a decision on the preferred programme, there are a number of key questions that need to be answered. These questions have come from within the LGWM team, project partners, stakeholders and the public and have been the focus of the most recent investigations. These questions are outlined below.

- What form of MRT is preferred?
 - a. Why does MRT not go to the Airport?
- Are large-scale or minor improvements preferred at the Basin Reserve?
 - a. If large-scale, why does it have such a large footprint?
- Is a new Mt Victoria tunnel needed?
- How will the options integrate with the wider transport system?
- How can urban intensification be achieved?
- Are parking levies or congestion charging proposed?

9.1 What form of MRT is preferred?

The two forms of MRT being considered are LRT and BRT. The Mode Report¹⁹ contains details on the specifications and assumptions of these modes and the process used to get to this short list. BRT could be provided to both the south and east, but due to the affordability threshold, the higher cost of LRT means that it would only be able to be provided on the southern corridor, where urban intensification has the potential to be greater, and so a high level of bus priority (Continuous Bus Priority) would be provided to the east.

LRT is provided in Options 1, 3 and 4. BRT is provided in Option 2.

The key differences between outcomes for each of the two options are summarised in the table below assuming that the intensified land use scenario is adopted.

Table 9: MRT Mode Summary Assessment

	Option 1: LRT to the south with bus priority to the east	Option 2: BRT to the south and east
IO1: Liveability: Urban Development	Catalyses an 8,500 increase in households on the southern corridor to 2046 Potential 11.5% increase in value uplift Further capacity available to support additional long term growth	Catalyses a 6,500 increase in households on the southern corridor to 2046 Potential 5% increase in value uplift
IO2: Access	Available capacity in 2046 with vehicles at 5 minute frequencies	Limited ability to increase the frequency to account for growth beyond 2046 compared to LRT.
IO3: Mode Shift and Carbon	Best mode shift due to highest intensification Best enabled carbon outcome	Slightly reduced patronage compared to LRT due to less development enabled to the south
IO4: Safety	Good safety benefits, however presence of tracks is a safety risk for cyclists.	Good safety benefits
IO5: Resilience	Slight improved resilience as additional transport mode	Significantly improved resilience as BRT can divert around issues or along a different route if needed

¹⁹ Report yet to be published

Other differentiators		Slight noise benefit compared to LRT as no rails Significant network benefits as BRT is flexible Ability for staged implementation.
Stakeholder and Public Engagement	53% support LRT (public) 59% support LRT (online panel)	23% support BRT (public) 41% support BRT (online panel)

The key differentiators and other items for discussion are outlined below.

9.1.1 Urban Development and Urban Amenity (Liveability)

MRT has a significant effect on development feasibility by increasing land values and demand for housing and commercial space near MRT stations. But within this, LRT and BRT deliver different levels of benefits.

The comparative cities work (presented in the Mode Report) determined that 'rails on the ground' presents a permanence the development market responds more positively to than BRT. However, the ongoing enhancements in BRT technologies and the multiple city contextual variations these modes have been retrofitted into makes this difficult to quantify. The flexibility of BRT offers some network resilience and is operationally quieter than LRT, which may have a positive impact on the noise environment and thus amenity.

The need with either BRT or LRT to rebuild complete streets with redeveloped sites along them and within walkable catchments generates a significant opportunity for public space amenity improvements. Within the street itself reconstruction will be required and would enable new stops and street crossings (which assist connectedness), additional street edge building redevelopment around stops which would assist with activation, connectedness to anchors spaces along the routes like open spaces/parks, and increased comfort from customer experience infrastructure at stops, street trees and new footpaths and active mode infrastructure. The opportunity to generate redeveloped sites that are designed for good quality urban living has the potential to make a city with enhanced amenity along with the diversification of living options and affordability. It is very important for urban amenity that there is provision made to both enable positive outcomes by (a) aligning infrastructure to leave viably shaped and fronted streets (i.e. not 'left over bits'); (b) to require comprehensive development 'master plans' or the like so the areas are designed to reveal positive outcomes (from integrated design for open space, connections through blocks, street edge relationships, energy efficient built form etc); (c) that the market is incentivised to deliver the redevelopment expediently so there are not potentially large areas of dormant vacant land in the city.

There are contemporary studies and reports that present a forward-facing future city form which includes street space and the way in which these can be reconfigured to both enable specific modes (including MRT) but also to link with city-making opportunities. These opportunities, such as Te Ngākau Civic Square for example, are not expected to be delivered by LGWM, but the integration in design processes with next stages of the Business Case process enables mutual benefits for urban amenity and development to be optimised. To this end, LGWM's Spatial Integration Study (2022) prepared with LGWM stakeholders consolidates a range of the contemporary studies and reports by Council and others (such as GEHL Architects) as they apply to the central city and identifies a range of city making opportunities area by area. This Spatial Integration Study will assist direction to the DBC as a 'brief' of key urban amenity and development considerations to be worked through.

Ensuring the opportunity for good urban development enablement and 'density done well' will require an investment in planning, design and implementation – the models for delivering on these different needs

(planning may be different than implementation) should have the objective see to integrate the multiple influences on amenity where multiple buildings, streets and open spaces and existing values such as heritage are being designed and delivered comprehensively across a wide area.

9.1.2 Capacity

The line loading analysis undertaken as part of the modelling indicates that both modes have capacity to accommodate forecast demand up to 2046 in the core land use scenario. However, under the intensified land use scenario, BRT on the southern route exceed the current modelled capacity by 2046 (based on the assumed frequencies and vehicle capacities) – see Figure 12 and Figure 13.

The model inputs have assumed five-minute service frequencies for LRT (220 capacity vehicle per service) and three minute frequencies for BRT (110 capacity vehicle per service). For both modes, vehicle size and frequency could be increased, however there is less ability to do so for BRT in the longer term and Levels of Service will deteriorate more quickly in the future.

Also, any additional services on the southern route then need to merge with services from the east to go through the CBD with an appropriate Level of Service. Overall, this means that BRT, with the already higher service frequency, has less ability to cater for increased demand in the longer term, without compromising network performance.

9.1.3 Cost and Economics

The estimated 95%ile cost of the two MRT options, as described in Option 1 and Option 2 are as follows:

- Option 1 LRT – \$2.43B
- Option 2 MRT - \$2.12B

As presented earlier, the more intensive land use scenarios have better economic outcomes, therefore, with all other elements being the same (e.g. Basin Reserve, Mt Victoria Tunnel, other pricing), LRT can deliver more intensification and therefore a higher BCR.

- Option 1 (High Land Use) – 0.9 to 1.2
- Option 2 (High Land Use) – 0.8 to 1.0

As noted above, higher capacity BRT could be provided to increase the carrying capacity and benefit streams for Option 2. This would, however, increase the cost of the option and would therefore require reassessment.

An incremental BCR has been calculated to determine whether the additional benefits gained outweigh the additional costs. This calculation has shown that the incremental BCR of Option 1 over Option 2 is greater than 3, meaning that the additional infrastructure in Option 1 is a good investment.

9.1.4 Carbon

In a similar manner to economics, the more intensification that can be enabled, the better the outcome for carbon. This is due to both shorter trips being required and a greater proportion of those trips using active or public transport modes.

Whilst these changes haven't been modelled, enabling land use intensification significantly outweighs any small embodied carbon benefit of BRT over LRT, which would be present due to reduced pavement construction requirements.

9.1.5 Engagement

A total of 53% of respondents support LRT, with the primary reasons being:

- High capacity (over 300 people per trip²⁰)
- Reliability and frequency
- Improved carbon performance.

However, most people have the impression that LRT will provide a quiet solution despite information supplied. When asked about BRT, 23% were in support for the following reasons:

- Flexibility and ability to be extended to more suburbs in the future
- Less investment and is faster to implement
- Quicker recovery time from a natural disaster.

The online panel research gave a slightly different result to the public engagement in relation to the form of MRT. LRT was preferred by 59% of respondents, compared to 41% for BRT, which is closer than that identified through the public engagement. When considering the responses from only Wellington City residents, the preferences are even closer with 52% preferring LRT and 48% preferring BRT.

The LRT preference was noted as being due to it feeling more novel, reliable and greener. There were, however, concerns with what a light rail system could mean for the city including the expense and low expectations around resilience, which made some participants feel it is not worth the investment. It's inflexibility in relation to extendability and the time it would take to implement was also concerning. The impact earthquakes may have on the rail system also a raised concern to its practicality within the region.

9.1.6 Resilience and Scalability of Network and Services

A major benefit BRT has over LRT is its flexibility in terms of routes and the extent of services. For the LGWM project, this presents itself in a number of ways:

- Potential for extending MRT services to the north (e.g. Churton Park, Johnsonville) to connect northern growth areas, while likely reducing the need to transfer
- Potential to improve network resilience – particularly for high probability/low impact events and network disruptions such as breakdowns, crashes, utilities maintenance
- Potential to stage delivery so benefits can be realised sooner, with the least amount of disruption
- Ability for stabling to be located away from the routes gives more flexibility in terms of available land and cost.

The resilience score for Option 2 did not change under the intensified land use scenario.

9.1.7 Why does MRT not go to the Airport?

The Programme Business Case recommended a route to the Airport via Newtown, a new tunnel under Mt Albert, Kilbirnie and Miramar. Further assessment of this route raised a number of concerns regarding its viability, including the indirectness of the route, slower travel speeds than previously envisaged, the need for many customers to transfer from shuttle buses and lower than expected demand

²⁰ Vehicle capacity was modelled at 220 people, but actual capacity can be larger.

from the airport. Additionally, the feasibility of the route was further impacted by the cost of tunnelling under Mt Albert and reduced urban development potential in the eastern suburbs due to resilience issues.

Due to the wide geographic footprint of the eastern suburbs, effective public transport needs to provide multiple routes to achieve the necessary coverage, as evidenced by the existing bus network. Consequently, it was determined that the most appropriate investment in the eastern suburbs would be through BRT or bus priority capable of supporting multiple routes. This formed the basis for developing options for the eastern suburbs, all of which would deliver significant improvements to travel speeds and reliability for BRT or bus services, including to the airport.

Although the issues listed above relate to the outer route section east of Newtown, the core route section between Wellington Rail Station and Newtown was found to align well with project objectives. This route was then extended from the hospital to Island Bay via Berhampore as it provides greater potential for increased urban development and population growth.

All four options would provide frequent, reliable access to the Airport via public transport. This includes MRT in Option 2 and dedicated bus lanes in Options 1, 3 and 4.

9.1.8 Mode Question Summary

The investigations have shown that Wellington needs a high quality MRT system with quality, capacity and permanence characteristics similar to LRT to successfully encourage, and then service, intensified land use in the CBD and southern corridor.

However, there are many benefits associated with rubber tyred vehicles that should not be ruled out at this early stage of system development, such as resilience, flexibility and stageability.

As BRT technology is constantly evolving, it is recommended that LGWM define the expectations for an MRT system that has enough capacity and permanence but reserve a decision on the type of system until the DBC stage or later, when more detailed information can be sourced on the latest and emerging MRT systems.

9.2 Are large-scale or minor improvements preferred at the Basin Reserve?

The two options being considered for the Basin Reserve are a minor upgrade that retains the current configuration or a major upgrade that extends the Arras Tunnel thereby grade separating north-south transport movements from east-west.



Figure 18: Arras Tunnel extension option

The Arras Tunnel extension option is included in Options 1, 2 and 3. Option 4 retains the current configuration.

The key outcomes for each of the two options are summarised in the table below assuming that the intensified land use scenario is adopted.

Table 10: Basin Reserve Summary Assessment

	Retain current configuration with minor upgrade	Extension of Arras tunnel and grade separation of movements
IO1: Liveability	Current poor amenity will remain. Some urban development outcomes due to redevelopment on the western side, but more limited intensification to the east.	Positive amenity outcomes due to substantive development and better connectivity. Good urban development outcomes due to redevelopment south of Haining Street. Enables intensification to the east.
IO2: Access	Adds congestion for all modes onto Taranaki Street. Some improvement for walking and cycling trips.	Enables new Mt Victoria Tunnel and PT improvements to the east. Reduces congestion for all modes around the Basin Reserve. Significant improvement for walking and cycling trips. Enables MRT to the south on the preferred corridor (Kent/Cambridge)
IO3: Mode Shift and Carbon	Lowest embodied carbon	Enables PT improvements and intensification to the east which assists mode shift and better long term carbon outcomes.
IO4: Safety	Minor improvements to safety	Significant local benefits through separation of traffic and more walking and cycling facilities.
IO5: Resilience		Positive effects due to improved access
Other differentiators	Very minor impacts	Significant construction disruption and greater environmental effects
Stakeholder and Public Engagement		61% of 980 comments support major changes

The key differentiators and other items for discussion are outlined below.

9.2.1 Impacts on MRT routes

The Arras Tunnel extension option facilitates better MRT routes in two main areas:

- It enables MRT to travel down Kent Terrace/Cambridge Terrace rather than Taranaki Street. This is preferred for a number of reasons including better travel time performance for all modes, less PT service duplication, better safety outcomes and less impact on the culturally rich area of Te Aro Pā.

- Allows MRT to traverse the Basin Reserve and therefore enables the Mt Victoria Tunnel project to proceed, thereby supporting improved public transport services and frequencies, and urban intensification to the eastern suburbs.

Without the major improvements at the Basin Reserve, MRT would be prevented from accessing the eastern suburbs via Mt Victoria Tunnel. It also makes it very difficult to achieve this in the future due to the MRT route utilising Taranaki Street.

9.2.2 Carbon and Mode Shift

The Arras Tunnel extension option does have significant embodied carbon associated with the construction. However, if delivered as part of the intensified land use scenario, this is offset by the changes in enabled emissions.

There is some perception that large scale improvements at the Basin will encourage more people to drive, but as capacity limitation on all approaches is retained then this is unlikely. This has been confirmed in the modelling that shows similar levels of public transport patronage from the south regardless of the Basin Reserve option chosen.

Any difference here is significantly outweighed by the change in mode shift to the east which is enabled if both the Basin Reserve and Mt Victoria tunnel projects are progressed.

The Arras Tunnel extension option results in reduced congestion on the urban road network in this location, which enables private vehicles and public transport to flow more freely and also encourages through traffic to use the state highway rather than rat-running through other city streets which should be prioritised for non-car modes.

However, whilst the option will reduce congestion, large travel time savings for private vehicles that would counter mode shift are not expected with this option. The greatest saving is likely to be a 3 minute saving in an otherwise 10 minute journey for trips from Miramar to Taranaki Street.

9.2.3 Urban Development and Urban Amenity (Liveability)

The three options that provide for an extension of the Arras Tunnel enable a significant opportunity for comprehensive urban development of adjacent sites and including any residual land generated from acquisition to enable movement/transport infrastructure. The scale of change if well planned enables urban amenity enhancement for the Basin and supporting public space. Opportunities include:

- Improved connectivity across the Basin area for walking and cycling which will assist movement east/west and north/south but also importantly the destination aspects of the Basin and the many educational facilities in this context.
- Increased open space 'park' land that can support higher density residential living in the context of the Basin reserve as an extension of Pukeahu and its connection to the Basin space – this can also act as 'game day' or event support/spill over space.
- Enhanced Basin operational spaces and better accessibility with extensions to the Basin Space footprint especially at the north side.

There remain several key urban amenity and development considerations that will need a comprehensive urban design process to address which include the relationship to the Kent and Cambridge Terrace and releasing opportunity for this well recognised heritage and connectivity pathway to the waterfront, as well as the design of the new streets to address these as 'complete' streets that deliver amenity as well as their desired movements by the multiple modes.

9.2.4 Environmental and Social Effects

The Basin Reserve is an area with strong heritage, social, cultural and environmental significance and this has been highlighted through the [Basin Bridge Project's Board of Inquiry decision in 2014](#). The Arras Tunnel extension option has significantly reduced effects compared to the previous Basin Bridge proposal, particularly in relation to the urban amenity and visual relationship between the heritage values of the Basin Reserve and the canal reserve down Kent/Cambridge Terraces. However, further work needs to be undertaken to minimise the heritage effects of the proposal and maximise heritage, social, cultural and environmental opportunities.

Retaining the roundabout with only minor upgrades has little to no environmental and social effect.

9.2.5 Walking and Cycling

The extension of the Arras tunnel will result in a step change in facilities for pedestrians and cyclists.

The Basin Reserve is currently an unattractive place for active modes, with few facilities, all of which are narrow. The Basin Reserve itself surrounded by a three lane road with only three crossing facilities. This is a particular concern due to the importance of local destinations including the many schools in this area, Pukeahu National War Memorial Park and the walking and cycling facility through Mt Victoria.

The Arras tunnel extension option provides full connectivity to all these locations with significantly improved width and amenity for all users.

9.2.6 Cost and Economics

The estimated 95%ile cost of the two Basin Reserve options, as described in Option 1 and Option 4 are as follows:

- Basin Reserve Arras tunnel extension – \$770M
- Basin Reserve Minor upgrades – \$27M

As economic evaluation has not been undertaken for Option 3, the incremental BCR for the Basin Reserve itself cannot be presented²¹. However, the economics has been run for Option 4 and Option 1 which shows that there is an economic case for doing the Basin Reserve and Mt Victoria Tunnel together. This is presented in Section 11.3.2 this report.

9.2.7 Stakeholder and Public Engagement

The Basin Reserve received a stronger percentage of support with 61% of the 980 comments on the Basin Reserve supporting the changes however there were concerns about that the changes at the Basin would delay investment elsewhere. The main reasons for the support of the Basin Reserve are:

- People want reduced congestion and improved traffic flow around the Basin Reserve
- Enhanced, people-centred, open space
- Those living in the wider region think changes will make it easier for them to get to the Hospital and the Airport.

The reasons for people being less supportive are:

- Question if changes will fix congestion, since traffic merges and bottle necks continue

²¹ Previous preliminary economic analysis showed that the Arras tunnel extension option in isolation delivers a BCR of around 0.6 but this did not take into account the benefits associated with Mt Victoria Tunnel or MRT. The at-grade improvements would deliver a BCR of less than 0.2.

- Extension of Arras Tunnel too carbon costly
- Arras Tunnel also perceived as incentivizing driving over public transport or active modes.

9.2.8 Why does the Arras Tunnel extension option have a large footprint?

The footprint of the Arras Tunnel extension option has been determined by a number of factors:

- The desire to create a good urban amenity outcome and facilitate appropriate urban development in the immediate area.
- The Sussex Street extension needs to tie back to ground at Cambridge Terrace at an appropriate grade and angle to allow MRT and active mode users to traverse this portion of the network safely and with minimal discomfort. To ensure this design requirement was met, additional space and distance was required increasing the footprint north of Buckle Street.
- The Sussex Street footprint enables the provision of two MRT/PT lanes, two traffic lanes and active modes, while the current configuration is three lanes only with minimal active mode provision.
- The footprint around Rugby Street is currently controlled by MRT requirements, as MRT stations should be accommodated along straight sections, extending the footprint south beyond Rugby Street.
- The northeast corner footprint is extended beyond the existing to maximise the space for active mode connections to/from the south and east.

It is expected that the footprint of the Basin Reserve will be refined during the DBC.

9.2.9 Basin Reserve Summary

The investigations have shown that the Arras Tunnel extension option provides a wide range of benefits in relation to the project objectives. It can significantly improve development opportunities and amenity in the area, it improves both public and private vehicle times and provides much improved routes for walking and cycling. Safety and resilience are also improved through the upgrade.

It is also fundamental to facilitating two new public transport lanes through Mt Victoria, without which services to this part of the city reach capacity before 2046, even under normal growth conditions. This also future proofs this corridor for future MRT expansion.

It is noted that the costs of the improvements are large, there are greater environmental effects, and it does result in an increase in embodied carbon compared to a minor upgrade. The DBC should therefore focus on opportunities to reduce these impacts and to enable the opportunities for urban development and urban amenity to be delivered.

However, as a standalone project it is unlikely to provide significant benefits in relation to all investment objectives without being delivered alongside the Mt Victoria Tunnel as together they allow MRT to traverse through the Basin Reserve and Mt Victoria to provide significant benefits in terms of access, carbon and mode shift for the Eastern Suburbs. This is discussed further in the next section.

Future design considerations relating to urban integration for the Basin Reserve include amplifying the sense of green belt to green belt connections, enhancing active mode connections for increased comfort, and integration between active mode facilities, the street space, and the built form. The DBC will further explore future design considerations relating to embodied carbon, amenity, and improvements for integration with any new Mt Victoria tunnel.

9.3 Is a new Mt Victoria tunnel needed?

Two options are being considered for the Mt Victoria Tunnel, a new tunnel for just walking and cycling or a new tunnel that, along with the existing tunnel, will have provision for two public transport lanes, two general traffic lanes, and much improved walking and cycling facilities through Mt Victoria. There are different possibilities in terms of the alignment of any new tunnel or which modes share in which tunnel, but this level of detail will be determined at the DBC stage, should this programme element be taken forward.

A walking and cycling tunnel is only included in Options 3 and 4 whereas a new tunnel enabling two new PT lanes as well as better walking and cycling facilities is included in Options 1 and 2.

The key outcomes for each of the two options are summarised in the table below assuming that the intensified land use scenario is adopted.

Table 11: Mt Victoria Tunnel Summary Assessment

	Walking and Cycling Only Tunnel	New Tunnel enabling two new PT lanes
IO1: Liveability	Has some local urban amenity effects at tunnel portals Does not enable intensification in the eastern suburbs.	Has greater local urban amenity effects at tunnel portals. Enables intensification to the east therefore overall scores better than other option.
IO2: Access	Improves access for walking and cycling. PT services through the Hataitai Bus Tunnel reach capacity before 2046.	Significantly improves public transport access by expanding route capacity and enabling PT priority routes to the east and the Airport. Improves access for walking and cycling
IO3: Mode Shift and Carbon	Improved mode share for walking and cycling. Lower levels of embodied carbon	Enables PT improvements and intensification to the east which assists mode shift and carbon outcomes. Improved mode share for walking and cycling
IO4: Safety	Minor improvements to safety, particularly for pedestrians and cyclists	Minor improvement to safety for pedestrians and cyclists as well as other modes.
IO5: Resilience		Significant improvement in resilience, particularly if a diagonal tunnel as existing Mt Victoria tunnel portals are in a high risk area.
Other differentiators	Fewer impacts	Reduced noise for local residents, particularly if diagonal tunnel. More difficulty in relation to property and construction. Greater visual impacts due to two new tunnel portals
Stakeholder and Public Engagement		69% of 1616 comments support

The key differentiators and other items for discussion are outlined below.

9.3.1 Public Transport capacity

Although analysis has shown that the Hataitai bus tunnel itself has sufficient capacity to accommodate growth (albeit with some unreliability due to tunnel signal operations), the physical and network constraints either side of the tunnel will result in significant deterioration of journey times and reliability. This is the case under both the core and intensified land use scenarios. This will limit mode shift and potentially limit sustainable development to the east and the ability to provide a high frequency public transport service to the Airport.

A new Mt Victoria Tunnel with MRT/PT lanes delivers significant accessibility improvements through improving capacity and reliability for the eastern suburbs and Airport and will provide three times the PT lane space between the eastern suburbs and CBD leading to increased PT mode share and improved PT travel times.

The number of people living within an hour of the Airport by public transport in 2046 increases from 160,000 in the Do-Minimum scenario to 190,000 for Options 3 and 4

Providing additional PT capacity enables an additional 80,000 people to live within a 60-minute public transport journey to the Airport, compared to only providing a walking and cycling tunnel (see Figure 14).

9.3.2 Urban Development and Urban Amenity

The eastern suburbs have less urban intensification potential due to a number of constraints including coastal inundation and Airport noise. Nevertheless there is still potential for an additional 1,000 households along a potential MRT corridor over and above what would be expected under the core land use scenario. This would be much more difficult to achieve without more regular PT services. The insertion of the new tunnels into an existing urban context will require careful attention to the urban amenity outcomes of the public realm and the values in the receiving environment given the schools, heritage values in Mt Victoria and also the town belt open space, residential context and local movements in the Wellington Road context.

Furthermore, most of the scope for additional development is in central Kilbirnie and on the Miramar peninsula. Due to the distance to the CBD, commuting from this location is best served by public transport (the distance will deter pedestrians and some cyclists). Despite the relatively modest levels of intensification assumed for the east in the intensified land use scenario, the modelling shows an increase in public transport demand of around 40%. This is because of intensification of employment in the CBD reducing reliance on the private car and encouraging a greater mode shift to public transport.

9.3.3 Carbon and mode shift

As outlined above, the provision of the new Mt Victoria Tunnel will facilitate a step change improvement in PT uptake from the east. As it will be a dedicated PT tunnel, it provides a high degree of reliability and makes a very strong statement about the modal hierarchy. Increased PT ridership will contribute to reduced enabled carbon emissions. Over time, this will offset the significant embodied carbon emissions during construction.

9.3.4 Resilience

The current Mount Victoria tunnel is one of the identified high-risk elements on the transport network due to the stability of the tunnel portals. If this tunnel was to fail, all traffic would need to travel east via Constable Street or Oriental Parade.

Providing an additional Mt Victoria tunnel that was able to be used by public transport and general traffic would mean that safe and efficient routes were available during any event.

9.3.5 Stakeholder and Public Engagement

Respondents who are concerned about better access for cars and other vehicles questioned why only a two-lane tunnel is proposed and would like to see four lanes for general traffic (two in each direction) because they believe this would future-proof the investment and support population growth and intensification.

Those who support the aim of getting cars off the road worry a new tunnel would be counter-productive to that goal, as it would encourage car use. In addition, people are concerned about the level of disruption that construction of a new tunnel and its carbon impacts.

9.3.6 Cost and Economics

As outlined above, incremental analysis of Options 1 and 4 indicates an incremental BCR of between 1.1 and 1.4 under the intensified land use scenario. Therefore, as with other elements of the transformational programme, investment in the Mt Victoria Tunnel (and Basin Reserve) is justified if the intensified land-use scenario can be achieved.

9.3.7 Mt Victoria Tunnel Summary

Similar to the Basin Reserve analysis, the investigations have shown that providing a new Mt Victoria Tunnel that allows for two new PT lanes provides a wide range of benefits in relation to the project objectives. It significantly improves public transport, walking and cycling access to and from the east, whilst also significantly improving resilience and safety.

Without such investment, public transport services to the east are expected to have poorer performance before 2046, even under normal growth conditions. This will make public transport less attractive, limiting further growth potential and constraining progress towards mode shift and carbon emission reduction goals.

As with the Arras Tunnel extension, it is noted that the costs of the option are large, there are significant environmental effects and urban amenity considerations, and it does result in an increase in embodied carbon compared to a minor upgrade. The DBC should therefore focus on opportunities to reduce these impacts.

9.4 How can urban intensification be achieved?

The Spatial Plan identifies MRT stations as locations for higher density urban development. The "precincts" or areas around these stations have the opportunity for high quality comprehensive mixed-use development, including quality buildings for living and a mix of uses (high density housing, employment opportunities etc), housing choice and affordability, pedestrian connections, public spaces and streets with purposeful allocation to specific 'place' and 'movement' objectives. The greater the intensification around the stations, the greater the benefits for mode shift and lower carbon emissions.

The main methods for this urban development are district plan land use controls that enable high density, infrastructure upgrades, and facilitating or delivering the development. WCC and other agencies are already using these methods anticipating a future MRT within planning documents such as the Spatial Plan and the upcoming Proposed District Plan. The amount of development enabled by the Proposed District Plan will be much greater than the core scenario (or number reflected in the Spatial Plan) as the Proposed Plan anticipates Transit-Orientated Development around MRT stations once they are confirmed and is very enabling of development especially along within the Central City and to Newtown. The intensified land use scenario discussed above considers around 26,000 new households in these catchments. If LGWM partners support an intensified land use approach, a stronger and more proactive approach to high density urban redevelopment would be needed as discussed below.

9.4.1 District plan

The draft district plan already enables high density development in the MRT corridor from Wellington Station to Newtown. This corridor is in all four options. Decisions on these district plan provisions are scheduled for around November 2023. High density is not yet enabled south of Newtown and/or east of the Basin, except for the town centres of Berhampore, Kilbirnie, Miramar and Island Bay, until the MRT station locations are confirmed. RMA national direction requires district plans to enable (which does not mean require) at least 6 storey buildings in the “walkable catchments” from these rapid transit stops. However, natural hazards, historic heritage, Airport noise restrictions and other matters can limit these district plan high density areas. These will limit high density development in large areas to the east.

Once the preferred option is selected, urban areas within 10 minutes’ walk of the future MRT stations (that are not already zoned for high density) will be zoned to enable 6 storey developments, except where the limiting matters apply. To increase urban development towards the intensified scenario, land use rules need to enable building heights above 6 stories near future MRT stations south of John St/Adelaide Rd, and/or east of the Basin Reserve. This is because constructing 5-8 storey buildings is typically not commercially feasible in these areas, and because some tall apartment towers would be needed to maximise housing around MRT stations.

9.4.2 Infrastructure upgrades

The Spatial Plan already prioritises the Central City to Newtown for infrastructure upgrades (along with Johnsonville and Tawa growth nodes). Berhampore and Island Bay are next in line, aligning with transport upgrades from 2031. Timing for Kilbirnie and Miramar is uncertain, depending on MRT decisions and having the growth constraints noted above. Three waters infrastructure and multi-modal transport infrastructure have critical constraints that need significant upgrades in these areas. Other upgrades to electricity, parks, schools etc. are also important.

To increase urban development towards the intensified scenario, the infrastructure capacity will need to be increased with larger pipes, better quality cycleways and pedestrian connections, thicker cables, more community services and assisted housing projects. It is noted that under the intensified scenario, the overall population in the region will not change, but the location and density will. This means that more infrastructure could be required in some locations, but not in others.

9.4.3 Development within the walkable catchment of the MRT corridor

Some level of intervention in urban development is likely to be appropriate to secure the urban environment outcomes discussed earlier. LGWM can have a role in facilitating or delivering urban development where urban development is not at sufficient scale, pace or quality around MRT stations. This might be in situations where:

- Land parcels are too fragmented or have complicated ownership arrangements and would benefit from acquisition and amalgamation to create larger and more feasible development sites
- Where there are opportunities to better utilise LGWM partner/Crown land
- To achieve high-quality and high-density development closely integrated with MRT stations (Transit-Orientated Development (TOD))
- Land is acquired for transport construction purposes with residual land used for urban renewal and development.

As LGWM’s approach to urban development has been progressing, the programme has been focussed on providing confidence that there is shared commitment to enabling quality urban development and enhancing urban amenity alongside MRT, as appropriate for this stage in the process including:

- Development of working objectives for urban development to guide effort across LGWM funding and Mana Whenua partners and with Kāinga Ora and the Ministry of Housing and Urban Development
- Agreeing what the parties are collectively and individually committing to progress in relation to urban development
- Developing a Specified Development Project (SDP) proposal in partnership with Kāinga Ora (see below).

To increase urban development towards the intensified scenario, the facilitation and delivery of urban development would need to be significantly increased. In particular: acquisition and amalgamation of land by MRT stations, development of LGWM partner and Crown land, partnerships with developers, iwi authorities and Kāinga Ora, and facilitating good urban design and community outcomes.

The programme is considering pathways under both the RMA and Urban Development Act (UDA) for the selected option and associated urban development. The UDA is new legislation that facilitates urban development by combining the planning, funding and approvals for the development, transport, and infrastructure within an SDP. An SDP would be a useful process to coordinate redevelopment towards an intensified land use scenario. A decision on whether to submit an SDP application for Ministerial approval is scheduled to go to LGWM partners in the first half of 2023.

Regardless of the pathway chosen, an Urban Design Framework will be developed during the DBC phase to set out the overall urban design vision for the Project and how it will integrate with wider aspirations and plans in surrounding areas.

9.4.4 Considerations regarding growth elsewhere in the region

As articulated earlier in the report, the scenarios have assumed the same total quantum of growth across the Wellington region, and under an intensified land use scenario, this is assumed to result in a reduction of growth elsewhere in the region. This reinforces the importance of LGWM being well-integrated with wider work occurring through the Wellington Regional Leadership Committee (WRLC) on the Wellington Regional Growth Framework.

LGWM modelling for the intensified scenario has shown that the greater the number of people living and working within the MRT corridor catchment, the more the region can deliver on the regional 2050 climate change targets. A more intensified scenario has the ability to significantly reduce regional transport emissions generated through private travel elsewhere in the region (reduced VKT) and support more people within Wellington City taking MRT or walking and cycling.

During 2022, the WRLC is advancing work on a regional emissions reduction plan and also undertaking further work on the sequencing of growth across the region. LGWM analysis will support this activity and greater ambition needs to be sought via the WRLC and WRGF to more actively prioritise transit-orientated development growth along the MRT corridor and discourage growth in greenfield areas or more dispersed growth through the greater land use controls and prioritisation of supporting infrastructure.

9.5 How will the options integrate with the wider transport system?

Consideration has been given to how the public transport system would need to change upon implementation of MRT systems with each of the four programme options.

All four programme options include a suite of improvements across the wider public transport network. These include the provision of peak hour bus lanes on the Thorndon Quay/Hutt Road corridor, along with bus priority measures on other key corridors across the city street network. As such, the remaining

elements of the bus network will be configured to maximise the benefits of these investments to provide city and region wide benefits.

The differences between the options mainly relate to how they deliver improvements to the south and east. Options 1, 3 and 4 all feature LRT to Island Bay and varying degrees of bus enhancement to the east. Option 2 features BRT on both corridors. In all cases it is assumed that other bus services can benefit from the dedicated MRT facilities when they share a corridor.

Options with LRT will integrate well into the wider transport system as LRT to Island Bay replaces route 1 south via Kent/Cambridge. Route 1 north is routed to Lyall Bay via Taranaki/Wallace (current route 3) avoiding route duplication. Route 2 is maintained in full (Karori to East) with 'enhanced' bus infrastructure from the Station to Miramar. The new route 2 will travel via a new Mt Victoria tunnel and bypasses Hataitai and Mt Victoria. But this option assumes the retention of a core bus route via the bus tunnel to pick up Hataitai and Mt Victoria inner east catchments.

There is significant potential to upgrade 'enhanced' bus to BRT type infrastructure on east-west corridor as some point in the future. Scalability to the west can achieve at least 'enhanced' bus upgrades but is likely to be a bit more constrained than the East. Tighter curves/ horizontal geometry, narrower road corridors (Chaytor/ Glenmore) and Karori tunnel are likely to preclude the implementation of fully dedicated right of way to Karori from Wellington Station without significant property impacts.

In addition, refined modelling shows that there is an imbalance of frequencies between Golden Mile and Second Spine which result in bus-on-bus congestion on Golden Mile, this could be mitigated by moving some services to second spine, truncating or hubbing services. This must be investigated in more detail over the coming phases of the project.

9.6 Are parking levies or congestion charging proposed?

The Programme has investigated both priced and non-priced Travel Demand Management approaches, including two priced approaches: a commuter parking levy and congestion pricing.

These elements have been the subject of a number of sensitivity tests, including transport modelling. These sensitivity tests show that interventions that serve to reduce the traffic demand entering the central city by way of pricing have a significant positive impact on the performance of the options in relation to the investment objectives. The benefit of congestion pricing or parking levies is significant regardless of the programme option.

Previous modelling²² has indicated that a congestion charge could reduce traffic entering the central city by 8%. It has also indicated that it could increase PT patronage by over 2000 per hour²³ (with a particularly notable increase in rail patronage from the north).

The conclusion in the PBC was that a combination of infrastructure investment, service improvement and travel demand management was required to maximise delivery on the overall investment objectives. That conclusion remains the same.

A congestion pricing system appears to have advantages over a commuter parking levy: the price directly affects all drivers, it can be used to influence behaviour at particular locations and times, and it impacts all traffic, rather than just parked cars. However, further work is required on congestion pricing to understand its effectiveness and impacts, including on equity.

The use of pricing schemes needs further investigation and will involve further engagement with Wellingtonians. Both congestion pricing and a commuter parking levy would need legislation to enable

²² [2021-10-22-LGWM-PASLO-Report.-Final_Redacted.pdf \(amazonaws.com\)](#)

²³ [2021-11-01-LGWM-PASLO-Modelling-Report_Redacted-v2.pdf \(amazonaws.com\)](#)

their implementation, but it is understood that work is progressing in this space. Before pricing schemes are introduced, consideration will be given to the timing of the scheme in relation to the other elements of the LGWM programme to ensure that the capacity and performance of public transport services and active mode infrastructure provide viable alternatives to private vehicles.

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10 Uncertainties and Risks

The previous sections of this report have presented the performance of the options in a future that can be reasonably expected. However, the future cannot be predicted and therefore the preferred programme option should be resilient and flexible enough to continue to provide the best value for money outcomes in range of other circumstances.

The biggest uncertainties that affect the options, and therefore also affect the choice of preferred option, are outlined below along with a discussion about the level of the risk and a determination of which option is likely to respond best to the risk.

- **Cost Escalation:** As presented previously in this report, this programme is at an early stage the overall project lifecycle and therefore costs have a degree of uncertainty.
 - **Mitigation:** This has been mitigated to some extent by undertaking parallel estimates, reporting on the 95%ile estimated costs and the development of an affordability threshold, but there remains an ongoing risk. It can be further mitigated by selecting an option well below the affordability threshold, or reducing the scope of the preferred programme option at a later date. It is considered that BRT has a greater ability to reduce scope compared to LRT, particularly in terms of the level of infrastructure provided to the east. It should be noted that the high cost of land coupled with increasing costs of construction currently present challenges outside the direct control of LGWM partners but will require a coordinated approach with central government to address challenges facing New Zealand more broadly.
- **Level of land use intensification** – This report shows the importance and impact of high levels of intensification to deliver the programme objectives, however the level of intensification that can be realised is still very uncertain. Work to date has shown that continuation of a BAU approach to land use, or even adopting the ‘core’ land use scenario, has significantly fewer benefits compared to a high land use scenario. Not facilitating high land use could result in consenting risks (as the transport solution will have to show ‘need’) not achieving the expected outcomes and/or over-investing in a transport solution.
 - **Mitigation** - To ensure intensification is not limited, Option 1 provides the necessary capacity south and east. Section 9.4.3 outlines the measures LGWM are undertaking to help facilitate growth, but more will be needed by Wellington City Council, Kainga Ora and others. If intensification levels greater than those represented in the “core land use scenario” are not able to be achieved, roll out of any form of MRT system is unlikely to be value for money and a ‘Continuous Bus Priority’ network may provide appropriate outcomes and a lower cost although issues such as the impact on urban amenity would need to be assessed. This needs to be reviewed during the DBC phase.
- **Pricing:** The addition of congestion pricing and/or a parking levy will reduce the amount of travel by private car and increase the demand on the public transport system.
 - **Mitigation:** Pricing could have a similar impact to greater land use intensification and therefore this is best managed by implementation of Option 1 which provides the greatest capacity.
- **Future MRT technologies:** A number of different companies around the world are developing rubber tyre-based MRT vehicles that will have similar characteristics as light rail such as multiple car units, low floor walk through units, driverless services etc. This means that BRT could provide the same capacity and customer experience as LRT, whilst having the other benefits of BRT such as flexibility, extendibility and resilience.

- **Mitigation:** Not restricting the mode would enable these future technologies to be investigated further during the DBC phase.
- **COVID 19 and future ways of working:** The pandemic has resulted in significant periods of lower travel demand, a reluctance to use public transport due to proximity to others and an increase in employees working from home. This could result in a lower demand for travel.
 - **Mitigation:** The DBC phase should monitor these effects over the next two years to enable this trend to be understood further before a funding decision is made
- **Climate change policies:** There is an understanding that further climate change policies will be enacted in the near future. As the modelling has shown, the best way to enable reduced emissions is to facilitate intensification and implement pricing.
 - **Mitigation:** As above, intensification and pricing will result in additional demand for MRT to both the south and east, which is best enabled by Option 1
- **Other changes:** The preferred option decision is not a decision to build now. That decision comes at the end of the DBC phase. The decision now should allow flexibility to determine what is the best way of achieving the best outcome for Wellington, but still enabling flexibility for the key determination at the end of the DBC.
 - **Mitigation:** The best way to enable flexibility but not impact on programme if circumstances do change, is to investigate all components through the DBC. That would mean investigating both LRT and BRT as well as Basin Reserve and Mt Victoria tunnel.

From the above discussion, there are risks and uncertainties which are best managed and mitigated by retaining some flexibility in the preferred option through the detailed business case phase.

11 Selecting the Preferred Programme Option

This chapter discusses the key decisions towards selecting a preferred programme option. It presents:

- The preferred programme options from the MCA analyses, which were Option 1 and 2
- The impact of high intensity land use scenario and how that intensification and high capacity MRT are interdependent
- Why Options 3 and 4 do not provide an appropriate solution for the eastern suburbs to make a step change in mode shift
- A discussion on the relative benefits of Option 1 and Option 2

11.1 Multi Criteria Analyses

The original MCA analysis undertaken as part of the PASLO report identified that Options 1 and 2 were the better performing options, with Option 2 performing slightly better due to its ability to provide better transport accessibility, flexibility and resilience. However, the majority of the aspects that Option 2 performed slightly better in than Option 1 are not considered key outcomes as sought in the Programme Objectives. For example, Option 2 does not encourage as much urban development as other options.

The MCA on the intensified scenario indicates that a high capacity MRT service is required to the south and high quality public transport is required to the east. This translated clearly to a preference for Option 1, which provides this to the east through the provision of the Basin Reserve and Mt Victoria Tunnel, and to the south through LRT which can move more people than BRT.

11.2 High Intensity Land Use and BCR

From the economic analysis, it is clear that MRT needs to be implemented under the intensified land-use scenario to provide an economic return on investment. If options are delivered with the core land use scenario, the BCR is approximately 0.5 but if delivered with the high intensity scenario, the BCR reaches 1.0 (with the highest BCR being achieved for Option 1).

In a complementary way, modelling has shown that high quality public transport is needed to service the level of intensification that is required to make MRT economic. For the south this means high capacity services and for the east it means provision of new PT lanes.

Accordingly, MRT and intensified land use need to be delivered concurrently and this will not happen with a business-as-usual approach. Targeted and specific action needs to be taken to deliver this intensification along the MRT corridors.

The analysis has also shown that intensification has the largest impact of any other intervention investigated as part of LGWM in relation to reducing carbon emissions. It therefore is likely to be a focus of upcoming carbon and housing policy changes.

For the purposes choosing a preferred programme option, it has been assumed that this level of intensification can be delivered. If it is not, and development happens elsewhere in the city and region, then none of the four programme options are appropriate. Other programme options will need to be developed that are based around an enhanced bus system.

11.3 Options 3 and 4

The image below shows how the options perform against the decision criteria presented in Section 1.2. The reasoning behind the colours is summarised in the text below the table.

	Updated objectives performance	Updated BCR, economics	Risk and cost certainty	Sensitivity testing	Engagement response	Key Questions
Option 1	Green	Light Green	Red	Green	Green	Green
Option 2	Light Green	Light Green	Light Green	Light Green	Light Green	Red
Option 3	Light Green	Light Green	Light Green	Light Green	Light Green	Red
Option 4	Light Green	Light Green	Light Green	Light Green	Light Green	Red

11.3.1 Updated Objectives Performance

The Basin Reserve grade separation has a wide range of benefits compared to retaining the existing layout with minor improvements. It improves amenity, reduces congestion for all modes, provides much better and safer facilities for walking and cycling and was supported by the community. However, the ongoing benefits for carbon and mode shift are limited unless it is paired with the Mt Victoria tunnel²⁴ to deliver PT capacity improvements to the east.

Options 3 and 4 performed less well in both the core land use and high intensity land use MCA. They deliver poorer outcomes against the investment objectives, particularly in relation to access and resilience.

Overall, providing Option 1 in comparison to Option 4 (for the core land use scenario) provides:

- More people living in close proximity to key destinations (230,000 people living within 1 hour of the Airport compared to 190,000).
- Improved PT travel time and travel time reliability (11.5 minute journey time from Mirimar to CBD compared to 8.5 minutes).
- Better comparative travel times between public transport and private car (journeys from Airport to Bowen Street take the same amount of time for Option 1, but PT journeys take 20% longer than private car journeys in Option 4).
- Reduced car mode share (42% increase in non-car mode share compared to 38%).
- Better mode share in the central city (52% compared to 46%).

These outcomes become even more pronounced when considering the high intensity land use scenario.

In addition, capacity calculations for future years have shown that the one-lane Hataitai bus tunnel, coupled with the side friction and congestion in the residential areas on either side of the tunnel results in poor levels of service, delays and unreliable journeys for PT services to the east. In order to achieve mode shift targets, this needs to be rectified as, with the longer journeys from Mirimar and the Airport,

²⁴ The Mt Victoria tunnel cannot be delivered without the Basin Reserve as the investigations undertaken through the Mass Rapid Transit workstream have shown that there is not an efficient route that can service the south and east via Mt Victoria without traversing the Basin Reserve.

active travel is not always a feasible alternative. Not providing this additional capacity would limit development to the east, inhibit mode shift and reduce accessibility to the Airport and Airport businesses.

However, Options 3 and 4 can be delivered with less infrastructure in shorter timeframes, therefore having less impact in terms of short-term embodied carbon.

11.3.2 Updated BCR, Economics

- Option 1 intensified land use – 0.9 to 1.2
- Option 4 intensified land use – 0.9 to 1.1

Both Options 1 and 4 facilitate intensification to the south. However, Option 1 also allows for improved public transport services and mode shift to the eastern suburbs with the extension of the Arras Tunnel and a new Mt Victoria Tunnel.

An incremental BCR has been calculated to determine whether the additional benefits gained outweigh the additional costs. The better public transport services and walking and cycling interventions around the Basin Reserve and Mt Vic Tunnel result in significant increases in Public Transport and Health Benefits. The better connectivity to the east also results in a large uplift in agglomeration benefits, contributing to an incremental BCR of Option 1 over Option 4 of around 1.4. This indicates that the additional infrastructure in Option 1 is a good investment.

11.3.3 Risk and Cost Certainty

Options 3 and 4 cost significantly less (whole of life costs of \$5.8 and \$6.6B compared to \$7.4B for Option 1) and therefore have greater flexibility for cost increases within the affordability threshold.

11.3.4 Sensitivity Testing

The uncertainty and risk analysis discussion earlier shows the benefits of further investigation into the Basin Reserve and Mt Victoria tunnel projects as they provide the most flexibility to respond to different future conditions such as greater land use intensification, road pricing, future technologies and climate change policies.

11.3.5 Engagement Response

Proceeding with these two projects was the preference of the public engagement and online panel research.

11.3.6 Key Questions

The conclusion from the Key Questions section was to proceed with Basin Reserve and Mt Victoria Tunnel as both significantly contributed to the outcomes sought.

11.3.7 Overall

Overall it is therefore recommended Options 3 and 4 be removed from further investigation. They would not unlock public transport capacity and travel time improvements to the east to support mode shift and carbon outcomes.

However, removing the options at this stage would not preclude them to be fall back positions if, at the end of the DBC, circumstances (such as forecast land use) have changed, as only moderate additional work would be required to the MRT investigations to change from the other options.

11.4 Options 1 and 2

Programme Options 1 and 2 both include the Basin Reserve and Mt Victoria Tunnel but provide different forms of MRT to both the south and east.

The image below shows how the options perform against the decision criteria presented in Section 1.2. The reasoning behind the colours is summarised in the text below the table.



11.4.1 Updated Objectives Performance

Under the core land use MCA, Options 1 and 2 perform similarly. Option 2 performed slightly better in terms of resilience but otherwise the scores were similar. However, when considering the intensified land use scenario, Option 1 outperforms Option 2 in relation to Liveability as well as Carbon and Mode Shift.

Exact performance metrics are not available for Option 2 as that option has not been modelled to the same extent as Options 1 and 4.

However, the land use assessment work and comparative city analysis has shown that BRT is likely to catalyse less development than LRT due to the perceived permanence of the infrastructure and the potentially lower levels of service.

With more intensification comes better carbon outcomes. This is due to both shorter trips being required and a greater proportion of those trips using active or public transport modes.

11.4.2 Updated BCR, Economics

- Option 1 intensified land use – 0.9 to 1.2
- Option 2 intensified land use – 0.8 to 1.0

An incremental BCR has been calculated to determine whether the additional benefits gained outweigh the additional costs. This calculation has shown that the incremental BCR of Option 1 over Option 2 is greater than 3, meaning that the additional infrastructure in Option 1 is a good investment.

11.4.3 Risk and Cost Certainty

Option 2 (\$7.0B) costs slightly less than Option 1 (\$7.4B). BRT also has more flexibility resulting in a greater ability to descope the project (and reduce cost), but this may impact benefits delivered.

BRT also has more flexibility to stage construction. However, whilst a delay to construction will show a reduction in the programme costs over the 30 year period, construction inflation will increase costs and interest and principal repayments will be pushed into the period beyond the 30 years.

11.4.4 Sensitivity Testing

The uncertainty and risk analysis discussion earlier shows the Option 2, as modelled does not provide the same ability to respond to intensified land-use scenarios when compared to Option 1, particularly when thinking very long term. However, other BRT systems which have not been modelled, do have greater capacity and these systems would perform better.

BRT systems also have more flexibility to respond to changing MRT vehicle technology.

11.4.5 Engagement Response

The public generally preferred LRT over BRT for reasons previously mentioned in this report, although the gap narrowed for the online panel research, particularly when considering those who live in Wellington City.

11.4.6 Key Questions

The key question section noted that Wellington needs the capacity and permanence of a system with the characteristics of LRT but noted the benefits associated with BRT based systems. The section recommended that LGWM define the expectations for an MRT system that has enough capacity and permanence, but reserve a decision on the type of wheel until the DBC stage or later, when more detailed information can be sourced on the latest and emerging MRT systems.

11.4.7 Overall

Overall it is recommended that both options proceed through to the Detailed Business Case. There is very little difference in infrastructure that would be required between the two options at a DBC level of detail. LRT has benefits over BRT in terms of facilitating urban intensification but internationally, BRT systems are improving in this space.

Nevertheless, it is important to define the ideal characteristics that MRT should have for the Wellington situation as a basis for further investigation. These are described further below.

11.4.8 Desired MRT Characteristics

11.4.8.1 Network

The evaluation undertaken by specialist teams to date has identified a range of advantages and disadvantages of 'open' and 'closed' MRT systems. In reality, any system in Wellington is unlikely to be fully closed and the design of an MRT service or services for Wellington and how this interfaces or affects legacy bus routes needs to weigh up these trade-offs including the potential benefits of a more closed system such as journey time reliability, against any disbenefits for passengers on other corridors such as the need to transfer.

Network integration work has demonstrated the following attribute requirements for the wellington system:

- Core, frequent services that run throughout the day
- Flexibility to accommodate additional peak services as required to accommodate surges in demand
- A dual spine through the CBD to maximise capacity for MRT and bus services

- Capacity to accommodate up to 5,000 people per hour at the peak load points on the southern and eastern approaches to the Basin Reserve²⁵
- Extendability, particularly to the north and west where population is expected to grow.

11.4.8.2 Infrastructure

A high level of segregation is recommended to maximise journey time reliability and travel time competitiveness. It was also identified that regardless of level of segregation the MRT should operate on a high-quality running surface (rails or road pavement). Broken or rutted pavements, or uneven tracks present significant barriers to speed and reliability as well as passenger comfort.

The location and spacing of MRT stations is a key element to a successful MRT system but represents a trade-off between catchment and in vehicle speed. Stations should assist in the MRT performing a rapid / limited stops function within the urban public transport network and therefore it is typically expected that stations would be greater than 400m apart. The ultimate location of stations will be influenced by factors such as land use, urban form, the street network and redevelopment potential. Regardless of location, MRT stations should be high quality with the following common features:

- Easy access to the station – excellent, inclusive, pedestrian and cycle connections with shade/ weather protection and minimal pedestrian delays (e.g. signals).
- Comfortable and safe platforms – sufficient space for standing, sitting and manoeuvring (including for wheelchairs, prams etc) as well as weather protection (wind, sun, rain), security/ CCTV, excellent lighting and activation from surrounding land uses.
- Information and reassurance – real time passenger information, help facilities, printed maps and timetables along with network information suitable for all users (e.g. visually impaired).
- Secure cycle and e-scooter parking – to improve first mile-last mile access and expand the effective catchment area.

11.4.8.3 Operational systems and policies

High quality and efficient MRT systems would exhibit the following operational system and policy features:

- Off board ticketing and ticket validation
- All door boarding
- Dynamic real time passenger information systems that can convey vehicle location and on-time status to multiple locations including to web apps.
- A high degree of priority for MRT vehicles at signals to minimise journey time and reduce travel time variability.

11.4.8.4 Vehicles

The recommended MRT vehicle suitable to the study area would have the following characteristics:

- High capacity and low floor with multiple wide doors and aisles
- Electric propulsion
- A bespoke vehicle design with a tram-like appearance and similar interior layout and level of quality
- Modular/flexible to operate different vehicle lengths to meet demand while retaining consistent maintenance and stabling requirements. It is noted that stabling needs and location can be significantly different depending on vehicle choice.

²⁵ This is higher than the 2046 demand, but provides a factor for additional growth after this time period.

As these will be longer/wider vehicles than can legally be operated on New Zealand roads, legal assessment including road controlling authority approval will be required to enable these vehicles to operate MRT services beyond the end of the dedicated MRT infrastructure.

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12 The Preferred Programme Option

The preferred option that should be progressed to detailed business case is a high quality, high capacity MRT solution along the southern corridor from Wellington Station to Island Bay with a new tunnel through Mt Victoria to improve facilities for active modes and public transport and a grade separated solution at the Basin Reserve. This is the same as Option 1 but it is recognised that BRT could provide similar outcomes to LRT if appropriately specified and designed. This is the preferred programme option as:

- **It best enables, and responds to, intensified land use.** BRT as modelled as part of Option 2 may not meet Level of Service expectations to the south in the long term and new public transport lanes are required to the east. Only the capacity provided in Option 1 can provide this certainty.
- **It enables the most mode shift away from private cars.** Providing LRT and the Mt Victoria tunnel creates the most comprehensive mass transit network, thereby enabling the most intensification which then leads to the best mode shift for the region.
- **It has the best reduction in enabled carbon.** With mode shift comes a significant reduction in enabled carbon emissions.
- **It enables improved movement to and from the Airport and the east.** The Basin Reserve improvements and the Mt Victoria tunnel ensures that many more people can live within 60 minutes of the Airport by public transport services.
- **It best enhances urban amenity and active travel around Te Aro.** The Basin Reserve improvements and the Mt Victoria tunnel provide a step change in safe and efficient facilities for pedestrians and cyclists wanting to travel through this part of Te Aro to connect north south east or west. The surrounds to the Basin Reserve will also be beautified to make this a place people will want to be, connecting Pukeahu, the Basin Reserve facilities and the surrounding schools and catalysing adjacent development.
- **It has the best return on investment.** The BCR for Option 1 is above 1 and the largest of all the options considered. It also returns a positive incremental BCR when compared to other options.
- **It contains elements that received the most positive response from engagement.** Respondents replied most positively to LRT, the Basin Reserve and Mt Victoria Tunnel improvements compared to the alternative options.

However, the preferred option does not come without issues or risks:

- **It has the highest cost.** It is therefore closest to the funding threshold and has the highest risk of exceeding this value.
- **It has the highest embodied carbon.** Constructing more infrastructure results in higher levels of embodied emissions. This is problematic for Wellington's short-term targets but is countered in the long term by better enabled emissions.
- **It has the highest level of effects.** Newtown, Mt Victoria and The Basin Reserve are all sensitive areas and construction through them will require comprehensive consideration and detailed management plans to minimise impacts on people and the environment.

- **LRT has less flexibility and extendibility.** Due to the in-ground infrastructure, LRT services cannot deviate from the route or extend past where the tracks finish. This makes it harder for services to extend, for example, to Johnsonville. Likewise, it is not as easy to stage construction. Accordingly BRT alternatives will continue to be considered.
- **It has lower resilience to unexpected events.** In earthquakes, floods or even when crashes occur, light rail vehicles cannot take a different route to avoid affected sections of the network. Again, BRT alternatives will continue to be considered.
- **It relies on acceptability and market delivery of high-density urban development in the MRT corridor.** The National Policy Statement on Urban Development and the new Medium Density Residential Standards require various levels of medium to high density to be enabled in most of Wellington's existing urban areas. The public acceptability and commercial attractiveness of intensification, and the number of existing opportunities for more dispersed development may limit the intensified land use modelled in this report, and the outcomes that can be achieved.

In addition, there are other factors to consider:

- **There are still a lot of uncertainties.** These include different land use scenarios, future investment in rail network capacity, future ways of working, the ongoing impact of COVID-19, future MRT technologies and additional policy changes in relation to climate change.
- **This is not a decision to build yet.** The decision now should determine what is the best way of achieving the best outcome for Wellington, but still enabling flexibility for the key determination at the end of the DBC.

The preferred programme is therefore as presented in the figure overleaf. This is fundamentally the same as Option 1 with the exception that the 'light rail' element of the MRT system is not specified and instead the requirement is for a high-quality high-capacity system to the south.

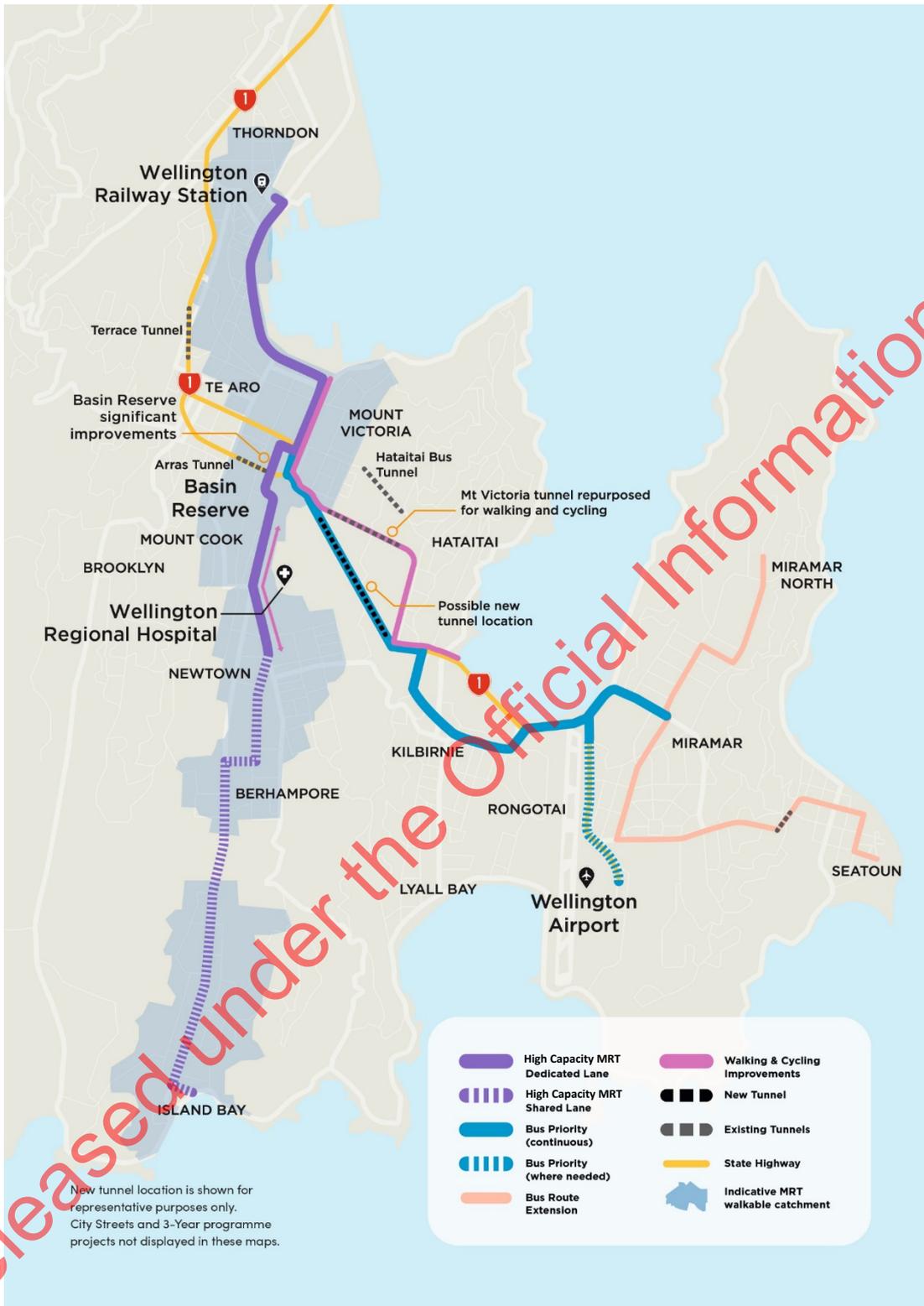


Figure 19: Preferred Programme Option

13 How the programme will be delivered

13.1 Sequencing and Timeframes

Careful planning of the implementation of the Programme is required to ensure appropriate prioritisation of elements within the Programme, consideration of how the Programme interfaces with other works being undertaken in the city and that any impacts of implementation can be appropriately managed.

Work is currently underway²⁶ to identify the best way to sequence all the programme elements. This is subject to further investigation and development but presents an initial indication as to the likely implementation sequence and timing.

Specific elements of the 'base' scenario from the System Plan are:

- Potential for City Streets Featherston Street project to be delayed if required to help manage disruption in the CBD whilst the Golden Mile works underway
- Deliver eastern Continuous Bus Priority as early as possible to realise the benefit of this part of the MRT scheme and make use of the City Streets project (CBD to Kilbirnie and Miramar Town Centre)
- Break MRT substantive works into two to four stages, first stage from the CBD end to the Basin, which would provide an opportunity (subject to stabling yard location) to be able to operate this stage earlier.

Overall this would result in the programme implementation being complete in 2032. A summary of the key dates are:

- 3 year programme (including Golden Mile) finished by 2025
- City Streets Trance 1 finished by 2026, except Featherston Street which would be finished by 2026
- MRT, Basin and Mt Victoria tunnel investigations, design and consenting start as soon as possible which would enable construction start in 2027. Mt Victoria tunnel would follow Basin Reserve and both would happen in parallel with MRT construction.

13.2 Funding

The programme cost estimates are presented in Section 7.3.

LGWM is a significant investment and is expected to deliver benefits locally, regionally and nationally. The cost shares are expected to recognise this. At this time, cost shares have not been finalised, so a working assumption has been used. The principles applied are:

- **Investment split:** The split between central and local government in the funding work to date is based on the indicative split in the May 2019 Cabinet paper of 60% central government 40% local government. There is no formal agreement on the cost sharing between the local government partners. For the purpose of financial analysis this has been assumed to be 75% WCC and 25% GWRC, based on the relative size of the rates for each Council. Overall this simplifies the cost share assumption for this analysis to 60% Waka Kotahi; 30% WCC; and 10% GWRC.

²⁶ System Plan Stage 1 Report, April 2022

- **Ongoing cost split cost:** Allocated to the asset / service owner with current Funding Assistance Rates (FAR) applied.

At this time the funding sources have not been agreed and a range of options are still being considered. The most likely sources are:

- the National Land Transport Fund for central government share, although other crown funding sources may also be used
- City Council and Regional Rates for the local government share
- A range of other sources to reflect the specific benefits some groups will receive, such as a value capture targeted rate, travel demand management pricing, public transport fares and development contributions.

13.3 Key Questions for the DBC

This preferred programme work has identified a number of key questions that will need to be answered in the DBC for Strategic Highways and Mass Rapid Transit. These are in addition to the questions that a DBC normally seeks to answer and those identified in the IBC. These will need to be scoped in detail, but are summarised below:

- Are there ways of delivering MRT earlier, or staging the delivery, to realise economic benefits and carbon reduction as quickly as possible?
- What is the likely impact of upcoming climate change policies and how can that be reflected in the preferred programme option?
- What opportunities are there for reducing embodied carbon in the construction of the programme including electric plant, lower carbon materials and more efficient ways of working?
- What opportunities are there for future proofing the MRT system so that it can be extended north at some point in the future?
- What is the regionally agreed intensified land use scenario(s) that should be used as a basis for estimating public transport demand and undertaking the economic analysis?
- What BRT systems are likely to be available that can deliver the quality, capacity and outcomes required for agreed levels of intensification and what is their likely impact on urban uplift and/or urban development compared to LRT systems?
- What is the likely future commuter travel demand based on changes to ways of working and COVID-19?
- What are the likely future weekend travel demands (the current modelling only applies to weekdays)?
- What urban amenity improvements are needed as part of the programme to ensure the liveability objective is achieved?

It is acknowledged that the answers to some of these questions could impact on the choice of a programme option. Accordingly, early in the DBC, once the land use scenario(s) are agreed, it is recommended that the programme options be re-tested with the new information to ensure the best programme option is progressed.

13.4 Next Steps

Whilst this report recommends a preferred programme option, the full case for investment in the MRT and SHI elements of the programme will be provided in the final IBC, which is due to be completed by the end of 2022. The MRT and SHI IBC will fully document the case for investment, detail the assessment process and provide details on how future work could be delivered.

Prior to the completion of the IBC approval a recommended way forward will be presented to partners. This will enable a quicker transition from IBC to DBC and the option of starting some DBC work early, both of which will reduce the overall duration of the investigation phases.

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14 Conclusion

Investigations into the packages, and how these best combine to form an overall programme, have identified that:

- there is a good investment case for MRT in Wellington City, subject to realising the intensified land-use scenario,
- focusing the highest quality MRT along the southern corridor has the greatest potential to both drive and support intensification,
- the priority to the east is fast and reliable public transport journeys to drive mode shift, urban development and access, including for trips to the Airport by public transport. This does not require MRT, but does require new infrastructure through Mount Victoria and grade separating the Basin Reserve to provide additional public transport lanes,
- a solution at the Basin Reserve has been identified that can deliver transport benefits by separating and prioritising MRT and enhanced public transport to both the south and the east, whilst also delivering urban development and urban amenity benefits,
- new public transport lanes are required through Mt Victoria to provide more direct and reliable access for public transport to the east, but there are different tunnel options to provide those lanes,
- there is support for and benefits associated with a dedicated active mode facility through Mt Victoria, and
- there is strong public support for change and for investment in MRT, a new Mt Victoria Tunnel and for grade separated improvements at the Basin Reserve. There is also a strong appetite to make it happen sooner, deliver the best value and get public transport right.

But there is a lot that needs to be considered during the next phase of planning, including:

- agreeing intensified land use distributions that should be used in the assessment of the programme and how best to assist in delivering urban intensification;
- ensuring that urban amenity enhancements are recognised and provided for in the public realm and the way in which urban development is delivered;
- assessing different MRT vehicle types and enabling infrastructure to deliver high quality, high capacity MRT to the south in a resilient way that is scalable to address different growth scenarios and strong the growth to the north;
- more detail in regard to the infrastructure required to enable MRT to the south and east including road space allocation, stabling and power supply;
- developing more detail in regard to the layout and form of the Basin Reserve solution;
- determining the alignment and configuration of existing and new tunnels through Mt Victoria to provide better facilities for walking and cycling and two new public transport lanes;

- integration with the wider transport network, and how best to maximise the benefits of the MRT infrastructure across the wider public transport network;
- identifying opportunities to reduce costs, limit environmental effects, and constrain embodied carbon;
- Determining how best to assist in delivering the urban development outcomes along the southern corridor;
- addressing public concern around social impacts and construction disruption; and
- determining how to further support giving life to Mana Whenua values and aspirations.

While this next phase of planning work continues, the programme will continue to deliver the 3-year programme elements of Golden Mile, Thorndon Quay and Aotea Quay and will be looking for opportunities to accelerate elements of the MRT/SHI Transformational Programme, such as a second public transport 'spine' down the waterfront in preparation for MRT.

In addition, the wider programme will be delivering important bus priority walking, cycling and amenity improvements to lock in early benefits and minimize disruption once construction begins on the larger elements of the programme.

Released under the Official Information Act 1982

Appendix A: Modelling Report

Released under the Official Information Act 1982

Appendix B: Economics Report

Released under the Official Information Act 1982

Appendix C: Carbon Report

Released under the Official Information Act 1982